
TECHNICAL REPORT

**THE SUSTAINABLE ENERGY ACCESS & CLIMATE
ACTION PLAN (SEACAP):**

“ADAPTATION PILLAR”

THE COUNTY GOVERNMENT OF NAKURU, KENYA

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EXECUTIVE SUMMARY

The increased frequency and magnitude of extreme weather events associated with climate change will significantly affect developing countries whose economies are still struggling to raise their population's living standards and alleviate poverty. The intergovernmental panel on climate change (IPCC) in its reports has emphasized the need to build the resilience of economies, societies, and populations since the impacts of climate change have outpaced the mitigation efforts that have been put in place. In 2020, Kenya updated her Nationally Determined Contributions (NDCs) to the United Nations Convention on Climate Change (UNFCCC), and these are expected to be implemented through sub-national/ county climate action plans. Subnational/Counties are closer to the people and are strategically placed to develop and implement climate mitigation and adaptation action plans that align to the needs of the local communities- who are most vulnerable to the effects of climate change.

The GIZ, through ICLEI Africa, commissioned technical support for the development of the **“Adaptation” pillar of the Sustainable Energy Access and Climate Action Plan (SEACAP)** for the county government of Nakuru, Kenya. The SEACAP is an initiative facilitated by the Covenant of Mayors in Sub-Saharan Africa (CoM SSA) - a regional pillar of the Global Covenant of Mayors for Climate & Energy (GCoM). ICLEI Africa and GIZ lead the SEACAP implementation in Nakuru County to support local authorities such as Nakuru County in tackling the interconnected challenges of climate change and access to sustainable energy.

This report outlines a **Risk and Vulnerability Assessment (RV&A)** for Nakuru County upon which strategic and realistic adaptation action planning will be based. The report is based on a triangulation of primary and secondary data collection and data collection and consultative engagements with the county, national governments, NGOs, and local communities. Based on the Joint Research Centre guidelines, the study focused on identifying and ranking climatic hazards and third risks to people, sectors, and services. The data collection involved an initial inception and scanning secondary databases, analysis of national and county level policies to identify available data and develop a contextual understanding of Nakuru county's climate change experiences including impacts, trends, and adaptation. The desk reviews were triangulated with primary data collected where 400 households (total, 56 percent of men and 44 percent of women) across the 11 sub-counties were interviewed to understand climate impacts and adaptation needs. The data was then used to develop a risk and vulnerability outlook which forms the basis for climate change action planning for the county.





The key findings show that climate risks in Nakuru are experienced differently by different sectors, different stakeholders, and different population groups necessitating a tailored approach to adaptation action planning. While findings show that similar hazards experienced at the household level manifest at the broader community and county levels, the impacts of these hazards differ from households to the general sub-county and county levels. Certain climatic impacts such as extreme cold and hot temperatures are experienced at household levels but not necessarily at the general sub-county or county level.

Similarly, different groups are exposed to different climatic risks and experience impacts differently. For instance, climate hazards like floods severely affect women and girls. Evidence shows that in most African settings such as Nakuru female gender spends long hours on the farms, hence susceptible to heat stress. Similarly, as the primary caregivers, women are widely responsible for daily household livelihoods and spend more time at home with children thus are more exposed to risks such as floods, and hunger risks. At the same time, other groups such as low-income households are less endowed with assets that could build their long-term adaptive capacity thus can only cope with daily -relatively moderate climatic risks but become highly vulnerable to severe events such as floods, landslides, etc.

Sectors are also impacted differently. For instance, the agriculture, livestock, and fisheries sectors seem to be the most affected sectors and most at risk due to observed crop failure, pests and diseases, and yield losses caused by drought. Similarly, both drought and floods affect several other key sectors such as energy – where inadequate rainfall destabilizes hydroelectric power supply and even creates pressure on the forest to supply wood fuel as perceived convenient and low-cost energy. The waste management sector is more at risk of ground fires. Overall, the differentiated impacts across communities, households, sectors, and population groups imply that adaptation planning for the county should target tailored and contextualized actions and use these to build more inclusive and locally embedded adaptation plans.

In terms of adaptation and adaptive capacity, the assessment shows that the community has different coping and adaptation strategies. At the household and community level, coping and adaptation seem to be mainly reliant on government support, local social networks such as saving and lending (table banking). The coping and adaptation strategies identified largely show that the residents of Nakuru county undertake largely small-scale – localized adaptation actions that only enable them to cope with the prevailing impacts of climate change in the short term but do not necessarily have the long-term adaptive capacity. Given the dynamics of risks in the county, this puts the county at high risk, especially to hazards that take long to occur but are very consequential when they occur.



The households reported a relatively high level of satisfaction with their adaptation actions. This perceived satisfaction is however based on households' contexts and might be influenced by many factors including lack of adequate information on adaptation opportunities, culture, awareness among others. This means the perceived satisfaction does not necessarily show that the measures being pursued are effective. However, from a broader point of view, this perceived satisfaction contradicts the severe level of impacts being felt by these households. It is, therefore, possible that households lack opportunities for upscaling their adaptive actions thus are settling for the current options despite their ineffectiveness. There is a need for policies that can upscale adaptation strategies by providing technological, market opportunities, and best practices that can not only help the communities to respond to prevailing impacts but also build adaptive capacity towards identified risks. The findings show that several factors including access to healthcare, access to education, resource availability among others highly support adaptive capacity while poverty, unemployment, and inequalities highly impede adaptive capacity.

KEY CHALLENGES TO ADAPTATION

Despite the opportunity to spur subnational action planning through the county, the general review shows that the process is subject to multiple challenges including lack of risk-based data – where a lot of information to support this planning is anchored at the national level. There is generally a lack of adequate and well-organized data and evidence at the county level to inform effective planning and action. The SEACAP process promises to be a strategic step to bridge the gap. Through the participatory risk and vulnerability assessments, emerging evidence provides a good starting point to depend on the understanding of local-level climate risks and use these to inform effective planning. Additionally, challenges around lack of adequate awareness especially at the local level have resulted in households and communities mainly adopting localized responses to climatic impacts and this has meant that coping with short-term impacts rather than building long-term adaptive capacity.

PRELIMINARY RECOMMENDATION

- a. A dedicated stakeholder forum for Nakuru County and other Counties could help spur dialogue and enable effective coordination and promote synergies in developing and operationalizing the County Adaptation plans.
- b. Promote county-led adaptation action strategy that could enhance pro-poor and contextualized actions, better coordination, and linkages to national-level resources. The SEACAP process is a step towards this direction and could be comprehensively embedded in ongoing county climate action planning and legislative processes.



- c. An integrated climate planning process that builds synergies between mitigation and adaptation. The vast majority of the Nakuru County climate policy initiatives have been focused on mitigation given the high mitigation potential through renewable energy as highlighted in the energy assessment report. The county's adaptation planning could benefit more if anchored alongside mitigation for greater synergies and pursuit of low carbon development.
- d. Establish a localized climate action database for Nakuru and other Counties to inform strategy, planning, and actions. Currently, lack of data or its access impedes adaptation strategies especially decision on where to intervene, how, and when.
- e. Capacity building and systematic awareness are key to unlocking climate action information and technologies for a wider Nakuru community segment. Capacity support to the county to enable it to develop adaptation programs and mobilize resources for action. The awareness for the wider Nakuru community is critical to breaking systemic socio-cultural barriers to climate adaptation options.

NEXT STEPS

- a. Undertake consultative dialogue with the county departments to identify the legislative opportunities for strengthening country-led adaptation planning.
- b. Provide technical support to the county to develop/update the specific energy policy/strategy drawing on the findings from this assessment
- c. Undertake capacity building on clean energy innovation and provide linkages with various opportunities pursuing the same.
- d. Explore options for scaling the SEACAP model to other counties in close collaboration with the national government and related county climate planning initiatives.





CHAPTER 1: INTRODUCTION

As Parties move to implement their Nationally Determined Commitment under the Paris Agreement, the role of sub-national/local authorities' interventions is becoming more central. Subnational are closer to the people and are strategically placed to develop and implement climate mitigation and adaptation action plans that align to the needs of the local communities- who are most vulnerable to the effects of climate change.

The GIZ, through ICLEI Africa, commissioned technical support for the development of the **"Adaptation" pillar of the sustainable energy access and climate action plan (SEACAP) for the county government of Nakuru, Kenya**. The SEACAP is an initiative facilitated by the Covenant of Mayors in Sub-Saharan Africa (CoM SSA)- a regional chapter of the Global Covenant of Mayors for Climate & Energy (GCoM). ICLEI Africa and GIZ lead the SEACAP development and implementation in Sub-Sahara Africa (SSA) to support local authorities such as Nakuru County in tackling the interconnected challenges of climate change and access to sustainable energy.

The SEACAP process in Nakuru generally involves three interconnected pillars/actions that include climate mitigation (emission accounting), climate adaptation (vulnerability assessment and adaptation planning, and the energy access assessment. This technical report focuses on the development of the adaptation pillar of the SEACAP based on a risk and vulnerability assessment (RVA) approach, as guided by the [Joint Research Centre \(JRC\) Guidebook](#).

The development of the adaptation Pillar for Nakuru County under the SEACAP initiative builds involves the identification of climate hazards, and impacted sectors of the economy and assess the level of adaptive capacity through a Risk and Vulnerability Assessment (RVA) process that then informs adaptation planning. The process also involves reviewing the current climate change action plan to identify the areas of strengthening and sharpening in terms of adaptation targets and actions. Overall, the adaptation pillar development is a supplementary process to the County's exiting climate action initiatives and ambitions.

AIMS AND OBJECTIVES

The specific objectives of the development of the Adaptation pillar include:

- i. Assessing climate risk and vulnerability for households., communities and ecosystems
- ii. Identify key opportunities for building adaptative capacity in response to the risks.
- iii. Set targets and develop action plans on energy access in Nakuru County.



This technical report is organized into five sections. The next section outlines the general contextual information about Nakuru's adaptation actions including demography, policies, stakeholders among others drawing on the initial scoping study. The third section outlines the RVA process/methodology and its application in Nakuru County. The fourth section describes the results and outcomes of the RVA process based on different information sources including secondary data, household interviews, and stakeholder engagements through RVA-policy and technical workshops. The final section outlines some general reflection on the RVA process and provides policy recommendations and possible next steps.

GENERAL INFORMATION OF NAKURU COUNTY

Nakuru County is among the 47 counties/sub-nationals of the Republic of Kenya that came into existence with the Kenyan Constitution 2010. The County covers approximately 7,498.8 Km² inland area size administratively divided into eleven sub-counties and 55 wards (KNBS, 2019). The county is cosmopolitan, drawing its population from different ethnicities and nationalities (KNBS, 2019). About 54.2% of the people in Nakuru live in rural areas, whereas 45.8% live in urban areas. According to the 2019 National Population and Housing Census, the County's population was approximately 2.16 million, with 1.077 million male, 1.084 million female, and 95 intersexes. Individuals aged 18-35 are approximately 33%, which is a predominantly youthful population (KNBS, 2019).

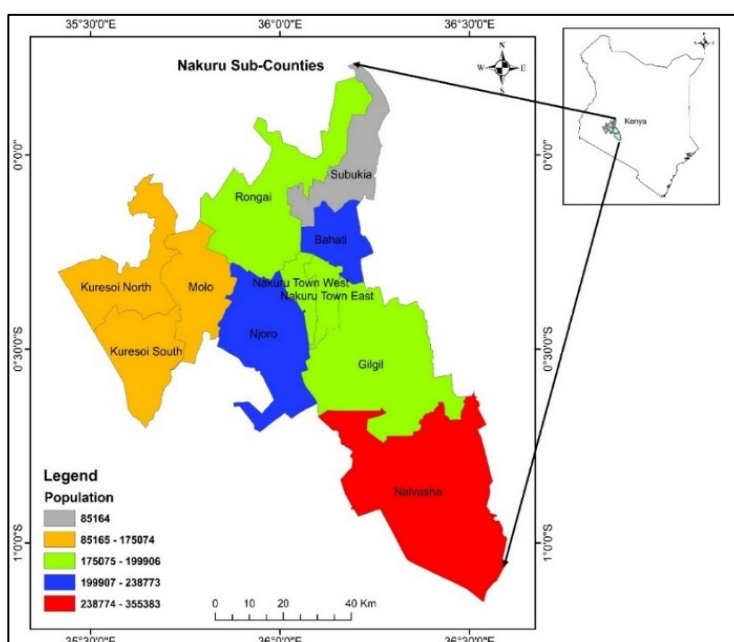


Figure 1: A map of Nakuru County with the Sub counties and their respective 2019 population Source (KNBS, 2019)

The main economic activities within Nakuru County are; agribusiness, financial services, and tourism (CIDP 2018-2022). The County's economy is built around agriculture, which accounts for approximately 60% of total economic activity (Nakuru County, 2020). The County's Gross Domestic Product (GDP) for 2019 was estimated at KSh 613 billion (at current prices), accounting

for 6.9% of Kenya's GDP (KNBS, 2019, 2020c). About 29.1% of the population live under the poverty line of US\$ 2 a day relatively below the national poverty level of 36.1%¹.

CLIMATE CHANGE ADAPTATION INSTITUTIONAL, REGULATORY, AND POLICY FRAMEWORK

Table 1: National level

Policy Documents	Mitigation and Adaptation Provisions
Constitution of Kenya 2010	- Kenya's Constitution provides the basis for action on climate change by guaranteeing citizens a clean and healthy environment, which is a fundamental right under the Bill of Rights. - Provides for the devolved system of governance (counties) which ensure participation of communities and equitable national resource distribution to address socio-economic disparities
Vision 2030	- Under the social strategy, Kenya aims to be a nation that has a clean, secure, and sustainable environment by 2030 by harmonizing environment-related laws for better environmental planning and governance. - Kenya will also enhance disaster preparedness in all disaster-prone areas and improve the capacity for <u>adaptation</u> to global climate change.
Vision 2030' Third Medium Term Plan (MTP).	Thematic area: Climate Change and Disaster Risk Management (DRM). - To mitigate drought, the Government will strengthen the Integrated Early Warning Systems and National Drought Emergency Fund - Addressed through the promotion of a low carbon climate resilient and green growth development. - This will be achieved through strengthening climate change governance and coordination, climate change monitoring, reporting and verification, capacity

¹ <https://www.unicef.org/esa/media/7021/file/UNICEF-Kenya-Nakuru-County-Budget-Brief-2020.pdf>

	building and public awareness, and formulation and implementation of the Green Economy Strategy and the National Climate Change Action Plan.
Climate Change Act 2016	• It provides a framework for mainstreaming climate change across sectors. • Facilitate the formulation of a five-year National Climate Change Action Plan (NCCAP) that addresses all sectors of the economy and provides mechanisms for mainstreaming climate change into all sectors and the County Integrated Development Plans (CIDsPs) • Provides mechanisms for mainstreaming climate change into the County Integrated Development Plans (CIDsPs)
Environmental Management and Co-ordination (Amendment) 2015	• Article 56 A. on Guidelines on climate change: The Cabinet Secretary shall, in consultation with relevant lead agencies, issue guidelines and prescribe measures on climate change. (Government of Kenya, 2015)
National Climate Change Response Strategy (2010),	• The mission is to strengthen and focus nationwide actions towards climate change adaptation and GHG emission mitigation
Kenya Climate-Smart Agriculture Strategy 2017 - 2026	• To support adaptation to climate change, build the resilience of agricultural systems while minimizing emissions for enhanced food and nutritional security and improved livelihoods. • The Strategy was subjected to wider stakeholder consultations that brought together all the 47 counties • Nakuru County does not have a county CSA strategy. However, the Strategy has provision for the County Agriculture Sector Ministries, Departments, and Agencies (MDAs) to spearhead the implementation of the identified strategies in the counties.
2nd National Climate Change Action Plan-NCCAP (2018-2022)	• Guide Kenya on the priority adaptation and mitigation climate change actions that help define Kenya's low carbon climate-resilient development pathway and lead to the achievement of Kenya's NDC targets.



	Counties will align their Strategic Plans and County Integrated Development Plans (CIDPs) to the Vision 2030 national development blueprint, the MTP III, and the NCCAP 2018-2022 through a consultative process.
draft Climate Change Policy, 2018	This Policy was developed to facilitate a coordinated, coherent, and effective response to the local, national and global challenges and opportunities that climate change presents.
Kenya National Adaptation Plan (2015-2030)	NAP is designed to operationalize the NCCAP and support adaptation strategies in the country
Nationally Determined Contributions (NDCs)	The NDC sets out mitigation and adaptation contribution of mainstreaming mitigation and adaptation into Medium Term Plans and implementing mitigation and adaptation actions.
Sector Plan for Drought Risk Management and Ending Drought Emergencies 2013 – 2017	It sets 2030 mitigation targets defined in Kenya's NDC
National Disaster Risk Management Policy, 2018	It lays down the strategies for ensuring the Government commits itself to the enhancement of research in disasters and formulation of risk reduction strategies.
Green Economy Strategy and Implementation Plan, 2016-2030	Building resilience: - This strategy is expected to strengthen the resilience of economic, social, and environmental systems to the adverse effects of external shock. - GESIP is linked with the NCCAP, 2013-2017, NAP, 2016-2030, and National CC Act 2016 - Strategies under the thematic are on building resilience: ➤ Promote livelihood diversification for vulnerable communities Enhance disaster risk reduction measures
National Spatial Plan 2015-2045:	The National Spatial Plan supports the mainstreaming of climate change into the national and county planning processes



The Value Added Tax (Amendment) Act 2014	Offers an exemption from value-added tax (VAT) and import duties for supplies imported or bought for the construction of a power-generating plant or geothermal exploration. Kenya is expanding geothermal projects to generate clean energy and cut GHG emissions
Public Finance Management (Climate Change Fund) Regulations, 2018	Provide financing mechanisms to priority climate change actions and interventions Empowers counties to develop climate finance policy frameworks
The Public Finance Management (National Drought Emergency Fund) Regulations, 2018	The Regulations are meant to guide the operations of the National Drought Emergency Fund which is to be established to improve the effectiveness and efficiency of drought risk management systems in the country as well as to provide a common basket of emergency funds for drought risk management.
National Policy on Climate Finance (draft) 2016	Recognizes climate finance is an important enabling aspect of efforts to address climate change. Preparing the country to tap into the external and internal climate finances to support mitigation and adaptation activities. Significant financial resources from the public and private sectors are expected to be channeled towards climate activities.
The Kenya National Green Climate Fund (GCF) Strategy, 2017	- strengthening the national capacity to effectively and efficiently plan for, access, manage, deploy and monitor climate financing, through the GCF - It recognizes that the country must boost the mobilization of adequate and predictable financial resources from domestic and international sources. Notably, County governments are critical co-financiers and can take the role of Executing Entities and/or Implementing Entities of low-carbon and climate-resilient initiatives(The National Treasury, 2017).
National Food and Nutrition Security Policy (FNSP), 2011	Acknowledge that: the current food crisis is fueled by such new driving forces as climate change and

	- adaptation interventions that enhance farming communities' resilience to climate change-induced effects are critical for the realization of the principal objectives of FNSP - Promote the integration of climate change adaptation in development programs and policies; - Improve forecasting of climatic change and support communities to respond to new opportunities and challenges. - But it doesn't detail how to engage the counties to realize the FNSP
Kenya Youth Agribusiness Strategy 2017-2021	- Positioning the youth at the forefront of Agricultural Growth and Transformation - The strategy has identified strategic issues which include: Strategic Issue 10: Negative impacts of climate change and weak environmental governance (Ministry of Agriculture Livestock & Fisheries and the Council of Governors, 2017) - The MoEF in consultation with the County Governments and development partners have developed the Strategy with a view to the increasing meaning and sustainable youth participation in the agricultural sector
Climate Change Indicator Development Guidebook, 2018	Identification of indicators at national and county level

Table 2: County level policies and strategies

Policy Documents	Mitigation and Adaptation Provisions
Second County Integrated Development Plan (CIDP) 2018-2022	strategic focus and program implementation frameworks and support to tackle climate change provide policy advice and tools,
Draft Nakuru County Climate Change Plan, 2018-2022	- Mitigation and adaptation: - Provide the 'Vision' to enable Nakuru County to transition to a low carbon, climate-resilient economy that sustains the livelihoods of its citizens while contributing to national development.



	• Anticipate to be achieved through eight strategic objectives namely: ✓ Food security. ✓ Water security. ✓ Ecosystem conservation for sustainable economic development. ✓ Green energy production and use. ✓ Climate change- resilient infrastructure. ✓ Knowledge management and capacity building of community, stakeholders, and county officials. ✓ Sustainable financing for climate change action. ✓ Governance and coordination of climate change adaptation and mitigation. • Highlight the formulation of a vision, mission, and strategic objectives for Nakuru County Climate Change Adaptation Plan
Nakuru County Climate Change Fund Bill (2020) (at 2nd Reading at the County Assembly)	• has provision for mobilization of local climate finance and leveraging of international climate finance for county led climate actions
The Nakuru County Charcoal Bill, 2014	• Mitigation: Support energy-efficient technologies and gradual exit from use of charcoal and control of tree harvesting for charcoal production • Establishment of County Environmental Committee
Nakuru County Waste Management Bill, 2019	• Mitigation: facilitate appropriate waste management and utilization to generate clean energy
The Nakuru County Agricultural Training and Mechanization Service Bill, 2019	• Establishment of the Agricultural Development Fund • Mitigation: aim to reduce inappropriate land preparation technologies like burning
The Nakuru County Urban Agriculture Promotion and Regulation Bill, 2015	• Mitigation: Inclusion of urban Agriculture in County as a way of maximizing space, introducing green spaces, and use of organic waste





CLIMATE CHANGE ADAPTATION INSTITUTIONAL ARRANGEMENTS

Table 3: National level

Institution	Coordination units	Role	Adaptation commitments
National Climate Change Secretariat (NCCS)	Ministry of Environment and Natural Resources	National Focal Point for the UNFCCC	Kenya National Adaptation Plan 2015-2030
	Ministry of Devolution and Planning	Ensure the integration of climate change in the MTPs	
	National Environmental Management Authority (NEMA)	National Implementing Entity (NIE) for the Adaptation Fund and the Green Climate Fund (GCF)	
	National Treasury	National Designated Authority for the GCF	
	NDMA	- Exercise overall coordination over all matters relating to drought management in Kenya; - Oversees adaptation and resilience-building in the arid and semi-arid areas (ASALs); - The secretariat of the Common Programme Framework in Ending Drought Emergencies in Kenya.	





Table 4: County-level

Department	Thematic Area	Overview	Adaptation commitments
Department of Agriculture, Livestock, and Fisheries	Modernizing Agriculture	Agriculture, livestock, and fisheries potential; the County has various agro-ecological zones that support diverse husbandries. Diminishing agricultural land, budget constraint, climate change, and market constraints limit sector potential.	Support the adoption of modern methods of production and technologies; enhance value addition; improve infrastructural facilities that link production market centers; farm inputs subsidies; construction of storage facilities to reduce post-harvest; improve coordination by establishing cross-sectorial frameworks; strengthen the farmer organizations and cooperatives; improve the extension services and provide insurance facilities to cushion farmers; disease control and surveillance.
ENREW, NEMA, Development Partners, Community	Conserving the Natural Environment	Natural environment; Nakuru County has a unique geological formation that has shaped its agro-ecological and climatic zones. The County ecosystems are under pressure from unsustainable management practices such as poor waste management, deforestation, degradation of the environment, pollution, poor land-use planning, etc.	• Mapping of ecologically fragile zones • Conserve water catchment areas • Implementation of the Integrated Solid Waste Management Strategy • Implementation of the Climate Change Action Plan 2018-2023 and mainstreaming the National Climate Change Act 2016 • Implementation of the Nakuru Clean Energy Action plan and Clean energy policy, 2016 • Development of Environmental Management policy framework • Establishment of a Water and Sanitation Networking forum and enforcement of water Management and Sanitation best practices



CHAPTER 2: THE RISK AND VULNERABILITY ASSESSMENT

A. KEY TERMS AND DEFINITIONS

The term risk refers to the anticipated/potential losses from a certain hazard to a certain element at risk over a predetermined timeframe. The risk may be measured in terms of the extent of physical property damage, or terms of numbers of lives lost, or in terms of expected economic loss (UNDRO, 1979). Risk assessment entails the use of data to quantify the risk. The aim is to provide evidence-based adaptation planning and action. Often, adaptation is viewed as more effective when carried out as a planned process instead of in response to already existing impacts.² Vulnerability is multi-faceted. It is the proclivity of things to be destroyed by a hazard. People's lives and wellbeing are at risk from the hazard's effects (UNDF, 1992). Vulnerability is thus a critical concept used to guide the design, assessment, and targeting of programs.

Moreover, a vulnerability assessment can help shape successful disaster mitigation interventions by showing where and what kinds of actions are needed most to address risks. Most disaster mitigation work is centered on reducing vulnerability and informing development planners on which components/sectors of the society are most at risk (Moret, 2014). Strategies of vulnerability assessment can be applied in a wide range of areas including natural hazards, sustainable livelihoods, poverty analysis, food security, and related areas. These approaches - each with their nuances - provide a basis for future best practices in understanding climate change adaptation and vulnerability (Bringing down & Patwardhan, 2002).

B. RISK AND VULNERABILITY ASSESSMENT METHODOLOGY

A triangulation of consultations, primary and secondary data collection methods, and multistakeholder workshops was applied to collect relevant data and information. The data needs and possible data sources were identified through continuous review, consultations with ICLEI, GIZ, Nakuru County Governments, and the various stakeholders guided by the scientific grounded JRC guidelines for the SEACAP development. The RVA was therefore conducted in three steps outlined below

² IPCC (2014) defined adaptation as “the process of adjustment to actual or expected climate and its effects.” Adaptation can be reactive or planned. Reactive adaptation involves remedial interventions taken in response to an impact which has already occurred while planned adaptation actions, on, are intervention to remedy anticipated impacts based on risk predictions.

STEP 1: INCEPTIONS, SITUATIONAL ANALYSIS AND REVIEW OF SECONDARY DATA-BASES

The first step involved inception activities including scanning secondary databases, review of policy and academic documents relevant to Nakuru climate impacts, and adaptation planning and consultation with key stakeholders (including the county and national government agencies) to inform a situational analysis and build data-sets for the JRC template and the RVA process. More specifically, the inception involved retrieving historical climate information for Nakuru. The understanding by the study team of the historical climate information enabled them to identify the past, present, and future climatic hazards and risks, and the sectors affected. The historical outlook also reveals the key factors enabling or impeding the County's adaptive capacity. The historical climate outlook for Nakuru including satellite climatic data was retrieved from the archives of the Kenya Meteorological Department (KMD) and other agencies including the Ministries such as agriculture where we retrieved the Kenya County Climate Risk Profile for Nakuru County-2016, Ministry of Environment Climate Change Unit the Kenya Climate Working Group among others (see Annex 3 for databases and documents reviewed). Country archives also provided useful information including reports that indicate the county's efforts towards adaptation planning. The retrieved secondary data provided some overall indication of Nakuru county adaptation efforts but again were largely reflecting at the national scale especially on impacts and vulnerability necessitating primary data collection within Nakuru County to contextualize risk and vulnerability data.

STEP 2: PRIMARY DATA COLLECTIONS THROUGH HOUSEHOLD SURVEYS

The second step involved primary data collection within Nakuru County to triangulate the secondary data and contextualize some of the national-level climate impacts and vulnerability data to the County context. The primary data was mainly collected through the household surveys using questionnaires based on a representative household sample drawn from the eleven (11) sub-counties of Nakuru.

Before designing the sample size and household interviews, a rapid appraisal was undertaken through consultative discussions with selected key stakeholders, including county government, National Government stakeholders - Nakuru KPLC office, and the Kenya Bureau of Statistics - Nakuru office, the civil society –World Vision, and the community-based organization worked on climate change and energy issues in the area. The rapid appraisal was aimed at identifying and characterizing the sub-counties and collectively designing appropriate and representative sample sizes.

Through close consultation with the county government, a random stratified sampling was adopted and designed to capture the physical and socio-economic diversity of the County's adaptation situation. The sampling process drew from the household population of 616,046 in the County based on recently concluded National housing and population 2019 census results (KNBS, 2019). Using Solvin's formula (Eq. 1), a sample size of 400 was arrived at against the total household population within a confidence limit of 95%, and an error margin of 0.05 only. An additional 20 households were also selected for testing/piloting the data collection – alongside the energy survey bringing the total sample to 420 households (i.e., the statistical sample plus the test sample).

$$\begin{aligned}
 N &= \text{Total Population} \\
 n &= \text{Sample size} = N \div (1 + Ne^2). \\
 N &= \text{Number of households in the County} = 616046 \text{ household} \\
 e &= \text{error margin (0.05)} \\
 n &= \text{Sample size} \\
 n &= 1000 / (1 + 1000 \times 0.05 \times 0.05) \\
 n &= 399.74 \approx 400
 \end{aligned}$$

Equation 1: Household Sample Calculation

The initial appraisal also noted that households' groups in Nakuru are heterogeneous and are made up of diverse social groups experiencing climate change impacts differently due to differentiated adaptative capacity. As such, the 420-sample size was differentiated through 3 main categories that capture this heterogeneity and defines adaptation actions:

- i. Geographical contexts, i.e., samples distributed in each of the 11 sub-counties based on sub-county households' numbers
- ii. Gender – where samples were drawn from both male and female-headed households and
- iii. Wealth ranking - where we applied income-based wealth ranking (Scoones, 1995) to differentiate households into various wealth categories and draw insights on how income defines adaptation action.



Ultimately, the 420 households distributed across the sub-counties (Figure 2) were contacted for telephone interviews even though nine of these declined due to different reasons, including network challenges.

To effectively execute the interviews amidst the COVID-19 restrictions, virtual data collection was designed using the Kobo toolbox and phone interviews. The phone numbers of the 420 households were acquired and verified through the Sub-county officers working under the County Government of Nakuru. Twelve field assistants who were tasked with undertaking the interviews were taken through a two-day face-face covering the overall introduction to the SEACAP process and aims, virtual data collection process, -using phone interviews, the use of the Kobo-toolbox, and general ethics in engaging households amidst COVID-19.

Pilot interviews were executed with a sample of twenty households during the training session, allowing for testing the tool's effectiveness, identifying gaps, and timely remedial guidance. The actual data collection then commenced 2 days after the training and involved conducting phone call interviews surveys with the sampled households. The Kobo-tool box aided the monitoring of the data collection process by allowing audio-recording of the interviews to verify and authenticate the information collected as well as close monitoring of the enumerator's performance.

The interviews captured both qualitative and quantitative aspects of adaptation including assets profiles, climate impact experiences, adaptation actions preferred, and general climatic data. Premised on the assumption that the respondents had not made prior contacts with study questions, all the information obtained was classified as primary raw data as they emerged from the study contexts without any tinkering.

Data acquired were subjected to several analysis stages which include the use of a GIS environment to visualize the sampled households and the spatial representation of the different variables collected. Microsoft Excel and SPSS were used to undertake qualitative and quantitative analysis were employed. Qualitative data drawn from the interviews and stakeholder engagements were coded to draw out themes (Hopkins, 2007). Household questionnaire data were analyzed using SPSS to generate descriptive statistics and non-parametric statistical tests.



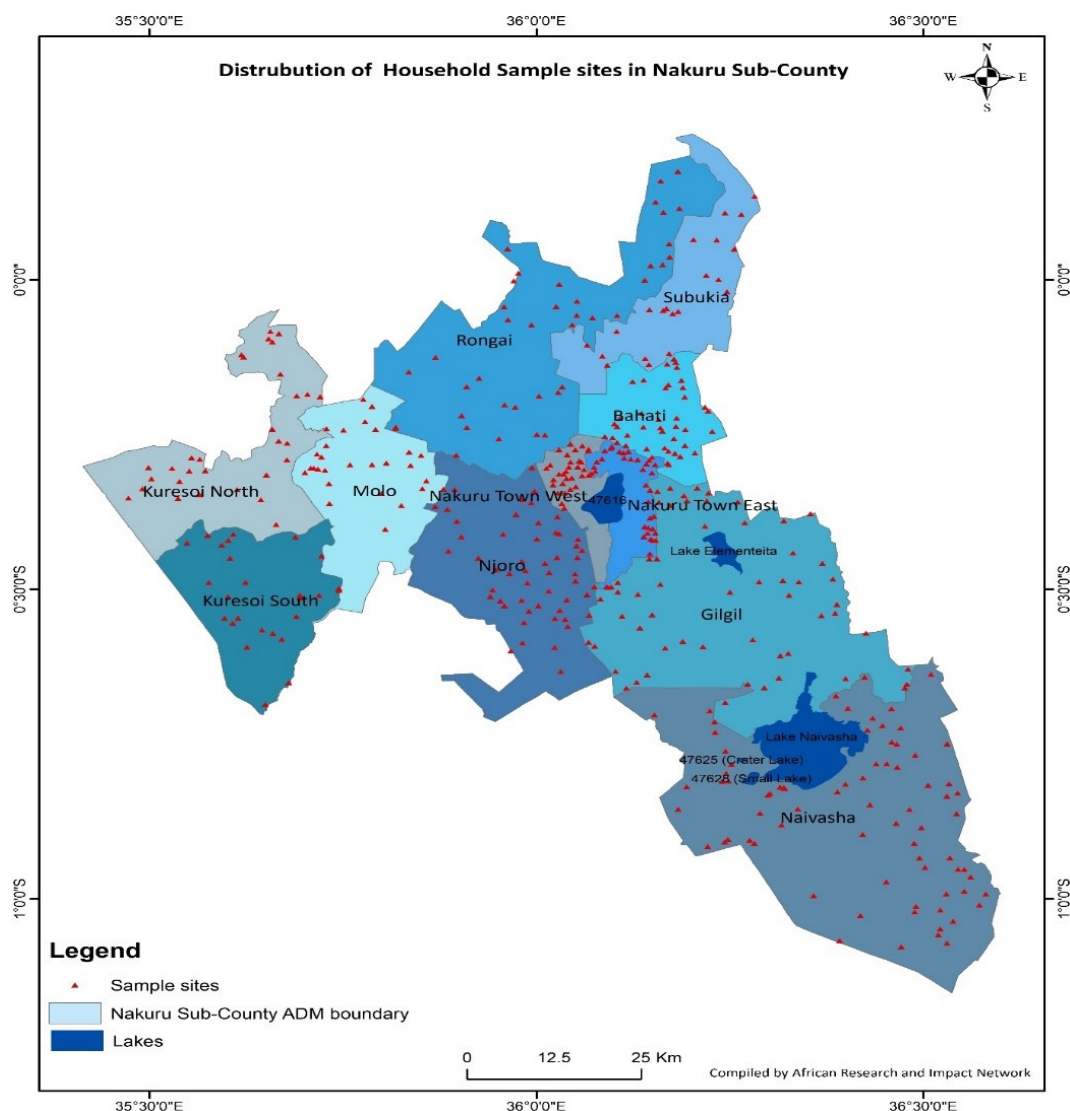


Figure 2: Household random distribution sample sites in Nakuru Sub-County

STEP 3: PARTICIPATORS RVA WORKSHOPS

The secondary and primary data on climate hazards and adaptation actions were complemented through two participatory workshops to provide insights on policy and technical elements of the assessments. The first workshop aimed at bringing together policymakers to provide inputs on the county's climate change planning and to reflect on the SEACAP adaptation planning process and progress. The details of this workshop can be retrieved from the detailed workshop report included in Annexure B of this report. The second workshop held on 19th January 2021 focused on bringing together the technical teams from different sectors at the county and national level to review and identify the key risks, hazards, and adaptive capacity indicators across the eleven

sub-counties. In addition to supporting the RVA assessment through policy and technical outputs, the two workshops were also meant to create awareness and promote co-ownership of the climate change action planning process in Nakuru. While the policy workshop was undertaken virtually, the technical RVA processes were executed



physically in Nakuru with key technical teams working in groups to provide risk and vulnerability data guided by specified RVA matrices. The detailed technical RVA workshop report is included in Annexure B of this report.



CHAPTER 3: KEY FINDINGS

INCEPTION AND SECONDARY DATA AND DOCUMENT REVIEWS

The key findings of these secondary and document reviews have been reported as part of situational analysis. Key observations include that while climate action is required more at the county level, a lot of information to support this planning is anchored at the national level. There is generally a lack of adequate and well-organized data and evidence at the county level to inform effective planning and action. The SEACAP process, therefore, promises to be a strategic step to bridge this gap. Through the participatory risk and vulnerability assessments, emerging evidence provides a good starting point to depend on the understanding of local-level climate risks and use these to inform effective planning enabled by the county's goodwill towards

HOUSEHOLD DEMOGRAPHICS FROM THE PRIMARY DATA

During the survey, 56 percent of men and 44 percent of women, mostly within the age bracket 35 and 44 years, were interviewed, with most households headed by males. The majority of those interviewed had secondary education implying desirable literacy levels. (Table 5).

Table 5: Demographics characteristics of the household

Variable	Percentage
Gender of the respondent	
Male	56
Female	44
Education Level	
Pre-school	2
Primary	26
Secondary	44
Tertiary	29
Age of the respondent	
<65 Years	5
18-24 Years	4
25-34 Years	21





35-44 Years	30
45-54 Years	24
55-64 Years	17
Household main Earner	
Child	7
Father	67
Mother	25
Don't know	0.8
Both parent	2

HOUSEHOLD STRUCTURES

As shown in figure 3 below, about 47% of Nakuru Residents live in houses with stone walls, 24% in mud and wattle walls, and 17% in wood panel walls. Stone-walled houses provide some relative resistance to certain climatic conditions such as hailstorms and floods. However, a good segment of the residents at 47%, who reside in mud-walled houses could be exposed to such extreme events.

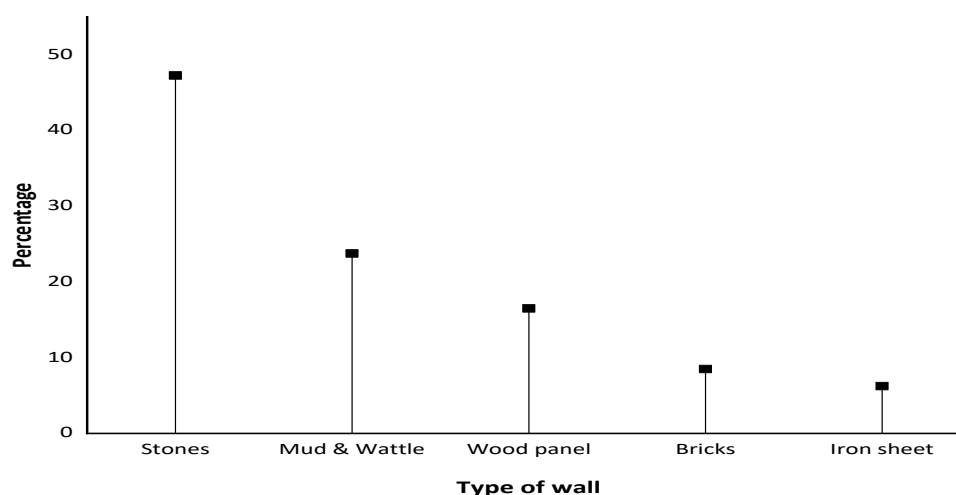


Figure 3: Household type of wall

HISTORICAL AND PROJECTED CLIMATE INFORMATION

Nakuru experiences a bimodal rainfall pattern receiving heavy rainfall from March to June and low rainfall from September to November. On average, dry spells are longer around the second wet season ranging from 35 to 80 days in any given year. Around the first wet-season, the dry-spell ranges between 25 to 60 consecutive days every year. Extreme precipitation and flood risks are moderate in both seasons even though relatively higher in the first season³.

Observed trends show that climate change is taking place in the County. Since 1981, the County has experienced a moderate (1°C) increase in mean temperature and heat stress especially in the first wet season and the associated reduction in the crop cycle, the second wet season experienced a mild (~0.5°C) increase in temperature and no precipitation change (Figure 4 and 5). This explains the observed increasing trend in the intensity and frequencies of the climatic hazards such as floods and drought in the County.

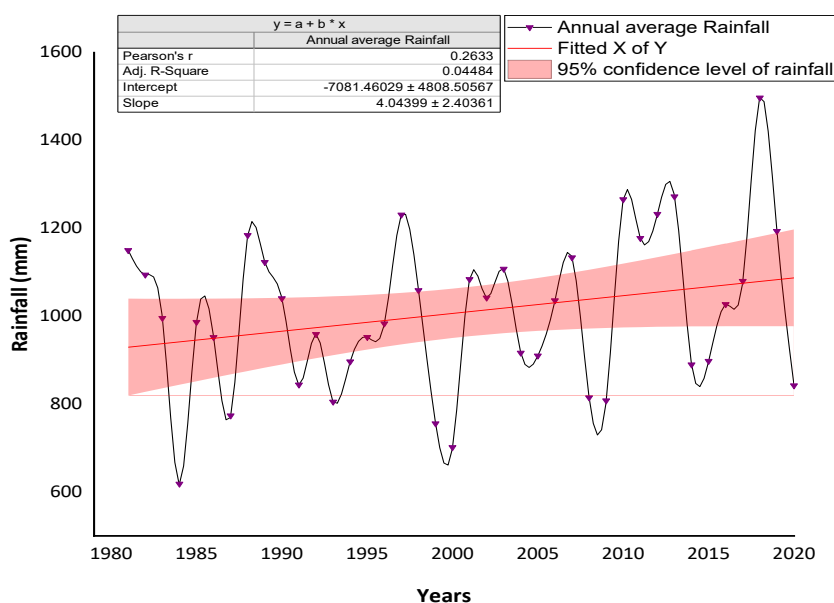


Figure 4: Historical Annual Rainfall for Nakuru County of 1981-2020

³ https://cgspace.cgiar.org/bitstream/handle/10568/80458/Nakuru_Climate%20Risk%20Profile.pdf

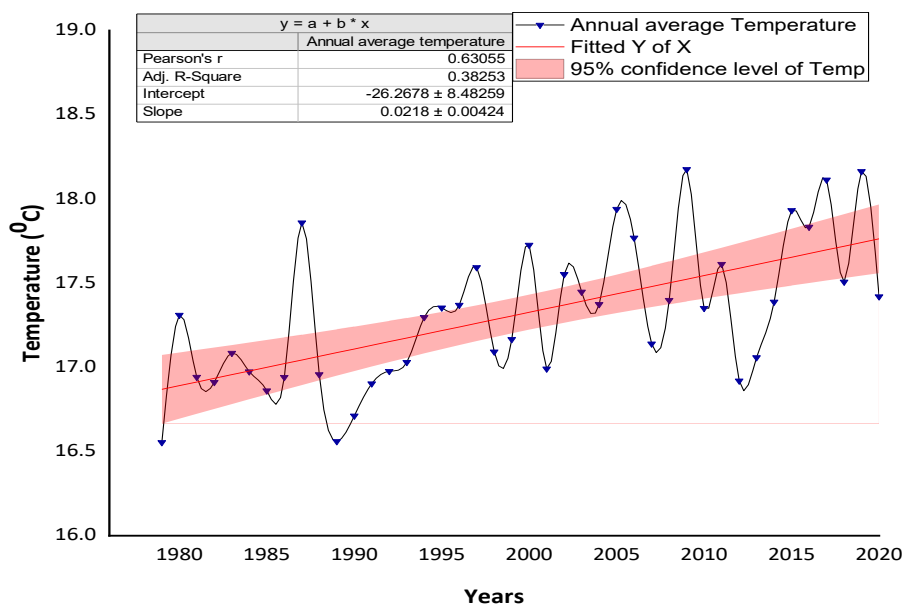
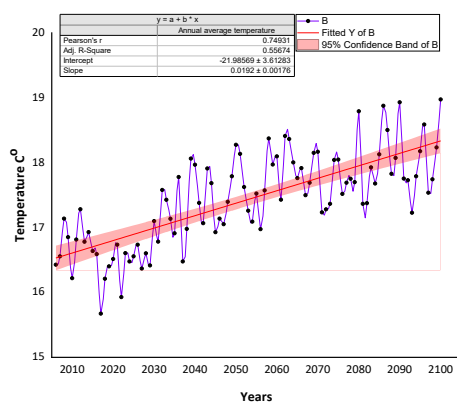
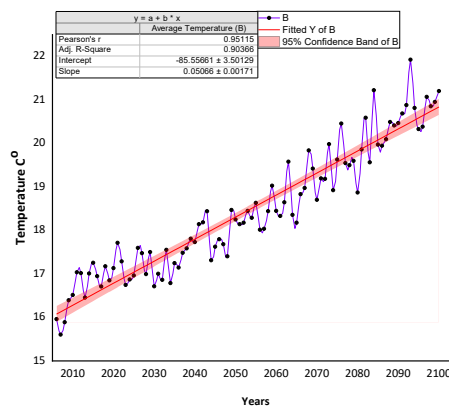


Figure 5: Historical Temperature of Nakuru County from 1979-2020

The future projected climate under Representative Concentration Pathways (RCPs) 4.5 and 8.5 reveal the persistent increase in both temperatures and rainfall in Nakuru County. Based on the two RCPs scenarios, the temperature is expected to increase steadily with and the worst-case scenario of RCP 8.5 revealing a very sharp and steady temperature rise in Nakuru from 2006 to the end of the Century. The rainfall trends are projected to increase gently with the frequencies and intensities expected to vary significantly. In this regard, the temperatures are projected to increase steadily while the rainfalls become more erratic and unpredictable in terms of intensity and frequency. Since the County's economy is majorly dependent on agricultural production, the projected climate poses a potential risk on the agricultural productivity which cascades to the households. With the projected high temperatures and erratic rainfall in Nakuru County in the coming years, prolonged moisture stress is projected to occur across both rainfall seasons of the year. Precipitation is projected to increase by 0.3% in the first wet season, and 6% in the second wet season. These all indicate the need of preparing for the expected increased incidence of droughts and floods in the future that may affect Nakuru County. The impacts of the climatic hazards are usually felt differently in the society with the vulnerable groups such as the young, women, the elderly, the poor, and the sick most affected. Nakuru County is not an exception and the impacts of climate change are most likely to manifest most among these groups of the society.

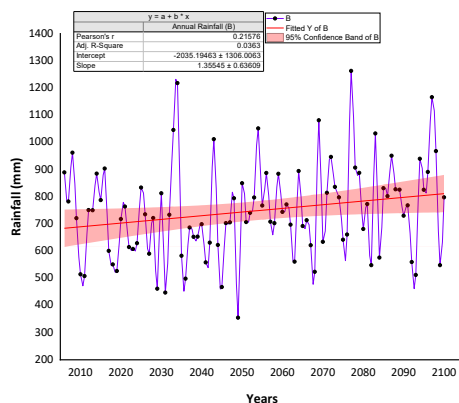


Scenario 4.5

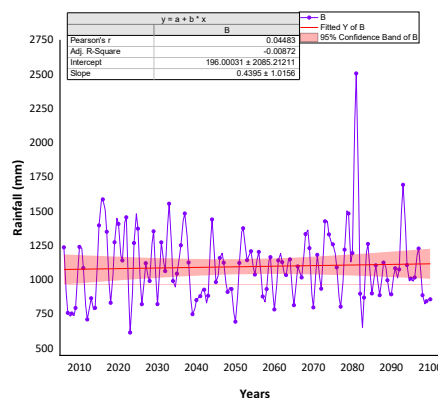


Scenario 8.5

Figure 6: Projected Annual Average temperature (RCP 4.5 and 8.5)



Scenario 4.5



Scenario 8.5

Figure 7: Projected Annual Rainfall totals from 2006 to 2100 (RCP 4.5 and 8.5)

CLIMATIC RELATED RISKS EXPERIENCED IN NAKURU COUNTY

From the household survey (HHS), the County in the last 5-30 years, has experienced extreme weather events, majorly floods, droughts, extreme hot and cold temperatures, rainstorms, and hailstorms. Incidences of wildfires, landslides, fog, and lightning strikes have been identified, albeit on low scales.

Scanning through the same period, the respondents identified floods and droughts as major climatic hazards in the County. Fire risks are more common in Kuresoi South while floods more common in Naivasha. The probability of hazard

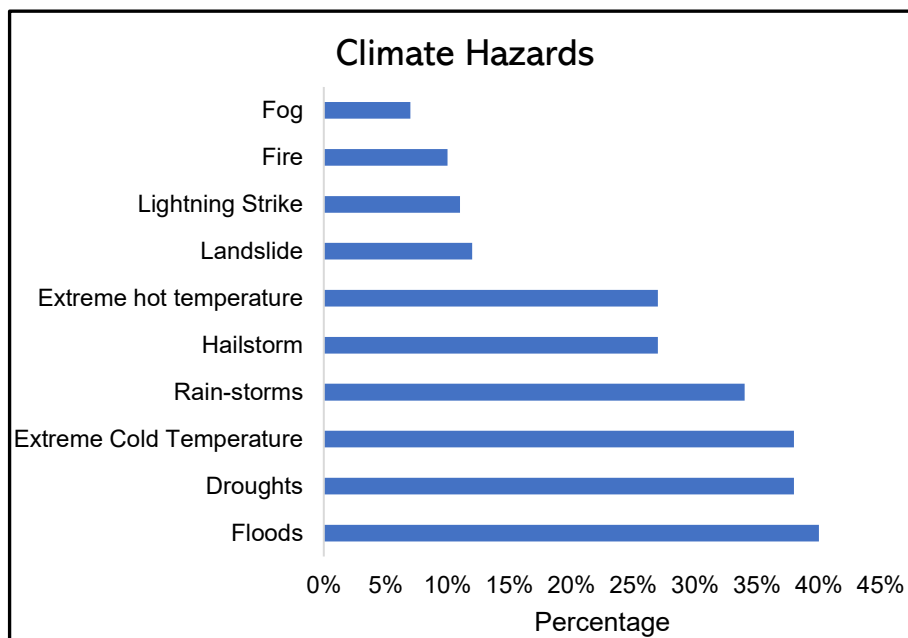


Figure 8: Climate Hazards Identified by the HHS

occurrence varies depending on vulnerability and exposure. From the survey, it was depicted that flood (55.8%), droughts (49.3%) with, rainstorms (47.9%), lightning strikes (44.4%), and extremely cold temperature (44.3%) had a high probability of occurrence. The majority of respondents (51.2%) reported that extreme hot temperature has a moderate probability of occurrence while even though the fire is reportedly a major hazard, its occurrence alongside hailstorms and landslides are rated below. This means that the damage caused by fire whenever it occurs is relatively severe (Figure 8 & 9).

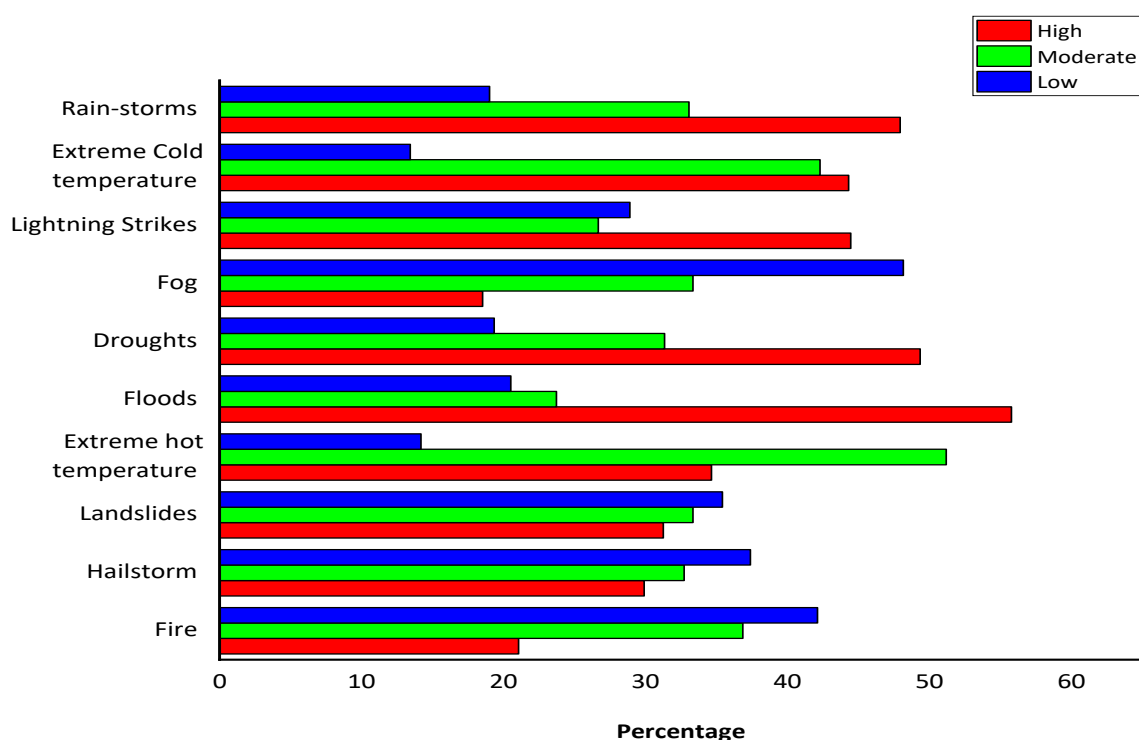


Figure 9: Risk Probability Occurrence in the last 5 – 30 years

The county stakeholders mobilized through the R&VA workshops, including the county sector representatives, generated more detailed rankings, as shown in Table 8 below. The stakeholders identified a range of hazards- that reflect on the household survey results. The stakeholders identified floods, droughts, rainstorms, waterborne diseases, vector-borne diseases, airborne diseases, and insect infestation as the top climate hazards experienced across all the sub-counties. (Table 6 & 7).



Table 6: Common climatic risk in Nakuru Sub-counties as per the RVA workshop

Climatic Hazard	Nakuru Sub-counties										
	Rongai	Molo	K. North	K. South	Nakuru T W	Nakuru T E	Bahati	Gilgil	Naivasha	Njoro	Subukia
Rain Storm	3	3	5	5	3	3	4	2	4	3	1
Hail	1	4	2	3	1	0	4	0	2	2	1
Severe Wind	2	1	1	1	2	1	2	1	3	0	0
Tropical Storm	0	0	0	0	0	0	0	0	0	0	0
Thunder Storm / Lightening	4	4	4	5	3	3	4	3	2	4	1
Extreme Winter Conditions	1	1	2	2	0	0	1	0	1	0	0
Cold Wave	2	2	2	2	1	1	2	1	2	2	0
Extreme Cold Days	1	5	5	5	1	1	3	2	2	2	0
Heat Wave	2	0	0	0	1	1	0	3	3	1	0
Extreme Hot Days	4	0	0	0	3	4	2	5	4	1	0
Drought	5	4	3	4	5	5	4	5	5	3	1





Forest Fire	2	2	1	1	2	2	4	2	2	2	0
Land Fire	3	0	0	0	2	2	2	2	4	1	0
Flood/Surface Flood	4	3	2	2	4	3	4	3	4	3	1
River Flood	2	3	0	0	3	1	1	5	4	4	0
Groundwater Flood	2	1	0	0	2	2	0	1	3	1	0
Permanent Inundation	0	1	0	0	3	1	0	1	3	2	0
Landslide	2	1	2	1	2	0	2	0	2	0	1
Rock Fall	1	1	1	1	1	0	2	0	0	1	1
Subsidence	2	1	1	1	2	1	1	1	2	1	0
Water-Borne Diseases	4	3	2	2	5	5	4	3	5	3	1
Vector-Borne Diseases	3	2	1	1	4	4	2	2	3	2	1
Air-Borne Diseases	2	3	3	3	4	4	2	4	4	4	1
Insect Infestation	4	3	3	3	2	2	3	2	2	3	1





Table 7: Common Climatic hazard in Nakuru Sub-counties from HHs Survey

Nakuru Sub-County	Climatic Risks									
	Fire	Hailstorm	Landslides	Hot temperature	Floods	Droughts	Fog	Lightening	Cold temperature	Rainstorm
Bahati	5%	10%	3%	44%	36%	23%	3%	8%	49%	15%
Gilgil	3%	27%	14%	27%	35%	41%	8%	14%	32%	41%
Kuresoi North	24%	44%	12%	24%	28%	56%	28%	40%	60%	44%
Kuresoi South	27%	32%	0%	77%	9%	73%	0%	9%	59%	36%
Molo	4%	35%	4%	27%	31%	12%	0%	8%	8%	19%
Naivasha	9%	20%	24%	32%	64%	42%	3%	5%	31%	18%
Nakuru Town East	5%	21%	5%	26%	47%	21%	3%	0%	32%	32%
Nakuru Town West	13%	48%	20%	20%	50%	40%	3%	0%	23%	43%
Njoro	0%	11%	3%	29%	26%	37%	11%	3%	37%	34%
Rongai	15%	42%	9%	36%	42%	42%	21%	39%	58%	48%





Subukia	21%	50%	43%	43%	50%	79%	7%	36%	93%	50%
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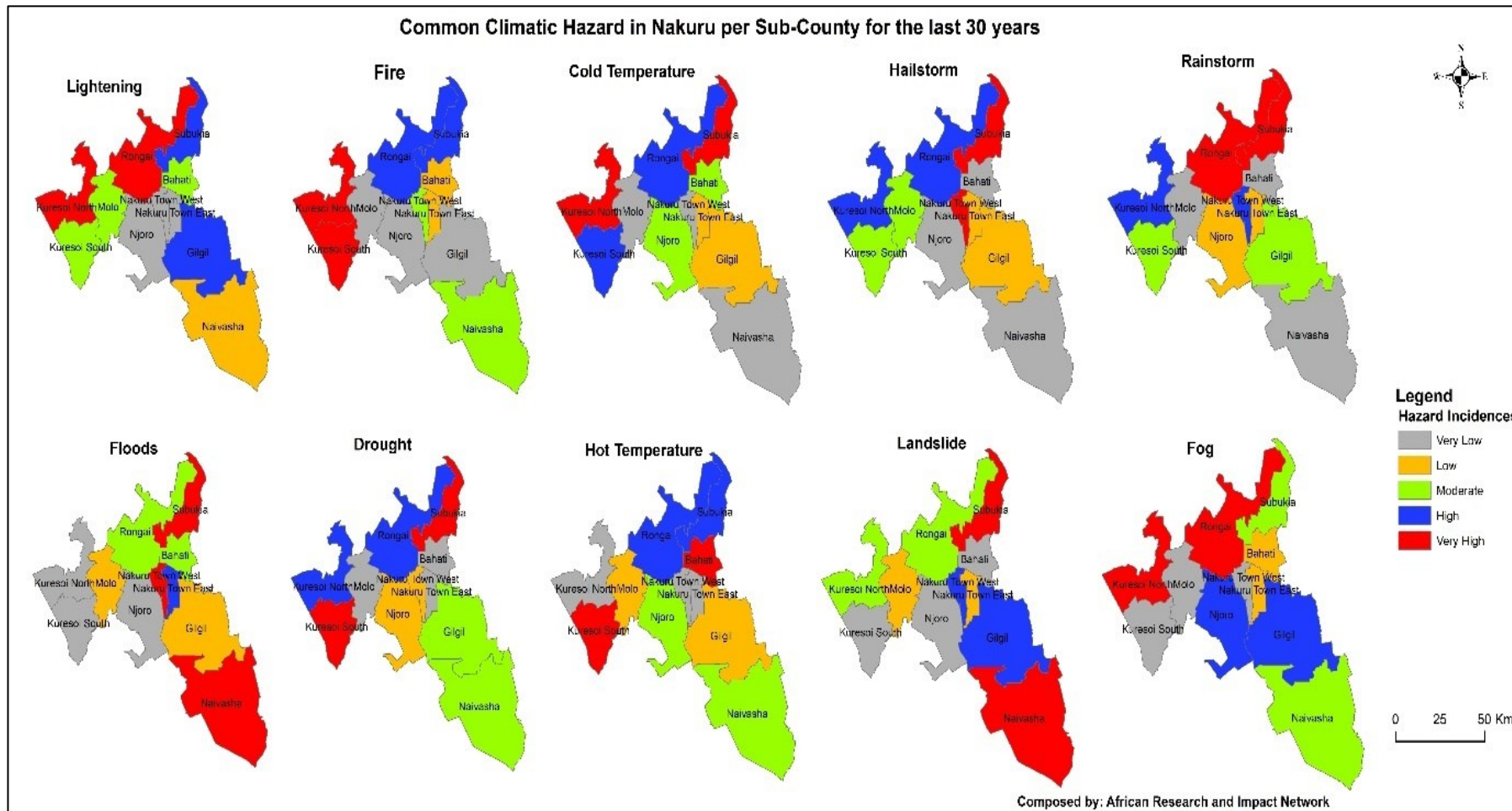


Figure 10: Spatial mapping of climatic hazards in Nakuru Sub-counties



Current Level of Risk of Climate Hazards in Nakuru County

The risks associated with the various hazards identified in Nakuru were also mapped based on a risk matrix scaled 1–5 with 1 being the ‘low’, 2 being ‘low-medium’, 3 being ‘medium’, 4 being ‘medium-high’ and 5 being ‘high’. The ranking was based on the probability of each hazard occurring, the consequence of the hazard should it occur (Table 8). The probability/frequency of hazard occurrence are estimates based on the county stakeholders’ lived experiences. This stakeholder’s real and lived experiences were a reasonable estimation of risks given the lack of accurate historical data records of hazard incidences and associated consequences.

The overall hazard risk was generated by multiplying the probability of occurrence and the level of consequence. The risk mapping shows that droughts, flash/surface floods, rainstorms, river floods, and Water-Borne Diseases pose a greater risk in Nakuru County (Table 8). Based on this exercise’s outcomes, following extensive discussion, the stakeholders agreed that the top (5) hazards deemed as having the most significant impact on Nakuru County are drought, water-borne diseases, flash/surface floods, rainstorms, and river floods.

This result of the mapping largely conforms with the household survey, which ranked floods and drought as the most common hazard (Table 6 & 7 above). According to the HHS interviewed, the analysis showed that they found that the top (5) hazards are flooding (55.8%), droughts (49.3%), rainstorm (47.9%), lightning strikes (44.4%), and extremely cold temperature (44.3%) had a high probability of occurrence with the moderate for extreme hot temperature (51.2%). However, the technical R&VA workshop participants ranked drought the top climate hazard with a high probability to occur.

The secondary literature especially the Climate Risk Profile for Nakuru (MoALF. 2016) also ranked drought and flood as the most common climate hazards that challenge productivity, incomes, and food security in the County and are expected to pose even greater challenges in the future. Overall, the risk mapping shows that Nakuru county is vulnerable to several climatic hazards. The vulnerability builds from the household level and accumulates through the community and county level. Additionally, several hazards do not occur frequently but have very high risks due to the consequences associated with such hazards when they occur. The need to put adequate mitigative measures for such hazards is a priority even as the most frequent hazards are given attention.



Table 8: Hazards Experienced In Nakuru County, Probability of Hazard Occurrence, Consequence of Hazard and Social Impact of Hazard Overall

Hazards Relevant to the local government/city	Probability (Rate between 1 & 5)	Consequence (Rate between 1 & 5)	Hazard Risk (Total)
Drought	4	4	16
Water-Borne Diseases	4	4	14
Flash/Surface Floods	4	4	16
Rain Storm	4	4	16
River Floods	4	4	16
Air-Borne Diseases	3	3	9
Thunder Storm / Lightening	2	3	6
Groundwater Flood	2	3	6
Landslide	2	3	6
Severe Wind	2	2	4
Forest Fires	2	2	4
Extreme Cold Days	2	2	4
Extreme Hot Days	2	3	6
Vector-Borne Diseases	2	2	4
Rock Fall	2	2	4
Hail	1	2	2
Cold Waves	2	2	4
Subsidence	2	2	4





Insect Infestation	2	2	3
Permanent Inundation	1	2	2
Land Fires	2	1	2
Heat Waves	1	1	1
Tropical Storm	1	1	1
Extreme Winter	0	1	0

UNDERSTANDING CLIMATE CHANGE IMPACTS ON HOUSEHOLDS

This section presents the respondent's understanding of climate impacts and variability. Households feel that food security is mostly affected, and this is linked to drought. Drought is a major cause of food insecurity in Kenya as the country experiences severe drought every 4-5 years⁴ (Huho et al. 2010). Respondents mainly associated climate change with changing rainfall patterns including distribution, and cessation. Most respondents reported that there has been a change in the rainfall patterns, especially from the onset, with almost half of the respondents (41%) reporting the early onset of rainfall than expected. Other respondents (31%) also reported delays in certain seasons. More than half of the respondents (64%) acknowledged an increase in the County's rainfall amount. On average, 58% of the respondents mentioned the rainfall amount is high in the first season of the rainy season compared to the second season.

Several indicators were used to evaluate the temperature change. The indicators were divided into three categories, as shown in Table 9. On average, 39% of respondents reported to have experienced a decrease in temperature, 28% have experienced an increase in temperature in certain times, and only 32% moderate temperature change over the last 30 years. The respondent evaluation on change in temperature could be associated with their daily socio-economic activities and contexts.

⁴ <https://www.ifrc.org/docs/appeals/11/MDRKE016REA.pdf>



The high dependence on rainfall for animal forage production has had adverse effects on livestock farming in Nakuru County. Livestock production depends on the availability of fodder, and lack of feed (41%), as reported by the respondent, is responsible for low milk production (Table 9). The unpredictable weather coupled with increased sunlight intensity and soil physicochemical parameters additionally affect the development and yields of crop-based agricultural products (Table 9). At some times, however, and especially during rainy periods, increased rainfall has been observed again sometimes affecting ecosystem balance. The variation in weather affects the vital component of the ecosystem affecting the aquatic and terrestrial organisms.

Fish farming is widely practiced in the county given the lake Nakuru, Naivasha, streams, and fish ponds. Respondents reported a decrease in fish yields in the County by 16% over the last 30 years. The variation in humidity, increase in soil erosion, and rising water level shows a negative sign of aquaculture production, causing the change in physiological and biochemical properties that affect the feeding and breeding of the cold blood fish⁵.

The impacts on food security can also be manifested through other hazards such as floods that affect the value chain of agricultural produce (Table 9). For instance, in Nakuru County, infrastructure, especially roads, are destroyed by heavy rains leading to inaccessibility of some areas due to the poor road network resulting in post-harvest losses and low prices for the agricultural produce (MoALF. 2016. Climate Risk Profile for Nakuru).

Table 9: Impacts of climate change on livelihood from HHs

Categories	Livelihood	Percentage
Crop Farming	Crop damage	55%
	Crop failure	29%
	Pest Infestation	6%
Livestock Farming	Lack of feeds	41%
	Low milk production	21%

⁵ Ficke, A. D., Myrick, C. A., & Hansen, L. J. (2007). Potential impacts of global climate change on freshwater fisheries. *Reviews in Fish Biology and Fisheries*, 17(4), 581-613



	Water shortage	9%
Fishing	High fish catches	4%
	Low fish catches	16%
	Low fish weight	2%
Water resources	Decreased water availability	32%
	Decreased water quality	13%
	Increased water availability	43%
Land Resources	The decline in soil fertility	20%
	Land degradation	19%
	Soil erosion	39%
Rainfall onset	Rainfall onset	
	Delays	31%
	Early	41%
	Normal	16%
Rainfall amounts	Increased	64%
	Light	17%
	Normal	15%
Rainfall seasonal distribution	Heavier in the first season	58%
	Normal	22%
Cessation (end of rainy season)	Early	31%





	Normal	36%
Temperature	Increased	28%
	Lower	39%
	Moderate	32%

IMPACTS OF CLIMATE HAZARDS ON VARIOUS POPULATION GROUPS

Households and communities in Nakuru are impacted differently by climatic hazards depending on the magnitude of the hazard, and their adaptive capacity. The HH interviews covered the following population groups: vulnerable group, women, and girls, less educated, indigenous population, marginalized group, persons with disabilities, persons with chronic diseases, low-income households, persons living in sub-standard housing, and unemployed persons. The HHS assessed the level at which the identified climate hazards impact the nine (9) population groups.

The findings illustrated in Figure 11 indicates that women and girls are more vulnerable to most disasters such as **a fire (21.5%)**, Extreme hot temperature (22.2%), floods (23%), droughts (23.7%), and rainstorm (20.4%). The rainstorm (22%) and landslides (24.6%) and floods are also common among the low-income household while those with an existing chronic condition are severely affected by cold temperature. The summary analysis of the climate hazard which severely affects a particular population group is presented in Figure 11.

Evidence shows that in most African settings such as Nakuru female gender spends long hours on the farms, hence susceptible to heat stress. Similarly, as the primary caregivers, women are widely responsible for daily household livelihoods and spends more time at home with children thus are more exposed to risks such as floods, and hunger risks (Atela et al, 2019). Low-income households are less endowed with assets that could build their long-term adaptive capacity thus can only cope with daily -relatively moderate climatic risks but become highly vulnerable to severe events such as floods, landslides, etc. Overall, the differentiated impacts could help in tailoring adaptation actions towards targeted social groups.



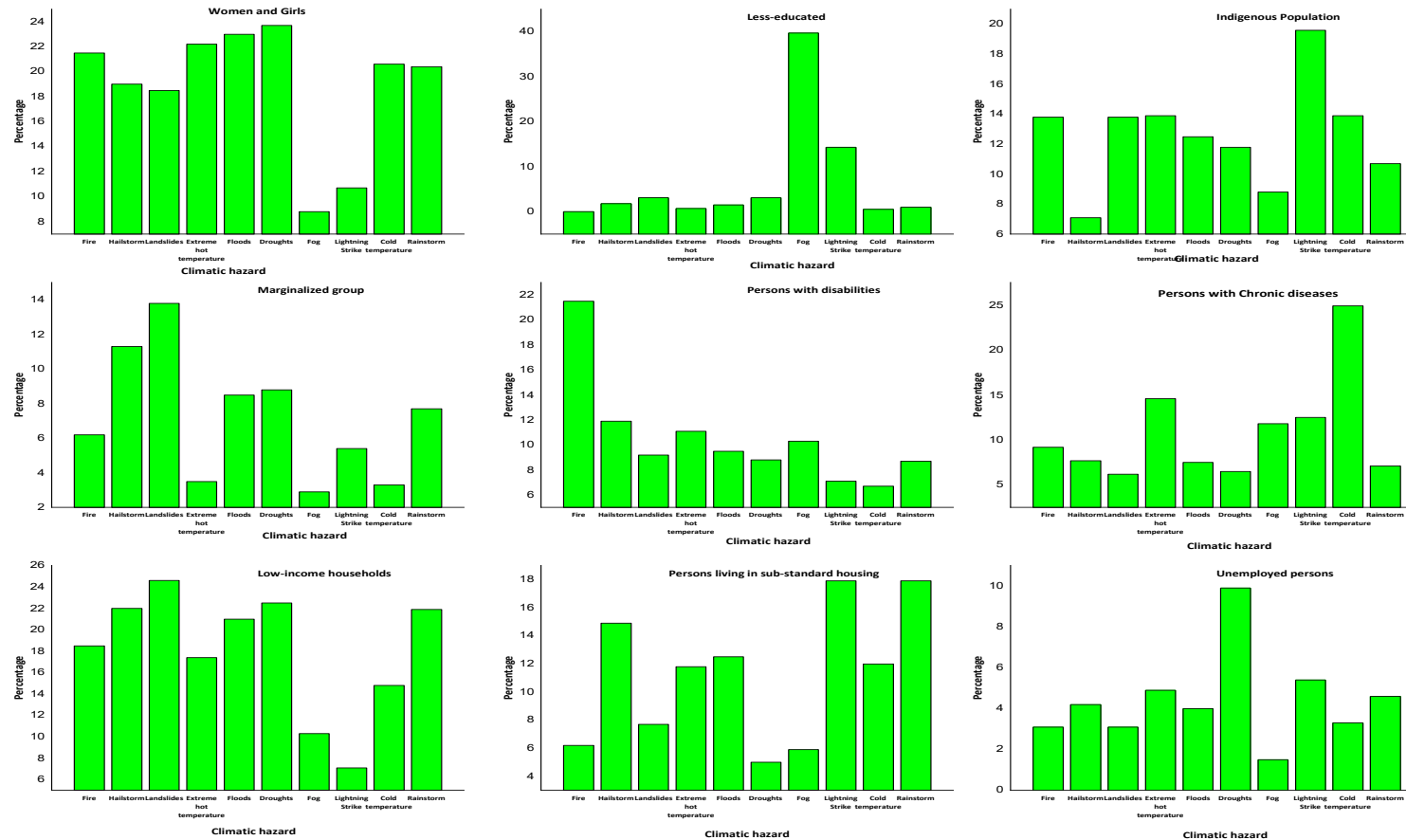


Figure 11: Population groups at risk of climate-related risk (%)



SECTOR ANALYSIS AND CLIMATE CHANGE

The National Climate Change Action Plan (2018-2022) has identified some key sectors as relevant for the Mount Kenya and Aberdares Counties Trade and Investment Block, to which Nakuru County is part. These include industrialization, infrastructure, information, and communications technology (ICT), gender, agribusiness, tourism, health, & forestry. Building on the regional sectoral priorities, Nakuru County Government- in its Climate Action Plan, has made further steps towards identifying country-specific sectors that are key to promoting low carbon and climate-resilient economy and livelihoods: agriculture, livestock, and fisheries, water, wildlife, and tourism, forestry, transport and infrastructure, health, energy, mining, manufacturing, and trade.

Insights from the primary data; and the R&VA workshop (Figure 12) revealed additional sectors for Nakuru's Climate Action Plan (2018-2022). These include waste management, information & communications technology, environment, biodiversity, & forestry, industrial, commercial, residential, education, public health, community & Culture, Law & Order, Emergency Management, Land Use Planning, and Tourism. The stakeholders ranked all the above sectors as illustrated in Figure 12 below with energy, water supply & sanitation; water resources, transport, food & agriculture, waste management among some of the top-ranked.

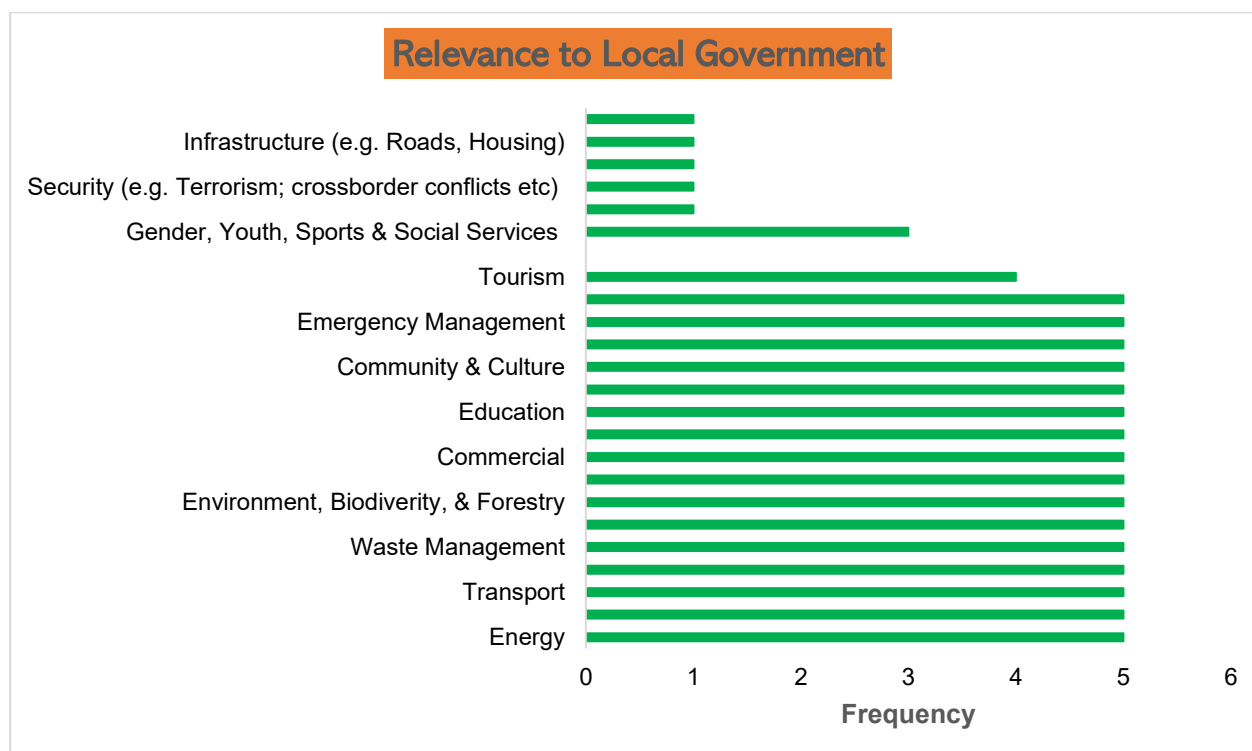


Figure 12: Sectors Relevant to Nakuru County Government

In addition to listing the relevant sectors, the analysis of the primary data generated a unified presentation indicating the impacts of climate change on the most relevant sectors, assets, or services (Table 10).

Table 10: Sectors and Services at risk of climate-related events from the Stakeholders engagement

Sectors	Climate Hazards	Impacts
Agriculture, livestock, and fisheries sector	prolonged dry spells, frost, intense precipitation, flooding, heat stress, and increase in temperatures	• Crop failure becomes common • increase in disease and pest incidences • loss of crops and livelihoods
Water	frequent, prolonged droughts	• Over-abstraction of water • Depletion of aquifers • Fluctuating water levels in the lakes and rivers: Lake Nakuru and Lake Naivasha • Soil erosion and degradation • Flooding and stormwater • Water pollution due to, e.g., discharge of agricultural effluents
Wildlife and tourism	Flooding, prolonged dry spells	• Fluctuating water levels in the lakes and rivers • Disease prevalence and wildlife deaths due to diseases and water scarcity • The spread of invasive species
Forestry	prolonged dry spells, fires	• Loss of biodiversity and habitats • Forest fires • Increased incidences of diseases and pests infestations in forests • The spread of invasive species
Transport and infrastructure	Flash floods, fog, and mist	• hamper visibility • destruction of transport and other infrastructure • human and animals' deaths and injuries



Health	Floods, fires,	- increased deaths from malnutrition and human diseases - breakdown of health infrastructure, including houses
Energy	Unreliable rain, floods	- the high cost of electricity - overreliance by the poor mainly on biomass energy (firewood and charcoal) leading to increased carbon footprint and respiratory complications
Mining	flooding	unsustainable harvesting of sand and stones causing injuries, death, and sinking of houses; habitat destruction
Manufacturing and Trade	prolonged dry spells, frost, intense precipitation, flooding, heat stress, and increase in temperatures	- Disruption of access to raw materials - unreliability water and power supply - air, water, and soil pollution - increased incidences of respiratory diseases - ecosystem contamination

RANKING KEY SECTORS, SERVICES CURRENTLY IMPACTED BY CLIMATE HAZARDS IN NAKURU COUNTY

The workshop stakeholders assessed the relevant sectors, assets, or services most impacted by the county's current climate hazards. As recommended by the Joint Research Centre guiding template, cities are expected to indicate all relevant sectors, assets, or services impacted by the current climate hazards. Stakeholders at the RVA workshop identified the impact of the above climatic hazards on the priority sectors: water supply & sanitation, transport, food & agriculture, waste management, information & communication technology, environment, biodiversity & forestry, industrial, commercial, residential, education, public health, community & culture, law & order, emergency management, land use planning, tourism & other,

Based on the group discussions (i.e., respondents were divided into five groups of six stakeholders-each having a mix of county and national government and non-state actors.), stakeholders reflected on the impact of the hazard risks on the selected sectors. The stakeholders indicated the degree/magnitude to which each climate hazard impacts these sectors. The sectors



were selected from the list of sectors included in Annex D of the GCoM Reporting Framework (September 2018) and updated with the county priority sectors outlined in the County Climate Action Plan. The stakeholders rated the degree/magnitude of the impact of each hazard on each sector based on the Joint Research criteria and the GCoM Reporting Framework (Annex D) i.e., either High/Extremely Serious - indicated in red (3), Moderate/ Moderate Serious- indicated in orange) (2), or Low/Lower Serious-indicated in yellow (1) or not relevant-indicated in white. The resultant ranking is illustrated in Table 11:



Table 11: Sectors and Services currently impacted by climate hazards in Nakuru

Note: 3 High/Extremely Serious 2 Moderate/Serious 1 Low/Less Serious 0 Not relevant

Red=High/Extremely Serious Orange=Moderate/Serious Yellow=Low/Less Serious	Lightening / Thunder Storm	Cold Waves	Extreme Cold Days	Heat Waves	Extreme Hot Days	Drought	Forest Fire	Land Fire	Flash/Surface Flood	River Flood	Rain storm	Fog	Hail	Severe Wind	Tropical Storm	Groundwater Flood	Permanent Inundation	Land slide	Avalanche	Rock Fall	Subsidence	WaterBorne Diseases	VectorBorne Diseases	Air-Borne Diseases	Insect Infestation
Water Supply & Sanitation	2	1	2	1	1	2	2	2	2	2	3	1	1	1	1	2	1	2	1	1	1	1	1	1	1
Transport	1	1	1	1	2	3	1	1	3	3	3	1	1	1	1	3	1	3	1	1	2	3	2	2	2
Food & Agriculture	2	1	1	1	1	1	1	1	3	3	2	2	2	1	1	2	2	3	1	3	2	1	1	1	1
Waste Management	1	1	3	2	3	3	2	3	3	3	3	1	3	2	1	2	2	3	1	2	2	2	2	2	3
Information & Communication Technology	1	1	1	1	1	1	1	1	2	2	2	1	1	2	1	2	1	2	1	1	1	2	2	2	2



Environment, Biodiversity & Forestry	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	1	1	1	1	1	1
Industrial	2	1	2	1	2	3	3	3	3	3	2	1	1	2	1	2	2	2	1	2	2	2	2	2	2
Commercial	2	1	1	1	2	2	2	2	2	2	2	1	1	1	1	1	1	2	1	2	2	2	2	2	2
Residential	2	1	1	1	2	2	2	2	2	2	2	1	1	1	1	1	2	2	1	1	1	2	2	2	2
Education	2	1	2	1	2	2	2	2	3	2	2	1	1	2	1	2	2	2	1	2	2	2	2	3	3
Public Health	2	1	2	1	2	3	2	2	3	3	2	1	1	2	1	2	2	2	1	2	2	2	2	3	3
Community & Culture	2	1	2	1	2	3	1	2	3	3	2	1	1	1	1	2	2	2	1	2	2	3	2	3	2
Law & Order	2	1	2	1	2	3	3	2	3	3	2	1	1	1		1	2	2	1	1	2	3	2	3	3
Emergency Management	1	1	1	1	1	1	1	1	1	1	2	1	1	1	0	1	1	1	1	1	1	1	1	1	1
Land Use Planning	2	1	2	1	2	2	2	2	3	3	3	2	2	2	1	2	2	3	1	2	2	3	2	3	2
Tourism	2	1	2	1	2	2	2	2	2	2	2	1	1	2	1	2	2	3	1	2	2	1	1	1	2
Other	2	1	2	1	2	3	2	2	3	3	2	2	1	1	1	1	2	2	1	1	1	2	2	2	0



COPING STRATEGIES

The risk mapping shows that Nakuru County residents are vulnerable to impacts of flood, drought, extreme temperatures, and hailstorms, among others. Depending on the nature of risks, the residents have developed strategies to cope with these adverse impacts. These strategies, however, depend on the nature of the risk.

The majority of residents (35%) tend to rely more on government assistance (such as food and insurance Aid) to cushion them from the negative impacts of the hazard. Community work social capital such as food for work is also a common coping strategy for several residents (25%). This provides useful coping with immediate impacts such as lack of food even though they might not build long-term resilience. Inter-household transfers and village saving and lending mechanisms such as table banking were prevalent ways for coping with both drought and flood Reducing consumption e.g., reducing the number of meals per day are additionally deployed during droughts. Approximately 10% of the HHS interviewed admitted to having sold their household assets in response to climatic impacts. Property ownership is seemingly an integral part of a household's ability to adapt an indication of some of the key adaptive capacity indicators for the residents. (Figure 13).

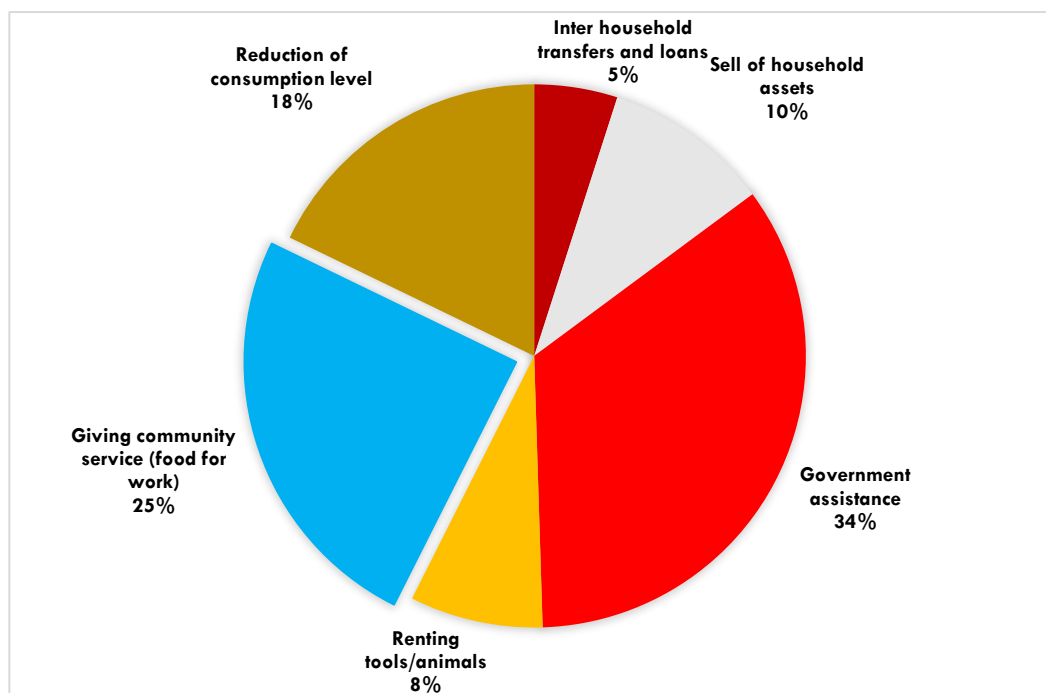


Figure 13: Hierarchy of Coping strategies



The identified categories of the coping strategies for the identified climate hazards still vary, even though the main coping strategy for climate hazards is the government assistance, as shown in figure 14. The climate hazards responded to through government assistance are fire (42.1%), landslides (30.6%), floods (22.5%), droughts (21.2%) & lightning strikes (20%), rainstorms, hailstorm, extreme hot and cold temperatures. Figure 14 shows that the households' coping strategies differ in scale when responding to each climate hazard. Overall, the strategies identified largely show that the residents of Nakuru county undertake actions that only enable them, to cope with the prevailing impacts of climate change in the short term but do not necessarily build long-term adaptive capacity. Given the dynamics of risks in the county, this puts the county at high risk especially to hazards that take long to occur but are very consequential.



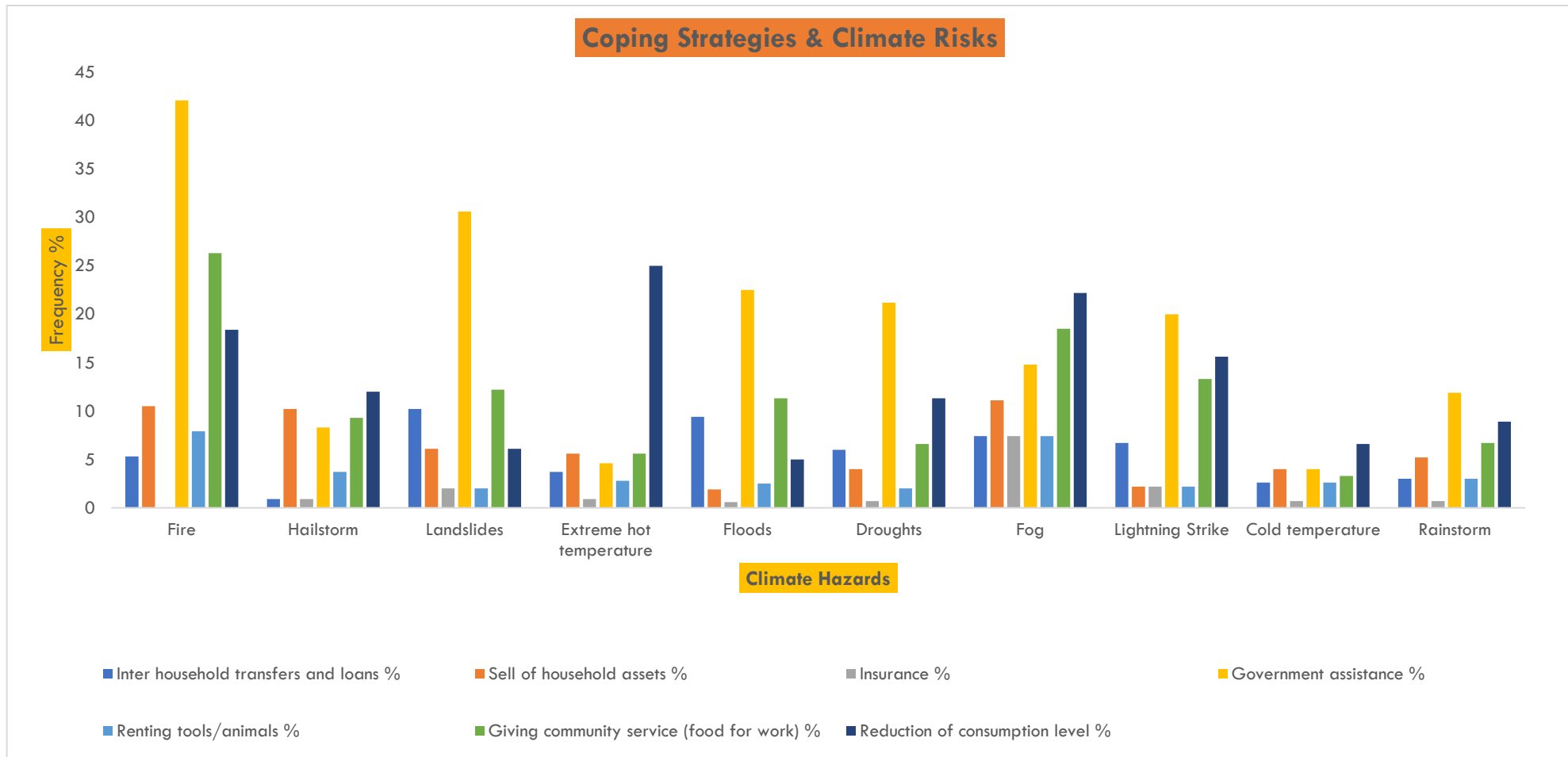


Figure 14: Summary of Coping strategies to climatic risks



CHAPTER FOUR: ADAPTATION STRATEGIES

Adaptation strategies are strategic actions that households/communities undertake to respond or prepare for the impacts of climate change. The household survey shows that the community has adopted different strategies to mitigate climate change's negative impacts. The key strategies include water harvesting techniques, which are currently being adopted by 80% of the residents (respondents), followed diversification of crops (69%), shifting of the planting dates (59%), and implementation of soil management techniques (57%) as shown in figure 15. Rural to urban migration, irrigation practices, greenhouse farming, change of animal breeds, and aquaculture were the least adopted techniques by Nakuru residents (Figure 15).

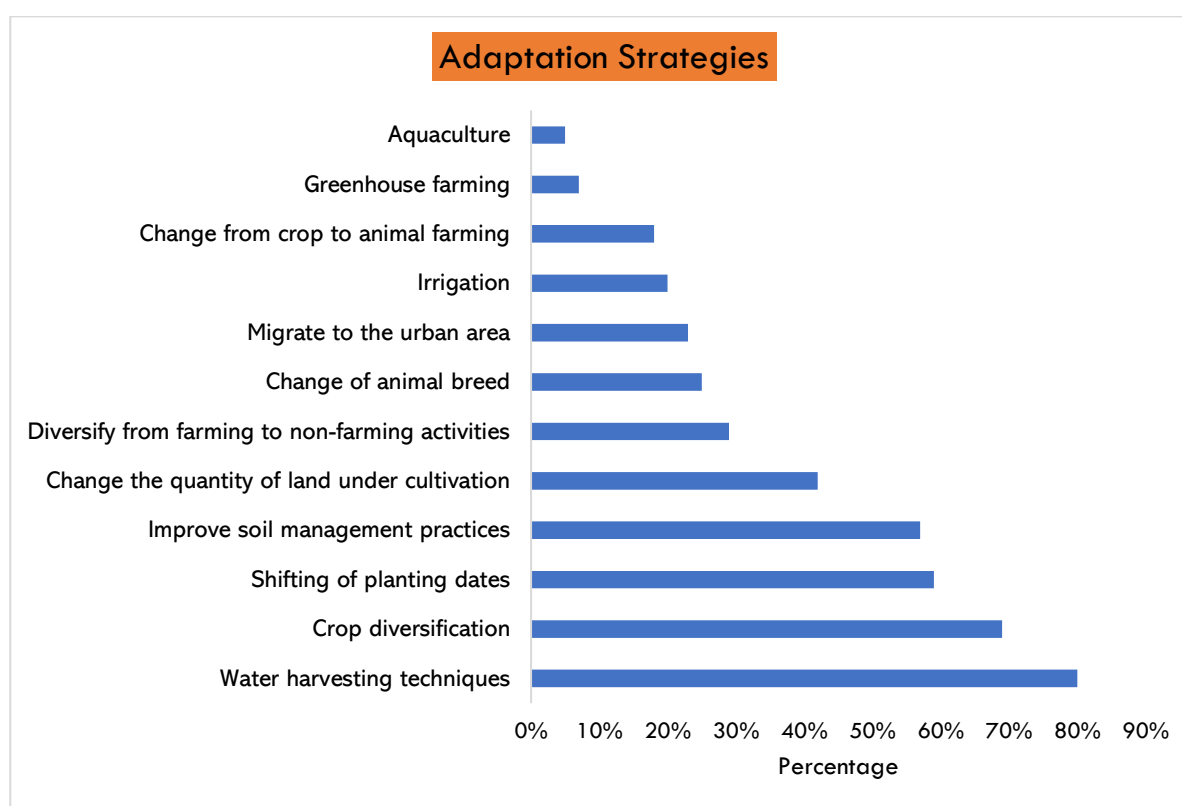


Figure 15: Adaptation Hierarchy for Nakuru residents

While there's a severe need to improve on the already working strategies that are context-specific and have acquired the local communities' legitimacy, much focus is needed to exploit the potential in aquaculture, climate-smart greenhouse farming, and improved crop and animal breeds, among others.

RESPONDENTS SATISFACTION WITH THE CURRENT ADAPTIVE MECHANISM

The level of satisfaction of the respondent to the adaptive mechanism was also measured. Overall, most of the respondents were satisfied (70.5%) with their current adaptive measures (Figure 16). This perceived satisfaction is however based on households' contexts and might be influenced by many factors including lack of adequate information on adaptation opportunities, culture, awareness among others. This means the perceived satisfaction does not necessarily show that the measures being pursued are effective. However, from a broader point of view, this perceived satisfaction contradicts the severe level of impacts being felt by these households. It is, therefore, possible that households lack opportunities for upscaling their adaptive actions thus settling for the locally available options despite their ineffectiveness. There is a need for policies that can upscale adaptation strategies by providing technological, market opportunities, and best practices within the communities.

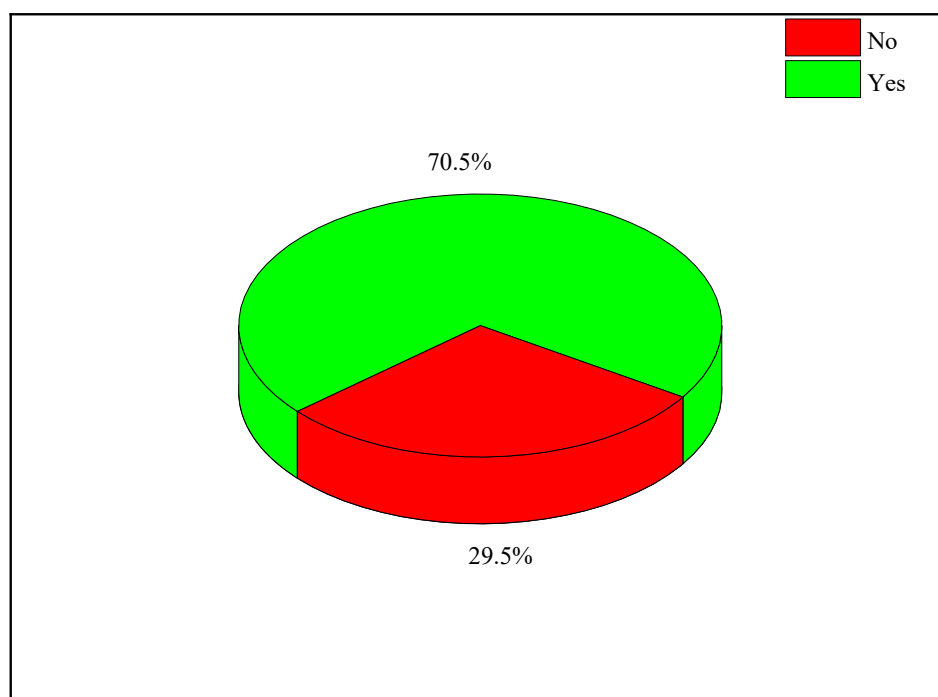


Figure 16: Perceived satisfaction with the adaptive mechanism(s) currently employed as an option for the future.

CONSTRAINTS IDENTIFIED BY THE LOCAL COMMUNITIES

Several factors constrain the ability of local communities to implement adaptation actions. Findings show that lack of adequate capital (money) (61%) is the most significant adaptation

constraint, followed by an information barrier at 43% (Figure 17). Poor market access, absence of extension services, and poverty also posit major challenges to households' ability to adapt to climate change. These findings also reflect some of the constraints to building adaptive capacity as presented later.

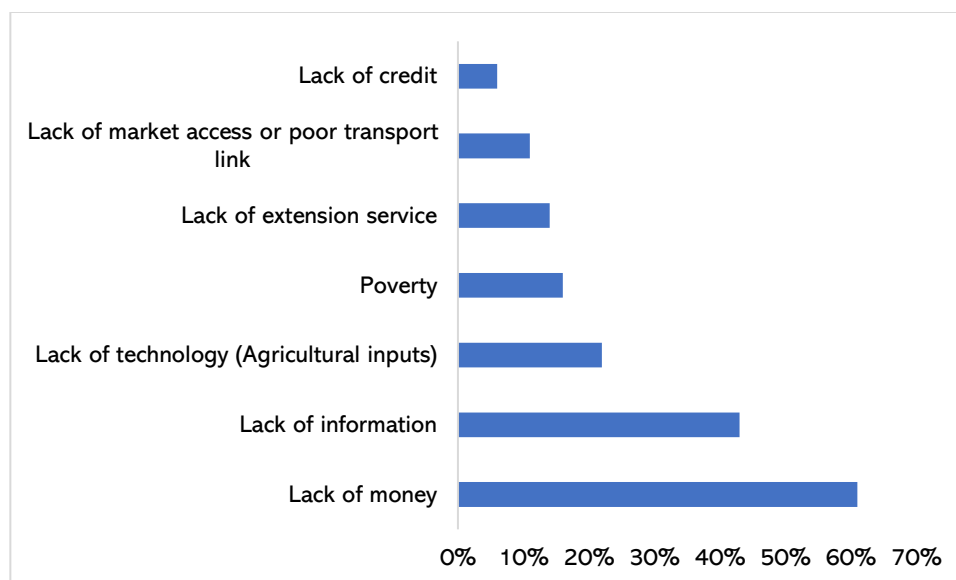


Figure 17: Major constraints that hinder the ability to adapt to climate change

FACTORS THAT SUPPORT OR CHALLENGE THE ADAPTIVE CAPACITY

The respondents shared highlights about the factors that support or challenge their adaptive capacity in different sectors based on the county's socio-economic contexts (Table 12). The factors that enable adaptive capacity also represent opportunities for prioritizing adaptive capacity. The list of factors also validates findings from the document review and captures the components of the County's Climate Change Action Plan 2018-2022.

Table 12: Factors that support and challenge the adaptive capacity

Sectors	Factors that support adaptive capacity	Factors that challenge the adaptive capacity



Agriculture, livestock, and fisheries sector	✓ Agricultural and Livestock insurance and safety net schemes ✓ Improved technology to handle post-harvest losses ✓ Mainstream & promote climate-smart agriculture and livestock development ✓ Improved communication systems on CSA extension and agroecological issues. ✓ Sustainable management of land, soil, water, and other natural resources	✓ Unpredictable and unreliable rainfall ✓ Disruption of planting and harvesting time for crops leading to losses ✓ Over-reliance on agriculture by the population increases the risk of vulnerability. ✓ Retarded innovation and slow uptake of technology that would improve crop and animal varieties ✓ Conflict over land-use policies in the agriculture-livestock sectors. ✓ Irresponsible consumption patterns by the population that increases post-harvest losses
Water & Sanitation	✓ Domestication of the National Water Master Plan to ensure dams, dykes, lakes, and rivers are protected. ✓ Improved water harvesting techniques ✓ Mainstreaming climate change into water plans and issues	✓ Increased demand for water in other sectors and an increasing human population ✓ Incoherent and insensitive policies to deal with over-abstraction of water and other water management issues ✓ Limited data on current and future water situation ✓ Poor water governance that has seen the permeation into the water sector of ghost water cartel and vendors that exploit the population
Wildlife and tourism sectors	✓ Ineffective if not inadequate policies that would reduce human-wildlife conflict through the creation of special ecological zones	✓ Increased wildlife-human conflict ✓ Lack of strong political will to protect the tourism zones. ✓ Poor citizen mindset on local or domestic tourism.





	✓ Lack of a robust risk and vulnerability assessment for wildlife and tourism.	✓ Over-exploitation of wildlife habits due to the absence of proper laws to support wildlife benefits to the population. ✓ Climate variability and change that causes unprecedented wildlife dispersal and extinction
Forestry	✓ Invest in participatory resource management ✓ A community-based adaptation would restore the degraded forests and enhance the county forest cover beyond the 10% level. ✓ Integrate forest policies into other sectors of the county economy.	✓ Massive logging by the general public and other unauthorized entities. ✓ Inadequate public participation in forest restoration initiatives. ✓ Fragmented forest policies that don't consider sustainability practices. ✓ Loss of indigenous forest knowledge and practices that protected certain areas for community benefits.
Transport and infrastructure	✓ Ensure county guidelines that would promote climate-proofing of the county transport infrastructure ✓ Improve the design codes to anticipate and reduce transport climate risks	✓ Irregularities in public procurement procedures result in poor workmanship. ✓ Increased frequency and magnitude of extreme weather and singular events that continue to exceed the set infrastructure standards.
Health	✓ Strengthen the integration of climate change adaptation plans into the health sector ✓ Improve on the public awareness level on the climate health risks	✓ Flamboyant behavior in population lifestyle that has largely ignored the ecosystem benefits to human health. ✓ Little knowledge on the co-benefits of ecological integrity to health ✓ Insufficient funds to support research on climate-related





	✓ Develop health programs to reduce the incidences of malaria and other climate-mediated diseases.	diseases, especially those in the tropics hence increased endemism
Mining & Extractives	✓ Integrate climate change adaptation strategies into the mining sector	✓ Poor technology development and training to deliver safe mining of natural resources ✓ Over-extraction of natural resources has contributed to degraded landscapes hence more emergent vulnerabilities.
Manufacturing and Trade	✓ Create an enabling environment for the resilience of both the public and private industry sectors to thrive in and operationalize environmentally-friendly investments. ✓ Strengthen partnerships and linkages that would ensure resource mobilization for the county green projects.	✓ Lack of policies that promote a circular economy in manufacturing and trade. ✓ Non-committal by the government to increase finance into the green economy. ✓ Stranded assets in the fossil fuel industry have delayed the transition to green manufacturing and trade.

Stakeholders at the technical RV&A workshop further indicated the degree to which the various factors impede adaptive capacity and obstruct climate resilience drawing on a long list of factors outlined in one of the guiding matrices. The stakeholders -working in groups of six (6)- discussed how each of the factors could challenge or support Nakuru County's adaptive capacity. Once the factors had been selected, the stakeholders were asked to discuss and rate the degree to which a particular factor challenges or supports adaptive capacity. The rating was based on a scale of 'High,' 'Moderate,' 'Low,' 'No The workshop stakeholders found the factors relevant because they all endorsed as factors affecting Nakuru's adaptive capacity. The findings show that several factors including access to healthcare, access to education, resource availability among others highly





support adaptive capacity while poverty, unemployment, and inequalities highly impede adaptive capacity (Table 13).

Table 13: Ranking of Factors that support or challenge Nakuru County's Adaptive Capacity (RVA workshop)

Factors	Is this a factor that affects Your adaptive capacity? YES-Y/NO-N	Does it support (S) or challenge (C) your adaptive capacity	To what extent does it affect your adaptive capacity? 3=High; 2=Medium; 1=Low	Comments
Access to basic services	Y	S	3	Empowers and gives the ability to put in place adaptation actions to co-exist with living conditions created by impacts of climate change
Access to healthcare	Y	S	3	
Access to education	Y	S	3	
Cost of living	Y	C	3	
Housing	Y	C	2	
Poverty	Y	C	3	Poverty is a challenge to adaptive capacity in that the poor tend not to adopt the adaptation methods, and they engage in deforestation activities that challenge adaptive capacities.
Inequality	Y	C	3	
Underemployment	Y	C	3	
Unemployment	Y	C	2	





Public Health	Y	S	3	
Political Stability	Y	S	3	
Political engagement/transparency	Y	S	2	
Government capacity	Y	S	3	
Budgetary capacity	Y	S	3	
Migration	Y	C	2	
Safety & Security	Y	C	3	
Economic Health	Y	S	3	
Economic Diversity	Y	S	2	
Rapid Urbanization	Y	C	2	
Resource Availability	Y	S	3	Availability supports our adaptive capacity; Resources contribute to development; Proper resource planning & mobilization; Well utilization of resources
Environmental Conditions	Y	S	2	
Infrastructure conditions /Maintenance	Y	C	3	
Infrastructure Capacity	Y	S	3	
Land Use Planning	Y	S	3	
Community Engagement	Y	S	3	Support the adaptive capacity. However, community engagement has to be holistic and adequately planned and executed
Access to quality/relevant data	Y	S	2	



ANALYSIS OF PRIORITY SECTORS

During the RVA workshop, stakeholders assessed priority sectors for developing adaptation actions. The sectors were analyzed by each of the five discussion groups at the workshop with a focus on, impacts of climate hazard risks, and developed projection under the Business as Usual (BAU) scenario. The stakeholders described how climate hazards could impact the sectors in the future if no action is undertaken. Table 14 below shows the analysis of the priority sectors including environmental protection, water & natural resources, land use planning, and agriculture.

Table 14: Analysis of Priority Sectors

Priority Sector for adaptation actions	Sector Description	Impacts of Climate Hazards on the sector	Projected Impacts of Climate Hazards Under BAU Scenario
Environmental Protection, Water & Natural Resources	Climate change issues cut across all sectors and the environmental sector is mandated to mainstream climate actions within all other sectors. Agriculture and food contribute substantially to the County's economy and are highly vulnerable to climate change impacts. Developing adaptation actions addressing food and agriculture will, directly and indirectly, deal with other interrelated sectors, thus improving resilience to climate change impacts across the sectors. It provides food and creates employment (Directly and indirectly), end foreign exchange (Revenue), and	Changing rainfall patterns impacts negatively on production due to erratic and unpredictable patterns. This leads to post-harvest losses and affects the cropping calendar -the majority rely on rain-fed. Flooding leads to loss of crop and livestock; drought leads to loss of production; incidences of pests and diseases, locusts, fall armyworm, livestock diseases, East Coast fever.	If unchecked, the sector could be adversely affected, leading to conflict, rural-urban migration, and crop-livestock farmer conflicts during the search for pasture.



	provision of raw materials for Industries.		
Land Use Planning	The land sector guides resource use/utilization and management in the entire County. Properly planned and integrated land-use plans are very key to community adaptive capacity. This might entail the development of spatial plans to guide resource utilization and management. In this case, the county and its citizens need to be proactive in planning rather than reactive.	Land: The increasing effects of climate change in Nakuru county has ensured increase forest fires, continuous mix in land uses, decrease land potential(agricultural), urban sprawl, surging of lakes, increase migration and conflict as a result of porous borders and fight or resources. Consequently, the sector has increasingly lost its value and promoted community incapacitation to adapt to the impacts of climate change.	If no action is taken, increasing challenges such as sinking grounds and even loss of lives could be seen shortly in Nakuru County
Agriculture	The agriculture sector entails agriculture, livestock, and fisheries. The backbone of the country economy important in addressing food security; One interlinked department -cuts across all the departments It is the backbone of the County's economy. Most of the land in the in the County is agricultural	Land: The increasing effects of climate change in Nakuru county have ensured increase forest fires, continuous mix in land uses, decrease land potential(agricultural), urban sprawl, surging of lakes, increase migration, and conflict as a result of porous borders and fight for resources.	Increased vector-borne, water-borne, and airborne diseases affect farming and efforts in agriculture. In the future, it is projected to increase making it difficult to continue with farming practices and activities due to various diseases. In a future perspective, increasing precipitation



		The temperature increase has been a key determinant on the productivity of most agricultural products where some crops like wheat have been negatively affected due to meteorological droughts and the associated increase in crop pathogens that limit acreage productivity; The occurrence of terms has negatively affected legumes and the production of some cereals too	is likely to cause soil saturation and affect productivity generally. The increasing frequency of droughts, on the other hand, is likely to lower wheat and production of key crops in the country
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PROPOSED ADAPTATION STRATEGIES IN RESPONSE TO CLIMATE CHANGE

The existing adaptation strategies currently carried out by the local communities in Nakuru county may not be sufficient to respond to the increasing impacts of climate change. These measures can either be improved, or new innovative strategies are adopted to augment the already viable ones. In pursuit of more resilient and sustainable communities within Nakuru county, it's essential to recognize the underlying socio-ecological characteristics, vulnerabilities, and opportunities with such contexts. Building on the analysis of population and sectoral impacts, several measures can be pursued:

- Build the capacity of communities and institutions to effectively deal with the common incidences of floods, droughts, and landslides, among others. This can be done by training community-based organizations (CBOs) on disaster risk preparedness, response, and recovery. Adequate budget allocation will also enhance the financial wherewithal of the relevant institutions.
- Improve on research and development to support the crop and animal varieties characteristic of the area. The information from research would be useful in advising

communities on what crops to plant and when, and whether, how, and when to shift to livestock breeding.

- Strengthen policies on water security to ensure its availability, quality, and access by the residents. While digging of wells and boreholes is necessary, more attention should be shifted to water use. Further studies are urgent to understand the available groundwater resource, current abstraction rate, and future dynamics.
- Diversify livelihoods to avoid overreliance on farming and consider entrepreneurial activities. This, however, needs to be monitored to prevent the risk of food insecurity in the County, which may be aggravated by rural-urban migration.
- Harmonize the indigenous weather forecasting with up-to-date scientific weather information to improve disaster early warning for early action by the communities and relevant authorities. This good relationship would also ensure regular updates on planting and harvesting dates.
- Create a funding model within the County to help finance climate change adaptation activities. Delinking climate finance mechanisms from the general finance system would boost innovation, enhance disaster risk actions, and improve community safety nets.

CLIMATE CHANGE MITIGATION

Nakuru County also acknowledged the need to mitigate the occurrence of climate change by putting in place strategies that will reduce greenhouse gas emissions (GHG) in line with the targets set in the nationally determined contribution (NDC). Kenya aims to abate its GHG emissions by 30% by 2030 relative to the BAU scenario of 143 MtCO₂eq; and in line with its sustainable development agenda to achieve a low carbon, climate-resilient development pathway. Kenya promotes and continues to implement the following mitigation activities:

- Expansion in geothermal, solar, and wind energy production, other renewables and clean energy options,
- Enhancement of Energy and resource efficiency across the different sectors,
- Progress towards achieving a tree cover of at least 10% of the land area of Kenya,
- Clean energy technologies to reduce overreliance on wood fuels,
- Low carbon and efficient transportation systems,
- Climate-smart agriculture (CSA) in line with the National CSA Framework
- Sustainable waste management systems

Nakuru county has outlined plans to mitigate the impact of climate change in various country-led policies including the CIDP (2018-2022 and the draft County Climate Change Action Plan (2018-2022) in line with the NDCs and the national climate change action plan (2018-2022). It is however worth noting that Nakuru's climate change action plan has not delineated mitigation and adaptation actions.

The SEACAP process has attempted to identify mitigation strategies based on primary and secondary data collected for the Nakuru process. The county government is promoting renewable energy technologies, waste management and working in partnership with the national government to improve the transport system, which includes the incorporation of the non-motorized transport system for the bicycle riders, PWDs, and general pedestrians in Nakuru City and other emerging urban centers in the county.

IMPACT OF WASTE IN NAKURU COUNTY

The results in figure 18 below indicate that the respondents were more concerned about the effects of waste on the environment (60%) and human health (53%). The respondents were least concerned about the effects of waste on animal health (2%), while 7% did not recognize the effects of wastes. This analysis shows that the effect of waste is more pronounced on the environment and with knock-on effects on other sectors including health and livelihoods.

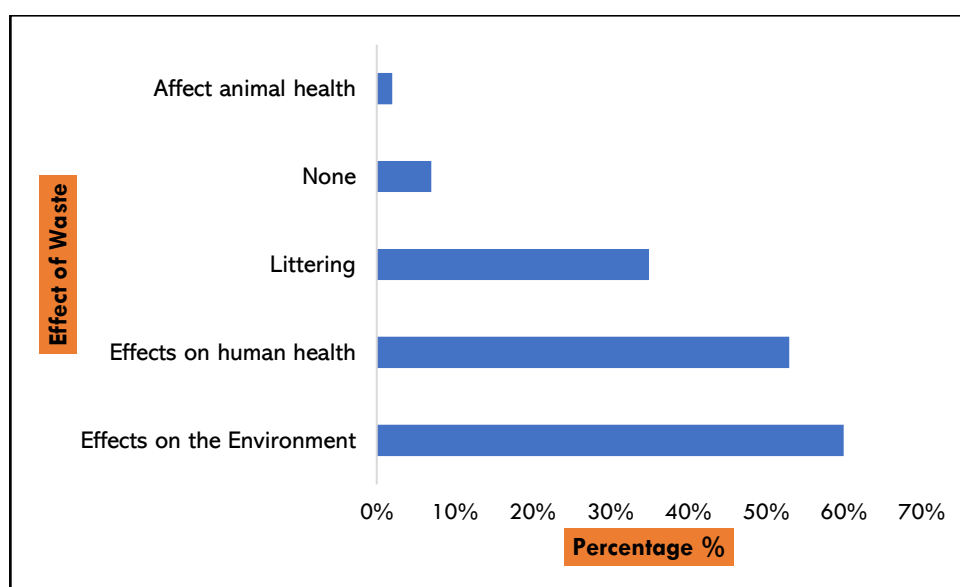


Figure 18: Respondent opinion on priority concerning waste in the county

Types of wastes generated

Kitchen waste accounts for 45% of the total waste. On average, 13% of the waste generated by the household consist of plastic while glass and metal wastes constitute 2.9% and 2.3 %, of wastes.

Waste Collection

The respondents also disclosed various methods of waste storage. The most common method was the rubbish bin reported by 43% of the respondents while the open hole method was reported by only 3% of the respondents. Rubbish bins were more used compared to other methods because the respondents considered them to be accessible and convenient.

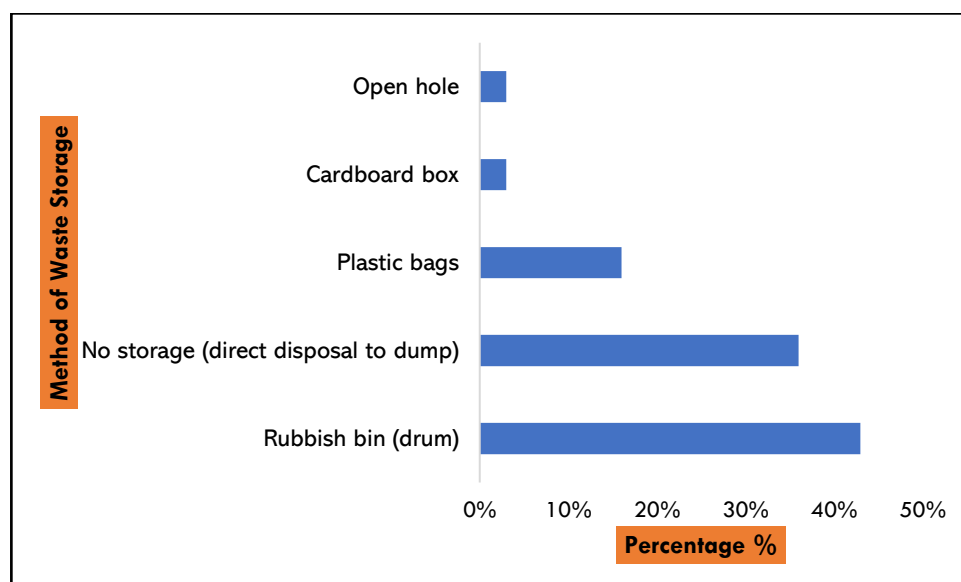


Figure 19: Method of waste storage

Figure 19 above indicates that the majority of the respondents did not have trash cans (27%). However, the most used trash cans (16%) by the respondents were above 25L, while the least used trash cans (3%) were of the small size of 2L. This could partly indicate the number of wastes generated by various households.

Waste disposal most common method of household waste disposal in an allocated area for waste collectors to collect (36%) On the other hand, incineration was the least used to dispose of wastes (3%) (Figure 20). This is because of the complexity of incineration as a waste disposal method. It's also less convenient and costly compared to the other waste disposal methods.

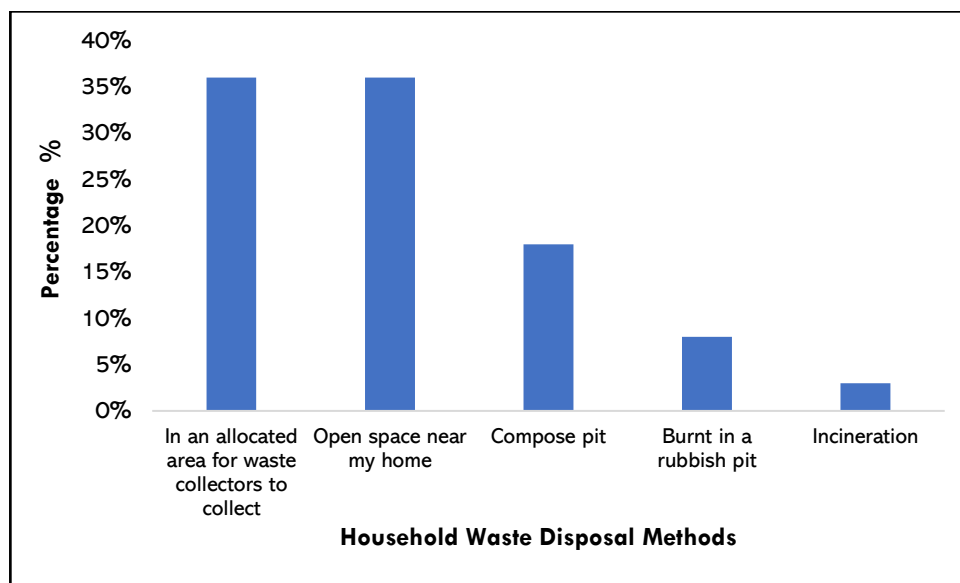


Figure 20: Household waste disposal methods

Figure 21 below shows that most of the respondents (48%) dispose of their wastes daily and a sizeable number of HHs dispose of wastes weekly. Others dispose between 2 days – 1 month.

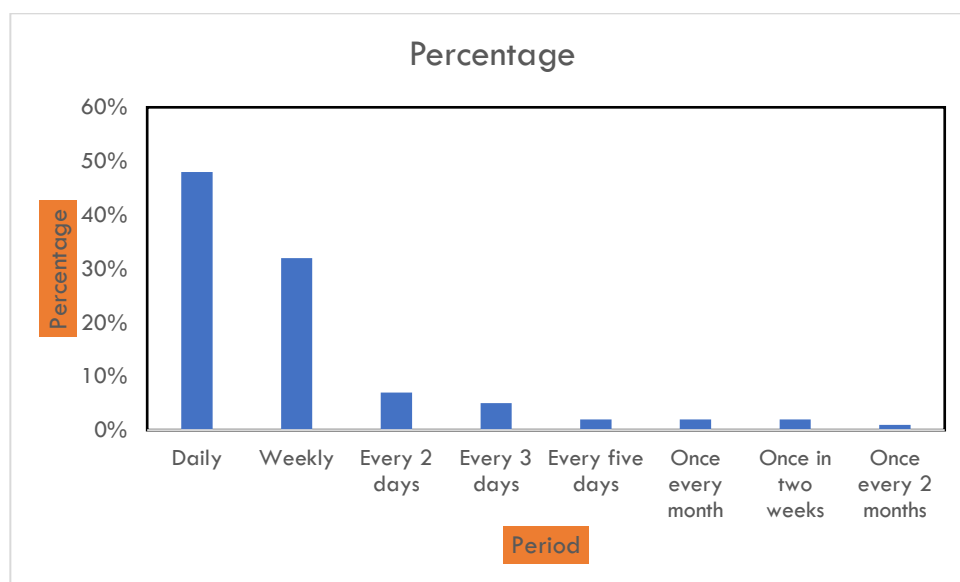


Figure 21: How often do respondent empty their trash

Figure 22 below shows that sorting waste before disposal (50.13%) and not sorting waste before the respondents' disposal was nearly proportionate among the respondents (49.62%). However, a small fraction of the respondents (0.25%) was not aware of the implications of waste sorting. Most respondents (30%) sorted recyclables waste from non-recyclable wastes while 13% sorted biodegradable wastes. However, 50% of the respondents were not involved in any of the types of waste sorting specified (Table 15). Nonetheless, the observed sorting of wastes denotes a level of awareness and opportunities for integrated waste management practice.

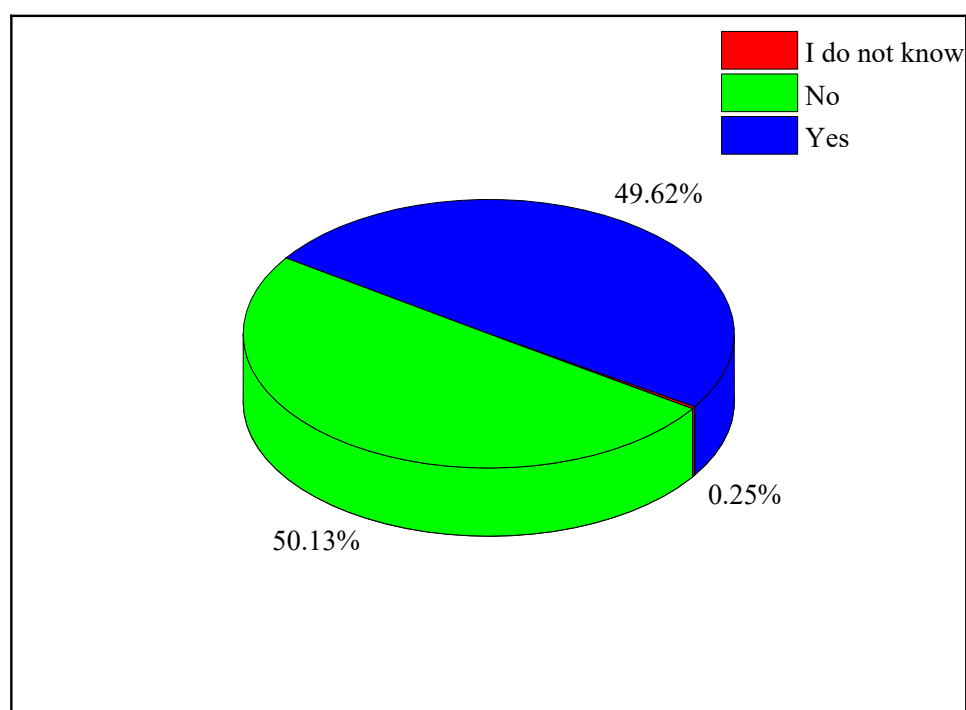


Figure 22: Percentage of respondent who sorts waste before disposing

Table 15: Type of waste sorting do you do with your household waste

Waste sorting	Percentage
Recyclables from non-recyclables	30%
Perishables from non-perishables	14%

No sorting	50%
Bio-degradable from non-bio-degradable	13%

Garbage collection service provider

The results also indicate that most a large fraction of the respondents (65%) who used garbage collectors' services preferred private collector service providers followed by state-owned waste collector service providers accounted for 21% of the respondents (Figure 23). The respondent pays an average of Kshs 248, paying a minimum of Kshs 50 and a maximum Kshs 2000

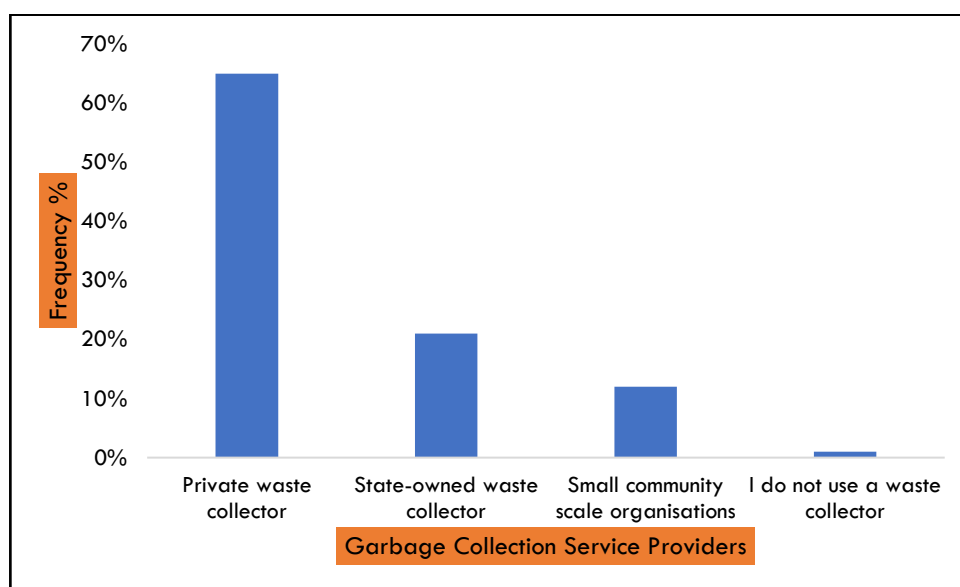


Figure 23: Garbage collection Service Provider

Satisfied with your current waste collection service

When asked if they are satisfied with the waste collectors' services, 90% of the respondents stated that they were satisfied with the services offered compared to 10% who were not satisfied with the services they obtained from the waste collectors (Figure 24). Similarly, the respondents gave reasons for being satisfied by the waste collectors' services. The majority of the respondents accounting for 64% indicated that the services were regular; 25% of the respondents stated that the waste collection services offered were affordable.

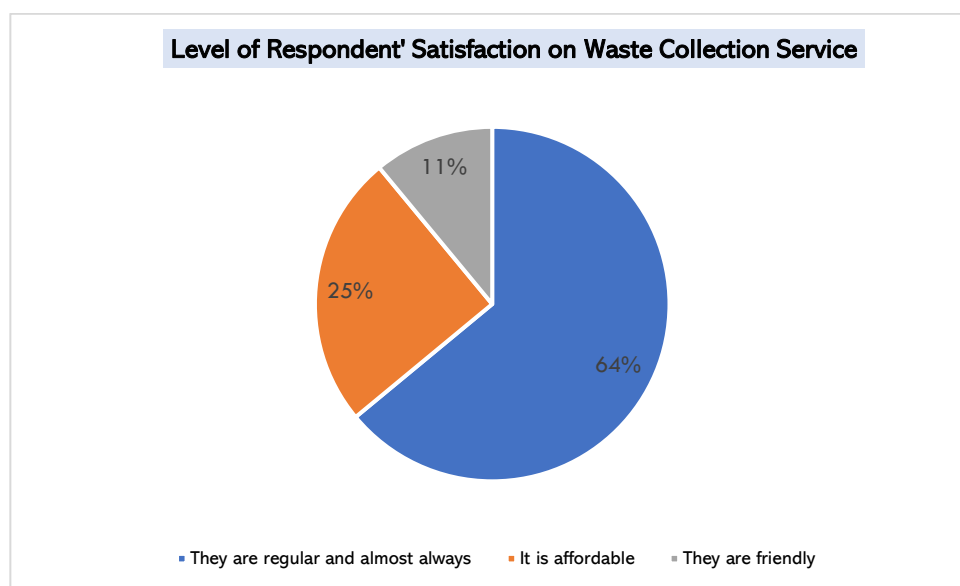


Figure 24: Level of satisfaction

Availability of sewage system or wastewater collection system in the respondent's area

Findings indicate that most of the respondents accounting for 76% of the total respondents revealed no sewage system or waste collection systems in the study area while 23% of the respondents indicated a sewage system in their area (Figure 25). Only 1% of the total respondents were not aware of whether there was a sewage system in the study area or not.

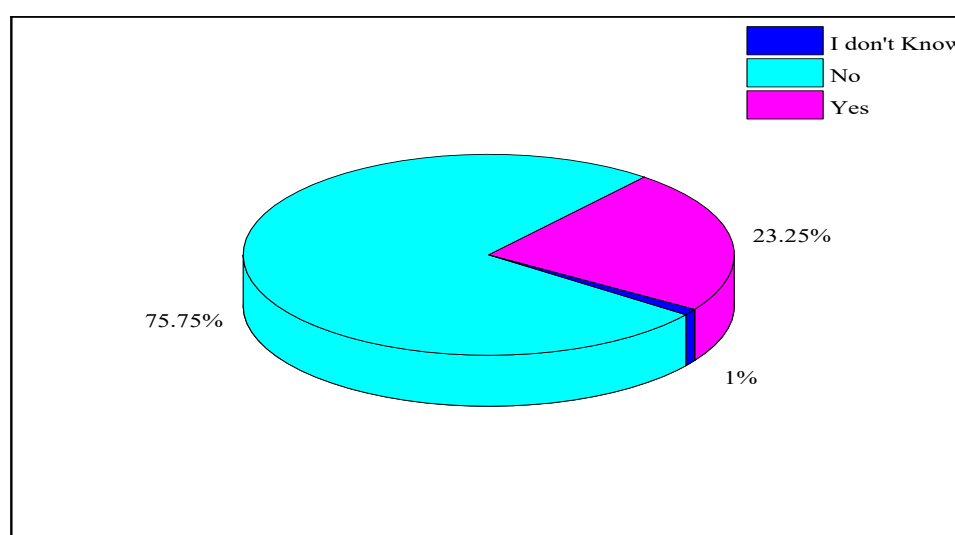


Figure 25: Availability of sewage system or wastewater collection system available in the respondents' area

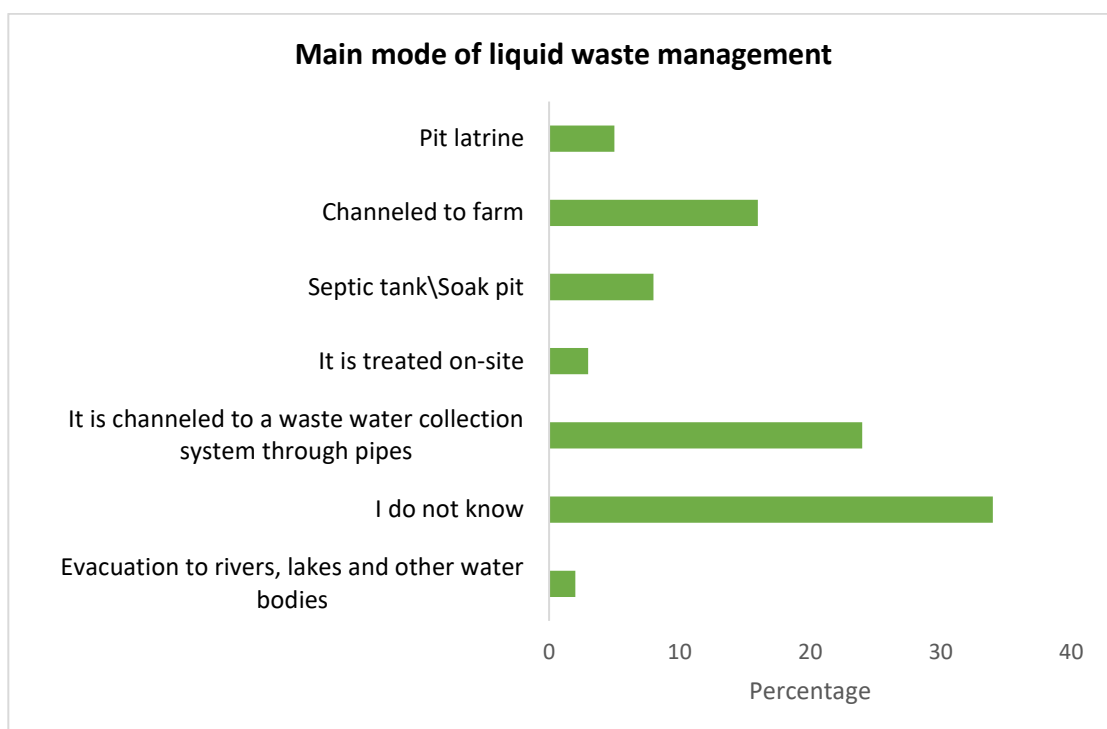


Figure 26: Main mode of liquid waste management in your household

Various modes are used to manage liquid waste in households. The most common method of liquid waste management was the sewer system (24%), while only 3% of the total respondents treated their waste on-site. However, 34% of the total respondents did not use any of the liquid waste management modes.



CHAPTER FIVE: OVERALL SUMMARY AND NEXT STEPS

Overall, risk mapping shows that Nakuru county is vulnerable to several climatic hazards. The vulnerability builds from the household level and accumulates through the community and county level. Additionally, several hazards do not occur frequently but have very high risks due to the consequences associated with such hazards when they occur. The need to put adequate mitigative measures for such hazards is a priority even as the most frequent hazards are given attention.

The key findings indicate that climate risks in Nakuru are experienced differently by different sectors, different stakeholders, and different population groups necessitating a tailored approach to adaptation action planning. While findings show that similar hazards experienced at the household level manifest at the broader community and county levels, the impacts of these hazards differ from households to the general sub-county and county levels. Certain climatic impacts such as extreme cold and hot temperatures are experienced at household levels but not necessarily at the general sub-county or county level.

Furthermore, the identified risk is associated with changes in climatic conditions. It is depicted based on the RCPS scenarios; temperature and rainfall will increase in the future. This is an indication that Nakuru will experience both positive and negative impacts associated impacts. Besides, if the future climatic condition will be as RCP scenario 4.5, the projected extreme condition will have a devastating impact on the population. This will also affect the sectors. Similarly, different groups are exposed to different climatic risks and experience impacts differently. For instance, climate hazards like floods severely affect women and girls and this applies to other hazards. They affect various population groups differently and at different scales and degrees. Evidence shows that in most African settings such as Nakuru, the female gender spends long hours on the farms, hence susceptible to heat stress. Similarly, as the primary caregivers, women are widely responsible for daily household livelihoods and spend more time at home with children thus are more exposed to risks such as floods, and hunger risks. Concerning the projected climatic trends, there is a higher probability that the incidences of hazards will increase in the county. Low-income households are less endowed with assets that could build their long-term adaptive capacity thus can only cope with daily and relatively moderate climatic risks but become highly vulnerable to severe events such as floods, landslides, etc.

At the same time, sectors are impacted differently. For instance, sectors such as agriculture, livestock, and fisheries seem to be the most affected sectors (most at risk) due to observed crop failure, pests and diseases, and loss of yields caused by drought. Similarly, both drought and floods affect several other key sectors such as energy: where inadequate rainfall affects hydroelectric power supply; and exerted pressure on forests to supply wood fuel as the perceived convenient and low-cost energy. The waste management sector is more at risk of ground fires. Overall, the differentiated impacts across communities, households, sectors, and population groups imply that adaptation planning for the county should target





tailored and contextualized actions and use these to build more inclusive and locally embedded adaptation plans.



NEXT STEPS

- a. Undertake consultative dialogue with the county departments to identify the legislative opportunities for strengthening country-led adaptation planning.
- b. Provide technical support to the county to develop/update the specific energy policy/strategy drawing on the findings from this assessment
- c. Undertake capacity building on clean energy innovation and provide linkages with various opportunities pursuing the same.
- d. Explore options for scaling the SEACAP model to other counties in close collaboration with the national government and related county climate planning initiatives.

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ANNEXES

ANNEX A: LIST AND DEPARTMENT OF STAKEHOLDERS ENGAGED



Key stakeholders
_RVA Workshop.xlsx

ANNEXURE B: OTHER DETAILS (LIKE QUESTIONNAIRE, WORKSHOP DETAILS, ETC.)

Household Questionnaire	Click here to access it
	Sustainable Energy Access and Climate A
Workshop	RVA workshop Report_Decision Mak
	RVA workshop Report_Technical Tear

Annex 1: Monthly Precipitation of Nakuru County from 1981 to 2020



Ranfall data
Nakuru.xlsx

Annex 2: Monthly Temperature of Nakuru County from 1979 to 2020

1979	16.5	16.7	17.4	17.1	16.7	16.0	15.1	15.4	16.5	17.5	16.6	17.1	16.6
1980	18.2	19.1	19.0	18.6	17.1	16.2	15.3	15.5	16.7	17.6	16.9	17.7	17.3
1981	18.6	18.9	18.2	17.2	16.8	16.4	15.2	15.6	15.8	16.7	16.9	17.1	16.9
1982	18.2	18.7	19.5	17.4	17.0	16.4	15.8	15.2	16.1	16.3	16.2	16.1	16.9
1983	17.3	18.2	19.9	18.6	17.9	16.9	15.9	16.1	15.9	16.4	16.4	15.8	17.1
1984	16.4	17.6	19.4	18.9	17.8	16.7	15.8	15.7	16.2	16.5	16.4	16.4	17.0
1985	17.7	17.9	18.5	17.1	16.7	16.0	14.9	14.9	16.2	17.6	16.9	17.9	16.9
1986	18.8	19.4	18.0	17.5	17.1	15.9	15.0	15.0	15.8	17.1	16.8	17.1	16.9
1987	18.4	19.1	19.4	18.4	17.7	16.5	16.2	16.3	18.0	18.8	17.5	18.2	17.9
1988	18.0	19.4	18.9	17.6	17.2	16.2	15.6	15.6	16.1	16.3	16.4	16.3	17.0
1989	17.0	16.8	18.3	16.8	16.7	16.1	15.4	15.5	16.2	16.3	16.7	16.9	16.6
1990	16.6	18.4	17.4	17.3	17.2	16.2	15.6	15.4	16.4	17.2	16.4	16.5	16.7
1991	17.7	19.0	18.8	17.3	17.2	16.7	15.2	15.4	16.0	16.4	16.4	16.9	16.9
1992	17.9	18.8	19.6	18.3	17.2	16.7	15.3	15.2	15.9	16.3	15.9	16.5	17.0
1993	16.3	16.8	17.9	18.6	17.6	16.5	15.5	15.6	16.5	17.6	17.7	17.9	17.0
1994	18.7	19.2	19.4	18.3	17.2	16.3	15.5	15.5	16.9	17.3	16.6	17.0	17.3
1995	18.0	18.2	18.3	18.5	17.7	17.2	15.7	16.5	16.6	17.0	17.5	17.0	17.4
1996	17.5	18.7	19.3	18.8	18.1	16.4	15.6	15.7	16.5	17.4	16.9	17.5	17.4
1997	18.7	19.2	19.9	17.6	17.1	16.9	16.1	16.0	18.0	17.6	16.9	17.1	17.6



1998	17.1	18.1	18.9	18.8	18.0	16.6	15.3	15.5	16.3	17.0	16.6	17.0	17.1
1999	17.9	18.4	18.1	17.8	17.5	17.1	15.9	15.7	16.8	17.2	16.8	16.8	17.2
2000	17.7	18.5	19.9	19.5	18.5	17.2	15.9	15.9	16.8	17.6	17.4	17.9	17.7
2001	17.4	18.6	18.4	17.3	17.3	16.0	15.4	16.0	16.9	17.1	16.7	17.1	17.0
2002	17.8	18.8	18.6	18.0	17.4	16.7	16.8	16.4	17.4	17.7	17.7	17.5	17.6
2003	17.9	19.2	19.6	18.5	17.4	16.7	15.8	15.8	16.6	17.9	17.2	16.9	17.4
2004	17.8	18.4	19.1	17.7	17.4	16.4	16.2	16.5	17.5	17.4	16.6	17.6	17.4
2005	18.6	19.6	19.7	19.1	17.7	16.9	15.9	16.5	16.9	18.0	17.9	18.6	17.9
2006	18.7	19.8	19.4	18.0	17.8	17.2	16.5	16.5	17.2	18.3	16.9	17.1	17.8
2007	17.6	17.8	18.4	18.1	17.8	16.7	15.7	15.9	16.4	16.9	17.2	17.2	17.1
2008	18.0	18.4	18.5	17.5	17.5	16.9	16.0	16.5	17.3	17.0	17.3	18.0	17.4
2009	18.2	19.0	20.0	19.5	18.2	17.9	16.9	17.3	18.3	17.5	17.8	17.6	18.2
2010	17.6	18.7	17.7	18.3	17.7	17.3	16.1	15.9	16.4	17.2	17.2	18.3	17.4
2011	18.8	19.0	19.1	19.2	18.1	17.3	16.6	16.0	16.7	17.4	16.8	16.7	17.6
2012	17.1	18.1	19.3	17.8	17.0	16.2	15.4	15.8	16.2	16.9	16.7	16.7	16.9
2013	17.4	18.3	19.3	17.6	17.3	16.4	16.0	15.6	16.3	17.0	16.8	16.8	17.1
2014	17.9	18.1	18.5	17.7	18.1	16.8	16.6	16.0	17.0	17.6	17.2	17.2	17.4
2015	18.0	19.4	19.3	18.0	17.8	17.1	16.9	17.4	18.0	18.5	17.4	17.4	17.9
2016	17.9	18.9	20.7	19.2	17.8	16.8	16.2	16.1	17.1	18.0	17.3	18.0	17.8
2017	18.7	19.4	20.5	19.6	18.1	18.3	16.7	16.8	17.0	17.8	16.9	17.6	18.1
2018	18.5	19.8	17.6	17.4	17.5	16.4	15.8	16.2	17.4	17.9	18.3	17.5	17.5
2019	18.5	19.5	20.2	21.0	19.2	17.2	16.8	16.7	17.1	17.5	17.4	17.0	18.2
2020	17.5	18.2	19.0	18.2	18.1	16.8	16.2	16.4	16.6	17.4	17.1	17.6	17.4



Annex 3: Reviewed Literature

Title	Author(s)	Findings	Type/ Impact sector	Indi. Code	Indicators
Assessing the impacts of climate variability and climate change on biodiversity in Lake Nakuru, Kenya	(Wambui et al., 2018)	- The recorded rise in the mean annual rainfall during the period 2009 – 2014 led to the increment in the lake's surface area of 22.9 km² (71.92%). - Reduced mean conductivity of the lake leading to the loss of phytoplankton on which flamingos depended upon. - The projected rise in temperatures, rainfall, and evaporation for the period 2017 – 2100 under RCP 2.6 & RCP 8.5 r.l.t 1971 -2000 baseline.	Tourism Environment & Biodiversity Climatic		-% change in tourist flows/tourism activities -% change in the number of native species % of native (animal/plant) species affected by diseases related to extreme weather conditions/events -Number of days/nights with extreme temperature (compared to ref. annual/seasonal temperatures at day/night times) -Number of days/nights with extreme precipitation (compared to ref. annual/seasonal rainfall at day/night times for each season)



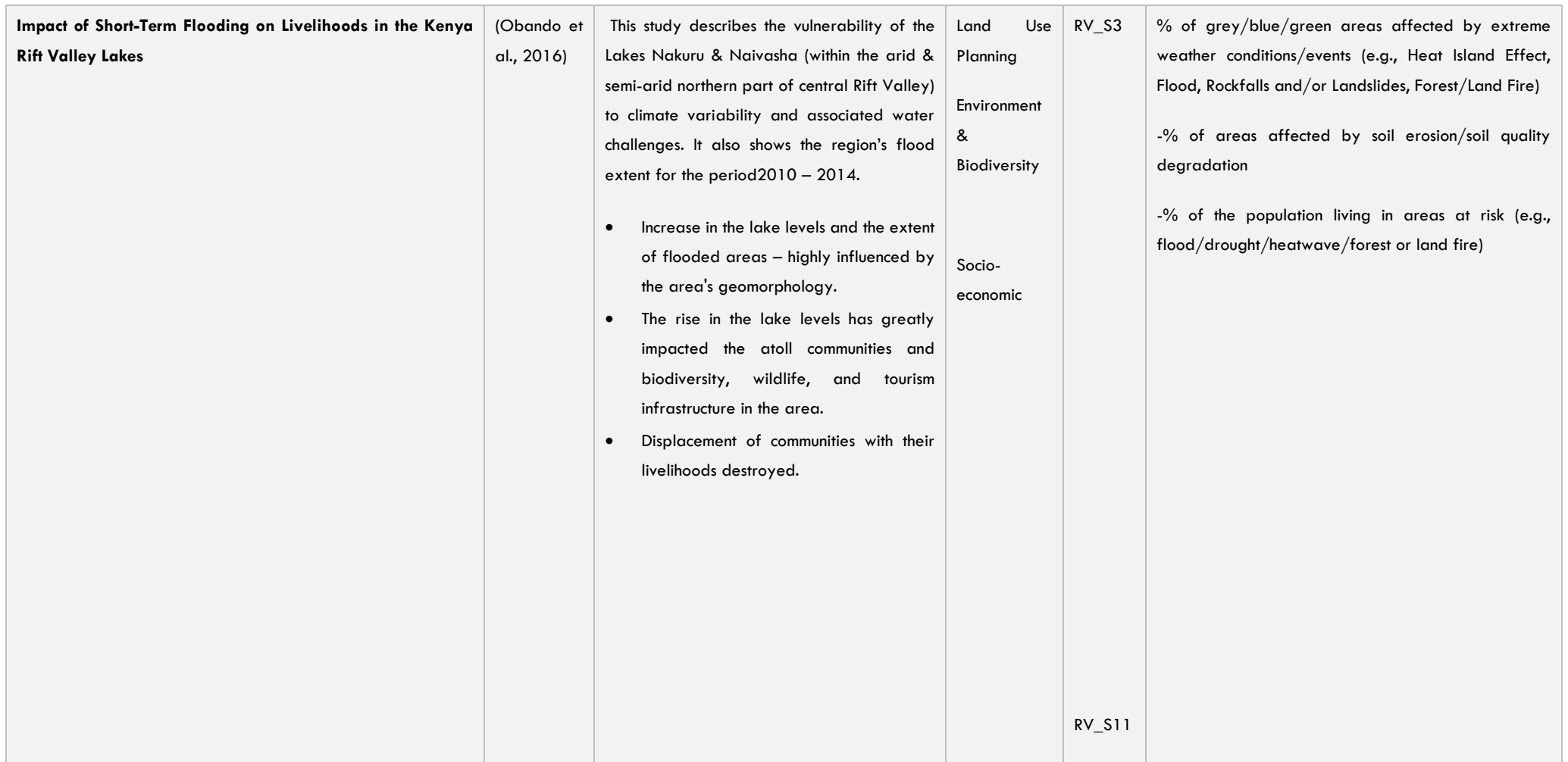
An Assessment of Climate Change Adaptation Strategies by Smallholder Agribusinesses in Mau Ranges, Nakuru County Background of the Study	(Paul & James, 2018)	• The use of technology in facilitating marketing and disseminating information in the agribusiness sector was significantly low (19.1%). • Low rate (34%) of adoption of indigenous methods of treating pest and animal diseases. • The number of businesses using table banking was significantly high (70.2%). • Only 38.8 % of agribusinesses had farm management systems. • The diversification rate of agribusiness enterprises stood at 59.6%. • Considerably low (31.9%) use of energy-saving & efficient strategies in the agribusiness sector • The use of biodegradable resources within the agribusiness sector stood at 29.8%. • 44.7 of agribusinesses have not adequately utilized business innovation opportunities in climate change adaptation. • Low (29.8%) capacity building by agribusinesses on risk management	Socio-economic	RV_A1	Number of households educated in house energy/water/waste management --Number/percentage of the population with electricity access.
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		• Support to agribusinesses by institutions working in the area such as AFC stood at 29.8 % • Support by stakeholders to business projects mitigating risks was at 38.3 % • Only 31.9 % of the respondents agreed to be having business risk management strategies in response to climate change adaptation • 40.4 % of the respondents confirmed their supply chain optimization strategies respond to climate change adaptation.			
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County Government of Nakuru Nakuru County Integrated Plan 2018 -2022		• Threats to the environment include climate change, deforestation, pollution, droughts, and floods. \ • Huge demand for wood fuel and other timber products is attributed to aridity and increased soil erosion in the county. • Few designated areas for solid waste disposal sites (Naivasha, Nakuru & Mahi Mahiu towns) do not meet the ever-growing population rate. • 37 % of Nakuru residents do not have access to improved treated water (piped, rainwater, borehole, protected well, and spring), with 51.5 % of HH lack access to piped water. • Only 21.8 % of Nakuru residents have water points within their premises, with the majority (72.5 %) still walk nearly half an hour to collect water. • Only 15.3 % of HH are connected to the main sewer, with 18.6 % of HH have a place for hand washing near the toilet facility. • Poor human waste disposal still rampant among the informal settlements.	Socio-economic	RV_A4	Population density (compared to national/regional average in year X in country/region X)
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Climate Finance in Kenya: Review and Future Outlook.	(Odhengo et al., 2019)	• Lack of linkage county climate change fund with the national climate fund. • Only five counties have established county climate change fund (Unfortunately Nakuru is not among them)			
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ANNEX F: ANALYSIS OF THE DATA

Annex 4: Hierarchy of Coping strategies

Coping Strategy	Percentage
Inter household transfers and loans	5%
Sell of household assets	10%
Government assistance	35%
Renting tools/animals	8%
Giving community service (food for work)	25%
Reduction of consumption level	18%



Annex 5: Summary table of Coping strategies to climatic risks

	Coping strategies (%)						
	Inter household transfers and loans	Sell of household assets	Insurance	Government assistance	Renting tools/animals	Giving community service (food for work)	Reduction of consumption level
Fire	5.3	10.5	0.0	42.1	7.9	26.3	18.4
Hailstorm	0.9	10.2	0.9	8.3	3.7	9.3	12.0
Landslides	10.2	6.1	2.0	30.6	2.0	12.2	6.1
Extreme hot temperature	3.7	5.6	0.9	4.6	2.8	5.6	25.0
Floods	9.4	1.9	0.6	22.5	2.5	11.3	5.0
Droughts	6.0	4.0	0.7	21.2	2.0	6.6	11.3
Fog	7.4	11.1	7.4	14.8	7.4	18.5	22.2
Lightning Strike	6.7	2.2	2.2	20.0	2.2	13.3	15.6
Cold temperature	2.6	4.0	0.7	4.0	2.6	3.3	6.6
Rainstorm	3.0	5.2	0.7	11.9	3.0	6.7	8.9



Annex 6: Population groups at risk of climate-related events (%)

Climatic risk	Vulnerable Groups								
	Women and Girls	Less-educated	Indigenous Population	Marginalized group	Persons with disabilities	Persons with Chronic diseases	Low-income households	Persons living in sub-standard housing	Unemployed persons
Fire	21.5	0.0	13.8	6.2	21.5	9.2	18.5	6.2	3.1
Hailstorm	19.0	1.8	7.1	11.3	11.9	7.7	22.0	14.9	4.2
Landslides	18.5	3.1	13.8	13.8	9.2	6.2	24.6	7.7	3.1
Extreme hot temperature	22.2	0.7	13.9	3.5	11.1	14.6	17.4	11.8	4.9
Floods	23.0	1.5	12.5	8.5	9.5	7.5	21.0	12.5	4.0
Droughts	23.7	3.1	11.8	8.8	8.8	6.5	22.5	5.0	9.9
Fog	8.8	39.7	8.8	2.9	10.3	11.8	10.3	5.9	1.5
Lightning Strike	10.7	14.3	19.6	5.4	7.1	12.5	7.1	17.9	5.4
Cold temperature	20.6	0.5	13.9	3.3	6.7	24.9	14.8	12.0	3.3
Rainstorm	20.4	1.0	10.7	7.7	8.7	7.1	21.9	17.9	4.6

Annex 7: Adaptation Hierarchy for Nakuru residents

Hierarchical Adaptation Measures	Percentage Ranking (%)
Water harvesting techniques	80%
Crop diversification	69%
Shifting of planting dates	59%
Improve soil management practices	57%
Change the quantity of land under cultivation	42%
Diversify from farming to non-farming activities	29%
Change of animal breed	25%
Migrate to the urban area	23%
Irrigation	20%
Change from crop to animal farming	18%
Greenhouse farming	7%
Aquaculture	5%

Annex 8: Major constraints that hinder your ability to adapt to climate change

Constraints	Percentage
Lack of money	61%
Lack of information	43%
Poverty	16%



Lack of credit	6%
Lack of technology (Agricultural inputs)	22%
Lack of extension service	14%
Lack of market access or poor transport link	11%

Annex 9: National Level

Lead Institution	Regulatory framework	Policy framework
Ministry of Environment and Natural Resources	National Climate Change Response Strategy (NCCRS)	Climate Change Act, 2016
		National Climate Change Framework Policy
National Climate Change Council	Ensuring climate mainstreaming by national and County governments	National Climate Change Action Plan (NCCAP); oversees the administration of the Climate Change Fund
National Drought Management Authority (NDMA)	National Drought Contingency Fund - With offices in 23 ASAL counties, the authority coordinates and supervises drought management efforts in Kenya	National Drought Management Authority (NDMA) Act, 2016
The National Treasury - National Designated Authority for the Green Climate Fund	National climate fund	Climate finance policy that establishes the legal, institutional, and reporting frameworks to access and manage climate finance.
	National Drought Contingency Fund	
	Arid and Semi-Arid Lands Drought Contingency Fund	





	Kenya Livestock Insurance Program	
	Kenya Crop Insurance Program	
National Environment Management Authority (NEMA)	Adaptation fund (GCF) & Green Climate Fund (GCF)	National Implementing Entity (NIE) for AF & National Designated Authority (NDA) for GCF – vet eligible projects for funding from the adaptation fund & GCF
Kenya Agriculture and Livestock Research Organization	Climate Change Unit	Development of drought-tolerant seeds
National Climate Change Activities Coordinating Committee (NCCACC)	Coordinating the government's activities on climate change	National Climate Change Action Plan (NCCAP)
Kenya Industrial Research and Development Institute (KIRDI)		Kenya' National Designated Entity (NDE) for the Climate Technology Centre & Network (CTCN). Have the opportunity to submit CTCN requests in collaboration with NDAs for GCF if targeting the GCF Readiness Programme. CTCN is collaborating with the GCF to facilitate access to environmentally sound technologies that address climate change and its effects

Annex 10:Local level





Institution	Regulatory framework	Policy framework	Plans
Nakuru County Government	Nakuru County Climate Change Fund Bill (2020) (at 2 nd Reading at the County Assembly)		Draft Nakuru County Climate Change Plan, 2018-2022
	County Integrated Development Plan	Public Finance Management Act, 2012	
	The Nakuru County Charcoal Bill, 2014	Establishment of County Environmental Committee	
	Nakuru County Waste Management Bill, 2019	Establishment of County Waste Management Committee	
	The Nakuru County Agricultural Training and Mechanization Service Bill, 2019	Establishment of the Agricultural Training Centre	
		Establishment of the Agricultural Development Fund.	
	The Nakuru County Urban Agriculture Promotion and Regulation Bill, 2015	Inclusion of urban Agriculture in County physical	

