REPUBLIC OF KENYA

COUNTY GOVERNMENT OF NYAMIRA

DEPARTMENT OF ENVIRONMENT, ENERGY, WATER, CLIMATE CHANGE AND NATURAL RESOURCES

PARTICIPATORY CLIMATE RISK ASSESSEMENT REPORT

MAY, 2023

FOREWORD

This is the first Participatory Climate Risk Assessment on Climate Change that has been developed through a consultative process in the County. Climate change poses undoubtedly the greatest risk to the realization of the ideals of Sustainable Development Goals, Kenya vision 2030, the Big Four Agenda, the County Integrated Development Plans and other blueprints that push agendas for poverty reduction and food security. Our County has experienced extreme weather events which heighten threat to food security, contribute to deteriorating water resources, diminished biodiversity and increased land degradation.

The Conference of Parties, COP 25 in Paris 2019, Parties to the UNFCCC agreed to combat climate change by formulating improved emissions reduction plans, accelerating and intensifying the actions needed for a sustainable low carbon future. Therefore, the County is committed to providing a framework to increase the ability to adapt to the adverse impacts of climate change, foster resilience and low greenhouse gas emissions development. Nyamira County borrows largely from the Climate Change Act,2016 and the National Climate Change Action Plan,2018-2022, Nyamira County Climate change Action Plan 2021-2026, Nyamira County Climate Change Policy 2021, Nyamira County Climate Fund Act 2021. The County government has also dedicated 2% of its development budget to Climate Change response. This provides and elaborate framework for enhance response to climate change impacts through proposing low carbon climate smart actions. For a stable climate system, there is need for the County to conserve and increase its carbon sink as well as adopting clean production technologies. There is also need to mainstream climate considerations into our flagship projects for resilience to achieve the Sustainable Development Goals. It is our mandate to direct efforts towards ensuring that our economy is recalibrated to support climate-smart and carbon-efficient pathways investment in "Bankable Projects" such as renewable energy and water harnessing. The actions proposed in this Plan are geared towards ensuring that our development remains sustainable in the event of any adverse climate change impacts, including droughts, floods, and other extreme climate events that have in the recent past occasioned resulting to negative implications on our economy. It will also contribute to the achievement of our Nationally Determined Contribution under the Paris Agreement.

This Participatory Climate Change Risk Assessment is an approach that enables communities to identify climate change hazards, their impacts and proposes community-initiated solutions for Climate change action planning and implementation. This process is inclusive of all stakeholders ranging from the county government, the civil society, research and academia, private sector and the local community to ensure its effective implementation for the benefit of the present and future generations. A Climate Change Action Plan shall be developed, primarily guided from the finding of this PCRA report to give community led guidance to aid in the response to Climate Change and its impacts on the community.

Hon. Amos Kimwomi Nyaribo.

Governor Nyamira County

ACKNOWLEDGEMENT

The process of preparing this document could not have been accomplished without the commitment, dedication, sacrifice and determination of all the members of staff of the County Government, citizens and other stakeholders who provided valuable inputs. I would wish to sincerely thank and acknowledge all individuals who collectively and individually contributed towards the development and production of this Plan. First and foremost, I acknowledge the valuable leadership and support of H.E Amos Nyaribo Governor, Nyamira County.

Great thanks go to all the County Executive Committee Member Environment, The Chief Officer, Department of Environment, Water, Energy, Mining, Climate change & Natural Resources, Meteorological Department, Nyamira County Directorate of Climate Change and Adaptation consortium consultants during the PCRA process. The National Treasury's FLLoCA Program Implementation Unit (PIU) provided technical and substantive inputs to the implementation of the PCRA process. Great thanks to the PCRA Technical working group, which included representation from the County departments of Environment, Agriculture, Water, Public Health, Economic Planning, Lands all under the coordination of the Nyamira County Director Climate Change and Civil Society organizations for their participation in the community engagements.

I may not mention everybody, but do acknowledge all those individuals who directly or indirectly contributed Through their active participation in the identification and prioritization of Climate Change issues in their wards which informed the preparation of this document.

Hon. John Matiangi

CECM-Environment, Water, Energy, Mining, Climate change & Natural Resources

EXECUTIVE SUMMARY

The Nyamira County Participatory Climate Change Risk Assessment (PCRA) was carried out between April and May 2023. The objective of the PCRA was to guide the county to identify climate risks and hazards with their associated impacts within Nyamira County in order to inform the climate change action planning; integration of climate issues into the CIDP and the County Climate Change Action Plan. PCRA is also one of the conditions for accessing the Climate Resilience Investment Grant from the National Treasury's Financing Locally Led Climate Action, (FLLoCA). The PCRA report documents prevalent climate risks, source of vulnerability and the prioritized adaptation response actions. The County prioritizes the issue of climate change which is why it focuses on developing relevant plans and strategies that aim towards promoting resilience to the effects of climate change.

Nyamira County's economy is highly dependent on the natural resource base therefore highly vulnerable to climate variability and change. Climate change adversely impacts key sectors that are important to the economy and society, including water resources management, agriculture, fisheries and livestock; land use management; energy; public works; environment, disaster risk reduction; tourism wildlife and culture; trade and extractive industry and public health. This Action Plan provides a clear and concise articulation of priority actions to climate variability and change as well as addressing implementation gaps in these areas.

The Nyamira County Climate Change Action Plan 2021-2026 is informed and guided by key global, regional, national and county climate change adaptation frameworks, policies, legislations, and aspirations. NCCAP seeks to provide mechanisms and measures to achieve low carbon climate resilient development, in a manner that prioritizes adaptation, and recognizes the essence of enhancing the climate resilience. The Action Plan supplements the Nyamira County Adaptation Plan as it takes cognizance of the impacts of climate change on the socio-economic sectors. NCCAP identifies strategic areas where climate action is linked to the Big Four agenda, recognizing that climate change is likely to limit the achievement of these pillars. It provides a framework for priority enabling actions to be addressed which include; enabling policy and regulatory framework, technology and innovation, capacity development and knowledge management, climate finance and resources mobilization, transparency, measurement, reporting and verification.

The Action Plan identifies the relevant institutions and sectors that will be essential for the actions to realize the strategic objectives and the problem to be solved. It also outlines the implementation roles of the relevant county agencies and expected results in the delivery and coordination mechanisms.

Ombogo Marwanga
Chief officer,
Department of Environment, Water, Energy, Mining,Climate Change and Natural Resources

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DEFINITION OF TERMS

Climate Change	Change in the climate system that is caused by significant changes in the concentration of greenhouse gases due to human activities, and which is in addition to the natural Climate Change that has been observed during a considerable period.
Adaptation	Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.
Adaptive capacity	Ability of systems, institutions, humans, and other organisms to adjust to potential damage, take advantage of opportunities, or respond to consequences.
Global warming	Observed or projected gradual increase in global surface temperature. It is one of the consequences of Climate Change.
Greenhouse gases	Gases that absorb and emit radiant energy within the thermal infrared range. The main GHGs measured in a GHG inventory are, carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), per-fluorocarbons (PFCs), hydro-fluorocarbons(HFCs), sculpture hexafluoride (SF6) and nitrogen tri-fluoride (NF3).
Mitigation	Human interventions to prevent or slow down atmospheric GHG concentrations by limiting current or future emissions, and/or enhancing potential sinks for greenhouse gases.
Resilience	Capacity of social, economic and environmental systems to cope with a hazardous event, trend, or disturbance.
Vulnerability	Propensity or predisposition to be adversely affected. It encompasses sensitivity or susceptibility to harm, and lack of capacity to cope and adapt.

LIST OF ACRONYMS AND ABBREVIATIONS

CBOs	Community Based Organizations
CCAP	Climate Change Action Plan
CCF	County Climate Change Fund
CIDP	County Integrated Development Plan
CSO	Civil Society Organizations
ECDE	Early Childhood Development Education
FLLoca	Financing Locally Led Climate Action
KFS	Kenya Forest Service
KIHBS	Kenya Integrated Household Budget Survey 2015-2016
DNMP	Division of National Malaria Programme
KMD	Kenya Meteorological Department
NEMA	National Environment Management Authority
PCRA	Participatory Climate Risk Assessment
PWD	Persons with Disability
TVET	Technical and Vocational Training Colleges
WG	Working Group
WRA	Water Resources Authority
WRUAs	Water Resource Users Association

CHAPTER ONE: BACKGROUND AND CONTEXT

1.0 Background of Nyamira county

Situated in the Western part of Kenya, Nyamira County has since evolved from different administrative creations and boundaries since independence. It is indeed formed part of one of the divisions of the larger Kisii district way back in 1970s. In 1987, the Nyamira as a divisional boundary was created a district which has since existed with four constituencies. In 2013 with the coming of the devolution, Nyamira forms part of the 47 County Governments with one extra Constituency created and 20 electoral wards. The County Headquarters is located in Nyamira South Sub County, Township ward formerly the head-quarter for Nyamira District

Agriculture is the County‘s economic backbone where 90% of its population is dependent on agricultural production and marketing directly and indirectly. It supports 80% of total employment opportunities in the county. Nyamira County lies in the Lake Victoria region, a region whose thirteen (14) counties have come together and formed the Lake Region Economic Bloc with the common understanding that strategic connections between Counties with shared interests seated in a desire for mutual benefit can be an effective and intelligent means of increasing the possibility of creating notable development impact across several counties. The Lake Region Economic Bloc is made up of Bungoma, Busia, Homa Bay, Kakamega, Kisii, Kisumu, Migori, Nyamira, Siaya, Vihiga, Bomet, Trans Nzoia and Kericho Counties

1.1.1 Position and size of Nyamira county

Nyamira County is one of the forty-seven Counties in Kenya. The County borders Homabay County to the north, Kisii County to the west, Bomet County to the south east and Kericho County to the east. The County covers an area of 899.4km2. It lies between latitude 00 30‘and 00 45‘south and between longitude 340 45‘and 350 00‘east. The County neither borders any international County nor does it have any major water bodies.

1.1.2 Socio-economic characteristics

Agriculture is Nyamira County’s economic backbone. About 90% of the county’s population depends on agricultural production and marketing, either directly or indirectly. The region has fertile land and favorable climate conditions for agricultural activities Agriculture plays a key role in food security, poverty reduction, and job creation in Nyamira County. The county’s agricultural practices include farming of both food and cash crops, livestock farming, bee keeping, and fish

farming. Its major food crops include maize, beans, finger millet, sorghum, cassava, sweet potatoes, vegetables, and fruits. Its major cash crops include tea, coffee, pyrethrum, avocados, and bananas

Agriculture furnishes a significant portion of household income in Nyamira County, with crop-related activities generating the majority of the income. County households earn an average of 79,123 Kenyan shillings (KSh) per year, with crop-related activities contributing the largest portion of this income (ASDSP, 2014). Female-headed households earn an average KSh 86,962 per year from on-farm activities, compared to KSh 85,005 for male-headed households, and KSh 46,098 for youth-headed households. Female headed households earn a majority (almost 79%) of their income from crops, as compared to male- and youth-headed households, which earn approximately 72% and 55% of their income from crops, respectively.

Agriculture is a major source of income, food, and employment for Nyamira County, both directly and indirectly. A majority (74%) of the adults are engaged in crop and/or livestock farming, while 8% have formal salaried employment as public servants, private-sector employees, non-farming laborers, and domestic workers. About 11% are self-employed in agriculture related business and trade activities, 4% depend on a pension scheme, and 3% rely on other occupations (ASDSP, 2014). Several types of businesses operate in Nyamira County, employing many people (County Government of Nyamira, 2018).

1.1.3 Transport, Energy and ICT

Energy Infrastructure and ICT sector are

Nyamira county has a total road network of 1,574.59 km of classified & Unclassified roads distributed across the four constituencies;

Table 1:Road classification per constituency in Nyamira county

Constituency	Earth(Km)	Gravel (Km)	Narrow(Km)	Road Network (Km)
North Mugirango	4.34	170.82	117.38	292.54
Borabu	31.72	265.95	155.18	452.89
West Mugirango	21.78	215.71	112.95	350.44
Kitutu Masaba	50.03	266.51	162.20	478.74
Total	**107.87**	**918.99**	**547.71**	**1,574.61**

Narrow roads are the current opened roads by the County Government whose road reserve ranges from 4m – 13m. The above road networks are composed of earth or gravel roads except for the following roads of which the indicated kilometres are paved within Nyamira County.

Table 2;Paved Roads in Nyamira count

Road Number	Road Name	Km Paved
B4	B3 Ogembo-Itumbe-Kisii-Ekerenya-B6 Ngoina	57
B5	B2 Kendu Bay-A1 Kadongo-Nyamira-B4 Siamani-B4 Kebirigo-B6 Keroka-B3 Nyangusu	19
B6	A1 Kisii-Keroka-Sotik-Litein-Chemosit-A12 Kericho	30
C750	Chabera-Ikonge-Chebilat_ Gorgor	40
C863	Kisii-Kegogi- Miruka-Nyamusi- Chabera	2
C864	Kendu Bay-Kosele- Oyugis-Rioma-Marani- Nyabioto	4
C892	Getare-Ngenyi-Bunyunyu-Nyamaiya- Ekerenyo	4
C895	Olmelil - Manga- Kijauri	4
	Total	**160**

The general condition of road network in the County is considered fair. However, sections of Borabu Constituency are poor owing to the black cotton soil. The road network within urban centres is not well developed. A lot of the county roads have been encroached upon by people carrying out economic activities. Nyamira County has 54 market centres and each of the market has provision for bus parks. Currently Nyamira town, Keroka town, Ekerenyo and Ikonge bus parks have been upgraded but not well developed. Other markets require development of bus parks. Currently there is no rail transport and there is land designated for Air strip but not developed in Nyamira County. Equally the County does not have ports and jetties.

Firewood is the main source of energy for cooking in the county with 48 percent of the population using it, while gas (LPG) constitutes 22 %. Currently electricity coverage is 49.5 % with about 80,000 connections. These are mainly in towns and markets within the county. However most rural households (57 %) use paraffin as source of lighting. Other sources of energies exploited include home solar and solar powered street lighting which constitute 5 %.

Information and Communication Technology (ICT) is a vital sub-sector in the County development plan. The ICT infrastructure and services has grown steadily over a time. However, with advancement of technology, telephone and other wired communications have in the process drastically reduced with an increase of cyber units and mobile gadgets. There is fibre optic connection at the HQs that has enhanced connectivity for effective and swift communication. The County Government of Nyamira has installed Local Area Networks and Point to Point connection

for Integrated Finance Information System (IFMIS) at the headquarters and there is need to extend the same to the Sub counties and Wards so as to increase coverage and effective communication. Currently, we are using 30 MBS bandwidth bundles but still need more bandwidth of 20 MBs. The county has got one Huduma centre at the County headquarter.

1.1.4 Education and Literacy

About 51 percent of the male and 41percent female of Nyamira county citizens are literate (KNBS,2019). This is attributed to free primary education and the recently introduced subsidized secondary education. Further still the county government assist needy students through the county bursary fund. However, low awareness on the importance of education, inadequate special needs education facilities, inadequate staffing levels, infrastructural development and insufficient funding are the major challenges affecting this sector.

1.1.5 Agriculture

More than 70% of the land in Nyamira County is freehold. Approximately 72% of land parcels in the county have title deeds, while the rest are in different stages of acquiring title deeds. Nyamira County has three main types of land holdings, of distinct sizes, in different sub-counties. They consist of large-scale, medium-scale, and small-scale farmers. Medium- and large-scale farms account for a small percentage of the holdings but cover the largest area. Borabu Sub County and some parts of Nyamira North Sub-County contain large parcels of land owned by multinational companies for tea growing and processing as well as for settlement schemes. The four-remaining sub counties encompass smaller parcels of arable land. Manga Sub-County features the smallest farm area, followed by Masaba North. Multinational farmers hold less than 10% of Nyamira County's land. Individual, large-scale farmers hold an average of 4 ha in Borabu Sub-County, whereas small-scale farmers hold an average of 0.7 ha in other sub-counties.

Zero-grazing dairy farming is gaining popularity in Nyamira County due to diminishing land availability, weather conditions, and a ready market for milk. Bee keeping or apiculture is also growing in popularity. Nyamira County has promoted apiculture over the last five years, and as a result, farmers have recorded improved yields per hive.

1.1.6 Health services

The Nyamira County department of health services administratively has three directorates namely; Medical services, Preventive and Promotive health services and Administration, health human

resource and finance. Since 2013, the department has significantly invested in development and improvement of health infrastructure in order to improve access to essential health services. Currently there are a total of 145 health care facilities up from 122 in 2013.

1.1.7 Water, environment and Natural resources

The county has 7 major permanent rivers namely Sondu, Gucha, Charachani, Kemera, Eaka, Nyabomite and Menyenya. They all drain their water into L. Victoria. The county has 2,021 shallow wells, 735 protected springs, 69 dams as well as over 2,790 unprotected springs and 7 permanent rivers. The main challenge facing improvement of access to water resources is the planting of blue gum trees at springs and along riverbanks. The county has adopted Integrated Solid Waste Management System which is International recommended approach in sustainable Development. It entails source reduction, recycling, Combustion, and land filling. 20,000 tonnes of waste are collected and dumped annually by the county Govt representing 25 % of the total garbage produced. The county has placed a lot of emphasis on farm forestry to increase the tree cover from 15 % to 35 % for provision of wood fuel and timber. The county has about 48 percent of its total population engaged in forest related activities, with a total of 6650 farm forests in the entire county. It has to be noted that the higher the number of forests, the higher the incomes accruing to the farmers. The county has embarked on awareness creation on the economic and environmental benefits of Bamboo farming as alternative to Eucalyptus in catchment areas.

1.1.8 Youth, Gender, Sports and Culture

The County is developing two stadia at Manga and Nyamaiya (Nyamira south) Sub-counties. The stadia will house facilities for Athletics, volleyball, netball, basketball, and a swimming pool. The facility at Manga is at 20% completion and Nyamaiya is at tendering stage as at 5-3- 2018. Every school in the county has a playground that is not to standard. The County has high altitude suitable for training and sports tourism. The county currently has no facility for indoor games, however the county has proposed to build a social hall in budget of 2017/18 which if complete will provide space for the games. The county is therefore encouraging partners to provide equipment. The games include darts, ajua, table tennis, boxing and scrabble.

Nyamira County is endowed with talents in sports, dance, music, drama and creative arts. To address the above, the County has established a talent academy at Kiendege High school in Manga Sub- County for tapping, nurturing and developing talents among the youth

1.1.9 Trade Industry, Mining and Tourism

1.1.9.1 Trade Industry

In the county, the markets are managed by market committees who manage the market on daily basis. The main activities that take place in these markets include cereals sales, fruits and other vegetable, livestock trade. Currently the department is working on securing and developing the markets, this will enhance revenue collection for the department and increase sanity. There are 54 gazetted markets (open air markets), however 34 markets are active. The markets include open air, retail, wholesale and others; the department needs to develop infrastructural amenities such as road network, lighting, provision of water, waste management and modern shades and stalls

1.1.9.2 Mining

Brick making is a major economic activity especially in Sironga valley, Ekerubo, Nyambaria, Rigoma and Mochenwa Wetlands. Quarrying activities are mainly ballast making, murram & hardcore excavation and sand harvesting. Currently the number of people involved in brick making and quarry production activities are estimated 4750.

1.1.9.3 Tourism

Nyamira has three main tourism sites namely: Keera falls where there is a natural waterfall and flora, the county has a plan to demarcate and secure the site for development. Manga Ridge has natural ridges and natural caves. The department has plans to demarcate and secure it. Kiabonyoru is the highest view point in Nyamira County where the following centres can be viewed Lake Victoria, Kericho town, Keroka town.

1.2 Policy context

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

Table 3;Climate Plans and regulations at County government level

County Framework	Description
County Integrated Development Plan 2018-2022.	This is the County‟s five-year plan to guide development. It is required that the plan mainstream climate change.
County Department of Environment, Water, Energy, Mining and Natural Resources Strategic Plan (2018-2022)	It presents fundamental thematic areas that were built on the Department and breadth of its programming to support it realize its mandate effectively and efficiently.
County Annual Development Plan 2020/2021	Provides for mainstreaming of Green economy considerations in all capital projects.
Nyamira County Climate Change Policy 2020	The Policy proposes a legislative framework to institutionalize climate change management as well as facilitate flow of climate finances from international and national sources to finance locally led projects.
Nyamira County Water Act 2021	Provides for rain water harvesting, bulk water harvesting and use of clean energy such as solar.
Nyamira County Climate Change Act 2021	The Act provisions for establishment of County Climate Change Fund; Climate change governance structures; climate change adaptation and mitigation plans; and up scaling of climate

1.3 Purpose of the PCRA Report

The Participatory Climate Risk Assessment report identifies major climate risks, sources of vulnerability and priority adaptation actions to identified risks. The PCRA process gives the community a chance to identify climate change hazards, impacts of the hazards and recommend response actions at the ward level that can be incorporated into the County Climate Change Action Plan (CCAP) and the County Integrated Development Plan (CIDP). It is also one of the conditions set to access the climate change Investment Grants from the National Treasury's Financing Locally Led Climate Action (FLLoCA).

1.4 Nyamira County PCRA Process

The PCRA formulation was guided by the guidelines set in 8 main steps as detailed in the section below;

1.4.1 Creation of the Technical Working Group

The technical working group was constituted in April 2023 through appointment by the Director in Charge of Climate Change. Considerations for appointment to the technical working group

were: representation of climate change relevant sectors such as environment, water, agriculture and gender; commitment to create time for the exercise, knowledge, skills and experience relevant to the task among others. Those appointed to the committee were county directors and technical officers in charge of: Climate Change, Technical and Vocational Education, Gender and Social Services, Crops Development, Livestock Production, Public Health, Water and Sanitation. The county director of meteorology and a Civil Society Organization (CSO) representative were also incorporated into the task team. In total, the technical working group had 11 members.

This technical working group was supported by a wider consultative group which provided advice through the whole process. The wider group had a broader membership which included the Ward Climate Change Planning Committees, Finance department, Communication department, County Disaster Management Unit, Economic Planning, County Climate Change Steering Committee and County Climate Change Planning Committee, national government agencies such as NEMA and KMD, Members of the CSO,

1.4.2 Training of Technical working group

The Technical Working Group was trained for three days on the PCRA process. The training involved understanding of the process, its relevance in development planning and implementation and how each step of the PCRA process should be conducted as described in the PCRA guidance templates. The training was coordinated by a team of experts from Adaptation consortium.

1.4.3 Stakeholder Identification and Analysis

The stakeholders were identified by the Technical Working Group during the training session broadly categorized to represent: Individuals/organizations formally responsible for climate action and building resilience; involved in climate action and responses to climate impacts; those with knowledge and expertise relevant to climate adaptation and building resilience and community representatives and those impacted by climate change

1.4.4 Preparation of ward level engagements

Sensitization on the PCRA process was done on radio and mobilization for the ward engagements done with Sub- County administrators, Ward administrators and Environment and climate change officers at the Sub-county level. The technical working group facilitated the session during the

ward engagements. Tools and materials and venue allocation was done earlier to facilitate a smooth process.

1.4.5 Engagement of Communities at the ward level on PCRA

The ward level engagement was done with a group of 15 participants representing each ward. The participants consisted of community members including Ward climate change planning committees, National government administrative officials, Youths, PWDs, Community Based Organizations, Technical officers and members representing different livelihood groups at the ward level. The community engagements tarted by a brief introduction on the PCRA process and introduction of the tools that were to be used in the process. The first session was climate hazard mapping that involved sketching a ward map, identifying the hazards and assets on the map. Thereafter, the climate change risk assessment tools were introduced for the communities to identify the main hazards, prioritize them, identify vulnerabilities, response action and identify suitable adaptation strategies. The result of this process was that communities identified key climate risks and hazards at the ward level and recommended priority measures

1.4.6 Data analysis and Preparations for the County Level Participatory Climate Change Risk Assessment

Data from the wards was compiled and summarized into reports that represented the ward level. This included incorporating sketch of the hazard maps capturing the main hazards and prioritized action per ward and sub-county level.This was followed by one-day meeting of technical committee to develop the workshop program and share responsibilities among team members as well as agree on the workshop execution strategyThe county overview on historical, current and projected climate scenarios for the county were prepared by the County Director of Meteorology while the director economic planning prepared the presentation on socio-economic status of the county.

1.4.7 County Level Workshop on Participatory Climate Change Risk Assessment

A one-day workshop was held with the main objective of validating the findings from the wards and have shareholders incorporate their views into the Nyamira county PCRA process. The workshop had a total of 50 participants that included Government ministries, Representatives from

government agencies such as Kenya Power, GWASCO, Meteorological, water, agriculture, environment, climate change and public health, economic planning, community representatives, academia Community Based Organizations and the PCRA team. During the workshop, the participants were introduced into the PCRA process and a presentation on the current and projected climate change scenarios. The presentation was followed by an introduction of (FLLoca) process, identification of climate hazards identified and prioritized at the ward level. The participant made valuable contribution to the discussion on issues that needed to be incorporated. The wards were clustered into sub-counties due to the counties small geographical are and similarity in the source of livelihoods.

1.4.8 Participatory Climate Risk Assessment Report

The report was developed by a multi-sectoral team from various departments that included consolidation of data gathered through the climate risk assessment process. Necessary support from adaptation support was given in the development of this report that was consolidated by the Director of Climate Change.

CHAPTER TWO: NYAMIRA COUNTY CLIMATE HAZARD PROFILE

2.1 Current and Historical Climate Hazards and Trends

The annual rainfall in Nyamira County ranges from 1400-1900 mm. The County receives a bimodal rainfall pattern, which is evenly distributed throughout the year with March to May (Long

Rains' season) receiving highest amounts of rainfall with a rainfall peak in the Month of April, while October to December (short rains' season) relatively high amounts of rainfall is registered annually with a seasonal monthly rainfall peak in the month of November annually. In January and February the County receives light rains and occasional heavy rains, but generally prolonged dry spells are observed during these months. The temperatures range from 15°C and 30°C. The months of January and February are relatively dry bearing the highest temperatures during the year, though, occasional precipitation of varying amounts are also experienced during that period. Other months have comparatively similar temperatures though slightly lower apart from July and August which experience moderately cold conditions that worsen towards higher grounds of the County like Ichuni and the surrounding wards among other comparable grounds. The county has an average humidity of 78%. Since the 1960s both the maximum (day) and minimum (night) temperatures have been on the rising trend in the County. Recent prognoses show increases in temperature, and current tendencies display a marked increase in inter-annual variability and distribution of rains, with an increase in the number of consecutive dry spells. Future climate change may lead to a change in the frequency or severity of such extreme weather events, potentially worsening impacts. Increased average temperatures and changes in annual and seasonal rainfall will be felt across key economic sectors, such as agricultural production, health status, water availability, energy use, infrastructure, biodiversity and ecosystem services which includes forestry and tourism. Impacts are likely to have extreme effects on the poor, the marginalized, aged and disabled. Such groups have fewer resources to adapt to climatic changes and therefore are more vulnerable to climatic change impacts.

The average annual precipitation in Nyamira County falls between 1400 and 1900 mm. Nyamira County is divided into three major climatic zones namely;

i) Zone 1: comprises the following wards; - Borabu, Nyansiongo, Esise, Mekenene. These are zones which experience an annual average rainfall amount of between 1400-1500mm.
ii) Zone 2: Kiabonyoro, Rigoma, Gesima, Gachuba, Bosamaro, Itibo, Magwagwa, Bokeira. The wards under this zone experience the annual rainfall amount of between 1500-1750mm.
iii) Zone 3: Kemera, Manga, Magombo, Bosamaro, Bonyamatuta, Bogichora, Township, Bomwagamo. Each of the Zones has similar weather /climate characteristics.This zone has a long term average annual rainfall of between 1750-1900mm.

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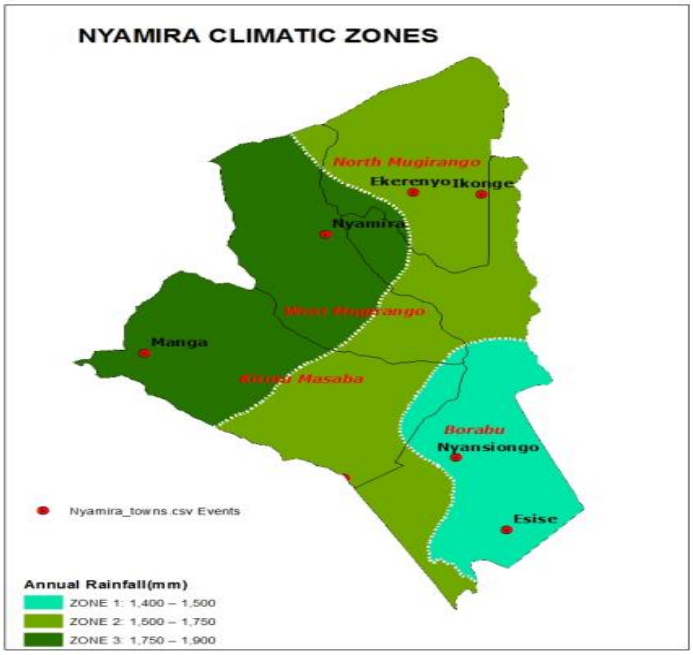

Figure 1; Main climatic zones of Nyamira County

Historic climate trends include: Increased average temperature of 0.34°C per decade from 1985–2015; greatest increases March to May and in arid and semi-arid regions. Little change in average annual precipitation but declines in the long rains in central Kenya since the 1970s, and possible increased rainfall in the north and decreased rainfall in the south. Sea level rise of 5.8 cm from 1932–2001 (Mombasa). Glacial volume loss of more than 66 percent in last 100 years; Lewis Glacier (Mount Kenya) has lost 90 percent of its volume since 1934.

Projected changes by the 2050s include: Increase in average temperatures of 1.2–2.2oC, with warming greatest in the west. Increased duration (+9–30 days) of heat waves. A likely increase in average rainfall (projections range from -3 to +28 percent), mainly from October to May and in the coast and highlands. Increased inter seasonal rainfall variability. Increased frequency and intensity of heavy rainfall events. Likely decrease in duration of dry spells but increase in severity (-2 to +27 percent). Rise in sea levels of 16–42 cm.

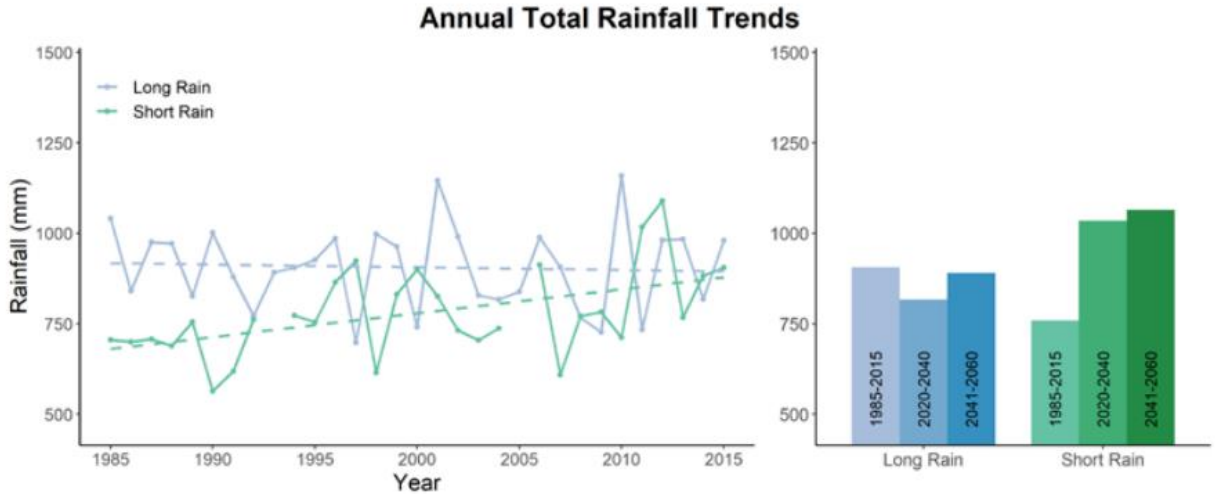

Figure 2;Annual total Rainfall trends for the long rains and short rains seasons in the past (1985-2015) and in the future (2020-2040 and 2041-2060). (By the Kenya County Climate Risk Profile for Nyamira County

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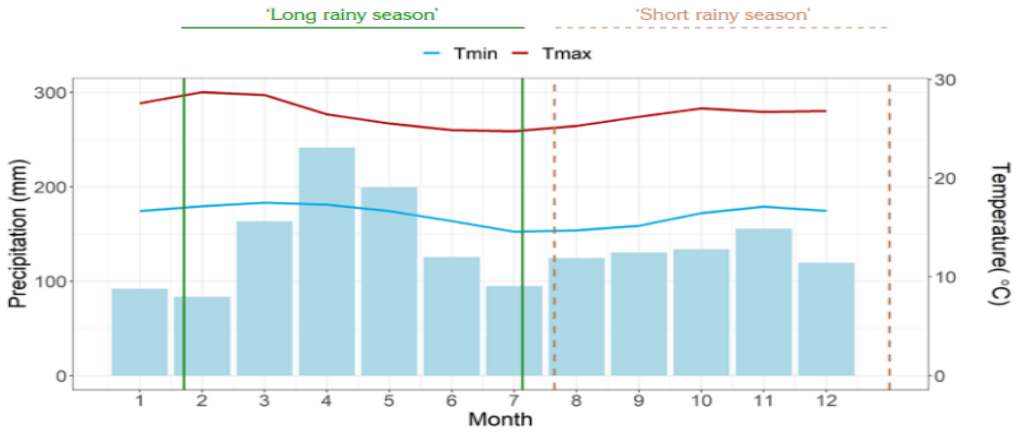

Figure 3;Historical mean monthly temperature and precipitation in the last 30 years in Nyamira County. The first long rainy season is the 100 –day wettest period from January to June. While the second, the short rainy season is the 100-day wettest period from July to December. Bars represent total monthly precipitation. Red and blue lines represent maximum and minimum monthly mean temperatures respectively (By the Kenya County Climate Risk Profile for Nyamira County)

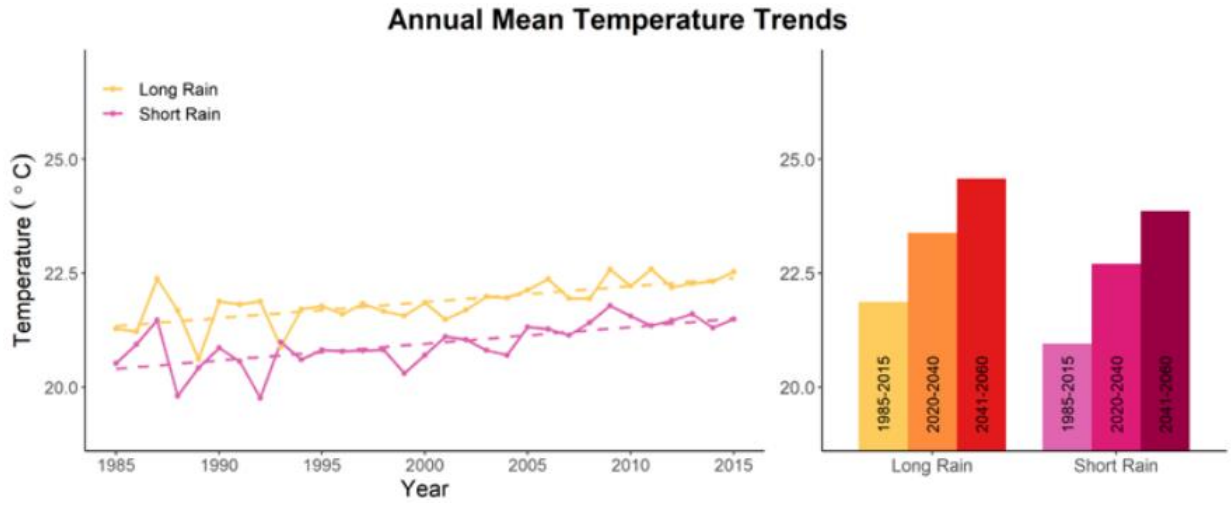

Figure 4; Annual mean temperature trends for the long rainy and short rainy seasons in the past (1985-2015). (By the Kenya County Climate Risk Profile for Nyamira County)

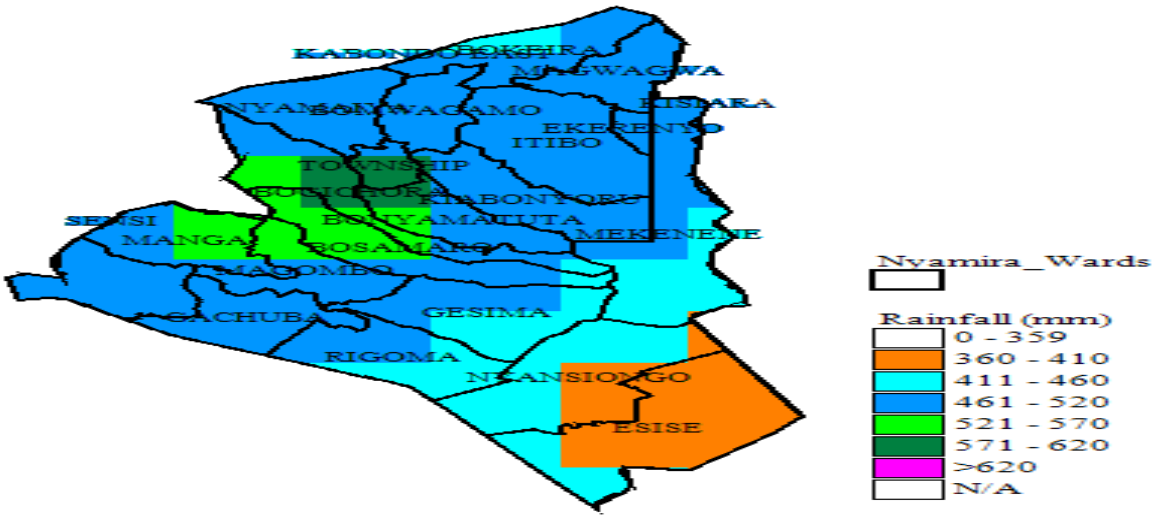

Figure 5;Shows the Nyamira County October- November- December (OND) Short rains long term rainfall averages, experienced during the period of over 30 years, between 1981 and 2010.

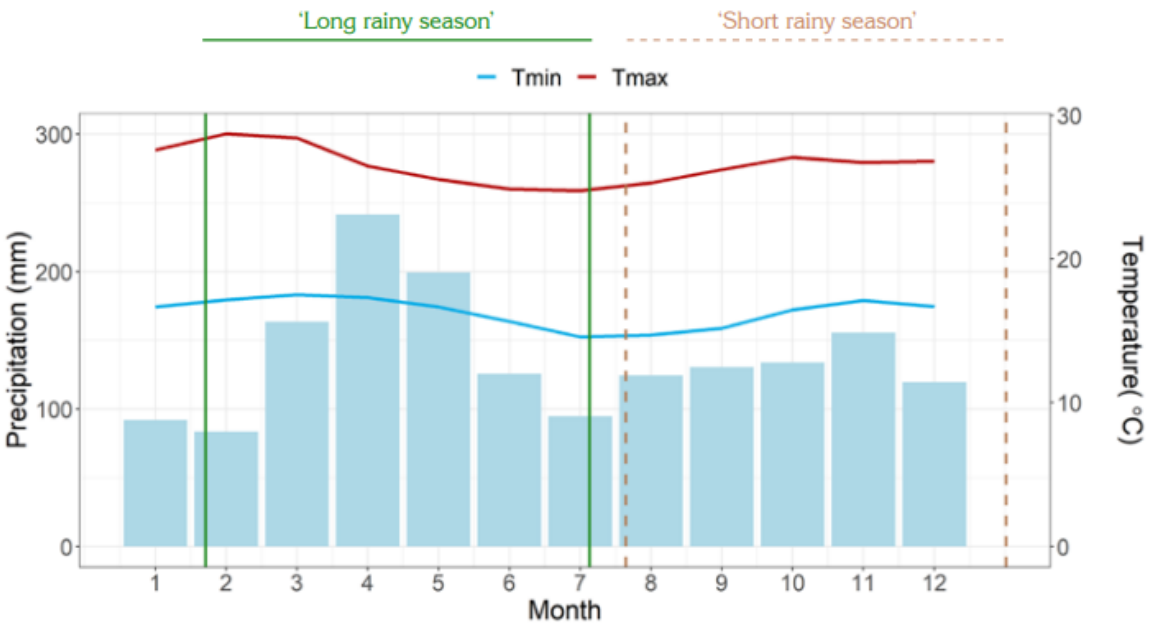

Figure 6; Historical mean monthly temperature and precipitation in the last 30 years in Nyamira County. The first long rainy season is the 100 –day wettest period from January to June. While the second, the short rainy season is the 100-day wettest period from July to December. Bars represent total monthly precipitation. Red and blue lines represent maximum and minimum monthly mean temperatures respectively. (By the Kenya County Climate Risk Profile for Nyamira County).

2.1.1 Precipitation and Temperature trend in Nyamira county

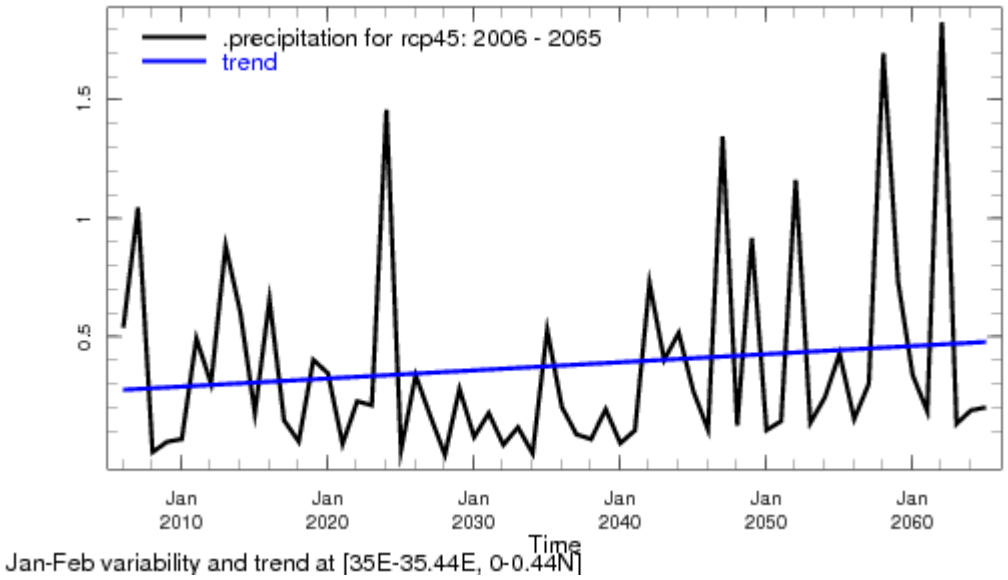

Figure 7; Nyamira County –Jan and February rains, 2006-2065 analysis indicate that more frequent increased rainstorms are expected between 2045-2060.

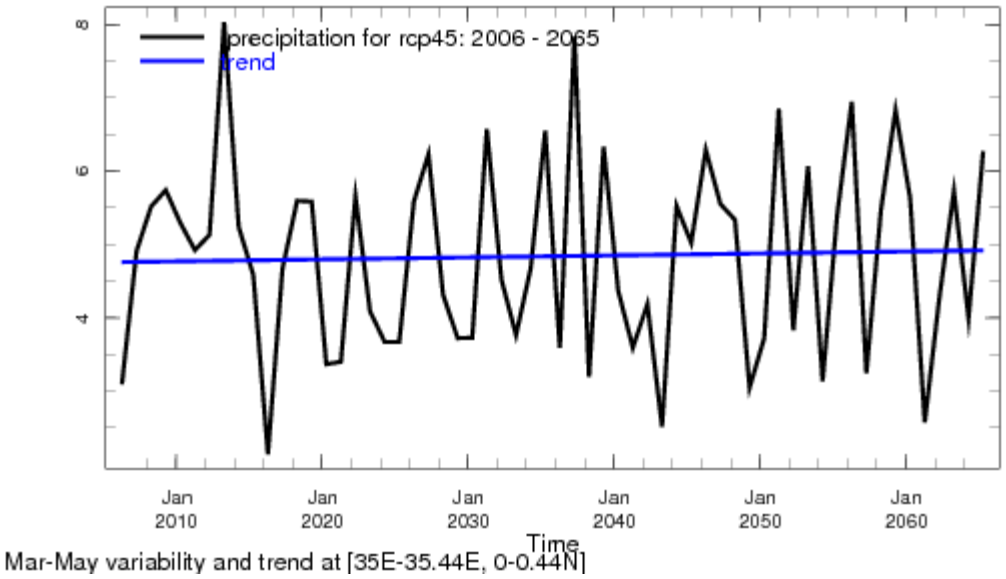

Figure 8;In this analysis, the Nyamira County Long rains season of March to May (MAM) is slightly in the decreasing trend, unlike during the October to December season where the trend is increasing during the years of 2010-2060.

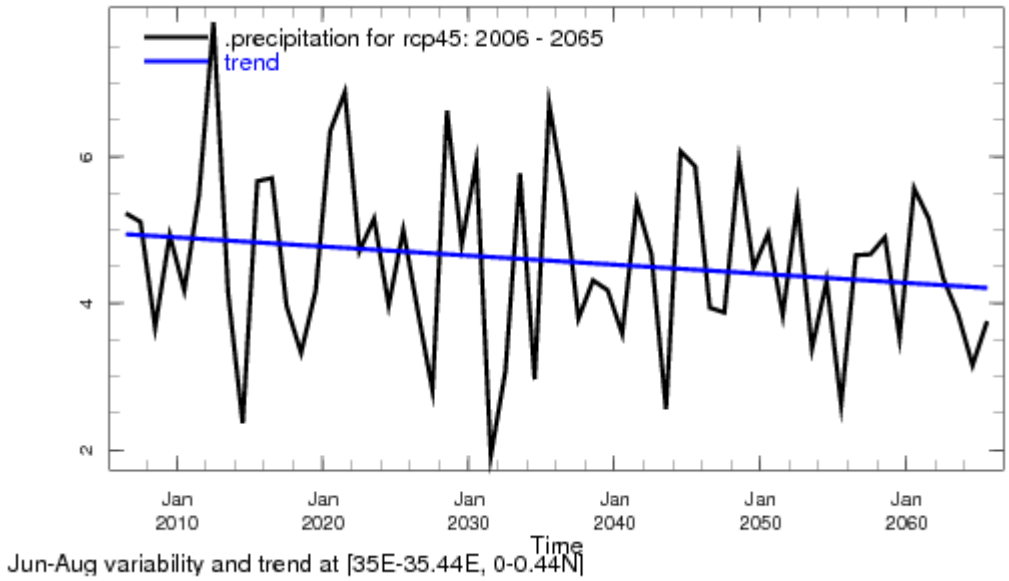

Figure 9;shows that precipitation in Nyamira County for the June to August season is on the decreasing trend between the years 2006 to 2065.

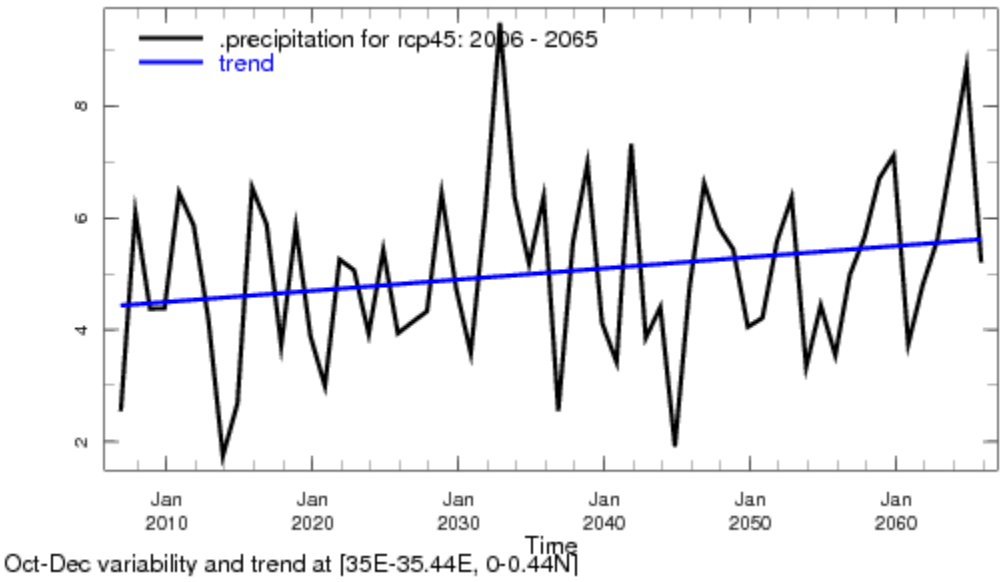

Figure 10; Nyamira County -October to December (OND) short rains season 2010-2065 is on the increasing trend

2.1.2 Precipitation and Temperature trends in Nyamira County

This trend was generated by analyzing both past and future projections on weather mainly focusing on precipitation and temperature within Nyamira County. The two variables were used to link the related hazards that were noted during the PCRA process that include Prolonged dry spells, Droughts, Floods and Changes in the duration of growing season

The trends relating to temperature included:

- Changing seasons on the start and end of rainy seasons within the County. This is likely to contribute to changing growing season for farmers. For each season, heavy precipitation events of extreme rainfall for at least 5 consecutive days were recorded which is indicative of risk of floods and Increased hailstorms
- The total annual rainfall trends showed a decrease of the precipitation in the past which will continue in the future (2020-2040) for the long rainy season.
- An increase in the number of dry days to be experienced within a year are likely to increase this will likely contribute to low rainfall

2.2 Exposure and Vulnerability profiles of the county

The County is characterized by a rapidly growing population, high population density, portable water scarcity, falling food production, and low resilience to climate change. The combined effects of climate change and rapid population growth are increasing food insecurity, environmental degradation, and poverty levels in the county. The Nyamira County Integrated Development Plan (CIDP), 2018-2022; identifies environmental degradation and climate change as key development challenges.

The growing population in the region coupled with the changing climate has resulted in severe environmental concern in the County. These challenges include poor land use planning, improper waste management; source and non-source pollution; dropping water levels; increase in catchment degradation (land and forest ecosystems); wetland degradation; and loss of biodiversity as well as deteriorating ecosystem services.

Global Climate Models (GCMs) projects a change in the climate of the Lake Victoria basin associated with extreme weather events such as unreliable rainfall, frequent floods and extended droughts resulting in high crop losses and food insecurity in the region.

The most significant climate change impacts in Nyamira county identified through the PCRA process include:

1) susceptibility to negative effects of climate change, such as deteriorating water quality and quantity, loss of biodiversity, emergence of invasive pests, weeds and declining agricultural productivity; which in tandem are already causing misery to inhabitants.
2) extreme weather events such as the severe droughts, and heavy rainfall leading to water shortage, food insecurity, soil erosion, floods and landslides; all of which are projected to be more intense, frequent and unpredictable.
3) increasing temperatures resulting in enhanced heat- and water-stressed conditions, particularly in rocky dominated landscapes, leading to reduced agricultural productivity as well as diminishing water yields from hitherto, highly productive springs.
4) Decreasing natural forest cover due to anthropogenic activities and rapid change in climatic conditions whose immediate impact include extinction and migration of natural vegetation plant and animal species.
5) conflict between upstream and downstream communities on sharing of diminishing water resources.
6) Increasing health risks.

Vulnerable groups to climate change hazards identified during the PCRA process: -

a) Households depending on springs and streams as sources of water.

b) Households depending on agriculture as their source of livelihood.

c) Children under 12 years who fully depend on their parents for livelihood

d) Youth most of them are dependent on parents with low or no income

e) The aged, over 60 years who are unable to adapt to climate change effects

f) People Living with disabilities (PWDs) whose coping mechanism is low

g) Women who have been left with roles of fetching firewood, vegetables, water among other weather dependent resources and when faced with scarcity, they are perceived to be weak and lazy.

h) Business community whose products revolve around natural resources

i) Households with low income

2.3 Differentiated impacts of climate hazards and risks

Nyamira county is expected to experience high number of dry days in the future. This is from the projected climatic trends that indicate that Nyamira county shall receive a higher rainfall amounts during rainy days and relatively a higher number of dry days during the short rains season. This is likely to increase the impacts of climate change felt by the community. The impacts of prolonged dry spells will contribute to low productivity and reduced water quantities from existing water sources.

Increased cases of pests and diseases occurrence have also been noted in the recent years. The emergence of Invasive species has been noted across the county. Increased occurrence of malaria cases have been noted and are linked to the increase of disease vectors such as mosquitoes affect children, expectant mother, the elderly, terminally ill and the poor who are more likely to be affected by malaria than the rest of the population. Climate change hazards has also contributed to the reduced quality of water contributing to increased cases of water-borne diseases.

The elderly and persons with disabilities (PWD) are populations that are mainly affected by the effects of climate change. They were found vulnerable to floods and reduced quality of water and reduced productivity from crops. Women were mostly affected by reduced water quantities because culturally they are delegated to bear the responsibility of fetching water for family for domestic use. Declining water levels in springs and reduced water levels in wells and rivers has

left women exposed as their main source of water remains affected by climate change. They take more time accessing water and do not have authority over resources within their households.

2.4 Spatial distribution of risks

Nyamira county has a total of five sub-counties namely Manga, Borabu, Nyamira south, Nyamira North, Masaba north having a total of 20 wards. The spatial distribution of climate hazards across the various wards within the county is mainly determined by existing human practices and the areas topographical features. The counties relatively small geographical size has made the area have minimal variation on the climate hazards within the various sub-counties. This section outlines climate hazards and their impacts per ward across the various sub counties in the county**.**

2.4.1 Manga Sub- County

Manga sub-county comprises of three wards namely Kemera, Magombo, Manga . The main climatic related hazards prevailing within Manga sub-county are: Droughts, Intense hailstorms, Increased occurrence of pests and diseases. The resulting effects from the climate hazards included low production from farms, reduced water levels in streams and within the sub-county.

Pests such as locusts and army worms have become more common and the prevalence of malaria is on the rise with 70% of population being at risk (Division of National Malaria Programme - DNMP 2021) and water borne diseases is on the rise. However, Nyamira county has made great strides in the management of Malaria registering a high drop in the number of malaria cases within the County. Invasive species have also been identified such as *Cuscuta Japonica* commonly known as Japanese dodder.

Environmental degradation accelerated by human activities is rampant within the sub-county mainly manifested through soil erosion has an impact on infrastructure roads and buildings, Increased cost of farming resulting from increased inputs, Siltation of rivers. Nyamira county is primarily a highland zone. However, increased rainfall leads to flooding in low lying areas next to rivers. The challenge of water has also been accelerated by the unsustainable human practices such as growing of eucalyptus trees, unprotected springs within the sub-county.

2.4.2 Borabu Sub- County

Borabu sub-county comprises of four wards namely Esise, Mekenene, Kiabonyoru, Nyansiongo. The main climatic related hazards prevailing within Borabu sub-county are: Droughts, Intense hailstorms, Increased occurrence of pests and diseases

Pests and diseases were identified as part of the climate hazards prevailing within the county. Pests such as locusts and army worms have become more common and the prevalence of malaria is on the rise with 70% of population being at risk (Division of National Malaria Programme - DNMP 2021) and water borne diseases is on the rise. However, Nyamira county has made great strides in the management of Malaria registering a high drop in the number of malaria cases within the County. Invasive species have also been identified such as *Cuscuta Japonica* commonly known as Japanese dodder.

Figure 11*; Photo of Cuscuta Japonica (Japanese dodder)*

Environmental degradation accelerated by human activities is rampant within the sub-county mainly manifested through soil erosion has an impact on infrastructure roads and buildings, Increased cost of farming resulting from increased inputs, Siltation of rivers. Nyamira county is primarily a highland zone. However, increased rainfall leads to flooding in low lying areas next to rivers. The challenge of water has also been accelerated by the unsustainable human practices such as growing of eucalyptus trees, unprotected springs within the sub-county.

2.4.3 Nyamira South Sub- County

Nyamira south sub-county comprises of three wards namely Township, Nyamaiya, Bonyamatuta. Bogichora, Bosamaro. The main climatic related hazards prevailing within Nyamira south sub-county are: Droughts, Intense hailstorms, Increased occurrence of pests and diseases, Landslides have also been noted within the area as it is primarily a highland area. The resulting effects from the climate hazards included low production from farms, reduced water levels in streams and within the sub-county.

Pests and diseases were also identified as part of the climate hazards prevailing within the county. Pests such as locusts and army worms have become more common and the prevalence of malaria is on the rise with 70% of population being at risk (Division of National Malaria Programme - DNMP 2021) and water borne diseases is on the rise. However, Nyamira county has made great strides in the management of Malaria registering a high drop in the number of malaria cases within the County. Invasive species have also been identified such as *Cuscuta Japonica* commonly known as Japanese dodder.

Environmental degradation accelerated by human activities is rampant within the sub-county mainly manifested through soil erosion has an impact on infrastructure roads and buildings, Increased cost of farming resulting from increased inputs, Siltation of rivers. Nyamira county is primarily a highland zone. However, increased rainfall leads to flooding in low lying areas next to rivers. The challenge of water has also been accelerated by the unsustainable human practices such as growing of eucalyptus trees, unprotected springs within the sub-county.

2.4.4 Nyamira North Sub- County

Nyamira North sub-county comprises of three wards namely Itibo, Bogwagamo, Bokeira, Magwagwa, Ekerenyo. The main climatic related hazards prevailing within Nyamira north sub-county are: Droughts, Intense hailstorms, Increased occurrence of pests and diseases. The resulting effects from the climate hazards included low production from farms, reduced water levels in streams and within the sub-county.

Pests and diseases were also identified as part of the climate hazards prevailing within the county. Pests such as locusts and army worms have become more common and the prevalence of malaria is on the rise with 70% of population being at risk (Division of National Malaria Programme - DNMP 2021) and water borne diseases is on the rise. However, Nyamira county has made great strides in the management of Malaria registering a high drop in the number of malaria cases within the County.

Environmental degradation accelerated by human activities is rampant within the sub-county mainly manifested through soil erosion has an impact on infrastructure roads and buildings, Increased cost of farming resulting from increased inputs, Siltation of rivers. Nyamira county is primarily a highland zone. However, increased rainfall leads to flooding in low lying areas next to

rivers. The challenge of water has also been accelerated by the unsustainable human practices such as growing of eucalyptus trees, unprotected springs within the sub-county.

2.4.5 Masaba North Sub- County

Masaba North sub-county comprises of three wards namely Gachuba, Gesima, Rigoma. The main climatic related hazards prevailing within Masaba north sub-county are: Droughts, Intense hailstorms, Increased occurrence of pests and diseases. The resulting effects from the climate hazards included low production from farms, reduced water levels in streams and within the sub-county.

Pests and diseases were also identified as part of the climate hazards prevailing within the county. Pests such as locusts and army worms have become more common and the prevalence of malaria is on the rise with 70% of population being at risk (Division of National Malaria Programme - DNMP 2021) and water borne diseases is on the rise. However, Nyamira county has made great strides in the management of Malaria registering a high drop in the number of malaria cases within the County. Invasive species have also been identified such as *Cuscuta Japonica* commonly known as Japanese dodder.

Environmental degradation accelerated by human activities is rampant within the sub-county mainly manifested through soil erosion has an impact on infrastructure roads and buildings, Increased cost of farming resulting from increased inputs, Siltation of rivers. Nyamira county is primarily a highland zone. However, increased rainfall leads to flooding in low lying areas next to rivers. The challenge of water has also been accelerated by the unsustainable human practices such as growing of eucalyptus trees, unprotected springs within the sub-county.

CHAPTER THREE: FUTURE CLIMATE SCENARIOS FOR THE COUNTY

3.1 National and downscaled climate change projections

3.1.1 National Projections

The following are the national and downscaled climate change projections on Temperature, Rainfall, Extreme rainfall and flooding, Drought and water scarcity, Effects on Agricultural value chain, sea level rise.

3.1.1.1 Temperature

At the national level average temperature nationally is expected to continue rising by 1.7% by 2050s and by3.5% at the end of the 21st century. The number of hot days and hot nights will increase, with hot days projected to occur on 19%-45% of days by mid-century. Hot nights are expected to increase even more rapidly, projected to occur on 45%-75% of nights by 2050. Rising temperatures are expected to increase making cold days and nights very rare.

3.1.1.2 Rainfall

Precipitation is expected to remain highly variable and uncertain. Nationally, rainfall is expected to increase slightly by 2050, especially for the 'short rains' which occur between October and December. However, each county's experience is likely to be highly contextual and localized, in particular: Rainfall in arid zones is likely to decrease, Temporal distribution and patterns are also expected to change, extreme rainfall events (heavy downpours) are likely to increase in frequency, duration and intensity, period between heavy rainfall events is likely to increase, proportion of rainfall that occurs in extreme rainfall events (heavy downpours) is likely to increase.

3.1.1.3 Expected Impacts

Changes in climate variables can seem abstract and difficult to connect to the lived experience of local communities that closely on natural resources for their livelihoods. Taken together, national climate projections suggest the following direct bio-physical impacts:

3.1.1.4 Extreme Rainfall and Flooding

Changes in rainfall are expected to contribute to the risk and intensity of floods in many counties, this is likely to be experienced in areas that are not exposed to floods e,g Baringo. The likelihood of increased experience of mudslides and landslides in mountainous areas that have are most prone to these areas. Soil erosion and land degradation are expected to increase, Increased flooding leading to extended periods of water logging of crops, Increased droughts and temperature will have an impact on water storage capabilities

3.1.1.5 Drought and Water Scarcity

Increased risk of drought and water scarcity in ASAL areas is expected to make ground and surface water more unreliable, Reduced rainfall associated with increasing temperature and longer droughts is expected to affect water storage capabilities

3.1.1.6 Agricultural Value Chain

The impact on specific crops and agricultural value chains of increase in temperature and changes in in moisture conditions is likely to be highly context dependent and will vary greatly by county. Rising temperatures may well change the character of crop and livestock pests, while an increase

in dry spells/droughts and reduced rainfall in the ASALs will affect yields for specific staple crops (maize, wheat, rice). Some agricultural areas may benefit from higher crop yields as a result of higher rainfall and temperatures, notably the temperate and tropical highlands, the Rift Valley and high plateau areas.

3.1.1.7 Sea level rise

Sea level rise is a major risk for the five coastal counties (Kwale, Mombasa, Kilifi, Tana River, Lamu) and the people that live there. This is linked to Increased likelihood of extreme weather events (storms and storm surges) means that flooding is likely to intensify in low-lying area. Contamination of fresh water aquifers with saline water affecting existing water infrastructure and supplies

3.1.2 Nyamira County Climate Change Projections

Nyamira County is divided into three major climatic zones namely;

iv) Zone 1: comprises the following wards; - Borabu, Nyansiongo, Esise, Mekenene. These are zones which experience an annual average rainfall amount of between 1400-1500mm.
v) Zone 2: Kiabonyoro, Rigoma, Gesima, Gachuba, Bosamaro, Itibo, Magwagwa, Bokeira. The wards under this zone experience the annual rainfall amount of between 1500-1750mm.
vi) Zone 3: Kemera, Manga, Magombo, Bosamaro, Bonyamatuta, Bogichora, Township, Bomwagamo. Each of the Zones has similar weather /climate characteristics.This zone has a long term average annual rainfall of between 1750-1900mm.

The annual average temperature falls between 19°C and 25°C. Nyamira County –Jan and February rains, 2006-2065 analysis indicate that more frequent increased rainstorms are expected between the years, 2045-2060 as shown below;

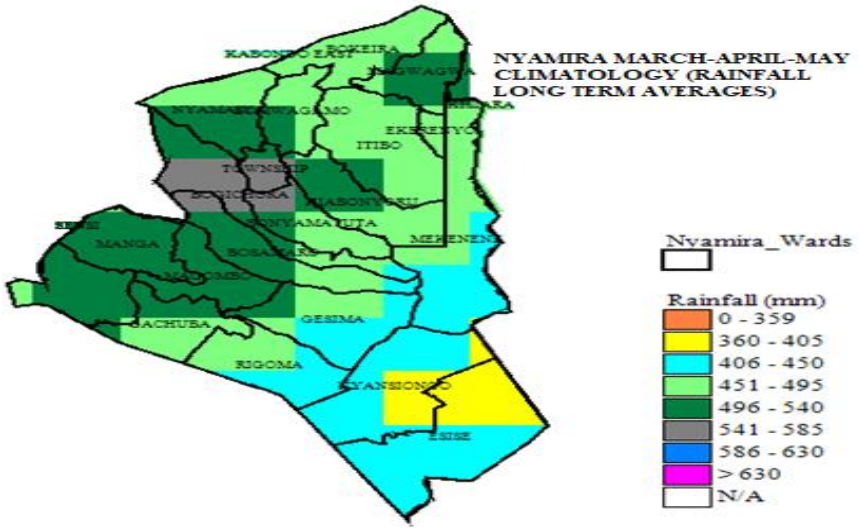

Figure 12;NYAMIRA March-April-May (MAM) Climatology -long term Rainfall averages. Shows the Nyamira County March- April- May (MAM) 'Long rains' long term rainfall averages, experienced during the period of over 30 years, between 1981 and 2010.

3.2 County future climate scenarios

There is the likelihood of warming with average temperatures expected to continue rising (figure 1). Just like nationally, the number of hot days is expected to increase and cold nights are expected to become increasingly rare by 2050. Projected changes by the 2050s include: Increase in average temperatures of 1.2–2.2°C, with warming greatest in the west. Increased duration (+9–30 days) of heat waves expected. There is a likely increase in the average rainfall (projections range from -3 to +28 %), mainly from October to May and in the coast and highlands. Increased inter-seasonal rainfall variability is also likely. Increased frequency and intensity of heavy rainfall events are expected. Likely decrease in duration of dry spells but increase in severity (-2 to +27 percent). The average rainfall is expected to increase slightly by 2050 especially for the 'Short Rains' (Figure 2). The precipitation will remain highly variable with extreme rainfall events likely to increase in frequency, intensity and duration.

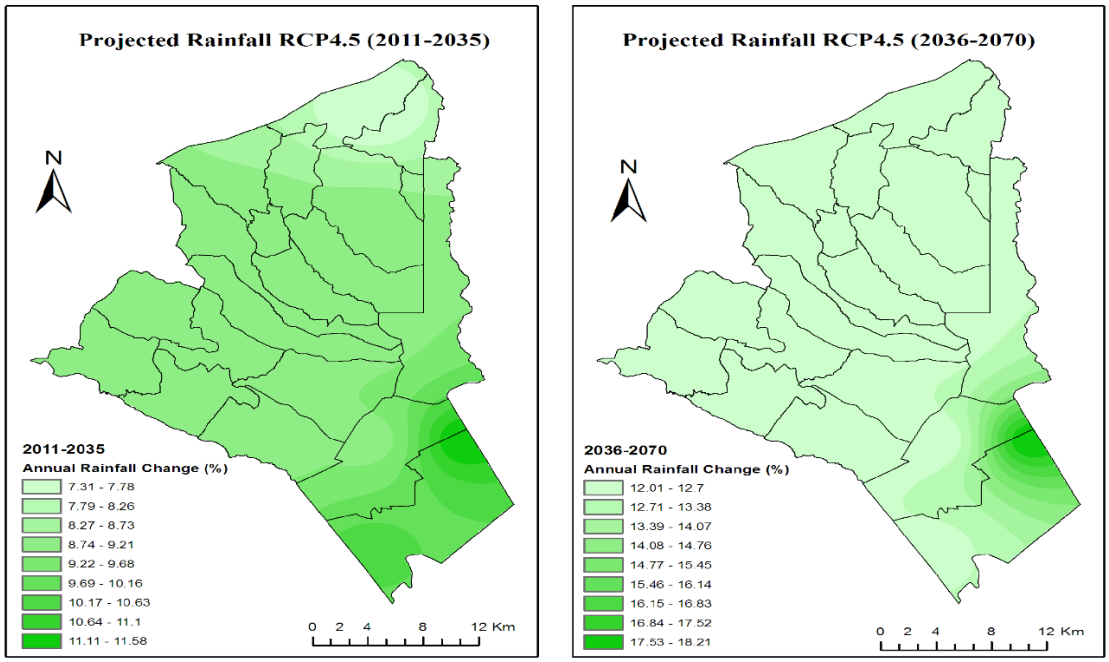

Figure 13; The projected Rainfall RCP4.5 (2011-2035) and that of (2036-2070) depict % increase of Annual Rainfall Change in both scenarios.

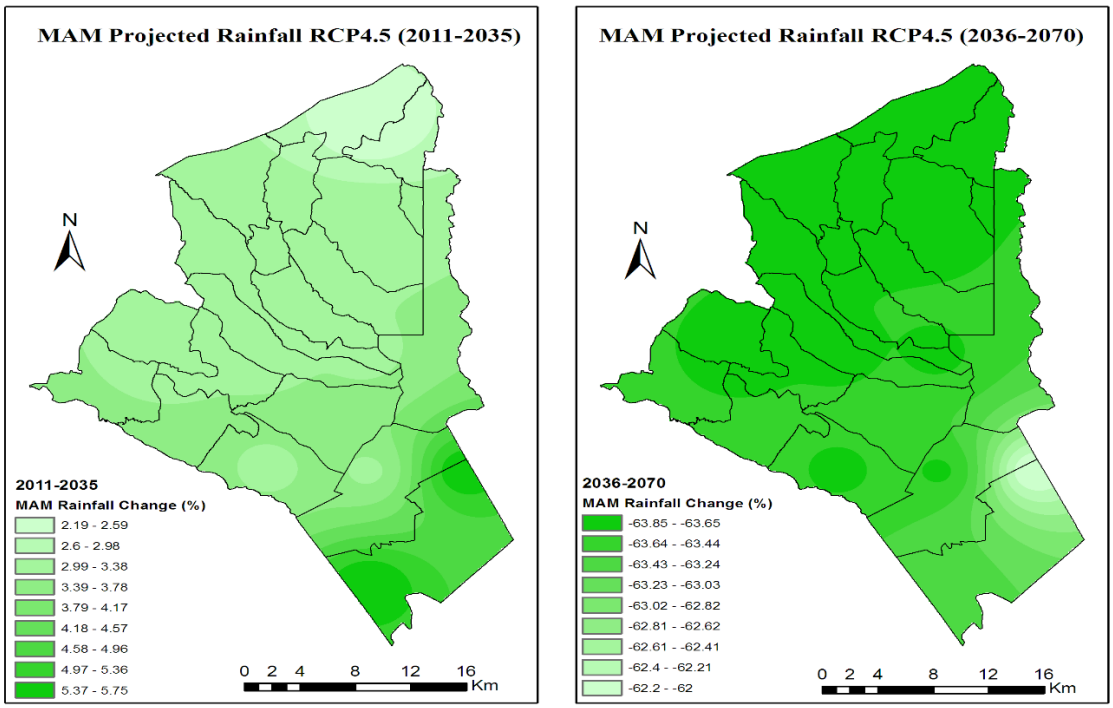

Figure 14;the March to May (MAM) projected rainfall in RCP4.5 (2011-2035) depict % increase in the MAM long rains seasonal rainfall, and a % decrease in the MAM projected rainfall rcp4.5 (2036-2070).

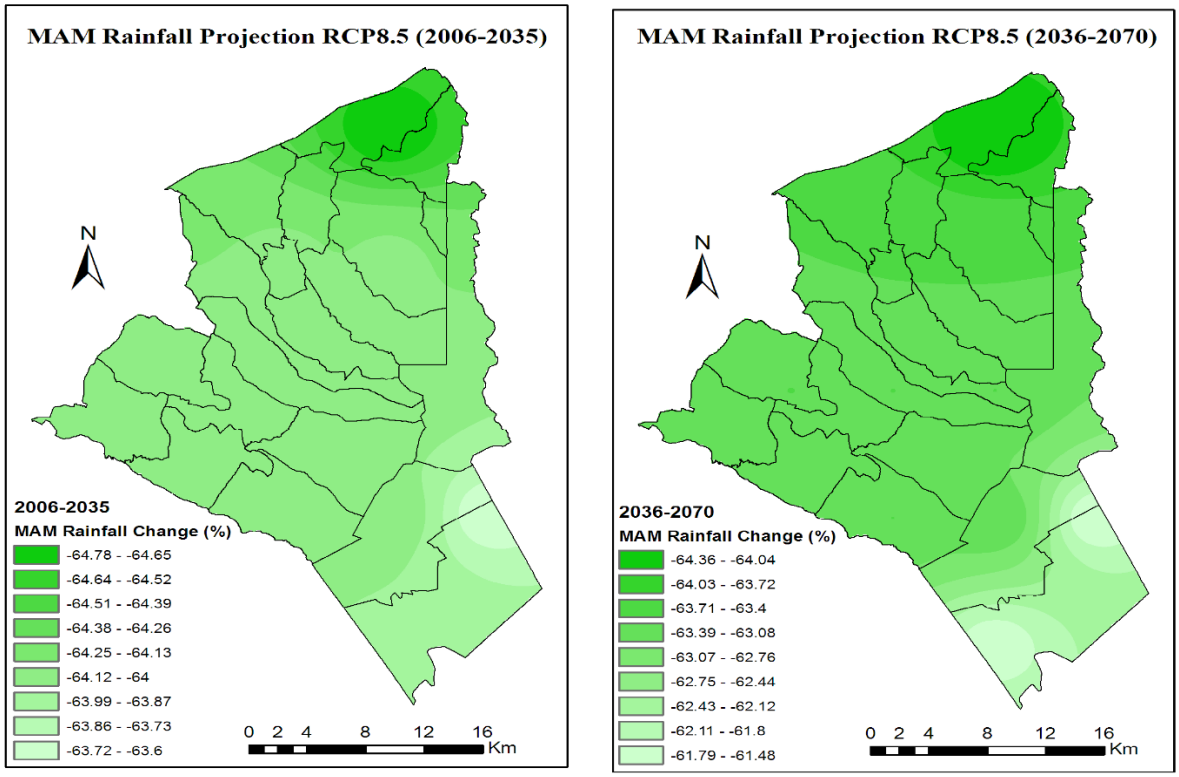

Figure 15;The two figures, that of MAM Rainfall Projection RCP8.5 (2006-2035) and that of (2036-2070) depict % Rainfall decrease in both scenarios

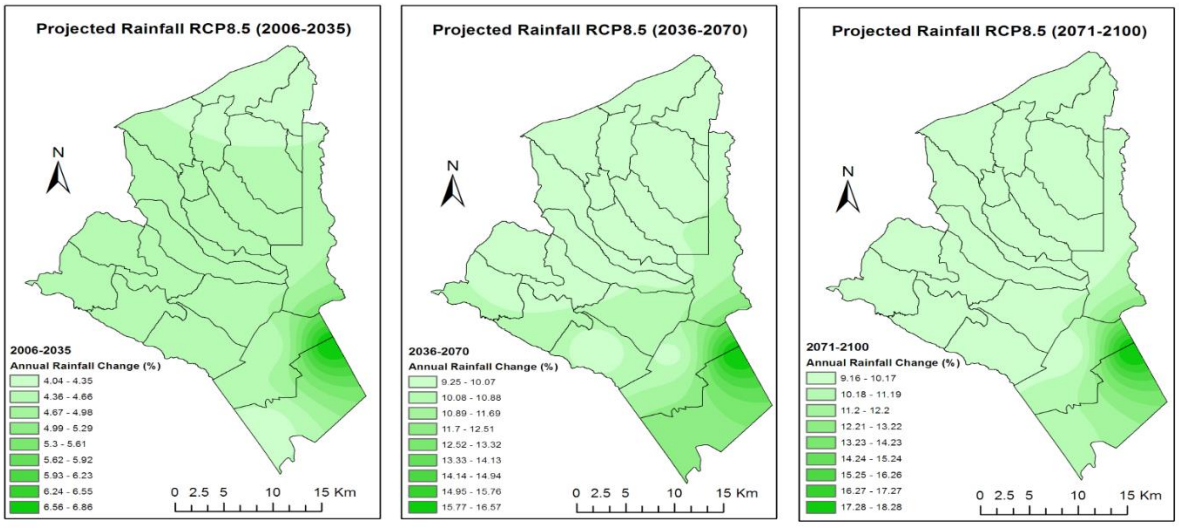

Figure 16;The Projected RCP8.5 for (2006-2035), (2036-2070), and (2071-2100) in Nyamira County depict increased annual Rainfall % Change in the three scenarios .

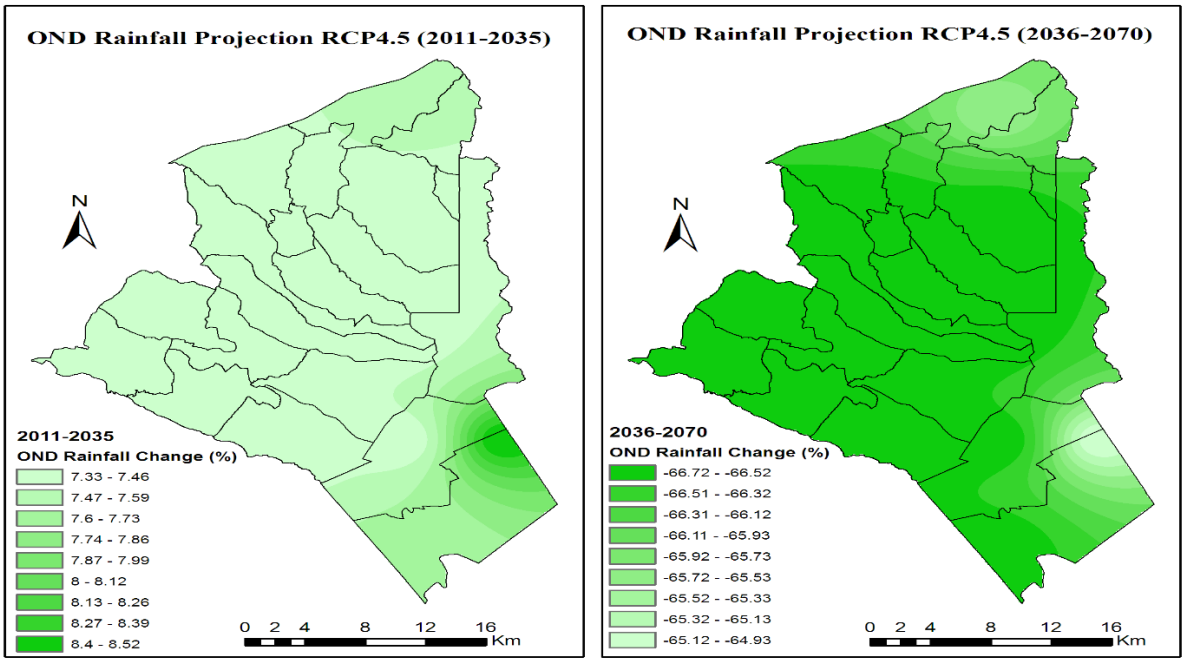

Figure 17;October to December (OND) Rainfall Projections RCP4.5 (2011-2035) shows increased % Rainfall Change, while, OND Rainfall Projection RCP (2036-2070) shows high % rates of decreased Rainfall Change.

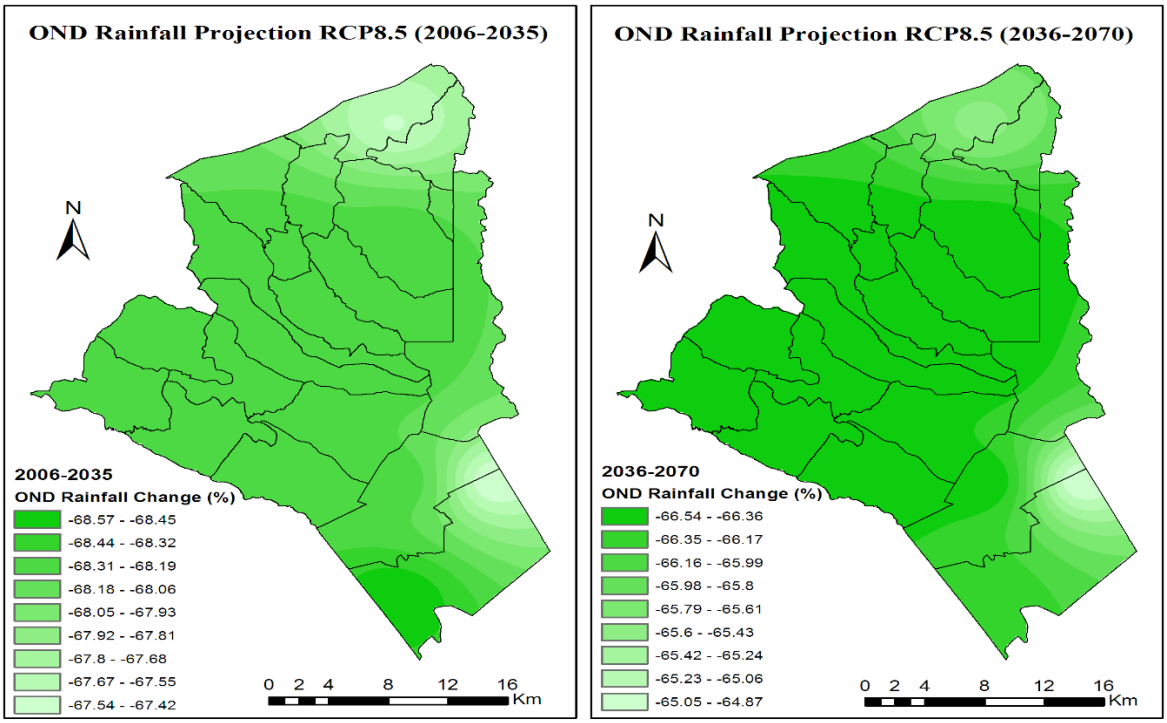

Figure 18;OND Projected Rainfall RCP8.5 (2006-2035) and (2036-2070) in both scenarios depict high rates of % decrease of OND Rainfall Changes.

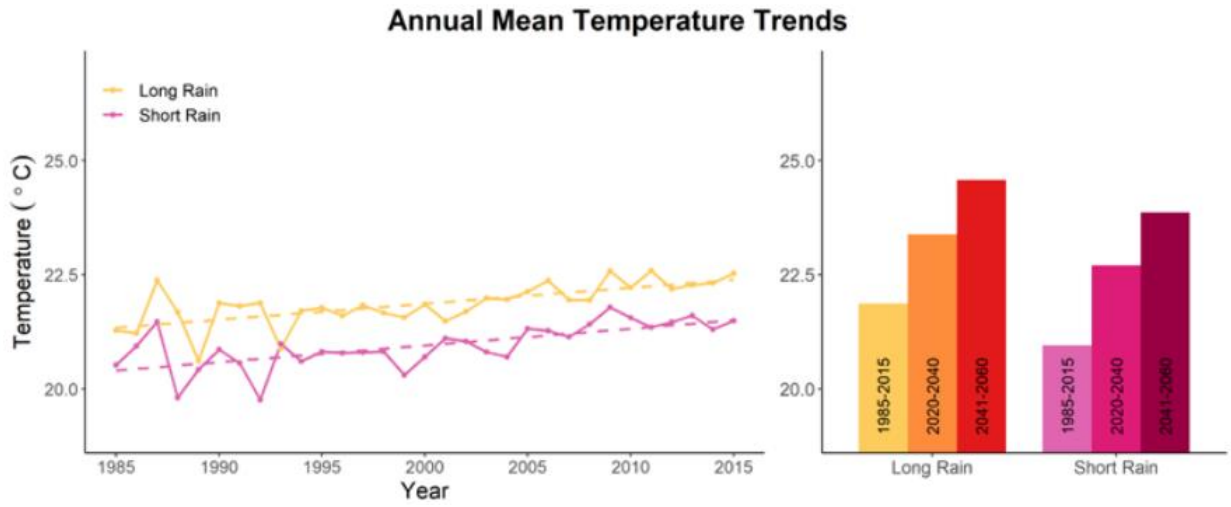

Figure 19; Annual mean temperature trends for the long rainy and short rainy seasons in the past (1985-2015) and in the future (2020-2040 and 2041-2060). (By the Kenya County Climate Risk Profile for Nyamira County).

Annual total rainfall trends for the long rain and short rain seasons in the past (1985-2015) and in the future (2020-2040 and 2041-2060) (CIAT 2021) From the projections, there is likelihood of climate hazards increasing in intensity, frequency and duration. This may have implications on the livelihoods and environment such as reduced crop yields, reduced reproduction and milk production in livestock, increased soil erosion and land degradation and increased occurrence of landslides. The interaction between human activities and climate change will alter the occurrence of hazards.

3.4 Likely future Impacts

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

Health: Increased temperatures is likely to bring more localized benefits, such as increased food production in certain areas, the overall health effects are likely to be overwhelmingly negative. Many of the social and environmental determinants of health will also be negatively affected. Malaria cases will be more with the increase of temperatures; the mosquitoes have now moved in and are infecting many humans with the malarial pathogens.

In Nyamira, Climate extremes (droughts, temperature, storms and floods) will be more frequent and will lead to increased number of people without access to clean drinking water, increased cases of food insecurity, and malnutrition and also increased exposure to diseases.

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

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

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

Trade, tourism and industry: Climate variability is likely to cause increased intensity and duration of extreme weather events such as rainfall, loss of indigenous knowledge and products and water scarcity which will bring brought about increased destruction of infrastructure (roads and bridges) making it difficult for goods to reach the market and other facilities that will cause risk to workers' health and safety, loss of lives and property, increased water borne diseases and loss of livelihoods, culture erosion and increased water borne diseases such as malaria and typhoid among other diseases. Small scale traders that depend on farm produce will have little or none to sell because of low agricultural produce in the farms.

Environment Natural Resources and Energy: Due to the expected extreme weather and climate events, dry months will be much drier in Nyamira County making forest fire instances inevitable

especially in the months of January and February. This will lead to increased greenhouse gas emissions, loss of biodiversity and animal extinction due to wetland decimation which are habitats for some species of endemic animals like newts, toads, snails, snakes, porcupines, ant bears, among others and loss of medicinal plant sources. Increase in warming/temperatures will lead to prolonged drought instances causing decline in forest productivity which will restrict availability of fuel wood and scarcity of water and medicine among other benefits.

Agriculture: Weather/Climate extremes further expected will alter the life cycles of plants and animals in the county. Weather patterns are changing leading to shifts in planting, low agricultural productivity due to crop failure and post-harvest losses. Exposure to invasive and parasitic species and pathogens and increased drought occurrences due to the changing weather patterns will bring about low livestock and crop production, reduced fish production, increase livestock deaths due to reduced pasture and access to water and due to heat stress. The changes in weather and climate will lead to changes in disease patterns and potential for re-emergence of climate related diseases and pests that will affect livestock and crops for instance fall armyworms. Changes due to temperature rise will cause reduced water table and levels leading to scarcity of water, crop failure, reduced livestock production and reduced fish production in Nyamira County.

Nyamira County will be faced with challenges that are linked with climate variability and change which will include delayed and unpredictable rains and the untimely cessations of seasonal rains, which will impact on the timing of key activities like land preparation, planting, and harvesting. Other challenges will include skewed rainfall distribution and intensity, more frequent instances of hailstorms, extremely high rainfall that will cause increased soil erosion and flood risks especially along river Gucha and other flood prone areas. There will be more frequent hailstorms which will affect crops such as beans (ASDSP, 2014), during the flowering and harvesting stage.

The rising temperatures will lead to increased number of Pests and diseases that are a threat to agricultural production. At least 41% of farmers have experienced some form of new insect pests or diseases (ASDSP, 2014). These new pests include the fall armyworm; the Maize Lethal Necrotic Disease, which mostly damages maize.

Gender related effects: Weather and Climatic changes in Nyamira County will bring about increased gender inequality, Increased Gender Based Violence Cases it will reduce women's ability to be financially independent since most of the time they will be involved

in searching for firewood and water from drying wells and water points from distant places, and will have an overall negative impact on the social and political rights of women, especially in Nyamira whose economies are heavily based on agriculture. Similarly, because of the projected weather extremes, pregnant women will be highly be susceptible to diseases.

Vulnerable and Marginalized Groups; Extreme weather events such as droughts, floods will most impact the vulnerable and marginalized leaving many vulnerable to poverty as well as displacing them as most might be least ready to adapt to the impacts of climate change. Floods may sweep away homes destroying homes and livelihoods. Heat can make it difficult to work in outdoor jobs. Water scarcity may affect crops therefore leading to food insecurity. Children might be exposed to child labor, malnutrition, diseases and might be left unattended most of the time when parents will be sourcing for water, food and alternative livelihood sources. People living with disabilities will be at increased risk of the adverse impacts of climate change including threats to their health, food security, water, sanitation, livelihood and also affect their mobility. Equally people living with disabilities will experience the effects of climate change differently and more intensely than others due to discrimination and marginalization.

CHAPTER 4: EXISTING ADAPTATION STRATEGIES

4.0 Introduction

The methods that various stakeholders are now putting into practice in the county to address the risks and hazards associated with climate change are presented in this section. To combat the effects of climate change, a variety of players, including the County government, civil society organizations (CSOs), and communities, have been taking various steps. Examples of such methods include establishing and improving community and county-level governance institutions for climate change, creating knowledge and capacity, establishing a legal framework, and implementing investments in climate change resilience across different wards. The plans are intended to support the majority of the population's chosen means of subsistence, including agricultural cultivation, raising livestock, trading, and artisanal mining.

4.1 Overview of existing adaptation strategies and their effectiveness

The main climate risks include unpredictable rainfall patterns that cause changes in the agricultural calendar, an increase in the number of days that follow one another without rain, which causes crops to dry out and scarcity of livestock feed, an increase in the number of episodes of intense rainfall that cause floods, crop failure, and landslides, environmental deterioration that causes soil erosion and water pollution, as well as the effects of these factors.

Rainwater harvesting, shallow well drilling, borehole sinking and water collection from springs, streams, and rivers are now used to combat extended dry spells and irregular rainfall patterns. Crop rotation, small-scale irrigation, cover crops, livelihood diversification, and intercropping are techniques employed in the agricultural industry. To mitigate the effects of dry spells, farmers also try planting early maturing crop varieties and drought tolerant crops like cassavas and sweet potatoes. The elderly have been particularly impacted by the problems caused by unpredictable, variable rainfall; therefore indigenous knowledge and traditional weather forecasting are used to address these issues.

Reforestation and afforestation of degraded areas, community forest conservation, planting of indigenous trees, livelihood diversification, and contour plowing are a few adaptation measures for environmental degradation. Soil erosion is managed via awareness-raising, skill-building, afforestation, and reforestation efforts. By establishing vegetative cover in catchment regions, we can safeguard them and increase the resilience of our water resources. Ash, powder soaps, and handpicking are used to control pests, while some farmers now use commercial insecticides.

Utilizing mosquito nets and maintaining a clean environment are two ways to combat mosquitoes. Urban drainage systems are improved, and trenches are dug to combat flooding and flash floods.

It was discovered that some techniques are more successful than others in mitigating the effects of climate change. For instance, land fallowing was found to be less successful given the tiny land parcel sizes in the county. The implementation of climate smart agricultural methods was further hampered by inadequate extension services, which therefore reduced their effectiveness. Due to the tiny land parcel sizes in Nyamira, push and pull technology, which is particularly successful in managing crop pests, is not as widely used as soap and pepper concoctions, whose accessibility and affordability in the region made them popular.

Figure 20;(a) Participatory Community Climate Change Risk Mapping for Nyansiongo Ward and (b): Kemera Ward WCCPC and Community Reprentative During the PCRA in May 4

Figure 21; Nyamira County Technical Working Group workshop, 26th -28th April 2023 at Itibo Resort

4.2 Effectiveness of adaptation/Resilience strategies.

A variety of adaptation strategies are used to meet the identified climate risks and hazards, as explained in section 4.1 above. According to the evaluation made during this procedure, the success of these tactics varies. The section that follows lists the climate-related risks and how they affect livelihood systems. It also lists the top adaption measures, the community segments that are using them, and how gender is taken into account for each sub-county. The ranking was determined by popular vote, which took into account the strategy's cost, rate of use at the time, and operational and technical effectiveness. This was decided upon after ward-level community participation, a multi-stakeholder county climate risk assessment, and additional evaluation and input from a technical team at the county level. Improved access to and use of climate information, capacity training through expanded extension services, and better coordination amongst actors are all necessary for the adaptation measures to be more successful.

4.2.1 Manga Sub- County (Manga ward, Kemera Ward & Magombo Ward)

Table 4;Adaptation strategies in Manga Sub County

Risk/Hazard	Livelihood/ Economic System	Ranked Climate Resilience Strategies	Stakeholder Group Applying the Strategy	Gender and Social Inclusion information
Prolonged dry season	• Farming • Trade	1. Water harvesting and storage at household, community and institution level; wells, boreholes, & tanks 2. Conservation of water catchment areas (removing of eucalyptus from the riparian areas), Stream protection 3. Reforestation and afforestation of degraded lands, establishment of tree nurseries in sub counties, 4. Adoption of Climate Smart Agriculture specifically early maturing and drought resistant crops such as sweet potatoes, millet, cassava	• County government of Nyamira • Farmers • Development partners. • Multinational companies e.g sasini ltd. • Churches & Schools. • Community based Organizations • Kenya Forest Service.	Women & children stand to benefit more from conserved water sources

Environmental degradation such as i. Destruction of water sources by human activities (planting of eucalyptus along the riparian land), i. Soil Erosion i. Quarrying and Mining activities e.g (Kiabiraa)	• Farming • Trade • Transport sector	1. Sustainable Land use (terracing, catchment conservation reforestation and afforestation of degraded lands. 2. Capacity building of the community members on environment conservation & management. 3. Removing the eucalyptus from the riparian areas. Planting indigenous tree species. 4. Rehabilitation of degraded landscapes.	• County government of Nyamira • Farmers • Development partners. • Churches & Schools. • Community based Organizations	Programs targets both men, youth, women and PWDs
Emerging pests, diseases and invasive weeds species such Japanese dodder	• Farming (livestock & crops). • Trade	1. Adoption of disease resistant crops varieties. 2. Regular vaccination for livestock.	• County government of Nyamira • Farmers • Development partners. • NGOs.	strategy is all gender inclusive

(Cuscuta japonica)		3. Spraying with agro chemicals. 4. Integrated pest management practices. 5. Recruitment of more extension officers		
Erratic Rains.	• Farming • Small scale traders • Roads networks	1. Establishment of the weather/ Climate Change Service Centre(s) and Weather Stations to enhance early warning systems and; access and use of Climate Information Services (CIS). 2. Livelihood diversification 3. Adoption of modern farming techniques. 4. Use of appropriate certified seeds.	• Meteorological department. • County government of Nyamira. • Farmers. • Development partners. • Multinational companies e.g Sasini ltd. • Churches & Schools. • Community based Organizations	strategy is gender inclusive
Floods & Storms (Hailstorms & Thunderstorms)	• Small scale traders • Roads networks • Farming	1. Establishment of the weather/ Climate Change Service Centre(s) and Weather Stations to enhance early warning systems and; access and use of Climate Information Services (CIS). 2. Thunder arrestors. 3. Soil and land management practices	• County government of Nyamira • Farmers • Development partners. • Multinational companies e.g Sasini ltd. • Churches & Schools. • Community based Organizations	strategy is gender inclusive

4.2.2 Borabu Sub- County (Nyansiongo ward, Esise Ward, Kiabonyoru Ward & Mekenene Ward).

Table 5;Adaptation strategies in Borabu Sub County

Risk/Hazard	Livelihood/ Economic System	Ranked Climate Resilience Strategies	Stakeholder Group Applying the Strategy	Gender and Social Inclusion information
Prolonged dry season	• Farming • Trade	1. Water harvesting and storage at household, community and institution level; wells, boreholes, dams, water pans & tanks 2. Conservation of water catchment areas (removing of eucalyptus from the riparian areas), Stream protection 3. Reforestation and afforestation of degraded lands, establishment of tree nurseries in sub counties. 4.Adoption of Climate Smart Agriculture specifically early maturing and drought resistant crops such as sweet potatoes, millet, cassava	• County government of Nyamira • Farmers • Development partners. • Multinational companies e.g sasini ltd. • Tea factories • Churches & Schools. • Community based Organizations	Women, PWDs & children stand to benefit more from conserved water sources
Environmental degradation such as 7. Destruction of water sources by human activities (planting of eucalyptus along the riparian land), Soil Erosion Wetlands destruction and Quarrying activities	• Farming • Trade • Transport sector	1. Sustainable Land use (terracing, catchment conservation reforestation and afforestation of degraded lands. 2. Adoption of Climate Smart Agriculture (CSA) specifically early maturing, drought resistant crops and cover crops. 3. Capacity building of the community members on environment conservation & management. 4. Removing the eucalyptus from the riparian areas. Planting of eucalyptus trees. 5. Encouraging of environmental	• County government of Nyamira • Farmers • Development partners. • Multinational companies e.g Sasini ltd. • Churches & Schools. • Community based Organizations	Programs targets both men, youth, women and PWDs

		friendly aquaculture farming 6. Rehabilitation of degraded landscapes and wetlands		
Emerging pests, diseases and invasive weed species such Japanese dodder (Cuscuta japonica)	• Farming (livestock & crops). • Trade	1.Adoption of disease resistant crops varieties. 2.Regular vaccination for livestock. 3. Spraying with agro chemicals. 4.Integrated pest management practices. 5. Training and Capacity building of farmers	• County government of Nyamira • Farmers • Development partners. • Multinational companies e.g Sasini ltd. • NGOs.	strategy is all gender inclusive
Erratic Rains.	• Farming • Small scale traders • Roads networks	1. Establishment of the weather/ Climate Change Service Centre(s) and Weather Stations to enhance early warning systems and; access and use of Climate Information Services (CIS). 2. Livelihood diversification 3. Adoption of modern farming techniques. 4. Use of appropriate certified seeds.	• County government of Nyamira • Farmers • Development partners. • Multinational companies e.g Sasini ltd. • Churches & Schools. • Community based Organizations	strategy is gender inclusive
Floods & Storms (Hailstorms & Thunderstorms)	• Small scale traders • Roads networks • Farming.	1. Establishment of the weather/ Climate Change Service Centre(s) and Weather Stations to enhance early warning systems and; access and use of Climate Information Services (CIS). 2. Thunder arrestors.	• County government of Nyamira • Farmers • Development partners. • Multinational companies e.g Sasini ltd. • Churches & Schools. • Community based Organizations	strategy is gender inclusive

4.2.3 Nyamira South Sub- County (Township Ward, Nyamaiya Ward, Bogichora Ward Bonyamatuta Ward, & Bosamaro Ward).

Table 6;Adaptation strategies in Nyamira South Sub-County

Risk/Hazard	Livelihood/ Economic System	Ranked Climate Resilience Strategies	Stakeholder Group Applying the Strategy	Gender and Social Inclusion information
Prolonged dry season.	• Farming • Trade	1. Water harvesting and storage at household, community and institution level; wells, boreholes, dams, water pans & tanks 2. Conservation of water catchment areas (removing of eucalyptus from the riparian areas), Stream protection 3. Reforestation and afforestation of degraded lands, establishment of tree nurseries in sub counties, 4. Adoption of Climate Smart Agriculture specifically early maturing and drought resistant crops such as sweet potatoes, millet, cassava	• County government of Nyamira • Farmers • Development partners. • Tea factories • Churches & Schools. • Community based Organizations	Women & children stand to benefit more from conserved water sources

Environmental degradation such as v. Destruction of water sources by human activities (planting of eucalyptus along the riparian land), i. Soil Erosion i. landslides e.g Kenonga i. Wetlands destruction e.g Sironga. x. Quarrying and Mining activities	• Farming • Trade • Transport sector	1. Sustainable Land use (terracing, catchment conservation reforestation and afforestation of degraded lands. 2. Adoption of Climate Smart Agriculture (CSA) specifically early maturing and drought resistant crops. 3. Capacity building of the community members on environment conservation & management. 4. Removing the eucalyptus from the riparian areas. 5. Encouraging of environmentally friendly aquaculture farming 6. Rehabilitation of degraded landscapes and wetlands	• County government of Nyamira • Farmers • Development partners. • Churches & Schools. • Community based Organizations	Programs targets both men, youth, women and PWDs

Emerging pests, diseases and invasive weeds species such Japanese dodder (Cuscuta japonica)	• Farming (livestock & crops). • Trade	1. Adoption of disease resistant crops varieties. 2. Regular vaccination for livestock. 3. Spraying with agro chemicals. 4. Integrated pest management practices. 5. Training of farmers.	• County government of Nyamira • Farmers • Development partners. • Multinational companies e.g Sasini ltd. • NGOs.	strategy is all gender inclusive
Erratic Rains.	• Farming • Small scale traders • Roads networks	1. Establishment of the weather/ Climate Change Service Centre(s) and Weather Stations to enhance early warning systems and; access and use of Climate Information Services (CIS). 2. Livelihood diversification 3. Adoption of modern farming techniques. 4. Use of appropriate certified seeds.	• Meteorological department • County government of Nyamira • Farmers • Development partners. • Churches & Schools. • Community based Organizations	strategy is gender inclusive
Floods & Storms (Hailstorms & Thunderstorms)	• Small scale traders • Roads networks	1. Establishment of the weather/ Climate Change Service Centre(s) and Weather Stations to enhance early warning systems and; access and use of Climate Information Services (CIS). Thunder arrestors. 2. Soil and Land management practices	• Meteorological department • County government of Nyamira • Farmers • Development partners. • Churches & Schools. • Community based Organizations	strategy is gender inclusive

4.2.4. Nyamira North Sub- County (Itibo Ward, Ekerenyo Ward, Magwagwa Ward, Bokeira Ward &Bomwagamo Ward)

Table 7;Adaptation strategies in Manga Sub County

Risk/Hazard	Livelihood/ Economic System	Ranked Climate Resilience Strategies	Stakeholder Group Applying the Strategy	Gender and Social Inclusion information
Prolonged dry season	• Farming • Trade	1. Water harvesting and storage at household, community and institution level; wells, boreholes, dams, water pans & tanks 2. Conservation of water catchment areas (removing of eucalyptus from the riparian areas), Stream protection 3. Reforestation and afforestation of degraded lands, establishment of tree nurseries in sub counties, 4. Adoption of Climate Smart Agriculture specifically early maturing and drought resistant crops such as sweet potatoes, millet, cassava	• Meteorological department • County government of Nyamira • Farmers • Development partners. • Tea factories (Mogeni tea factory & KTDA) • Churches & Schools. • Community based Organizations • Kenya forests Service (KFS)	Women ,PWDs & children stand to benefit more from conserved water sources

Environmental degradation such as 1. Destruction of water sources by human activities (planting of eucalyptus along the riparian land), 2. Soil Erosion 3. landslides 4. Wetlands destruction	• Farming • Trade • Transport sector	1. Sustainable Land use (terracing, catchment conservation reforestation and afforestation of degraded lands. 2. Adoption of Climate Smart Agriculture (CSA) specifically early maturing and drought resistant crops. 3. Capacity building of the community members on environment conservation & management. 4. Removing the eucalyptus from the riparian areas. 5. Encouraging of environmental friendly aquaculture 6. farming 7. Rehabilitation of degraded landscapes	• County government of Nyamira • Farmers • Development partners. • Churches & Schools. • Community based Organizations	Programs targets both men, youth, women and PWDs

		.		
Emerging pests, diseases and invasive species weeds such Japanese dodder (Cuscuta japonica)	• Farming (livestock & crops). • Trade	1. Adoption of disease resistant crops varieties. 2. Regular vaccination for livestock. 3. Spraying with agro chemicals. 4. Integrated pest management practices.	• County government of Nyamira • Farmers • Development partners. • Multinational companies e.g Sasini ltd. • NGOs.	strategy is all gender inclusive
Erratic Rains.	• Farming • Small scale traders • Roads networks	1. Establishment of the weather/ Climate Change Service Centre(s) and Weather Stations to enhance early warning systems and; access and use of Climate Information Services (CIS). 2. Livelihood diversification 3. Adoption of modern farming techniques. 4. Use of appropriate certified seeds.	• County government of Nyamira • Farmers • Development partners. • Churches & Schools. • Community based Organizations	strategy is gender inclusive
Floods & Storms (Hailstorms & Thunderstorms)	• Small scale traders • Roads networks	1. Establishment of the weather/ Climate Change Service Centre(s) and Weather Stations to enhance early warning systems and; access and use of Climate Information Services (CIS). 2. Thunder arrestors. 3. Soil and Land management	• County government of Nyamira • Farmers • Development partners. • Churches & Schools. • Community based Organizations	

4.2.5 Masaba North Sub- County (Rigoma, Gesima, Gachuba)

Table 8;Adaptation strategies in Masaba North Sub-County

Risk/ Hazard	Livelihood/ Economic System	Ranked Climate Resilience Strategies	Stakeholder Group Applying the Strategy	Gender and Social Inclusion information
Prolonged dry season	• Farming • Trade	1. Water harvesting and storage at household, community and institution level; wells, boreholes, dams, water pans & tanks 2.Conservation of water catchment areas (removing of eucalyptus from the riparian areas), Stream protection 3. Reforestation and afforestation of degraded lands, establishment of tree nurseries in sub counties, 4. Adoption of Climate Smart Agriculture specifically early maturing and drought resistant crops such as sweet potatoes, millet, cassava	• County government of Nyamira • Farmers • Development partners. • Multinational companies e.g sasini ltd. • Churches & Schools. • Community based Organizations	Women & children stand to benefit more from conserved water sources

Environmental degradation such as 1. Destruction of water sources by human activities (planting of eucalyptus along the riparian land), Soil Erosion Quarrying activities	• Farming • Trade • Transport sector	1. Sustainable Land use (terracing, catchment conservation reforestation and afforestation of degraded lands. 2. Adoption of Climate Smart Agriculture (CSA) specifically early maturing and drought resistant crops. 3. Capacity building of the community members on environment conservation & management. 4. Removing the eucalyptus from the riparian areas. 5. Encouraging of environmentally friendly aquaculture farming 6. Rehabilitation of degraded landscapes.	• County government of Nyamira • Farmers • Development partners. • Tea factories. • Churches & Schools. • Community based Organizations	Programs targets both men, youth, women and PWDs
Emerging pests, diseases and invasive weed species such Japanese dodder (Cuscuta japonica)	• Farming (livestock & crops). • Trade	1. Adoption of disease resistant crops varieties. 2. Regular vaccination for livestock. 3. Spraying with agro chemicals. 4. Integrated pest management practices. 5. Training of farmers.	• County government of Nyamira • Farmers • Development partners. • NGOs.	strategy is all gender inclusive
Erratic Rains.	• Farming • Small scale traders • Roads networks	1. Establishment of the weather/ Climate Change Service Centre(s) and Weather Stations to enhance early warning systems and; access and use of Climate Information Services (CIS). 2. Livelihood diversification 3. Adoption of modern farming techniques. 4. Use of appropriate certified seeds.	• County government of Nyamira • Farmers • Development partners. • Multinational companies e.g Sasini ltd. • Churches & Schools. • Community based Organizations	strategy is gender inclusive

Floods & Storms (Hailstorms & Thunderstorms)	• Small scale traders • Roads networks	1. Establishment of the weather/ Climate Change Service Centre(s) and Weather Stations to enhance early warning systems and; access and use of Climate Information Services (CIS). 2. Thunder arrestors. 3. Upgrade drainage system 4. Soil and Land Management	• Meteorological department • County government of Nyamira • Farmers • Development partners. • Tea factories (Mogeni tea factory & KTDA) • Churches & Schools. • Community based Organizations	strategy is gender inclusive

CHAPTER 5 SECTOR SPECIFIC PRIORITY AREAS

As presented in chapter 4, the major climate risks and hazards identified by stakeholders across the five sub-counties in Nyamira county include Prolonged dry seasons, Environment degradation, Increased occurrence of pests and diseases, Storms and Floods, Erratic rainfall patterns that is felt within the county. During community consultation forums and the County Level Multi-stakeholder workshop, the climate hazards in the county prioritized at ward level were presented in the view of the current and projected climate outlook. This was followed by sector-wise identification and prioritization of the response actions for the identified climate risks. This section presents the prioritized strategies for addressing climate risks and their impacts in four priority areas namely water, agriculture, environment and disaster management. The strategies are summarized in the table 9 below;

Table 9;Strategic Priority Areas Summary

1. Prolonged Dry Season			
Water	**Agriculture**	**Environment**	**Disaster management**
1. Enhance water harvesting and storage in public institutions, households and farms 2. Rehabilitation, protection and conservation of water catchment areas and water sources 3. Capacity development in water sector; application of solar energy in water supply and mobilizing resources 4. Drilling of boreholes as well as water distribution	1. Promotion of climate Smart Agriculture achieved through irrigation, modern technology and early maturing and drought tolerant varieties and breeds and certified seeds. 2. Livelihood diversification such as apiculture and aquaculture 3. Strengthen extension services	1. Conservation and protection of water catchment areas to be achieved through afforestation and reforestation 2. Establishment of fruit tree nurseries and agroforestry; Supporting private and community tree nurseries with fruit trees, bamboo and indigenous tree species 3. Capacity building and	1. Strengthening of Early Warning Systems to be achieved through; • Improving climate information systems. • Scaling up and improving existing local weather stations.

		resource mobilization	
2. Environmental degradation such as; Destruction of water sources by human activities (planting of eucalyptus along the riparian land),Soil Erosion			
5. **Water**	4. **Agriculture**	4. **Environment**	2. **Disaster management**
1. Promotion of water harvesting and storage 2. Conservation and restoration of water catchment areas 3. Climate proof water infrastructure and rehabilitation of existing infrastructure 4. including promotion of clean energy in water supply	1. Afforestation, agroforestry and reforestation 2. Soil erosion control through construction of gabions terracing, grass striping and cover cropping with focus on ecosystem based solutions 3. Awareness, sensitization and capacity building	1. Conservation of water catchment areas to be achieved through afforestation and reforestation programs 2. Replacing of eucalyptus trees within riparian zones 3. Promotion of green energy e.g. biogas and solar 4. Capacity building and awareness creation on environmental conservation	1. Development and equipping of disaster response unit 2. Promote research and strengthen early warning systems 3.
3. Emerging pests, diseases and Invasive weeds			
Water	**Agriculture**	**Environment**	**Disaster management**
1. Nature based solutions in addressing pests to avoid chemical pollution of water sources	1. Strengthening crop pest and disease surveillance 2. Promotion of pest resistant varieties and nature-based solutions to pests 3. Vaccination campaigns and extension services	1. Promote environmentally friendly pesticides 2. Strengthen capacity to monitor and control use of agrochemicals	• Setting up of an Agricultural Emergency kitty • Pest, diseases and weed surveillance Strengthening extension services
4. Intense / erratic rainfall			

Rain water harvesting expand storage promote on farm water storage and conservation	1. Cover Cropping, 2. Soil erosion control (Grass stripping, trenching, terracing, gabions among others) 3. On farm water storage	1. Increased tree planting 2. Establish soil and water conservation structures	Improve climate information services
5. **Flash Floods & Storms (Hailstorms & Thunderstorms)**			
1. Storm and water harvesting and storage to be achieved through infrastructure development, capacity building on best water harvesting techniques and nature-based solutions 2. Protection of riparian zones and river banks Afforestation and increase in vegetation cover	1. Planting of cover crops 2. Terracing 3. Maintaining buffer zones between farms and water sources	1. Improved drainage systems 2. Physical planning requirements Conservation of riparian zones	1. Strengthen disaster response institutional capacity 2. Community capacity building on Disaster Risk Reduction 3. Strengthening Early Warning System •
Hailstorm risks were identified in water sector	1. Promotion of crop insurances 2. Agricultural enterprise diversification 3. Use of agricultural shade nets for small gardens.	Capacity building of residents on livelihood diversification on livelihood resources such as Apiculture, fish farming,	1. Strengthen early warning system on hailstones • Promote crop insurance schemes
Thunder Storms		Installation of lightening arrestors in institutional buildings and social buildings	• Map lightning prone areas, carry out sensitization and install lightning arrestors

CHAPTER 6 CONCLUSION AND RECOMMENDATION

Nyamira county is an agricultural county that is heavily reliant on rain-fed agriculture, small-scale trade and services, murram, ballast and kaolin mining, as well as the exploitation of natural resources including forests and rivers. Recent changes in the weather patterns linked to climate change has left the county vulnerable to climatic risks such as Prolonged dry spells, Increased occurrence of pests and diseases, flooding, Hailstorms and irregular rainfall patterns. Increasing human activities contributed to by the ever-growing population has led to Deforestation, Invasion of riparian zones, unsustainable mining practices, Increased waste generated which has increased pressure to the environment.

The National government, County government, Local communities and CSO's are key players in managing the impacts of climate change. This is through policy and programme development actions focused on attaining sustainable climate change response as discussed in Chapter 4. However, there is a need for more enhanced multi-disciplinary approach to have a more successful outcome in attaining resilience among communities within Nyamira county.

The Participatory Climate Risk Assessment process provided a platform for thorough consultations with various actors within the county that are likely/have been affected by climate change that include; representatives from the Private sector, county and national government officials, research and higher learning, CSO's and communities. This involved getting information on current practices and setting strategies that can be incorporated to climate change adaptation.

RECOMMENDATIONS

It is recommended that this PCRA report:

1. Develop a Climate Change Action Plan to serve as a framework for implementing the suggested adaptation methods over the course of the next five years 2023-2027. Chapter three-identified common climate threats should be the main focus of the response plan. Namely invasive pests and diseases, irregular rainfall patterns, and extended dry spells.
2. In general, temperatures have risen while hailstorm strength and frequency have both increased. Floods and flash floods, soil erosion, decreased soil fertility, environmental degradation, a rise in pests and diseases and an increase in the number of continuous dry days during wet seasons are some of the effects of these dangers. The suggested actions should

focus on the most susceptible categories, which include: agriculture, water, environment and disaster risk management.

3. That all parties unite behind the action plan and assist the county government in putting the priority measures listed in the plan into action. The plan should be updated frequently to keep it current. The implementation of climate action should be mindful of the fact that certain initiatives are more successful than others at mitigating the hazards posed by climate change. For instance, sustainable land management techniques like terracing, catchment conservation, reaforestation and afforestation of degraded lands, and support for use of modern cooking stoves have all been proved to be quite effective. Resources adoption of Climate Smart Agriculture (CSA), particularly early-maturing and drought-tolerant crops, use of organic manure, and community member capacity building on soil conservation are additional effective methods to strengthen climate resilience.
4. On the other end of the spectrum, it was recommended that in order to increase resilience against prolonged dry seasons, livelihood diversification, the adoption of modern farming techniques, the use of suitable certified seeds, the strengthening of early warning systems, and access to and use of Climate Information Services (CIS) through improved collaboration with the Kenya Meteorological Department (KMD) be prioritized.
5. Key players in the implementation of climate action should have their capacities strengthened, including the County Climate Change Unit, which should be strengthened to efficiently coordinate and monitor the implementation of prioritized climate change actions, and the County Climate Change Planning Committee and Steering, which should be strengthened to enable informed decision-making Strengthening capacity across all sectors is necessary to promote the mainstreaming of climate action. Along with this, the county's capacity to track and monitor climate funds across multiple sectors should be increased. The existence of the Ward Climate Change Planning Committees serves as an instrumental tool for effective community-centered risk assessment and action planning for climate change.

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ANNEX

Appendix 1

Fig 1 .Magwagwa ward members working on the

ward`s seasonal calendar

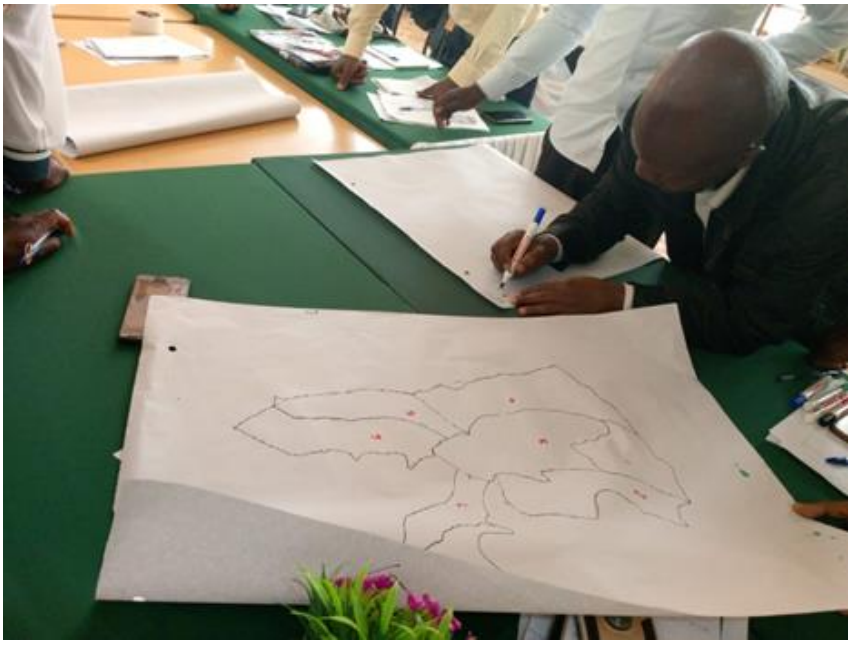

Fig 2. Magombo ward hazard map taking shape

Fig 3. Gachuba Ward presenting their vulnerability assessment

Fig 4. Bomwagamo ward stakeholders discussing Hazard cause effect

and vulnerability assessment

Fig 5. The final day of the Borabu PCRA workshop is highlighted by group presentations.

Fig 6. Kiabonyoru Team discussing the Hazard vulnerability and Capacity assessment

Fig 7. CCO Environment, Ombogo Marwanga joins the PCRA process at Fahari Hotel

Fig 8. Borabu sub-County PCRA group members group photo.

Fig 9. PCRA and CCCAP validation public participation workshop at Bogichora ward.

Fig 10. Nyamaiya Ward Members during the PCRA Process