THARAKA NITHI COUNTY

Participatory Climate Risk Assessment Report

May 2023

Leaving No One Behind

WORLD BANK GROUP

Sweden Sverige

KFW

Kingdom of the Netherlands

Vision

A prosperous, industrialized, and cohesive County

Mission

Enhance sustainable socio-economic growth and optimal utilization of resources.

Core Values

As Tharaka Nithi County, we are committed to championing these core values as the key tenets for our operations:

(ICT)²

Integrity

Straightforwardness, ingenuousness, honesty, and sincerity are an integral part of our undertakings which we shall firmly adhere to in every duty to our society.

Inclusiveness

We believe in equity and equality. As a County we do not regard status or personal preferences but approach our work as guided by principles of fairness and non-bias. People from diverse Backgrounds or communities are involved in the County development, and we incorporate the needs, assets, and perspectives of communities into the design and implementation of county programs.

Citizen focused

We consistently endeavor to create enduring relationships with our citizens; in so doing our approach goes beyond standard citizen participation principles and makes their input an integrated, formalized part of setting county projects/program goals, performance measures, and standards.

Creativity & Innovativeness

We thrive on creativity and ingenuity. We seek the innovations and ideas that can bring a positive change to the County. We value creativity that is focused, data0driven, and continuously0improving based on results.

Transparency and Accountability

We will remain accountable to our stakeholders and will acknowledge responsibility for our actions and decisions. Thus, we shall always endeavor to be transparent, answerable, and liable at all times.

Teamwork

Every person is important and has a part in county development. We endeavor to build a workplace environment that cultivates a person's uniqueness, encourages staff participation, collaboration and integration of diverse skills and capabilities.

FOREWORD

Climate change is a global challenge that cuts across all sectors. Its impacts are increasingly devastating, ranging from rising sea levels, more frequent and intense natural disasters, to severe heatwaves, and droughts. These impacts threaten to undo decades of progress in poverty eradication, human development, and economic growth in Kenya. At the National level, Kenya formulated the National Climate Change Action Plan (Kenya) 2018-2022 with priority actions to ensure that national development remains sustainable in the event of any adverse climate change impacts, including droughts, floods, and other extreme climate events.

The implementation of climate change in the counties is anchored on the County Climate Change mechanism. At the core of this is the need to support local participation in the process of addressing the climate crisis through. This demands for active participation of those severely affected by the climate impacts.

This report sets the tone for the climate change action by highlighting the urgency of the climate crisis and the need for collective action. It provides an overview of the key components of the action plan, including the mitigation, adaptation, and financing strategies. It also sets out the principles that underpin the plan, such as equity, justice, and community participation.

Effective implementation of the climate change action plan requires the commitment and collaboration of all actors, from national governments to the county institutions, local communities, NGOs and the private sector. It requires innovative approaches, bold leadership, and creative solutions. It demands that we rethink the way we produce, consume, and live, and find ways to make our societies more sustainable and equitable.

The Participatory Climate Change Risk Assessment is a product of abroad consultative process among the key players in the climate change landscape in Tharaka Nithi County is not just a document but represents a shared vision for a sustainable and resilient future for the county it has presented the felt needs of the various stakeholders in the county and how the same need to be addressed.

Mr. Njue Njagi Kaithungu
COUNTY EXECUTIVE COMMITTEE MEMBER
ENVIRONMENT, MINING AND NATURAL RESOURCES

ACKNOWLEDGEMENT

The Tharaka Nithi county climate change department wishes to appreciate all individuals who sacrificed their time and expertise for the preparation of this participatory climate risk assessment report.

We are particularly grateful to the World Bank who have been the main donors to this Climate Change PCRA. We acknowledge their contribution through capacity building throughout the processes. They have facilitated training of the technical working group who spent a significant amount of time in supporting this process and conducting the participatory vulnerability and capacity assessments in all the 15 wards.

Special appreciation goes to the County Executive Committee Member in charge of climate Change Mr. Njue Kaithungu for providing steadfast leadership during PCRA process. We appreciate the key role provided by the County Climate Change Board in supporting the overall supervision of the process and ensuring that they avail themselves during the whole exercise. The County Technical Working group implemented the PCRA process by ensuring the different activities were well-coordinated and executed in timely and efficient manner.

We recognize the role of the several stakeholder organizations who were very critical during the engagements in the multi stakeholder workshop that was a key element of the PCRA process. Without them the process could not have been a success. Their participation and contribution have been key in enriching the PRCA process and action planning due to the extensive knowledge they possess regarding past, current, and future climate change patterns and challenges.

We are grateful to the Ward Climate Change Planning Committee members for supporting the data collection and the community at large for their engagement throughout the exercise. Their dedication and valuable support in the process ensured the identification of the local needs to be included in the action plan were raised. They acted as key informants during the discussion.

We ultimately thank the County Climate Change Unit for successfully coordinating the PRCA exercise and for their dedication, sacrifice, and commitment to public service.

Mr. Peterson Mwirigi Kathenya
Chief Officer, Environment and Natural Resources

Table of contents

FOREWORD I

ACKNOWLEDGEMENT II

TABLE OF CONTENTS III

LIST OF FIGURES V

LIST OF TABLES VI

DEFINITION OF TERMS VII

LIST OF ACRONYMS AND ABREVIATIONS IX

EXECUTIVE SUMMARY XI

1. CONTEXT OF THE PARTICIPATORY CLIMATE RISK ASSESSMENT (PCRA) 1

1.1 Background 1

1.2 Policy Context 3

1.3 Purpose and objectives of the PCRA Report 4

1.4 Key steps in the county's PCRA process (Methodology) 4

1.5 County location, Demographics and Administration 6

1.5.1 Location *6*

1.5.2 Demographics *7*

1.5.3 Administration *7*

2. THARAKA NITHI COUNTY CLIMATE HAZARD PROFILE 9

2.1 Current and Historical Climate Hazards and Trends from the community 9

2.2 Exposure and vulnerability profiles of the county 12

2.3 Differentiated impacts of climate trends and risks 14

2.4 Spatial Distribution of Risks 16

3. FUTURE CLIMATE SCENARIOS FOR THE COUNTY 20

3.1 Introduction 20

3.2 Climatic scenarios of Tharaka Nithi County 20

3.3 Current and Future Rainfall Trends 21

3.4 Current and Future Maximum Temperature Trends 21

3.5 Current and Future Minimum Temperature trends 22

4. ANALYSIS OF EXISTING RESILIENCE/ADAPTATION STRATEGIES TO CURRENT AND FUTURE CLIMATE RISKS 24

4.1 Overview of Existing Adaptation/Resilience Strategies and Their Effectiveness to Current Climate Risks.....29
4.2 Effectiveness of Adaptation/Resilience Strategies to Future Climate Risks 35
DROUGHT.....*35*
PEST AND DISEASES.....*39*
FLOODS.....*40*
5. THARAKA NITHI COUNTY CLIMATE STRATEGIC ADAPTATION INVESTMENT/ACTION PRIORITIES..... 43
6. CONCLUSION..... 45
ANNEXES 46

List of Figures

Figure 1: Tharaka Nithi County's Administrative units 8
Figure 2: Precipitation trends 10
Figure 3: Maximum temperatures trends 11
Figure 4: Minimum Temperature trends 11
Figure 5: Distribution of Hazards within the County 16
Figure 6: Drought Vulnerability levels in Tharaka Nithi county 17
Figure 7: Flood vulnerability assessment in Tharaka Nithi County 18
Figure 8: Pest vulnerability in Tharaka Nithi County 19
Figure 9 : Mean Rainfall distribution 21
Figure 10: Current and future Rainfall trends 21
Figure 11: Current and Future Maximum temperature trends for Tharaka Nithi 22
Figure 12: Current and Future minimum temperature trends outlook for Tharaka Nithi 22

List of Tables

Table 1: Current and Historical climate hazards and trends from the community 9
Table 2: Climate change vulnerabilities to key groups 13
Table 3: Vulnerability of key interest groups 14
Table 4: Climate change risks, hazards and vulnerabilities in the county 15
Table 5: Summary of Climate change Risks 23
Table 6: Climate Change Vulnerabilities / impacts 23
Table 7: Rainfall aspects and future predictions 24
Table 8: Existing climate resilience strategies 25
Table 9: Drought Adaptation strategies to future climate risks in Crop production sub sector 35
Table 10: Drought Adaptation strategies to future climate risks in Livestock sub sector 36
Table 11: Drought Adaptation strategies to future climate risks in water sector 37
Table 12: Drought Adaptation strategies to future climate risks in Environment sub sector 38
Table 13: Drought Adaptation strategies to future climate risks in Trade and Industry sub sector 39
Table 14: Pests and diseases Adaptation strategies to future climate risks in crop production sub sector 39
Table 15: Pests and diseases Adaptation strategies to future climate risks in Livestock sub sector 39
Table 16: Floods Adaptation strategies to future climate risks in Crop production sub sector 40
Table 17: Floods Adaptation strategies to future climate risks in Environment sub sector 40
Table 18: Floods Adaptation strategies to future climate risks in Water sub sector 41
Table 19: Floods Adaptation strategies to future climate risks in Trade and industry sub sector 41
Table 20: Strategic priority actions 43

DEFINITION OF TERMS

Term	Definition
Adaptation	It is used to mean the process by which an individual or a system adjusts and evolves in response to changes in its climatic, environment or circumstances to increase its chances of survival and success. It involves learning, modification, or development of physical, behavioral, or physiological traits that allow a person or a system to better fit and thrive in its surroundings. Adaptation can be natural, occurring over generations through the mechanism of natural selection, or artificial, through deliberate human intervention.
Adaptive capacity	The ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.
Climate Change	Refers to the long-term alterations in global or regional weather patterns that result from the increase in Earth's average surface temperature due to human activities, such as burning fossil fuels, deforestation, and industrial processes. These changes can include rising sea levels, melting of ice caps and glaciers, more frequent and severe weather events, changes in precipitation patterns, and altered ecosystems. The process of climate change is driven by the gradual accumulation of greenhouse gases, such as carbon dioxide, in the earth's atmosphere, which trap heat from the sun and cause a gradual increase in temperature over time.
Climate Change Mainstreaming	The integration of priority climate change adaptation responses into development, to reduce potential development risks and take advantage of opportunities.
Climate Change Vulnerability	The degree to which geophysical, biological, and socio-economic systems are susceptible to, and unable to cope with adverse impacts of climate change. Impact here refers to a specific change in a system caused by its exposure to climate change
Climate hazard	A physical process or event (hydro-meteorological or oceanographic variables or phenomena) that can harm human health, livelihoods, or natural resources

Energy Efficiency	Refers to the use of less energy to perform the same task, i.e., Eliminating energy waste.
Exposure	Refers to whether the asset or system is located in an area experiencing direct effects of climate variables.
Global warming	Refers to the observed or projected gradual increase in global surface temperature. It is one of the consequences of climate change**.**
Greenhouse gases (GHGs)	Are gases that absorb and emit radiant energy within the thermal infrared and include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), Sulphur hexafluoride (SF6) and nitrogen trifluoride (NF3).
Mitigation	Refers to the actions taken by individuals, organizations, and governments to reduce greenhouse gas emissions and limit the severity of climate change. It typically involves changes in energy consumption, transportation, agriculture, and other human activities that produce greenhouse gases, such as carbon dioxide, methane, and nitrous oxide, which trap heat in the atmosphere and contribute to global warming.
Resilience	Refers to the capacity of social, economic and environmental systems to cope with a hazardous event, trend, or disturbance. It is manifested through responding or reorganizing in ways that assert the essential function, identity, and structure of the system, while also maintaining the capacity for adaptation, learning and transformation.
Vulnerability	Refers to the degree to which individuals, communities, and ecosystems are susceptible to the impacts of climate change. This vulnerability is influenced by factors such as exposure to climate hazards (such as extreme weather events, rising sea levels, and changes in precipitation patterns), sensitivity to these hazards (due to, for example, physical or economic dependencies on natural resources), and adaptive capacity (the ability to manage and respond to the impacts of climate change). Vulnerability can vary across regions and communities, based on geography, socio-economic factors, and other local contexts.

LIST OF ACRONYMS AND ABREVIATIONS

AEZ	Agro-Ecological Zones
AI	Artificial Insemination
ASALs	Arid and Semi-Arid Areas
CAP	County Adaptation Plan
CBOs	Community Based Organizations
CCD	Climate Change Directorate
CFA	Community Forest Association
CIDP	County Integrated Development Plan
COP27	27th Conference of the Parties
FLLOCA	Financing Locally Led Climate Change Action
GDP	Gross Domestic Product
GHG	Green House Gases
IL	Intermediate lowland
IPCC	Inter-Governmental Panel on Climate Change
KCEP-CRAL	Kenya Cereals Enhancement Program-Climate Resilience Agriculture Livelihood
KFS	Kenya Forests Services
KMD	Kenya Meteorological Department
KPHC	Kenya Population and Housing Census
LM	Lower Midlands
NDMA	National Drought Management Authority
NGOs	Non-Governmental Organizations
PCRA	Participatory Climate Risk Assessment
PFMP	Participatory Forest Management Plan
PLWDs	Persons Living with Disabilities
RCPs	Representative Concentration Pathways
TNCG	Tharaka Nithi County Government
TWG	Technical Working Group
UM	Upper Midland

UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
VCC	Value Chain Commodities
WMO	World Meteorological Organization

EXECUTIVE SUMMARY

From the foregoing, climate change is a global phenomenon with specific regional, national and local consequences. In Kenya, the impacts of climate change are already evident with increased occurrence of extreme climatic events such as flooding and droughts which have caused immeasurable damage to both life and property in the country. Loss of livelihoods that has resulted in misery and desperation amongst the affected populations is of greater concern. The change is also alarming to a state that need immediate, future, and ultimate interventions to ensure that the earth globe will keep in sustaining life. The Kenya Vision 2030, which is the overarching development policy in Kenya, recognizes that climate change is becoming one of the most serious challenges to the achievement of Kenya's development goals. It identifies Kenya as already highly susceptible to climate-related hazards, and in many areas, extreme events and variability of weather are now the norm; rainfall is irregular and unpredictable, while droughts have become more frequent during the long rainy season and severe floods during the short rains. Spearheading the activities that clearly puts into place strategies that if implemented will ensure Kenya will be at the forefront in curbing the climate change related hazards, is an excellent idea.

PCRAs are key tools in providing the necessary information on Climate change mitigation and adaptation measures. Through the PCRAs, the local communities are able to come up with appropriate methods with the aim of minimizing adverse effects of climate change mitigation and adaptation, especially in Tharaka Nithi County. A cross-sectoral county technical working group was formed that spearheaded the PCRA process. A cross-sectoral county technical working group was formed that spearheaded the PCRA process. This TWG was trained on their tasks which included review of secondary data, conducting technical analyses, participation in the community engagements and stakeholder workshops, and providing technical inputs to the climate change plan. The TWG review consisted of analysing the existing climate change adaptation strategies, evaluate them if they are applicable to the current and future climate risks and if not propose and prioritize other climate change adaptation strategies. It is important to note that addressing climate change requires a multi-faceted approach involving governments, businesses, communities, and individuals. Efforts must be made at all levels to reduce greenhouse gas emissions, adapt to changing conditions, and build a sustainable future for generations to come. If the above strategies are embraced and passionately put into action, climate change issues will be addressed.

1. CONTEXT OF THE PARTICIPATORY CLIMATE RISK ASSESSMENT (PCRA)

1.1 Background

Climate change has been a threat to the very existence of Planet Earth for a long time. The conversation about climate change and its threats to world ecological order began in the late 1950s when scientists began to identify evidence of anthropogenic climate change drivers. Studies then showed that there was an increasing amount of Carbon Dioxide concentration in the atmosphere mainly because of increasing industrial activities and destruction of forested areas. This was then linked to the observed increases in global temperatures. In the 1970s, the concern about the global environment became prominent leading to the 1972 United Nations conference on the environment in Stockholm, Sweden. This birthed the Stockholm Declaration and Action Plan for the Human Environment. A major outcome of the Stockholm Conference was the creation of the United Nations Environment Programme (UNEP). By 1980s, the climate change conversation continued to dominate the world agenda and in 1989 the Brundtland report also known as "Our Common Future" was released by the United Nations. The report contained several recommendations on addressing the threats and impacts of climate change and explained in detail the increasing concentration of Green House Gases (GHG) in the atmosphere. This led to the formation of the Inter-Governmental Panel on Climate Change (IPCC) jointly by the UNEP and the World Meteorological Organization (WMO). The IPCC was formed to provide science backed information on climate change. In 1992, the United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit, was convened in Rio de Janeiro, Brazil. The outcome of this conference was the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC has since been ratified by over 192 countries and has been the main vehicle through which the world has been addressing issues around climate change. Article 2 of the UNFCCC calls on National Governments to work towards reducing and stabilizing GHGs concentration in the atmosphere at levels that would avoid dangerous anthropogenic interference with the climate system. As a result of the UNFCCC ratification, there have been subsequent protocols and agreements on climate change including the Kyoto Protocol that committed 37 industrialized countries to reduce their GHG emissions by at least 5 per cent below the 1990 levels by the year 2012. This, however, failed due to the binding nature of the Protocol and the feeling amongst the targeted industrialized countries that the Protocol worked against their respective national development goals. By the year 2015, the world gathered in Paris, France and produced

the Paris Agreement. The Paris Agreement contains provisions to address climate change from all perspectives, including mitigation, adaptation, financing, technological transfer, transparency and accountability, minimization and addressing losses associated with climate change, climate change capacity building and education, training and public awareness and compliance.

From the foregoing, climate change is a global phenomenon with specific regional, national and local consequences. In Kenya, the impacts of climate change are already evident with increased occurrence of extreme climatic events such as flooding and droughts which have caused immeasurable damage to both life and property in the country. Loss of livelihoods that has resulted in misery and desperation amongst the affected populations is of greater concern. Thus, climate change is a threat to the development of Kenya including the achievement of national goals and aspirations such as the Kenya Vision 2030. The Kenya Vision 2030, which is the overarching development policy in Kenya, recognizes that climate change is becoming one of the most serious challenges to the achievement of Kenya's development goals. It identifies Kenya as already highly susceptible to climate-related hazards, and in many areas, extreme events and variability of weather are now the norm; rainfall is irregular and unpredictable, while droughts have become more frequent during the long rainy season and severe floods during the short rains. The arid and semi-arid areas (ASALs) are particularly hard hit by these climate hazards, thereby putting the lives and livelihoods of millions of households at risk.

Tharaka Nithi County is one of the ASALs counties in Kenya and the main occupation of the people of the county is agriculture which includes both crop and livestock production (CRPTNC, 2017). According to the County Climate Change and Response Strategy, 80% of the county's population is engaged in agricultural activities while agricultural production occupies 1,449.6 km2 of arable land in the County. Approximately 43,799 hectares is under food crops while 14,839 hectares is under cash crops. Additionally, the county's economic growth heavily depends on tourism and water resources. The Climate Risk profile for Tharaka Nithi County conducted in 2017 indicates that historic climate trends in the last decades showed a moderate increase in temperature in the rainy seasons and an increase in rainfall in the second wet season (July-December). Future climate projections for the years 2021- 2065 indicate that the County will remain highly susceptible to more days with moisture stress and continued moderate increases in temperatures. This therefore calls for efforts to manage and sustain the environment and natural resource base. This necessitated the need for the county to conduct Participatory Climate Risk Assessment

(PCRA) across the county to establish the climate risks and hazards experienced over time and the future trends of the same.

1.2 Policy Context

To address the threat posed by climate change, Kenya has made progress in establishing the policy, legal and institutional framework to tackle it. The country has been engaged in the formulation of several policies on climate change including: The Climate Change Response Strategy 2010; the National Climate Change Framework Policy of 2016; the National Adaptation Plan 2015-2030; the National Climate Change Action Plans and the National Climate Finance Policy 2017. All these policies have since been enacted into law under the Climate Change Act of 2016.

The Climate Change Act, 2016 established an institutional framework on climate change including the National Climate Change Council chaired by the President of the Republic and the National Climate Change Directorate (CCD) charged with the technical and administrative issues on climate change. The Act requires the commitment of both the National and County Government to tackle climate change, effectively making climate change a responsibility of both levels of government.

Tharaka Nithi county has not been left behind on matters of climate change. The County developed the Climate Change bill that was enacted into law under the Tharaka Nithi County Climate Change Act, 2019, which allows for the establishment of a Climate Change Fund to facilitate and coordinate financing of Climate Change Adaptation and mitigations.

To effectively address the threats posed by climate change and enhance resilience to its impacts, there needs to have a targeted approach with specific objectives and defined outcomes. Financing Locally Led Climate Change Action (FLLOCA) has been on the fore front to enabling the locals take climate change considerations into account in their social, economic and environmental policies and actions. PCRAs are key tool in providing the necessary information on Climate change mitigation and adaptation measures. Through the PCRAs, the local communities are expected to come up with appropriate methods with the aim of minimizing adverse effects of climate change mitigation and adaptation. This is in line with the Paris Agreement that requires parties to the Agreement to engage in adaptation planning processes and the implementation of actions including the development of relevant plans and policies. The National Climate Change Framework Policy requires the Government to ensure integration of climate change risk and vulnerability assessment in environmental impact assessments and strategic environmental assessments. This is aimed at enhancing climate resilience and adaptive capacity.

1.3 Purpose and objectives of the PCRA Report

Climate Change is becoming one of the most serious challenges the globe is facing. Various efforts have been put to battle the effects of Climate change, the latest being the 27th Conference of the Parties (COP27) held in Egypt in November 2022 which saw the United Nations converge to agree on policies to limit global temperature rises and adapt to impacts associated with climate change. Mostly, the focus of most of the climate change initiatives has been at the national level hence the need to mainstream climate change into county level policies, programmes, and development plans as stipulate in the Climate Change Act, 2016 section 19, therefore ensuring locally relevant, integrated adaptation responses with active involvement of local stakeholders.

Tharaka Nithi County carried out the PCRA process across the 15 wards countywide. Basically, it is considered that through PCRA, the community is able to come up with appropriate adaptation and mitigation measures that promote the prudent use of natural resources in the county. The Participatory Climate Risk assessment's main aim was to establish the key climate change risks, hazards and vulnerabilities in Tharaka Nithi County; establish the probability and impact of climatic hazards currently and in the future in the County; develop a climate change vulnerability and risk map of the County; identify the climate change adaptive capacities and mitigation measures; identify strategic investment areas for climate resilience; support additional county planning processes as well as develop a five year participatory county climate change action plan.

1.4 Key steps in the county's PCRA process (Methodology)

The following steps were followed during the PCRA process:

Step 1: Formation of the Technical Working Group (TWG) and training.

A cross-sectoral county technical working group was formed that spearheaded the PCRA process. This TWG was trained on their tasks which included review of secondary data, conducting technical analyses, participation in the community engagements and stakeholder workshops, and providing technical inputs to the climate change plan. The team was also tasked to identify the type of data and information that will be needed for the climate risk assessment workshop. The TWG planned for the community engagement meetings for the 15 wards and the multi-stakeholder workshop. Throughout the PCRA process, the TWG ensured that PLWDs, the youth, women and any other marginalized and vulnerable groups actively participate in the process.

Step 2: Stakeholder Analysis.

In this step, a stakeholder analysis was done by identifying all key stakeholders at county, sub-county and ward levels who can contribute and should participate in the participatory climate risk assessment and climate action planning process. The mapped stakeholders included those formally responsible for climate action, those involved in climate action implementation, those with knowledge and expertise on climate change, those affected by climate change (the community), providers of scientific and statistical data at county and/or national level as well as representatives of groups traditionally marginalized and vulnerable to the impacts of climate change.

Step 3: Community Engagement

Community engagement involved engaging with community members to gather input from the community members. This was done in 15 wards across the county. The objective of this activity was to ensure that communities and other key local actors actively participate and have a strong voice in the participatory climate risk assessment process. In this process, the community members identified and assessed climate risks and vulnerabilities. The community engagements involved the following activities:

- Identification of key climate change hazards and impacts in the county, such as floods, Droughts, Incidences of migratory pests etc.
- Conducting a vulnerability assessment to determine which populations, sectors, and areas are most at risk from the identified hazards. The objective of this activity was to identify the people in the community most vulnerable to climate risk (and other risks). These are usually the most economically, socially and politically marginalized and disadvantaged individuals, households and groups in the community.
- Developing a risk assessment by combining the information on hazards and vulnerability. In this section, the community highlighted the top three climate hazards (and its associated impacts) in turn, the facilitator asked the stakeholders about existing strategies or practices they use to avoid the negative consequences of the hazard or to take advantage of the opportunities it brings.
- Prioritization of risks based on severity and likelihood.
- Developing adaptation strategies and actions based on the prioritized risks. This involved identifying and prioritizing actions to address the identified risks.

Step 4: Multi-stakeholder climate risk assessment workshop

This process involved engaging with stakeholders to gather inputs, build support, and ensure that the final report and the County Climate Change Action Plan are tailored to the needs of the community. The stakeholders for this workshop included County Government Departments involved directly or indirectly in climate change issues, selected members of the Ward Climate Change Committee, Civil Society Organizations engaged directly with climate change issues and government agencies like KMD, NDMA, KFS. The TWG typically lead the stakeholder engagements and some of the issues discussed include a brief overview of the county, current county climate change context, National Climate Projections and future county climate change projections, an analysis of climate change risks, threats and impacts, the most vulnerable groups to climate change, adaptations and mitigation measures and strategies.

STEP 5: Climate risk assessment report

The TWG finally compiled the climate risk assessment report which integrated the discussions and outputs from the participatory climate risk assessment workshops both for the community and the multi-stakeholder meetings. The report concentrates on the county overview, county climate hazard profile, current and future county climate scenarios, an analysis of existing resilience/adaptation strategies to current and future climate risks, county climate strategic adaptation priority areas with much concentration on the principles for locally led climate action. The report also indicates how the views and needs of women, youth, ethnic minorities, people living with disabilities and other marginalized and vulnerable groups are integrated and addressed.

1.5 County location, Demographics and Administration

1.5.1 Location

Tharaka Nithi County is in the eastern part of Kenya and borders the counties of Embu to the south and south-west, Meru to the north and north-east, Kirinyaga and Nyeri to the west, and Kitui to the east and southeast. The county lies between latitudes 000 07’ and 000 26’ South and between longitudes 370 19’ and 370 46’ East. It covers a total area of 2,662.1Km^2. The highest altitude of the county is 5,200m in Chuka/Igambang’ombe and Maara while the lowest is 600m Eastwards in Tharaka. The main physical feature of the county is the 360 Km^2 of Mt. Kenya Forest distributed between Maara and Chuka/Igambang’ombe constituencies. The total area for Chuka and Maara sub-counties includes 179Km^2 and 184Km^2 of Mt. Kenya Forest respectively.

Temperatures in the highland areas range between 14^{o}C to 30^{o}C while those of the lowland area range between 22^o C to 36^o C. Some areas in the lower region experience temperatures of up to 40^o

C especially during the dry season. The county has a bi-modal rainfall pattern with long rains falling during the months of April to June and short rains in October to December. Short rains are more reliable than the long rains. The rainfall ranges from 2,200mm to 500mm with the high-altitude areas experiencing reliable rainfall, middle areas receiving moderate rainfall, while the lower areas receive low, unreliable, and poorly distributed rainfall. The County has two main ecological zones. The highlands cover the upper zone of the county that nears Mt. Kenya and receives adequate rainfall for mixed agriculture. The semi-arid which covers the lower zone receives less rainfall and is suitable for cereals farming and livestock production. Poor methods of farming and soil conservation, charcoal burning and overgrazing have left the earth bare and rocky. The sloping areas have experienced uncontrolled soil erosion, which has resulted in deep gullies across the landscape, especially in Tharaka. The drainage pattern consists of rivers and streams that ultimately drain into the Indian Ocean through Tana River.

The main Agro-Ecological Zones (AEZ)are: Upper Midland UM2, 3 and 4; Lower Midland 4 (LM 4), Lower Midland 5 (LM5), Intermediate Lowland Zone 5 (IL5); and Intermediate Lowland Zone 6 (IL6). The AEZ IL5 and IL6 cover the north-eastern and southern tip of the county; they are the driest agro-ecological zones with agro-pastoralism as the main livelihood. Zone LM4 covers the western part of the county and is characterized by mixed farming (near Tunyai) and rain-fed cropping in the north-west.

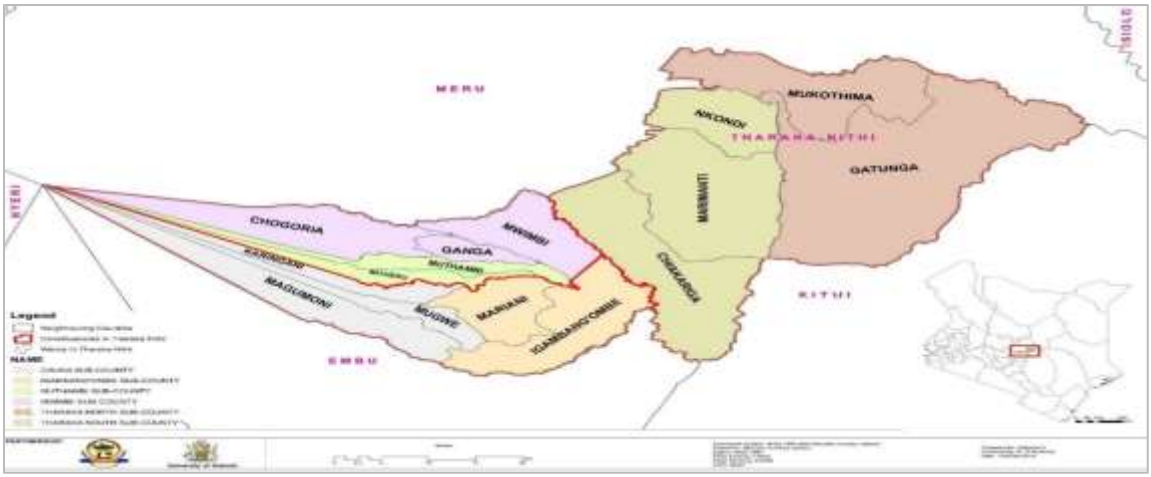
1.5.2 Demographics

The county had a total population of 393,177 comprising 193,764 males, 199,406 females and 7 inter-sex as determined by the 2019 population and housing census. This is projected to be 401,484 in 2022 (197,861 males and 203,624 females) and 415,735 by 2027 (204,885 males and 210,851 females). The county's annual population growth rate is 0.75%. Population density is largely influenced by climatic and ecological factors. Areas with good climatic condition and fertile soil will generally have dense populations. The average population density of the County is 153 people per square kilometer.

1.5.3 Administration

During 2019 Kenya Population and Housing Census (KPHC), Tharaka Nithi County had 5 sub counties namely Igambang'ombe, Maara, Meru South, Tharaka North and Tharaka South. However, to ensure efficient service delivery, these sub counties were later reorganized and gazette into eight (8) sub counties: Igambang'ombe, Chiakariga, Tharaka North, Tharaka South, Mwimbi, Muthambi, Chuka North and Chuka South. These are the sub counties that the county government

uses for administrative purposes. The county has a total of fifteen (15) wards as indicated in the figure below.



Source: TNCG.

Figure 1: Tharaka Nithi County's Administrative units

2. THARAKA NITHI COUNTY CLIMATE HAZARD PROFILE

Historic climate trends in the last decades showed a moderate increase in temperature in both seasons and an increase in rainfall in the second wet season (July-December). Future climate projections for the years 2021- 2065 indicate that the County will remain highly susceptible to more days with moisture stress and continued moderate increases in temperatures. There is however expected to be a moderate decrease in length of drought spells as well as a slight decrease in intense rain expected in the first season.

2.1 Current and Historical Climate Hazards and Trends from the community

Table 1: Current and Historical climate hazards and trends from the community

Hazard	Year of occurrence
Drought and famine	1961, 1967, 1980,1982,1984, 2000
Floods	1972, 1997, 1998, 2016
Insects, pests & diseases	1965, 1983, 1999, 2020, 2021
Human wildlife conflicts	1987, 2005, 2010
Wildfires	2018
Hail stones	2012, 2018, 2021
Lightning and thunderstorms	1963, 1988, 2019, 2023
Strong winds	1986, 2012, 2019
Land slides	2017, 2019

Scientific Data/Information

The community recalled that climatic hazards have been occurring in the area since time immemorial, though their effect were not as excruciating as the present time hazards since the environment was able to regenerate quickly and shield the community against such hazards. The community could recall the drought of 1962 where they said that there was rain failure which resulted to crop failure and consequently leading to famine. Analyzing the rainfall and temperature data from the Kenya Meteorological Department (KMD), the year recorded depressed rainfall and very high maximum temperature which confirms the community's reports. Also, the community pointed out that in the year 1972 they experienced heavy and prolonged rainfall resulting in massive flooding in the area. Looking at rainfall and temperature data from KMD, the year received enhanced rainfall and low maximum temperature concurring with the community's position.

Precipitation

In 1972 the recordings depict flooding due to the highly recorded precipitation. 1962, 1976, 1980, 1982 and 1984 experienced drought as a result of precipitations countywide.

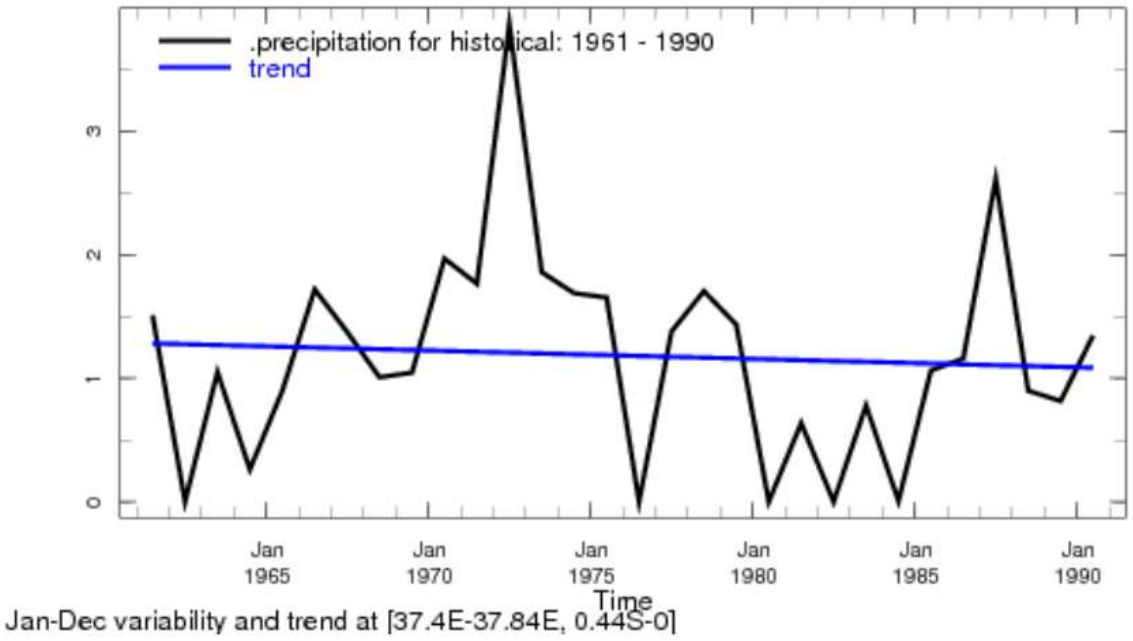


Figure 2: Precipitation trends

Maximum and minimum temperatures

1969 and 1989 recorded extreme temperatures with 1962, 1964, 1976 and 1983 recording low temperatures**.**

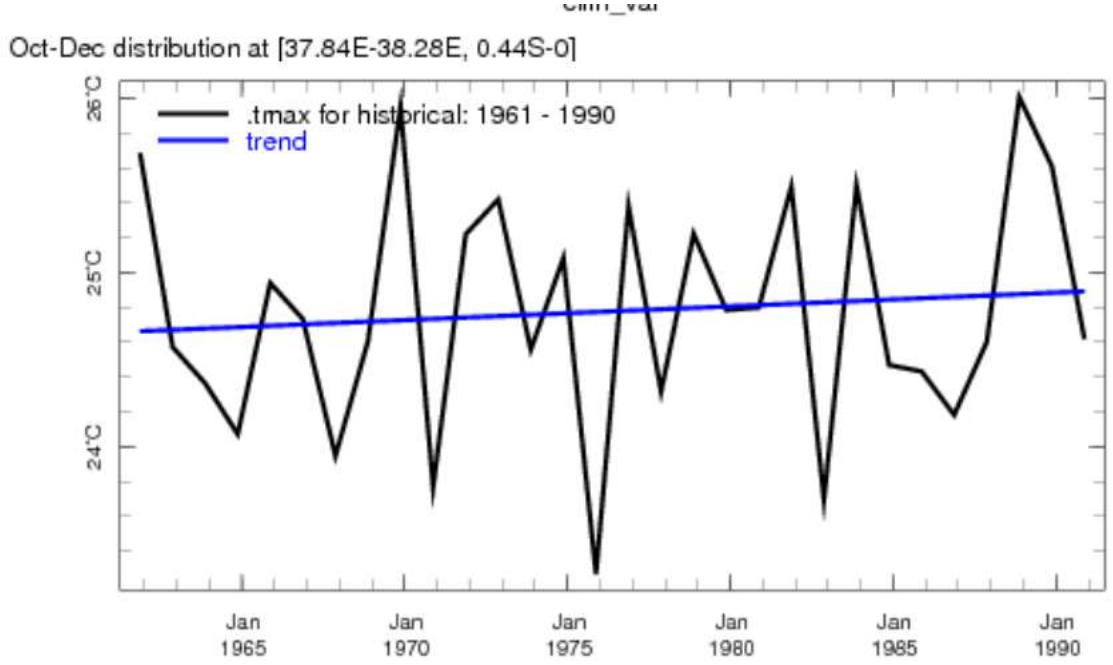


Figure 3: Maximum temperatures trends

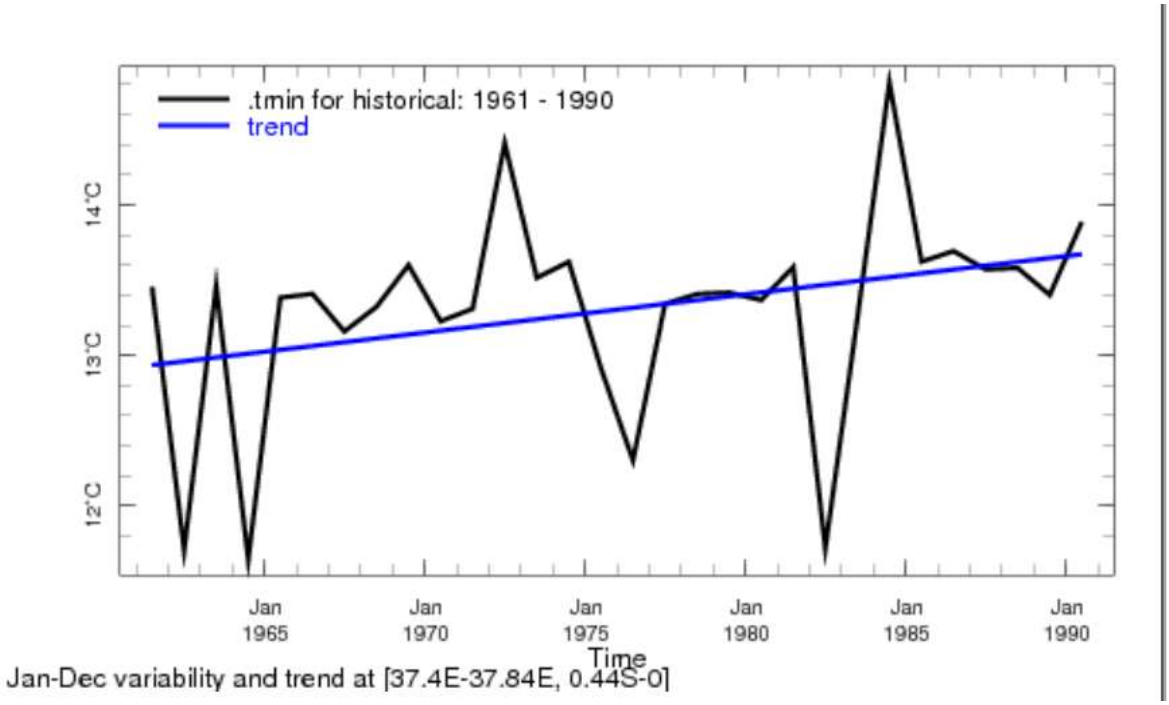


Figure 4: Minimum Temperature trends

2.2 Exposure and vulnerability profiles of the county

Over 40 percent of the county's population lives below the poverty level (less than 1 US$ a day) and has challenges accessing basic human necessities like food, clothing, and decent shelter. This is attributed to lack of resources to invest in other sectors that can enhance their capacity to generate income, access improved infrastructure, increase food productivity, and adapt to adverse climatic conditions.

Women and youths are among the most vulnerable groups in the county, with the lowest adoption rates of adaptation strategies. There is need for more initiatives that are geared towards job creation and alternative livelihoods particularly for women and youth. However, Tharaka Nithi County Adaptation Plan (CAP), whose main theme is enhanced climate resilience for sustainable development analyses the climate hazard and vulnerability of various groups in Tharaka Nithi County highlighting the key climatic hazards as droughts, floods, wildfires, human-wildlife conflicts, extreme temperatures, and erratic rainfall. Drought is identified as a prime recurrent natural disaster in the county which previously led to crop and livestock losses, famine, and population displacement.

Tharaka Nithi County being an ASAL county, the Climate Change occurrences introduce an additional uncertainty into existing vulnerabilities especially on vulnerable groups in the County such as the women, youth, the elderly and ethnic minorities who form part of the dependent population in our societies. Droughts have been known to cause some of the devastating and pervasive socio-economic consequences and it is estimated to have greatly lowered the country's GDP. Further, floods are also considered to cause havoc in the county with the vulnerable groups being the most affected by the after effects. Though the county has been on the forefront to counter drought effects, more needs to be done especially on; improving weather forecasting, introduction of better-adapted livestock breeds, food processing, and preservation techniques. Farmers need reliable information to understand the urgency of adapting to climate change by being able to access appropriate extension services in a timely manner. The capacity of institutions offering these extension services is constrained by limited financial and human resource capacities, hence are limited to effectively deliver the services. Successful implementation of climate adaptation strategies requires strengthening of the institutional and financial capacity of the respective stakeholders.

Vulnerability indicators in Tharaka Nithi County

1. Poverty levels
2. Gender inequality
3. Environmental degradation
4. Water scarcity
5. Population growth
6. Heavy disease burden
7. High reliance to national economy
8. Land tenure insecurity

Major climate hazards in Tharaka Nithi County

- Drought
- Floods
- Insects, Pests, and diseases

Climate change vulnerabilities to key groups in respect to overall climate hazards

Table 2: Climate change vulnerabilities to key groups

Ecological zone	**Constituency**	**Vulnerable groups**	**Age**
		Gender	
Upper high potential	Maara	Woman	19-60
Transitional	Chuka Igambang'ombe	Men	<18
Lower semi-arid	Tharaka	Women	<18

From the table, it is evident that women of age 19-60 years in the upper high potential ecological zone, men and women of less than 18 years in the transitional and lower semi-arid ecological zones respectively are highly vulnerable to climate change hazards.

Vulnerability of the key interest groups and their livelihoods to climate hazards and trends

The table below gives an analysis of the key interest groups and their livelihoods that were highly vulnerable to climate hazards and trends.

Table 3: Vulnerability of key interest groups

Vulnerable group	Livelihoods	Vulnerabilities/Impacts
Women	▪ Goat keeping ▪ Poultry keeping ▪ Dairy cattle keeping ▪ Apiculture ▪ Basket weaving ▪ Crop Farming ▪ Tree nursery trade	***Impacts*** ▪ Migrations due to drought ▪ Gender based violence due to food scarcity. ▪ Malnutrition ▪ Increased school dropouts ▪ Increased teenage pregnancies. ▪ Increased displacements ▪ Mental health issues ▪ Discrimination ***Vulnerabilities*** Social, Economic and Physical vulnerabilities
PWD	▪ Table banking ▪ Poultry keeping ▪ Apiculture ▪ Maize mills ▪ Goat keeping	***Impacts*** ▪ Difficulty in accessing services. ▪ Low income ▪ Low living standards ▪ Highly prone to hazards especially to severe PWD in respect to physical mobility and mental health ▪ Discrimination ***Vulnerabilities*** Social, Economic and Physical vulnerabilities
Children		***Impacts*** ▪ Poor health due to their weak immune systems ***Vulnerabilities*** Physical vulnerabilities
Youth		***Impacts*** ▪ Low living standards due to low income from lack of income generating activities. ▪ Discriminations due to lack of confidentiality in their experience ▪ Prone to climatic conditions since they are responsible for finding food and water in harsh climatic conditions ***Vulnerabilities*** Social, Economic and Environmental vulnerabilities
Elderly		*Impacts* ▪ Poor health due to their weak immune systems ▪ Low productivity ▪ Discrimination due to their ages ***Vulnerabilities*** Social, Economic and Physical vulnerabilities

2.3 Differentiated impacts of climate trends and risks

The Climate Risk profile for Tharaka Nithi County conducted in 2017 indicates that the County is adversely affected by extreme weather events, mostly drought, moisture stress and high temperatures. Increased periods of drought have led to reduction in water level of permanent rivers which has transited to reduced water supply in the County for domestic, livestock and crop production. It is estimated that 80% of the county's population is engaged in agricultural activities.

Further, agricultural production occupies 1,449.6 Km^2 of arable land in the county with approximately 43,799 hectares under food crops and 14,839 hectares under cash crops. Continued adverse climatic conditions have led to food insecurity leading to increased poverty levels and environmental degradation. Not being limited to drought, the county has also experienced quagmires resulting from floods, pests and diseases within the county. All these climatic hazards have heavily impacted the backbone activity of the county, which is agriculture, which has been conspicuous to how Tharaka Nithi residents have led a poor living. The effects of these hazards on the livelihoods of the people of Tharaka Nithi will then translate to a dilapidated economy of the county.

Climate change risks, Hazards, and vulnerabilities in Tharaka Nithi County

Table 4: Climate change risks, hazards, and vulnerabilities in the county

Climate Hazard	Vulnerabilities
Drought & Famine	Shortage of food Malnutrition Closure of schools due to food shortage Early marriages and pregnancies Family disputes and divorces Loss of lives both human and animals Human wildlife conflicts Drying of rivers and wells Stunted crops growth
Floods	Destruction of road infrastructure Destruction of crops i.e., beans, maize, bananas, arrowroots Destruction of bridges Destruction of shelters Drowning causes loss of lives. Soil erosion Emergence of new pests Waterborne diseases
Insects, pests and diseases Army worms Narrow bee fly Locust	Destruction of grass family species Severe skin rush Clearance of vegetation
Hail stones	Destruction of vegetation
Lightning and thunderstorms	Destruction of Vegetation Loss of lives due to lightning strikes
Strong winds	Damage of trees Soil erosion
Land slides	Loss of property Destruction of farms Migrations
Human wildlife conflicts	Destruction of crops Deaths of livestock
Forest fires	Loss of vegetation Loss of wildlife

2.4 Spatial Distribution of Risks

County Hazards Profile

The three agro-ecological zones of the county have different risk levels to climate hazards. The upper zones are more vulnerable to landslides than the lower zones while the lower zones are more vulnerable to drought than the upper zones.

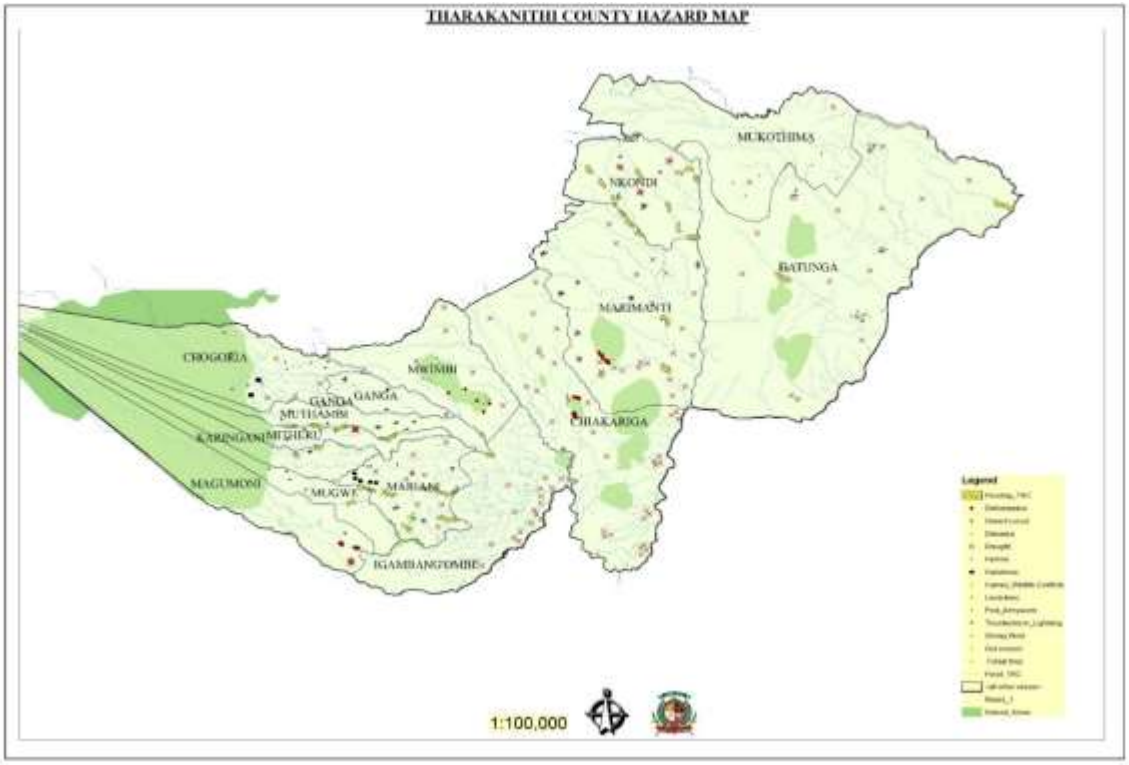


Figure 5: Distribution of Hazards within the County

Hazards Vulnerability in Tharaka Nithi

The three main climate change risks in Tharaka Nithi County are the occurrence of floods, droughts, and pests. The map shows that most parts of the county is faced with the occurrence of either risk.

i. Drought

Drought has been experienced in most parts of the county over time though the rate of prevalence varies across the agro-ecological zones.

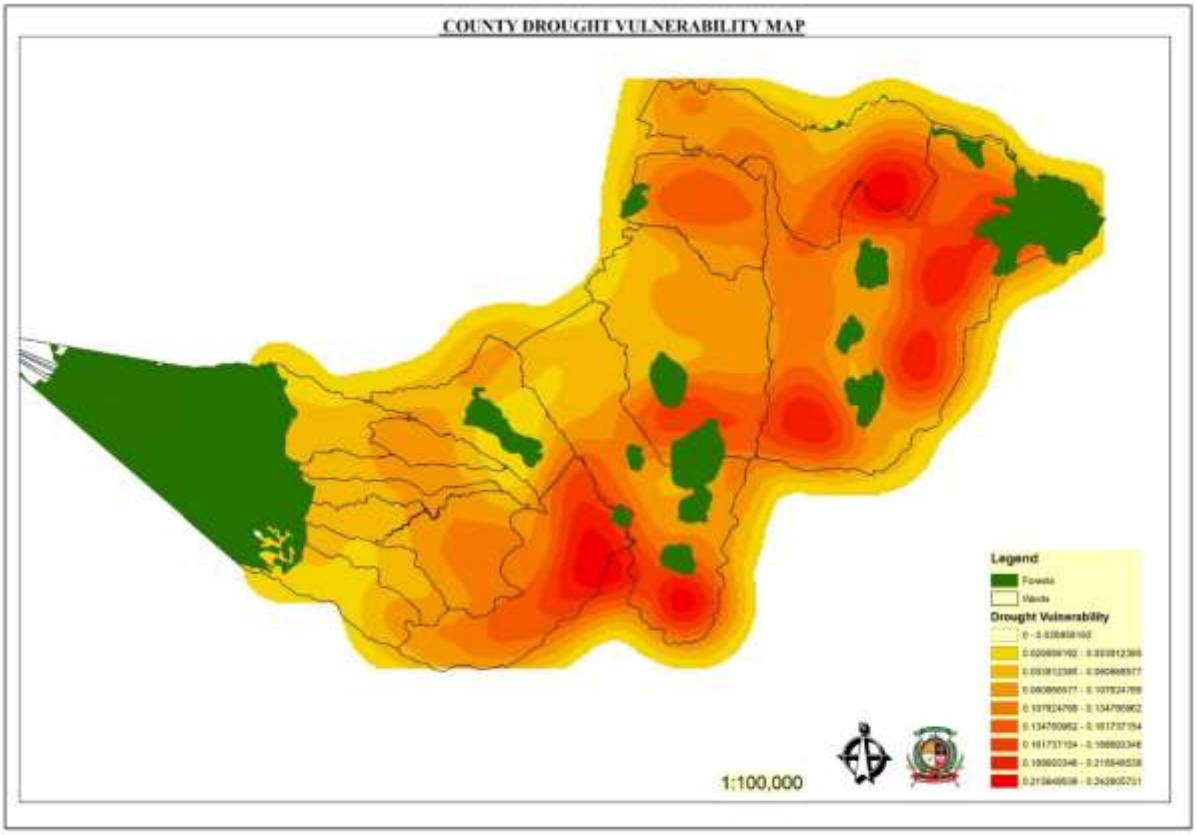


Figure 6: Drought Vulnerability levels in Tharaka Nithi county

The lower zones like Kandondo, Gaceuni, Maragua, Kamanyaki and Kamaindi are more vulnerable to drought that the upper zones of Mugwe and Muthambi

ii. Floods

The upper zones are vulnerable to floods along the river valleys while the lower zones have a risk of riverbank overflow causing floods. The medium zones are less vulnerable to flooding.

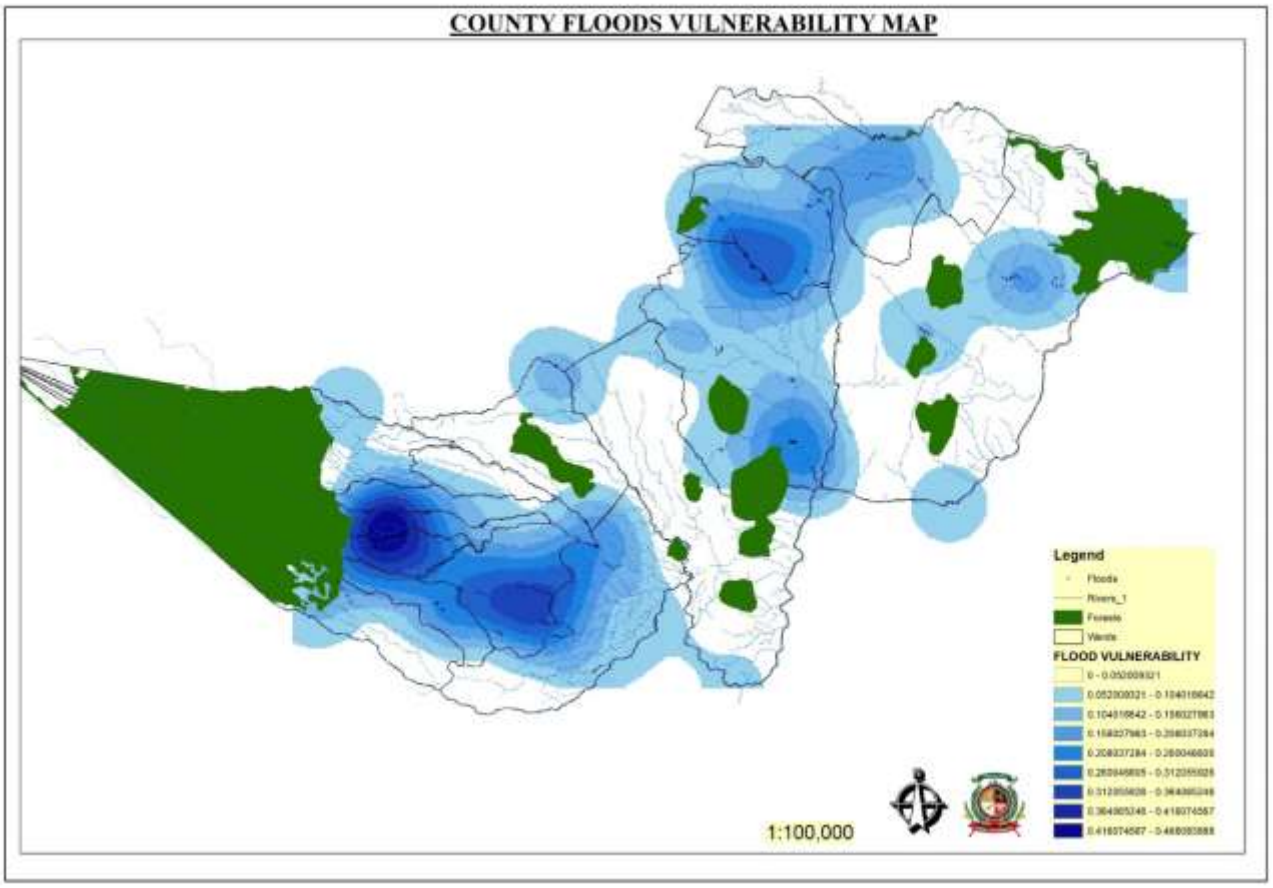


Figure 7: Flood vulnerability assessment in Tharaka Nithi County

In the lower zones, Nkondi, Gatunga, Kandondo are more vulnerable to flooding. In the upper zones the areas like Kibumbu and parts of Kithangani are more vulnerable to flooding

iii. Pest and Diseases

All parts of the county are vulnerable to pests and diseases but vary by type. Our analysis based on vulnerability of the areas to desert locust and armyworm indicates that in lower zones, areas of Kamaguna, Kiamurkima, Gaceuni and Kasarani are vulnerable to desert locust. The upper zones like Kairini, Kaanwa and Magutuni are more vulnerable to pest.

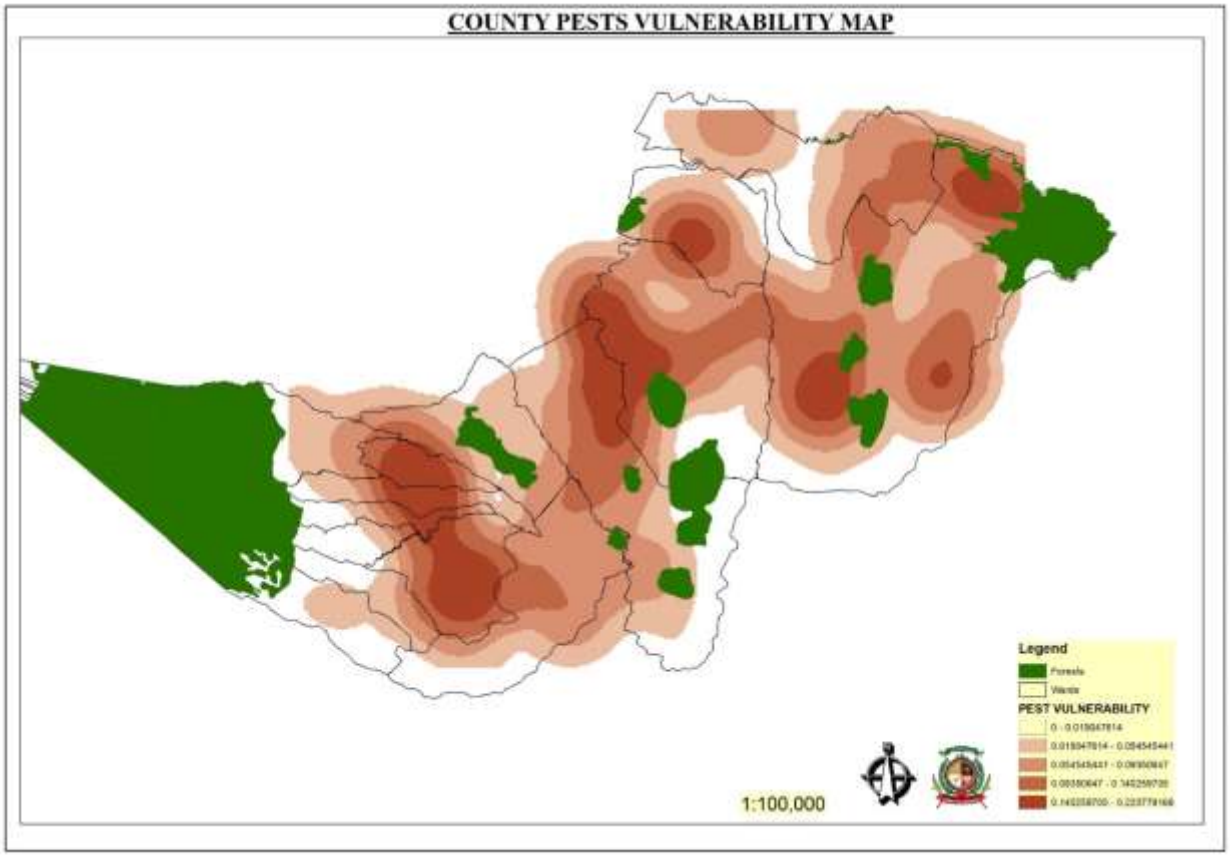


Figure 8: Pest vulnerability in Tharaka Nithi County

3. FUTURE CLIMATE SCENARIOS FOR THE COUNTY

3.1 Introduction

Tharaka Nithi County has a mean annual temperature that range from below 21°C in the west to above 25°Cin the east, this variation being primarily due to an east to west pattern of rising altitude. Similarly, rainfall in the county exhibits a strong east-west gradient of increasing rainfall. Most of the western part of the county receives average rainfall of 1000- 1250 mm annually; a small pocket in Chogoria Forest receives as much as 2200 mm annually. On the other hand, most of the eastern part of the county receives an average of 750-1000 mm annually, except for a small southeastern corridor where rainfall is 500 - 750 mm.

In general, the highland areas in the west have higher, more reliable rainfall and lower temperatures while the lowland areas in the east have lower, less reliable rainfall and higher temperatures. Generally, the month of December receives the highest rainfall, followed by April and October while July receives the least. The observed seasonal rainfall changes in the county has resulted to drought hazards that have caused major negative impacts, intense heavy downpour as resulted to floods While erratic rainfall led to loses in the farm produces.

3.2 Climatic scenarios of Tharaka Nithi County

Climatic future projections (2006-2035) and current (1990-2020) based on two models representative concentration pathways (RCPs10) indicate that under both scenarios' temperatures are expected to increase. Under the business-as-usual emissions scenario, rainfall is expected to increase. However, this will not result in an increase of rainy days. As from current observations seasons are getting shorter with heavy downpour becoming common therefore drought and moisture stress are becoming a concern to the community.

Given the large range of temperature and rainfall in the county, the climatic hazards and risks are similarly broad. They include dry spells and heat stress as well as changes in rainfall patterns and durations along with incidences of flooding.

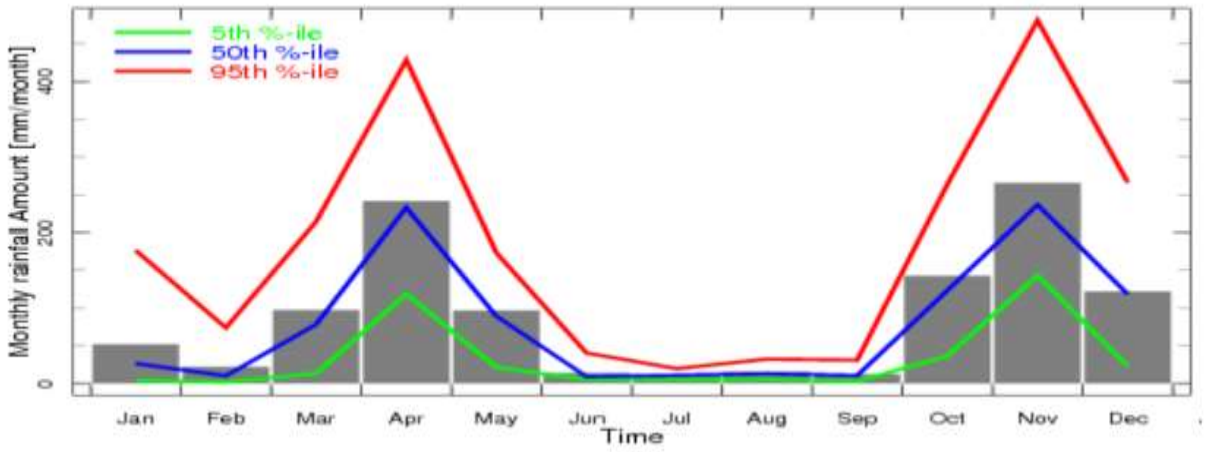


Figure 9 : Mean Rainfall distribution

3.3 Current and Future Rainfall Trends

Current and future trends analysis of rainfall shows increase of variabilities in the rain duration, onsets, amounts and distribution over time it is believed that these changes have impacts on the drought patterns and flooding incidences in the county. Though rainfall trends analysis shows that rain amount will increase over time, rain season duration increase is not guaranteed which is very important for crop growth. See figure below.

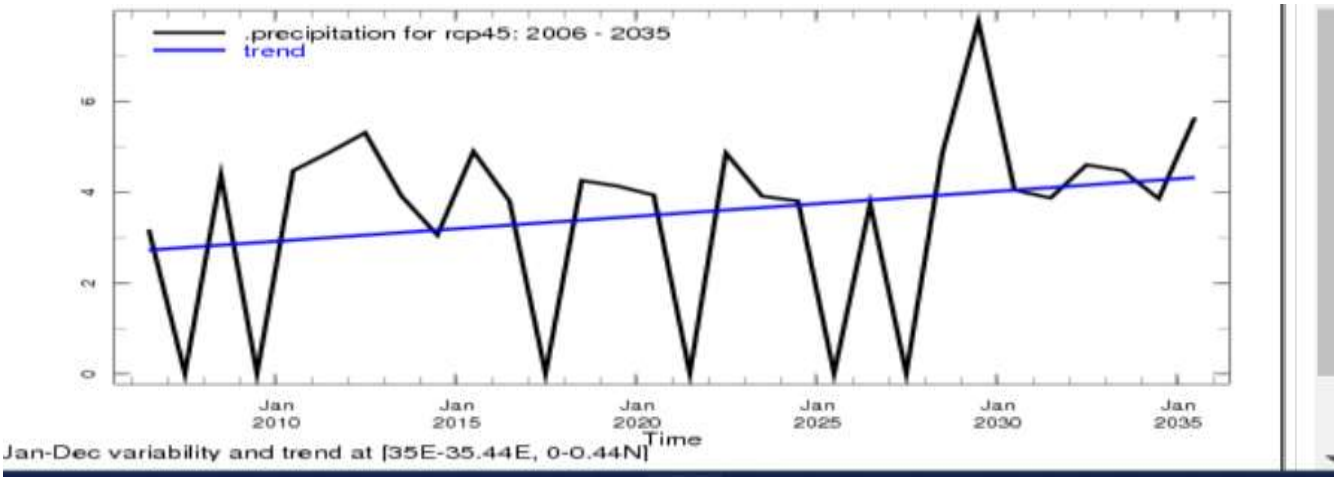


Figure 10: Current and future Rainfall trends

3.4 Current and Future Maximum Temperature Trends

Current and future Maximum temperature analysis shows that maximum is increasing over time. These increases in temperature have resulted in a moderate increase in heat stress. drought cycles and severity and erratic rainfall. With models indicating further increase in maximum temperature in future these hazards will be more common and intense in future. See Figure 11

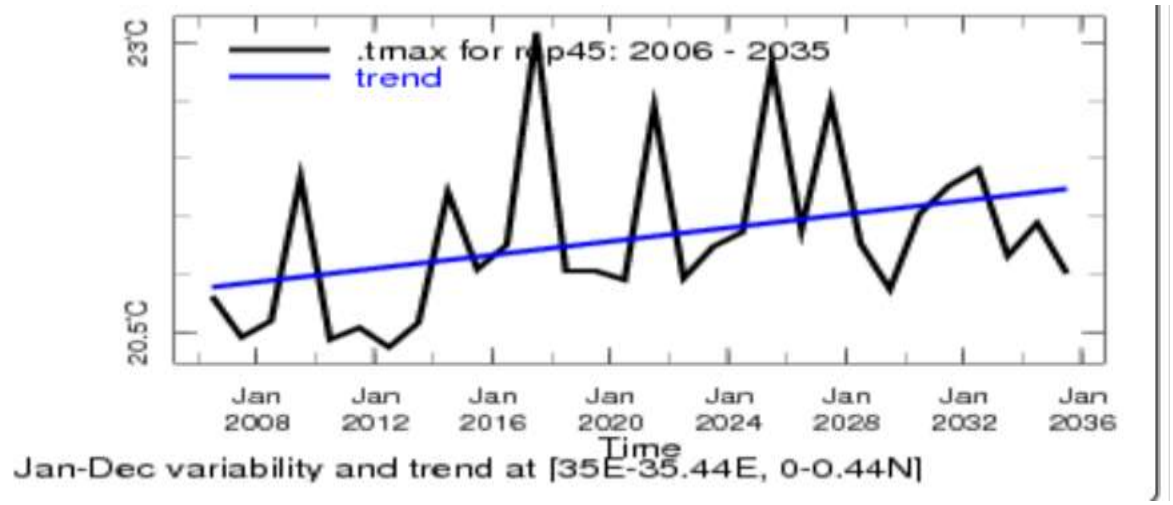


Figure 11: Current and Future Maximum temperature trends for Tharaka Nithi

3.5 Current and Future Minimum Temperature trends

Analysis of minimum temperature shows that they are going up over time this has impacts on the climate by affecting the already dry areas to be more dryer and increase more demand for water on the growing crops and livestock by increasing evapotranspiration and evaporation. In future the demand for water will be more since the projection shows that the minimum temperature will continue raising. This is represented in the following figure.

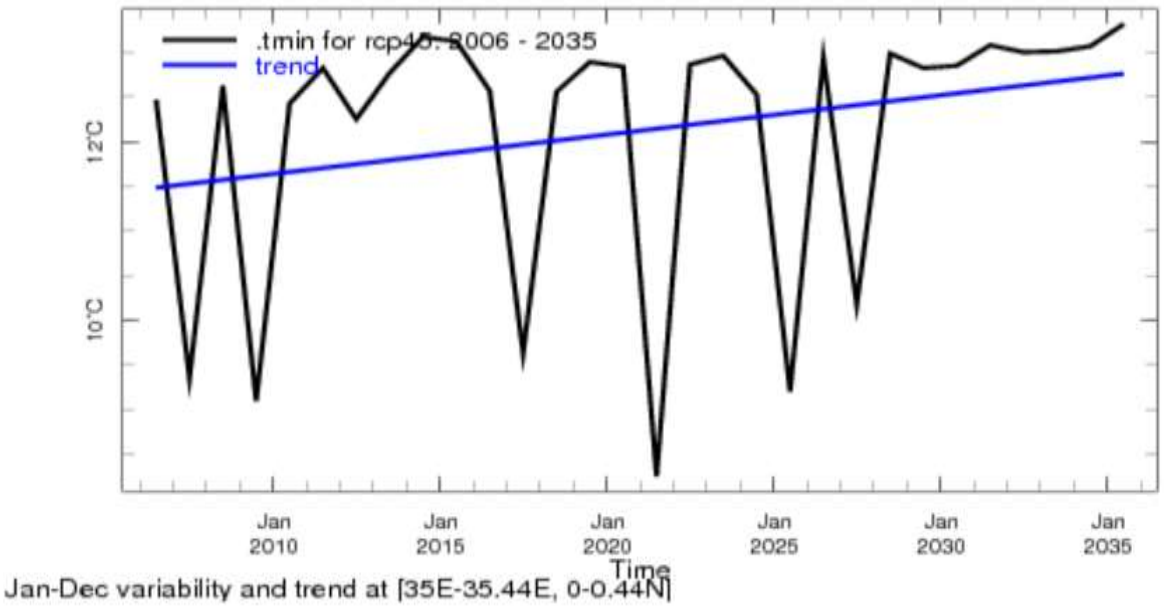


Figure 12: Current and Future minimum temperature trends outlook for Tharaka Nithi

3.1.5 Identification of climate Hazards in Tharaka Nithi

The table below gives a summary of climatic variables, their magnitudes associated with different climatic hazards and risks.

Table 5: Summary of Climate change Risks

Climate Variables		**Climate Hazards**	**Climate Change Risk**
Variable	**Magnitude**		
Rainfall	Short/ Low	Drought	Drought become more common and brutal, outbreak of diseases increases, increasing desertification, Flooding incidence increases
	Extreme	Floods	Flooding incidences increases, Outbreaks of livestock diseases and Destruction of infrastructure
Temperature	Extreme	Erratic Rainfall	Incidences of displaced rainfall will become common, Rain season become irregular and short, Famine become common
	Extreme	Drought	Drought become common and severe, loss of livelihood of the community and increase of wildfires

Table 6: Climate Change Vulnerabilities / impacts

Climate Change Risks	**Vulnerabilities/ Impacts**
Floods	i. Destruction of naturals resources and property ii. Loss of lives. People and animals drown or get swept away by the floodwaters. iii. Damage of homes, businesses, and public infrastructure such as roads and bridges iv. Displacement: people are forced to move from their homes and seek shelter elsewhere. v. Destroys crops, livestock, and farm infrastructure which led to significant economic implications for farmers and their families. vi. Loss of livelihoods, and social disruption especially due to displacement vii. Emergence of new pests i.e., narrow bee flies viii. Waterborne diseases, pets and infections increased (Both for human, crop and livestock)
Drought /Famine	i. Food and water shortage ii. Diseases as results of malnutrition iii. Death from lack of food, water and malnutrition iv. Increased poverty levels v. Loss of natural vegetation vi. Loss of livestock vii. Drying of water sources and vegetation viii. Human-wildlife conflicts that would even results to deaths
Migratory Pests	i. Loss of crops and vegetation ii. Loss of livestock due to lack feeds

Table 6 gives a summary of the different climate change risks and their associated vulnerabilities and impacts.

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

Given the large range of temperature and rainfall in the county, the climatic hazards and risks are similarly broad. They include dry spells and heat stress as well as changes in rainfall dates and duration along with incidences of flooding.

Currently the air surface temperature is above the normal anticipated temperature. From the climate scenarios, the increase in temperatures results to increase in unpredicted rainfall/precipitation patterns which eventually leads to the above hazards, i.e. Drought, Floods and pest and diseases.

Future climatic projections (2006-2035) and current (1990-2020) based on two models Representative Concentration Pathways (RCPs10) indicates that under both scenarios' temperatures are expected to increase. Under the business-as-usual emissions scenario, rainfall is expected to increase.

Table 7: Rainfall aspects and future predictions

Rainfall aspects	**Future predictions**
Rainfall distribution	Poor and uneven
Rainfall onset and cessation	Unpredictable (before or after the due day)
Amount of rainfall	Increase rapidly
Rainfall duration	Reduce.

Increase in the above scenarios, means that the drought will be anticipated to be more severe, the floods will be more damaging than they are, and pest and disease invasion will increase with many more hazards increasing in their severity. Below is a list of the existing strategies adopted by different stakeholders to counter specific climatic hazards that affect different livelihoods/economic systems.

Table 8: Existing climate resilience strategies

Risk/ Hazard	Livelihood/ Economic System	Climate Resilience Strategies	Stakeholder Group Applying the Strategy	Gender and Social Inclusion information
Drought	Agriculture	Provision of weather-related information through Drought susceptibility bulletins	NDMA KSCAP Meteorological department	Ensuring that brochures are distributed to rural to ensure access be even the poor.
Drought	Agriculture	Distribution of drought tolerant seeds	TNCG	Transport at homesteads to access PWD.
Drought	Agriculture	Distribution of farm inputs.	IFAD KCEP-CRAL) KSCAP	Transport to homesteads to enhance access by PWD.
Drought	Agriculture	Training farmers on modern and conservation agriculture	KCEP- CRAL TNCG	Using local language.
Drought	Agriculture	Irrigation agriculture	TNCG	Ensuring there is equality and equity.
Drought	Agriculture	Value chain development	TNCG World bank	Ensuring there is equality and equity.
Drought	Agriculture	Aquaculture promotion	TNCG	Job creation for youths and PWD
Drought	Agriculture	Promotion of post harvesting management practices	TNCG	Ensuring cereals aggregation centres at grassroots.
Drought	Agriculture	Diversification of adaptive enterprises	TNCG	Capacity building youth and women.
Drought	Agriculture	Agroforestry programs	Farmers TNCG	Introduce forestry value chain to attract interests of youth.
Drought	Agriculture	Pest management and control programs	Farmers TNCG	Job creation for youths and PWD
Drought	Agriculture	Integration of information technology to access agricultural extension services	Farmers TNCG	Ensuring that brochures are distributed to rural to ensure access be even the poor.
Drought	Livestock	Distribution of goats program	KSCAP	Transport to homesteads to

				enhance access by PWD.
Drought		Distribution of subsidized pasture seeds	County government	Capacity building youth, PWD and women.
Drought	Livestock	Poultry value chains program	KSCAP	Provide incentives to attract the interest population dependent.
Drought	Livestock	Livestock vaccination programs	KSCAP	Transport to homesteads to enhance access by PWD
Drought	Livestock	Feed and fodder conservation during high supply season	TNCG	Capacity building youth, PWD and women.
Drought	Livestock	Provision of farm residue to livestock as animal feeds	KCEP- CRAL County government	Capacity building youth, PWD and women.
Drought	Livestock	Promotion of aquaculture value chain for diversification of livelihoods	TNCG	Provide incentives to attract the interest population dependent.
Drought	Water	Drilling and equipping boreholes	TNCG	Ensuring water draw system are gender sensitive (with a raised base platform)
Drought	Water	Development of catchment plans	TNCG	Ensuring water draw system are gender sensitive (with a raised base platform)
Drought	Water	Development of climate proofing water infrastructure	KSCAP	Ensuring water draw system are gender sensitive (with a raised base platform)
Drought	Water	Water metering programs		Provide incentives to attract the interest population dependent.
Drought	Water	Construction of check dams	KCEP- CRAL TNCG	Ensuring water draw system are gender sensitive

				(with a raised base platform)
Drought	Water	Construction of rainfall water harvesting structures	KCEP- CRAL TNCG	Ensuring water draw system are gender sensitive (with a raised base platform)
Drought	Water	Construction of rock catchment infrastructures	KCEP- CRAL	Ensuring water draw system are gender sensitive (with a raised base platform)
Drought	Water	Construction of check dams Construction of run- off harvesting structures	TNCG	Capacity building youth, PWD and women.
Drought	Environment	Maintain and restore wetlands	TNCG	Introduce nature based enterprises
Drought	Environment	Preservation of habitats	Community	Capacity building youth, PWD and women.
Drought	Environment	Afforestation programs	Community	Using local language.
Drought	Environment	Development of participatory forest management plans	Community	Using local language.
Drought	Environment	Promote alternative technologies to reduce demand for biomass	TNCG	Provide incentives to attract the interest population dependent.
Drought	Trade and industry	Promotion of value chain development	TNCG	Provide incentives to attract the interest population dependent.
Drought	Trade and industry	Promotion cooperatives	KCEP- CRAL TNCG	Transport to homesteads to enhance access by PWD
Drought	Trade and industry	Provision of seeds aggregation and storage facilities	TNCG	Transport to homesteads to enhance access by PWD
Drought	Trade and industry	Provision of cooling plants and equipment	TNCG	Transport to homesteads to enhance access by PWD
Drought	Trade and industry	Promotion of value chains	TNCG	Ensuring cereals aggregation

				centres at grassroots.
Drought	Trade and industry	Market infrastructure development		Consider AGPO in contracting.
Drought	Trade and industry	Supplementing energy supply such as using solar energy	TNCG	Subsidize the prices.
Floods	Agriculture	Irrigation agriculture	TNCG	Ensuring there is equality and equity.
Floods	Agriculture	Promotion of post harvesting management practices	TNCG	Ensuring cereals aggregation centres at grassroots.
Floods	Agriculture	Diversification of adaptive enterprises	TNCG	Provide incentives to attract the interest population dependent.
Floods	Agriculture	Promotion of agroforestry	TNCG	Introduce forestry value chain to attract interests of youth.
Floods	Agriculture	Installation of soil protection structures such as gabions	TNCG	Introduce mechanization.
Floods	Environment	Afforestation programs	TNCG	Introduce forestry value chain to attract interests of youth.
Floods	Environment	Conservation of wetlands	TNCG	Introduce nature based enterprises
Floods	Environment	Conservation of riparian areas	TNCG	Capacity building youth, PWD and women.
Floods	Water	Development of catchment plans	TNCG	Using local languages
Floods	Water	Construction of check dams	KCEP- CRAL TNCG	Consider AGPO in procurement.
Floods	Water	Construction of run- off water harvesting structures	KCEP- CRAL TNCG	Consider AGPO in procurement.
Floods	Water	Construction of storm water sewers	KCEP- CRAL TNCG	Consider AGPO in procurement.
Floods	Water	Climate proofing water infrastructure	TNCG	Consider AGPO in procurement.
Floods	Water	Enactment of Tharaka Nithi County water Act	TNCG	Provide incentives to attract the interest

				population dependent.
Floods	Trade	Promotion of value chains	KCEP- CRAL TNCG	Provide incentives to attract the interest population dependent.
Floods	Trade	Market infrastructure development	TNCG	Use climbing ramps.
Floods	Trade	Supplementing energy supply such as using solar energy	TNCG	Provide incentives to attract the interest population dependent.
Pest and diseases	agriculture	Emergency locust response project	TNCG	Use local language to capacity build.
Pest and diseases	Agriculture	Pests and diseases control programs	TNCG	Transport to homesteads to enhance access by PWD
Pest and diseases	Livestock	Provision improved animal breeds	TNCG	Transport to homesteads to enhance access by PWD
Pest and diseases	Livestock	Promotion of vaccination programs	TNCG	Transport to homesteads to enhance access by PWD
Pest and diseases	Livestock	Subsidizing of Artificial Insemination (AI) services	TNCG	Transport to homesteads to enhance access by PWD
Pest and diseases	Livestock	Deploying indigenous knowledge and technology in animal treatment	TNCG	Ensuring that brochures are distributed to rural to ensure access be even the poor.

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

Provision of weather-related information and data

Access to weather-related information is key in planning of weather- related activities with direct impact to agriculture and livestock livelihoods as well as planning for natural calamities such as floods. In Tharaka Nithi County such information is shared by the meteorological department and NDMA agency. Droughts and floods pose a huge risk to the people of Tharaka Nithi and as such

sharing timely and accurate weather information would be helpful in management of the risks associated with these disasters. This is because; both of these phenomena can have drastic effects on the county ecosystems, economies, and societies. Their impacts are particularly felt more by women, youth, ethnic minorities and people living with disabilities, who are in most cases dependent on agriculture and livestock keeping sustaining their livelihoods. Currently, sharing of this information has been made through Emails, SMSs and What's app messages targeting few officers and farmers hence increasing inaccessibility to the people. Development of integrated modern climate information system using the right models can be used to provide accurate and timely weather information and data. In addition to Emails and bulletins, other platforms such as a local radio stations, social media, local governance structures (such as Njuri Ncheke) can be integrated in disseminating weather information to the people hence increasing audience.

Provision of farm inputs

Climate change presents a threat to the county's agriculture and livestock related livelihoods. The main economic activity of the people of Tharaka Nithi County is agriculture, which includes both crop and livestock production. Drought adversely affects food security through its impact on crop yields, food prices, and food availability. Dry weather conditions lead to declines in the production of most agricultural and livestock commodities, because of the reduction in suitable areas for cultivation and reduction of fodder and forage caused by temperature increases. Strategies such as provision of certified drought-tolerant seeds, subsidized fertilizers, fodder seeds and agro-chemicals have been previously been used to increase adaptation and resilience to farmers. The distribution of these inputs has been facing challenges related but not related to high capital demand and late distribution hence making them unsustainable. Coupling the above strategies with others such as insuring farmers, formation and strengthening Cooperatives and strengthening relevant value additions would go extra mile in increasing resilience to farmers.

Training farmers on modern and conservation agriculture

One of the strategies is to prioritize sustainable and conservation agriculture practices which enhance food security and preserve the environment. These agricultural practices should be promoted to reduce greenhouse gas emissions, increase crop yields, and strengthen climate resilience. Practices such as conservation tillage, agroforestry, intercropping, and crop diversification can help farmers adapt to climate change and maintain their food security. The above practices can only be achieved by offering enough training to farmers. Currently, most of trainings are done by agricultural extension service officers with less or no background on

renewable energy and climate change. Integrating several components in these trainings would increase production, conserve environment, use renewable energy and diversify livelihoods. Moreover, farmers should also be empowered to adopt new technologies such as drought-resistant seeds, smart irrigation, and precision farming.

Irrigation agriculture

The main economic activity of the people of Tharaka Nithi County is agriculture, which includes both crop and livestock production with an upcoming number involved in aquaculture. An estimated 80 percent cent of the county's population is engaged in agricultural activities while agricultural production occupies 1,449.6 km2 of arable land in the County Approximately 43,799 hectares is under food crops while 14,839 hectares is under cash crops. In contrast, most of farmers in the county rely on rainfall for rain fed agriculture and watering livestock. Government and partners have come hand in hand and in development of several irrigation water project in the county. The main challenge with these water projects has been unsustainability due to drying of rivers, lack of funding and projects' management issues. In many occurrences, the management positions have been occupied by people with little capacity, in term of management and resource mobilization. Measures towards wetlands management, water metering, and discouragement of illegal extraction should be strengthened to improve water availability. In addition, capacity building to project management committees should be strengthened to improve governance and help in resource mobilization.

Integrated Water supply planning and watershed management

Climate change poses a severe threat to water resources, including water supply and watershed management. To adapt to climate change's impact, priority actions are crucial to ensure sustainable water supply and watershed management. The decline in access to quality water in the county is exacerbated by climate change, and its associated droughts. Erratic rains due to climate change have affected water supply, with severe impacts on food production. Many hitherto permanent rivers in Tharaka Nithi County have become seasonal and dry up during the dry season thus impacting the residents negatively.

Government has invested in increasing water storage capacities to cope with extreme climate events. They include construction of earth dams, water pans, rock catchments and drilling of boreholes in order to make use of underground water. As droughts and floods become more frequent, increasing water storage capacities will enable the residents to store water and

supplement their water needs during dry spells. The water collection strategies have found to be appropriate and sustainable for collection of storm water. In addition, Government has also invested in restoring degraded watersheds and wetlands to increase the forests' water retention capacity, which can contribute to reduced pollution, improved water availability and control flooding.

Environmental conservation and afforestation programs

Climate change has over the years caused severe impacts on environment and forests in Tharaka Nithi County. Rising temperatures, extreme weather events, and changes in precipitation patterns have detrimental effects on ecosystems, including biodiversity loss, loss of ecosystem services, damage to wildlife habitats, and increased forest fires. Several forest conservation efforts have been made including protecting forests from deforestation, illegal logging, and other human activities. On the other hand, reforestation strategies involving planting new trees as a part of a long-term conservation plan has been achieved. These actions have helped in restoring the degraded forest ecosystem, rangelands and carbon sequestration. Wetlands restoration, riverine protection, school greening programs, hilltop protection and tree nurseries management have been strategies proved to be productive in this sector. The above strategies need to be strengthened especially improving their allocation.

In order to improve public participation in environmental management, participatory forest management plans (PFMPs) and rivers' management plans have been developed for several mountains, hilltops and rivers. In addition, community forest associations (CFA) have been formed for several gazetted forests. The challenge has been lack of funding to fully operationalize the management plans. Likewise, lack of funding has been adversely affecting the management of CFAs. More PFMPs and management plans need to formed for the remaining forests and rivers.

Promotion of post harvesting management practices and Agricultural value chain development

A broad diversity of agricultural commodities is grown in Tharaka Nithi county. Of these, various value chains have been prioritized as being strategic for the county. The following four major value chain commodities (VCCs) have been promoted: they are poultry, cattle (milk), goat (meat), and green grams.

Local Chicken

The poultry industry in Kenya has, over the years, progressed to become one of the most important livestock enterprises. Local chicken is predominantly found in the rural areas where they play a key role in enhancing household food security. The sector is constrained by low quality of feeds, low productivity, fluctuations in production and demand levels, poor marketing infrastructure, diseases, and inadequate research and development. Local poultry keeping is low-input and often does not require supplemental feeding where the chickens are left to scavenge for food. Chicken-rearing is traditionally considered a women's activity, but provides assets that benefit the whole household. The involvement of women and youth is high at all the four stages of the value chain. The main production systems practiced are free range, semi intensive, and intensive. The semi-intensive and intensive systems are practiced for commercial purposes. The free-range system is practiced everywhere but is most common in Tharaka North and South sub-County. The semi-intensive system is practiced in Meru South sub-County while the intensive system is practiced in Maara sub-County. The free-range system is the most preferred; the chicken produce quality meat and eggs.

The government has been supporting this value chain by providing training to farmers, chicks, chicken feeds, incubators and connecting farmers to the market. Supporting chicken value chain has been productive as the value chain is supporting the whole society including women, youth and people living with disability.

Green grams

Green grams are an important food and commercial crop in semi-arid parts of Tharaka Nithi County. The areas include: Tharaka North, Tharaka South, and Meru South, particularly Igamba Ng'ombe area. Production of green grams was noted to be increasing; largely attributed to market assurance, with an associated increasing trend in adoption of improved varieties particularly NS26 (Nylon) green grams. This variety is mainly used as food by the farming households.

The county government has been supporting this value chain by providing farmers with free certified drought tolerant seeds, and construction of green grams aggregation centres. Supply of free seeds is unstainable and therefore formation of cooperatives can solve the issue of lack of seeds during the planting season.

Cattle (milk)

Many of the stakeholders in the dairy sector in Tharaka Nithi is subsistence and/ or small scale. This sector is bedeviled by several challenges including inadequate feed, prevalence of diseases,

unavailability of quality replacement stock, low adoption of technologies, high cost of farm inputs, and low value addition among dairy producers. Eighty percent of the households in Tharaka Nithi keep dairy cows for food and income, with the livestock department estimating that there are 46,188 dairy cattle in the county which produced approximately 34 million liters of milk in 2016. The main breeds kept include Friesian, Guernsey, and Ayrshire breeds.

The government has been supporting this value chain by purchase of milk coolers, provision of subsidized fodder seeds and provision of subsidized semen. Cattle milk value chain need to be supported fully as it is offering bright future for many farmers. In addition, the value chain has been adopted by all gender including women, youth and people living with disabilities.

Goat (meat)

Goats are versatile and have adaptable feeding habits. They are therefore less affected by weather hazards and climate change; making them important especially given that climate change is expected to be more severe in the pastoral and agro-pastoral production systems in the low rainfall areas. At household level, goats are useful for wealth creation, insurance, trade, as an easy source of cash, and as a recovery strategy after drought. Over 80 percent of the people are engaged in this value chain, with at least every household having a goat. Free range, mixed or semi enclosed (partly free range and partly enclosed) methods and the enclosed method are the major goat production systems practiced in the county. The dominant system is the free-range system mostly happening in Tharaka and Igambang'ombe sub counties. Farmers keep more than 50 goats in over 4 hectares of land.

The proposed goat meat technologies, innovations, and management practices entail having a preferred breed. The main preferred breeds are the Small East African and the Galla goat. Breeding and breed management entail castration. Improved livestock health management practices are necessary in controlling mortality. The government has providing Gala goats to farmers with the objective of improving production and cross breeding with the view of producing a superior breed than the local.

Promotion of trade, industry and cooperative development

The government has been having programs and activities related to promotion of trade, industry and establishment of cooperatives in the county. These include: improvement of road network, improvement of telecommunication network, construction of markets' shelters, issuing soft loans to residents and tax reliefs to business community among others. In addition, many cooperatives

have been established mostly to help in marketing of farm produce. The above strategies proof effective to current climate risks by providing capital, providing favorable environment for trade, cushion traders against losses and increase transaction efficiency. Moreover, cooperatives help farmers in marketing of produce. This minimizes post harvesting losses. More financial allocation is needed to develop the necessary infrastructural structures, offer loans and tax reliefs for proper development of agri-business in the county.

Pest and diseases control and surveillance programs

Crops and livestock have become more vulnerable to pest attacks and diseases; leading to reduced crop yields, poor quality produce, and sometimes total crop failure. Varied production also presents a challenge for marketing. The desert locust is the most dangerous migratory pest in the world. It is a voracious eater and highly mobile when travelling in swarms, trait that make it formidable threat to livelihoods and food security. The county government of Tharaka Nithi has conducting programs aimed at control of pests and diseases such as vaccination programs, promotion of artificial insemination (AI), provision of certified seeds, provision of improved animal breeds, deployment of indigenous knowledge and technology in animal treatment among others. These strategies are effective and therefore should be enhanced.

4.2 Effectiveness of Adaptation/Resilience Strategies to Future Climate Risks

It is important to note that most of the adaptation strategies to counter different climatic hazards in respect to different livelihoods are effective or otherwise as summarized in the following tables.

DROUGHT

Crop Production sub sector

Table 9: Drought Adaptation strategies to future climate risks in Crop production sub sector

Sn. No.	Strategy	Analysis (Effectiveness)	Improvement actions
1	Provision of weather-related information through Drought susceptibility bulletins.	Information derived from indicators and indices is useful in planning and designing applications. Since the hazard is predicted to be more severe, this strategy will be effective if well implemented and sustained to keep farmers and stakeholder informed.	It's an effective strategy even in future.
2	Distribution of drought tolerant seeds.	Some of these seeds have been conventionally bred to be more tolerant to low water levels and can comfortably grow with minimal rainfall amount. The hazard is predicted to be even worse, but the seeds are bred to adapt to the current hazard state.	Its an effective strategy even in future.

		To be more effective, there is a need to have a continuous improving of breeds annually as per the hazard change.	
3	Distribution of farm inputs.	Distribution of farm inputs is mainly done by government or its agencies. The supply is mainly done by the common mode of transport, roads and water. The strategy might have some shortcomings since sometimes the load of distributing tones of inputs within a short time may overwhelm the system. For this to be more effective, including Public Private Partnership in both distribution and procurement can curb the gap.	Its an effective strategy even in future.
4	Training farmers on modern and conservation agriculture and integration of information technology to access agricultural extension services.	These trainings improve farmers' skills and knowledge, for the worsening drought prediction, in areas such as planting techniques, irrigation, pesticides, crop rotation, and crop storage after harvest. These skills enable farmers to improve yields, protect their crops against weather-related shocks, and smooth their incomes year-round. If the strategy will be sustained will be effective.	Its an effective strategy even in future.
5	Value chain development and diversification of adaptive enterprises	Describes the full range of activities that are required to bring a product or service from conception, through the intermediary phases of production and delivery to final consumers, and final disposal after use. This includes activities such as design, production, marketing, distribution, and support services, up to the final consumer. Activities constituting a value chain are often divided among several businesses, though they may sometimes be contained within a single, large business, in which it's an effective strategy even in future.	Its an effective strategy even in future.
6	Promotion of post harvesting management practices	This is a solution to food security and poverty. Enhances potential for exporting traditional crops. Improves and increases a farmer's chances of making profits. Since the strategy is designed to curb the current risk which leads to its limitations. For it to be effective, the promotion should be diversified.	Improving them annually as per the climate trends

Livestock sub sector

Table 10: Drought Adaptation strategies to future climate risks in Livestock sub sector

SNo.	Strategy	Analysis (Effectiveness)	Improvement actions
1	Distribution of goat program and subsidized pasture seeds	Distribution of drought resistance goat breeds and subsidized pasture seeds on commercial farms in different areas helps	It's an effective strategy even in future.

		farmers have their livelihoods even with droughts. The method in future will be effective if the breed keeps on being improved.	
2	Poultry and aquaculture value chains program for diversification of livelihoods.	Poultry value chains link the actors and activities involved in delivering poultry and poultry products to the final consumer, with products increasing in value at every stage. Shortening the chain makes it easier to earn the livelihood even during the drought.	It's an effective strategy even in future.
3	Feed and fodder conservation during high supply season and provision of farm residue to livestock as animal feeds.	Since the rainfall has become unpredictable and its being predicted to be more unpredictable even in future, when there is surplus fodder and feeds storage is done to ensure the is feeds during drought. Thus, the method is effective even in future. And also using crops residue as livestock feeds and storing them in large amount to be used during the drought.	Its an effective strategy even in future.

Water sector

Table 11: Drought Adaptation strategies to future climate risks in water sector

SNo.	Strategy	Analysis (Effectiveness)	Improvement actions
1	Drilling and equipping boreholes	Drilling of more boreholes helps to make people more resilient to droughts. This strategy is effective even for future climate risk adaption.	It's an effective strategy even in future.
2	Development of catchment plans	Catchment management is an environmentally friendly and potentially low-carbon impact method of influencing raw water quality at its source by managing land use practices on a catchment scale.	It's an effective strategy even in future.
3	Development of climate proofing water infrastructure	It is a strategy in which all water projects are ensured that they are all climate friendly. Like the dams which spill water can be reconstructed to hold more water to	It is an effective strategy for future climate risk adaption.

		be used during drought. It is an effective strategy to adapt to future droughts.	
4	Water metering programs	It is a policy that will encourage efficiency use of water. It will minimize water wastage and collect revenue for maintenance of the system	It is an effective strategy for future climate risk adaption.
5	Construction of rainfall water harvesting structures (check dams, rock catchments and gutter harvesters)	About 80% of the rainfall goes as run-off without being barred anywhere. If stored and impounded, it can be used during drought spell.	To make the strategy more effective, more rainfall water harvesting structures can be constructed

Environment sub sector

Table 12: Drought Adaptation strategies to future climate risks in Environment sub sector

SNo.	Strategy	Analysis (Effectiveness)	Improvement actions
1	Maintaining and restore wetlands and preservation of habitats.	Wetlands are habitats for plants and animals. Wetlands are valuable for flood protection, water quality improvement, erosion control, natural products, recreation, and aesthetics. The strategy is effective even in future.	The strategy is effective even in future.
2	Afforestation programs	Promoting afforestation increases the area for carbon sink, thus it is a good mitigation strategy.	The strategy is effective even in future.
3	Development of participatory forest management plans	This is capacity building stakeholders and community in general to equip them with knowledge of forest management to ensure no more forest eradication. The strategy needs to be considered and maintained since it is effective.	The strategy is effective even in future.
4	Promote alternative technologies to reduce demand for biomass.	Promote alternative technologies to reduce demand for biomass strategy is effective.	The strategy is effective even in future.

Trade and industry Sub sector

Table 13: Drought Adaptation strategies to future climate risks in Trade and Industry sub sector

SNo.	Strategy	Analysis (Effectiveness)	Improvement actions
1	Promotion of value chain development	Not effective – In future the method will not be effective if drought increases.	Advancing the chain at the production level.
2	Promotion of cooperatives	Effective	Improving them annually as per the climate trends
3	Provision of seeds aggregation and storage facilities	Effective	The strategy is effective even in future.

PEST AND DISEASES

Crop Production sub sector

Table 14: Pests and diseases Adaptation strategies to future climate risks in crop production sub sector

SNo.	Strategy	Analysis (Effectiveness)	Improvement actions
1	Emergency locust response project	The project that helps farmers recover from destruction of crops invaded by locust is an effective strategy especially children.	Its an effective strategy even in future.
2	Pests and diseases control programs	Integrated chemical and traditional pest and disease control is an effective strategy to adapt to drought.	Its an effective strategy even in future.

Livestock sub sector

Table 15: Pests and diseases Adaptation strategies to future climate risks in Livestock sub sector

SNo.	Strategy	Analysis (Effectiveness)	Improvement actions
1	Provision improved animal breeds	It is an effective strategy where animal breeds that are resistance to diseases are bred.	Its an effective strategy even in future.
2	Promotion of vaccination programs	This strategy is to minimize deaths of livestock due to diseases that are caused by excessive floods.	Its an effective strategy even in future.
3	Subsidizing of Artificial	The strategy may not be effective since the process needs traveling to the subject which is inhibited by excessive floods	It is not effective.

	Insemination (AI) services		
4	Deploying indigenous knowledge and technology in animal treatment	It is an effective strategy since the farmers will learn to rely on themselves rather than travelling a lot where floods may hinder them.	Its an effective strategy even in future.

FLOODS

Crop production sub sector

Table 16: Floods Adaptation strategies to future climate risks in Crop production sub sector

SNo.	Strategy	Analysis (Effectiveness)	Improvement actions
1	Promotion of post harvesting management practices.	Huge storage facilities will help store foods that will be used during floods, whereby Women and PWD can access it easily.	Its effective
2	Diversification of adaptive enterprises.	Shifting to a farming practice as per the flood status is an effective strategy.	Its effective
3	Installation of soil protection structures such as gabions.	Installing gabions ensures during floods the farmland remain intact eradicating danger to PWD.	Its effective
4	Promotion of agroforestry	Integrating crops and forests together enhances water absorption during floods creating room for men to comfortably work on farms.	Needs to be adverse.
5	Irrigation agriculture	Furrow irrigation helps in sustaining water in fields as it awaits percolation to soils even when floods increase. In which women can comfortably work on farms.	Its effective

Environment sub sector

Table 17: Floods Adaptation strategies to future climate risks in Environment sub sector

SNo.	Strategy	Analysis (Effectiveness)	Improvement actions
1	Afforestation programs.	Promoting afforestation increases the area for carbon sink, thus it is a good mitigation strategy.	It's an effective strategy.
2	Conservation of wetlands	Wetlands are habitats for plants and animals. Wetlands are valuable for flood protection, water quality improvement, erosion control.	Its effective

3	Development of catchment plans	Catchment management is an environmentally friendly and potentially low-carbon impact method of influencing raw water quality at its source by managing land use practices on a catchment scale.	It's an effective strategy even in future.

Water sub sector

Table 18: Floods Adaptation strategies to future climate risks in Water sub sector

SNo.	Strategy	Analysis (Effectiveness)	Improvement actions
1	Construction of check dams.	The check dams are impounds that reduce the speed of water and amount of water flowing on surface which make less severe to children and PWD.	Need to be added in number.
2	Development of catchment plans	Catchment management is an environmentally friendly and potentially low-carbon impact method of influencing raw water quality at its source by managing land use practices on a catchment scale.	It's an effective strategy even in future
3	Climate proofing water infrastructure	It is a strategy in which all water projects are ensured that they are all climate friendly. Like the dams which spill water can be reconstructed to hold more water to be used during floods and ensure no excessive flow giving time to PWD to escape.	It's an effective strategy even in future
4	Enactment of Tharaka Nithi County water Act	The act will ensure water usage is monitored and areas that need to govern noted. It will cut across equal use of water to all even PWD.	It's an effective strategy even in future
5	Construction of storm water sewers	Sufficient and efficient flush floods drainage system will ensuring that water is drained the moment it lands on surface paving way for schools.	It's an effective strategy even in future

Trade And Industry sub sector

Table 19: Floods Adaptation strategies to future climate risks in Trade and industry sub sector

SNo.	Strategy	Analysis (Effectiveness)	Improvement actions
1	Promotion of value chains	The chain is limited to increase in floods.	Innovate a new strategy

2	Market infrastructure development	Storied market structure ensures that market runs even with floods	It's an effective strategy even in future
3	Supplementing energy supply such as using solar energy	Incase power breaks due to floods demolishing powerlines, solar energy effectively ensures the activity of processing and manufacturing proceeds	It's an effective strategy even in future

5. THARAKA NITHI COUNTY CLIMATE STRATEGIC ADAPTATION INVESTMENT/ACTION PRIORITIES

Tharaka Nithi County is vulnerable to the impacts of climate change in all sectors and livelihood zones. This assessment has identified vulnerabilities in the considered sectors of agriculture, livestock, social and enablers, water, and health. This assessment identified adaptation options that should be considered as a response to the identified vulnerabilities in the previous sections. In response to the vulnerabilities mentioned above, this assessment identified the following as adaptation options in broad categories as enumerated below in each priority area:

Table 20: Strategic priority actions

Drought	**Floods**	**Water**
▪ Social protection to vulnerable groups. ▪ Drought early warning systems ▪ Climate information services ▪ Water harvesting and storage. ▪ County emergency fund ▪ Improve the coordination of disaster risk management, including of floods, droughts, disease outbreaks, landslides, and other disasters by enacting and implementing a county *Disaster Risk management policy and Act.* ▪ Staff training and capacity building	▪ Establishment of early warning systems ▪ Protection of riparian areas along rivers ▪ Strategic placement of dams /dykes Drainage systems for storm waters / storm water harvesting ▪ Flood early warning systems ▪ Water and flood control, including dikes, drainage systems, and water storage. ▪ Design and implementation of integrated flood management plans for water storage, drainage networks reforestation and rehabilitation of riparian areas ▪ construction of dams ▪ Land use restriction ▪ Capacity development of communities ▪ Improve the coordination of disaster risk management, including of floods, droughts, disease outbreaks, landslides, and other disasters by enacting and implementing a county Disaster Risk management policy and Act	▪ Water harvesting ▪ Water storage ▪ Development and implementation of sub catchment plans ▪ Climate proofing water infrastructure ▪ Flood control (storm water and check dams) ▪ Water metering ▪ Inspection to ensure water quality. ▪ Implementation of the national and county water ACTs ▪ Water sector governance reforms ▪ Dams, boreholes, and water pans ▪ Protection of springs and water catchment areas ▪ Water treatment ▪ Capture of water run-off on roads ▪ Management of ground waters
Food Security and crops	**Livestock and fisheries**	**Forestry, Wildlife and Tourism**
▪ Irrigated agriculture ▪ Efficient irrigation systems ▪ Household Water harvesting ▪ Value chain promotion and development	▪ Improved dairy management ▪ Increasing aquaculture production ▪ Fish farming and harvesting	▪ Land afforestation ▪ Tree planting -county greening program ▪ Seedling production ▪ Forest management and planning ▪ Promoting agro forestry

▪ Promotion of Climate smart agriculture ▪ Post harvest management ▪ Construction of cereal stores ▪ Promotion of drought resistant and early maturing crops ▪ Subsidies for appropriate farm inputs ▪ Sustainable land management practices promoted. ▪ Disease and pest control ▪ Diversify adaptive enterprises. ▪ Crop insurance ▪ Climate information services accessed by farmers. ▪ Farm forestry /Agroforestry ▪ Improved agricultural extension services. ▪ Soil and water conservation		▪ Sustainable timber production ▪ GIS, computer tagging and tracking system adopted and used.
Ecosystem Degradation	**Energy and Transport**	**Manufacturing**
▪ Restoration of water catchment Areas ▪ Soil conservation and control of ▪ erosion (terracing, gabions) ▪ Promote the conservation of natural resources. ▪ Protection of wetlands ▪ Rehabilitation of degraded rivers	▪ Renewable/ green energy (wind, solar, biogas, briquettes) ▪ Promotion of briquettes and efficient cookstoves	▪ Regulations and laws on charcoal production Promotion of the briquetting industry
Health and sanitation	**Climate Monitoring and Information**	
▪ Vaccination /immunization campaigns ▪ Disease surveillance and reporting ▪ Malaria prevention ▪ Promotion family planning ▪ Waste to energy Proper waste management, including recycling	▪ Establish a climate Monitoring infrastructure	

6. CONCLUSION

Climate change is an urgent and pressing issue that poses significant risks to the environment, ecosystems, and human societies around the world. The impacts of climate change are already being observed and are expected to worsen if appropriate actions are not taken. However, there are remedies and solutions available to mitigate and adapt to climate change.

With the adverse effects being felt in Tharaka Nithi County, the county will embark on mitigation measures expected to reduce greenhouse gas emissions which is crucial in limiting the severity of climate change. This will be achieved through transitioning to clean and renewable energy sources, improving energy efficiency, promoting sustainable transportation, and adopting eco-friendly practices in industries.

The County efforts will also focus on adaptation measures in order to minimize the impacts on communities and ecosystems. This will involve implementing measures such as building resilient infrastructure, improving water management, developing climate information systems and early warning systems for extreme weather events.

Climate change being a global menace, it requires international cooperation which will involve collaboration with the aim to unite efforts to combat climate change and limit global warming. Tharaka Nithi County will also ensure sustainable land use and conservation which will involve protecting and restoring forests, wetlands, and other ecosystems to help absorb carbon dioxide and preserve biodiversity, while sustainable agriculture practices can reduce emissions and enhance resilience.

The county will also continue embracing public awareness and education about climate change and its impacts which is crucial for fostering public support and encouraging individuals to take action. Education plays a vital role in promoting sustainable practices and empowering communities to adapt to the changing climate.

It is important to note that addressing climate change requires a multi-faceted approach involving governments, businesses, communities, and individuals. Efforts must be made at all levels to reduce greenhouse gas emissions, adapt to changing conditions, and build a sustainable future for generations to come. By taking collective action and implementing effective solutions, we can mitigate the impacts of climate change and create a more resilient and sustainable world.

ANNEXES

MAARA CONSTITUENCY COMMUNITY ENGAGEMENT

CHUKA IGAMBANGOMBE CONSTITUENCY COMMUNITY ENGAGEMENT

THARAKA CONSTITUENCY COMMUNITY ENGAGEMENT