

UNIVERSITY OF NAIROBI

INSTITUTE OF DIPLOMACY AND INTERNATIONAL STUDIES

**ROLE OF INTERNATIONAL NON-GOVERNMENTAL ORGANIZATIONS IN THE
ADAPTATION AND MITIGATION OF CLIMATE CHANGE BY VULNERABLE
GROUPS IN EAST AFRICA. CASE STUDY, KENYA; 2000-2016**

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REQUIREMENT OF THE DEGREE OF MASTER OF ARTS IN INTERNATIONAL
STUDIES.**

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DECLARATION

THIS RESEARCH PAPER IS MY ORIGINAL WORK AND HAS NOT BEEN SUBMITTED FOR A DEGREE AWARD TO ANY OTHER UNIVERSITY

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ABSTRACT

Although climate change affects everyone, effects are disproportionate with different populations having different experiences. Corresponding to the vulnerability of developing countries to climate change is the vulnerability of vulnerable groups who make up the majority of the world's poor and are therefore more affected by the effects of climate change. The vulnerable groups are the most affected by climate change due to the location of their habitats as well as the manner by which they make their livelihood. They live in unsafe areas such as low-elevation coast zones, have no insurance and have no alternate source of livelihoods. Their livelihoods involve much interaction with climate change and are greatly compromised by climatic events whose occurrence leaves them penniless. Vulnerability to climate change is affected by factors such as age, gender, socio-economic status, health status and geographical factors. According to the Kenyan constitution, vulnerable groups include children, women, youth, disabled, the poor and the elderly. Parties under the United Nations Framework Convention on Climate Change committed to promote and consider their obligations to people and communities in vulnerable situations when addressing climate change and adopt approaches that are not only country driven but which are also gender responsive and take into account vulnerable groups and communities. The Kenyan government is therefore obligated to include vulnerable groups in its climate change strategies. Despite this, the government is not able to carry out its duty because it does not have the resources to reach these groups. INGOs are therefore vital in filling this gap. They are one of the key players in climate change management and have been crucial in climate change management in Kenya. 89% of the surveyed NGOS had climate change related projects in place or in progress. They have performed a variety of roles in mitigation and adaptation of climate change through the development of strategies and projects addressing environmental issues as

well as sustainable development. This has been accomplished through collaboration with the government, local NGOs and Community based organizations.

Chapter 1 Introduction

Climate change is a global issue with impacts on all continents, regions and people. It creates significant changes in the society, environment and economic sectors through the destruction of livelihoods, ecosystems and countries' economic growth. Measure to address the issue must therefore be taken. Finding solutions to climate change cannot be achieved by individual states which is why various nations have united to address these issues and develop and implement measures to mitigate these effects of climate change. The commitments by nations have however not been fruitful with some countries, like America, withdrawing from commitments. It has therefore become necessary for non-state actors to step in. International non-governmental organizations especially play a key role in climate change mitigation and adaptation due to their resources, finance and coverage of and presence in multiple states.

Despite being the least contributors to climate change, developing nations, especially those in Africa, suffer the greatest impacts. This is due to their financial power which is significantly lower than that of the developed nations. Climatic impacts in developing nations affect the populations differently as well with the poor experiencing the effects more than the well-off. Vulnerable groups make up majority of the poor and are most affected by climate change impacts.

Lack of enough resources to manage climate change and its impacts in developing countries has created the need for external interventions. Non-state actors have become involved in the development of adaptation and mitigation measures especially among the vulnerable communities. This study aimed to show how the INGOs have helped these vulnerable groups in.

Background

Climate change is a phenomenon that has been taking place for millions of years and has been part of nature and as such, its impacts have been managed by nature. This however changed with the start of the industrial revolution and humans began influencing climate. The burning of fossil fuels, manufacture of cement and deforestation led to emission of more greenhouse gases into the atmosphere than the land and oceans could absorb. The gases accumulated in the atmosphere which created the current problem of global warming and worldwide average temperatures have been on the increase since then.

Climate change is therefore no longer a threat to be dealt with in the future. Impacts such as melting of glaciers, rising sea-levels, changing rainfall patterns, droughts and floods are affecting all nations of the world and they have in return created new challenges to international relations, economic growth, human rights and humanity in general. The impacts of climate change are unequal with some nations and people experiencing it more than others. Developing countries are most vulnerable to climate change mainly because they do not have the economic and social strengths needed to mitigate, adapt and recover from the impact of climatic events. In addition to this, developing countries greatly depend on climate sensitive sectors for economic growth. Nations that have majority of their economy in climate-reliant sectors experience increased exposure to climate change than nations with a lower share. This results in stagnation and even reversal of achieved growth and goals. The location of developing countries also increases their vulnerability because they are in hot climates and therefore suffer more when there is increase in temperatures.

Although climate change affects everyone, effects are disproportionate with different populations having different experiences. Corresponding to the vulnerability of developing countries to

climate change is the vulnerability of vulnerable groups who make up the majority of the world's poor and are therefore more affected by the effects of climate change. The vulnerable groups are the most affected by climate change due to the location of their habitats as well as the manner by which they make their livelihood. They live in unsafe areas such as low-elevation coast zones, have no insurance and have no alternate source of livelihoods. Their livelihoods involve much interaction with climate change and are greatly compromised by climatic events whose occurrence leaves them penniless.

Lack of adequate resources in the affected nations necessitates the intervention of International Non-Governmental organizations whose operations support to vulnerable groups in numerous ways. This study aimed to examine how this support is given to vulnerable groups.

Statement of problem

The climate change issue has been the focus of a great deal of research by scholars from all parts of the globe. Existing research has covered a wide range of topics including; climate change as a threat to peace and security, climate change and environment sustainability, African policies on climate change, economic impacts of climate change on agriculture, strategies to counter climate-related threats, climate variability in Africa and many more.

Numerous studies have focused on the agricultural aspects of climate change in terms of crop produce and sustainability. Food security and climate change is a theme that has drawn much focus over the years with work such as; **Impact of climate change on agricultural productivity and food security resulting in poverty in India**¹, (Kaur, 2017), **Climate change and food security in Kenya** (Jane Kabubo-Mariara, 2014)², and **Assessing the impact of climate change on food security of communities in Turkana county**³, (Burugu, 2016).

Growing literature on the gender aspect of climate change has taken place over the last two decades with much focus being on women because they are most vulnerable to climate change. Examples of studies of the gender aspect of climate change include; **The effect of climate change policy on gender (in)equality**⁴ (Broeck, 2017), **Gendering climate change**⁵ (Manata

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Kaur, J. (2017). *Impact of Climate Change on Agricultural Productivity and Food Security Resulting in Poverty in India*. Retrieved 12 10, 2018, from <http://dspace.unive.it/handle/10579/10586>

² Jane Kabubo-Mariara, M. K. (2014). *Climate Change and food security in kenya. CSAE Conference (pp. 1-14)*. UK: Environment for Development Initiative.

³ Burugu, A. N. (2016). *Assessing the impact of climate change on food security of communities in Turkana county*. Nairobi: University of Nairobi.

⁴ Broeck, K. V. (2017). *Gender and Climate: 'The effect of climate change policy on gender (in)equality'*. Belgium: Ghent University.

⁵ Manata Sandra, P. I. (2009). *Gendering Climate Change; A Perspective on the Overlooked Gender Dimension of Climate Change in the Developing World*. Aarhus: Aarhus University.

Sandra, 2009) and **Gender resilience to climate change adaptation in Africa: A Case study of women in Eastern Kenya**⁶, (Oyosi F, 2016).

Studies focusing on INGOs and climate change such as; **Non-state actors in international climate change negotiations**⁷ (Betzold, 2013), and **The dynamic roles of non-state actors in global climate change governance**⁸, (Nasiritousi, 2016), focus on negotiations under the United Nations Framework Convention on Climate Change (UNFCCC) and on *whether* and *how* International Non-Governmental Organizations can influence the decisions and activities of states. Limited attention has however been given to a detailed investigation of the role played by International Non-Governmental Organizations in the adaptation and mitigation of climate change especially in relation to vulnerable groups in developing countries.

This study investigated, using collected data, the role of INGOs in the adaptation and mitigation of climate change by vulnerable groups in developing countries. This involved analysis of current effects of climate change in Africa, their impacts on vulnerable groups, and the impacts of INGOs on climate change.

⁶ Oyosi F, S. (2016). *Gender resilience to climate change adaptation in Africa: a case study of women in eastern Kenya*. institute of diplomacy and international studies. Nairobi: University of Nairobi.

⁷ Betzold, C. (2013). *Non-state actors in international climate change negotiations*. Retrieved 12 10, 2018, from <https://research-collection.ethz.ch/mapping?type=diss&nr=21193>

⁸ Nasiritousi, N. (2016). *Shapers, Brokers and Doers ; The Dynamic Roles of Non-State Actors in Global Climate Change Governance*. Department of Thematic Studies – Environmental Change. Linköping: Linköping University.

Objectives

The main objective of this paper is to carry out an in-depth investigation on the influence of international non-governmental organizations on the adaptation and mitigation of climate change by vulnerable groups in developing countries.

Specific Objectives

- To analyze the involvement of INGOs in conservation of the environment
- To investigate the impact of climate change in East Africa.
- To assess how INGOs support vulnerable groups in climate change mitigation and adaptation.

Research Questions

What measures have INGOs taken to conserve the environment?

What are the impacts of climate change in East Africa?

How do INGOs support vulnerable groups in climate change adaptation and mitigation?

Research Justification

Academic justification

This research is important because it adds to the existing body of knowledge base of climate change. This study assists in better understanding the involvement of INGOs in adapting to climate change.

Policy justification

This study examines the effectiveness of INGOs in addressing challenges and in developing measures that aid in coping with climate change. This assists policy makers in better

understanding the role of INGOs in climate change and encourages the inclusivity of INGOs in formulation of strategies that are more effective in tackling climate change.

Public justification

The climate change issue is one that is projected to increase in the years to come and whose risks and effects are expected to have immense consequences for the world. Understanding methods of managing these impacts as well as sources of assistance and knowledge, provides for better coping mechanisms and solutions for the public.

Literature Review

The Literature review looks at existing studies on the overall impact of climate change, effect of climate change as well as the studies on the INGOs and vulnerable groups.

Climate Change

Climate change is a change in weather patterns that occurs over long periods of time. The IPCC describes climate change as a “change in the state of climate that can be identified by changes in the mean of its properties that persists over a long period of time (decades or longer)” while the United Nations Framework Convention on Climate Change describes climate change as a “change in climate attributed directly or indirectly to human activity which changes the composition of the atmosphere and that is observed over long periods of time”⁹ (syr, 2007).

Studies show that earth’s temperatures have increased by 0.6°C since the mid-90s while the concentrations of atmospheric CO₂ levels have increased by more than a third (NASA, 2018)¹⁰. This is attributed to increase in burning of fossil fuels, which has contributed to 80% of CO₂ emissions, while livestock and crop cultivation and deforestation have contributed to 20% of increase of CO₂ in the atmosphere (U.S Global Change Research Program , 2009)¹¹. IPCC (2014) ¹² states that presence of greenhouse gases, such as carbon dioxide, methane and nitrous oxide, in the atmosphere are the most probable cause of the continuous warming observed since the mid-20th century. According to the study, the greatest emissions took place between 2000 and

⁹ syr, I. a. (2007d). *Climate Change 2007: Synthesis Report. A Contribution of Working Groups I, II, and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. (C. W. Team, R. Pachauri, & A. and Reisinger, Eds.) IPCC. Retrieved 12 10, 2018, from

http://www.ipcc.ch/publications_and_data/ar4/syr/en/contents.html

¹⁰ NASA. (2018, May 16). *Global Climate Change; Vital Signs of the Planet*. Retrieved from A blanket around the Earth: <https://climate.nasa.gov/causes/>

¹¹ Program, U. G. (2009). *Global Climate Change Impacts in the United States*. New York: Cambridge University Press.

¹² IPCC. (2014). *Climate Change 2014 Synthesis Report Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]*. Geneva: IPCC publishing, Pp151.

2010 with burning of fossil fuels and industrial processes contributing to 78% of greenhouse gases from 1970-2010.

1.7.1.1 Impacts of climate change

Greenhouse gases atmospheric increase results in not only temperature increases but changes in rainfall patterns, extreme events like droughts and floods, melting of ice and increase in sea levels as well¹³. This in turn affects water resources, energy, infrastructure, agriculture, human health and the society.

1.7.1.2 Precipitation, droughts and floods

Udayashankara et al¹⁴ in their study note that rainfall pattern variation is one of the major impacts of climate change. According to the U.S.A study on Global impacts of climate change, temperature changes will have an impact on precipitation patterns. This is because temperature affects factors that govern distribution of rainfall. The study shows that changes in precipitation frequency, intensity and amount have been observed over the years with increases in North America, parts of South America, and in northern Europe while decreases have occurred in most of Africa, Southern Asia and the Mediterranean. The IPCC¹⁵ (2008) reports that the West African and Sahel regions have experienced the most reduction in precipitation since 1901. Sadashiva M et al observe that changes in rainfall patterns will affect regions whose water resources are rain-fed. The study notes that impact of climate change on water resources will interrupt water supply in such regions which will interfere with the well-being of humans.

¹³ Stéphanie Jamet, J. C.-M. (2009). *ASSESSING THE IMPACTS OF CLIMATE CHANGE: A LITERATURE REVIEW*. France: OECD publishing.

¹⁴ Udayashankara T.H., S. M. (2016). Impact of Climate Change on Rainfall Pattern and Reservoir Level. *Journal of Water Resource Engineering and Management*, 9-12. 10

¹⁵ IPCC. (2014). Observed and projected changes in climate as they relate to water. *Climate Change and Water, Technical paper VI*, , 16-21. 17

The Intergovernmental Panel on Climate Change reports that precipitation will increase over high latitudes while sub-tropical and mid latitude areas will experience a decrease in precipitation. This will lead to changes in water quality and quantity, loss of forests and grass lands, loss of fresh water wet lands and destruction of ecosystems.¹⁶

The technical paper observes that increased heavy precipitation events have occurred even in areas where precipitation has decreased. The study attributes this to increasing temperatures which increase atmospheric water vapor. Studies¹⁷ show that increase in global temperatures, due to the trapping of heat by greenhouse gases, has led to more water evaporation from the land and oceans. The higher temperatures have created a warmer atmosphere which can hold the increased water vapor. This increases the likelihood of heavy rainfall which is the primary contributor of floods in many regions. According to studies by the union of concerned scientists (2018), floods result in loss of lives, destruction of crops, closure of businesses and destruction of infrastructure.

Studies by Arnell W, 2008¹⁸ show that climate change increases worldwide drought potential while studies by the UOCS¹⁹ show that temperatures increase will result in precipitation falling as rain instead of snow in more areas, increased evaporation and transpiration and earlier melting of snow. As per studies by the climate reality project, the increase in temperatures results in

¹⁶ IPCC. (2008). *Climate Change and Water, Technical paper VI, Climate change and water resources in systems and sectors*, pg 3-7. Geneva: Intergovernmental Panel on Climate Change

¹⁷ The union of concerned scientists. (2018). *Climate Change, Extreme Precipitation and Flooding: The Latest Science*. Cambridge: The union of concerned scientists.

<https://www.ucsusa.org/sites/default/files/attach/2018/07/gw-fact-sheet-epif.pdf>

¹⁸ Arnell, N. (2008). *Climate change and drought*. United Kingdom: University of Reading.

¹⁹ Scientists, U. o. (n.d.). *Union of Concerned Scientists*. Causes of Drought: What's the Climate Connection?: Retrieved from, <https://www.ucsusa.org/global-warming/science-and-impacts/impacts/causes-of-drought-climate-change-connection.html#.W5aOvegzbIU>

reduction of water availability in soils and plants which disrupts plant life and eventually leads to drought.

Climate change and vulnerable groups

Studies by the Global Gender and Climate Alliance²⁰ indicate that though climate change affects everybody, certain individuals are more likely to feel the effects of climatic shocks and consequences than others. According to the study, individuals who experience the most impacts are those exposed to social, economic, cultural and political inequalities and who lack access to capital and resources to adapt and mitigate to climate change. Gender and age are some of these inequalities. UNDP²¹, in its study found that the poor and marginalized community are the most vulnerable to climatic impacts because not only do they lack funds and resources, they also earn their livelihood from natural resources which are vulnerable to changes in climate and are in many cases not included in social and economic progress²².

According to studies by the Asian Development Bank, the chances of women and children dying or getting injured during disasters are fourteen times higher than those of men²³. Children, low-income earners, pregnant women, and the elderly are especially vulnerable to health impacts brought about by climatic events²⁴. According to Mosberg²⁵ children are among the most vulnerable due to their dependence on other people e.g. guardians. As per the study, this

²⁰Sellers, S. (2016). *Gender and Climate Change*.: Washington: published by Global Gender and Climate Alliance

²¹ UNDP. (2013). *Overview of linkages between gender and climate change* . New York,: published by United Nations Development Programme.

²² UN. (2016, October 3). *UN News*. Retrieved from Inequalities exacerbate climate impacts on poor and vulnerable people – new UN report: <https://news.un.org/en/story/2016/10/541742-inequalities-exacerbate-climate-impacts-poor-and-vulnerable-people-new-un>

²³ Ahsan, I. (2016). Impacts of Climate Change on Vulnerable Groups. *Third Asian Judges Symposium on Law, Policy, and Climate Change* (pp. 9-13). Manila, Phillipines: Asian Development Bank.

²⁴ McGill, N. (2016, November/December). Vulnerable populations at risk from effects of climate change: Public health working to find solutions. *The Nation's Health, Vol. 46, Issue 9*, pp. 1-14.

²⁵ Mosberg, M. (2015). *Vulnerable Groups & Sustainable Climate Change Adaptation - Seminar Summary Report*. Norway: published by Norwegian University of Life Sciences.

increases their exposure to death and injury during climatic events as well as abuse and trafficking if separated from their caretakers. The study also shows that climate change increases occurrence of water and sanitation diseases which affect children under 5 years the most due to their undeveloped immune system and play behavior.

Women are also vulnerable to climate change. Studies by the International Union for Conservation of Nature²⁶ state that women make up 70% of the world's poor, hence majority of the world's poor and are more vulnerable to effects of climate change than men. UN Women watch fact sheet²⁷ attributes this vulnerability not only to their lack of means to cope with climate change impacts but also their dependence on the environment as their source of livelihood. This is especially so for the women in rural areas due to the nature of their duties and responsibilities²⁸.

The women watch fact sheet by UN shows that apart from being vulnerable to climate change, women are also key agents of managing climate change. Their societal positions mean that they interact with climate change the most and consequentially have a broad body of knowledge and expertise and can be the originators of possible mitigation and adaptation solutions. Empowering women is beneficial for the community as was shown in a research by Marilee K²⁹ who found that introduction of sugarcane as a cash crop in the region of Central America provided employment for men which increased money in the community but also resulted in an increase in

²⁶ IUCN. (2015). *Gender and Climate Change Issue Brief*. Switzerland: Published by IUCN. Retrieved from <https://www.iucn.org/resources/issues-briefs/gender-and-climate-change>

²⁷ UN Women. (2009). *Women, Gender Equality and Climate Change*. Published by UN Women Watch. Retrieved from Women Watch: http://www.un.org/womenwatch/feature/climate_change/

²⁸ Habtezion, Z. (2011). *Gender and Climate Change Capacity Development Series – Africa*. New York: Published by UNDP Bureau for Development Policy.

²⁹ Kar, M. (2009). *Inseparable: The Crucial Role of Women in Food Security Revisited*. Manila: Published by ISIS International.

malnutrition levels in the community. This is because cash earned by men was not used to acquire food which led to food insecurity. Studies by Quisumbing attribute this difference in spending of income by the two genders to societal and cultural norms. As per his studies, women have the role of ensuring that members of the household receive enough share of the available food.

INGOs and developing countries

Studies by Brian Tomlinson³⁰ show that INGOs have a significant role in the delivery of aid to developing countries and are also important actors within the international community. INGOs occupy an important position due to their size and scope an example being World Vision whose budget is more than the GDP of African developing nations. As per the study, INGOs in developing countries have a major presence and they receive sizeable donations to perform humanitarian assistance and development work. Not only do they offer finances, INGOs also bring expertise and knowledge. The study further explains that the key objectives of INGOs are reduction of poverty and inequality and states that INGOs have different roles in developing countries which they achieve through working with target groups and sector for example Save the Children works with protecting and empowering children while Action Aid concentrates on food and women rights, climate change, HIV/AIDs and education. The study states that INGOs are directly involved in program management, implementation as well as monitoring and evaluation.

³⁰Brian Tomlinson. (2013). *WORKING WITH CIVIL SOCIETY IN FOREIGN AID POSSIBILITIES FOR SOUTH-SOUTH COOPERATION?* (O. U. The Write Effect, Ed.) China: published by United Nations Development Programme.

According to studies by Yoon et al³¹, INGOs are major contributors to the improvement of the quality of healthcare and in the control of epidemic crises in developing nations through the development of healthcare infrastructure and provision of medical supplies.

Studies by Pang³² state that INGOs provide assistance in developing countries through survival aid where they deliver basic needs to communities especially those in drought and war-stricken areas. They also provide funding and/or volunteers to educate children and instill technical skills in the communities for better livelihoods as well as provide loans to farmers which are used for investment purposes.

Summary of gaps in Literature review

The literature reviewed focuses on the impacts of climate change on the environment and the effects that this has on communities while the literature on the impact of climate change on women focuses on their vulnerability to climate change as well as the roles that they play in the society. Literature on INGOs focuses on how they operate, their provision of aid, their contribution to the development of developing nations and their involvement in the improvement of healthcare systems.

These studies have researched the different aspects of climate change but in-depth studies on the role of INGOs in climate change are missing. This has resulted in a literature gap that this study

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Yoon Ah Shin, J. Y. (2018). The Effectiveness of International Non-Governmental Organizations' Response Operations during Public Health Emergency: Lessons Learned from the 2014 Ebola Outbreak in Sierra Leone. *International journal of environmental research and public health*, 15(4), 650. doi:10.3390/ijerph15040650

³² Suk-man, D. P. (2015). Emergence of International Non-governmental Organizations (INGOs): Success and Limitation of Cooperation. China. Retrieved from https://www.edb.gov.hk/attachment/en/curriculum-development/kla/pshe/references-and-resources/history/IA_Lecture_2_Pang_Eng.docx

aims to fill. Other gaps identified include, the relationship between climate change and debt increase in developing countries, achievement of the hunger and poverty reduction millennial development goals in the wake of climate change, climate change and economic growth in developing countries and the role of women self-help group in adaptation to climate change

Theoretical Framework

The Sustainability Development Theory

It is based on the concept of achieving human goals without compromising the ability of natural systems to provide resources and services which the society and economy depend on. The theory states that use of resources and activities by humans to improve their living conditions should not come at a cost to the natural system by disrupting its stability and integrity. As per the theory, development for the present generation should take place without negatively affecting the ability of development of future generations

The theory is relevant to the study because it integrates socioeconomic matters with environmental ones. It places responsibility on the current generation to be conscious of the actions that they take to improve their lives and the effects these actions have on the natural system so that they do not expose future generations to injustices and deprivations that are as a result of their present actions. The current generation should therefore take measures to reverse what their actions have destroyed.

The Liberalism Theory

The liberalism theory recognizes that international organizations are just as important as states in international relations due to the influence that they possess in various areas e.g. agenda setting by states. They facilitate inter-state cooperation and interactivity through information collection, establishment of credible agreements and monitor existing agreements. As per the theory,

International organizations are not formed for the benefit of one state but are instead formed for benefits of all participating nations with regards to international issues. Becoming part of an international organization is therefore beneficial to a state.

The theory recognizes that International Organizations can influence state behavior e.g. the concession of Russia joining the World Trade Organization (WTO) led to the ratification of the Kyoto Protocol by Russia and acknowledges that peace and harmony are essential for the cooperation of states.

This theory is relevant to the study because it acknowledges that climate change is global problem both in its causes and its effects and that there is therefore need to address it in its entirety through international cooperation. The theory recognizes the importance of the role played by INGOs in resolving the climate change issue e.g. the collection of information, establishment of treaties and reduction of costs and shows that INGOs are created to help all members including the developing and underdeveloped nations in dealing with international issues.

Hypotheses framework

- 1) Activities by International Non-Governmental Organizations have mitigated impacts of climate change for vulnerable groups.
- 2) Collaboration between INGOs and government is essential for successful adaptation and mitigation to climate change.

Research Methodology

This section presents the methodology that was used. It describes the study area, sample, sample size and the data collection techniques that were used.

Study Area

The study was conducted in East Africa, Kenya with focus on INGOs in the region due to the researcher's familiarity with the region as well as the existence of INGO driven climate change projects there.

Sampling Methods

The researcher interviewed 26 participants involved in climate change adaptation activities by INGOs. This included informed specialists occupying different positions in various INGOs as well as government officials who have worked with INGOs in this capacity. This study used snowball sampling and simple random sampling.

Data Collection Methods

The study used both primary and secondary methods for data collection.

Primary Data Sources

Questionnaires

The researcher made use of questionnaires to collect primary data from the participants. Questionnaires were administered to INGO and government officials in Kenya and they were both open-ended and close ended.

Interviews

The researcher had face to face discussions with researchers from different organizations and government ministries. The researcher had a list of topics which were discussed with the various participants.

Secondary data sources

Data was also acquired from other sources such as meteorological findings, journals, newspapers and articles.

Data Analysis Method

Responses from interviews and direct quotes from open-ended questions were typed into word document. The responses provided were analyzed qualitatively, with issues and patterns identified in the responses presented to reflect the most common patterns. The data from quantitative analysis was analyzed numerically. Therefore, the results and findings of the research were presented through tables, pie charts and bar graphs.

Scope and limitations of the research

Funds to carry out the research were limited. The researcher needed to travel to collect data and provide the necessary data collection materials and funds to facilitate this were scarce.

The busy schedules of the interviewees made it difficult to have a face to face interview.

Chapter Outline

Chapter one gives an Introduction and background of the study as well as statement of the problem, justification, conceptual framework, literature review, hypotheses and the methodology of the study.

Chapter two researches on initiatives by INGOs and other non-state actors in the conservation of the environment. It studies how they came to be involved, why they are involved as well as what they are doing about the climate change issue

Chapter three is an overview of the impacts of climate changes on the different sectors of East Africa's economy and their impacts on vulnerable groups.

Chapter four investigates how INGOs are supporting vulnerable groups in climate change mitigation and adaptation as well as how they work with local NGOs and the government.

Chapter five

- Findings and Conclusions
- Recommendations.

Chapter 2 OVERVIEW OF INITIATIVES BY INGOS FOR CONSERVATION OF THE ENVIRONMENT

The failure of states to adequately commit to UNFCCC climate change agreements has increased the importance of the role played by INGOs and other non-state actors. International non-governmental organizations, Multi-National Corporations and development banks have as a result started various initiatives such as BINGO (Business and Industry Non-Governmental Organizations), ENGO (Environment Non-Governmental Organizations), IPO (Indigenous People Organization) and RINGO (Research and Independent Non-Governmental Organizations). These organizations were formed to aid in climate change management through the wealth of knowledge that they possess and initiation of projects³³. The activities and sizes of non-state actors grew with time and eventually spread to countries other than that of origin and in so doing become international non-governmental organizations.

The international nature of climate change calls for a response from all international actors, states and non-states. The impacts of climate change are not limited to one country but are instead felt across the globe regardless of the degree of contribution to the issue. Loss of ecosystems, floods, droughts and land degradation are being experienced in all nations which calls for development of international responses while addressing them. This chapter studies the various measures taken up by INGOs to conserve the environment.

Water Initiatives

Studies by WWAP (World Water Assessment Programme)³⁴ show that climate change is increasing water demand but decreasing water supply. Changes in the water cycle have disrupted

³³ UNEP. (2015). *Climate commitments of subnational actors and business: A quantitative assessment of their emission reduction*. Nairobi: United Nations Environment Programme (UNEP).

³⁴

the water balance and this has in return threatened water availability. Water for consumption, agriculture and other uses has become scarcer especially in the African continent where reduced rainfall has led to drying up of rivers and high temperatures have resulted in the melting of glaciers. In East Africa, declining rainfall levels have reduced water levels in Rivers Pangani and Ruvu and Lake Victoria³⁵. The study observed that reduction in water availability leads to lower agricultural production, increases fungal and insect infestations and lowers hydropower production.

The impact of climate change on water sources necessitate INGOs involvement in collaborative water initiatives. They aim to bring water to conflict-torn ones where war increases vulnerability to the impacts of climate change and reduce access to drinking water for millions of people. Water in these states is used as a war weapon, as is the case in Yemen where water supply for 15 million people was cut off, while in Syria³⁶, water sources were contaminated, and water pump destroyed to cut the supply of water.. Attacks on water supply affect vulnerable groups the most who are more susceptible to malnutrition and cholera. Out of the half a million Cholera outbreaks reported in Yemen, 53% were children. Somalia also experienced 77,000 cases of cholera outbreaks and South Sudan experienced 19,000 cases³⁷. Indirect and direct access to

UNEP. (2015). *DISTRICT ENERGY IN CITIES; Unlocking the Potential of Energy Efficiency and Renewable Energy*. United Nations Environment Programme.

³⁵ GWP. (2014). *Tanzania: Pangani River Basin: Building consensus on water allocation and climate change adaptation*. Global Water Partnership.

³⁶ Wijesekera, S. (2017, January 1). When Water Becomes A Weapon Of War. *Huffpost*. Retrieved from https://www.huffingtonpost.com/sanjay-wijesekera/when-water-becomes-a-weap_b_14500786.html

³⁷ UNICEF. (2017, August 29). Children's access to safe water and sanitation is a right, not a privilege. *Sustainable Development Goals*. Retrieved from <https://www.un.org/sustainabledevelopment/blog/2017/08/childrens-access-to-safe-water-and-sanitation-is-a-right-not-a-privilege-unicef/>

water has also been linked to the high mortality rate, 133 per 1000, of children under 5 in Somalia³⁸.

Due to climate change, water shortages in war-torn countries are more widespread because of drying up of water sources and decrease in groundwater levels³⁹. The study found that conflict exacerbates these effects because the people and government are not able to take the required steps to lessen or stop these impacts and existing infrastructure and water sources are destroyed due to the presence of rebels as is the case with the Houthi rebels in Yemen⁴⁰. The study found that the presence of INGOs in these war-torn countries helps improve access to water and sanitation services and thus reduces risks associated with water scarcity such as infant and child mortality as was witnessed in Somalia where, five INGOs (International Rescue Committee, Save the Children, Cesvi, Concern Worldwide and the Norwegian Refugee Council) formed a partnership called **Building Resilient Communities in Somalia** through which they had by 2015 managed to increase water access to 66% of the population⁴¹.

INGOs also work on increasing water availability in major towns who suffer from unreliable water sources that compromise the health and economic development of the residents. SNV has collaborated with Vitens Evides International to improve water infrastructure, support the water service authorities for effective management and designs for climate change adaptation and mitigation in Nakuru.

³⁸ ORODA, A. S. (2018). *ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN KISMAYO AND BAIDOA WATER AND SANITATION PROJECT*. Nairobi: Published by African Development Bank.

³⁹ World Bank. (2014, November 24). Future Impact of Climate Change Visible Now in Yemen. *The World Bank*. Retrieved from <http://www.worldbank.org/en/news/feature/2014/11/24/future-impact-of-climate-change-visible-now-in-yemen>

⁴⁰ Alia Chughtai, F. E. (2018, September 19). Yemen conflict: Who controls what. *Aljazeera*. Retrieved from <https://www.aljazeera.com/indepth/interactive/2016/08/yemen-conflict-controls-160814132104300.htm>

⁴¹ Piton, P. (2016). *BRCIS Consortium - Building Resilient Communities in Somalia*. Retrieved from <https://www.nrc.no/what-we-do/brcis-consortium---building-resilient-communities-in-somalia/>

Improvement of water supply to the poor and underserved is another goal for non-state actors. The poor are the most affected by water scarcity. Without water, they cannot grow food, they cannot continue earning an income and they cannot stay healthy. They are therefore not able to improve their lives and end up stuck in the cycle of poverty. This is especially hard on vulnerable groups in developing nations. Women, adolescent girls, and children are forced to spend hours daily searching for and transporting water which is at times located many kilometers away from their homes. Women in Africa and Asia cover on average a distance of 6km daily when collecting water⁴². Many INGOs recognize the reason behind the failure of majority of development projects is the exclusion of vulnerable groups and therefore create and implement projects that benefit them the most.

Emissions reduction

Greenhouse gas emissions into the atmosphere resulting from human activities are the greatest drivers of climate change. They include CO₂ (65%) which is as a result of burning fossil fuels, deforestation and industrial process, CH₄ (methane, 16%) from agricultural activities and N₂O (Nitrous Oxide, 6%) from agricultural activities such as use of fertilizers⁴³. CO₂ levels in the atmosphere have increased by 40% since mid-1800s⁴⁴. Increased levels of greenhouse gas emissions are more than nature has the capacity to absorb which means that the gases remain in the atmosphere where they gradually increase in concentration and in the process increase the average temperature of the planet. Temperature increase due to human activities is 0.8-1.2

⁴² UNICEF and WHO. (2012). *Progress on Drinking Water and Sanitation: 2012 Update*. New York: Published by UNICEF.

⁴³ United States Environmental Protection Agency. (2018). *Global Greenhouse Gas Emissions Data*. Retrieved from Greenhouse Gas Emissions: <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data>

⁴⁴ E.I.S. (2018, July 20). *Greenhouse Gases' Effect on the Climate*. Retrieved from U.S Energy Information Systems: https://www.eia.gov/energyexplained/index.php?page=environment_how_ghg_affect_climate

degrees Celsius higher above pre-industrial levels⁴⁵. The increase in temperatures causes changes in precipitation patterns, increase in sea level, reduction of ice and snow and climatic shocks such as floods.

Corporate sectors are greatly involved in climate change as both contributors to and mitigators of climate change. The 1000 most greenhouse gases releasing companies are responsible for 20% of the world's annual emissions⁴⁶. Participation of these companies in reduction of emissions is crucial when dealing with climate change. INGOs have therefore partnered up with companies in various initiatives such as RE100 which create a forum whereby companies can contribute towards environmental conservation.

The cement industry is one of the key producers of CO₂ and makes up 5% of man-made GHG emissions⁴⁷. Companies in the cement industry have formed partnerships with INGOs and other organizations to address the emissions issue. The Cement Sustainability Initiative, a global organization made up of members who have operations in more than 100 countries and who account for 30% of worldwide cement production, was created for this purpose. Through the initiative, companies have committed themselves to the development of a climate change mitigation strategy and emissions monitoring and clear and understandable reporting of cement process emissions using continuous emission monitoring (CEM) technology. Bamburi, the leading cement company in Kenya, has in line with the initiative committed to “produce 40%

⁴⁵ IPCC. (2018). *Special Report on Global Warming of 1.5 °C (SR15)*. Incheon: published by Intergovernmental Panel on Climate Change.

⁴⁶ UNEP. (2015). *Climate commitments of subnational actors and business: A quantitative assessment of their emission reduction*. Nairobi: United Nations Environment Programme (UNEP).

⁴⁷ Richard Aylard, L. H. (2002). *The cement sustainability initiative, our agenda for action, Cement Sustainability Initiative*. Switzerland: World Business Council for Sustainable Development.

less CO₂ per ton of cement” than it did in 1990⁴⁸. Research by the study found that the company is using waste derived fuels, manufacturing low carbon cement and developing innovative solutions that reduce emissions from buildings and infrastructure such as concrete paved roads whose production produces fewer emissions than the refining of crude oil for bitumen. The company has also invested KES 800 Million for the upgrade of precipitators to control emissions and has replaced 60% of fossil fuels consumption by using alternative fuels such as rice husks.

The Cement Sustainability Initiative has also partnered up with UNEP to address presence of mercury in cement manufacturing⁴⁹. Mercury has negative effects on people and on the environment. If consumed by people, mercury affects the nervous systems, lungs, gastrointestinal tract and can induce kidney toxicity among other effects. CSI recognizes these risks and its impacts on stakeholders, especially local communities, and is therefore working with UNEP in the development of global legally binding instrument to manage mercury emissions. The goal of CSI is provision of a platform for its members to share knowledge and expertise on issues related to the development of the cement sector. Through the partnership, CSI has shared mercury monitoring and controlling technology and developed guidance material on best available techniques and environmental practices⁵⁰.

Energy

Widespread consumption of energy and burning of fossil fuels, oil, gas and coal as well as plastics make the energy sector the greatest contributor to global warming with its contributions

⁴⁸ Lafarge Holcim. (n.d.). *Sustainability*. Retrieved from Climate: <https://www.lafargeholcim.com/climate>

⁴⁹ Cement Sustainability Initiative. (n.d.). *Global Mercury Partnership*. Retrieved from <https://www.wbcscement.org/index.php/key-issues/emissions-reduction/mercury/global-mercury-partnership>

⁵⁰ World Business Council for Sustainable Development. (2018). Retrieved from Global Mercury Partnership: <https://www.wbcscement.org/index.php/key-issues/emissions-reduction/mercury/global-mercury-partnership>

amounting to two thirds of the total greenhouse gas emissions⁵¹. The study noted that the growing population, increasing temperatures and continued economic growth for developing countries is increasing the demand for more energy production. A survey by Ispy⁵² shows that since 2000, energy consumption in Africa has increased by 45% accompanying the economic growth in the region. Warm regions in developing countries are becoming warmer and with the increased economic growth, the poor can afford air conditioning to better cope with the increased temperatures. Contributions by governments alone are not enough to reduce emission by the energy sector and while many governments would like to implement energy efficiency policies and strategies, they lack the expertise, finances and technical skills to do so. There is therefore need for the involvement of non-state actors in developing measure and policies for reduction to be achieved.

Energy initiatives such as the Global Energy Efficiency Accelerator Platform have as a result been formed. Their key objective is to promote partnerships between public and private entities in the establishment of energy efficiency policies, activities and investments to increase improvement of energy utilization by 2030. The platform aims to partner up with jurisdictions, businesses and financial institutions in the adaptation of energy reduction action plans⁵³. It therefore encourages collaboration of the civil, private and public sectors through which wider sharing of information takes place and larger problem areas are covered which leads to accelerated implementation of actions. The study observed that the partners commit to the adaptation of improved actions that are guided by policies developed at the sectorial, regional or

⁵¹ Deshpande, V. M. (2015). Sustainable Energy for All: Global Energy Efficiency Accelerator Platform. *Conference on Climate Change and Energy* (pp. 2-4). Korea: UNEP.

⁵² Ispy publishing. (2018). *An African Energy Industry Report* .: Bolton: ispy publishing limited.

⁵³ UNFCCC. (2015, September 1). *Global Energy Efficiency Accelerator Platform*. Retrieved from <https://unfccc.int/news/global-energy-efficiency-accelerator-platform>

state levels, which will increase energy efficiency. INGOs in this partnership develop a market for the distribution of clean energy products manufactured by member companies . For the companies to access the new markets they must follow the policies of the initiative which ends up being a win-win case for all parties.

The objectives of the global energy efficiency accelerator platform are to promote global access to modern energy services, increase rate of improvement in energy efficiency and increase usage of renewable energy sources⁵⁴. Four energy efficiency accelerators have been launched under this platform. They include the Building Efficiency Accelerator, Efficient Appliances Accelerator, Lighting Efficiency Accelerator and the District Energy Accelerator.

Buildings account for a quarter of greenhouse gases per year due to their large consumption of energy⁵⁵. Adoption of best practices can reduce energy consumed by buildings and reduce the long-term effects associated with poor practices in building. The Building Efficiency Accelerator addresses this issue by providing a platform for the partnering of companies, INGOs and NGOs with governments to facilitate the provision of expertise, tools and financial aid to enable building efficiency policies. According to UNFCCC (2015), the goal is to establish policy options which will cover areas such as, building and equipment standards, benchmarking and financial models and provide technical support to governments. The alliance also provides a platform for participating governments to share their commitments, progress and experiences.

⁵⁴ UNEP. (2015). *Climate commitments of subnational actors and business: A quantitative assessment of their emission reduction*. Nairobi: United Nations Environment Programme (UNEP).

⁵⁵ Sustainable Energy for All - Building Efficiency Accelerator Partnership. (2014). *An Introduction to the SE4ALL Building Efficiency Accelerator*. SE4ALL. Retrieved from <http://e-lib.iclei.org/wp-content/uploads/2015/06/Introduction-to-the-SE4ALL-Building-Efficiency-Accelerator1.pdf>

The Efficient Appliances Accelerator partnership⁵⁶ acknowledges that appliances and equipment including fridges, air conditioners, lighting, electric motors and transformers contribute to GHG emissions. It encourages partners to adopt measures and policies supporting the utilization of energy saving products that will enable sustainable and affordable transformation.

Cities account for 70% of energy demand globally⁵⁷ and 43% of total GHG emissions. This is because they contain a high population and have increased economic activities. Energy consumption in districts is mostly in heating, cooling and hot water which are responsible for 60% of energy demand in city buildings⁵⁸. Reducing energy consumption in cities by shifting to low carbon sources will greatly contribute to the achievement of global energy saving ambitions. It is for this purpose that the District Energy Accelerator was initiated. The District Energy Accelerator initiative states⁵⁹ that it aims to accelerate the implementation of district energy systems, which are better ways of heating and cooling, while also delivering environmental, social and economic benefits. Adoption of district energy systems helps cities to reduce energy consumption and greenhouse gases emissions. Adopting the systems can help cities reduce energy consumption by 50%. This is because the district energy systems are able to integrate 100% renewable energy sources into the heating and cooling sectors.

20% of electricity is used up for lighting which is also responsible for 6% of the greenhouse gas emissions and which uses up 3% of global oil. If control measures are not taken, lighting

⁵⁶ United for efficiency. (n.d.). *Transforming markets TO ENERGY-EFFICIENT PRODUCTS*. Retrieved from United for efficiency: <https://united4efficiency.org/>

⁵⁷ UNEP. (2015). *DISTRICT ENERGY IN CITIES; Unlocking the Potential of Energy Efficiency and Renewable Energy*. United Nations Environment Programme pg 13-15.

⁵⁸ District Energy in Cities Initiative. (n.d.). Retrieved from <http://www.districtenergyinitiative.org/why-district-energy>

⁵⁹ District Energy in Cities Initiative. (n.d.). *The Power of District Energy*. Retrieved from <http://www.districtenergyinitiative.org/power-district-energy>

consumption will increase by 60% by 2030⁶⁰. To reduce this demand, people will be required to change their habitual manner of lighting utilization, a task that is not possible. The only other option is replacement of conventional sources of lightning with higher efficiency light sources such as compact fluorescent lamps (CFLs), and light-emitting diodes (LEDs). The Lighting Efficiency Accelerator initiative also known as en.lighten was established to accelerate the transition from regular lighting technologies to energy efficient lighting technologies. The initiative is an UNEP-GEF initiative who have partnered with Phillips Lighting, National lighting test center and Osram. The main goal of the en.lighten initiative is to mitigate climate change by formulating and implementing national or regional energy efficient lighting strategies through partnerships that propel the utilization of efficient electrical appliances and in so doing reduce greenhouse gas emissions. It achieves this through the promotion of best practices and energy efficient lighting technologies initiatives in developing countries where demand for electricity has been on a constant increase. It has also developed international strategies to phase-out traditional and uneconomical lighting technologies and substitutes them with environmentally friendly alternatives.

The study observed that by joining any of the Global Energy Efficiency Accelerator Platforms, participants get access to information, identify possible partners and build networks. Through collaboration with diverse energy efficient stakeholders who include experts and private companies, jurisdictions (governments, cities and counties) get access to advice in the formulation of policies and strategies to phase-out conventional lighting products and bring to the market energy efficient lighting technology, numerous resources such as efficient lighting

⁶⁰en.lighten initiative. (2013). *THE RAPID TRANSITION TO ENERGY EFFICIENT LIGHTING: AN INTEGRATED POLICY APPROACH*. The United Nations Environment Programme.

toolkits that provide best practices guidance and technical and practical tools during the phasing-out stage, funding for the implementation of energy efficiency projects and commitment from the private sector to adopt energy efficient best practices.

Nearly 3 billion people and over 90% of rural area households in developing countries⁶¹ cook their food using open fires or stoves fueled by biomass (animal dung, agricultural residue, wood and charcoal) or coal. A report by Choudhury (2013) Burning biomass releases toxic substances such as black carbon and methane, which gives rise to respiratory illnesses. Exposure to these toxic elements results in the deaths of 4 million people each year⁶² including 4,900 children in Kenya. The released elements also contribute to greenhouse gases in the atmosphere. Biomass and coal therefore have great impacts on the environment and human lives and adoption of better cooking products will lead to the reduction of a large share of greenhouse gas emissions and decrease the threat to human life.

To address this issue, INGOs, over 1,800 private companies and IGOs have collaborated with governments to establish the Global Clean Cook stove Alliance⁶³ whose goal is to increase global utilization of clean cookstoves and fuel. The alliance's goal is for 100 million households in developing countries to adopt cookstoves by the year 2020 which it hopes to achieve by eliminating market barriers that might hinder the global use of clean cookstoves. The Alliance has collaborated with partners in Kenya to encourage the removal or reduction of taxes and tariffs which create barriers for the growth and spread of cook stoves in the country. The Kenyan government has consequentially reduced import duty on fuel-efficient cookstoves from 25% to

⁶¹Marcos Arbex, J. E. (2004). Biomass burning and its effects on health. *Jornal Brasileiro de Pneumologia*, vol. 30(2)(158-175). Retrieved from <https://dx.doi.org/10.1590/S1806-37132004000200015>

⁶²Choudhury, N. (2013, November 4). Clean cookstoves can save lives and slow climate change. *Climate Home News*.

⁶³*Clean Cooking Alliance*. (n.d.). Retrieved from <http://cleancookstoves.org/partners>

10% and removed VAT on biomass cookstoves and LPG⁶⁴. Through its initiative, the alliance aims to reduce life loss, improve children's health, mitigate climate change, empower women and girls and improve livelihoods. Recognizing that women are mainly responsible for household energy management and are therefore vital in adoption of clean cooking initiatives, the alliance provides funding to organizations that enable the development of initiatives that that empower women, increases the number of women participating in business and in so doing tackle gender issues.

The study observed that clean cookstoves not only have health benefits, but they also contribute to a cleaner environment. The clean cooking alliance reports (Clean Cooking Alliance, n.d.) that energy efficient cookstoves reduce fuel usage by 30-60%. Widespread distribution and usage of cookstoves therefore has the potential to greatly reduce greenhouse gas emissions. Black carbon, also known as soot, has a short life span with its levels in the atmosphere being washed out within a few days⁶⁵. Decrease in its production through cookstoves is therefore one of the fastest ways to reduce warming, more so because burning biomass is responsible for 25% of the black carbon in the atmosphere⁶⁶. Reduction of biomass burning emissions also reduces air pollution, decreases deforestation and increases economic growth and time saving because consumers do not have to search for fuel e. g firewood or spend money on expensive fuel.

Oil and Gas

The oil and gas sector is the second largest contributor of greenhouse gases through its contribution of methane, CO₂ and N₂O. Studies by the Global Methane Initiative (2011) found

⁶⁴ Clean Cookstoves Alliance. (2016, June 22). Retrieved from Kenya Drops Trade, Tax Barriers to Aid Adoption of Cleaner Cooking Technologies: <http://cleancookstoves.org/about/news/06-22-2016-kenya-drops-trade-tax-barriers-to-aid-adoption-of-cleaner-cooking-technologies.html>

⁶⁵ Venkatesh Rao, J. H. (2010). Black Carbon as a Short-Lived Climate Forcer: A Profile of Emission. *Presented at the EPA Emissions Inventory Conference* (pp. 1-4). San Antonio: US Environmental Protection Agency.

⁶⁶ Charity Garland, S. D. (2017). Black carbon cookstove emissions: A field assessment of 19 stove/fuel combinations. *Atmospheric Environment, Volume 169*(ISSN 1352-2310), 140-149.

that the sector is responsible for 20% of anthropogenic methane emissions which are responsible for 40% of radiation trapping by anthropogenic greenhouse gases in the atmosphere. Though methane has a shorter life span than carbon, it has greater effects on climate change due to its effectiveness in absorption of heat. While it is in the atmosphere, the gas is over 30 times more harmful than CO₂⁶⁷. Oil production produces natural gas as a by-product which has methane as one of the key constituents. After production, the gas is released into the atmosphere or burnt to emit carbon dioxide which is less potent than methane. Decreasing methane emissions in the oil and gas sector can reduce 15% of total greenhouse gas emissions⁶⁸. Companies are the key actors in production of oil and gas and action from them will have more impact than from governments alone. If the companies, NGOs and governments cooperate, even more success is achieved. Non-state actors have in response to the need for reduced methane and CO₂ reduction started initiatives such as the Climate and Clean Air Coalition Oil & Gas Methane Partnership and the Global Gas Flaring Reduction Partnership.

The Climate and Clean Air Coalition Oil & Gas Methane Partnership is an initiative by INGOs, IGOs, states and oil and gas companies including Eni, Southwestern Energy, Total, PTT, Statoil and Pemex. The study found that the companies commit to develop methane reduction action plans in collaboration with a CCAC representative within 6 months of becoming partners by signing a Memorandum of Understanding. They also commit to carry out emissions surveys of nine sources that are mainly responsible for methane emissions during oil and gas production in

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Yvon-Durocher, G. A.-P.-D. (2014). Methane fluxes show consistent temperature dependence across microbial to ecosystem scales. *Nature*, 488-491.

⁶⁸ CCAC. (n.d.). *The CCAC Oil & Gas Methane Partnership*. Retrieved from <http://ccacoalition.org/en/activity/ccac-oil-gas-methane-partnership>

accordance with the initiatives' framework⁶⁹. The surveys are done to identify and document existing sources of emissions, document control measures already in place as well as measures being implemented and quantify methane emitted by the uncontrolled sources. For the uncontrolled sources, the companies agree to assess mitigation measure made available by the CCAC and implement recommended emission mitigation options or alternatives where required. As per the framework, the companies also agree to submit to submit an annual report to the CCAC detailing the operations on which emissions surveys were carried out, the results of the survey, a summary of methane reduction projects, estimate of methane emissions reduction achieved, scheduled methane reduction and prevention activities and progress in achievement of goals. The partnership also develops tools and documents to aid the participating companies by giving technical guidance on best practices as well as questionnaires and forms to guide companies in identification of mitigation options.

INGOs such as SNV have in collaboration with intergovernmental organizations such as the World Bank and governments of oil producing nations and international oil and gas companies formed the public-private initiative Global Gas Flaring Reduction partnership⁷⁰. The goal of the partnership is to collaborate in the reduction of gas flaring by eliminating technical and regulatory market barriers as well as challenges to the development of gas infrastructure. To achieve this, the collaboration has facilitated the commercialization of natural gas, established policies to guide companies on the reduction of flaring and developed standard flaring reduction policies which the host governments are expected to implement (World Bank).

⁶⁹ CCAC. (2014, August 8). *CCAC OIL AND GAS METHANE PARTNERSHIP FRAMEWORK*. Retrieved from <http://ccacoalition.org/en/resources/ccac-oil-gas-methane-partnership-framework-document>

⁷⁰ World Bank. (n.d.). *Global Gas Flaring Reduction Partnership (GGFR)*. Retrieved from <http://www.worldbank.org/en/programs/gasflaringreduction>

The Global Gas Flaring Reduction partnership has managed to raise global understanding of gas flaring and its impacts on climate and it has provided a platform for the usage of satellites to observe and quantify flaring globally. It has contributed to reduction of emissions caused by flaring through the establishment of regulations in different states and through the development of gas utilization projects. The partnership has implemented projects in countries to demonstrate the utilization of natural gas and it has helped developing countries such as Nigeria and Cameroon to reduce levels of flaring through collaboration with the oil companies in the countries⁷¹.

Forestry Initiatives

Forests are essential in maintain nature's cycles. They absorb over 30% of the total carbon emissions⁷² and are considered to be the largest reservoirs of carbon. However, just as forests absorb carbon emissions, they are also a big source of carbon as can be seen in figure 1 below. The absorption ability of trees decreases as the tree ages, is overused or cleared and when the forests is not managed. Studies by Imo. M⁷³ showed that the forests covered 1.7% of the total in 1996 which was a decline from the 12% forest land 2-3 centuries ago.

⁷¹

World Bank. (2006). *Global Gas Flaring Reduction Partnership Issue Brief*. World Bank.

⁷² Buis, A. (2014, December 29). NASA Finds Good News on Forests and Carbon Dioxide. *NASA*. Retrieved from <https://www.nasa.gov/jpl/nasa-finds-good-news-on-forests-and-carbon-dioxide>

⁷³ Imo, M. (2012). *Forest Degradation in Kenya: Impacts of Social, Economic and Political Transitions*. (J. W. Wangai, Ed.) Nairobi: Nova Publishers.

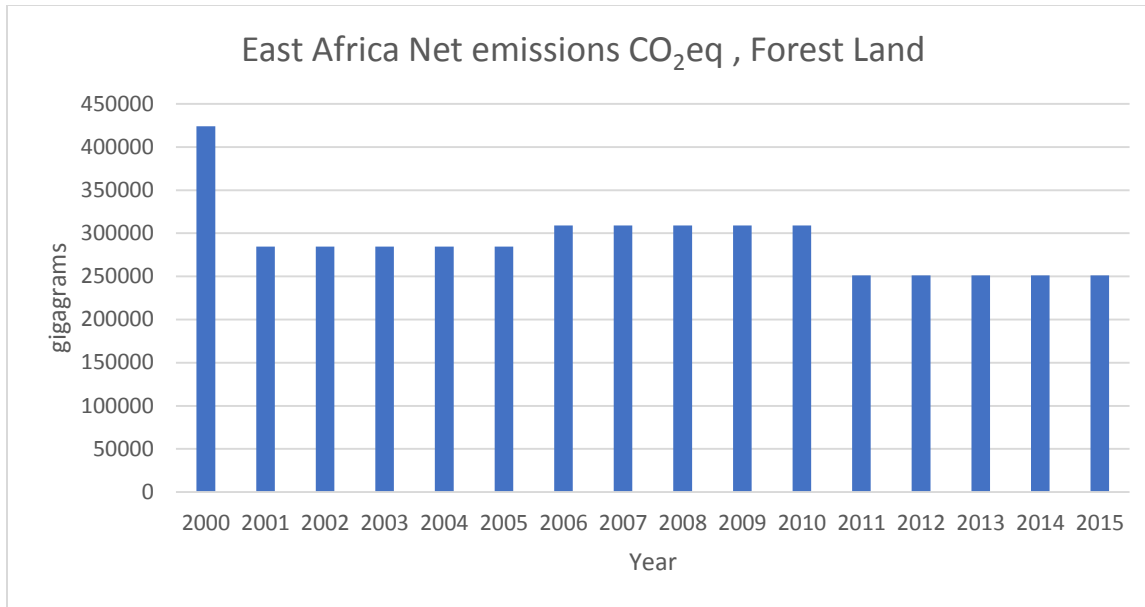


Figure 1 Emissions produced by forest land in East Africa. Data Source; FAO

When mismanagement of forests happens, they become emitters of carbon with a fifth of emissions originating from trees. It is therefore necessary to stop destruction of forests and to manage them to continue getting the benefits and avoid the negative effects. Various non-state actors have formed partnerships alone or by collaborating with governments to address this issue.

The Bonn Challenge is one such initiative. International Union for Conservation Nature partnered with the German government to form this initiative and was later joined by New York Declaration on Forests⁷⁴. The initiative stated that its objective is to regain landscape to ensure present and future needs and human well-being are met and to restore land usability and benefits over time. It aims to increase the health and number of trees and restore the productivity of land by restoring 150 million hectares of deforested and degraded land globally by 2020 and 350ha by 2030 (Bon Challenge, n.d.). The initiative further explained that this restoration is expected to result in economic benefits that will result in an increment of income opportunities for rural

⁷⁴ Bon Challenge. (n.d.). Retrieved from <http://www.bonnchallenge.org/content/challenge>

households through jobs availability while achievement of the restoration of 350ha will result in increased crop yields and more absorption of CO₂ from the environment (Bon Challenge, n.d.). The initiative does not focus on individual states but on entire landscapes instead where it restores and improves the sustainability of forests and other ecosystems without destroying existing forests. Different stakeholders including vulnerable groups are involved in decision making regarding land recovery action plans and goals and benefits sharing among other processes. The Bonn challenge bases its approach on the economic, social and cultural values and needs of the local community and uses this information in combination with scientific knowledge and best practices to establish to implement strategies. Through the challenge, partners exchange information and learn while new tools and knowledge are developed. By 2017, the initiative had received pledges of 168.43 million hectares of land with Kenya pledging to restore 5.1 million hectares by 2030 which is expected to have economic benefits that total USD\$1.6 billion and reduce 0.48gigatonnes of carbon emissions (Bon Challenge, n.d.).

The Bonn Challenge inspired the development of similar regional initiatives such as AFR100 for Africa and Initiative 20x20 for the Caribbean and Latin America. The initiative 20x20 aims to reduce land degradation by restoring 20 million hectares of land by 2020 and in so doing support the achievement of the Bonn Challenge. The initiative's members include 43 technical organizations, 17 states and 21 private investors from Latin America and the Caribbean. Technical partners include NGOs such as ICRAF and Ecoplant Bamboo, among others, who provide the required information and support restoration activities. Financial partners include

private companies and investors who provide finances that support projects. The participating private investors have at the time of this committed USD\$2.6 billion for restoration projects⁷⁵.

The study found that⁷⁶ that AFR100 aims to restore 100 million hectares of degraded landscape as mandated by the African Union. By doing this, the initiative contributes to the achievement of the Bon challenge goals as well. The initiative so far has 21 partnering states, 12 technical partners and 9 financial partners. The technical partners include NGOs such as Catholic relief services, Kijani Forests for Change and the Greenbelt Movement among others while the financial partners include private sector partners such as Ecoplanet Bamboo and Terra Global Capital who have committed to provide US\$ 481 million. The financial partners make it possible for AFR100 to convert commitments into actual results while the technical partners provide technical support for planning, monitoring, workshops for sharing tools and knowledge and enabling conditions. In 2017, technical partners established teams to identify and resolve implementation barriers and set-up approaches and measures that could be successfully implemented by all partners.

UCS⁷⁷ states that some of the biggest causes of deforestation are palm oil and soya cultivation, livestock rearing and trees felling for paper and board production. According to the study, the four products result in loss of 3.83 million hectares of forest land. All these are major ingredients in production by most consumer goods companies. The European Palm Oil Alliance states that (EPOA, n.d.), palm oil is the most produced vegetable oil and is used in the production of different products such as cooking oil and margarine in the food industry and cosmetics and soap

⁷⁵ The initiative 20x20. (2018). Retrieved from <https://initiative20x20.org/publications/initiative-20x20-infographic>

⁷⁶ AFR100. (n.d.). Retrieved from <https://afr100.org/content/about-us>

⁷⁷ UCS. (2017). What's Driving Deforestation? Union of Concerned Scientists. Retrieved from <https://www.ucsusa.org/global-warming/stop-deforestation/whats-driving-deforestation#.XBEWZmgzBIU>

in the oleochemical industry. The Soy is also one of the major crops in the world⁷⁸. It is used as food for human and animals, in the manufacturing of cosmetics and as biofuel. The growing global population has increased demand for beef which has contributed to an increase in livestock production and expansion of pasture for it⁷⁹. As a result, forests are cleared and burned to create room for grazing. Cattle grazing in these areas is beneficial only for a short period after which the land becomes degraded due to overgrazing and nutrient loss and can support neither grazing or farming. The consumer goods forum reports⁸⁰ that 40% of industrial wood trading worldwide is because of the paper and pulp industry. There is therefore need for responsible sourcing in all these industries.

Companies in these sectors have therefore come together to form the Consumer Goods Forum. The initiative recognizes that the members are responsible for the high demand of these goods and can therefore ensure sourcing of ingredients does not contribute to deforestation. The initiative aims to achieve zero net deforestation by 2020 through the sourcing of raw materials from farms that comply with the set laws and regulations and who do not involve burning when planting, re-planting or managing existing cultivations. Members are required to establish policies that avoid controversial sources of ingredients, work with stakeholders to stop deforestation and vegetation loss and source from certified producers in accordance with the initiative's guidelines⁸¹. The companies agreed that they will monitor supply at farm levels to

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Herman, G. L. (2011). *Crops that feed the World 2. Soybean—worldwide*. Springer.

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DeCapua, J. (2012, March 28). Developing Countries See Sharp Rise in Meat Consumption. *VoA*. Retrieved from <https://www.voanews.com/a/decapua-farm-animals-29mar12-144898655/179917.html>

⁸⁰

CGF. (n.d.). *Paper & Pulp*. Retrieved from <https://www.theconsumergoodsforum.com/initiatives/environmental-sustainability/key-projects/deforestation/paper-pulp/>

⁸¹ Consumer Goods Forum. (2016). *The Sustainable Soy Sourcing Guidelines* (Second Edition ed.). The Consumer Goods Forum.

ensure no deforestation is taking place. The initiative's objective is being achieved through partnerships with NGOs and governments and stakeholder meetings, documentation and other materials.

Agriculture

Agriculture is affected by climate change and is also a producer. Changes in temperatures, rainfall patterns and increase in severity and frequency of climatic shocks have a great effect on agriculture. These changes affect food security through decrease in food availability and increase in food prices. Increased temperatures have contributed to the spread of pests. Areas that were previously inhabitable for pests due to unfavorable conditions are now warming up and becoming habitable⁸². In addition to this, cases of droughts and floods have been on the increase over the last few decades. The reduction in water availability during droughts decreases crop yield while floods wash away crops and spreads pathogens. While increased CO₂ levels increase plant growth, they decrease the nutritional quality in crops such as cereal and forage which have lower protein concentrations when exposed to high CO₂ conditions⁸³.

Though agriculture is affected by climate change, it also contributes to it. 30% of global methane emissions are from livestock farming⁸⁴.

⁸²Deutsch, C. A. (2018). Increase in crop losses to insect pests in a warming climate. *Science*.

⁸³ Francoise Briet, C. T. (2003). Effect of malnutrition and short-term refeeding on peripheral blood mononuclear cell mitochondrial complex I activity in humans. *The American Journal of Clinical Nutrition*, 77(5), 1304–1311.

⁸⁴ Morris, J. (n.d.). Enteric fermentation. Retrieved from <http://www.ccacoalition.org/en/activity/enteric-fermentation>

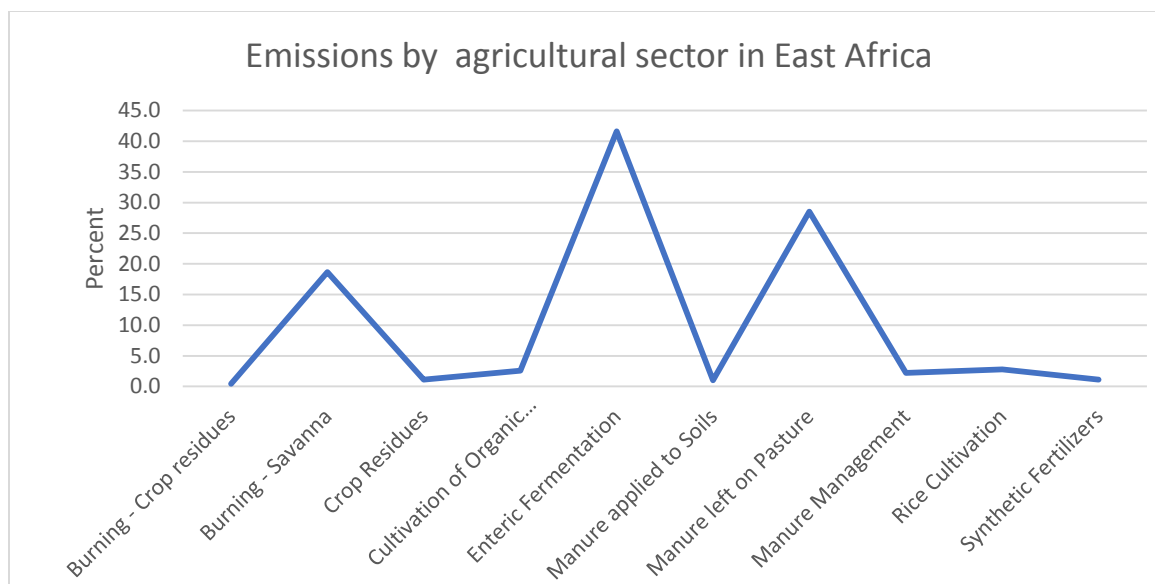


Figure 2; emissions in East Africa's agricultural sector from 2000-2015 with enteric formation as the main source. Source; FAO Database

Figure 2 below shows that the main source of methane in the agricultural sector is enteric fermentation, a digestive process in ruminant animals. Ruminant animals such as cattle and goats produce methane as a by-product when digesting food and later release it mainly through belching. Presence of numerous animals in one area means that there is plenty of manure. When exposed to anaerobic conditions, manure decomposes with some of the end products being CO₂ and methane⁸⁵. Ammonia in manure is converted into nitrate and the nitrate is later converted into Nitrous Oxide which is released into the environment. The use of Nitrogen fertilizer also contributes to emission of Nitrous Oxide. Soil microbes convert the Nitrogen fertilizers into nitrous oxide and release the gas into the atmosphere. Nitrous oxide has 300 times more warming power than carbon dioxide⁸⁶ and a lifespan of 110 years before it is naturally removed from the atmosphere through a process that also reduces the ozone layer. Land use changes due to agriculture also result in increased emissions. Land use changes such as deforestation for use in agricultural production compromises greenhouse gas sinks and creates more room for increased

⁸⁵ Paul Jun, M. G. (2002). *CH₄ AND N₂O EMISSIONS FROM LIVESTOCK MANURE*. ICF Incorporated.

⁸⁶ Waldman, S. (2017, May 30). Nitrous Oxide Poses Fresh Threat to the Arctic. *Scientific American*.

emissions through the increased agricultural practices. Reduction in emissions could probably prevent more than 50 Million tons of annual crop loss which will result in significant economic gains⁸⁷ and a slow-down in global warming.

Initiatives addressing the four largest sources of emissions in the sector which include enteric fermentation, paddy rice production, livestock and manure management and open burning of agricultural crops have therefore been developed by various non-state actors. The CCAC has developed livestock and manure management measures for the introduction of manure management practices into existing agricultural systems. By doing so, existing practices are improved, and emissions of harmful gases are reduced. To achieve this, the initiative has partnered with regional centers including International Livestock Research Institute (ILRI) in Africa who are collaborating with local farmers and other key stakeholders to incorporate best practices in their agricultural activities such as feeding practices which will increase milk production from fewer animals. In Kenya and Ethiopia, ILRI has worked with stakeholders to encourage production and utilization of improved quality of forage for animal feed which has the potential of reducing emissions by 8-24% and up to 27% in Kenyan and Ethiopia respectively. ILRI is also encouraging the use of bio-digesters in intensive livestock farms. Where methane produced due to the digestion of the manure can be used for cooking and in so doing reduce emissions and diseases. This form of manure management could potentially reduce manure emissions by 60%-80%⁸⁸.

⁸⁷ WMO, U. a. (2011). *Integrated Assessment of Black Carbon and Tropospheric Ozone*. Nairobi: UNON/Publishing Services Section.

⁸⁸ KASYOKA, S. (2018). Investing in low emissions development strategies in the dairy sector: Viable options for Kenya and Ethiopia. *Sustainable Livestock systems*.

Chapter 3 Climate change in East Africa and it's impacts on vulnerable groups

East Africa consists of four main climatic regions. The first region is the Horn, which comprises of an arid and semi-Arid climate with rainfall in the June-October period. Second is the highlands region, where the climate is humid to sub-humid with rainfall during the March–May and October–December periods. Third is the coastal region whose climate is mostly semi-arid with the same rainfall pattern as the highlands and finally the southern regions which have experienced temperature increases since the 1980s⁸⁹.

The East African region is especially vulnerable to climate change due to a few reasons. The first being its geographical position. The regions closeness to the equator means that it already experiences high temperature and is therefore very hot. Some of the hottest nations in the world such as Ethiopia and Sudan are found in East Africa. The East Africa region is also already prone to droughts and floods due to the La Nina and El Nino effect where moisture is pulled from East Africa towards Australia and Indonesia and vice versa⁹⁰. These climatic shocks are not only on the increase but are also becoming unpredictable with climate change.

The second reason for the region's vulnerability is poor governance and ethnic conflict which lead to inadequate healthcare systems and infrastructure. When these are combined with the lack of adequate resources and the rapidly increasing population, adapting and mitigating climate change is nearly impossible. The final reason is the environmental stress due to human activities

⁸⁹ Rigaud, K. K., de Sherbinin, A., Jones, B., Bergmann, J., Clement, V., Ober, K., . . . Midgley, A. (2018).

GROUNDSWELL, PREPARING FOR INTERNAL CLIMATE MIGRATION. Washington, DC: © World Bank.

⁹⁰ Caroline C. Ummenhofer, A. S. (2009). Contributions of Indian Ocean Sea Surface Temperatures to Enhanced East African Rainfall. *Journal of Climate*, 993-1013.

in the region. Deforestation and pollution increase the impacts of climate change and compromises the region's ability to mitigate the effects of climate change. Deforestation in Africa is mainly due to the increasing population which demands for more food and shelter. Mt. Kilimanjaro and the Mau Forests have been destroyed to create room for farming and settlements and East African countries like Tanzania and Burundi have been losing 1% and 3% of their forests per year⁹¹. These vulnerabilities mean that climate change is and will continue having intense impacts in the different sectors of Africa.

Figure 3 shows that temperatures in East Africa have increased over the years from 0.25°C in 1960 to over 1°C in 2015. These increases have had an impact on East Africa's economic sectors such as agriculture, water and energy. This chapter reviews these impacts.

⁹¹ *Mongabay.com*. (n.d.). Retrieved from <https://rainforests.mongabay.com/deforestation/archive/Burundi.htm>

Mean Temperature Change of Meteorological year (1961-2017)

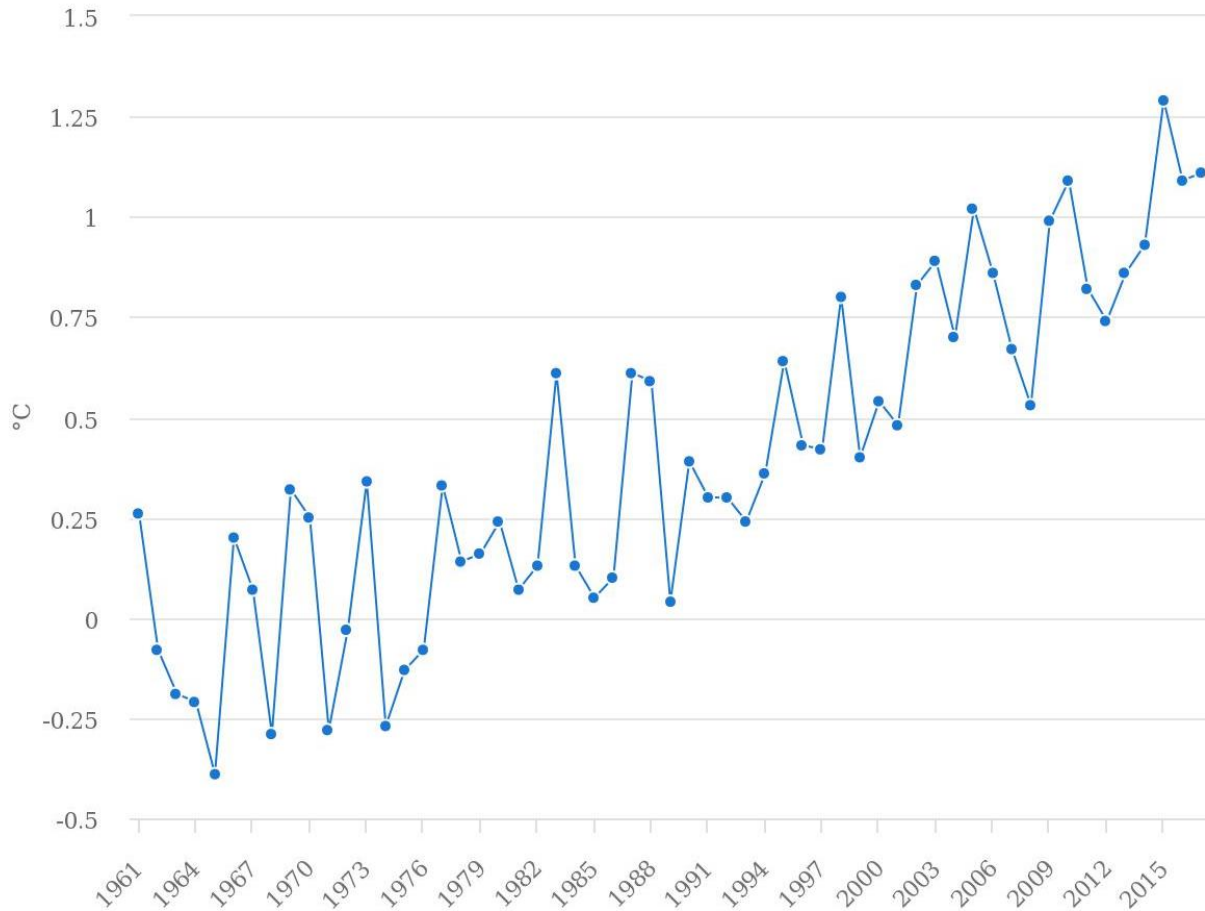


Figure 3 East Africa Temperature Change; source; FAO Database

Water Sector

The water sector is greatly vulnerable to climate change due to the involvement of climate change in all components of the hydrological cycle and is one of the major ways through which the effects of climate change are felt. Climate change poses a threat to water availability and not just in quantity but in quality and temperature as well. This will especially increase pressure on nations that already experience issues in accessing fresh water such as inadequate water or water pollution which will be exacerbated by climate change.

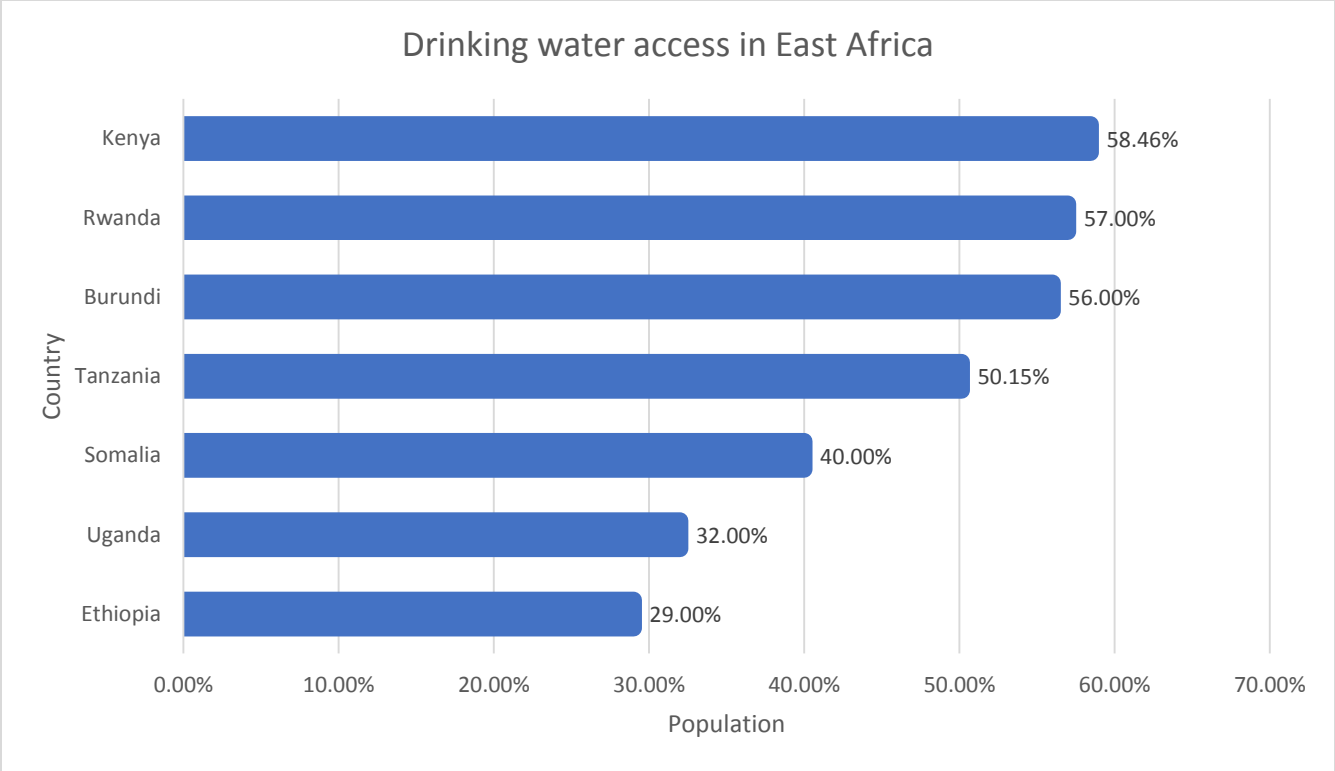


Figure 4: Percent of population with Access to basic and safely managed water services in East Africa, source WHO statistics.

East Africa is located in the second driest continent in the world. Globally nearly 700 million people do not have access to safe drinking water and around 150 million of these are in East Africa⁹² where a good portion of the population currently has no access to basic drinking water services. According to WHO⁹³, drinking water is considered to be basic when it is from an improved source and collecting time is not more than 30 minutes. As per the graph in figure 4 above, only four East African countries have at least half of their population accessing basic drinking water while majority of the citizens in the other country have no access. This means that over 50% of the population in East Africa does not access water that is free of contamination or that is readily available. Threats to water quality and quantity in the region will therefore have a great effect on many people and the nations will be forced to look for water sustainability

⁹² Delivering clean water in East Africa, Center for public impact

⁹³ WHO, retrieved from https://www.who.int/gho/mdg/environmental_sustainability/water/en/

measures which will be a challenge considering the limited resources of the East African countries.

Water shortage in East Africa is mainly due to the uneven distribution of water resources within the region.

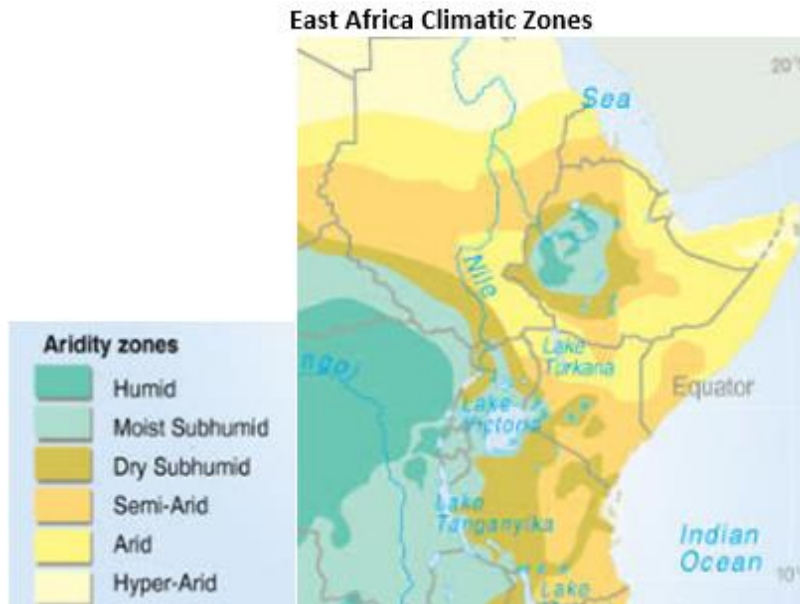


Figure 5; Climatic Zones of East Africa. Source; Institute Water for Africa

Figure 5 above shows that water distribution varies greatly within the region which has four climatic zones. Moist sub-humid in Burundi, Uganda and Rwanda, dry sub-humid in parts of Ethiopia, Kenya, Tanzania and Semi-arid and arid in most of Somalia, Ethiopia and Kenya.

The moist sub-humid zones experience a rain surplus while Arid and Semi-Arid areas experience a water deficit. East African governments lack the funds necessary for the infrastructure required to transport water from high availability to low availability water area and as a result, water remains in areas where it is not needed and does not find its way to where it is required. This study reviewed how climate change has affected different water sources in East Africa.

Lakes and Rivers

Lakes and rivers are an important source of water in East Africa. Water from lakes and rivers is needed for consumption, agriculture and energy. Fishing from lakes and rivers also provides a source of food for the residents in these areas. Lakes in east Africa have experienced a temperature increase since the 1900s. Lake Tanganyika has experienced a 0.9 to 1.3° C temperature increase over the last 150 years and is warmer at the moment than it has ever been in 1500 years. Warmer lake temperatures have resulted in dire consequences for the lakes' ecosystems because they have warmed up the surface water of the lake making it lighter in the process while the deeper layers have maintained cool temperatures⁹⁴. This has created a density difference in the lake's water which the wind is therefore unable to mix. Oxygen is consequently not transported to the deeper layers of the lake and nutrients are not transported to the surface water which results in plankton reduction⁹⁵. This has resulted in loss of habitat and food for the fish and ultimately fish decline. Fish decline in Tanganyika Lake has been taking place since the 19th century which is when increase in water temperatures began. The warming has resulted in decrease of the lake species by 38% since the 1940s. Lack of Oxygen in the deeper layers of the lake has also led to death of bottom dwelling creatures. This is supported by a Cohen A et al (2016) study on the remains of algae and sea creatures that were located in the sediment at the bottom of the lake shows that increase in the lake's temperatures resulted in a decrease in the number of algae and sea creature bits in the sediment.

Warmer temperatures have also increased the evaporation rate and thus caused a decrease in water levels in East African lakes. Temperatures around Uganda's Lake Wamala have been on

⁹⁴ Lake Tanganyika, <http://www.climatehotmap.org/global-warming-locations/lake-tanganyika-tanzania-africa.html>

⁹⁵ Climate warming reduces fish production and benthic habitat in Lake Tanganyika, one of the most biodiverse freshwater ecosystems by Andrew S. Cohen et Al. Aug,08,2016.

an annual increase of 0.02-0.03°C since the 1980s⁹⁶. Figure 6 below shows a continuous decline in the lake's water levels that is as a result of increase in evaporation rate which has disrupted the water balance.

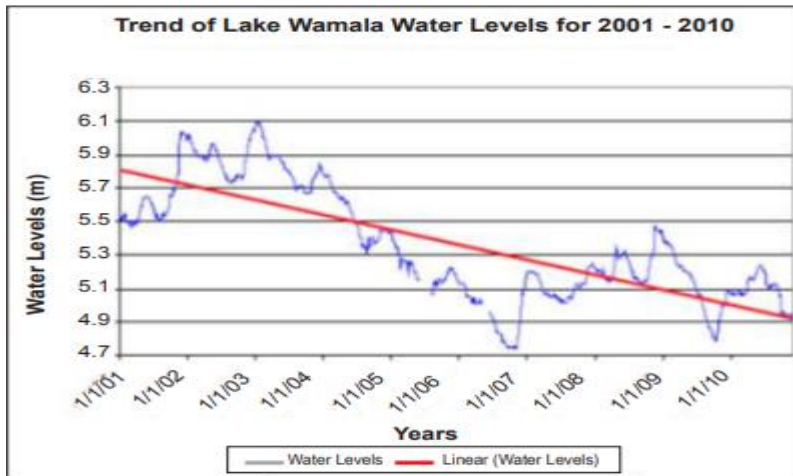


Figure 6 Lake Wamala changing levels. Source UGANDA WETLANDS ATLAS Volume Two

While the lake receives 80% of its water from rainfall, it is now losing 86% of its water through evaporation⁹⁷. The lake is therefore not able to maintain its historical water levels. Lake Wamala has in the past supported farmers and provided employment through sale of Tilapia to other regions but the retreat and at times drying up (1994-1998) of lake water has caused a reduction in fish availability forcing farmers to look for alternate sources of food.

Precipitation.

Climate change has created rainfall pattern variations in the region. Rainfall in the Horn region has declined with increases in temperature for the last six decades while rainfall in the other East Africa regions has decreased over the last three decades for the March-June period. This decrease has been linked to increase in temperatures of the Indian Ocean which result in

⁹⁶ Climate Change Shrinking Uganda's Lakes and Fish, Wambi Michael, <http://www.ipsnews.net/2015/08/climate-change-shrinking-ugandas-lakes-and-fish/>

⁹⁷ Government of Uganda. (2016). *Uganda Wetlands Atlas Volume II_Popular Version*. Government of Uganda.

increased rainfall over the ocean and lead to a decrease in rainfall in East Africa. With the exception of the highlands, rainfall variability is projected to increase throughout East Africa.

This is a concern for resources that greatly rely on rainfall as the source of water supply such as Lake Victoria, which gets 80% of its water from rain.

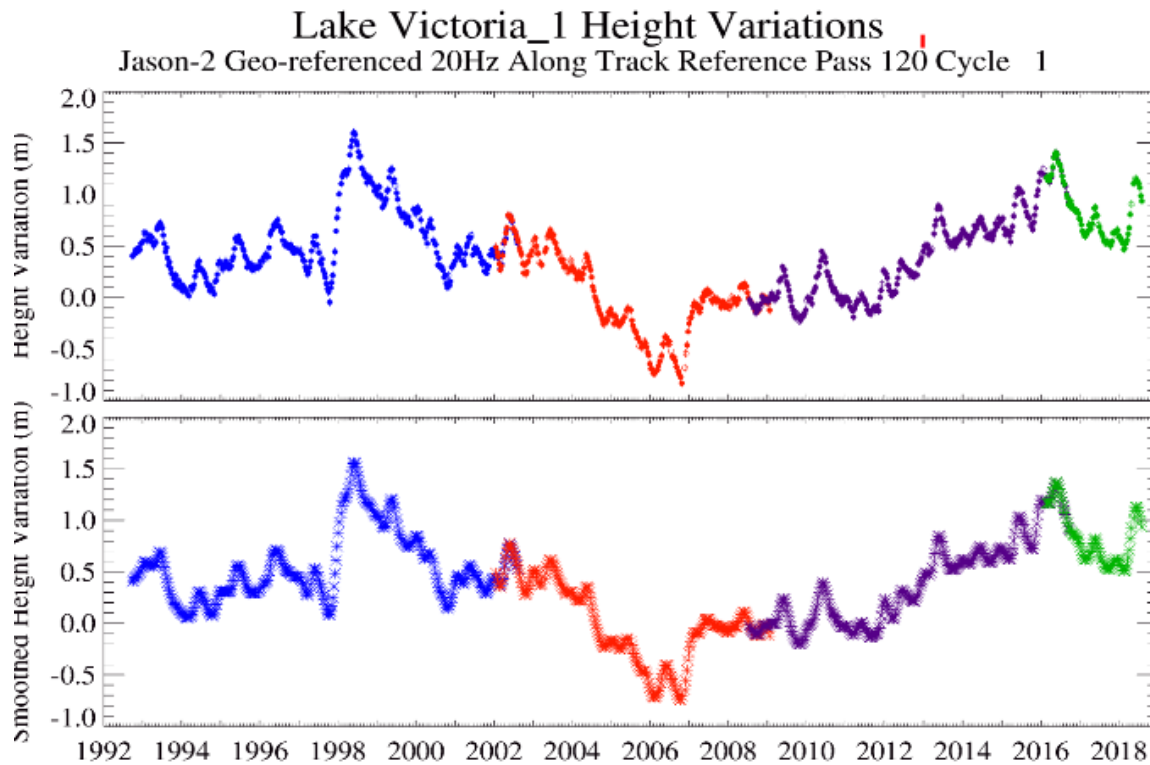


Figure 7 Lake Victoria height variations; source United States Department of Agriculture, Foreign Agricultural Service

Figure 5 above shows rainfall variations have an impact on water levels for water resources in East Africa. Above normal rainfall in 1998 resulted in an increase of around 1.8 meters in Lake Victoria while failure of the short rains between late 2005 and early 2006 resulted in below average water levels in the lake. Continued rainfall failures will cause a substantial change on the levels of the lake which provides water, and supports the agriculture and fisheries industries for Kenya, Uganda and Tanzania. Declining water levels will therefore result in immense losses for the region. During the 2005-2006 period, Uganda experienced power shortage due to the low

Lake Victoria water levels which reduced hydropower output⁹⁸. Decrease in precipitation has also reduced run-off for River Pangani and River Ruvu in Tanzania and as a result, the two rivers are projected to decrease by 6-9% and 10% respectively.

Glaciers

Glaciers in Africa are all situated in East Africa and can be found on Mount Kenya in Kenya, Mount Kilimanjaro in Tanzania, and Mount Rwenzori which borders Uganda and the Democratic republic of Congo. Reports by UNEP⁹⁹ showed that glaciers have since 1900 reduced by 80% and are projected to completely melt away by 2030. They are a major source of freshwater, in East Africa, which they release seasonally. This water refills rivers as well as water beneath earth's surface. Mount Kenya provides water to two million people and is the main source of water for rivers Tana and Ewaso Ng'iro. River Tana supports about three quarters of Kenya's electrical needs while River Ewaso Nyiro provides water in North Kenya, a land that is arid¹⁰⁰. Mount Kilimanjaro provides a livelihood to three quarters of the 1.5 Million people living around it who depend on the mountain for water and soil.

The impact of climate change on water resources in East Africa is intensifying the dryness currently experienced in the region. The decline of safe drinking water in the lakes and the retreating of the glaciers will result in water shortage increase in East Africa and will contribute to a decrease in agricultural produce.

⁹⁸ Kasita, I. (2012). Strategic plan to increase power supply pays dividends. *New Vision*.

⁹⁹ Initiative, I. C. (2012). *East African Highlands*. International Cryosphere Climate Initiative. Retrieved from <http://iccinet.org/east-african-highlands>

¹⁰⁰ Gichuki, F. N. (2005). *Threats and Opportunities for Mountain Area Development in Kenya*.

The Agricultural sector

Agriculture, on average, contributes to 43% of the annual gross domestic product in East Africa's and provides a living for about 80% of East Africans. This precise percentage however changes from one country to another with agriculture accounting for less than 30% of the GDP in Kenya, Madagascar and Eritrea but contributes more than 50% in Tanzania, Burundi, Congo, Ethiopia and Sudan¹⁰¹. The common factor in all these countries is that agriculture is mainly rain-fed and therefore greatly vulnerable to climate change. A change in climate therefore has substantial consequences for farmers in East Africa more so for the small-scale farmers who possess little or no technical and financial resources for better adaptation to climate change. Climatic events such as droughts and floods associated with climate change have become more noticeable in East Africa countries in recent years¹⁰². These events have become increased in severity and unpredictability and have had negative impacts on the agricultural sector through increase in crop and livestock loss. Drought occurrence rate in some parts of East Africa has reduced from once in every 10 years in the 1970s, to once in every 5 years in the 1980s, to once in every two years in the 1990s, to every year in the 2000s¹⁰³. Medium and low potential agricultural zones are projected to be most vulnerable to climate change the region. This is due to the fact that higher temperatures are more likely to affect medium and low potential zones than changes in precipitation while the opposite is the case for the highlands which will not be affected much by temperature increases due to current low temperatures but will be affected by change in precipitation.

¹⁰¹ Kabuye, M. F. (n.d.). Agricultural Development in East Africa. *Conference on Sustainable Agricultural Development*. Africa 2000 Network .

¹⁰² Preparing for Climate Change in Eastern and Southern Africa, UNEP, 2007

¹⁰³ GoK. (2010). *National Climate Change Strategy*. Government of Kenya.

Impact on crops.

Climatic events such as droughts lead to lack of seeds for planting, crop wilting, stunted growth as well as crop failure which all lead to loss of crop yield¹⁰⁴.

Maize

Maize is the most important crop in the region especially in Kenya, Tanzania, Malawi, and Ethiopia with maize farming takes up 40% of the total area under crop production.

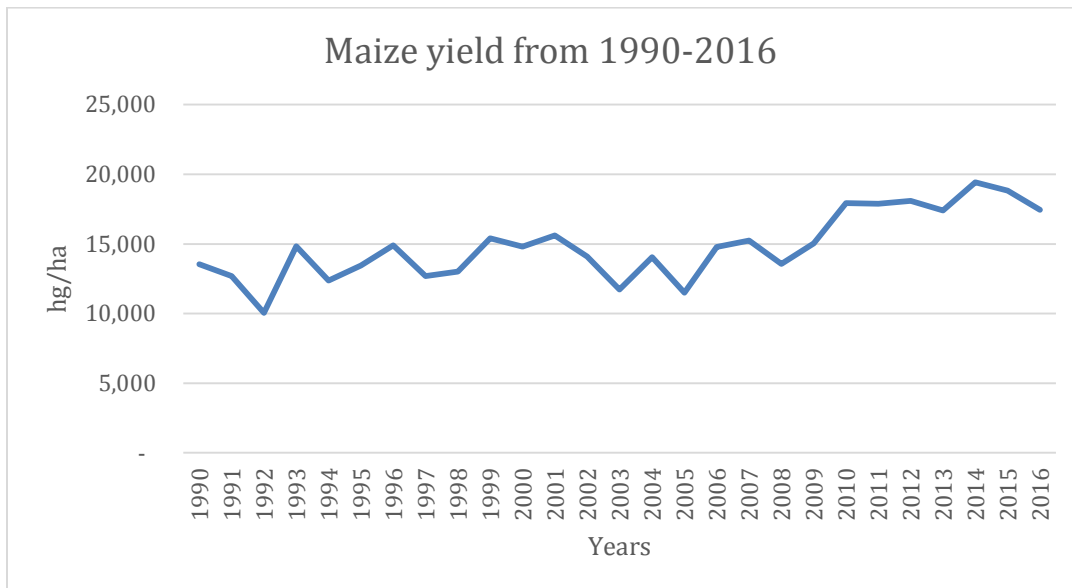


Figure 8 Maize yield produced. Source FAO

It is the major food in the region and is the main source of proteins and calories in most households providing more than one third of caloric intake in Kenya and Tanzania and one tenth in Uganda¹⁰⁵.

It is the most traded agricultural commodity and accounts for a large share of rural employment and agricultural GDP in the region.

¹⁰⁴ Huho, J. &. (2010). The Effects of Droughts on Food Security in Kenya. *International Journal of Climate Change: Impacts and responses*.

¹⁰⁵ Rico Ihle, S. v.-T. (2010). Country and border effects in the transmission of maize prices in Eastern Africa: evidence from a semi-parametric regression model. *AAAE Third Conference/AEASA 48th Conference* (pp. 2-4). African Association of Agricultural Economists .

Figure 8 above shows that maize is very sensitive to water shortage and water deficit. Below average rainfall in the East Africa region therefore has a negative effect on maize yield. Annual average maize yields per hectare in parts of East Africa for the 1995-2004 period was 13,546 hg/ha but during the 2006 drought, yields dropped from the mean by 2,054hg/ha which resulted in an increase in hunger across the region. Drought experienced in the 2016-2017 period also led to a decrease in maize production where yield for the July 2016-June 2017 period was 17,457hg/ha which was lower than production in the 2015-2016 periods.

Rice

Rice is another major crop in East Africa. It is the second most important crop in Tanzania and Malawi and third in Kenya and Zambia. (Nejadhashem, 2015)¹⁰⁶ Rice is mainly grown as a rain-fed crop in most East African countries with the exception of Kenya where it is irrigated and as a result rice production in East Africa is especially vulnerable to drought and heat stress. Figure 9 below shows that Exposure to temperatures high temperatures can contribute to poor plant yield and quality. Absence of rainfall which results in droughts means that there is inadequate water for irrigation in areas where rice is rain-fed. This affects the plant processes and eventually reduces crop yield. Climate change is generally projected to have a negative impact on rice in East Africa with the increasing temperatures expected to result in a 24% yield decrease by 2070 if adaptation measures are not taken.¹⁰⁷ On the other hand, an increase of temperatures in East African highlands, which are currently too low for rice growth, will provide new opportunities

¹⁰⁶ Climate change and eastern Africa: a review of impact on major crops pg. 117by Umesh Adhikari , A. Pouyan Nejadhashemi, & Sean A. Woznicki.

¹⁰⁷

Pepijn A. J. van Oort, S. J. (2017). *Impacts of climate change on rice production in Africa and causes of simulated yield change*. Wiley Online.

for rice growth because rice tends to thrive in warm climate. This shows that rice though rice will be affected by climate change, the magnitude may not be a much as that of other crops.

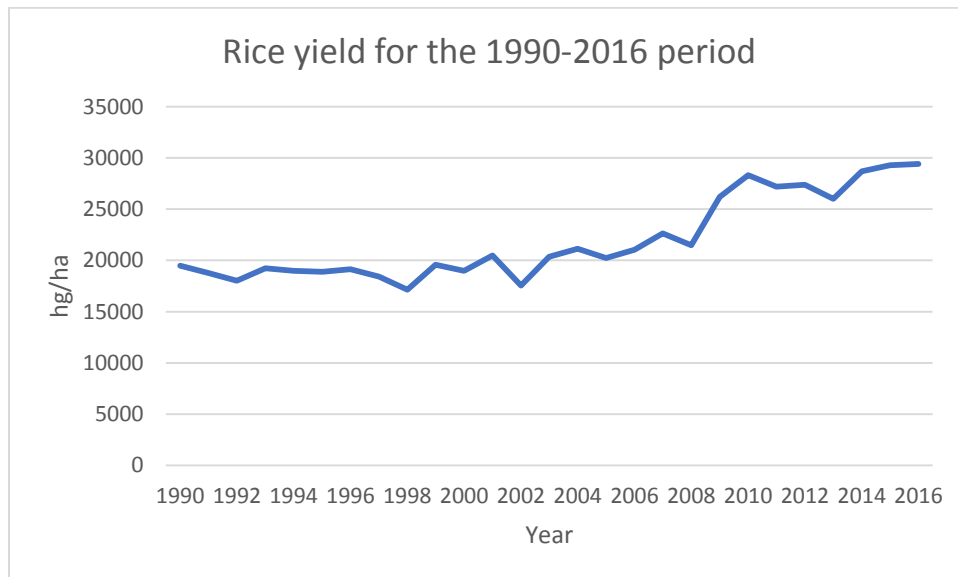


Figure 9; Rice yield 1990-2016, Source, FAO

Impact on Livestock

Livestock products are important for food security in the East Africa region. Livestock contributes 12%, 7.4%, 3.2, 10%, and 40% of the GDP in Kenya, Tanzania, Uganda, Rwanda and Somalia respectively. It also generates income and is a source of nutrition for households in the region as well as a source of employment. Farmers get income, from the sale of livestock and livestock products, which they use to meet their needs such as clothes, shelter and education. Livestock also provides required nutrition in the form of meat, milk, blood and eggs where 60% of edible livestock products is from cows (meat and milk), 20% from chicken (meat and eggs) and 20% is provided by small ruminants (meat and milk).

The livestock systems in East Africa create employment such as veterinary, herders, brokers and produce transporters. Livestock farming is therefore vital for economy and society of the East African region.

Climate change jeopardizes livestock farming in the region through extreme events which lead to competition for resources such as water between crops, animals and humans. Climate change has become evident in the East African region through frequent droughts, consecutive poor rains and unpredictable heavy rains that result in floods which makes climate change the major challenge to livestock farming in the region.

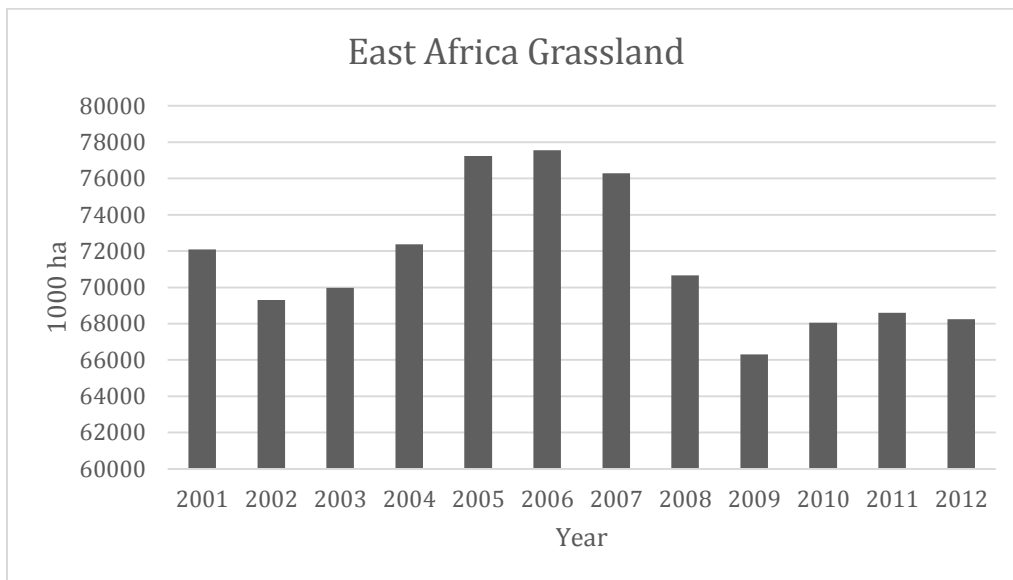


Figure 10 East African Grassland changes Source: FAO

According to Figure 10 above, crops are most susceptible to drought and a reduction in forage quantity and quality is the immediate result of drought. Little or no rainfall results in forage and feed reduction and ultimately no availability of food for livestock. The 2008-2009 drought experienced in East Africa led to a loss of 5,629,309ha of grassland. Heat stress also has an impact on forage quality. When forage is of poor quality e.g. it has low fiber and lignin content, it is more digestible. The retention time in livestock is reduced when poor quality forage is

ingested and the rate of passage of the food through the gastro-intestinal tract increases¹⁰⁸. These results in a decrease in nutrition acquired through forage which leads to a reduction in livestock produce such as meat and milk.

The decrease in forage creates more room for animal poisoning. Drought slows down the conversion of nitrate into proteins and amino acids in forage. This leads to a buildup nitrate in the plant and these high nitrate levels can be maintained in the plant for long periods of time. Plants such as grass and sorghum which are safe feed can become poisonous. Some naturally toxic plants like weeds, which have higher nitrate levels than crops, are drought resistant¹⁰⁹ and have the ability to survive the harsh conditions. Animals end up feeding on these plants as they are the only option available and the farmers feed some of the toxic weeds to their livestock. This leads to livestock death, reproductive failure and poor production. The Nyanza region in Kenya experienced livestock loss during the 2015 drought when cattle died from feeding on Bracken Fern, a drought resistant crop¹¹⁰.

The study discovered that reduction in water and food availability and the presence of heat stress force livestock farmers to sell off their animals at a rate lower than they would under normal circumstances and when the drought is over, the farmers have to buy livestock at a higher market price. Pastoralists sell part of their livestock so that they can buy food whose price, during the drought period, increase to up to three times its initial price. As was the case during the 2016-2017 drought in East Africa where according to FAO, food prices in Kenya increased by 30%

¹⁰⁸ Felipe Pino, L. K. (2018). Comparison of diet digestibility, rumen fermentation, rumen rate of passage, and feed efficiency in dairy heifers fed ad-libitum versus precision diets with low and high quality forages. *Full Terms & Conditions of access and use can be found at <http://www.tandfonline.com/action/journalInformation?journalCode=taar20> Journal of Applied Animal Research*, 1296–1306.

¹⁰⁹ Cornell University. (2012). *Drought and Risk of Nitrate Toxicity in Forages*. Retrieved from <http://nmsp.cals.cornell.edu/publications/factsheets/factsheet70.pdf>

¹¹⁰ Omoro, J. (2015, May 13). Cattle die in Homa Bay after eating toxic plant as drought persists. *The standard*.

and by 25% in Tanzania while livestock prices plummeted with goat prices decreasing by 60% in Somalia and 30% in Kenya¹¹¹.

Pastoralists are also forced to travel for long distances looking for food for their livestock with livestock in south Ethiopia travelling the greatest distance, 54km-75km, in search of grazing sites while livestock in Uganda cover the shortest distance.

Water is another reason behind the long-distance trekking. Lack of precipitation in arid and semi-arid areas of the region result in depletion of water sources which are under normal circumstances recharged by rainfall. Long dry periods lead to drying up of water sources which force the pastoralists to start tracking good quality water for livestock consumption. The¹¹²long distance treks reduces grazing time for the livestock and access to water by livestock is reduced to once every three to four days

The heats, water stress, decrease in food and unceasing trekking that are brought on by drought result in death of livestock. The 1995-1997 droughts in the East Africa region had a great effect on livestock mortality rate. The loss of livestock incurred in this period was greater than that experienced in other non-drought periods with Ethiopia experiencing the highest mortality rate of 45.5% per household and Uganda experiencing the lowest mortality rate of 9.5% per household. Cattle mortality increased to 46% in Ethiopia and 30% in North Kenya while small ruminant's mortality increased by 52% in Ethiopia and 33% in North Kenya¹¹³.

The Health Sector

East Africa's healthcare system suffers from shortage of health workers, technology, equipment, medicine and infrastructure especially in public institutions. These existing health issues could

¹¹¹ FAO. (2017, February 14). Drought is pushing food prices up sharply in East Africa. Retrieved from <http://www.fao.org/news/story/en/item/470220/icode/>

¹¹² Eastern Africa Federation Farmers, 2012, Eastern Africa Livestock Strategy Pp. 33-34

¹¹³ EAFF. (2012). *Eastern Africa Livestock Strategy*. Eastern Africa Farmers Federation.

intensify through increase in vector borne diseases, water borne diseases, and diseases due to disasters such as droughts due to climate change. The impact can be direct as is the case with heat stress or indirect for example vector-borne diseases such as the Rift Valley Fever and Malaria.

Rift Valley Fever and Malaria

Heavy rains and flooding in the region encourage the maturation of the Aedes and Culex mosquitoes which are the main transmitters of the Rift Valley Fever virus. The heavy rains cause flooding in low-lying grass lands which results in mosquito eggs hatching.

Kenya experienced a loss of 170 human lives in 1997 and 500 lives in 2006-2007 and a loss of 100,000 sheep in 1950-1951¹¹⁴. In 2018, WHO¹¹⁵ reported that outbreaks in Tanzania also resulted in a total of 109 mortality cases in the 2006-2007 periods while Somalia reported 51 life losses. The outbreaks were due to unusually high rainfall within the region which resulted in floods in many parts of Kenya, Somalia and Tanzania and created a suitable environment for the RVF virus. Climate change related heavy rainfall events as well as hydrological cycle extremes e.g. floods are likely to increase in future. This means that the likelihood of Rift Valley Fever occurrences in the country is likely to increase as well (Martin, 2008)¹¹⁶.

Heavy rains also encourage increase of Malaria which is regarded as the main potential impact of climate change in the region. The disease has been prevalent in the coast and swampy low land regions and has been a rare occurrence in the highlands. This has changed in recent decades and the disease occurrence rate in the central region has increased and highlands that were previously

¹¹⁴ Anyango, E. (2018, June 5). Kenya must wake up to the threat of Rift Valley Fever. *Business Daily*.

¹¹⁵ Rift Valley fever, Retrieved from <https://www.who.int/news-room/fact-sheets/detail/rift-valley-fever>

¹¹⁶ Martin, V. &. (2008). The Impact of Climate Change on the Epidemiology and Control of Rift Valley Fever. *Revue scientifique et technique (International Office of Epizootics)*, 413-426.

too cool for malaria are now experiencing an increase in this disease. The disease is deadlier in highlands because lack of exposure to the disease means that the residents have not developed immunity to it. Immunity is developed over generations of people exposed to the disease. East Africa's mountainous highlands were previously thought to be immune to malaria due to the low temperatures. Lack of exposure to the disease means that the impacts on the highland residents are more and complications such as lung and kidney failure occur after exposure especially if they do not get proper treatment which is likely the case due to high poverty levels as well as overstretched health care systems¹¹⁷. A malaria outbreak in the Kenyan highlands in 1998 resulted in the loss of hundreds of people. Increase of malaria incidents in Kenya's highlands is attributed to climate change related temperature increase in the region. The higher temperatures have made the region warmer and wetter resulting in an environment that is conducive for the malaria parasite to develop inside the mosquito¹¹⁸.

Cholera

Floods spread the bacterium to areas that were previously not infected and thus contaminates drinking water while droughts reduce water levels which lead to the accumulation of bacterium in high concentrations. The study observed that cholera in East Africa varies with changes in climate where high temperatures have been associated with increased cholera cases. Increased temperatures and excessive flooding during the 1997-1998 El-Nino resulted in a cholera epidemic in Kenya, Somalia and Tanzania¹¹⁹. High temperatures and rainfall around the Lake Victoria region have also increased the residents' vulnerability to cholera. The Lake Victoria

¹¹⁷ Barclay, E. (2008, January). Climate Change Fueling Malaria in Kenya, Experts. *National Geographic*. Retrieved from <https://www.buffalo.edu/content/dam/www/news/imported/pdf/January08/NatlGeographicMalaria.pdf>

¹¹⁸ Disaster Relief. (2002). *Highland malaria takes Kenya mountain towns by surprise*. Retrieved from <https://reliefweb.int/report/kenya/highland-malaria-takes-kenya-mountain-towns-surprise>

¹¹⁹ World Health Organization. (2016). *EL NIÑO AND HEALTH*. WHO.

region experienced a cholera outbreak following above normal temperatures and rainfall in April 1982 which later declined due to intervention but reoccurred once more in June when above normal temperatures and rainfall were experienced¹²⁰.

Energy Sector

Hydropower generates 70% of electricity in Kenya, 42% in Tanzania and 84% in Uganda¹²¹. Hydropower has been the most successful form of energy in the region because of its affordability, due to water availability, and the ability of experts to manipulate water flow to match demand. Climate change related droughts in East Africa negatively affect the regions' energy sector since hydropower heavily relies on precipitation for continuous productivity. Hydroelectric dams depend on the September-December and March-June rains for replenishment. Dry spells, with temperatures ranging between 25°C and 31°C, are experienced in between the rainy seasons in East Africa. The increase in temperatures results in increased evapotranspiration which reduces water levels in the dams. This makes hydropower production extremely vulnerable to climate change. East Africa drought during the 2004-2006 period caused a reduction in Lake Victoria levels which reduced hydropower generation in Uganda by 50MW and consequentially a decline in GDP from 6.2% to 4.9%¹²².

Droughts experienced in 1999-2000 in Kenya resulted in extremely low water levels in the seven forks. Hydropower production was therefore not enough, and this brought about countrywide

¹²⁰Wandiga, S. O. (2006). Climate Change Induced Vulnerability to Malaria and Cholera in the Lake Victoria Region. 48-50.

¹²¹Jiao Wang, L. S. (2017, June 29). World Resource Institute. Retrieved from <https://www.wri.org/blog/2017/06/no-water-no-power>

¹²² Stephen Karekezi, J. K. (2012). *Energy Security and Adaptation to Climate Change in East Africa and the Horn of Africa: Large Scale Hydropower vs. Decentralized Renewables*. Energy, Environment and Development Network for Africa.

power rationing that resulted in USD\$2 billion economic losses¹²³. Rainfall variability in the country and frequent droughts has resulted in a drop from 70% to 50% in hydropower production. The drought experienced in Kenya¹²⁴ in the year 2009, which is said to have been worse than any that had ever been seen before compelled the shutdown of Masinga dam which happened twice in that year.

Low dam water levels because of droughts have forced East African governments to switch to the more expensive diesel generated thermal power. In Kenya, the thermal power cost of KSH.20 is six times more expensive than hydropower (KSH.3) and 3 times more expensive than geothermal power (KSH.8)¹²⁵.

Impacts on vulnerable groups

Some groups are more vulnerable to climate change than others. This includes the elderly, children, the sick and the marginalized populations that are considered to be vulnerable because the nature of their tasks increases their exposure to climate change. Vulnerable groups suffer the most from climatic changes and events such as droughts and floods.

Low social economic status

Poverty and inequality continue to be an issue in East Africa despite the continued economic growth in the region.¹²⁶ 50% of the region's income is controlled by the top 20% of the population while the bottom 20% gets only 5% of the income.¹²⁷ By the year 2010, 38% of the

¹²³ Today, 2006, Drought in Kenya: Climatic, Economic and Socio-Political Factors. Pp 1-7, retrieved from <http://www.worldagroforestry.org/downloads/Publications/PDFS/NL06291.pdf>

¹²⁴ Standard media, KenGen shuts Masinga dam as water levels drop, the standard, 2009 <https://www.standardmedia.co.ke/article/1144018244/kengen-shuts-masinga-dam-as-water-levels-drop>

¹²⁵ OTUKI, N. (2017, May 10). Kenya drops on list of top hydropower producers. *Business Daily*.

¹²⁶ African Development Bank Group, 2018, *East Africa Economic Outlook*. Pp 10-13, retrieved from <https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/2018AEO/African-Economic-Outlook-2018-East-Africa.pdf>

¹²⁷ Social for International Development, 2012, *State of East Africa; Deepening Integration, Intensifying Challenges*

population in East Africa were living below the poverty line. Poverty levels in the region are greater in rural areas and in slums due to the low-income levels. Populations in these areas lack the capacity to cope with climatic changes which leaves them exposed to various climatic shocks that worsen their current situation.

Rising sea-levels in East Africa's Dar-es-salaam have eroded the coastline along with the plantation in it such as the coconut trees¹²⁸. This has affected low-income households who depend on coconut sales for income because they no longer have enough to sell and the decrease in residents means that they do not have as many customers for their products. In addition to this, floods are destroying houses and increasing the risk of infectious diseases among low-income households who reside in low lying coastal areas and have no means of preparing themselves for the rising sea-levels. (UNEP, 2018)

Children

Children are most vulnerable to climate change due to their physical, immunological, psychological differences in comparison to adults¹²⁹ an example being their small surface to body ratio which increases their vulnerability to dehydration and heat stress. Their underdeveloped immune system also makes them more susceptible to diseases unlike adults. Climate change in East Africa threatens to reverse steps made in reduction of child illnesses and mortality with 88% of climate change related diseases affecting children¹³⁰ particularly those from poor backgrounds. Children under 5 years and pregnant women are most vulnerable to malaria and rift valley fever. The risk of miscarriage in women is 7 times greater if they are

¹²⁸ UNEP, 2018, Rising sea-levels - How to stop a city from sinking.

¹²⁹ Science Daily, 2018, Children are highly vulnerable to health risks of a changing climate retrieved from

¹³⁰

Climate Change and Global Child Health, Rebecca Pass Philipsborn. (2018). *PEDIATRICS*, 141(6). Retrieved from <http://pediatrics.aappublications.org/content/141/6/e20173774>

infected with the Rift Valley Fever¹³¹. Children are the main victims of malaria with around 1 million children dying each year in Africa¹³².

Water shortage in times of drought as well as water contamination during floods increases risks of diarrheal diseases such as cholera which are a leading cause of mortality in East Africa¹³³. Floods experienced in Kenya in 2010 resulted in increases in incidences of cholera due to food and water contamination. Children under 5 years old were most affected by this with 70 mortalities in a day¹³⁴.

Food decrease due to increase in drought frequency and severity create situations of malnutrition. Malnutrition in East Africa results in children being underweight and experiencing stunted growth. Stunted growths in East Africa were 57.7%, 40.4%, 37.9%, 26%, 33.4% and 34.4% of the total children in Burundi, Ethiopia, Kenya, Rwanda, Uganda and Tanzania respectively while the number of underweight children were 28.8%, 25.2%, 11%, 9.3%, 13.8%, and 13.7%¹³⁵ in Burundi, Ethiopia, Kenya, Rwanda, Uganda and Tanzania. During the 2016 drought in East Africa, 6 million of the 10.2 million people in need of food assistance in Ethiopia were children while 100,00 of the 350,000 food insecure people in Somalia were children who UNICEF described as being acutely malnourished¹³⁶.

¹³¹Umea University. (2016). *Mosquito-borne Rift Valley fever virus causes miscarriage*. Retrieved from <https://www.sciencedaily.com/releases/2016/10/161003113242.htm>

¹³² Foundation., T. A. (2003). *The burden of malaria in Africa*. Retrieved from <https://www.againstmalaria.com/downloads/RBMBurdenMalariaAfrica.pdf>

¹³³Bethesda J. OConnell, M. A. (2017). Risk factors of diarrheal disease among children in the East African countries of Burundi, Rwanda and Tanzania. *GLOBAL JOURNAL OF MEDICINE AND PUBLIC HEALTH*, 6, 1-8.

¹³⁴SOS Children's Villages. (2010). *Climate Change Brings New Health Risks to Kenya and an Effort to Combat Them*. Retrieved from <https://www.sos-usa.org/newsroom/climate-change-brings-new-health-risks-to-kenya>

¹³⁵ J. Akombi, K. E. (2017). *Child malnutrition in sub-Saharan Africa: A meta-analysis of demographic and health surveys 2000-2016*. Plos One.

¹³⁶ UNICEF, 2016, *EL NIÑO'S IMPACT ON CHILDREN IT'S NOT OVER*, retrieved from https://www.unicef.org/environment/files/BRIEFING_NOTE_EL_Nino_EN.PDF

Elderly

The elderly are also vulnerable to climate change due to the aging process which results in loss of muscle and bones and increases susceptibility to diseases and limits mobility. Increase in temperatures has the most effect on people with health conditions which increase heat sensitivity such as diabetes and congestive heart failure. Aged people are therefore more vulnerable to temperature increase and have a high mortality in extreme climatic events with climate change related heat exposure estimated by WHO to cause an increase of 38,000 mortality cases among the elderly¹³⁷.

During emergencies such as floods and forest fires, the elderly are less able to escape harm. Aid provided after or during disaster also fails to focus on specific needs of the elderly more so the chronic conditions such as diabetes, strokes and heart diseases. Water scarcity among the elderly is also higher because they are not able to cover the distance and costs and poses the risk of dehydration which is associated with increased mortality as well as confusion and falling.

Women

Malaria affects 50% more women than men due to increased vulnerability in pregnant women. Pregnancy reduces immunity in women and increases their susceptibility to malaria which can cause anemia and death of both the mother and child¹³⁸. Women in Garissa Kenya use fat from animals for cooking or to relieve ailments and drink raw blood to replace blood lost during child birth which increases the risks of Rift Valley Fever transmission.

¹³⁷ Help Age International, 2015, Climate change in an ageing world, retrieved from https://reliefweb.int/sites/reliefweb.int/files/resources/COP21_HelpAge_PositionPaper_Final_0.pdf

¹³⁸ World Health Organization, 2003, *Lives at risk: malaria in pregnancy*, retrieved from <https://www.who.int/features/2003/04b/en/>

Food insecurity exposes women to malnutrition and undernutrition. Traditional beliefs place different values on men and women and this affects the allocation of food in the households. In East Africa, women are expected to put food on their plate after serving other persons in their households. This works against them more so if the food available is of little quantity and they end up sacrificing their share for the rest and in so doing expose themselves to undernutrition and malnutrition. Malnutrition results in low energy levels and low immunity levels. Malnutrition during pregnancy increases risk of low birth weight, birth defects, premature birth and high mortality during delivery. This can lead to development of diabetes type 2 by the child as well as cardiovascular disorders among others¹³⁹.

Water scarcity means that women must spend more time searching and collecting water. Women spend multiple hours a day collecting water which is often dirty and from unsafe sources. If the water supply is scarce, women deny themselves water for the sake of the other family members. Women also have other chores to complete in their households such as cooking and washing time and the more the time they spend in search of water, the lesser time they have to complete these chores which if not done, can cause arguments in the households.¹⁴⁰

In addition to this, reliance of women on climate sensitive activities such as agriculture as their sole source of income decreases their economic strength. They therefore do not have enough funds to access healthcare services when ill.

Reduction of tourism in the East Africa coast results in decrease of market for agricultural produce. Women in this region sell their fruits and vegetables either directly to the tourists or to the hotels. Tourism decline leads to closure and further decline in market. This leads to a

¹³⁹ Virtual Medical Care, *Under-Nutrition Before and During Pregnancy*, retrieved from <https://www.myvmc.com/pregnancy/under-nutrition-before-and-during-pregnancy/>

¹⁴⁰The Conversation, 2016, To empower women, give them better access to water

reduction in income which compromises their ability to support their families which is problematic for women led households. In addition to this, sea water intrusion into aquifers effects water availability while floods, storms and strong winds destroy crops and thus compromises their livelihood.

Water scarcity results in an increase in electricity prices which the poor cannot afford. They are therefore forced to use bio mass (firewood, agricultural residue like maize cobs, charcoal and cow dung) attainment of which is the responsibility of women and girls. Collection of biomass consumes a lot of their time and energy and opportunities to access education or training courses are lost. They are therefore not able to better their lives or find other sources of livelihood which further exacerbates gender inequality and increases climate change vulnerability. Burning biomass fuels in poorly ventilated kitchens also poses a threat to their health

Youth

Climate change events such as drought reduce the household incomes which can lead to an increase in school drop outs because the youth stop going to school so that they can help the parents search for food and income. The 2016-2017 East African drought forced students in to drop out of schools to assist parents in searching for water and pasture with schools reporting a decrease of up to 50%¹⁴¹ in the number of the students enrolled.

Increasing levels of unemployment have forced a significant portion of the youth to venture into agribusiness. The agriculture sector is greatly vulnerable to climate change and given their limited resources, the youth are not able to handle climate stress and risk being stuck in a cycle of poverty.

¹⁴¹ Citizen Digital, 2017, Garissa pupils drop out of school as drought bites. retrieved from <https://citizentv.co.ke/news/garissa-pupils-drop-out-of-school-as-drought-bites-178502/>

Chapter 4 INGOs in Kenya

INGOs in Kenya have been on the increase since the early 1990s contributing to the growth of the country's NGOs from 400 to 6000 in the 1991-2008 periods. They have operations in different areas from protection of the environment to economic development with majority of their expenditure being on health, HIV/AIDS, agriculture and children.

Year	Registered NGOs
2003-2004	3260
2004-2005	3,949
2005-2006	4,532
2006-2007	5,155
2007-2008	5,529
2008-2009	6,118
2009-2010	6,806
2010-2011	7,448
2011-2012	8,430
2012-2013	9,191
2013-2014	9,728

Table 1; Number of NGOs in Kenya from 2003-2013; Source NGO board of Kenya

Interviewed INGOs representatives stated that the increased need for assistance in the country is the reason for the increased involvement of INGOs, a claim that is supported by the INGO presence in remote areas such as Wajir and Kitui as well as in areas with increased poverty levels such as the Kibera slums. Others however, stated that the poor performance of development activities is the reasons for their involvement.

The organizations have been crucial in handling issues because of their ability to enhance development by providing aid in areas that the government does not have the capacity to reach due to lack of funds or expertise among other reasons. Figure 6 below shows that the government allocates an average of only 4% of its budget to conservation of the environment. The environment sector is therefore underfunded, a fact that was supported by interviewed government officials. Instead, the government chooses to focus most of its funds on the infrastructure (22% on average) and education (25% on average) sectors which are more in line with its development goals.

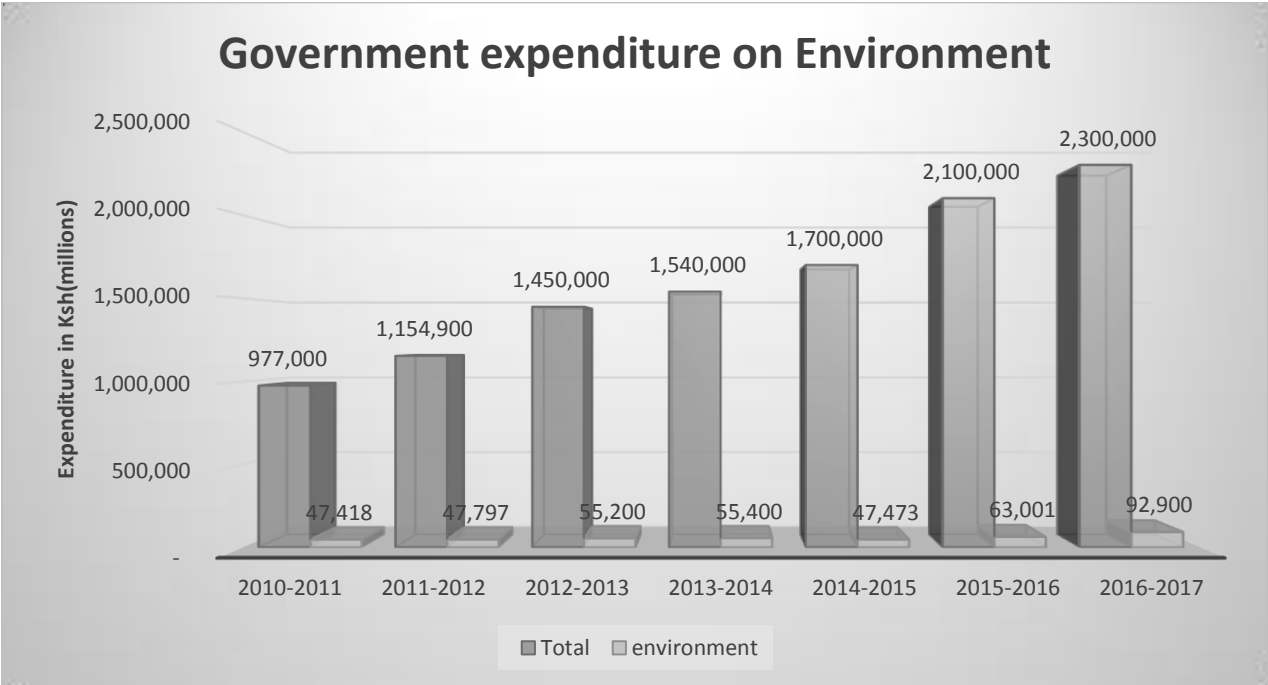


Figure 11; GoK expenditure on environment protection; source Kenya budget

Parties under the United Nations Framework Convention on Climate Change committed to promote and consider their obligations to people and communities in vulnerable situations when addressing climate change and adopt approaches that are not only country driven but which are

also gender responsive and take into account vulnerable groups and communities. The Kenyan government is therefore obligated to include vulnerable groups in its climate change strategies. Despite this, the government is not able to carry out its duty because it does not have the resources to reach these groups as can be seen in figure 11. INGOs are therefore vital in filling this gap. They are one of the key players in climate change management and have been crucial in climate change management in Kenya. 89% of the INGOs surveyed by the study had climate change related projects in place or in progress. They have performed a variety of roles in mitigation and adaptation of climate change through the development of strategies and projects addressing environmental issues as well as sustainable development. This has been accomplished through collaboration with the government, local NGOs and Community based organizations

Vulnerability to climate change is affected by factors such as age, gender, socio-economic status, health status and geographical factors. According to the Kenyan constitution, vulnerable groups include children, women, youth, disabled, the poor and the elderly.

Vulnerable groups	% of total population
Children	43%
Women	50%
youth	35%
Disabled	10%
Poor	42%
Elderly	4%

*Table 2*Table 2vulnerable groups in Kenya. Source Society for International Development and GOK

This study reviewed the support that given by INGOs to smallholder farmers and pastoralists as well as women and youth to assist them in capacity building in response to climate change.

Smallholder farmers and Pastoralists

On average, smallholder households in Kenya generate an income of \$ 2527 each year which amounts to \$1.4 per day in a household of 5 people¹⁴². Although they produce 70% of the country's food, a large percentage of the women, men and children live in great poverty. These poverty levels among smallholder farmers are due to lack of knowledge on best practices, lack of inputs and lack of finance and markets which contribute to their vulnerability to climate change. Climatic events such as increase in temperature and floods reduce crop yield which results in a reduction in income and greatly comprises the farmers' ability to feed themselves.

Majority of the pastoralists in the ASALs are also considered to be vulnerable. As at 2012, 80% of livestock farmers in Kenya's Arid and Semis Arid Areas were classed as poor¹⁴³ because they lived below the poverty line. They are vulnerable mainly due to lack of services and infrastructure and susceptibility to climate disasters. When exposed to climatic shocks, pastoralists in the ASALs experience great losses and in some cases become 'pastoralist drop-outs'. When the pastoralists lose livestock, they lose their source of livelihood and become destitute which forces them into aid dependency.

INGOs collaborate with county governments, local NGOs and community-based organizations to build capacity for smallholder farmers who are poor and often food insecure and for pastoralists whose livelihood is greatly dependent on climate. Climate change capacity building is developing the capability of individuals and households to cope with shocks caused by climate change without relying on external aid.

¹⁴² Rapsomanikis, G. (2015). The economic lives of smallholder farmers An analysis based on household data from nine countries. Pp 20-22.

¹⁴³ Fitzgibbon, C. (2012). Economics of Resilience Study– Kenya Country Report. 1-3

Surveyed INGOs use a three-step approach to build capacity for smallholder farmers and pastoralists. First, they help the farmers recover from the shock/absorb the shock, second, they help the farmers adapt to the shock and finally they show the farmer how to transform after the shock. The three approaches are interconnected and therefore do in most cases overlap an example being cash transfers which assist in absorption of climatic shocks as well as development of adaptive measures.

Absorbing shock

Table 3 shows that INGOs provide funds to the poorest households during times of disaster to reduce the impact of the disaster and assist in recovery. INGOs work with community members to identify households that are most affected by disasters and offer money to them for a certain period of time. The funds are allocated according to the severity of the disaster with extreme cases getting more than the less extreme. These funds lessen the impacts of climatic shocks on vulnerable individuals and households.

The money helps the households to survive and eventually bounce back after the climatic event. As per Table 3 households in need of financial aid grow as effects of the failed rains increased. This necessitated an intervention by majority of the surveyed INGOs who formed a consortium through which they collaborated with each other and with the government to provide cash to the most vulnerable households.

County	January		February		March		Total cash for 3 months
	No. of Households	Cash Transfers (KES)	No. of Households	Cash Transfers (KES)	No. of Households	Cash Transfers (KES)	
Turkana	-	-	-	-	5,045	12,360,250	12,360,250
Marsabit	5,379	13,178,550	9,450	23,152,500	13,486	33,040,700	69,371,750
Wajir	28,884	70,765,800	28,884	70,764,800	42,122	103,198,900	244,729,500
Mandera	-	-	7,807	19,127,150	29,029	71,121,050	90,248,200

Table 3 Cash Transfers for the Jan-March 2015 period; source Hunger Safety Net Programme.

Surveyed representatives stated that beneficiaries of the funds were selected from a registration list based on wealth order with the least wealthy being more prioritized. Funds were then given to them on a bimonthly basis.

In addition to provision of funds, interviewed participants stated that they also help the farmers preserve some of their assets by providing emergency programs such as veterinary care for animals as is the case when following the 2011 famine in Kenya, Catholic Relief Services helped the communities rebuild their goat herds. The INGO collaborated with the Kenya Ministry of Livestock Development, local organizations and the community leaders to identify villages in need of aid. Working with members of the community, the INGO was then able to identify the most vulnerable households which were 1,744 households out of the total 10,360

households. The identification criteria of vulnerable households according to the community members included pastoralists with five goats or less, female headed, elderly headed, and child headed households, the disabled and the chronically ill. These households were then given vouchers which they used to purchase goats at the livestock fairs organized by the INGOs. The goats were inspected before entry into the fairgrounds and the selected goats were vaccinated and dewormed at the fair exit and to ensure that the animals stayed healthy, training on livestock management was provided to all 1,744 households. To overcome cultural restrictions which were a barrier to women participation in the project, the INGOs encouraged the registration of women as house-heads which resulted in half of the beneficiaries being women. By doing this, the communities do not lose everything because the vendors are able to sell, and the beneficiaries are able to preserve some of their livelihood.¹⁴⁴

Adapting to the shock

Once communities have recovered from the shocks, the INGOs then help them adapt to climatic shocks. Training farmers on best practices is one of the adaptation techniques used by INGOs. 71% of the surveyed INGOs stated that they guided the farmers on best agricultural practices such as rain harvesting, fertility improvement, post-harvest management and group dynamics. 40% of the interviewees stated that they have in-house experts whose services they provide to the farmers at no cost. The experts advise the smallholder farmers on new practices such as drought tolerant seeds, garden farming and value addition an example being SNVs initiative to provide the youth with threshing machines which when used in farms save on time and reduce crop loss¹⁴⁵. DryDev which was a collaboration between SNV, World Vision, Caritas ,ADRA,

¹⁴⁴ CRS. (2013). *The Road to Resilience*. Catholic Relief Services.

¹⁴⁵ Mbingo, J. (2017). SNV Interview. (H. Wanjiru, Interviewer)

county governments and local community organizations had by 2016 reached a total of 70,622 farmers including men, women, youth and other disadvantaged groups. The farmers were trained on rain water harvesting through farm ponds, bench terraces and retention ditches, and on improvement of soil fertility through the use of compost manure as well as fertility trenches. This improved their input which translated to better harvests¹⁴⁶.

The farmers were also trained on better ways to store harvested crops to reduce postharvest crop loss which is a challenge faced by farmers in Kenya who, according to Table 4 below, lose an average of 20%¹⁴⁷ of their harvest each year.

Postharvest maize loss in Kenya (Percentage of total harvest)						
	2007	2008	2009	2010	2011	2012
Central	22.6	17.6	17.5	26.3	17.5	17.5
Coast	22.6	17.7	17.4	26.2	17.9	17.7
Eastern	22.6	17.6	17.4	26.3	17.4	17.4
Nairobi	22.6	22.3	22.3	30.3	22.3	22.3
North-Eastern	17.2	13.7	13.7	13.7	13.7	13.7
Nyanza	21.3	17.3	26.1	17.2	17.2	17.2
Rift valley	22.6	18.4	18.5	27.4	18.4	18.7
Western	20.9	17.2	17.2	26	17.2	17.2

Table 4 post-harvest loss in Kenya. Source; Africa Postharvest Losses Information systems

¹⁴⁶ The Drylands Development Programme. (2017). *2016 NARRATIVE REPORT*. The World Agroforestry Centre (ICRAF).

¹⁴⁷ Improving Food Security in Kenya through Better Post-Harvest Management, Australian High Commission

They were therefore trained on the usage of Purdue Improved Crop Storage (PICS) bags which reduce harvest loss resulting from insect infestation. The “air-tight environment inside PICS bags” kills insects due to lack of oxygen and prevents rotting of grains which results in nearly zero post-harvest loss with majority of users reporting that crops were affected by neither insects nor black spots even after being stored for long periods of time. According to Table 5 below, the number of farmers adopting the recommended practices has gradually increased which can be attributed to their witnessing how successful the practices were for other farmers.

year	Number of farmers (men, women and other disadvantaged groups, youth) practising improved soil and water management options on-farm	Number of farmers (men, women and other disadvantaged groups, youth) producing commodities of the targeted value chains	Number of farmers (men, women and other disadvantaged groups, youth) using/applying promoted climate smart production options	Value/amount of loans accessed by farmers (men, women and youth) in US\$	Number of farmers reached
2015	1,207	2,643	-	-	9,965
2016	6,574	3,638	2,204	42,730	18,695
2017	15,266	7,196	2,707	594,128	12,211

Table 5 Results of the DryDev project from 2015-2017 source: DryDev Kenya

The trainings were done through agricultural centers, established by the INGOs, where farmers walk in and learn new or better practices and have their questions answered as well. They also facilitate exchange programs where farmers are taken on trips to areas where other farmers have adopted the new techniques and witness how it has been beneficial to them.

INGOs facilitate access to finance for smallholder farmers by linking farmers to financial institutions. Smallholder farmers have little to no access to financial services for quality seeds and fertilizer required for increased production. The low yields result in low incomes which leave them without collateral with which they can acquire loans which makes them too risky for financial institutions. This traps them in a cycle of poverty where they have to plant substandard seeds which lead to low crop yields that result in low income levels. Increased access to loans, savings and insurance can break this cycle and assist vulnerable farmers to adapt to repetitive shocks and stresses. Recognizing this, INGOs work towards linking the farmers to financial services. They convince financial institutions to invest through risk sharing and provide technical training so that the financial institutions offer a broad variety of services at low rates. Despite loans by these financial institutions being friendly to the farmers, not all farmers can afford them especially so for some women who do not have much say in decision making in their households. INGOs therefore facilitate the development of savings groups where members of the groups meet and contribute what they can once a month and when enough money has accrued in their bank accounts, they proceed to make loans to each other or in some cases lend outside the group at higher interest rate which is in itself a profit-making investment. The involved INGOs guide the members on interest rates borrowing rules and repayment schedules. The INGOs also

hold regular meetings to ensure the right processes are being followed, verify the accuracy of financial books and provide additional financial and business training. The number of farmers joining savings groups has been on the increase as can be seen in the figure 12 below. This can be attributed to the success experienced by existing members which encourages others to join so that they to can benefit.

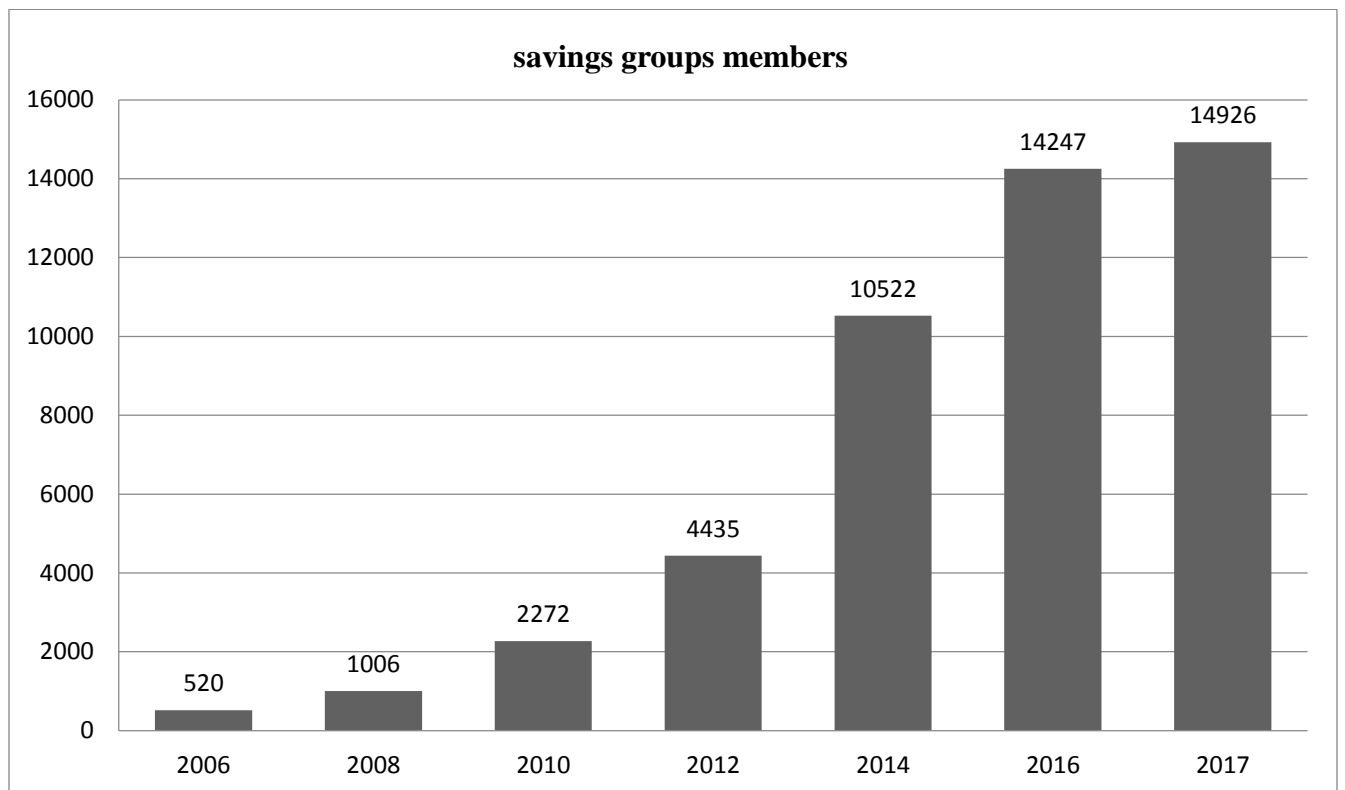


Figure 12 growth in community members joining savings groups. source; Five talents.

Facilitation of the availability of extension workers is another way that INGOs builds capacity for the farmers. The high poverty levels among small holder farmers are due to their lack of knowledge on value chains, limited knowledge on best farming practices and brokers between the farmers and the buyers. Farmers need advice on the type of seeds to grow, the emergence of new commercial crops, the type of fertilizers and pesticides to use and when to use them. This

advice should be provided by agriculture extension officers working for the government and whose salary is paid for by tax payers. This has however not been the case. The freeze applied on public employment by the Kenyan government has resulted in the lack of new officers to replace the retired ones.¹⁴⁸

The introduction of structural adjustment programs (SAP) by the World Bank and International Monetary Fund (IMF) also forced the government to eliminate agriculture subsidies which resulted in a decline in the agricultural extension budget as well as extension workers. The lack of funding and freeze on employment has not only created a shortage of extension workers but it has also limited the abilities of the workers to carry out their duties. As of 2011, there was 5470 staff members at the national level of which only 1464 were field workers holding agricultural diplomas¹⁴⁹.

The small holder farmers therefore have to depend on advisers provided by companies that export their products and in so doing pay double for extension services. They pay VAT when they purchase farm products such as seeds and are also taxed before they are paid for their produce and then use more money to acquire services of an agricultural advisor from the exporting companies. INGOs therefore provide facilitation packages where extension workers are given allowances such as transport, food and accommodation. Catering for these expenses, which the government is not in a position to, enables the workers to travel to different counties and provide guidance to the farmers.

¹⁴⁸ J.N, M. (2018, May 5). Just where did the rain start beating us. *The Standard*. Retrieved from <https://www.standardmedia.co.ke/article/2001279274/extension-services-just-where-did-the-rain-start-beating-us>

¹⁴⁹ Global Forum for Rural Advisory Services. (n.d.). Retrieved from <https://www.g-fras.org/en/world-wide-extension-study/africa/eastern-africa/kenya.html>

Transforming from shocks

When communities adapt to climatic shock, INGOs proceed to assist them in engage in long-term changes that reduce their vulnerability. To accomplish this, INGOs link farmers to markets. According to figure.13, The number of farmers trained and linked to markets by INGOs has increased drastically and so has the level of income for farmers who are linked to these markets.

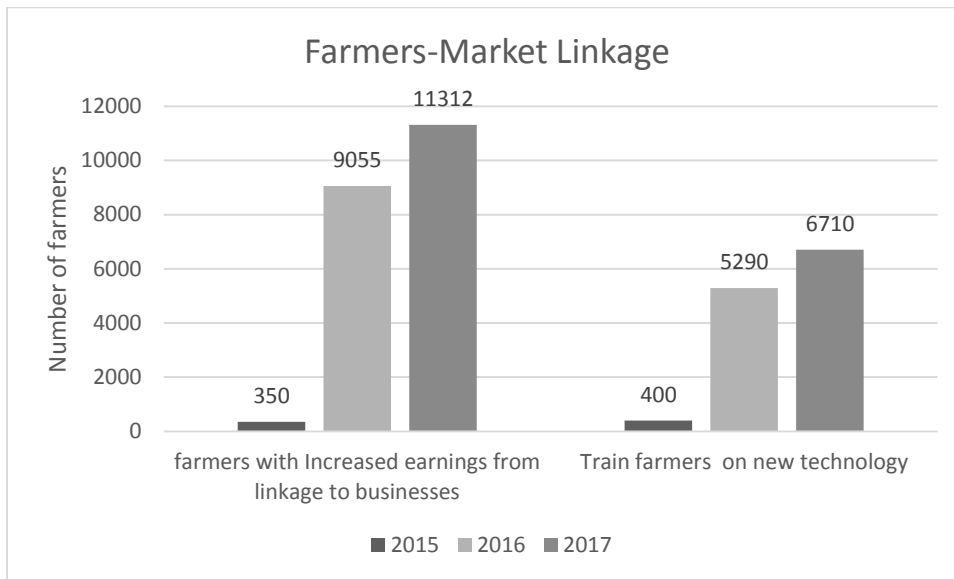


Figure 13 impact of linking farmers to buyers through the Kenya Market-led Horticulture Programme; Source survey data

The INGOs remove barriers such as transport and technology by making it available to the farmers through cost matching. The barriers are in majority of the cases removed through cost sharing where the INGO provides grants that cater for 50% of the cost while the beneficiary caters for the other 50% (Mbingo, 2017). This is done to lessen the cost burden and to also ensure there is commitment from the other side because it is more difficult for an individual to be negligent when they have parted with money for an investment. INGOs like mercy corps provide the equipment as a loan to be repaid indirectly. A track for milk transportation was purchased for

a beneficiary in Wajir and in order to pay for it, he had to offer transportation services to milk sellers at a low cost for an agreed period¹⁵⁰.

The INGOs also provide training to the farmers and organize them into groups which create a forum for the farmers to share resources and increase their bargaining power as well as quantity. In so doing, the farmers eliminate brokers who take advantage of the farmers and buy their produce at a low cost and can now sell their produce at a higher cost.

Advocacy

The INGOs ensure recognition of vulnerable groups and sustainability of their projects by influenced policy making in the country as can be seen in Table 6 below where the influence of INGOs has contributed to the successful development of County Climate Change Funds. They collaborate with the county governments in the policy making process where they offer advisory services to the policy makers such as performing a climate risk screening to identify practices that reduce the impacts of climate shocks from which action plans are formed. In addition to policy makers, the policy making process also involves members of the community a portion of which includes vulnerable groups such as women, youth, elderly and disabled who were previously not given the platform to contribute to discussions or to participate in control of the flow of climate finance from the national level to the communities' level.

Counties that had passed the County Climate Change Fund (CCCF) Legislations by 2018	No of INGOs who collaborated with the county government.
Garissa	2
Isiolo	1

¹⁵⁰ Burns, J. (2018). Mercy Corps Interview. (H. Wanjiru, Interviewer)

Kitui	1
Makueni	1
Wajir	2

Table 6 CCCFs passed in collaboration with INGOs

By doing so, the INGOs ensure that the policies address the needs of all the individuals and are able to make local government money available to the vulnerable groups. All of the surveyed INGOs surveyed explained that they operate under the ‘leave no one behind’ principle.

Some of the interviewed INGOs stated that they fund experts to come and increase awareness and understanding of environmental issues among policy makers while others stated that they finance consultation meetings where the policy makers meet with the members of the communities to increase understanding of on-ground issues and develop policies accordingly.

Through INGOs, the government of Kenya was influenced to implement the “Access to Government Procurement Opportunities” which advocates for thirty percent of all government activities to be set aside for the women, youth and disabled who are considered to be vulnerable.

INGOs have also influenced the inclusion and participation of women and youth in the development of county plans such as County Integrated Development Plans so that their voices are heard, and their needs are included when developing plans.

Women and Youth

According to Table 7 below, majority of households in rural areas in Kenya rely on biomass for their energy needs. The main sources of biomass are wood, agricultural waste and charcoal. Biomass is mostly used by the underprivileged who depend on the environment for their livelihood. Firewood is naturally availability at no costs and so is agricultural waste such as maize cobs.

Energy Access in Kenya			
	National	Rural	Urban
Population with access to modern fuel e.g. electricity and gas	15%	5%	51%
Population with access to modern fuel (Electricity, Gas or Kerosene)	17% Electricity (0.6%), Gas (3.5%), Kerosene (13.2)	4%	58%
Population using wood for cooking	69%	88%	10%
Population using charcoal for cooking	13%	8%	30%
Population relying on solid fuel for cooking that use Improved Cook Stoves	3%	3%	4%

Table 7 Energy Access in Kenya, Source: UNDP report¹⁵¹

¹⁵¹ The Energy Access Situation in Developing Countries: A Review Focusing on the Least Developed Countries and Sub-Saharan Africa, UNDP, 2009

As of 2008, only 15% of the Kenyan population had access to electricity with 51% of this population being in urban areas while only 5% of the population with electricity access was in the rural areas as can be seen in Table 7 above. This means that majority of Kenyans (81%) were relying on biomass as their source of energy. Despite its popularity, sources of biomass have begun to decline due to deforestation and changing weather patterns and finding them has become more difficult.

Energy in rural households, where majority of biomass is used, is managed by women. They decide when, what and how the energy should be used because they are the ones who carry out majority of the house chores such as cooking and lighting. The women collect the biomass fuel themselves or allocate the duty to the children or adolescent girls. The decline in availability of fuels forces the person in charge of collecting fuel to travel for long distances which takes up a lot of time and energy that could have been used for something else. The women also risk life threatening attacks such as animal attacks and rape as they look for fuel (SAFE, n.d.)¹⁵². In addition to this, the women, children and adolescent girls are exposed to air pollution generated while cooking or lighting because they spend the most time in the households. This increases their vulnerability to illnesses such as pneumonia and other lower respiratory infections which are the first most common cause of deaths in Kenya.

The implication firewood collection has on time, energy and health affects the ability of the women to involve herself in poverty reducing activities. The children's education is also compromised due to time spent collecting fuel, or school days missed due to illnesses or lack of lighting needed to study when at home.

¹⁵² SAFE. (n.d.). *Protection & Gender*. Retrieved from Safe Access to Fuel and Energy: <https://www.safefuelandenergy.org/issues/protection-gender.cfm>

INGOs have become involved in the energy sector to address the climate change induced decrease in fuel availability and to reduce the use of harmful fuels and encourage adaptation of clean fuel. This has been achieved through the introduction of energy products such as D-light and clean cookstoves. The INGOs collaborate with the manufacturer of the technology and work with them to provide the product in rural areas at an affordable rate. This is achieved through provision of advertising services by the INGOs on behalf of the producers. The INGOs enlighten the community about the product and its benefits and by doing so increase the levels of awareness. Companies therefore find a ready market for their products which encourages them to sell in these rural and remote areas. The INGOs also cater for other costs such as transportation costs which enables the seller to sell at his original price without increasing the prices to compensate for the costs.

In addition, INGOs offer grants to the distributors mostly for their initial purchase during project implementation up to the point when they can take advantage of the economies of scales because the communities are more aware of the product and are ready to buy it. The INGO also subsidize the costs of the products so that the buyers can buy them and in so doing act as a marketing strategy where other people will be interested in purchasing the product. Due to low income levels, the communities are not able to pay for the products upfront.

Average prices of clean energy products in Kenya		
D.Light prices	Mkopa prices	Biogas prices
2,150	43,332	50,000

Table 8 average charges of energy products in Kenya. Source, survey data

Table 8 above shows the prices of clean energy products which can be too high for a person with a low level of income and who uses their money to take care of their household.

Involved INGOs such as SNV and Hivos have therefore put in place payment platforms that allow buyers to pay in installments. One of these platforms is the Pay-As-You-Go which allows the buyer to make a down payment and then pay the rest in regular installments. If the buyer fails to make payment, the manufacturer automatically switches off the product¹⁵³.

Furthermore, the INGOs link the different actors of the value chain. They link distributors with manufacturers from whom they can purchase products directly and in so doing eliminate middle men and reduce costs. The INGOs fund workshops where the manufacturers and distributors can meet, interact and develop networks as well as get training related to the products and the markets.

Clean Lighting

Introduction of clean lighting energy products in 1709 households in Wajir had a positive impact on the community and its way of life. Before the lighting products, households spent \$ 11.50 per month purchasing batteries, torches and Kerosene. This has however reduced to \$2.32 per month due to clean lighting systems that eliminate the need for traditional lanterns which use kerosene and release toxic fumes (Burns, 2018). The households can now save \$9.18 more per month.

Business and livelihood benefits of solar lighting	
households where children have more study hours	99%

¹⁵³ Raja, T. (2018). SNV interview. (H. Wanjiru, Interviewer)

increased income from use of solar light in business	84%
Households losing less of their livestock to wild animals	63%

Table 9 Impact of solar lighting on the Wajir community. Source; Mercy Corps

As per Table 9, students were able to use the lighting products to study for more hours than before when they relied on torches and kerosene lamps. The better quality of light enabled them to study for longer hours at night without straining their senses.

Table 9 also shows an increase in household income which is because businesses remained open even after dark as the improved lighting helped them continue with their operations which led to an increase in income levels. In addition to this, households with the lighting lamps were able to offer phone charging services to their neighbors who were still using kerosene. This further contributed to their income growth.

The introduction of lighting lamps to the community also decreased the numbers of livestock lost to wild animals. The animals stayed away due to the light and this way the communities with the lighting lamps avoided loss of livestock unlike the households without lighting products which lost 6 head of livestock each year.

Impact of the lighting lamps on the community's health is not easy to quantify and research on this area is required but it is worth noting that majority of the households experiencing health problems were the ones that had not adopted the energy lighting products and instead used the kerosene lanterns as their source of light. As per table 10 below, 27% of households in Wajir were experiencing respiratory problems such as breathing difficulties while 29% had eye problems. Majority (90% and 99%) of the 27% and 29% experiencing respiratory and eye issues

respectively made use of kerosene in their households on most days. This points to a link between kerosene use and health problems due to toxic fumes and poor lighting. There is therefore a high probability that using improved energy lighting products reduces health risks associated with using kerosene.

Illness	% of total households experiencing the problem	From the households experiencing the problem, % using Kerosene
Respiratory problems	27%	90%
Eye Problems	29%	99%
Burns	5%	15%

Table 10 Association of health issues reported with Kerosene Usage Source; Mercy Corps ¹⁵⁴

Cookstoves

A lot of exposure to toxic gases happens when food is being cooked. Households in the slums can only afford firewood and charcoal as a source of fuel for cooking food which increases their exposure to the toxic gases. The decrease in forests, especially in urban areas like Nairobi leaves households in slums with no option but to travel long distances in search of fuel or make use of what they have which is in most cases plastic¹⁵⁵.

The use of clean cookstoves has therefore been introduced to communities by INGOs. This has resolved the problem of fuel shortage and consequential problems that accompany looking for fuel and health risks from using it and it has increased on savings because clean cookstoves

¹⁵⁴ MERCY CORPS AND D.LIGHT PILOT PROJECT EVALUATION Exploring the potential of village-based micro-retailers of solar lanterns in Wajir County, Mercy Corps, 2014

¹⁵⁵ Nzioka, S. (2018). Ministry of Energy Interview. (H. Wanjiru, Interviewer)

reduce charcoal usage by 50% (Kenya Cook Stoves, 2015). In addition to this, it has created employment for youth and women. INGOs market their opportunities to the most disadvantaged women and youth especially those in the slum communities and in so doing create a source of employment for them where they act as distributors of clean energy solutions in their communities.

Free primary and secondary education in Kenya has resulted in an increase of youth without access to education after high school which has increased the number of unskilled youths in the slums. A study by British Council¹⁵⁶ noted that 22% of persons aged between 15-24 were unemployed. Opportunities for this group, who are under-educated and under-qualified, are scarce and they therefore have no way of escaping poverty. They therefore have no way of coping with increased food insecurity and other impacts of climate change.

Women, on the other hand, suffer from different circumstances. Majority of households in the slums are single mother households who have no one to assist them in caring and providing for the family and whose income is not enough to alleviate them from poverty while others have to depend on their spouses as their sole provider of basic needs. They consequently have no means of protecting themselves from the effects of climate variation¹⁵⁷.

Through provision of training services, INGOs have managed to provide a slight resolution for this issue. Figure 14 below shows that the number of persons reached has been on the increase over the years. Some INGOs have setup training centers in slum communities where youth and women get free training relating to different areas in the marketing of cookstoves such as sales,

¹⁵⁶ Hall, S. (2017). *Youth Employment*. UK Department for International Development.

¹⁵⁷ Livelyhoods. (2018). Retrieved from <https://www.livelyhoods.org/what#impact-section>

communication, personal development and confidence building. From the training, the youth and women acquire skills and knowledge on environmental issues which they can put to use and escape poverty.



Figure 14 women and youth trained on marketing clean cookstoves. Source; Livelyhoods

After training, the youth and women get employed by the INGOs as sales agents where they go their communities and create awareness on environmental issues and the benefits of using cookstoves a task made easier by their wide networks and good understanding of the community problems and dynamics. Figure 15 below shows that jobs were created for the women and youth which contributed to a decrease in unemployment.

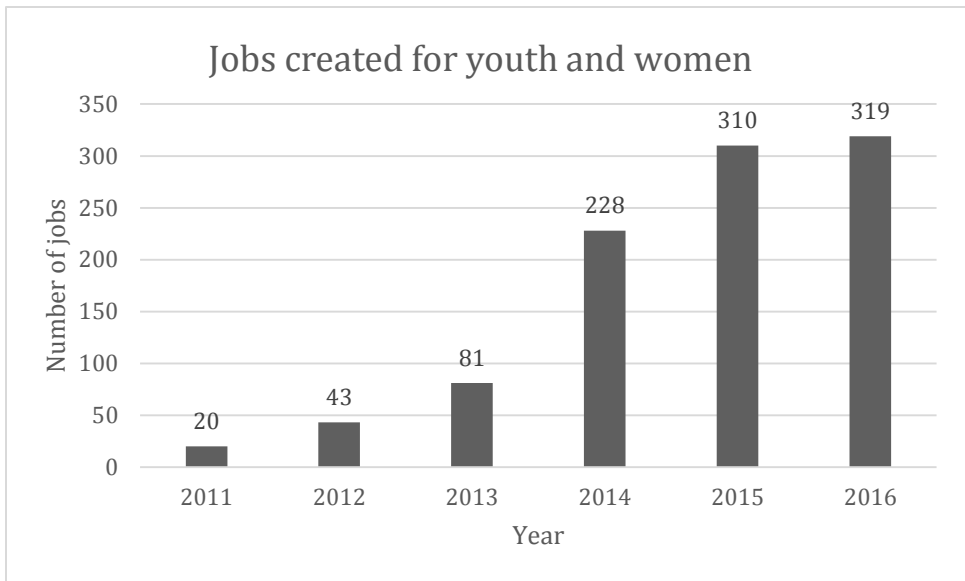


Figure 15 Employment for youth and women; source Livelihoods

Increased use of cookstoves and other solar products due to the partnership between livelihoods NGO, Kiva and the Global Alliance for CookStoves had by 2018 saved 564,973 trees due to decreased charcoal use (Livelihoods, 2018).

Chapter 5 Findings and Conclusions

INGOS can fill gaps and contribute to achievement of governmental goals because they possess the resources to do so. Majority of the INGOs get funds from foreign governments who happen to be developed countries. This is in accordance with the United Nations Framework Convention on Climate Change where developed nations vouched to provide financial resources to developing countries for projects relating to agriculture, energy, technology transfer, industry, transport and industry.

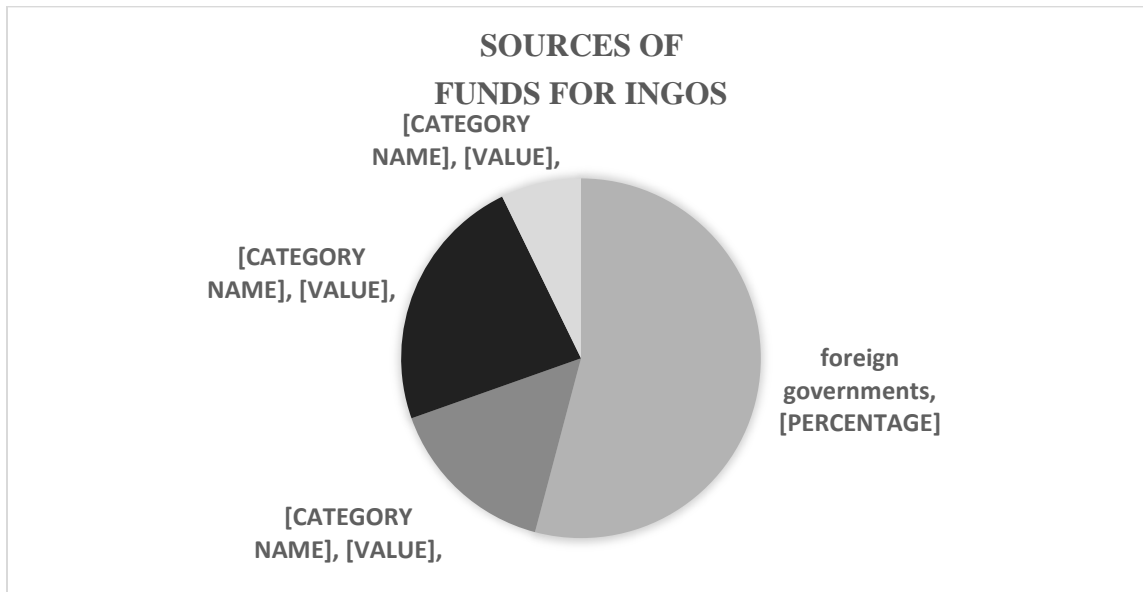


Figure 16; Sources of funds: survey data

As per the survey carried out, majority of INGOs with operations in Kenya are funded by various external donors with 54% of the surveyed INGOs getting funds from foreign governments such as USA and UK who provide funds through their developmental arms e.g. USAID and UKAID. 14% of the INGOs stated that they were funded by foundations such as the Bill and Melinda gates foundation while 21% listed IGOs such as the United Nations as a source of funds. Other

donors included well-wishers, churches and charity events e.g. the global citizen festival among others. All the INGOs interviewed stated that they do not get funds from Kenyan sources.

The research also found that role of INGOs in the management of climate change in developing countries is one that cannot be ignored. The resources that INGOs have which include funds and expertise are crucial for developing nations where the governments do not have enough resources and knowledge to provide assistance to all the citizens.

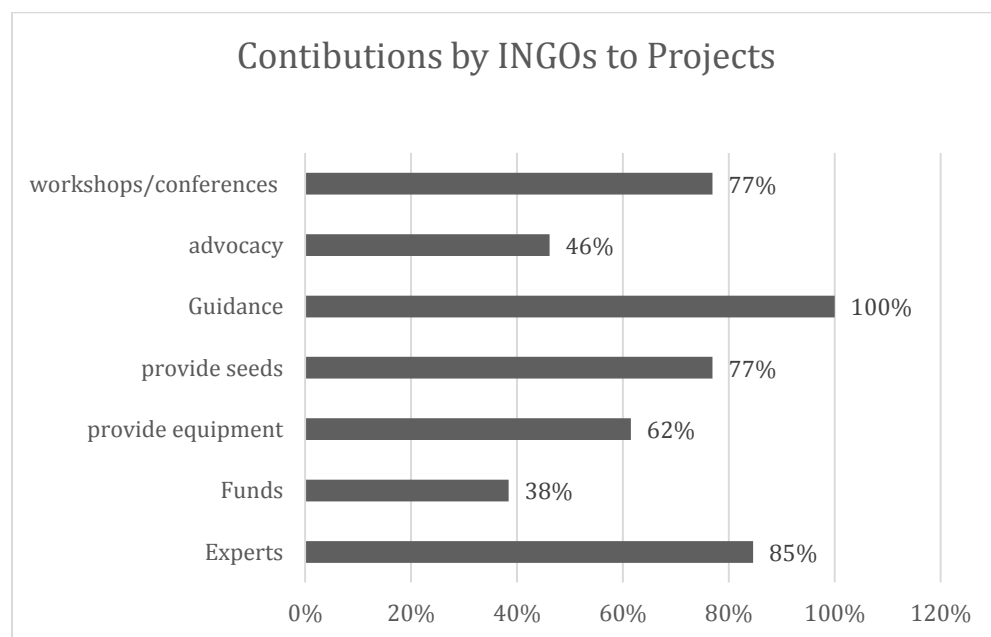


Figure 17; Source Survey data

From Figure 17 above, all of the interviewed INGOs stated that they provide guidance to the communities they are helping so as to not only get the most out of their project but ensure continuity even after their departure. 85% of the INGOs said that they provide experts where needed and even outsource from other countries if they do not have in-house experts. The experts then share their knowledge the members of the community who are then tasked with training other people.77% of the INGOs said that they have setup workshops in different counties where farmers can walk in and learn best agricultural practices as well as become informed on new

practices such as biogas usage. 62% of the interviewed INGOs stated they provide equipment to the community members. There were however two approaches of doing this with the first group providing the equipment in the existing workshops where the community members would come and use as they needed while the second group cost shared the expenses of the equipment with the interested persons where the interested persons came up with 50% of the investment and the INGO provided the other 50%. Only 38% of the INGOs stated that they provide funds and those that did e.g. Christian Aid and World Vision only do so during emergencies.

INGOs must work hand in hand with the government. Interviewed representatives stated that it would be impossible to carry out development work in a country without involving the government of that country.

Vision 2030 pillar	Contribution of INGOs
ECONOMIC AND MACRO PILLAR	Increased income from new markets and best practices
	Reduced Vulnerability from capacity building
	Development of Agricultural reforms through experts provided by INGOS
	Reduced Unemployment
SOCIAL PILLAR	Reduced diseases due to decrease in biomass fuel
	Increased School enrolment due to improved energy sources
	Post-Secondary training
	Reduced environment pollution through clean cooking
POLITICAL PILLAR	Improved Service delivery due to training of government officials
	Increased information sharing through workshops and conferenced
	Gender equality

Figure 18 Source: Survey data

Work done by the INGOs matches the government's priorities. The government uses its priorities to draw projects and the INGOs must complement the government in implementing policies from which needs are identified and projects developed. The Kenyan government provides experts such as extension workers who provide the required support from project

implementation to project monitoring and evaluation. The INGOs in return provide guidance to the government on policies such as the NCCRS.

Conclusions

Climate change has so far had a significant impact on all sectors of the East African region. The changing rainfall patterns and increased temperatures have compromised water sources in both quality and quantity which is concerning especially because East African nations already experience water problems that they have, so far, not been able to manage. The impact of climate change on water sources will result in a decrease in water availability in the region which will affect economies of the East African countries through rising costs of power generation and increasing instances of inability to generate required power levels.

Rainfall changes have also affected the agricultural sector. Lower than expected rainfall levels or failed rains result in a decrease in crop yield as well as an increase in livestock mortality rate. This has increased food insecurity in the region where some households do not have enough to feed themselves and the food available is not nutritious enough.

Because history is the best predictor of the future, the climatic events will continue to increase not only in frequency but in severity as well unless measures by the international community are taken to slow down the causes of these climatic changes.

The study found that most of the INGOs projects are aimed at the vulnerable groups in terms of the poor who have no way of adapting, those that have lost their only source of livelihood such as pastoralists in eastern Kenya and are forced to depend on aid, and the groups that are marginalized due to cultural beliefs such as women.

The study learnt that projects by INGOs transform the lives of vulnerable individuals, through increased incomes and capacity building, which ends up contributing to the achievement of

government policies. In Kenya, the provision of aid by INGOs contribute towards the success of the country's vision 2030. By uplifting vulnerable famers and pastoralists, the issue of food insecurity is reduced, there is more adoption of technology, health problems decrease, and households have more income to improve different aspects of their lives including shelter and education.

The study concludes that the presence of INGOs in Kenya has had a positive impact on the mitigation and adaptation to climate change. The support given to vulnerable groups such as poor farmers, pastoralists in the ASALs, women and youth has helped them to not only survive during climatic shocks but also adapt to them and transform their lives so much so that future shocks do not pose a threat. These findings support the first hypothesis of this study which stated that activities by INGOs have mitigated the impacts of climate change on vulnerable groups.

The second hypothesis stated that collaboration between INGOs and government is essential for successful adaptation and mitigation to climate change. All the government officials and INGO representatives confirmed that their projects cannot succeed without collaboration with the government which supported this hypothesis as well.

Recommendations

The government should streamline implementation of policies when collaborating with INGOs.

Interviewed INGO representatives stated that the long policy implementation process creates huge delays in commencing projects. This is especially troublesome when the policy making process is still in progress when there is a power change due to elections. The INGOs are forced in such instances to start working on the same policy from scratch and in the process use more time and resources which were already used with the previous administration.

The INGOs should also make efforts to reach other parts of the country. Though they are not as affected as the remote areas, many farmers in Kenya would benefit with a bit of guidance from the INGOs. The input required in such instances will be much less than in the remote areas, but the results will be massive. In doing so, they will have prevented the development of situations similar to those in Eastern Kenya because the farmers will start taking adaptation and mitigation measures in advance.

More attention needs to be given to the elderly. They make up only 3.5% of the total population and are therefore not much attention is accorded to them, yet they are among the ones that need aid the most due to their reduced immunity, memory, mobility and overall well-being. Most of the elderly depend on others who might not be able to provide to them the required help during disasters.

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APPENDIX 1

Questionnaires for INGOs

ROLE OF INTERNATIONAL NON-GOVERNMENTAL ORGANIZATIONS IN THE ADAPTATION AND MITIGATION OF CLIMATE CHANGE BY VULNERABLE GROUPS

This questionnaire is for purely for academic purposes with the aim of assessing the role of INGOs in climate change mitigation and adaptation by vulnerable groups.

Date of Interview
Name of Respondent
Organization
Occupation
Designation

- 1.
- 2. Does your NGO collaborate with INGOs in projects related to climate change?

No Yes

- 3. What are the reasons for the collaboration/lack of?

.....

- 4. How do INGOs contribute towards collaborated projects?

Provisions of experts Provide technical skills Finance the project

Provide guidance

Others, please specify.....

- 5. What are the sources of funds for your NGO?

Government INGOs

Others, please explain

.....

- 6. How do the INGOs provide funding for climate change projects?

Directly to NGOs Directly to the communities

Other, please elaborate

- 7. Are there any terms and conditions provided by INGOs for funding projects?

Yes No

Please explain

8. How do the performance indicators (where applicable) reflect success of NGO-INGOs collaboration projects?

Performance indicators	Before project	After project
<i>Improved Water Supply</i>		
<i>Reduced greenhouse gas emissions</i>		
<i>Reduced respiratory illnesses</i>		
<i>Increase in forest land</i>		
<i>Adoption of technologies</i>		
<i>if other please explain.</i>		

9. In your opinion, are current levels of collaboration between the NGOs and INGOS sufficient for effective project administration?

Yes No

Please elaborate.....

10. Are there programmes focused on vulnerable groups?

Yes No

If yes, please give examples

11. What are the vulnerable groups indicators?

Children Women Youth Elderly Sick

Survive on less than a dollar per day

Others, please specify

12. What strategies are used to ensure vulnerable groups benefit from projects?

Involvement in decision and Policy making Tenders reserved for vulnerable groups

Jobs reserved for vulnerable groups Provide Training to vulnerable groups

Others, please explain

13. What are the performance indicators reflecting success of the vulnerable group's projects?

Performance Indicator	Before project	After Project
Diseases Decrease		
Water accessibility		
Clean energy acquisition		
Increased school attendance		
Other, please specify		

Appendix 2

ROLE OF INTERNATIONAL NON-GOVERNMENTAL ORGANIZATIONS IN THE ADAPTATION AND MITIGATION OF CLIMATE CHANGE BY VULNERABLE GROUPS

This questionnaire is for purely for academic purposes with the aim of assessing the role of INGOs in climate adaptation for vulnerable groups.

Date of Interview

Name of Respondent

Organization

Occupation

Designation

Sector: Water

 Forests

 Energy

 Agriculture

 Other, please specify

1. Does the government collaborate with INGOs in projects related to climate change?

No

Yes

2. What are the reasons for the collaboration/lack of?

.....

3. How do INGOs contribute towards collaborated projects?

Provisions of experts

Provide technical skills

Finance the project

Provide guidance.....

Others, please specify.....

4. Are there any terms and conditions provided by INGOs for funding projects?

Yes.....

No.....

Please explain

5. How does the government contribute towards the projects?

Provisions of experts

Provide technical skills

Finance the project

.....

Provide guidance.....

Others, please specify.....

6. What are the performance indicators reflecting success of government-INGOs collaboration projects?

Performance indicators	Before project	After project

7. In your opinion, are current levels of collaboration between the government and INGOs sufficient for effective project administration?

Yes.....

No.....

Please elaborate.....

8. Are there groups that the government considers vulnerable?

Yes

No

9. If Yes, what are the vulnerable groups indicators?

.....

10. Are there INGO-government collaborated programmes focused on vulnerable groups?

Yes

.....

No

If yes, please give examples

11. What strategies are used to ensure vulnerable groups benefit from INGO-government collaboration projects?

.....