COUNTY GOVERNMENT OF NYANDARUA

PARTICIPATORY CLIMATE RISK ASSESSMENT REPORT

MAY 2023

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PARTICIPATORY CLIMATE RISK

ASSESSMENT REPORT, 2023

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

BEI	Baseline Emissions Inventory
CDD	Community-Driven Development
CFA	Community Forest Association
CIDP	County Integrated Development Plan
CIP	Climate Information Platform
CoM SSA	Covenant of Mayors in Sub-Saharan Africa
CSA	Climate Smart Agriculture
CSAG	Climate Systems Analysis Group
DRM	Disaster Risk Management
EC	European Commission
EU	European Union
GCF	Green Climate Fund
GCoM	Global Covenant of Mayors for Climate & Energy
GHG	Greenhouse Gases
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HHS	Household Survey
ICLEI	Africa ICLEI-Local Governments for Sustainability
IPCC	Intergovernmental Panel on Climate Change
JRC	Joint Research Centre of the European Union
KIHBS	Kenya Integrated Household Budget Survey
KMD	Kenya Meteorological Department
KNBS	Kenya National Bureau of Statistics
MTP	Medium Term Plan
NAP	National Adaptation Plan
NCCAP	National Climate Change Action Plan
NDC	Nationally Determined Contribution
RVA	Risk and Vulnerability Assessment
SCODE	Sustainable Community Development Services
SDGs	Sustainable Development Goals
SEACAP	Sustainable Energy Access and Climate Action Plan

H. E. Hon. (Dr.) Kiarie Badilisha

Governor, Nyandarua County

FOREWORD

In recent years, Nyandarua County has witnessed many negative impacts of climate change. Indeed, most sectors of Nyandarua County economy including water, agriculture, livestock production, fisheries, tourism, transport, manufacturing and energy are affected. The County has experienced extensive destruction of infrastructure including roads and buildings due to floods in various parts. Droughts and famine affecting communities particularly in the county's semi-arid areas have become more frequent. Frequent prolonged droughts coupled with unpredictable rainfall patterns have affected agricultural and livestock production negatively thus affecting the livelihoods of the majority of the people. Climate change has also led to reduced water availability leading to many residents of the county relying on poor quality water resulting in increased health issues associated with poor sanitation. The situation is worsened by increasing environmental degradation due to deforestation and pollution.

Vulnerability is the degree to which a human or natural system is susceptible to, or unable to cope with adverse effects of climate change. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity. Nyandarua County is, therefore, vulnerable to climate change impacts and it is important to assess the level at which various sectors and population groups in different areas of the county are vulnerable to the impacts of climate change. This will aid in designing an ambitious climate change adaptation strategy. Informed by this, the County government embarked on a process to develop a County Participatory Climate Risk Assessment Report.

In the spirit of locally led climate action, this Participatory Climate Risk Assessment Report was developed through a participatory process involving various stakeholders drawn from all sectors ranging from farmers, women, youth, people living with disability, minority groups, FBOs, CBOs, experts and technocrats among others at the ward level.

Lastly, I sincerely thank all the stakeholders that worked tirelessly to develop this report.

H. E. DR. KIARIE BADILISHA
GOVERNOR, NYANDARUA COUNTY

H.E. Hon. Mathaara Mwangi

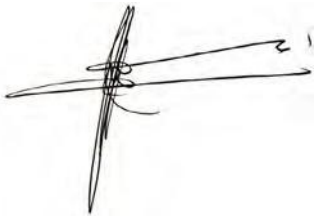
The Deputy Governor, Nyandarua County

ACKNOWLEDGEMENT

This Participatory Climate Risk Assessment Report is a product of Nyandarua County Government efforts to assess climate change hazards, risks and impacts to aid in planning of locally led climate actions. This report comes at the end of a process that involved various people. To that end, special appreciation goes to all Nyandarua County residents from all the 25 wards who provided the crucial information to develop this document. We appreciate the Covenant of Mayors in Sub-Saharan Africa (CoM SSA) Technical Helpdesk for technical support in training the technical committee.

Much Gratitude goes to the Department of Water, Environment, Climate Change and Natural Resources led by the County Executive Committee Member Mr. Samuel W. Mugo and the Chief Officer M/s. Njeri Njoroge. In particular, the County Directorate of Climate Change headed by Director Mwanzia Kyambia and Climate Change officers Kevin Guandaru and Josphat N. Karanja who were instrumental in the delivery of this report.

Our appreciation goes to the World Bank Funded FLLoCA program, particularly the Program Implementation Unit (PIU) for facilitation, coordination and technical support in developing this report.



H.E. Mathaara Mwangi
The Deputy Governor & Chairperson County Climate Change Steering Committee
NYANDARUA COUNTY

EXECUTIVE SUMMARY

The impacts of climate change have been and continue to be experienced in Kenya. The country has been ravaged by extreme climatic events such as droughts and floods that have damaged both property and livelihoods. Thus, climate change presents a threat to the achievement of Kenya's national goals, aspirations, and development priorities. This assessment was conducted to: Identify the climate change risks, hazards and vulnerabilities in Nyandarua County; establish the probability and impact of climatic hazards currently and in the future in the County; identify the vulnerable and marginalized groups to climate change impacts in the county; identify the vulnerable sectors to climate change in the County and identify their respective adaptive capacities and develop a climate change vulnerability and risk maps of the County. This is in line with international and national policies on climate change action that recognize the role of climate change risk and vulnerability assessments in enhancing a targeted approach to tackling climate change. For instance, the Paris Agreement calls for the development of relevant plans and policies including the assessment of climate change impacts and vulnerability with a view to formulating nationally determined prioritized actions. 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 to enhance climate resilience and adaptive capacity.

Nyandarua County faces various climate change risks, this assessment identified droughts, disease, floods, frost and strong winds as some of the climate change risks in the County. These risks are occasioned by the occurrence of climatic hazards such as drought and floods as a result of either low or extreme precipitation, respectively. A combination of the climatic hazards and the risks eventually contribute to vulnerabilities to climate change such as: Decreased productivity; emergence of aggressive and invasive insects and pets; food scarcity; loss of income; loss of livelihoods; and loss of lives. These vulnerabilities basically affect people's livelihoods and the ability or inability to cope with impacts.

CHAPTER ONE

1.0 Context of Nyandarua County Participatory Climate Risk Assessment Report (PCRA)

1.1 Background Information

Climate Change is having adverse impacts on Kenya's economic development and threatens the realization of the Country's blueprint goal of Vision 2030. Nyandarua County is not an exceptional having being amongst the frontline Counties affected by the impacts of Climate Change being an agricultural County.

This among many other negative impacts called the County into advancing issues of Climate Change Mitigation and adaptation. Identifying that the National Government through the National Treasury is implementing the Financing Locally Led Climate Change Action, the County embarked on the preparedness of the outlined set conditions.

The Nyandarua County Climate Change Act 2021 allows the county to further develop climate support policies Participatory Climate Risk and Vulnerability Assessment Report being one of them. It will gear to the development of the Nyandarua County Climate Change Action Plan 2023-2027.

Through the Ward Climate Change Planning Committees that were elected through a participatory process, the CCU organized for a conclusive and participatory PCRA process to collect data on the climate risks the communities are facing and their adaptive capacities. The Nyandarua Climate Change Act 2021 provides for the county to allocate at least 2% of the total county development budget to matters building resilience to the county.

1.1.2 County Context

Nyandarua County has an area of approximately 3304km^2; subsequently there are five sub-counties namely Kinangop, Kipipiri, Ol' Kalou, Ol' Joro Orok and Ndaragwa and there are 25 wards. In 2019, Nyandaura had a population of 638,289 persons, a population density of 194.3 individuals per km2 and an annual change of 0.68% (Kenya National Bureau of Statistics (KNMS), 2019). By 2026, the population in Nyandarua is predicted to grow to over 1 million people, with approximately 1000 additional households every year (Cities Alliance, 2020).

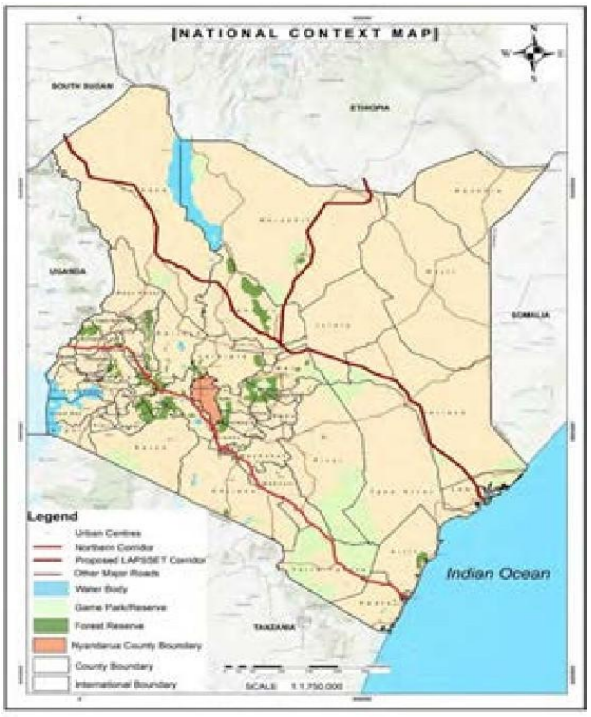
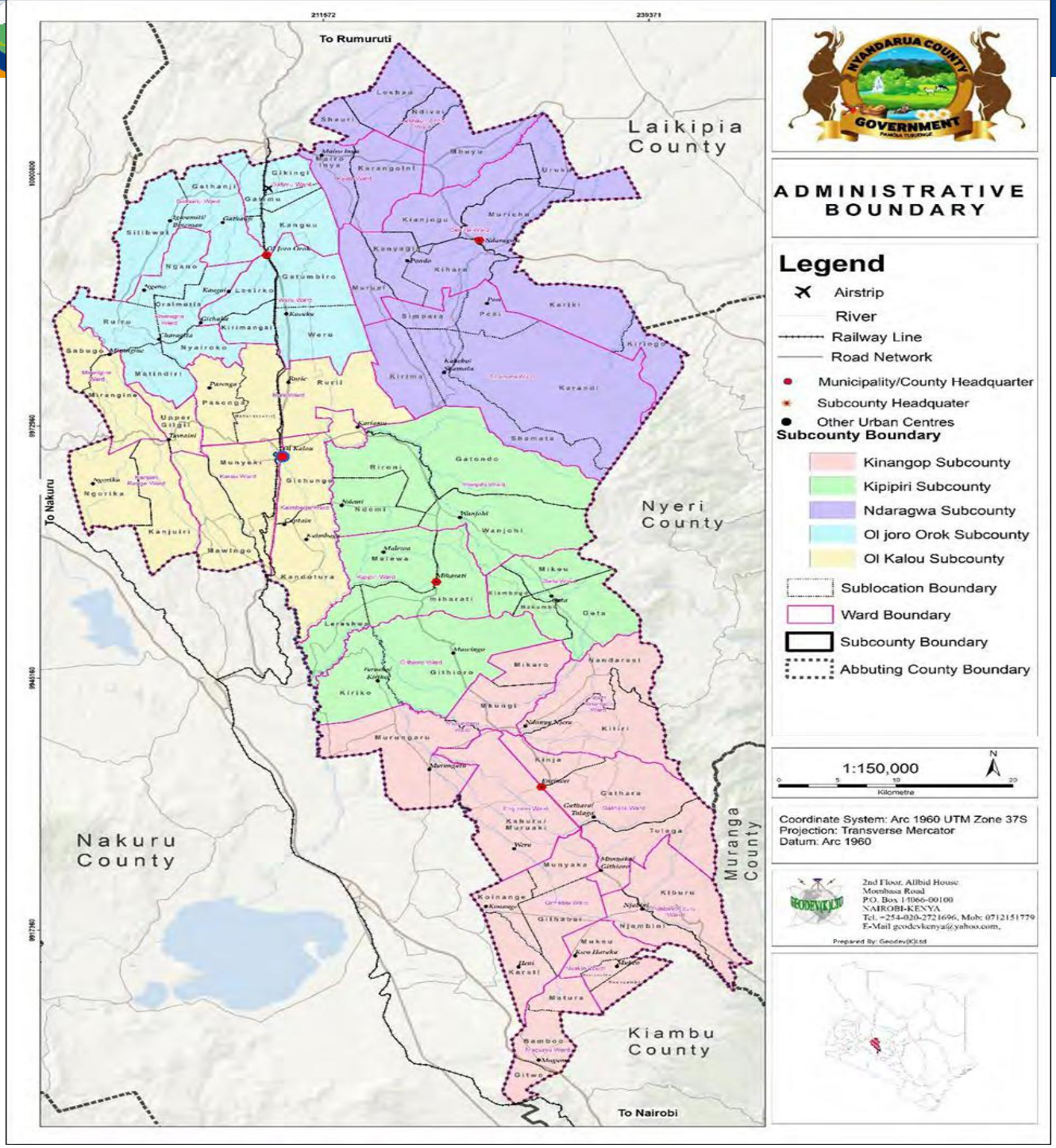


Fig. 1: Map of Nyandarua County, Kenya

The county experiences relatively cool (temperate) climate with temperatures ranging below 15°C annually. The eastern edge of the county receives rather high rainfall above 1250 mm per year while along the eastern to northern edge of the county receives rainfall below 750 mm per year. First wet season runs from



March to June and is 25% wetter and 1-2°C warmer than the second and shorter season which runs mainly from October to December. The county is 2667.11 meters above sea level. Lake Ol Bolossat is a major protected lake in the county.

Fig. 2: Local Administrative Map of Nyandarua County

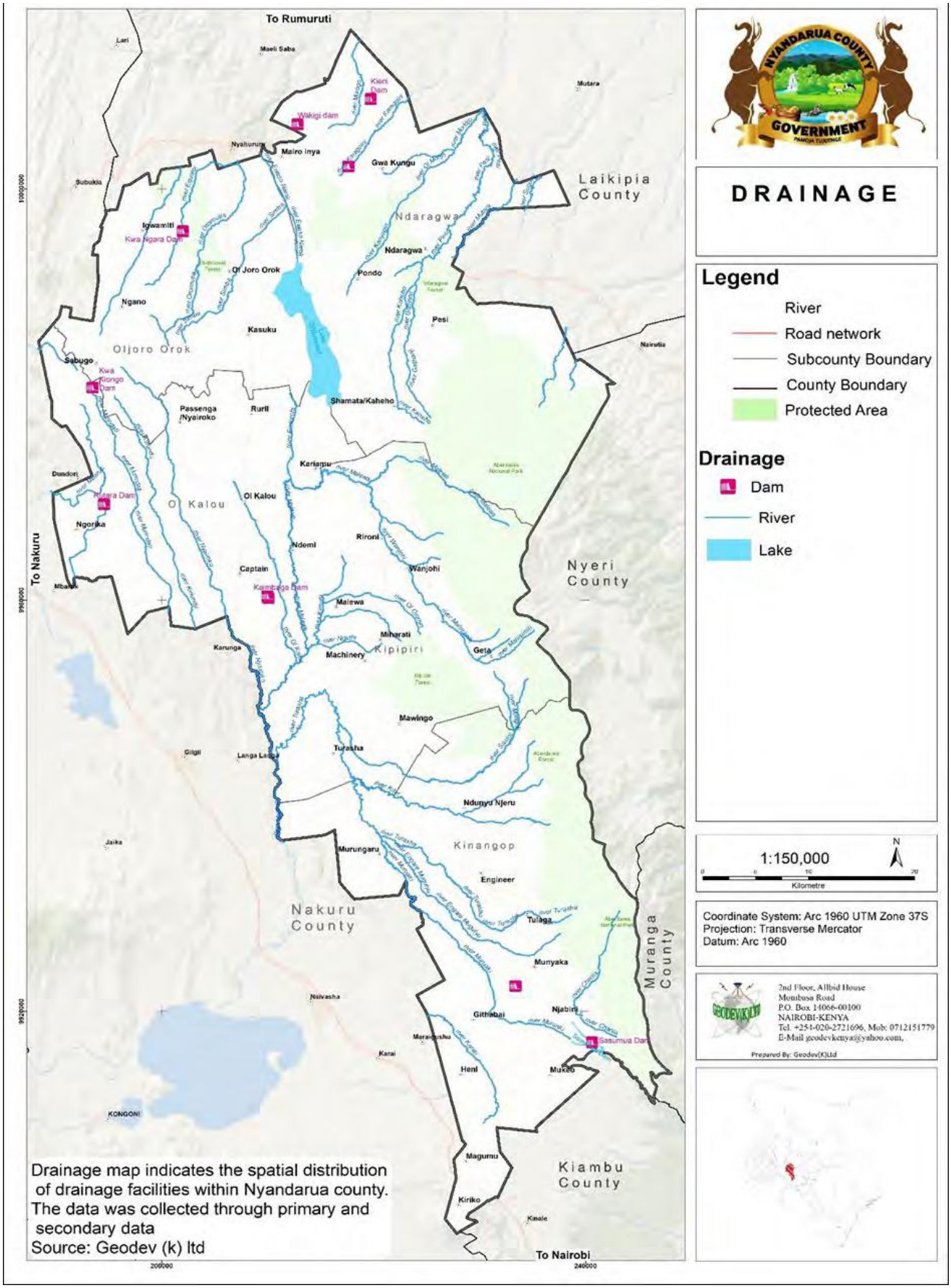


Fig. 3: Map of Nyandarua County Showing Rivers- Major rivers in Nyandarua are Malewa and Turasha Rivers. Turasha is Tributary of Malewa River which drains into Lake Naivasha

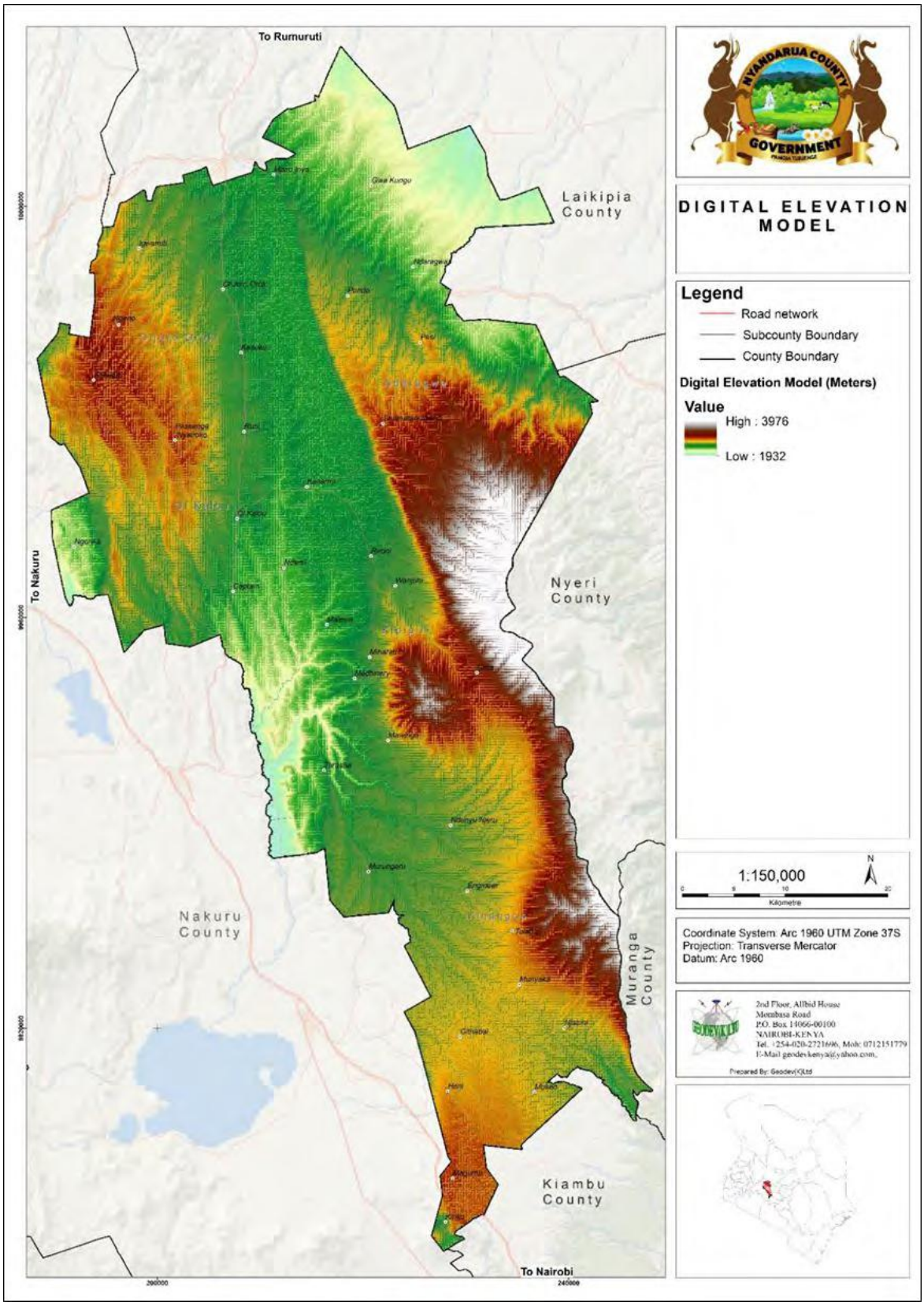


Fig. 4: Digital Elevation Map of Nyandarua County Population

POPULATION

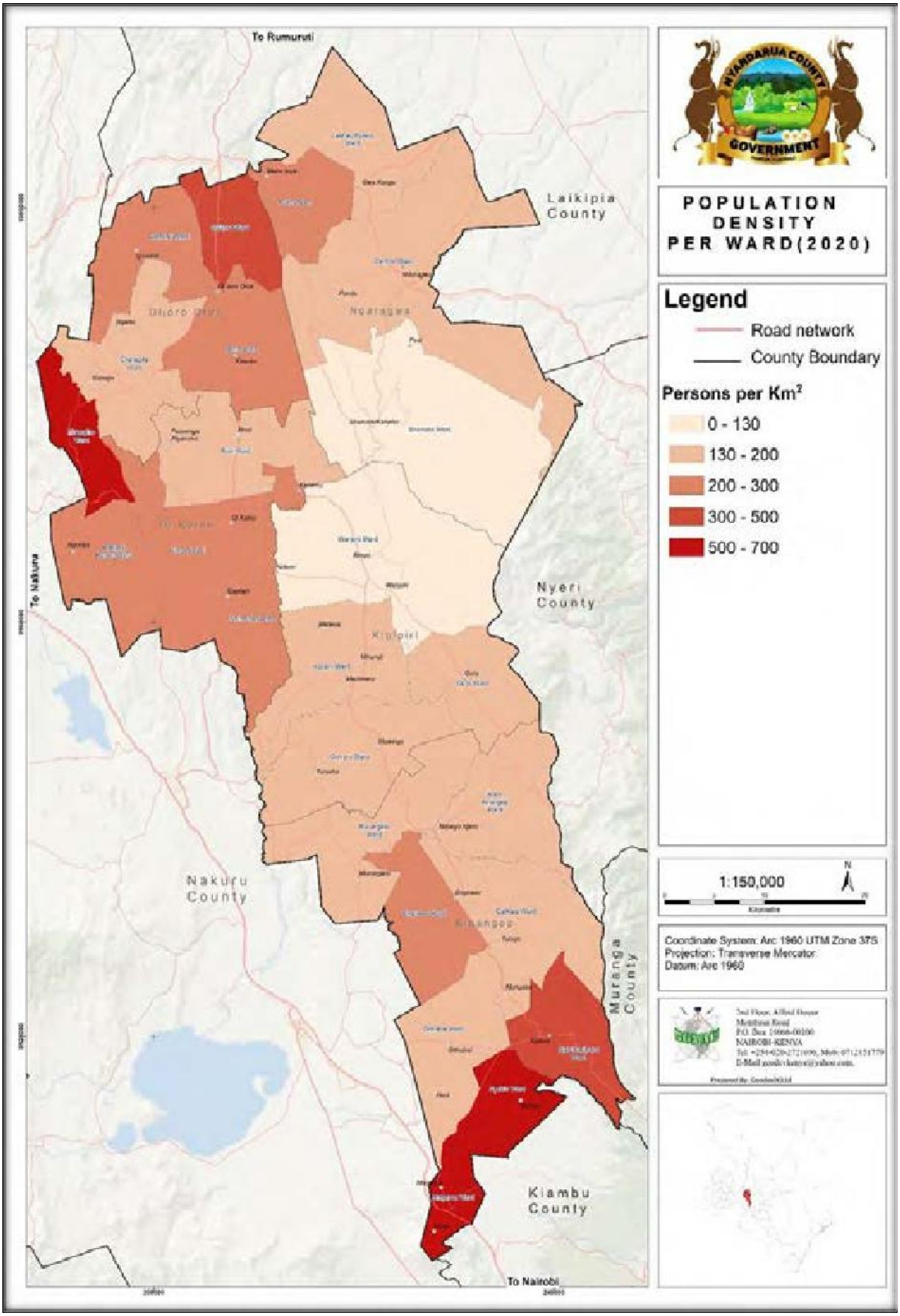


Fig. 5: Map of Population density per ward in Nyandarua County

Kinangop sub-county has the highest population among the five sub-counties and its projected population by 2026 is estimated at 115,000 people. Ol Kalou is characterized by a dense CBD/ urban core, immediate Sub-urban zone with both planned and ad-hoc sprawling development, as well as an immediate rural hinterland where most of the agricultural and quarrying activities are carried out.

It has a sex ratio of 49.4% males and 50.6% females with the largest population living in rural areas (89.6%) and 10.4% live in urban centres. The largest age group ranges between 15-64 years representing 58.7%, children between 0-14 years representing 35.7% while the over 65 years represents 5.6% of the total population (KNBS, 2019). Education levels vary drastically with 61% of the population having reached primary school, 19% secondary school and only 2% have a tertiary education level, which is similar to that of the country's education rates.

Education Level and Employment

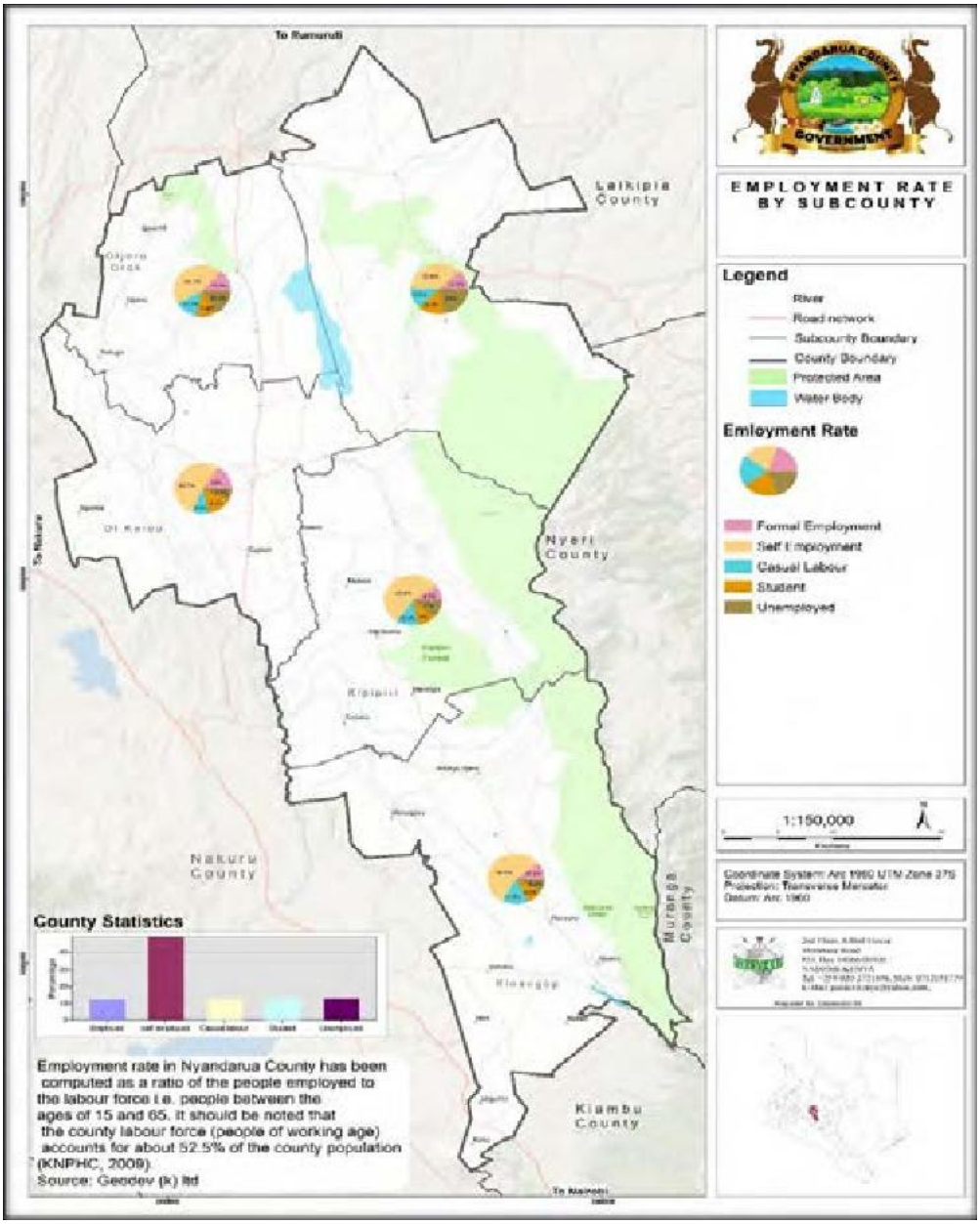


Fig. 6: Map of Employment Rate Density by Sub-county in Nyandarua County

It is noted in Nyandarua County that the chances of formal employment increase in proportion to one's level of education. For instance, the majority of those who are formally employed, about 53.3%, have completed either university or college. These are followed by those who have completed secondary school, accounting for a stake of approximately 30%. Among those who are formally employed, only a negligible percentage lacks any formal education.

However, it is also observed that a majority of the unemployed portion of the labour force, about 43.5%, have completed secondary school. This is an indicator of a glaring shortage of employment opportunities within Nyandarua County. In addition, the employment rate is approximately 53.9% within the county.

The table below shows the employment status of the working age population against their education levels.

Table 1: Working Age Population Employment Status by Education Level

Education status	Employed Formally	Self-Employed	Casual Labour	Student	Unemployed
Completed Primary.	8.6	27.0	38.8	0.3	17.4
Not completed Primary.	2.4	7.2	11.2	3.1	11.4
Completed Secondary.	30.0	39.8	30.3	12.0	43.5
Not completed Secondary.	2.9	10.0	11.8	57.2	7.6
Completed University/College	53.3	13.8	7.2	1.2	19.0
Not Completed University/College	2.9	1.3	0.7	26.2	0.5
No formal Education	0.0	0.8	0.0	0.0	0.5

Source: Field Survey, 2020

Agriculture is the main economic activity practiced in Nyandarua County mainly dairy farming, potatoes and vegetables. Agriculture is mainly supported by the temperate climate with the medium to high rainfall. There is variability in precipitation making the county prone to droughts/dry spells, intense precipitation and heat stress thus posing a great risk to agriculture (MoALF, 2016).

Nyandarua is serviced by several government hospitals and private hospitals, the main ones being; J M Kariuki Memorial County Referral Hospital in Ol' Kalou, Engineer Sub-County Hospital (locally known as Nyayo Ward) and North Kinangop Catholic Mission Hospital both in Kinangop. Others include Ndaragwa Sub County Hospital, Bamboo Hospital in Magumu, Njabini Health Centre, Leshau Pondo Health Centre, Kaanan Medical Centre, Ndindika Sub-County Hospital, Heni and Weru health Centres. Engineer Hospital is in the process of being upgraded with the collaboration between the National and County Governments. The Kenya Defense Forces are doing the actual construction.

The current administration has a plan of upgrading Njabini health centre to a level 4 facility due to its strategic location along the newly constructed MauMau road to serve the Kinangop residents easily. In July this year, the National Government in conjunction with Nyandarua County government have been upgrading dispensaries to health centres and offering more services, 22 new health facilities will be constructed across the county (Njeru, 2022).

By 2017, Nyandarua County was serviced by 224 km, 525 km and 2651 km of Bitumen, gravel and earth surface roads respectively. There is a 60 kms long gauge rail connecting Gilgil to Nyahururu that passes through the Nyandarua County with stations in Ol' Kalou and Ol' Joro Orok. Currently, the railway line, which was constructed in 1927, is in disuse and some of its infrastructures have been damaged. Currently the railway line is undergoing renovation with a new railway station being constructed in Ol' Kalou to revive the line and allow for transportation of goods between the three counties that is Laikipia, Nyandarua and Nakuru. This will also connect the line to the new Standard Gauge Railway (SGR).

Only 1% of residents in Nyandarua County use liquefied petroleum gas (LPG), while 1% use paraffin, 78% use firewood and 19% use charcoal. Therefore, the most common cooking fuel is firewood (Cities Alliance, 2020) Approximately 26.3% of residents rely on rivers and wells as a source for their water. The county government is responsible for ensuring safe, clean and adequate water supply is provided. Unreliable water supply is the biggest challenge facing residents across the five sub counties. It also includes lack of water treatment facilities, old and decaying infrastructure, and poor dam maintenance (Cities Alliance, 2020).

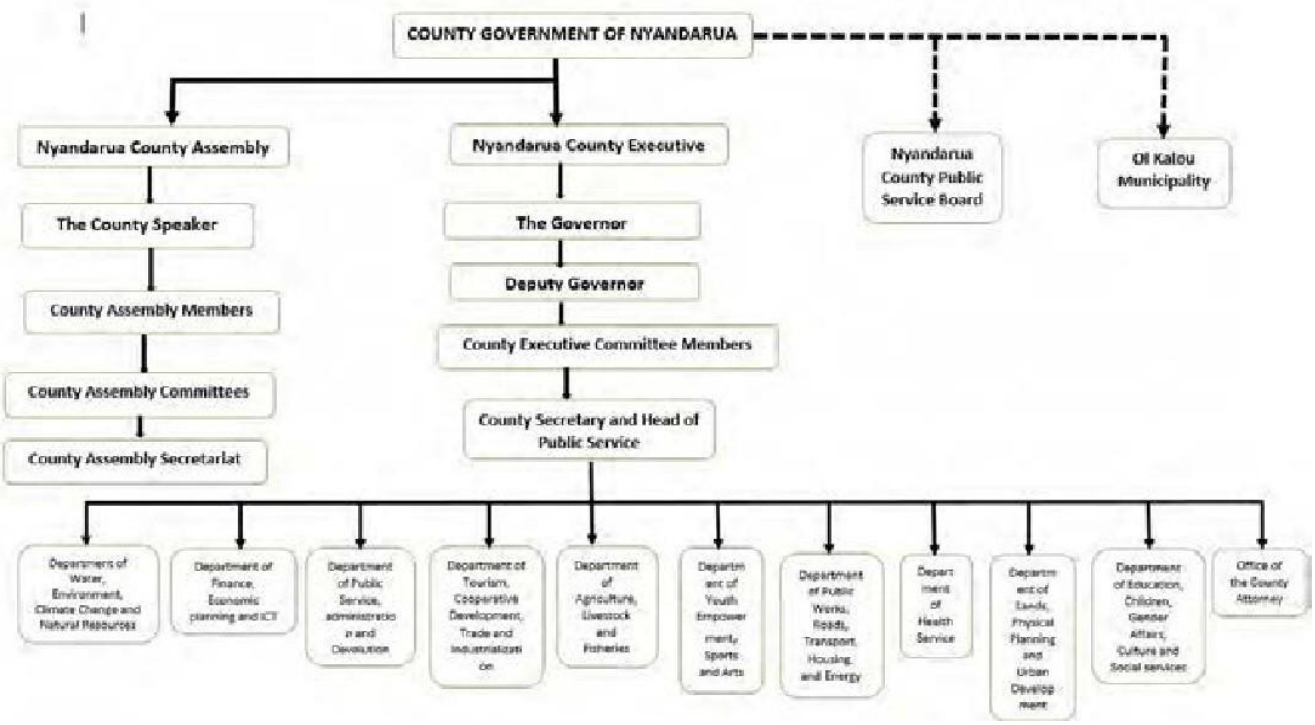


Fig. 7: Administrative Structure of Nyandarua County

1.2 Policy Context

The Climate Change Directorate has been established as a Directorate within the Department of Water, Environment, Climate Change and Natural Resources in the County. Whereby, the Climate Change Unit has been established as a secretariat for coordination and mainstreaming climate change action across all departments of the county government. The Climate Change Unit shall coordinate all climate change actions together with the steering Committee, the Planning Committee, the Sub-County Committees and the Ward Committees.

The Nyandarua County Climate Change Act of 2021, an act of the Nyandarua County Assembly to put in place the framework and mechanisms for mobilization and facilitation of the county government, communities and other stakeholders to respond effectively to climate change through appropriate adaptation and mitigation measures and actions and for connected purposes.

Nyandarua County Climate Change Act is the main legislature guiding climate change response actions at county level. Section 50 of the Act provides for the establishment of the County Climate Change Fund which is mainly 2% of the county development budget in addition to other funds dedicated to climate change. The object and purpose of the Fund is to provide funding for climate change activities identified in the County Climate Change Action Plan and County Climate Finance Framework and for connected purposes. It provides for the formation of climate change units and committees to run all the climate change functions within the county. Section 36-39 of the climate change act gives the contents, approval and publication, as well as review of the climate change action plan. Climate change action plan runs for a period of 5 years, must run concurrently with the current NCCAP, and CIDP and provides for the specific measures and actions to respond to climate change within the county. This is the first climate change action plan of the county. The table below presents the general policies guiding climate change management in the County.

Table 1: Nyandarua County Policy Context

Policy/Strategy	Description
National	
The Kenyan Constitution	Although the Kenyan constitution does not specifically deal with climate change, it does so indirectly by Articles 42 and 70. Under article 42, the constitution gives every person the right to "a clean and healthy environment" while Article 70 empowers any person whose right to a clean and healthy environment is violated to seek legal redress. As such any person who contributes to making the environment unhealthy can be sued for it. Article 360 (1b) of the Kenyan constitution requires that the state should work towards a 10% forest cover. County governments can use these constitutional provisions in the formulation of county-specific policies and strategies.
Vision 2030	Vision 2030 – the long-term development blueprint for the country – Aims to transform Kenya into "a newly industrializing, middle-income country, providing a high quality of life to all its citizens in a clean and secure environment." Emphasis was placed on infrastructure; Science, Technology, and Innovation; Public Sector Reforms; Tourism; Agriculture; Trade; Manufacturing; ICT (Information Communication & Technology) without the recognition that climate change can derail the realization of the goals.

Paris Agreement	Kenya signed and ratified the Paris Agreement in 2016.
Sendai Framework for Disaster Risk Reduction (2015-2030)	Kenya signed the Sendai Framework for Disaster Risk Reduction in 2015.
National Climate Change Response Strategy (2010)	Following the adoption of the Agenda 2030 and Sendai Framework as well as the ratification of the Paris Agreement, Kenya has fostered the alignment of respective policy processes in its National Adaptation Plan (NAP). The National Climate Change Response Strategy (NCCRS) 2010 was developed to help Kenya deal with the negative impacts of climate change and to maximize the positive impacts of climate change. The strategy was developed through a consultative process and its vision is a "prosperous, and climate resilient Kenya." Its mission is to strengthen nationwide focused actions towards adapting to and mitigating the changing climate. The strategy aimed to develop sectoral and cross-sectoral priorities for climate change adaptation and mitigation in the terms of short, medium and long-term actions.
National Climate Change Action Plan (2013-2017)	The National Climate Change Action Plan was formulated in 2012 and launched in 2013, just before county governments became effective. The National Climate Change Action Plan (NCCAP) was the product of a participatory process involving the public sector, the private sector, academia and civil society, under the leadership of the Ministry of Environment and Mineral Resources during the year 2012. It sets a 'low carbon' climate resilient development pathway in order to steer the National Climate Change Response Strategy (GoK, 2010), and meet Kenya's international obligations. The action plan recognizes county governments and rightly identifies that the climate change mandate is a mandate of both national and county governments and even allocates the county governments their respective responsibilities.
The National Climate Change Framework Policy (2018)	The National Climate Change Framework Policy provides a clear and concise articulation of overall response priorities to climate variability and change. It focuses on the interlinkages between sustainable development and climate change. Its objectives revolve around enhancing adaptive capacity and resilience to climate change and promote low carbon development for the sustainable development of Kenya. The policy framework guiding principles that are; to guide the implementation of this policy include common but differentiated responsibilities and respective capabilities, the right to a clean and healthy environment as enshrined in the Constitution, the right to sustainable development, partnership among stakeholders including women and youth, cooperation between the two levels of government, equity and social inclusion, prioritization of special needs groups, avoidance of maladaptation, integrity and transparency and cost-effectiveness in delivery.
Climate Change Act (2016)	The Climate Change Act (2016), provides the regulatory framework for enhanced response to climate change through mechanisms and measures to achieve low-carbon climate-resilient development. The Act acknowledges the interlinkages between sustainable development and climate change and is aligned with the constitution and Sustainable Development Goals. Objects and purposes of the Act include enhancement of climate change resilience and low carbon development for the sustainable development of Kenya as the key focus. The fact that the Act applies in all sectors of the economy.

Climate Adaptation Plan (2015-2030)	The National Adaptation Plan (NAP) (2015-2030) sets out Kenya's national circumstances, focusing on current and future climate trends, and describes the country's vulnerability to climate change. Priority actions are identified in 20 planning sectors for the short, medium and long term. This builds on the premise that all the country's socio-economic sectors are vulnerable to climate change impacts, although the manifestation of these impacts may vary from one sector to the other. NAP has mainstreamed devolution in the Adaptation plan, and identified relevant areas of linkages with the counties and ministry of devolution in the national government. Further the NAP emphasises that County Governments should integrate and mainstream climate change actions, interventions and duties into County Integrated Development Plans (CIDPs); and designate a County Executive Committee Member to coordinate climate change affairs; submit a report on the implementation progress of climate change actions to the County Assembly for review and debate, with a copy to the Climate Change Directorate for information.
Nationally Determined Contribution	The NAP is the basis for the adaptation component of Kenya's Nationally Determined Contribution (NDC) that was submitted to the United Nations Framework Convention on Climate Change (UNFCCC).
National Climate Finance Policy (2018)	The National Climate Finance Policy (2018) establishes the legal, institutional and reporting frameworks to access and manage climate finance in Kenya. The goal of the policy is to further Kenya's national development goals through enhanced mobilization of climate finance that contributes to low carbon climate resilient development goals.
National Climate Change Action Plan (2018-2022)	The National Climate Change Action Plan (NCCAP) 2018-2022 was the second 5-year national plan to guide Kenya's climate change actions. The NCCAP aims to further Kenya's development goals by providing mechanisms and measures to achieve low-carbon climate resilient development in a manner that prioritizes adaptation.
Environmental Management and Coordination Act (No. 8 of 1999 and Amendment 2015)	The Act is the principal instrument of Government for the management of the environment. It provides for the relevant institutional framework for the coordination of environmental management including the establishment of the National Environment Management Authority (NEMA), which is the Designated National Authority (DNA) for Clean Development Mechanism (CDM) and the National Implementing Entity (NIE) for the Adaptation Fund.
Water Act (No. 43 of 2016)	Kenya's Water Act establishes the National Water Harvesting and Storage Authority. Part V of the Act establishes a Water Sector Trust Fund and empowers it to work with relevant institutions to develop incentive programmes for water resources management including disaster management, climate change adaptation and mitigation.
Forest Conservation and Management Act (2016)	The act gives effect to Article 69 of the Constitution with regard to forest resources; to provide for the development and sustainable management, including conservation and rational utilization of all forest resources for the socio-economic development of the country and for connected purposes.
Urban Areas and Cities Act (2016)	Kenya's Urban Areas and Cities Act provides for the classification, governance and management of urban areas and cities; for the criteria of establishing urban areas, also provides for the principle of governance and participation of residents and for connected purposes.
Health Act (No. 21 of 2017)	Kenya's Health Act contains a section on environmental health and climate change (Part VII, sections 68 and 69) that is relevant to climate change.
Energy Bill (2017)	Part 3, section 43; Part 4, section 74 (i), and Part 9 address climate change-related issues.
National Urban Development Policy	The Kenya's National Urban Development Policy seeks to create a framework for sustainable urban development in the country and addresses environment and climate change and other themes relevant to urban development. The policy proposes that county headquarters and other deserving urban centres within counties be upgraded to municipal status. It is important that such developments be informed by a well thought out plan to deal with climate change impacts. To achieve this, the policy recommends that the National and County governments, and urban.

The National Disaster Management Policy (2012)	The National Disaster Management Policy of Kenya institutionalised disaster management and mainstreams disaster risk reduction in the country's development initiatives. The policy aims to increase and sustain resilience of vulnerable communities to hazards.
Green Economy Strategy and Implementation Plan (2016 – 2030)	The Green Economy Strategy and Implementation Plan (GESIP) 2016-2030 provides the overall policy framework to facilitate a transition to a green economy and outlines the need to mainstream and align green economy initiatives across the economic, social and environmental spheres. It aims to enhance low-carbon, resource efficient, equitable and inclusive socio-economic transformation. Its five thematic areas include promoting sustainable infrastructure; building resilience; sustainable natural resource management; promoting resource efficiency and social inclusion and sustainable livelihoods
The Agriculture Sector Development Strategy 2010-2020	This strategy is the overall national policy document for the agricultural sector. The strategy promotes sustainable food production and agroforestry. There are also broad implications for the forestry sector, which the strategy elaborates
The National Forest Programme (2016–2030)	The National Forest Programme is the first cross-sectoral and multi-stakeholder national framework for developing and coordinating forest development aimed at meeting the needs of Kenyans from 2016 to 2030. The framework aims at sustainable forest management and has the overall goal: "To develop and sustainably manage, conserve, restore and utilise forests and allied resources for socio-economic growth and climate resilience".
Climate Risk Management Framework (2017)	The Climate Risk Management Framework was developed in a participatory manner with technical experts and stakeholders working on disaster risk reduction and climate change adaptation. It recognizes that Kenya faces various forms of disasters, but focuses on hydro meteorological disasters given their magnitude, socio-economic and environmental impact, and frequency of occurrence.
Local	
County Government Act (2012)	This Act of Parliament requires counties to produce a ten-year spatial plan to guide development. Some of the actions recommended in this plan can be implemented in the formulation of the Nyandarua County Spatial plan. These activities include the mapping of wetlands and riparian habitat boundaries. Such actions will contribute to the county's climate change adaptation and mitigation strategies.

Nyandarua County Integrated Development Plan (2013-2017)	Nyandarua County Integrated Development Plan (2013-2017) was formulated in a Participatory Process that involved all sectors of both the national and county governments. The County Assembly also played a leading role through the County Assembly Committee on trade and planning. Adequate stakeholder consultation and participation provided an opportunity to articulate and mainstream some Climate Change elements in the CIDP. According to the document, it is evident that climate change in the county is a reality that manifests in a rise in average temperatures, shifts in rainfall pattern and subsequent long-term shift in the normal weather patterns. The document acknowledged the need for mainstreaming environment issues in development planning and identified the following measures/actions for realising this that include the following: • Ensuring Environmental Impact Assessment (EIA) requirement in the implementation of all projects and programmes that are likely to have effects on the environment, social settings and climate change as envisaged in EMCA 1999 (A) 2015. • Protection of wetland and forest reserves and ensuring community participation in the management of forest reserves and other ecologically sensitive areas is important. • Tree planting. • Enforcing both local environmental laws and adherence to internationally agreed regulations on environmental sustainability.
Nyandarua County Integrated Development Plan (2018-2022)	The CIDP 2018-2022 takes the lessons from the 2013-2017. It is premised on the priorities of MTP III 2018-2022 of Kenya's Vision 2030 that, among other areas, has a focus on mainstreaming climate change adaptation and mitigation. Just like its predecessor, this CIDP was developed in a participatory manner. In relation to the climate change action plan, it has taken bold steps to mainstream climate change in the county's development agenda. First, it recognizes that climate change is a key driver of environmental degradation. It negatively affects many sectors in Nyandarua County including agriculture, health, livestock, forestry and water. The plan recognizes climate change mitigation and adaptation activities that were underway by 2018. The CIDP lays a lot of emphasis on building resilience and enhancing adaptive capacity to climate change impacts, mainstreaming climate change at all sectors of the county government and promotion of research in climate change. Unlike the 2013-2017 CIDP, this second CIDP has allocated specific budgetary allocation for climate change actions.
Nyandarua County Integrated Development Plan (2023-2027)	The CIDP 2023-2027 priorities have been linked with the National priorities as captured in the MTP IV, Kenya's Vision 2030 among other plans. Just like its predecessor, this CIDP3 was developed in a participatory manner. In relation to the climate change action plan, it has taken bold steps to mainstream climate change in the county's development agenda. CIDP3 recognizes that climate change is a key driver of environmental degradation hence mainstreaming climate actions across all county departments and sectors. Among the major climate actions incorporated within CIDP 3 for implementation include: • Improving water access through rehabilitation of 300 colonial dams and expansion of water intakes • Improving community resilience to climate change impacts at household level • Disaster and risk management • Development and operationalization of County Climate Change Information Management System to aid in early warning system • Rehabilitation of degraded catchments • Restoration of Lake Ol Bolossat • Reduction of carbon emissions

	In the mainstreaming, some of the prioritized actions include: • Promotion of Climate smart agriculture • Mapping and survey public lands among them dams to aid in rehabilitation, restoration and protection of the resources • Promote and establish of integrated green and circular projects in institutions • Climate proofing of infrastructure ensuring accessibility and mobility thus community empowerment
Nyandarua County Climate Change Act (2021)	The Nyandarua County Climate Change Act (2021), provides the regulatory framework for enhanced response to climate change within the County through mechanisms and measures to achieve low-carbon climate-resilient development and is applied by the County Government in all sectors of the economy. The Act is anchored upon the Climate Change Act, 2016 recognizing that every county must have the act which then creates among others the County Climate Change Unit that mainstreams climate actions and responses within the County developments. Objects of the Act include enhancement of climate resilience through development planning, management, implementation, regulation and monitoring of adaptation and mitigation measures and actions.

1.3 Purpose of the Nyandarua Participatory Climate Risk and Vulnerability Assessment

During development of the PCRA report, the TWG raised awareness on climate change and locally-led climate action to the participants drawn from various villages at the ward level. Upon familiarization, the stakeholders then proceeded to identify and assess the climate risks and impacts they face in their specific wards. It is from the assessment that the participants then proposed and suggested adaptation strategies including priority climate investment areas to deal with the present and future climate scenarios to promote climate resilience and adaptive capacity of the community.

This PCRA Report therefore, examines the nature and extent of the risks that could pose threats or harm to the community, property, livelihoods and the environment on which they depend. It also assesses community vulnerability to the impacts of climate change, and highlights specific vulnerable population groups identified from each ward.

This PCRA report will therefore inform the County in preparation and development of Nyandarua County Climate Change Action Plan that will be embedded in the County Development Plans.

1.4 Key Steps in the Development of Nyandarua County Participatory Climate Risk Assessment Report (PCRA)

1.4.1 Technical Working Group

In order to develop the Nyandarua County Participatory Climate Risk Assessment Report, the County appointed a cross sectoral technical committee comprising representatives from Water sector, Agriculture, Health, Finance, Environment, Natural resources and forestry, Tourism and Trade, Social Services, Energy, Kenya Meteorology Department, physical planning and urban development and the Climate Change Unit. CoM SSA and the Nyandarua County Government held a three-day participatory training for the PCRA Technical committee in line with the FLLoCA program and Global Covenant of Mayors (GCoM) requirements.

The aim of the workshop was to follow an interactive and participatory approach in order to conduct ward level engagements in all 25 wards and help in:

- Identifying the most significant Risks faced by Nyandarua;
- Developing a risk profile indicating the probability and consequence of identified hazards;
- Discussing the adaptation strategies to reduce the impacts of climate hazards in Nyandarua;
- Identifying sectors, services and population groups within Nyandarua that are likely to be affected by climate hazards;
- Unpack potential factors which could affect Nyandarua's adaptive capacity, and
- Identifying strategic/investment priority areas to inform adaptation pathway.

Fig. 8: Training of the Technical Committee

1.4.2 Stakeholder mapping

After the training of the TWG, the team embarked on stakeholder mapping and analysis. The TWG agreed that the stakeholders had to be drawn from all the sub locations of the ward and represent all age groups for equal representation and avoid bias. This also was to ensure that information obtained ranged from historical to expertise. A team of 30 stakeholders per ward was agreed upon composed of 9 ward committee members, 1 Faith based representative, 1 Person Living With Disability, 4 farmers (crop and livestock from both genders), 1 agricultural officer, 1 livestock/veterinary officer, 1 farmers' cooperative society representative, 1 social development officer, 1 scout, 2 elders of both genders, 1 indigenous knowledge representative, 1 Mau Mau representative, 1 tree growers association representative, 1 Community Based Organizations representative, 1 business community representative, 1 Community Health Volunteer, 1 minority group representative and 1 National Government Administration Officers (Assistant chiefs, Chiefs and Assistant County Commissioners). These stakeholders from every ward were engaged for two days.

1.4.3 Ward level engagements

After the three-day training for the Technical Committee, ward level participatory workshops commenced to collect the data and the public views on climate risks, hazards and vulnerabilities.

Participants from each ward met at Sub-County level for the two days engagement from 11th May to 18th may 2023. Engagement venues were as follows; Aberdare ranges Resort for Ol Kalou Sub-County, Lake Ol Bolosst Resort for Ol Joro Orok, Mutanga CDF Hall for Ndaragwa, Miharati PCEA church hall for Kipipiri, Engineer AIC church hall for Kinangop North and Njabini Catholic Hall for

Kinangop South Sub-counties.

Questionnaires, guided templates and maps were used to collect data from the participants while oral interviews were used to collect data from the elderly participants to obtain historical and indigenous data.

Fig 9: Leshau Pondo Ward (left) and Karau Ward (Right) Participants

1.4.4 Draft PCRA Report

After the Ward level engagements, the TWG retreated to consolidate the data from the participants to develop ward PCRA reports. KMD through the county Director of Meteorological services provided climate historical data as well as future climate projections. After the development of 25 ward PCRA reports, the TWG then drafted the county PCRA report.

1.4.5 Multi-Stakeholder Climate Risk Assessment Workshop

After the drafting of the PCRA report. A Multistakeholder workshop was organized to engage major stakeholders at the county level who could not be engaged at the ward level. These stakeholders included NEMA, KFS, KWS, County Departments, Tertiary Institutions including Nyandarua National Polytechnic, AHITI, Research institutions including KARLO, CBOs such as COPICAD, CCV and LOCCOG. Others included County Climate Planning and Steering Committee as well as County Assembly Sectoral Committee.

The multi-stakeholders provided their views guided by their expertise in their respective fields of operation for incorporation within the PCRA report

1.4.6 Final PCRA Report

After the Multistakeholder Climate risk assessment workshop, the TWG again retreated to finalize the PCRA report. All views were incorporated a final, clean report developed.

The report was then tabled before the Cabinet for adoption. The cabinet adopted the report as a County PCRA on 29th May 2023.

CHAPTER TWO

2.0 Nyandarua County Climate Hazard Profile

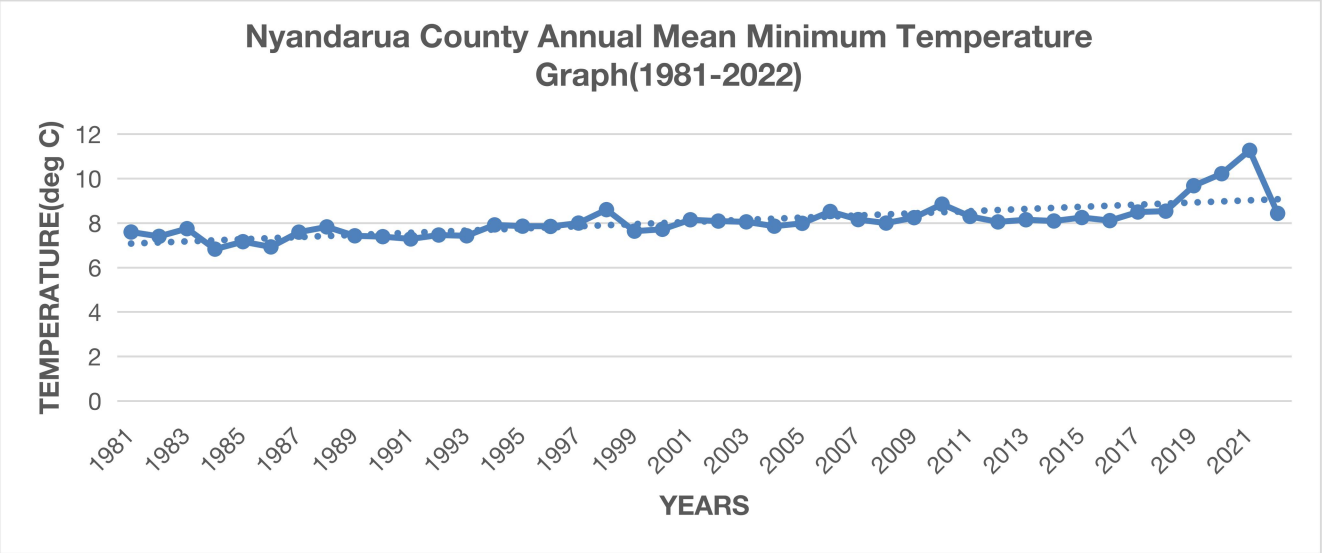
2.1 Current and Historical Climate Hazards and Trends

From the public participation, the elderly participants noted that Nyandarua experienced severe droughts in 1943, 1962, 1964 and 1984. The 1984 drought being one of the severest was noted to have resulted in drying of Lake Ol Bolossat for example. However, the famous ***Ng'aragu ya Mianga ("The Famine of Cassava", because besides banana trunks, cassava was the only thing left to eat)*** was noted to have occurred in 1943. It was also noted that July is the coldest month locally known as ***Mworia Nyoni, the month when birds rot, because birds would freeze to death and fall from the trees.*** The severity of the cold is changing and sometimes extending to August.

The participants noted two major rainy seasons, long rains occurring between March to early June while short rains occur between October to December. This correlated with the scientific data from the KMD.

Nyandarua county scientific data as provided by the KMD, dating back from 1981 correlated with the historical climate trend as provided by the participants. This is well illustrated in the graphs below showing annual average rainfall, maximum mean annual temperature and minimum average annual temperatures.

The seasons in Nyandarua County can be tracked as back as 1981, where the lowest mean annual Minimum Temperature was recorded to be 6.8°C in 1984 and the highest annual mean minimum recorded temperature is 11.3°C in the year 2021 showing that the lowest annual average minimum temperature reduced as shown by the graph below.



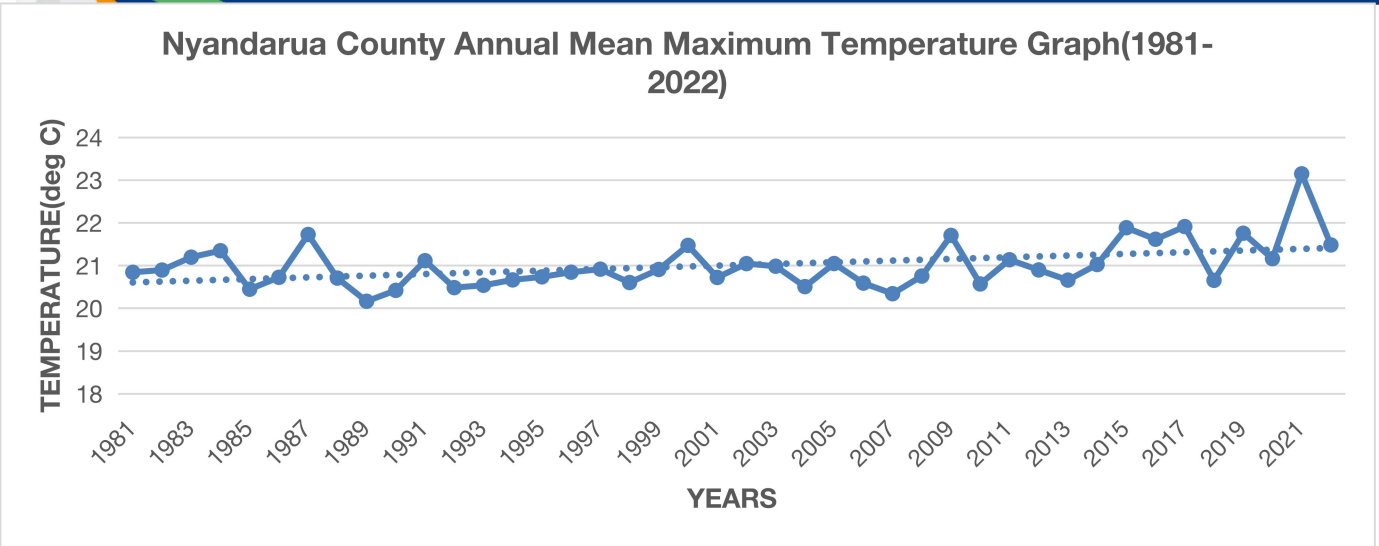


Fig. 9: Graphical illustration of Nyandarua county Historical Minimum and Maximum Temperatures (Source KMD)

The lowest annual mean maximum temperature recorded is 20.2°C in 1989 and the highest annual mean maximum temperature is 23.1°C in 2021. The average maximum temperature rose over the years with almost 0.5°C

The mean annual rainfall recorded between 1981 to 2022 rose over the years where the lowest rainfall recorded is in 2000 with 688.5mm and the highest being 2022 with 1523.1mm the annual rainfall rose over the years as shown below in the graph.

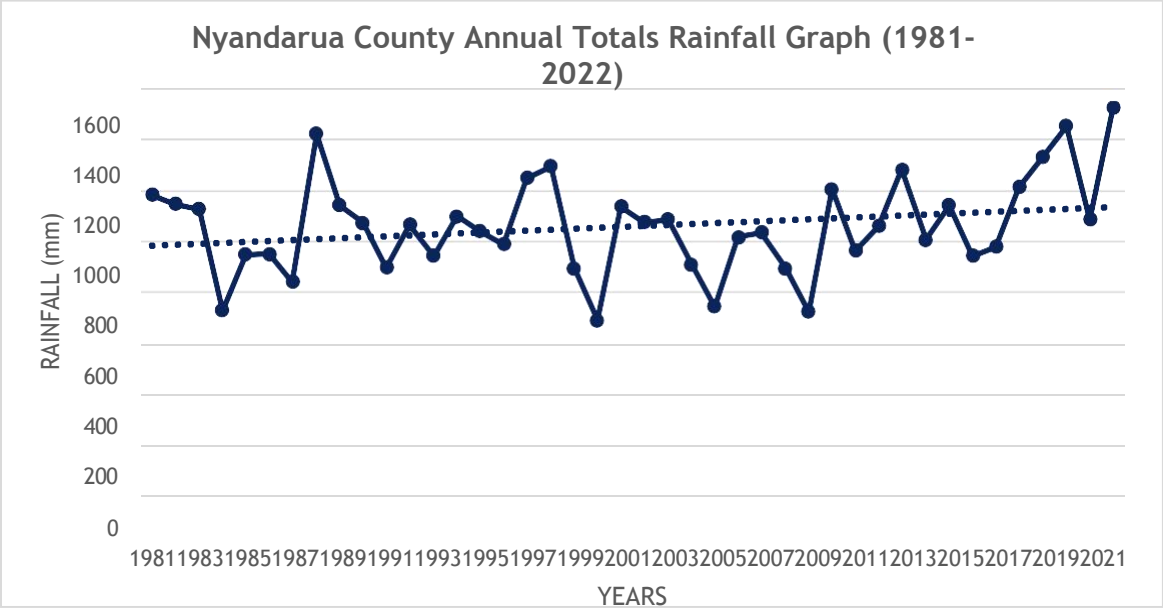


Fig. 10: Nyandarua County Annual Total Rainfall Graph (1981-2022)

The current distinct main seasons of the year identified during the stakeholder participation are three namely: long rains, short rains and the dry seasons. The long rains are experienced in the months of March to June in many areas. The weather during the long rain season is frosts and heavy rainfall, accompanied by thunderstorms, lightening and hailstorms varying from place to place, causing floods in areas like Kagera-ini in Nyakio ward and land/mud slide in Magumu. During the short rains' seasons which majorly occurs in the month of August to September, the weather is usually mild frost, misty and cold temperatures. The coldest month being July and November. The dry seasons happen in the month of December to February. Strong winds are also a major hazard evident in many areas. Other hazards identified are forest fires.

From History, the elderly participants described 1998 as the wettest year and 1984 as the driest year experiencing the longest drought.

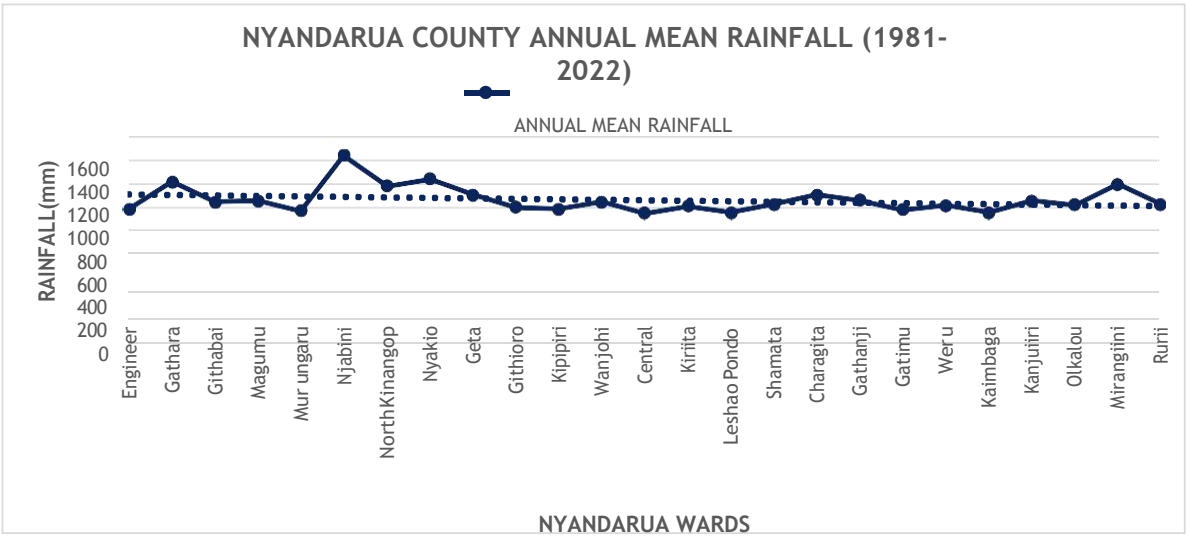


Fig. 11: Nyandarua County Annual Mean Rainfall (1981-2022)

2.2 Climate hazard, Exposure and vulnerability profiles of the county

2.2.1 Exposure to climate hazards and their impacts

The outcome of this public participation exercise as tabulated below across all wards in the county indicate that the climate hazards currently deemed as having the highest impact on most vulnerable groups are Drought, floods, crop pest and diseases, frost, strong winds, extreme change in temperature, forest fires, rock falls and mudslides. The top five vulnerable population groups identified as most affected by the current climate hazards are resource poor households, women, Persons living with disability, Elderly and children. These hazards have a great impact on agriculture, water, forests and health consequently affecting their livelihoods (social and economic activities) negatively. The identified vulnerable groups have no equal access and stake in the community resources and local decision making as they are looked down upon since they can't afford their own assets. They depend on inherited assets.

Table 2: Exposure to climate hazards and their impacts

S. No	Hazard	Vulnerable groups	Risk	Impact	Prevalent Wards
1.	Drought	Women Children Elderly PWLD Youth	• Increased Water scarcity	• Deforestation • Food shortage and Malnutrition • Loss of livelihoods • Deaths (people and livestock)	Leshau Pondo, Ndarangwa Central, Kiriita, Githioro, Murungaru, Engineer, Githabai, Magumu, Weru, Kaimbaga, Karau, Kanjuiri, Mirangine , Wanjohi, Kipipiri Charangita, Gatimu, Rurii, Gathara, Nyakio, North Kinangop, Shamata, Njabini, Gathanje, Geta,
			• Crop failure		Leshau Pondo, Ndarangwa Central, Kiriita, Githioro, Murungaru, Engineer, Githabai, Magumu, Weru, Kaimbaga, Karau, Kanjuiri, Mirangine , Wanjohi, Kipipiri Charangita, Gatimu, Rurii, Gathara, Nyakio, North Kinangop, Shamata, Njabini, Gathanje, Geta
			• Biodiversity loss		Kiriita, Central, Shamata, Weru, Gatimu, Rurii, Gathanje, Njabini, Gathara, North Kinangop
2.	Crop pests and disease infestation	Women Children Elderly PWLD Youth	• Loss of fodder and pasture • Increased cost of Production • Biodiversity loss	• Reduced production • Food insecurity hence malnutrition	• Leshau Pondo, Ndarangwa Central, Kiriita, Githioro, Murungaru, Engineer, Githabai, Magumu, Weru, Kaimbaga, Karau, Kanjuiri, Mirangine , Wanjohi, Kipipiri Charangita, Gatimu, Rurii, Gathara, Nyakio, North Kinangop, Shamata, Njabini, Gathanje, Geta
3.	Floods	Women Children Elderly PWLD Youth	• Destruction and loss of property and infrastructure • Poor water quality • Post Harvest losses	• Soil erosion • Water-borne diseases • Seasonal displacement of people	• Leshau Pondo, Ndarangwa Central, Kiriita, Githioro, Murungaru, Engineer, Githabai, Magumu, Weru, Kaimbaga, Karau, Kanjuiri, Mirangine , Wanjohi, Kipipiri Charangita, Gatimu, Rurii, Gathara, Nyakio, North Kinangop, Shamata, Njabini, Gathanje, Geta

4.	Strong winds	Women Children Elderly PWLD Youth	• Destruction of property • Drying of water pans and wetlands	• Soil erosion • Reduced crop production	• Murungaru, Githabai, Engineer and Lake Ol Bolossat area (Gatimu, Weru, Kiriita and Central)
5.	Frost	Women Children Elderly PWLD Youth	• Crop Failure • Increased instances of respiratory diseases	• Food insecurity • Small scale trading lowered	• Murungaru, North Kinangop, Githabai, Gathara,Nyakio, Magumu, Engineer and Njabini
6.	Extreme change in temperatures	Women Children Elderly PWLD Youth	• Loss of soil moisture from extreme high temperatures • Diseases (crop, livestock and human including arthritis and respiratory)	• Reduced agricultural production • Reduced trading/business activities	• Leshau Pondo, Ndarangwa Central, Kiriita, Githioro, Murungaru, Engineer, Githabai, Magumu, Weru, Kaimbaga, Karau, Kanjuiri, Mirangine , Wanjohi, Kipipiri Charangita, Gatimu, Rurii, Gathara, Nyakio, North Kinangop, Shamata, Njabini, Gathanje, Geta
7.	Fog and mist	Women Children Elderly PWLD Youth	• Poor visibility • Increased crop diseases	• Road accidents and reduced mobility • Reduced crop production	• Magumu, Nyakio, Njabini, Githabai
8.	Rock falls and mudslides	Women Children Elderly PWLD Youth	• Loss and destruction of property • Poor water quality	• Soil erosion • Reduced crop production • Deaths	• Magumu, Njabini, Wanjohi
9	Wild and Forest fires	Resource poor households who depend on forest products	• Loss of Biodiversity • Increased food insecurity	• Soil erosion • Reduced forest products	• Shamata, Kipipiri, Geta, North Kinangop, Gathara, Nyakio and Njabini

2.0.1 Nyandarua County Vulnerability profile on the population Groups

In addition to exploring the climate hazards impacts on various sectors and services in Nyandarua, stakeholders identified the vulnerable populations which are most affected by climate hazards and the magnitude of impact on the various population groups.

The degree/ magnitude of impact of each hazard on various population groups in Nyandarua County was rated by stakeholders at either High (3), Moderate (2) or Low (1) as shown in Table 2 below

Table 3: Nyandarua County Vulnerability profile

Climate Hazard	Women	Youth (18-35)	Children/ infants	Poor Resource Households	Elderly	Persons with Disabilities (PWD)	Persons with Chronic Diseases	Single-Parent Households	Pregnant Women	TOTAL
Extreme heat	3	2	3	3	3	3	3	2	3	25
Extreme cold	2	2	3	3	3	2	3	2	2	22
Frost	3	2	2	2	3	2	3	2	2	21
Extreme rainfalls	3	2	3	3	3	2	2	1	2	21
Fog	1	1	1	1	1	1	1	1	1	9
Hailstorms	1	1	2	2	2	2	2	1	1	14
Flash flood/surface flood	3	3	3	3	3	3	3	3	3	27
River flood	3	3	3	3	3	3	3	3	3	27
Droughts	3	3	3	3	3	3	3	3	3	27
Strong winds	1	1	1	1	1	1	1	1	1	9
Lightning and thunderstorms	1	1	1	1	1	1	1	1	1	9
Wild fires	1	1	1	1	1	1	1	1	1	9
Forest fires	2	2	1	1	1	1	1	1	1	11
Land fires	1	1	1	1	1	1	1	1	1	9
Landslides, mudslides and rockfalls	1	1	1	1	1	1	1	1	1	9
Erosion	2	2	2	2	2	2	2	2	2	18
Waterborne diseases	2	2	2	2	2	2	2	2	2	18
vector-borne diseases	1	1	1	1	1	1	1	1	1	9
Airborne diseases	2	2	2	2	2	2	2	2	2	18
Insect infestation and Pest infestation	2	2	2	2	2	2	2	2	2	18
TOTAL	**38**	**35**	**38**	**38**	**39**	**36**	**38**	**33**	**35**	

The outcomes of this exercise indicate that the climate hazards currently deemed as having the highest impact on the majority of vulnerable population groups in Nyandarua are droughts, river floods and flash floods/surface foods. The top four vulnerable population groups identified as most affected by current climate hazards are the Elderly, women, children/infants, poor resource households and persons with chronic disease. Due to the increasing risks associated with these population groups, they are more vulnerable to the impacts of various climate hazards. However, it is important to note that this does not mean other members of the population in Nyandarua County are not being impact by climate hazards.

2.0.2 Nyandarua County Climate Hazards and their Extent of Risk

To determine the most significant climate hazards faced by Nyandarua County, the ward level participants identified the climate hazards experienced within their respective wards highlighting the hazard occurrence probability, consequence to determine the risk extent. The hazards experienced in Nyandarua County are as illustrated below.

In the risk matrix (scale of 1- 5 with 1 being 'low', 2 being 'medium low', 3 being 'medium, 4 being 'medium high' and 5 being 'high' according to the probability of each hazard occurring, the consequence of the hazard should it occur and the impact of the hazard. The risk extent was obtained by multiplying the occurrence probability by hazard consequence.

Table 4: Nyandarua County Climate Hazards and their Extent of Risk

Climate hazard	Probability of occurrence of the hazard*	Consequences of the hazard	Extent of the risk	Prevalent Wards
Droughts	5	4	20	Leshau Pondo, Ndarangwa Central, Kiriita, Githioro, Murungaru, Engineer, Githabai, Magumu, Weru, Kaimbaga, Karau, Kanjuiri, Mirangine , Wanjohi, Kipipiri Charangita, Gatimu, Rurii, Gathara, Nyakio, North Kinangop, Shamata, Njabini, Gathanje, Geta
Erosion	3	4	12	Leshau Pondo, Ndarangwa Central, Kiriita, Githioro, Murungaru, Engineer, Githabai, Magumu, Weru, Kaimbaga, Karau, Kanjuiri, Mirangine , Wanjohi, Kipipiri Charangita, Gatimu, Rurii, Gathara, Nyakio, North Kinangop, Shamata, Njabini, Gathanje, Geta
Extreme cold	4	3	12	Geta, Njabini, Shamata, Njabini and Wanjohi
Extreme Rainfall	4	3	12	Leshau Pondo, Ndarangwa Central, Kiriita, Githioro, Murungaru, Engineer, Githabai, Magumu, Weru, Kaimbaga, Karau, Kanjuiri, Mirangine , Wanjohi, Kipipiri Charangita, Gatimu, Rurii, Gathara, Nyakio, North Kinangop, Shamata, Njabini, Gathanje, Geta
Extreme temperatures	2	2	4	Leshau Pondo, Ndarangwa Central, Kiriita, Githioro, Murungaru, Engineer, Githabai, Magumu, Weru, Kaimbaga, Karau, Kanjuiri, Mirangine , Wanjohi, Kipipiri Charangita, Gatimu, Rurii,

				Gathara, Nyakio, North Kinangop, Shamata, Njabini, Gathanje, Geta
Fog	1	1	1	Magumu, Nyakio, Njabini, Githabai
Forest/Wild fires	4	4	16	Shamata, Kipipiri, Geta, North Kinangop, Gathara, Nyakio and Njabini
Frost	3	4	12	Murungaru, North Kinangop, Githabai, Gathara,Nyakio, Magumu, Engineer and Njabini
Insect and pest infestation	3	4	12	Leshau Pondo, Ndarangwa Central, Kiriita, Githioro, Murungaru, Engineer, Githabai, Magumu, Weru, Kaimbaga, Karau, Kanjuiri, Mirangine , Wanjohi, Kipipiri Charangita, Gatimu, Rurii, Gathara, Nyakio, North Kinangop, Shamata, Njabini, Gathanje, Geta
Landslides	1	1	1	•Magumu, Njabini, Wanjohi
Lightning/thunderstorms	3	2	6	Kipipiri
floods	5	4	20	Wanjohi, Shamata, Njabini
Strong winds	1	2	2	Murungaru, Githabai, Engineer and Lake Ol Bolossat area (Gatimu, Weru, Kiriita and Central)
Vector-borne diseases	4	4	16	
Waterborne diseases	4	5	20	

Please note that the 'Frequency of Hazard Occurrences' are estimates based on the Nyandarua County stakeholders' lived experiences as there is no accurate historical data records of the incidences of these events.

Based on the outcomes of this exercise, following extensive discussion, the stakeholders agreed that the top (4) hazards deemed as having the most significant impact on Nyandarua County are drought; floods; waterborne diseases and air-borne diseases. The frequency and intensity of in consistent rainfall was discussed at length during this exercise. In addition, it was highlighted by various stakeholders that the impact of these hazards cannot be noted without expanding on the context, which will be referenced in the proceeding sections.

2.1 Differentiated Impacts of Climate Trends and Risks

2.1.1 Impacts of Climate Hazards on Vulnerable Groups

Climate hazards have various impacts on the different sectors and population groups within a region. This section includes details on how sectors, assets or services and population groups within Nyandarua County are impacted by the climate hazards; and indicate the magnitude of impact for each.

From the community engagements at the ward level, drought, floods, frost and forest fires emerged as the major hazards impacting the vulnerable groups as illustrated below.

Table 4: Differentiated impacts of climate trends and risks

S. No	Climate Risk/ Hazard	Past Climate Trends and Impacts	Impact Current Locally Experienced	Vulnerable Groups	How The Climate Trends and Impacts is Affecting Vulnerable Groups
1.	Forest fires	In recent past cases of forest fires have been increasing in the region devastating large portions of forest. This as pointed out was not that prevalence in the past as compared to now.	The impacts include; -Human wildlife conflict -Soil erosion -Death of wildlife -Air pollution and addition of GHGs in the atmosphere -Deforestation -Destruction of vegetation -Destruction of catchment leading to Water pollution and shortage downstream.	Women, PLWDs, Resource Poor Households, Elderly, minority and Youths.	Forest fires largely affect grazing area of the residents of various ward especially those neighboring the forest. The minority are affected due to the destruction of tree species used for making traditional medicine. The elderly majorly depends on their livestock for daily subsistence, smoke and low mobility. Youth will be highly affected due to reduced number of tourists. Women who are farmers are also affected by human wildlife conflict.
2.	Landslides	Though outlined as not that common but the trend has increased with time. With the intensity of rainfall increases, landslides have been on the rise.	-Loss of lives -Destruction of properties -Soil erosion -Disruption of key community services like school going kids cannot access the schools or hospitals.	Women, PLWDs, Resource Poor Households, Elderly and Youths.	When landslides occur, it is hard for any vulnerable team to be able to cope with the consequences. Nonetheless the poor resource households are more vulnerable having that their resilience or adaptive capacity is low when the hazard occurs as compared to other households.
3.	Deforestation	This has been a historical thing that is really affecting the climate of this region. The members of the community outlined that the Government imposed Moratorium on tree was really helpful.	-Drying of rivers -Reduction in honey production -Leads to massive soil erosion and eventually landslides.	Women, PLWDs, Resource Poor Households, Elderly and Youths.	Deforestation essentially affects all the people in the locality especially those that practice honey business.
4.	Drought	Drought was not a threat due to the adequate rainfall during that time but in the month of January to March.	-Destruction of crops and reduced production -Lack of pasture for livestock -Water scarcity -Human wildlife conflict.	Women, Persons Living with disability, elderly (PLWDs), youth, poor households.	All vulnerable groups including the business community are affected due to minimal production of farm produce, and lack of essential commodities like water. Human wildlife conflicts cause food shortage due to destruction of farms by elephants and hippopotamus.
5.	Floods	Floods were not lethal because the natural water ways were still open and availability of cover crops but has accelerated in the past 20 years.	-Displacement and extinction of species -Low production in farms -Destruction of crops and death of livestock -Destruction of infrastructure, e.g., roads and clogging of drainages. -increased water borne diseases	Women, Persons Living with disability, elderly, youth, poor households.	All the vulnerable groups are affected when road infrastructure is destroyed. Women and youth are highly affected when agricultural production is affected, e.g., potatoes. Displacement of the elderly particularly those with chronic diseases, PLWDs and poor resource households. A lot of the reported waterborne diseases are affecting the resource poor households.

6.	Frost	There were less prevalent frost cases due to the availability of plant covers like trees.	-Destruction and low production in crops. -Destruction of crops and defacing peoples face (gucinwo ni mbaa) also causes low production in livestock especially dairy cattle.	Women, youth, poor households, children and business communities.	Women, elderly, PLWDs and children will be highly affected due to low production due to plant scorching leading to food insecurity. The adaptive capacity of the children is low thus being the most affected.
7.	Strong winds and thunderstorms	Occurrence is rare.	Loss and destruction of property, accelerate soil erosion.	Women, elderly, PLWDs, poor households	Demolition of infrastructure affecting poor households, elderly, PLWDs and women.
8.	Extreme change in temperature	Temperatures have been rising gradually.	This has affected crop production and drying of pasture and water sources.	Farmers, elderly, women.	Vulnerable groups practicing crop farming are affected by temperature fluctuations and they are also affected by diseases associated with temperature fluctuations.
9.	Pest and disease infestation	The occurrence was rare.	-Loss of fodder and pasture Reduced production, food insecurity, increased cost of production.	Women, youth, elderly, PLWD and minority.	Poor agricultural produce leading to food insecurity affecting the elderly, PLWDs, women and children.
10.	Rock fall and mudslides	There are minimal occurrences that are not fatal.	-Loss and destruction of property. -Poor water quality -Reduced crop production	Poor households, women, youth and PLWDs.	Women, youth engaging in farming when mud slides occur because of destruction of agricultural lands thus production, while poor households suffer from destruction of property. Mobility for PLWDs is made hard. Poor water quality affecting women who search for clean water for long distances.
11.	Fog and mist	There was occurrence of the fog and mist especially during the cold seasons.	-Poor visibility. -Increased crop diseases. -Reduced crop production.	Business community, women, elderly.	Farmers and business community as well as women and youth engaged in agricultural produce are highly affected due to low production.
12.	Hailstorms	No or less hailstorms.	Unpredictable and frequent hailstorms.	Poor households. PLWDs. Elderly. Children.	It has caused the death of livestock, crops and food insecurity in the area. This has affected the elderly, children, and PLWDs.

It was noted that there has been change both in magnitude of impacts and trends across the entire County from time to time. The same was projected to change in the future as the county weather and climate has become more unpredictable.

2.3.1 Impact of Current Climate Hazards on Sectors

The participants identified the impacts of the climate hazards on key sectors dominant within Nyandarua County. This enhanced a deeper understanding of the interconnectedness of the challenges faced by Nyandarua and the various stakeholders drawn from key sectors within the County as well as the degree/ magnitude to which these sectors are impacted.

The degree/ magnitude of impact of each hazard on each sector in the County was rated by stakeholders at either High (3), Moderate (2) or Low (1). See Table 4 for a summary of the outcomes of this exercise.

Please note: The magnitude of impact is rated as 'High/ Extremely Serious' (indicated in red), 'Moderate/Serious' (indicated in orange) or 'Low/ Less Serious' (indicated in yellow). 'Not relevant' is indicated in white.

Table 6: Extent of Climate Hazard impact on the Sector within Nyandarua County

Climate Hazard	Building	Transport	Energy	Water	Waste	Regional Planning	Agriculture and forestry	Environment and Biodiversity	Health	Emergency and Civil Protection	Tourism	ICT[1]	Education	Society, Community and Culture	Informal Housing	TOTAL
Extreme heat	2	1	3	2	1	1	3	3	3	2	2	1	2	3	3	32
Extreme cold	2	1	3	1	1	3	3	3	3	2	2	1	2	3	3	33
Frost	0	0	1	2	0	2	3	3	1	1	1	1	1	2	1	19
Extreme Rainfall	2	3	3	3	2	2	3	3	2	3	2	2	2	2	3	37
Fog	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	3
Hailstorms	2	2	1	1	0	1	3	2	1	1	1	0	1	1	2	19
Flash flood/ surface flood	3	3	1	3	3	2	3	2	2	1	1	1	2	3	3	33
River flood	3	3	2	3	2	2	3	3	2	3	2	1	3	3	2	37
Droughts	2	1	2	3	1	2	3	3	3	3	3	1	3	3	3	36
Strong winds	1	1	0	1	1	1	2	2	0	0	0	1	0	1	2	13
Lightning and thunderstorms	1	1	0	1	1	1	2	2	0	0	0	1	0	1	2	13
Wild fires	1	1	1	3	1	2	3	3	2	3	3	1	1	1	1	27
Forest fires	0	2	2	3	1	2	3	3	2	2	3	1	2	2	2	30
Land fires	1	1	1	3	1	2	3	3	2	3	3	1	1	1	1	27
Landslides, mud slides and rockfall	1	1	0	0	0	1	0	1	0	1	1	0	1	1	1	9
Erosion	2	3	2	3	2	2	3	3	2	1	2	1	1	3	2	32
Waterborne diseases	0	1	0	3	2	1	2	3	3	2	2	1	2	3	2	27
vector-borne diseases	1	1	1	2	1	1	1	1	3	2	1	1	2	2	2	22
Airborne diseases	2	2	1	1	2	2	2	1	3	2	3	2	3	2	2	30
Insect and pest infestation	1	1	1	1	1	1	3	2	2	2	1	1	2	3	2	24
TOTAL	**27**	**30**	**25**	**39**	**23**	**31**	**48**	**46**	**36**	**35**	**33**	**19**	**31**	**41**	**39**	

1 Information and Communication Technologies

The outcomes of this exercise indicate that the climate hazards currently deemed as having the highest impact on the majority of sectors and services in Nyandarua are Extreme rainfall and floods followed by droughts. The top four sectors most affected by current climate hazards are Agriculture and forestry; Environment and biodiversity; Water and lastly, Society, community and culture. The frequency and intensity of droughts and their impacts in Nyandarua are increasing. Given that Nyandarua is predominately an agricultural county, the impacts of reduced rainfall and droughts are being felt strongly by the agriculture and forestry sector. The climate hazards currently deemed by the participants as having the lowest impact (comparative to the other hazards affecting the County) on the sectors and services in Nyandarua are fog and landslides.

The impacts of drought are increasingly being seen in Nyandarua County's biodiversity hotspot. Lake Ol Bolossat in Nyandarua covers approximately 43.3km^2 and is a critical site for hippos and bird species such as the endangered grey crowned cranes. In addition, the lake supports the livelihoods of communities, livestock and wildlife in Nyandarua and surrounding Counties. However, the increasing occurrence of droughts together with the increasing extraction of water from the Lake has led to it completely drying out in March 2023. This has impacts on the humans, flora and fauna utilising the lake.

Fig. 13: Dried Lake Ol Bolossat, Nyandarua (March 2023)

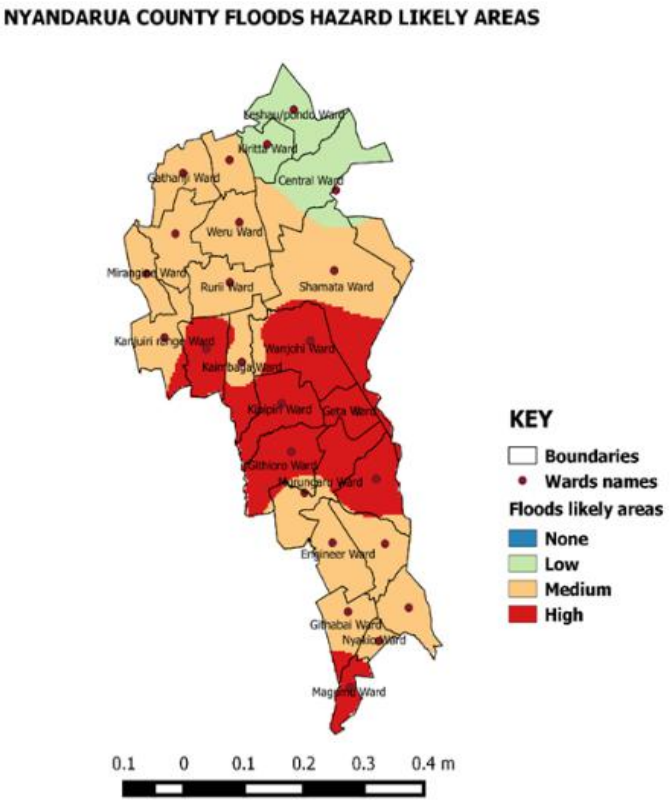
2.2 Spatial Distribution of Risks

From the ward-level workshops, drought, floods, frost and forest fires emerged as the prevalent hazards impacting the county. Drought was noted to be dominant in Ndaragwa central Ward, Leshau Pondo, Kiriita ward and the lower shamata, Rurii, Kaimbaga, Karau Githabai, Magumu, Murungaru, Githioro and lower Kipipiri wards. Flood was prone in Kipipiri and Ol Kalou sub-counties and Magumu ward where they were associated with soil erosion.

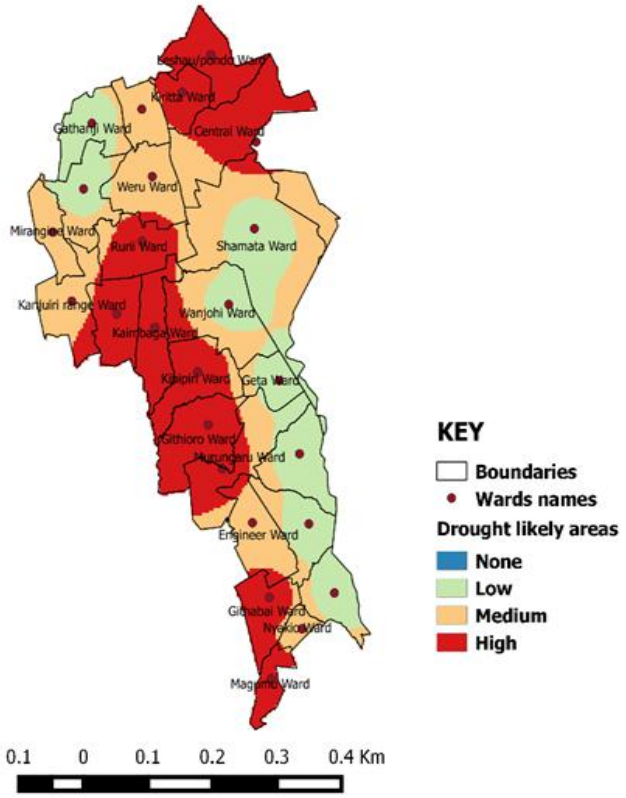
Frost was noted to dominant in North Kinangop, Engineer, Gathara and Murungaru wards where it was associated with massive destruction of crops and pastures. Forest fires were noted to be dominant inwards neighboring Aberdare Forest including Geta, North Kinangop, Njabini and Ol Bolossat Forest

in Gathanji.

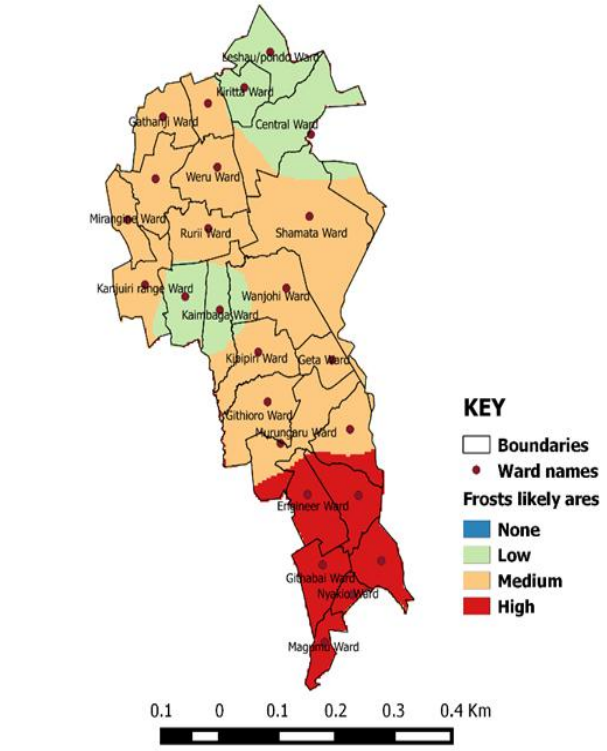
From the Ward level workshops, heatmaps were developed for the four dominant hazards experienced within the County as illustrated below:



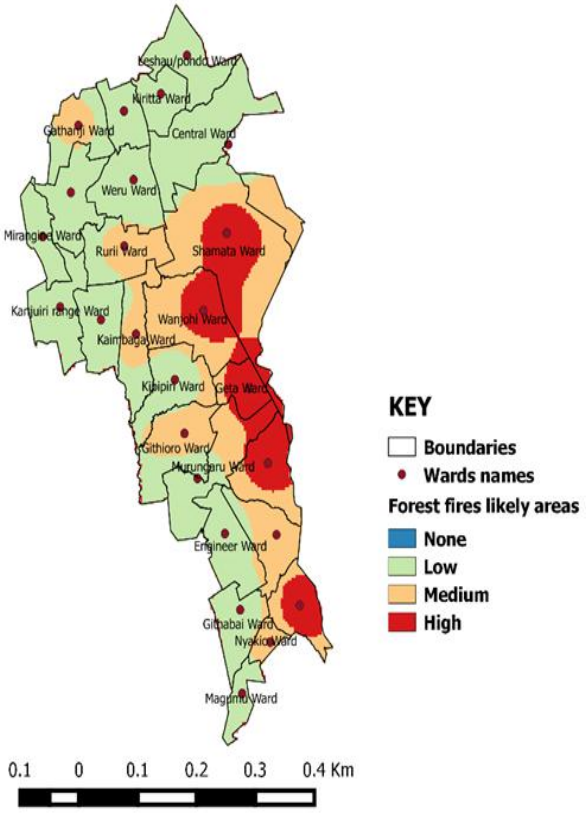
NYANDARUA COUNTY DROUGHT HAZARD LIKELY AREAS



NYANDARUA COUNTY FROSTS HAZARDS LIKELY AREAS



NYANDARUA COUNTY FOREST FIRES HAZARD LIKELY AREAS



CHAPTER THREE

3.0 Future Climate Scenarios for the County

3.1 Climate History

According to the World Bank Climate Change Knowledge Portal, Kenya's climate ranges from tropical (along the coast) to arid (in the mountain regions). The average temperature across the country is 24°C and the mean annual precipitation is 669 mm. The rainy season in Kenya usually begins in March and decreases in May to June. Since 1960, Kenya's mean annual temperature has increased by 1.0°C, at an average rate of 0.21°C per decade. The rate of increase has been most rapid in March to May (0.29°C per decade) and slowest in June to September (0.19°C per decade). Observations of rainfall over Kenya since 1960 do not show statistically significant trends, as trends in the extreme indices based on daily rainfall data are mixed.

In Kenya between 1960 and 2003, 1°C was witnessed, that is approximately 0.21°C per decade. Warming mostly occurred between March and May when great rains are experienced hence the planting season. This in turn affects agriculture which is depended upon by approximately 75% of the Kenyan population.

Kenya contributes approximately 0.13% of the global emissions, that is, 60.2MtCO2e. However, the emission rate is expected to increase with the increase in the rate of industrialization and urbanization. The greatest contributor to the emissions is agricultural sector with 62.8%, followed by energy with 31.2% then industrial sector with 4.6% and lastly waste with 1.4%.

Climate has been noted to change within the county as per historical analysis. Dry seasons and extreme precipitation have been witnessed to be hazardous over time. Rise in temperatures. For instance, since 1981, the first half of the year has recorded a moderate increase in temperatures (1°C) especially between March and May with a slight increase in precipitation while the second half has recorded a mild increase in temperatures of approximately 0.5°C with no change in precipitation.

Prolonged droughts. In the second half of the year, an increase in dry spells has been noted such that 30-60 (average of 45) consecutive days experiences moisture stress while in the second half of the year shorter dry spells have been recorded such that 25-60 (average of 30) consecutive days experiences moisture stress (MoALF, 2016). The droughts have been noted to extend even into the rainy seasons at the same time being long and intense (Government of Kenya, 2018).

Extreme precipitation and flood risks have been noted to increase by 25% in the first half of the year compared to the second half of the year. Between 1981-2015, in the first half of the year, at least each day received above 20mm of precipitation which only occurred for 3 years in the second half of the year in the same period (MoALF, 2016). Generally, the long rainy seasons have become shorter and drier while the short rainy seasons have become longer and wetter resulting in floods. However, the overall rainfall is still low. In the last 3-6 decades, heavy rainfall has become frequent with witnessed rainfall events causing floods being 7 per year in 1990s and 10 events per year between 2000-2006 (Government of Kenya, 2018). In 2020, the heavy rains witnessed caused flooding and landslides that resulted in washing away of Thitai Bridge along Malewa River in Ol' Kalou interfering with transport within the county.

In addition, instances and frequency of frost, cold days and nights have decreased while that of heatwaves, hot days and nights have increased. The frequency and magnitude of extreme weather conditions has increased within the county since 1950 (Government of Kenya, 2018).

3.2 National and Downscaled Climate Change Projections

The World Bank Climate Change Knowledge Portal uses the global climate model CMIP5 (RCP 8.5) to project future temperature and rainfall trends over Kenya. According to this widely used model, the mean annual temperature in Kenya is expected to increase by 1.0°C to 2.8°C by 2060 and annual rainfall is expected to increase between October and December as well as between March and May.

By the early 2040's it is projected that temperatures will increase by 0.3°C. During the same period, the first half of the year, precipitation is expected to decrease by 0.3% and by 6% in the second half of the year. It is expected that the number of consecutive days experiencing moisture stress will double to a range between 35-70 days within the first half of the year while in the second half of the year they are likely to range between 40-70 days. It is also expected that climate change impacts will remain the same despite the change on GHGs emissions (MoALF, 2016).

Downscaled Climate Change Projections

Using the Climateinformation.org developed by the Swedish Meteorological and Hydrological Institute (SMHI) on behalf of World Meteorological Organization, World Climate Research Program and Green Climate Fund, Nyandarua County climate projections were downscaled for the period 2011-2024 against reference period of 1981-2010. Mean annual temperature was projected to increase with 1°C. The average rainfall for the same period is projected not to change though the intensity could vary.

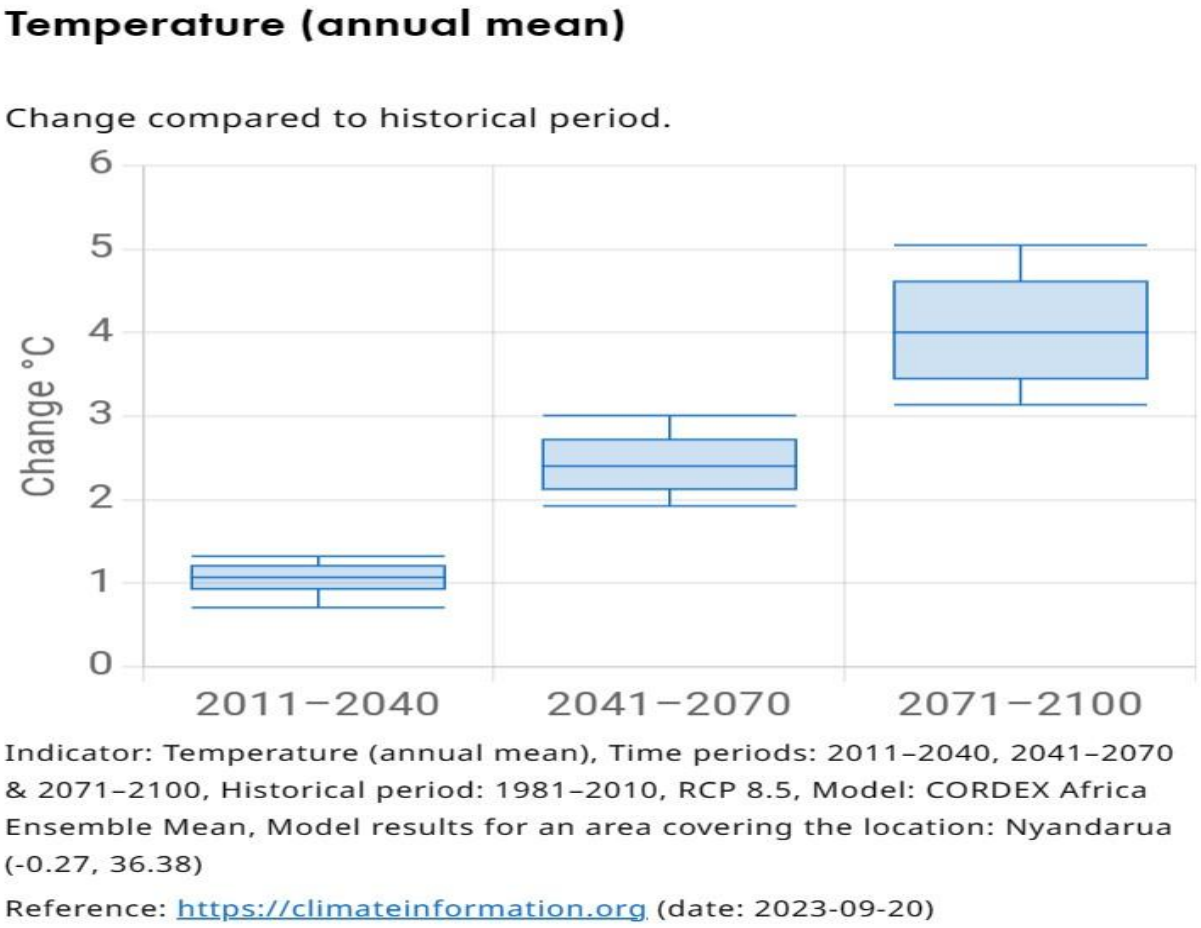


Figure 1: Nyandarua County projected mean Annual Average temperature

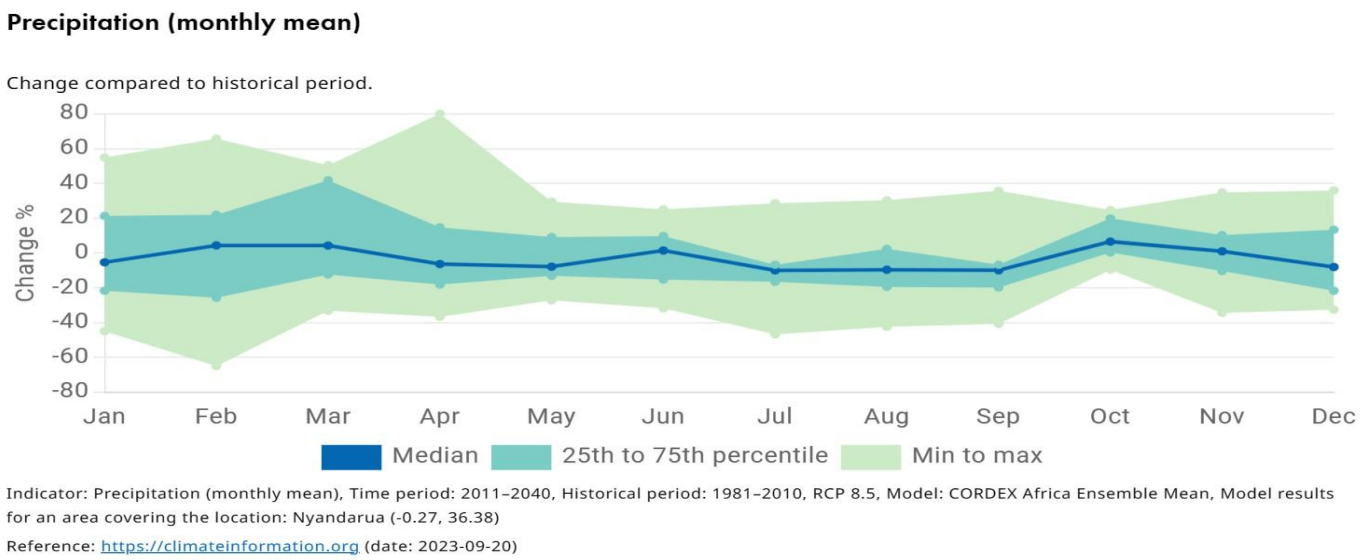
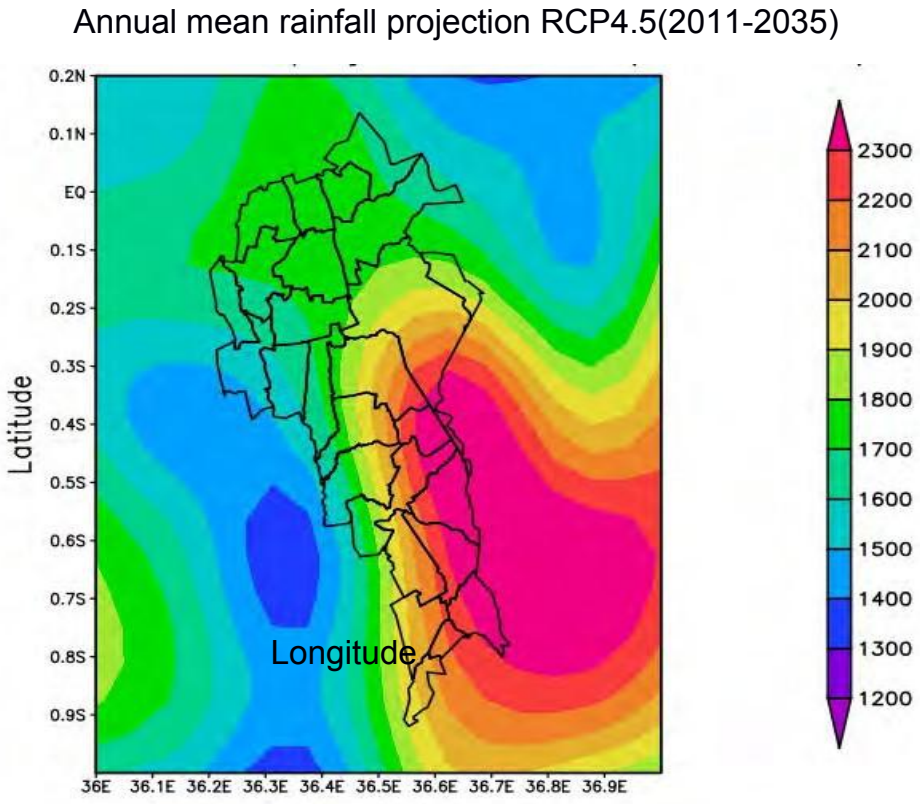


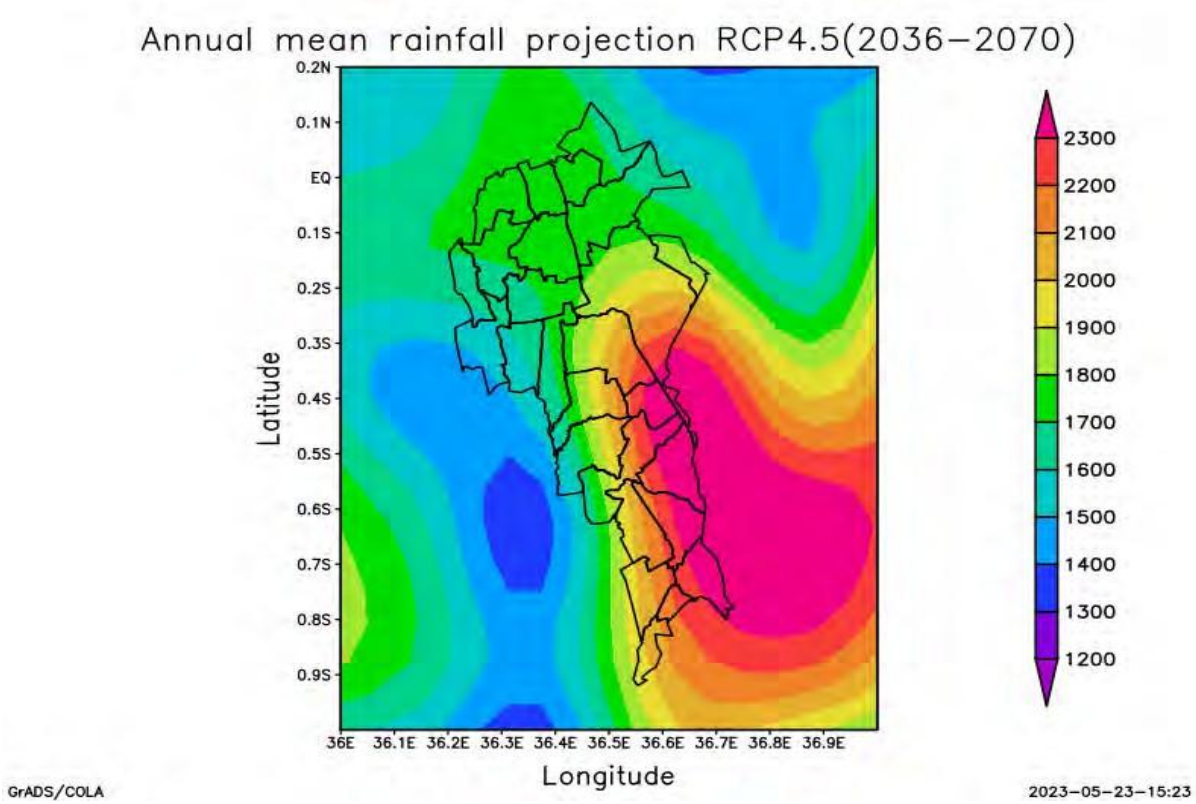
Figure 2 Nyandarua County Projected Mean monthly rainfall

3.3 County Future Climate Scenarios

In most of the ward engagements, prolonged droughts were projected to continue occurring frequently which will be accompanied by slight rise in temperatures as well as frost. Due to the increasing deforestation, strong winds were projected to increase both in dry periods of March as well as rainy seasons. This will accelerate the flooding and erosion rates especially in flood-prone wards.

The extreme cold was projected to increase across various wards which was projected to increase human diseases such as arthritis and respiratory diseases which may result to emigration of mainly elderly to other warmer Counties. The extreme cold was projected to increase pest and disease infestation in crops and livestock as well.




Annual mean rainfall projection RCP4.5(2036–2070)
0.2N
0.1N
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0.1S
0.2S
0.3S
0.4S
0.5S
0.6S
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0.8S
0.9S
Latitude
36E 36.1E 36.2E 36.3E 36.4E 36.5E 36.6E 36.7E 36.8E 36.9E
Longitude
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CHAPTER FOUR

4.0 Analysis of Existing Resilience/Adaptation Strategies to Current and Future Climate Risks

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

Climate change has been identified to pose numerous risks to communities that cannot be reduced to zero therefore trickling the engagement of the governments to take decisive action to help the community manage them. During the PCRA exercise conducted across the county, Hazards differentiated were drought, floods/extreme rainfall, frost, strong winds and forest fires. Effects of climate change are forcing the county to confront new challenges. To support the development and effectiveness of these strategies, the existing strategies were found to be effective and evidence based. In this regards the following strategies were identified existing adaptation/resilience for drought, floods, extreme temperature, frost, strong wind, thunderstorm and hails storm.

Adaptation Strategies for Droughts

All wards across Nyandarua County identified drought as the major hazard. However, the impacts of drought varied from ward to ward. Crop failure, food insecurity, malnutrition and poverty were mentioned as the most frequent direct and indirect impacts but with varying impacts across the words. All wards in Ndaragwa Sub-County and most other wards in relatively dry regions in Ol Kalou, Ol' Joro Orok and Kinangop identified water shortage as a major risk. This was associated. Livestock farming was also identified to be highly impacted by droughts through lack of pasture wand water sometimes leading to death/loss of livestock.

Communities outlined strategies that they are currently or have been traditionally employing to adapt or improve on resilience against the said impacts.

The most effective strategies identified includes:

(a) Water harvesting and reticulation

Though communities would like further support on this, water harvesting was identified as a strategy employed across the county. Specific approaches have been development of, borehole drilling, roof water harvesting and storage.

(b) Farm and agroforestry

Agroforestry, the purposeful integration of trees or shrubs with crops and/or livestock at farm, has been a very successful climate change adaptation strategy that helps increase resilience of farmers and agricultural systems. Specific approaches applied included; tree planting trees, planting of cover crops and trees friendly to the environment, planting fruit trees.

(c) Soil and water conservation

These encompasses activities that maintain or enhance the productive capacity of land in areas affected

(d) Conservation of forests and ecosystems

Kinangop, Ndaragwa and Kipipiri sub-counties are bordering Aberdare Forest Reserve and thus

conservation efforts in the Aberdare Mountains have been very effective in reducing the impacts of droughts and prolonged dry periods.

(e) Feed storage

Adaptation Strategies for Flood, Hailstorms and Extreme Rainfall

Just like droughts, all wards across Nyandarua County identified flood as a major hazard. As well, the impacts of floods varied from ward to ward but wards with more flat landscapes were more affected. Death of livestock, destruction of infrastructure, food insecurity and soil erosion were identified as the major impacts as a result of flooding.

Communities outlined strategies that they are currently or have been traditionally employing to adapt or improve on resilience against the said impacts.

From the public participation forums across the county, communities identified numerous strategies. A summary of the most effective strategies includes:

(a) Farm and agroforestry

Farm and agroforestry have been a very successful climate change adaptation strategy that communities have employed to reduce the impacts of floods and extreme rainfall. Specific effective strategies were, contour farming, planting cover crops, planting indigenous trees, planting fruit trees, building terraces and gabions.

(b) Soil and water conservation

Soil and water conservation measures were These encompasses activities that maintain or enhance the productive capacity of land in areas affected. Specific effective strategies were, water storage, construction of water pans.

(c) Early warning systems

Members indicated that early warning systems have been very instrumental in disaster risk reduction.

Adaptation Strategies for Frost and Strong Winds

Most wards in Kinangop, Ol Kalou and Kipipiri identified frost to pose a major risk and threat to crop production. Over the last 30 years, participants observed that the frequency and intensity of frost has increased. Like drought and flooding, high frequency and intensity of frost was associated with crop failure that was said to lead to food insecurity, malnutrition and poverty. The only effective strategies identified was planting more resilient varieties and timing as informed by indigenous knowledge.

Effectiveness of Adaptation Strategies in Relation to Vulnerable Groups

All the above strategies were associated with different degrees of effectiveness and were all well covering the interests of the vulnerable groups including, women, children, PWDs and youth to:

- Build resilient foundations with rapid and inclusive development
- Help people and firms do their part.

- Revise land use plans and protect critical infrastructure.
- Help people and firms recover faster and better.
- Manage impacts at the macro level.
- Prioritize according to needs, implement across sectors and monitor progress.

To achieve the resilience strategies, the Stakeholders Applying the Strategy shall integrate the governing laws, regulations and policies to climate change. The adaptation strategies will ensure high vulnerability populations have the financial, technical and institutional resources they need to adapt.

4.2 Effectiveness of Adaptation/Resilience Strategies to Future Climate Risks

Participants suggested adaptation issues, such as conservation of floodwater; irrigation of land during drought; provision of farm inputs by the County government; reduction of post-harvest losses; control of pests and diseases; and use of better and improved crop varieties. Others are diversification of livelihoods, on-farm adaptation measures to increase the resilience of production systems and livelihoods to a changing, unpredictable climate including soil management and conservation practices such as staggered cropping, green manure, composting, plowing back of the organic material, minimum tillage; promotion of drought-tolerant varieties intercropping and also water conversation practices rainwater harvesting and storage to enable use during the dry spell, water pans, and irrigation infrastructure. Measures that improve productivity while also building resilience to future climate change are generally referred to as 'no-regret' measures—that is, actions that make sense even in the absence of climate change.

The outcomes on this exercise and the future effectiveness of the resilience strategies are outlined in Table 6 below.

Table 6: Effectiveness of Adaptation/Resilience Strategies to Future Climate risks

Climate Hazard	Economic Sector Affected	Climate Resilience Strategy	Future Effectiveness	Description	Affected Vulnerable Group	Stakeholder Applying
Drought	Agriculture & Forestry	Planting drought resistant crops	High	Drought resistant crop will withstand harsh climate condition making chances of crop failure low in time of droughts	Women, children, Resource poor households, PLWDs, Youths	County Government National Government Farmers Community Members Department of meteorology NGOs CBO
		Conserving fodder crops to avoid livestock death	High	Conserving of fodder will ensure availability of fodder during the dry season thus preventing death of animals		
		Cold storage of food produce	High	It will minimize food waste in time of plenty and sold at late dates when market prices are favorable		
		Food preservation both modern and traditional	High	Community will be food secure in occurrence of drought		
		Growing and storage of Folder	High	Growing of fodder will ensure availability of fodder during the dry season thus preventing death of animals		
		Ealy warning systems	High	Community will find alternative ways to adapt to drought.		
		Soil testing	High	Farmers will have knowledge on the appropriate soil inputs to enhance soil fertility thus optimal production.		
		Government subsidy	Medium	Ensure farmers with inadequate resources access farm inputs		
		Practicing of Minimum Tillage	High	Ensure optimal soil nutrients and soil water conservation thus optimal crop production		
		Practicing Kitchen gardens	Medium	Residents with small parcels of land will produce fruits and vegetable to supplement their diets		
		Provision of Milk Coolers	High	It will minimize milk spoilage before getting to the market		
		Improved animal breeds	High	Ensure maximum livestock production and resistant to diseases		
		Agricultural extension services	High	Increased farmers knowledge on the type of crops to grow and livestock to rear and their management		
		Research on seeds	High	Community will plant high certified, clean seed thus optimal productions		
		Crop and animal insurance policies	Medium	Compensate farmers in case of death of crops and livestock.		

	Water Supply	Water Conservation	High	Water security for domestic and livestock will be available due to increased rainfall extremes		
		De silting and rehabilitation of dams and construction of individual water pans	High	Ensure high storage capacity of water to be used for domestic, livestock and irrigation purposes		
		Drilling boreholes	Low	Underground water aquifers will likely be depleted in future. Borehole drilling may not be a viable solution to curb future droughts		
		Roof water harvesting and water tanks	High	A lot of water goes to waste when it rains. Roof water harvesting is a viable solution to future droughts especially at Household level		
		Early warning system	High	Early warning systems will be a very important strategy for future droughts with the increased unpredictable occurrence of droughts. This will ensure that local communities are well prepared		
		Water supply and reticulation	Medium	it can only happen in areas where water is available. Where there is not enough water it is not viable at all		
	Education	School feeding program	Medium	It is not sustainable in future for it's a resource intense strategy. There is need for a better strategy		
	Environment and Diversity	Conservation of catchment areas	High	Through planting of indigenous trees which grow for a long period of time. This is a viable future strategy		
		Controlled activities in wetlands and riparian areas	High	This will lead to regeneration of the ecosystems. Therefore, it's a viable strategy		
		Fencing of lake Ol Bolossat	High	Fencing of the lake will control encroachment and Human Wildlife conflict in future		
		Provision of feeds to wildlife	Low	It no sustainable and there is need for a better strategy		
		Banning planting of eucalyptus trees	High	High water consumption tree species.		
		Community reconciliation	Medium	The insecurity is due to scarce resources, there		

Flood	Agriculture	Insurance policy on crops and animals	Medium	Compensation to farmers once the death occurs but there is need for better strategy to avoid the deaths.	Women, children, Resource poor households, PLWDs, Youths	County Government National Government Community Members Department of meteorology NGOs CBOs Farmers
		Use of cover crops	High	Controls surface run off and controls soil erosion		
		Contour farming	High	Controls surface run off an reduces soil erosion		
	Infrastructure	Construction of Gabions	Medium	Controls soil erosion but there is need for more climate proof roads		
		Construction of Drainage systems	High	It will control surface run off from build-up areas and avoid flooding		
		Building of terraces	Medium	Sometimes the terraces can break leading to increased soil erosion		
		Storm and surface run off water harvesting	High	This ensures enough water during the dry seasons which is very good in future due to increased flooding		
		Unclogging of drainage system	High	Clean drainage system ensures no clogging		
	Environment	Protection of riparian areas by planting indigenous trees	High	Through planting of indigenous trees which grow for a long period of time. This is a viable future strategy		
	Health	Improvement of health facilities	High	This will ensure access to health facilities to the increasing population in future		
		Supply of mosquito nets	Medium	Medium-There is need for better strategy to curb mosquitoes in future		
Forest fires	Energy	Provision of alternative renewable energy sources	High	Renewable energy is the future for energy sector. This will reduce deforestation due to use of firewood as the main source of energy in the rural areas	Women, children, Resource poor households, PLWDs, Youths	County Government National Government Community members NGOs CBOs
	Disaster management	Firefighting equipment and personnel	Medium	This ensures timely respond to wildfires and any other fire outbreak.		
		Training of firefighting personnel	High	Better firefighting skills are very necessary in future to fight forest fires		
		Awareness creation	High	Very important to ensure public are aware of the consequences and how to avoid forest fires		
		Surveillance	High	Very important in future top avoid future fires		
		Fencing and protecting of forests from illegal access	High	this will ensure sustainable use of the forests		

Frost	Agriculture	Crop rotation and inter cropping	High	Will break the disease and pests' cycle hence very effective in future.	Women, children, Resource poor households, PLWDs, Youths	County Government National Government Farmers Community Members Department of meteorology NGOs Credit firms CBOs
		Use of certified seeds including planting materials	High	Community will plant high certified, clean seed thus optimal productions		
		Integrated pest management	Medium	This ensures sustainable pests management but there is need for a better strategy in future		
		Rotational grazing	Medium	Not sustainable due to land fragmentation.		
Pests and Diseases infestation	Agriculture	Crop rotation and inter cropping	High	Will break the disease and pests' cycle hence very effective in future.	Women, children, Resource poor households, PLWDs, Youths	County Government National Government Community members NGOs CBOs
		Use of certified seeds including planting materials	High	Community will plant high certified, clean seed thus optimal productions		
		Integrated pest management	Medium	This ensures sustainable pests management but there is need for a better strategy in future		
		Rotational grazing	Medium	Not sustainable due to land fragmentation.		
		Agricultural extension services	High	Provides farmers with adequate knowledge on crop types to be planted as per future climatic conditions		
Extreme Wind	Agriculture	Supporting climbing crops with post	Low	Very poor strategy. There is need for a better strategy.	Women, children, Resource poor households, PLWDs, Youths	NCG, GoK Community members NGOs CBOs
	Forestry	Indigenous tree and assorted fruit tree planting,	High	Indigenous trees have a long lifespan hence very effective in controlling wind		
Landslides, mud slide and rockfalls	Forestry	Tree planting and agroforestry	High	The root system will hold the soil together and avoid landslides	Women, children, Resource poor households, PLWDs, Youths	NCG, GoK Disaster management department Community members NGOs, CBOs
	Disaster Management	Early warning systems	High	Very effective in future to avoid disasters		
	Infrastructure	Construction of gabion and climate proof infrastructure	Medium	Not sustainable in future. There is need for climate proof infrastructure		
Hailstorms	Agriculture	Insurance policies on crops	Medium	Only compensate in case of death or destruction. Need to for a strategy to avoid destruction or death	Women, Resource poor households, PLWDs, Youths	Disaster management department NGOs Credit firms
	Disaster Management	Early warning system	High	Very important strategy for all future hailstorms to ensure appropriate measures are taken		

4.3 Factors that Affect Adaptive Capacity

During the participatory workshop, participants collaboratively identified and described the factors that will most challenge or support Nyandarua County's adaptive capacity in the face of climate change. The outcomes on this exercise are outlined in Table 6 below.

Table 7: Factors Affecting Adaptive Capacity

Factor	Relevance to Nyandarua [Yes or No]	Supports/ Challenges adaptive capacity	Description of the factor
Services			
Access to Basic Services	Yes	Support & Challenge	Access to basic services increases the adaptive capacity of residence in Nyandarua. However not all people in the County have access to basic services. Therefore, the County as a whole is has a challenge of increasing access to basic services.
Access to Healthcare	Yes	Support	Access to medical facilities and services supports adaptive capacity. But it was noted that some are able to access healthcare more easily than others.
Access to Education	Yes	Supports	Access to education supports adaptive capacity. But it was noted that some are not able to access quality education.
Socio-Economic			
Housing	Yes	Support & Challenge	Housing supports Nyandarua adaptive capacity. But Informal settlements e.g. the colonial villages pose a challenge in Nyandarua County's ability to adapt effectively.
Poverty	Yes	Challenge	Poverty hinders adaptive capacity for poor people cannot cope with the impacts of climate change.
Unemployment	Yes	Support and Challenge	Unemployment will support Climate change for climate change programs will create jobs but unemployment hinders the adaptative capacity due to unemployed groups exploring the natural resource unsustainably.
Migration	Yes	Challenge	Nyandarua is experiencing population groups moving out of the County due to employment opportunities presented elsewhere, which is a challenge to adaptive capacity.
Economic Health and Diversity	Yes	Support	Climate change affects the social and environmental determinants of health – clean air, safe drinking water, sufficient food and secure shelter. This will greatly hinder the county's adaptative capacity.
Governmental			
Political Stability	Yes	Supports	There are some political disruptions in and outside of Nyandarua County. But overall, there is political stability in the County supporting their adaptive capacity.
Government Capacity	Yes	Support & Challenge	The county has set up policies which will support the adaptative capacity of Nyandarua County.
Budgetary Capacity	Yes	Support & Challenge	The county has set 2% of its development budget to cater for climate change programs, however this is not enough and lack of sufficient funding will hinder the counties adaptative capacity.
Land Use Planning	Yes	Support & Challenge	Land fragmentations is increasing in the county, this will hinder the county's adaptative capacity. However, the once the County completes the County Spatial plan, it will support the adaptative capacity.
Access to quality data	Yes	Support & Challenge	Documentation, County Climate Change information management system and County resource centers will ease access to up-to date data as well as enacting of the County Access to information act but lack of quality data hinders the county's adaptive capacity.
Community engagement	Yes	Supports	The community in Nyandarua are frequently and proactively engaged with, especially with regarding to local-led solutions.
Physical and Environmental			

Factor	Relevance to Nyandarua [Yes or No]	Supports/ Challenges adaptive capacity	Description of the factor
Rapid urbanization	Yes	Challenge	Rapid urbanization is accompanied with increasing waste management, road planning and land-use changes which can impact a regions capacity to adapt to climate hazard impacts.
Environmental conditions	Yes	Support & Challenge	There is complexity around environmental conditions. Natural resources enhance adaptive capacity. However, when natural resources are under stress, they can challenge an area's adaptive capacity.
Infrastructure conditions	Yes	Support & Challenge	Poor resource households living in informal settlements and areas with limited roads will limit their adaptive capacity. Opening up of these areas with tarmac and murram roads and cold stores will promote their adaptive capacity.
Multi-level governance	Yes	Support	There is cross-sector collaboration at both the national and local levels. This includes the integration occurring in some of their policies. Climate change mainstreaming is increasing at various levels. This enhances Nyandarua's adaptive capacity.

As indicated in Table 7, various factors were found to both support and challenge Nyandarua's adaptive capacity, including Access to Basic Services; government capacity, access to quality data and environmental conditions amongst others. It is worth highlighting that the participants noted multi-level governance as a key factor that can promote adaptive capacity of the community. This was due to the fact that Nyandarua is characterized with strong collaboration and integration between different departments and levels of government. This type of multi-level governance is highly advantageous to building climate resilience.

CHAPTER FIVE

5.0 NYANDARUA COUNTY CLIMATE STRATEGIC ADAPTATION INVESTMENT/ACTION PRIORITIES

From the participant engagements, priority adaptation strategies were proposed to respond to the main climate change hazards in order to promote community resilience. These priority projects revolved around ecosystem conservation, food waste, soil and water conservation thematic areas. Soil and water conservation projects were the most prioritized by the residents mainly due to the fact that drought and floods were identified as the major climatic risk occurring across all the twenty-five (25 wards).

In order of their priorities, the respective climate investment actions are as illustrated below.

Table 8: Priority Climate Investment Areas

S. No	Climate Hazard	Priority Climate Investment Areas				Vulnerable Group Benefiting
		Short-term goals		Long term goals		
		Priority 1	Priority 2	Priority 3	Priority 4	
1	Drought	Adequate Water provision: Water reticulation (Leshau pondo, Karau, kaimbaga, Rurii) Dams (Rurii, Kiriita wards) Masonry tanks in Kipipiri sub-county, Roof catchment across all wards Drilling boreholes (wanjohi, Githioro, Njabini,Githabai and all other wards)	Agricultural production: Climate smart agriculture: irrigation (Ndaragwa sub-county), Improved animal breed (Shamata Ward) greenhouses (county wide), provision of quality seeds (Countywide), drought tolerant crops (Ndaragwa and lower Kipipiri sub counties), government subsidies (countywide), Construction of cold stores, milk coolers in Kinangop, Kipipiri and Ol Joro Orok sub counties,	Early warning systems to advise on timely planting across all wards	Awareness raising and trainings on effective farming strategies across ala wards	PLWDs Elderly Women Children Youth
2	Floods	Construction of drainage system in major towns of Mairo Inya, Engineer and Njabini	Early warning systems in all the wards	Raise awareness and capacity building on insurance in agriculture in all the wards of the county	Construction and maintenance of all-weather roads to allow transportation of farm produce to markets	Women PLWDs Elderly
3.	Frost	Invest on irrigation in Kinangop Sub counties	Embrace use of green houses In Kinangop	Investing on early warning systems in all the wards	Agroforestry establishment of nurseries in all the wards	PLWDs, Elderly Women, Children Youth
4	Forest fires	Enforcement of existing law and policies mainly in North Kinangop, Geta, Wanjohi and Shamata wards	Adoption of alternative Renewable energy Sources (Biogas, Solar) in all the wards	Reafforestation and protection of catchment areas mainly in North Kinangop, Geta, Wanjohi and Shamata wards	Livelihood diversification to curb illegal charcoal burning and honey harvesting in North Kinangop, Geta, Wanjohi and Shamata wards	Women Children
5	Landslides, mudslides and Rockfalls	Construction of gabions in Magumu and Njabini wards	Practicing tree growing and contour farming in Magumu and Njabini	Early warning to warn people in prone areas		Children Youth and Poor resource households

6.	Strong winds	Establishment of tree nurseries to women and youth groups mainly in around lake Ol Bolossat and Githabai wards	Reafforestation and agroforestry and farm forestry to act as windbreakers in all the wards	Promoting adoption of wind power in Heni-Githabai wards and around Lake Ol Bolossat		PLWDs, Elderly Women, Children Youth
7.	Pest and disease infestation	Agricultural extension services in all the wards	Provision of certified seeds to farmers in all the wards	Research to introduce resistant crops in all the wards	Awareness raising, community trainings and education across all the wards	PLWDs, Elderly Women, Children Youth, Poor resource households
8.	Biodiversity loss	Conservation and protection of Lake Ol Bolossat	Adoption of alternative Renewable energy Sources (Biogas, Solar)	Conservation and protection of Protected areas		Women, youth, elderly, poor resource households, children
9.	Hailstorms	Provision of agroforestry trees to farmers across all the wards	Promote adoption of insurance cover against their crops across all the wards			Women, youth, elderly, poor resource households, children

CHAPTER 6

6.0 CONCLUSION

Climate hazards experienced in Nyandarua County include drought, floods, extreme winds and pests and diseases infestation. However, Kinangop Sub County participants identified frost as major hazard they face in their respective wards. Lightning/thunderstorm; hailstorms, landslides, Mudslide, Rock fall and erosion rockfall were also identified by the participants as major hazards particularly in Githabai and Magumu wards respectively. Wild fires including forest fires and land fires mainly in areas neighboring Aberdare forest; waterborne diseases; vector-borne diseases; air-borne diseases; insect and pest infestation (while partially linked to insect infestation, pest infestation was also hazard identified by stakeholders.

The top four hazards deemed as having the most significant impact on Nyandarua County are drought; floods; frost, waterborne diseases and air-borne diseases.

The climate hazards currently deemed as having the highest impact on the majority of sectors and services in Nyandarua are floods, droughts, extreme rainfall and extreme cold. The top four sectors most affected by current climate hazards are Agriculture and forestry; Environment and biodiversity; Water and lastly, Society, community and culture.

The climate hazards currently deemed as having the highest impact on the majority of vulnerable population groups in Nyandarua are droughts and floods. The top four vulnerable population groups identified as most affected by current climate hazards are the elderly, women, children/infants, poor resource households and persons with chronic disease.

In addition, various factors were found to both support and challenge Nyandarua's adaptive capacity, including access to basic Services; government capacity, access to quality data and environmental conditions amongst others. It is worth highlighting that the workshop participants noted an additional component that supports their county's ability to adapt to climate change impacts. This is multi-level governance. Nyandarua is noted to be characterized with strong collaboration and integration between different departments and level of government. This type of multi-level governance is highly advantages to building climate resilience.

The participants noted provision of adequate water both for domestic and agricultural purposes as a major adaptation strategy to dealing with drought. Some interventions such rehabilitation and desilting of dams was noted to be a solution to both drought and floods. This led to prioritization of dams, water harvesting and storage, expansion of intakes and reticulation as one of the key climate investment areas. Community education and training was advocated by majority of the participants across the wards to help raise their awareness on climate change as a way of promoting community resilience and adaptive capacity to impacts of climate change. To inform the community prior to occurrence of the hazards hence reduce risk, the participants recommended use of early warning system. This would only be possible through acquisition of a County Climate Information Management System.

CHAPTER SEVEN

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