University of Nairobi

Institute of Diplomacy and International Studies

Climate Change and Environmental Security Management in Kenya: A Case Study of National Environmental Management Authority

Evelyne Bwari

R50/5063/2017

Supervisor

Dr.Shazia Chaudhry

A Research Project submitted in partial fulfilment of the requirement of the Degree of Master of Arts in International Studies at the Institute of Diplomacy and International Studies

7th October, 2017

DECLARATION

I, Evelyne Bwari hereby declare that this research project is my own original work and it has not been presented in any University or College for examination purposes.

Name……

Signed……..Date…….

This research project has been submitted for examination with my approval as University Supervisor;

Supervisor's
Name……

Supervisor's
Title……..

Signed…….Date……..

DEDICATION

To my loving father, my greatest cheerleader, who has never stopped pushing me to achieve greater heights.

ACKNOWLEDGEMENTS

First and foremost, I wish to thank the almighty God for thegrace and strength that he bestowed upon me, enabling me to navigate this journey, which was characterised with extensive learning, immense pressure, moments of happiness, moments of frustrations and continuous challenges. Throughthe lord's favour, the journeyhas come to a successful end, and for that, I am forever grateful.

I wish to sincerely thank my supervisorDr.Shazia Chaudhry without whose guidance I would not have gone this far. Her professional guidance and advice were invaluable.Thank you Dr Chaudhry for often going out of your way tojolt me when I faltered and helping me to ensure that the project was completed. Not to forget the endless hours spent reading, commenting on and correcting my work. My heartfelt appreciation is also extended in a very special way to Dr Diana Mobagi, of NEMA who not only encouraged me as I embarked on my data collection, but also offered professional assistance.

Very profound appreciation goes to my family, who put up with my absence as I pursued the master's degreewith love, understanding and support. Special thanks to my husband Evans for his understanding and support. I wish to thank all my friends who stood by me throughout the trying journey, and continuously encouraged me especially during the most difficult times and when it appeared that the project would not be completed on time.

To the staff at the National Defence College, thank you for the continuous support you gave me as the course progressed. To my classmates at the National Defence College, my most sincere gratitude not only for the constant encouragement, but also the great camaraderie we shared, which always gave me strength to keep going. It is not possible to list all the people, but for all those who played a role in one way or the other, I thank you all.

ABSTRACT

Climate change has drawn a lot of interest among scholars in recent years, especially in the field of diplomacy and international studies. Researchers and specialists have for a number of years now intimated that there is significant climate change taking place as a result of human activity, leading to increasingly high levels of GHG emissions, to the extent that it has caused a significant shift in the general global environment, with substantial impacts on human security. Environmental security is one of the seven recognised elements of human security which refers to the security in the surroundings where people inhabit, and therefore greatly influencesthe sustenance of life. Climate change manifests itself in the form of Temperature changes and changes in precipitation. Climate change has caused rapid temperature rise and erratic rainfall, in recent years, both of which have a significant bearing in the ability of the environment to sustain life. Among the areas affected include agricultural systems, water availability, ecological services, forestry activities, biodiversity, coastal systems, health, and subsequent food security, all of which are pertinent to survival of human systems.

Kenya being one of the states in Africa is one of the most vulnerable to climate change, despite the fact that it makes insignificant contribution to global Green House Gas (GHG) emissions. This vulnerability is manifested because the country relies heavily on natural systems including rain-fed agriculture for the very survival of its people. As a result, climate change effects such as prolonged and recurring droughts and flush floods directly affect the livelihood of the people. In addition, the limited resources available to Kenya for mitigation or adaptation to climate change makes it difficult to cope with climate change, thus rendering it susceptible to the effects of the harsh conditions caused by climate change. The need to tackle climate change and environmental security therefore cannot be gainsaid.

In Africa however, managing climate change presents several challenges owing to among other factors, the scarcity of resources, and limited capacity to confront the impacts of climate change. This study examines the challenges Kenya faces in managing climate change while studying the National Environmental Management Authority as a case study.The institution is the Government body mandated with the management and coordination of environmental issues in Kenya.

This study, examined the theoretical linkages between climate change, environmental security, and the role of other actors including other states, non-state actors in managing the impacts of climate change in Kenya. The study extensively used secondary data as well as primary data which was obtained through semi-structured and unstructured interviews. Secondary data relied on the internet and library research. The major findings of the study are that Kenya’s environmental management institutions encountera number of challenges in dealing with climate change, some of the challenges being the limited capacity to monitor or ensure compliance especially among lead agencies; the lack of coherencein environment related policies; and funding of projects from the various donor groups; the challenge in collecting and maintaining data; and the limited resources to cope with the requirements to mitigate and adapt to climate change.Some of the solutions the study proposes include strengthening of institutions dealing with climate change and effective regional and international cooperation in dealing with the challenges.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

AF	Adaptation Fund
ASDS	Agriculture Sector Development Strategy
ATAR	Adaptation Technical Action Report
AU	African Union
CCCU	Climate Change Coordination Unit
CDM	Clean Development Mechanism
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
COP	Conference of Parties
DJF	December – January – February season
EAC	East African Community
EMCA	Environmental Management and Coordination Act
ENSO	El-Nino Southern Oscillations
EU	European Union
FAO	Food and Agriculture Organisation
GDP	Gross Domestic Product
GHGs	Greenhouse Gases
GCF	Green Climate Fund
GEF	Global Environmental Facility
HFCs	Haloflourocarbons
IDPs	Internally Displaced Persons
IEA	International Energy Agency
IGAD	Intergovernmental Authority on Development
IGOs	Intergovernmental Organisations
IPCC	Intergovernmental Panel on Climate Change
IPEEC	International Program on Energy Efficiency Cooperation
KCCAP	Kenya Climate Change Adaptation Programme
KEFRI	Kenya Forestry Research Institute
KFWG	Kenya Forest Working Group

KIFCON	Kenya Indigenous Forest Conservation Project
KMD	Kenya Meteorological Department
KWS	Kenya Wildlife Services
LULUCF	Land Use Land Use Change and Forestry
MDGs	Millennium Development Goals
MEF	Major Economies Forum
MENR	Ministry of Environment and Natural Resources
NACCACC	National Climate Change Activities Coordination Committee
NCCAP	National Climate Change Action Plan
NCCFP	National Climate Change Focal Point
NCCRS	National Climate Change Response Strategy
NCSA	National Capacity Needs Self- Assessment
NEAP	National Environment Action Plan
NEMA	National Environmental Management Authority
NGO	Non-Governmental Organisation
NIE	National Implementing Entity
REDD	Reducing Emissions from Deforestation and Forest Degradation
SAGA	Semi-autonomous Government Agencies
SON	September- October – November season
SSTs	Sea Surface Temperatures
TAR	Third Assessment Report
UN	United Nations
UNDP	United Nations Development Programme
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific, and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
UNODC	United Nations Office on Drugs and Crime
UNSC	United Nations Security Council
WTO	World Trade Organisation

OPERATIONALISATION OF KEY CONCEPTS

Climate change

In this study, climate change refers to a change in the properties of elements of climate when they persist for long, up to decades orlonger. For the most part, climate change has been found to be caused by anthropogenic/human activities. This study specifically deals with persistent human induced/anthropogenic changes in the composition of the atmosphere or in land use.

Environmental security. This is one of the seven elements of human security identified by the Human Development report, 1994, done by the United Nations Development Programme (UNDP), alongside health security, food security, economic security, community security, personal security and political security. It refers to "the ability of a society or state to withstand environmental threats such as scarcity of assets, environmental degradation, and loss of biodiversity, risks to the environmental or adverse changes, and tensions or conflicts that are environment-related."[1]

Climate variability

This term is used to represent deviations on climatic statistics over a short given period of time (e.g. a month, season or year) from the long-term statistics relating to the corresponding calendar period. Climate variability in this case is therefore measured by deviations, which are usually seenas anomalies such as El Nino. Climate variability may be caused by natural internal processes within the climate system (internal variability), or by variations in natural or anthropogenic external forcing (external variability).

[1]Institute for Environmental Security Horizon 21 Advancing Global Environmental Security
Science · Diplomacy · Law · Finance · Education

Deforestation: This refers to a natural or anthropogenic process of cutting, clearing, and removal of forestland followed by conversion of the land to non-forest uses such as agricultural farms, ranches, and human settlements. This has implications of causing degradation, reduced water availability, biodiversity and subsequent food insecurity.

Drought. A drought is an unusually severe and prolonged dry period caused by lack of rain. Drought is caused by not only lack of precipitation and high temperatures but is catalysed by overuse of land and over population. This study noticed that climate change led droughts in Africa have affected all aspects of human security with loss of livelihoods, famine, malnutrition, migration, and even conflicts.

Rainfall variability: This refers to an abrupt fluctuation in the average patterns of precipitation. It has greatly damages water availability, agricultural production, and pastoral activities in the sub-regions of Africa and especially in arid and semi-arid lands.

Climate change adaptation. This refers to initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects. This study looked at the role of international, regional, and national strategies for climate change adaptation in Africa, Kenya and in particular, programmes initiated by the National Environmental Management Authority.

Climate change mitigation Climate change mitigation involves technological change and substitution that reduce resource inputs and emissions per unit of output. Mitigation means implementing policies to reduce GHG emissions and enhance sinks. This study also examined the role of global, regional, and national climate change mitigation measures that can help reduce global GHG emissions.

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.0 Introduction

The dawn of the 21st Century marked the closure of certain issues and beginning of new concerns in global relations. While it brought a closure to the cold war era, and the dual super-power engagement in international politics; it laid the ground for the need to redefine some core issues in international relations, particularly with regard to security. The emergence of theconsequent new international security system raised fundamental issues of agendasetting in anew security framework.[2]This included a newly embraced definition of security from the traditional national security, which focused on the power of a state, and military power,[3] to human security.

The novelconcept of 'human security' is broader in its definition and is majorly characterized by a greater emphasis on community and individual security needs. It was first popularized by the UNDP[4] in a report, which described seven categories of security including health, economic, food and community, environmental, political and personal.[5]A core elements of human security, environmental security lays emphasis on issues which threaten the environment, such as climate change, increasing levels of pollution of air, water and land, desertification, threatening the security of private individuals, communities and even states at large[6].

---

[2]Bates, B. *et al*., *Climate Change and Water*, (Geneva: IPCC Secretariat, 2008).

[3]Commission on Human Security. *Human security now: protecting and empowering people*. New York: Commission on Human Security; (2003), p. 23.

[4] UNDP (1994), *Human Development Report 1994*, UNDP. DOI: http://dx.doi.org/10.18356/87e94501-en

[5]Commission on Human Security. Human security now: protecting and empowering people. New York: Commission on Human Security; (2003), p. 23.

[6]Houdret, A, Kramer, A. &Carius, A. *The Water Security Nexus: Challenges and Opportunities for Development Cooperation*, (Deutsche GesellschaftfürTechnischeZusammenarbeit (GTZ), 2010).

When mismanaged, climate change often leads to adverse effects on various issues. These include majorly the aspects that touch on the physical elements of change in climate, such as increase in surface temperature, extreme weather patterns, rise in sea level, hydrologic disruptions together with water and energy disruptions.[7]Climate change is now a major concern among other emerging security issues. Students of human conflict have over time recognized environmental factors as one of the common causes of organized violence between communities. Indeed the first recorded conflict for which there is any archaeological confirmation, pursued between Sumerian City States of Umma and Lagash in 2500 B.C., evidently was fought over control of irrigation canals.[8]

One major challenge in the management of environmental security in Africa as a whole, and Kenya in particular, is the ability to designboth mitigation strategies aimed at reducing climate change and adaptation approaches to cope with impacts that will inevitably continue to occur. Structures that can manage the challenges posed by climate change are inadequate and in most instances too feeble to reliably and effectively mitigate climate change effects. The heavy reliance of its people on its natural resources including rain-fed agriculture, for their day to day nourishment and their very survival, only serves to aggravate the situation. Obviously competition for the ever reducing availability of resources as a result of climate change is likely to create tension and probable violent conflict, threatening peace human security as well as human development.

In Kenya, the National Environment Management Authority (NEMA) was set up as the principal instrument charged with assisting government to attain proper management and rational utilization of environment resources on sustainable yield basis for the improvement

---

[7] Ibid.

[8] David Mitchel, *Environmental Security in a Globalizing World,* Stimson Spotlight, (2015), pp. 78.

of the quality of human life in Kenya.[9] To this effect, it also engages in various programmes aimed at climate change mitigation and adaptation.

1.1 Statement of the Research Problem

Despite the recent advances, attitudes to environmental security and climate changes have from time to time been affected by stereotypes that lead to an underestimation or lack of full understanding of expected consequences, causing a general uncertain and inadequate response.[10] Although the biophysical measurements of climate changehave been widely researched on the global scale, environmental security and climate change remains generally under-explored in Kenya. Therefore, there is an urgent need for researchto determine ways of managing such changes effectively through identification of relevant adjustment and alleviation programs to manage this element of human security.

This is critical as there are several prevalent aspects of climatic change in the region that have a negative effect on human security in Kenya that merit investigation. There is therefore need to obtain more evidence, gathered in various areas, and over extended periods, to construct and test assumptions on linkages between climate change and occurrences, livelihoods, society, tension and strife. It is imperative to examine the effect of different job frameworks to climate change; and the impacts of social, financial, and political changes on the susceptibility and flexibility of livelihoods. Thisgenerates a pressing need to seek more knowledge in relation to environmental security in Kenya.

It is on the basis of this foundation that the study seeks to do a research and obtain a response to the following research questions. What the relationship is between Climate

[9]Environmental Management and Coordination Act (EMCA) No. 8 of 1999

[10] Elliott L 2007. *Transnational environmental crime in the Asia-Pacific: Complexity, policy and lessons learned*, in Elliott L (ed) *Transnational crime in the Asia-Pacific: A workshop report*. Canberra: RSPAS, Australian National University: 1–8. http://rspas.anu.edu.au/ir/tec/documents/Transnational Environmental Crime in the Asia-Pacific.pdf.

change and environmental security.The challengesthat must be tackled as a result of climatic changes and environmental security in Kenya? Lastly what adaptation and mitigation strategies have been used to address climate change and environmental security in Kenya, with the case study of National Environmental Management Authority?

1.2 Objectives of the Study

1.2.1 General objective

Generally, the objective of the study is to establishchallenges of climate change and environmental security managementin Kenya, with key focus on the caseof National Environmental Management Authority.

1.2.2 Specific objectives

The study will be guided by the following specific objectives;

i. To determine the interrelationship between climate change and environmental security.

ii. To establish the challenges of climate change and environmental security in Kenya.

iii. To investigate the mitigation and adaptation strategies to address climate change and environmental security in Kenya, with the casestudy of National Environmental Management Authority (NEMA).

1.3 Literature Review

1.3.1 Climate change and environmental security: An Overview

In recent times, scholars in the field of international relations as well as other fields have been inclined to define security more broadly, moving away from thenarrow state-focused national

security towards the broader human security, which stresses on the individual and human prosperity.[11]Environmental security, which refers to relative safety from climatic and environmental change, is one of the seven elements of human security. Climate change can be defined as the variation noticed in weather patterns recorded over an extended period of time. Climate change according to NASA has taken place throughout history.

In the period before the Industrial Revolution which started in the 1700s, the balance of nature occurred naturally in a predictable and stable manner, and climate change, then minimal, was occasioned by natural causes.[12] Today however, the most significant causative factor to climate change is human activity which has led to an unprecedented high emission of greenhouse gases such as carbon dioxide (CO_2) Nitrous Oxide (N_2O) and Methane (CH_4). These gases contribute to the heat-trapping effect in the earth's atmosphere. Of these gases, CO_2, which is predominantly produced as a result of among other processes, fossil fuel burning, and whose reduction from the atmosphere is minimised by deforestation today constitutes the threat with the biggest concern upon our planet,[13] its proportion in the total amount of Green House Gases (GHCs) emitted being around 76%.[14]Looking at worldwide climatic change through the perspective of human security interfaces such issues as temperature increase, ocean level increase, softening ice tops and carbon outflows to value, conflict, and poverty.[15]

[11]Yingyi Situ, David Emmons,*Environmental Crime: The Criminal Justice System's Role in Protecting the Environment*(Sage Publications, 1999).

[12]National Research Council, *Advancing the Science of Climate Changes*. The National Academies Press, (Washington, DC, USA, 2010).

[13] Climate Change 2007: *Impacts, Adaptation and Vulnerability,* IPCC Working Group II.

[14] The Earth Science Communications Team at NASA's Jet Propulsion Laboratory | California Institute of Technology.

[15]Yingyi Situ, David Emmons Environmental Crime: The Criminal Justice System's Role in Protecting the Environment (Sage Publications, 1999).

1.3.2 Climate change in Kenya

The emergence of contemporary threats to the environmentsuch as the expansion of total populace, debasement of arable land, rapid urbanization and substantial increase of greenhouse gas emissions has progressively increased the significance of environment in the security perspective. This is because environmental insecurity threatenshuman wellbeing through effects such as water shortages, loss of tropical backwoods, exacerbation of the loss of biological species, air and water quality degradation, glacial ice melts, sea level rise and the increase of storm frequency.[16]

It is believed that Environmental insecurity can prompt clashes and present a danger to the national security and human health, especially if a there be a perception of discrimination among concerned communities in obtaining and accessing natural resources and/or if movement of unsafe material is seen or perceived to take place cross borders.[17]Yet the dangers that climate change poses to human security are yet to be singled out. The extent of utilization and contamination in advanced, high-vitality social orders have brought on vast increments in essential woodland spread; biodiversity misfortunes; exhaustion of fish stocks; land debasement; water contamination and shortage; beach front and marine corruption; the tainting of individuals, plants, and creatures by chemicals and radioactive substances; climate change and ocean level ascent.

These climate changes are ‘‘global’’ in light of the fact that they are pervasive and on the grounds that a few detrimental materialsincludinggreenhouse gasses and radioactive waste have worldwide outcomes.A number of states are encountering imminent significant threats to their regional integrity, including Small Island states defenceless against rise in sea

[16]Ibid.

[17] Ibid, p. 21.

level are in danger of being submerged. Some transboundary effects of climate change, such as changes in ocean ice, shared water assets, and the relocation of fish stocks, can possibly generate competition and conflict among states. The presence/nearness of powerful organizations would be significant in overseeing a significant number of these competitive tensions with the end goal that human security is not extremely eroded.[18]

Globally, analysts have posited several pathways by which environmental factors could contribute to political conflicts. Expanded interest, driven by populace development or financial improvement; or declining supply, driven by increased population, overexploitation of resources or ecological change, could trigger shortages of key natural resources, creating rivalry and competition between affected countries or communities.[19]

Africa is home to around 1/5 of the world species of plants, warm blooded creatures, and birds, and additionally 1/6 of creatures of land and water amphibians and reptiles. These species make some of the world's varied and naturally existing biological communities for example, savannahs, tropical timberlands, coral reef marine and freshwater living species, wetlands and different environments. These universal habitats set the economic foundation that's the lifeline of many African nations by providing water and nourishment. In view of climatic change however, these biological communities and livelihoods relying on them are debilitated.

It is becoming more widely acknowledged that climate change and its impacts can affect worldwide peace and security. In Africa particularly, insecurity is potentially more probable given that instruments that enable adaptation are feeble, inadequate and are

[18]United Nations, *Population Distribution, Urbanization, Internal Migration and Development: An International Perspective*, (2011), p. 10.

[19] FAO (Food and Agriculture Organization), 2006. *The state of food insecurity in the world, 2006*: Eradicating world hunger, taking stock 10 years after the World Food Summit. Rome: FAO.

employed in a less coordinated manner rendering the continent more helpless against uncertainty identified with water, sustenance, vitality, and natural calamities.[20]Climate experts caution thatchanges inelements of weather such as rainfall patterns very quickly impact on sustenance systems such as water accessibility, ultimately reducing farm produce such as grain yields with an impact on the survival of various species through seasons and generations.

Climate change also has an effect onachievable harvests, and consequently, profitability of agriculture, particularly in Africa. A substantial part of the populace is pre-occupied with rain-fed subsistence farming carried out on marginal farmlandsrendering them helpless against the hostile impacts of environmental change.[21] In situations where adaptation mechanisms are limited and their resources are managed in an unsustainable manner, food insecurity will be broader and more persistent.[22]

Climatic change also causes increased aridity in the sub-tropical zones, and continued desertification in deserts such as the Sahara. Consequently, evaporation of water will increase slowly leading to increased water scarcity and ultimateinstability of water security. This will eventually influence human security, raising the threat of water-related clashes. It is projected that people encountering water scarcity in Africa may grow by 75 million bythe year 2020 and some hundred million by the year 2050. The Nile Basin has been singled out as one of the major zones that'll experience this effect.

Together with other factors, environmental insecuritycan prompt mass movement of people, mostly within states or to bordering states rather than universal migration. In early stages of ecological degradation, movement is prone to be seasonal, round, or occasional. If

[20]Ibid.

[21]Norman Myers, *Consultant in Environment and Development, Special Advisor to* the Hague Conference on Environment, Security and Sustainable Development, (2004), p. 1.

[22]Ibid. p. 3.

and when however ecological corruption gets to be extreme or irreversible, especially in areas likely to experience ocean level ascent, movement may be permanent.[23]Movement as a result of progressive disintegration of ecological conditions is likely to affect more individuals than those moving due to natural disasters. Such developments cause increased pressures in receiving zones if not quickly tended to, especially when resources are strained. Similarly, the occasional movement of pastoralists is influenced by climatic change, leading to rivalry between fellow pastoralists, as well as sedentary agriculturists.[24] This rivalry has the potential to trigger local as well as cross-border clashes, as of now evident in Eastern Africa.

The very livelihoods of most East Africans and their food security are heavily reliant on rain-nourished agriculture rendering them susceptible to environmental inconsistency.Agriculture is the mainstay of 80% East Africans, contributing up to 40% of East Africa's GDP.[25] This is however being compromised by the noted weather changes. For instance, there was a decrease of 50-150 mm in precipitation for every season (March to May) between 1996 to 2003, and a consequent decrease in long-cycle yields, (sorghum and maize varieties that take long to mature) over most areas in eastern Africa.[26] Long-cycle crops rely on the rain during the wet season and a reduction leads to reduced yields, affecting the overall food supply quantities.

Kenya's distinctive landscape is habitat to a variety of wildlife that is valuable scientifically, intrinsically and economically. With a considerable number of wild animals seasonally or permanently living outside secured territories, the wildlife resource has often

[23] Ibid. p. 4.

[24]Spooner, B., *Climate Change and Conflict in Africa: Implications for Pan-Africa Strategy, A Desk-Based Study Commissioned by the Department for International Development Africa Regional Department and Africa Conflict and Humanitarian Unit*, (Kent: GlobalImpacts Limited, 2010).

[25]Ibid.

[26]Githeko, A.K. and Ndegwa, Pr*edicting malaria epidemics in the Kenyan Highlands using climate data: a tool for decision-makers.* Global Change and Human Health, (2001): pp. 54-63.

been affected by human activities which include poaching, wildlife products demanded in the illegal market, human–wildlife conflict and weak legislation.[27]

1.3.3. Climate Change Adaptation and Mitigation Strategies in Kenya.

While the effect of climatic change on security is clearer now than any time in recent memory, the issue is still not being tended to adequately by the global atmosphere administration, neither does it have any legitimate drive or support. Nonetheless, states, associations and different studies persist in bringing the issue to the limelight, and several states have made tremendoud steps in improving their national strategies in response to concerns and dangers.The issues relating to human security and conflictas a result of climatic change thus appear to have advanced to anapparently imperative segment as discourseson climatic change continue to take place, and are being attended to seriously in various fora through among other actions formulation of relevant policy, and preparation of reports.[28]As an example, the UNSC held two sessions addressing the issue of the security threat posed by climatic change.Similarly, an IPCC evaluation report committed a full Chapter to human security. In addition, the US Department of Defence developed and released an Adaptation Roadmap recognising the immediate threat posed by climate change to national security. The roadmap recommends the fusion of climatic change into the military's broader strategic thinking "about high-risk regions."[29]

The connectedness of climatic change, water assets and desertification and biodiversity misfortune, among other climatic phenomena make singular secluded

[27]Kamweti, D., D. Osiro, and Mwiturubani. *Nature and Extent of EnvironmentalCrime in Kenya*. Pretoria, South Africa: Institute for Security Studies, (2009).

[28] FAO (Food and Agriculture Organization), 2006. *The state of food insecurity in the world, 2006*: Eradicating world hunger, taking stock 10 years after the World Food Summit. Rome: FAO.

[29]Ibid.

administration reactions insufficient and conceivably counterproductive, and call for an integrated approach in mitigation efforts. More coordinated ways to deal with substantive issues, and spatial scale is important and requires a versatile administration structure.

As a member of the majority of global and regional environmental security institutions, Kenya has been very active in the world's effort to manage climate change through mitigation and adaptation. Kenya is also party to each and every environmental treaty, and has even hosted a number of international environmental conferences on climate change.

On the domestic front, Kenya has set up institutions and policy frameworks to managepolicies however are environmental challenges. These policies, while having significant links with the environment are however sectoral, individually addressing the fields of agriculture, land, water, forests, trade and industry, and there hasn't been an effort to formulate integrated and ecosystem-based approaches. This has proved insufficient in addressing environmental challenges. Some of the key policies and actors involved in addressing environmental sustainability with a focus on climate change in Kenya are addressed hereafter.

Vision 2030 mentions several environmental challenges facing Kenya, focusing on 'green' environmental issues, as opposed to 'brown' issues. Brown issues are expected to rise with the expected increase in urbanisation from 21 per cent in 2007 to the projected 33 per cent by 2030.

In Kenya, the de facto policy documents addressing climate change are the National Climate Change Response Strategy (NCCRS - (2010)),the National Climate Change Action Plan (NCCAP) and the Medium Term Expenditure framework (2013 – 2017) (MTEF). The

Agriculture Sector Development Strategy (ASDS), (2010 – 2020) also captures issues of climate change.

NCCRS gives mechanisms to incorporate climate concerns in the nation's development priorities, plans and budget,[30] the major focus being Agriculture, whereclimate adaptation and mitigation needs are identified. Other major goals for the policy include management of related issues such as food security and biodiversity conservation.The NCCAP, 2013, aims at operationalising the NCCRS through provision of an enabling mechanism for successful implementation. In addition, Kenya prioritizes climate adaptation in its Agricultural Sector Development Strategy (ASDS).[31]

In line with government priorities, the Second Medium Term Plan 2013-2017 (MTP) identifiesmajor policy actions, and priority programmes for implementation in the 2013-2017 period. These programmes are committed to securing Kenya's environment and building resilience to climate change, in collaboration with county governments and are aimed at environmental governanceimprovement; efficient waste management and pollution control; rehabilitation of rivers in urban areas; land reclamation; building water harvesting and storage infrastructure; restoration and protection of water towers, among other programmes[32]

Policy Actors

Policy actors include government ministries and departments and Semi-autonomous Government Agencies (SAGAs) such as the Ministry of Environment, and Natural Resources, (MENR), the National Environmental Management Authority (NEMA), the Climate Change Coordination Unit (CCCU), and other government parastatals and

[30]GoK 2010b

[31]GoK 2010a

[32]Emelie César, Anders Ekbom Wilfred NyangenaEnvironmental and Climate Change Policy Brief Kenya, Sida's Helpdesk for Environment and Climate Change www.sidaenvironmenthelpdesk.se pp 9

departments; international Non-Governmental Organizations (INGOs), such as the UN and related bodies; regional NGOs and corporations; national NGOs and Community Based Organizations (CBOs); development partners; the private sector; civil society organizations; and research and academic institutions.NEMA is the operational government body for the protection and management of environmental issues, and implementation of national environmental policies and priorities.The Climate Change Coordination Unit (CCCU), under the Deputy President provides the much needed political support that is so important in the implementation of climate change activities. By involving the deputy president's CCCU, it is apparent that the Kenyan government is keen on prioritizing climate change management, which among other activities involves upscaling the wider green growth plan in Kenya.

It is not possible to get one answer for environmentalchallenges. Worldwide reactions are importantin the upgrading of national borders and encouraging the uptake of arrangements among countries with shared characteristics/ethnic communities across borders. These reactions both at national and worldwide levels communicate and create incremental and transformational change at the local level. Similarly, the engagement of non-state organshas encouraged the communities in settling environment related conflicts amicably.

Dau-Schmidt notes that the recognition of climate change effects triggered the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) in 1973. CITES was set upprimarily is to ensure the regulation ofwildlife trade so as to ensure there is no extinction of any species, and guarantee that the trade does not threaten the survival of any species. According to CITES, all living species are categorized in three levels, so placed after considering what amount of protection is needed, for a particular species to ensure it is not driven to extinction. The determination of the classification that will apply to any species, is arrived at once a state comes forth and affirms whether in its judgement, trade in a particular species does not risk its extinction and can therefore continue, or if there is

some level of risk of extinction of a species if trade or hunting is allowed, and therefore there is need to closely regulate the trade, or if there is definite risk of a species being extinct and therefore its trade or hunting must stop to prevent the extinction.[33]

The significance of ecological sustainability has been set upon earlier formulated Sustainable Development Goals (SDGs). Although there has been progress in meeting these goals, a lot remains unaccomplished and new challenges hinder further development and derail gains so far achieved.The degree and persistence of worldwide environmental problems call for sustained collective endeavour to reach the desired global goals.

In East Africa, and Kenya in particular, climate change is a constraining factor for sustainable development. Key ecological determinants include environmental change, woods consumption and debasement, forest depletion, land and water degradation and loss of biological system administrations. In conclusion, Kenya requires a long-term plan for maintaining its natural resource base and sustaining its environment. When the natural resources are not preserved, an ecological crisis may arise.

1.3.4 Knowledge gaps

Several studies have been carried out on the climate change impactsbeing experienced and expected to continue being felt globally. Of special note are studies that relate to water and air pollution and carbon emissions, their effects and possible mitigations have been carried out extensively in the Western world. The East African region, and in particular Kenya has not had much research especially on the aspect of carbon emissions, climate change and environmental security, and its likely impact. While there is evidence of erratic weather patterns in recent years, there has been no research to link it to climatic change. Erratic

[33]Kenneth G.,Dau-Schmidt. (1990),*An Economic Analysis of the Criminal Law As a Preference-Shaping Policy*, DUKEL.J. 1, 26-27.

weather patterns in Kenya have contributed to difficulties in achieving sustained food production, since the country relies mainly on rain-fed agriculture.

Management of climate change is therefore critical for the country to achieve environmental security. There is also need to establish how institutions in particular NEMA, which is charged with managing the environment to ensure sustainable health of Kenyans have been able to mitigate climate change as they carry out their functions, and to determine what other mitigation strategies can be adopted. This research therefore aims to identify the challenges caused by climate change and to determine whether there is a link to the changes that have been experienced lately in weather patterns and environmental security, with a view to identify mitigation strategies that would be applicable in Kenya.

1.4 Justification of the Study

Environmental security encompasses many different fields of study and research. It is therefore necessary to collaborate with all other experts that may be involved in climate change such as politics, economics and societal behaviour. In the current dynamic society policy makers are increasingly compelled to make decisions that require them to devise strategies and policies to meet shifting security needs. This study aims at helping policy makers to strengthen global environmental sustainably through climate change action in Kenya. The policy makers are increasingly working under uncertain conditions and the conflicting goals and expectations require them to devise new solutions to the complex issues.It is in the backdrop of this that the study seeks to find out the challenges presented by this situation, and thus increase the knowledge on climate change in Kenya among academicians and researchers.

Climate change and environmental security is of great concern and while there is abundant data on a global scale, very little information available in the Kenyan context, detailing how climate change has impacted environmental security in Kenya, and the linkage between climate change and environmental security. The study therefore seeks to do a research in this subject with emphasis on role of the NEMAand how carrying out their mandate enables them to effectively mitigate against climate change and help the country to adaptto the inevitable effects of climate change, and thereforeensuring environmental security in Kenya.

1.5 Hypothesis of the Study

i. Climate change poses uncertainties in the sustainability of environmental security of Kenya.

ii. NEMA faces numerous challenges in its endeavor tomanageclimate change and environmental security issues.

1.6 Theoretical Framework

The study appliesliberalism theory to explain the linkages in the institutional challenges of climate change and environmental security. Liberalism believes that it is possible for states to gain absolute benefits as a result of international cooperation with other states. While Liberals agree that states will endeavour to achieve their own national interests by whatever means, and acknowledge that anarchy is a foundation of most paradigms in the international system, they argue that cooperation is one way in which these national interests can be realised. They acknowledge that although it is not any particular state's interests for cooperating states to gain more while it gains less in negotiations, it is in its national interest to make some gain,

however small, as a result of cooperation and therefore advocate for international cooperation.[34][35]

Liberalism can be used to explain the efforts being made to regulate and control global climate change, because it underscores the efforts of cooperation among states and stresses on among many other issues, the significance and importance of international institutions like the UN. It also acknowledges and applauds the role of regimes, including the United Nations Framework Convention on Climate Change(UNFCCC) as well as the Kyoto Protocol, in climate change management. It also explains the work of helping developing countries in reducing their GHG emissions.

Citing a lack of binding agreement by states committed to the Kyoto Protocol, the US withdrew in 2001 alleging there was no binding commitment to reduce greenhouse gas emissions.[36]Realists support developing countries hesitancyincommitting to agreements requiring GHG emissions reductions, asserting that the emissions are produced as the states strive to provide basic amenities for their citizens. The amenities which include electricity, warmth and water are yet to be provided in sufficient amounts in developing countries. Furthermore, developing countries do not have much money, and should therefore meet their national interests by spending the little they have in poverty reduction and development rather thanin reduction of emissions.[37]

[34]O'Neill, K. *The Environment and International Relations Cambridge,* (Cambridge University Press, 2009)

[35]Keohane, R., P. Haas, et al. (1994). *'The Effectiveness of International Environmental Institutions'. Institutions for the Earth: Sources of Effective International Environmental Protection Cambridge,*(Massachusetts, MIT Press, 1994) pp3-25.

[36]Bulkeley, Harriet and Peter Newell. *Governing Climate Change*. (London: Routledge, 2010). Pp30

[37]Ibid pg 46

Negotiations on climate change are driven by national interests and power politics, but most states have realised that it is in their best interest to cooperate rather than disagree when dealing with climate change governance. Fortunately, the withdrawal of the US from the Kyoto Protocol galvanised the European Union, China and the G77 into increased ratification."[38] When Russia ratified the protocol in 2005, the protocol was seen to remain relevant, despite widespread concern that the exit of the largest and powerful GHC contributor would reducethe significance of the protocol. So far, thirty three out of the thirty six countries that committed to reduce emissions have reduced and maintained stability in their recorded GHG emissions. Thirty of the thirty three that have reduced their emissions, have passed the baseline reduction amount required.[39]

It is evident therefore that liberalism is able to explain state behaviour at a deeper level than realist policies, since adaptation to climate change is only effective when embraced by several states as the negative effects of climate change transcends borders. Hopefully, as states formulate and design policies and programs to meet the requirements of climate governance,and manage climate issues,they will embrace liberalist ideals more, rather than administer mainly realist policies.

There are three pillars that define Liberal international relations theory, these are institutionalism, democratisationand economic inter-dependence. IPCC reports aver that these pillars all have the likelihood of being affected negatively as climate change continues to take place. On democratization theory, the IPPC report predicts negative impacts which

[38] Ibid pg 23

[39] http://unfccc.int/kyoto_protocol/items/3145.php UNFCCC. accessed on 18/01/2017at 0020hrs

includewater resource scarcity and its inequitable accessibility leading to a decline in human security, and possible social unrest.[40]

Conflict scenarios are likely to occur as a result of competition due to declining resources which are likely to be compounded further by security dilemmas. These dilemmas are delicate and call upon careful relationship management which is geared towards maximisation of areas where there is common interest. Poor management of regional affairs is likely to magnify the entropy of security dilemmascreating a higher likelihood of conflict potentials. Conflicts may arouse rising nationalist agitation which would provoke lack of cooperation, since multilateral negotiations are based largely on the domestic constituents permitwhilenegotiating an agreement[41]

It is therefore clear that states have recognised that systems, especially human systems, which depend onthe state as the basic unit of the broader, wider world, would best their interests when they learn that the bio-physical realities and embrace governance of the natural systems of the Earth as a whole rather than individuals.

1.7 Research Methodology

This section covers the procedures that were followed in conducting the research. These procedures include; research design, research methods, target population, sampling methods, data collection and ethical issues.

1.7.1 Study design

This study utilized a triangulation of explanatory and case study research design that sought to gain an in-depth understanding on the impact that climate changehas in the management of

[40]Cai, X.*Water stress, water transfer and social equity in Northern China -Implications for policy reforms.* Journal of Environmental Management(2008).87: 14-25.

[41]Putnam, R. (1988). *'Diplomacy and domestic politics: the logic of two-level games.'International Organization* (1988): 427-460.

environmental security in Kenya. Case studies was chosen because it provides rich, raw, and fresh material for advancing and testing theoretical ideas sometimes givinga perception at the various stages of theory building. Case studies are extremely valuable whennew theories are being tested, since they provide the wide ground required in the testing. Once information is seen to apply in many cases, it is then possible to use it to stimulate new theoretical thinking Additionally, case studies are very goodas research and teaching tools.

1.7.2 Research tools

Both primary and secondary sources of data were employed in this research. These include journals, books, media reports and other academic publications and technical reports by IGOsand NGOs, with examples such as the UNEP, NEMA, Kenya Meteorological Department (KMD), Ministryof Environmental publications, and Legal documents.

In the effort to acquire primary materials the study involved discussing questions with key informant persons through interviews to obtain their views.

1.7.3 Data Collection

The research methodology that was used wascollection of Secondary data from documented literature, publications and data from recognised institutions, as well as primary data. The study used quantitative techniques and qualitative research techniques to accomplish the set objectives. In this regard, both numerical data and qualitative results were collected. On the whole, the research relied basically on qualitative research techniques given that most of the data collected was in the form of the views of persons directly working with issues of climate change and environmental security.

In the primary data collection the research usedthe questionnaire method. This has been informed by the fact that the target population is large and widely spread geographically and the limited time within which the research has to be conducted.

The study appliedsnowball sampling technique to identify the sample of the study. This design is a purposive or judgemental sampling where interviewees were selected based on their expertise and skills, and because they had possession of the information required.[42] The snowball technique was used because the information that was required is technical and required the involvement of persons who are directly involved and personally deal with the environmental issues under discussion and therefore possessed expert knowledge. In addition, this sampling technique brings results that are more accurate than those that are obtained from the general population. The method also gives stakeholders a chance to participate.[43]

1.7.4 Research Analysis

The collected data was sorted and analysed using document analysis and thematic analysis techniques. Document analysis is a qualitative technique which interprets a given topic to give it meaning, while thematic analysis, which is also qualitativeorganizes and describes the main data-set in detail, identifying patterns in order to interpret the meaning. In this process, key issues of interest in the study were identified together with major subjects surrounding the issues and their interrelationships and associations discussed.

1.8 Study Outline

The research is organised in five chapters. Chapter One is an introduction in which the subject topic is introduced, together with the main objectives. The chapter identifies the

[42] A. G. Mugenda, *Social Science Research: Theory and Principles,* (Nairobi: Applied Research and Training Services, 20080, p. 196.

[43]Mugenda O and Mugenda A., *Research methods-quantitative and qualitative approaches*. Acts press, Nairobi, Kenya, (1999), p. 128.

problem that the study will endeavour to solve. The chapter also gives the literature review. Chapter Two analyses the relationship between climate change and environmental research. Chapter Three examines climate change and environmental security in Kenya and examines the key prospects and challenges.Chapter 4 studies the case of NEMA in the management of climate change and environmental security in Kenya, while examining the various challenges that NEMA faces in this management and in meeting its mandate. National Environmental Management Authority (NEMA), and finally chapter five presents thesummary of the study, conclusions and recommendations.

CHAPTER TWO

CLIMATE CHANGE AND ENVIRONMENTAL SECURITY: AN ANALYSIS

2.0 Introduction

Environment is an enabling factor for realising sustainable development and the people's optimal wellbeing. It is the support upon which living things depend. In addition, it enables the resilience and ability to sustain life, despite looming threats such as climate change, land and water degradation, which reduce the capacity of the land in agricultural production, and loss of ecosystem services. Some of the causal agents of environmental degradation include high population growth and its associated pressure on scarce natural resources, as agricultural production is increased to meet the increasing need, infrastructure expansion and increasing energy demand. Climate change affects various elements of weather causing an impact on environmental security; the variations being of such high magnitude that they may be a threat to the very existence of the state.

This chapter analyses how climate change relates with environmental security. It endeavours to determine the nexus between the two, highlighting how climate change affects environmental security and the entire impact on the wellbeing of the population in general. The first part of this chapter attempts to define climate change and explain environmental security and the variables that define them. The chapter then goes further and identifies theelements of climate change that have created negative impacts. The final section of the chapter gives a description of the link between climate change and environmental security.

2.1 Climate Change

Climate change may be defined generally as the statistical properties of recordings taken over extended time intervals on elements in the climate system, whose properties appear to be changing, in their mean and spread[44]. This is irrespective of what may be causing the

[44]"Glossary – Climate Change". Education Centre – *Arctic Climatology and Meteorology. NSIDC National Snow and Ice Data Centre Glossary*, in IPCC TAR WG1 2001.

change.[45] Since the recordings taken are mostly in the form of temperature, many stakeholders in the field regard climate change to be anthropogenicglobal warming, a term which refers only to increases in surface temperature.

In scientific journals however, variables of climate change have been given a wider perspective, to include other climatic elements that are affected by high greenhouse gasemissions, together with global warming. In this regard, other elements of climate change include the rise of sea level, warming oceans, shrinking ice sheets, erratic rainfall, glacial retreats, ocean acidification, decreased snow cover and extreme events. Extreme events refers to manifestations of extreme measurement observations such as very cold winters, extremely hot summers, and such events as droughts, floods, and storms.

Climate change affects basic support systems of life and can directly impact on "survival, which is the primary human goal and the first duty of all governments to its people, thus its importance cannot be underscored."[46] This is especially so since the Intergovernmental Panel on Climate Change, (IPCC) reports about theindisputable scientific evidence that warming of the climate is in fact taking place.[47]

2.2 Climate Change Impacts

Impacts of climate change are centred on the rising frequency of incidences and the severity of climate-related natural disasters which have taken place including flooding, which is caused by erratic heavy rains, melting ice and rising seas, which are particularly dangerous in

[45]"The United Nations Framework Convention on Climate Change". 21 March 1994.

[46]T. Wilson, Global climate, world politics and national security, In Nanda, V., (Ed), World Climate Change: The Role of International Law and Institutions. (Westview Press, Boulder, 1983) p. 71

[47]IPCC Fourth Assessment Report, Summary for Policymakers, p. 5

coastal areas, where cities and consequent populations have been rapidly growing.[48] Flooding also reduces water quality and water availability in the required quantities in some regions.

Heat waves: Summer heat waves as a result of increased temperatures are more frequent worldwide. High temperatures also accelerate water evaporation which exacerbates the likelihood of storms and aggravates extreme weather happeningswhich include hurricanes. Storm surges inareas with rising sea levels are capable of great and destructive damage, endangering life and property. In the more arid areas, intensified droughts and wildfires are experienced.

Glacier melting: On mountain tops, glaciers are melting across the world and reducing in size, including glaciers on Mount Kenya and Mount Kilimanjaro, both in East Africa, due to global warming. This negatively impacts on several people who are dependent on the world's 190,000 glaciers for the supply of water during the dry season. Ice in the Arctic sea is also melting faster than previously witnessed, further increasing the impacts of climate change. At the West Antarctic Peninsula, ice shelves are melting and coming tumbling to the sea. Glacier melting and melting of ice sheets on land contribute to exceptionally high rise of the sea level. While this rise has been happening over the years, the rate at which sea level has been rising in the past decade has been noticed to be almost double that recorded in the past century.[49] This may create existential threats to some low lying island states which face the danger of being submerged in the future. For instance, the

[48]European commission publication http://ec.europa.eu/clima/change/consequences, accessed on 23/01/2017 at 1745hrs.

[49]Church, J. A. and N.J. White (2006), *A 20th century acceleration in global sea level rise, Geophysical Research Letters*, 33, L01602, doi:10.1029/2005GL024826.

Maldives[50] and Kiribati[51], both island states in the Asia Pacific region clearly face a possibility being submerged as the sea levels rise occasioned by climate change.

Agricultural productivity: Climate change has a huge impact on agriculture, which is dependent on elements of climate such as rainfall. In Africa particularly, where agriculture is rain-fed for the most part, and where structures to mitigate the impacts of weather pattern changes are inadequate, erratic weather patterns have a huge adverse effect on production leading to food insecurity. Schlenker and Lobell projected yield losses of around 27–32% in main,stable and important crops such as maize, sorghum and groundnutin Africa if a warming exceeding 2^0C above what was recorded in pre-industrial levels is reached.[52] Similarly, Thornton et al estimate ‘‘Worst-case’’ mean yield loss of 24% for maize and 71% for beans for a warming exceeding 4^0C above optimal levels. Apparently, cassava is more resistant to high temperatures and unstable precipitation than cereal crops, according to Niang.[53] Similarly, the risk of crop failure has been found to be lower with multiple-cropping systems than single-cropping systems.[54]

[50] Mohamed Latheef, "*Climate Change and the Maldives: Adaptation, Mitigation, and Innovation*" (speech to the United Nations General Assembly, 2007), http://www.un.org/ga/president/61/follow-up/climatechange/ statements/statementMaldives.pdf.

[51] Solomon Times Online *"Kiribati Seeks Relocation as Climate Change Sets In,"* Feb 16, 2009, http://www.solomontimes.com/news.aspx?nwID=3584.

[52]Thornton PK, et al *Agriculture and food systems in sub-Saharan Africa in a world. Philos Trans A Math Phys EngSci*(2011) 369:117–136.

[53]Niang I, et al in: *Climate change 2014: Africa: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the IPCC*. Cambridge University Press, (Cambridge 2014)

[54]Waha K, et al *Adaptation to climate change through the choice of cropping system and sowing date in sub- Saharan Africa.* Glob Environ Change (2012) 23(1):130–143.

"Livestock production is affected by drought to a large extent, especially in instances where it relies on natural systems and local biomass production", according to Masike and Ulrich 2008,[55]and has a high likelihood of animal death as drought becomes more severe.

Human health is also greatly affected by the ever warming climate. The warmer climate experienced through global warming, is conducive for multiplication of disease causing organisms, increasing the likelihood of disease manifestation. Similarly, in polluted areas, the air gets clogged by the ozone present, leaving populations vulnerable to diseases like asthma. This has caused health insecurity especially in regions ill equipped to handle climate change effectively such as Africa.

Extreme weathers: With the prevailing tendency for extreme weather conditions, there has been a numerical rise in deaths related to extreme heat in some regions and cold-related deaths in other regions.[56] In southern and central Europe more recurrent heat waves, forest fires and droughts, have been reported in recent years, with the highest exposure to heat waves being in urban areas, where four fifths of the people now live. Other regions, such as northern Europe are getting significantly wetter, and it is feared that winter floods could become common with time. The Mediterranean is becoming drier, rendering it more vulnerable to droughts and wildfires.

Loss of biodiversity: Various animals and plants face extinction as their natural habitats get destroyed with climate change effects. As oceans get more acidic, and sea ice disappears, various species naturally living in the sea continue to struggle, their very survival being put to risk. The consequences of such occurrences can be tremendous and have serious impacts, such as actual extinction of a wide variety of species.On the flipside, some species

[55]http://climateanalytics.org/files/ssa_final_published.pdf accessed on 21st Feb 2017 at 2200hrs

[56]Commission on Human Security. *Human security now: protecting and empowering people.*(New York: 2003), pp. 23.

of disease causing organisms thrive with the changes, leading to increased disease prevalence. There are reports of some animals migrating from their natural habitats to seek friendlier environment. Such events have the potential of creating significant stress on nations that have inadequate resources and are limited in their abilities to respond effectively to the environmental strain. Some living things are therefore at an increasing risk of being wiped off the face of the earth if average world temperatures continue increasing unchecked.[57]

These threats are not experienced equally across the globe. While states of the south divide face problems due to desertification, the northern industrial countries are faced with the threat of acid rain. Meanwhile, Polar Regions may experience extensive depositions of persistent pollutants. Climate change is expected to cause unevenly distributed effects across the globe in the next century. As such, some countries will benefit while others will be disadvantaged.[58]

2.3 Environmental Security

Environmental security is one of the seven elements of human security alongside health security, food security, economic security, community security, personal security and political security,[59] as identified by the Human Development report, 1994.

Sometimes referred to as ecological security, environmental security can be described as "the ability of a society or state to withstand environmental threats such as scarcity of assets, environmental degradation, and loss of biodiversity, risks to the environmental or

[57]**http://ec.europa.eu/clima/change/consequences**

[58]Institute for Environmental Security Horizon 21 — *Advancing Global Environmental Security Science* · Diplomacy · Law · Finance · Education

[59]Commission on Human Security. *Human security now: protecting and empowering people.*(New York: 2003), pp. 23.

adverse changes, and tensions or conflicts that are environment-related."[60] The United Nations Environmental Program (UNEP) has defined the connection between environment and security as "inequitable access to natural resources, environmental degradation and the movement across boundaries of harmful materials that can degrade the environment leading to conflict and thus posing a risk to human health and national security."[61]

Another definition cited in a paper detailing the contribution of NATO to European Environmental Security, environmental security may be defined as "a threat to the national security caused by environmental problems coupled with their capacity to promote conflict and political instability."[62]In the academia, environmental security has been defined as the connection between the natural environment and issues concerning security such as tensions and armed conflict.

These definitions show a common premise in the understanding of environmental security given that environmental change can generally cause a reduction in the quality of life while increasing competition, tension, instability and violent conflict. Other manifestations of environmental insecurity include environmental degradation caused by pollution, extensive deforestation, insufficient infrastructure, corruption and violent conflictsand tension caused in part by practices such as mining of minerals and exploiting for oil, coal and gas.[63]

Studies in environmental security begun in 1960s when scholars started to criticize the traditional notion of security, indicating that the concept as then understood was narrow and

[60]Institute for Environmental Security Horizon Advancing Global Environmental SecurityScience · Diplomacy · Law · Finance · Education

[61]UNEP, "*Linking Environment and Security" Regional Office for Europe: Key Activities*. (2013).

[62]Butts, Kent Hughes. "*NATO's Contributions to European Environmental Security"* (1993).

[63]Institute for Environmental Security Horizon 21 — *Advancing Global Environmental Security Science · Diplomacy · Law · Finance · Education*

failed to address environmental problems either at national or at international levels.[64]At the time, it was acknowledged that it was important to link the environment with security due to concerns over the impact of nuclear weapons testing, being done in the early 1960s, on health.[65]

Academic discussions of definitions of security followed leading to significant expansion of the definition to include a larger spanof issues that threaten peace. They include concerns of political nature for example utilization of scarce resources, which could have a bearing on environment and related implications such as pollution.Environment concerns are very transnational, and a very important contributor to peace as well as national security, and human rights.

Although the exactmode of the environment's contribution to peace or lack of it, to lack of stability, human insecurity and conflict is viewed in divergent ways depending on thecircumstances and the person, it is increasingly being acknowledged that it can directly or indirectly cause instability, conflict and unrest.

Environmental security was eventually identified and recognised as a field of study in the mid1980s.A fast developing field, environmental security is critically relevant to those studying the relationship between the scarcity of resources and tension and conflict more so in the developing world. The environment forms a planetary support system upon which all other human activities and functions depend.

Three major approaches to security have been identified, each personifyinga distinct security referent. These approaches include Geopolitical environmental security, an approach

[64]Alan, Collins,*Contemporary Security Studies. Great Britain*, (Oxford University Press, 2013). pp. 190–207. ISBN 9780199694778.

[65] Chad Michael Briggs,*Environmental security, abrupt climate change and strategic intelligence*GlobalEESE (Global energy and environment Strategic Ecosystem, February 15, 2009)

which recognises that the security referent is the nation-state. In using the nation-state as the security referent, issues of sovereignty environment and related factors are the major dynamics. Theyare mainly associated with cross border impacts on national interests as a result of environmentally caused conflict in other states, especially the developing world.

The second approach that has been identified is referred to as the comprehensive environmental security. In this case the global system is the security referent, and the threat is the collective impact of the cumulative human activities in all the states on the global ecosystem and the ecological risk is viewed from the perspective of the entire global commons.

The third approach that has been identified in environmental security places the underprivileged global majority to be the security referent. Most of these people are located in developing nations. The large and continually growinggap between the wealthy and the poor in the distribution of global wealth is what comprises the security threat. Similarly, environmental change impacts arenot uniform, but discriminatedand these are kept in placeby newlyemerging forms of colonialism in the global world.

For political, cultural, social, and most significantly, economical systems to be viable and sustainable, there must be environmental security. Global environmental issues therefore are not only a legitimate global security issue but trickle down to affect national security, which is a concern for all countries. Furthermore, unlike military threats which are generally potential in nature, environmental security threats are real and ongoing.[66]

[66]Elizabeth L. Chalecki,*Environmental Security: A Case Study of Climate Change,* Pacific Institute for Studies in Development, Environment and Security pp 2

The Copenhagen School defines a referent object of environmental security as the environment, or some strategic part of it. Threats to environmental security are complex, transnational, have long term implications and their effective management requires cooperation among states actors and other relevant actors.

2.4 Climate Change and Environmental Security

Climate change is seen as having a connection toenvironmental security because it has been realized that when climate changes on a large scale, it so affects the environmental balance that it creates a possibility of the development of existential threats.[67]The environment provides the support system which sustains all human and other living enterprises. In their undisturbed and natural state, elements within the environment maintain an optimal balance, but that is being continuously disrupted, especially through various human activities, undermining livelihoods of the populace on all levels and leading to broader negative impacts on society.

Some of the ways in which climate change threatens environmental security, include causing environmental changes that affect availability of renewable environmental resources, ecological services and human systems, which are critical for human survival. These according to the IPCC include forestry resources which include boreal tropical forests, water supply, coastal zones, polar and alpine ecosystems, soils, coral reefs, fisheries,prairie wetlands, and remnant native grasslands and agricultural systems[68]consequently causing food shortages not just to human beings but other living beings as well among other impacts.

[67]Floyd, R (2011) '*Can securitization theory be used in normative analysis? Towards a Just Securitization Theory' Security Dialogue*, (2011), 42 (4-5), 427-439

[68]IPCC (Intergovernmental Panel on Climate Change)*Climate Change 2014 Synthesis Report Summary for Policy Makers.* (Cambridge University Press, Cambridge, 2014).pg 6.

In terms of geographical analysis, the IPCC sees developing regions as being more at risk than other regions to climate change, with Africa topping the list.[69] Latin America and Asia have also been found to have climate change related problems, although this is at lower levels than Africa. Asia may experience flooding and food insecurity, while Latin America's experiences of climate change are likely to be triggered by variations in El Niño Southern Oscillation (ENSO), reduced biodiversity which might lead to decreasing crop yields. This leads to environmental insecurity and food insecurity. Of all the vulnerable states to climate change, however, the small island states are likely to be most affected by warming of the sea surface, extreme events, coral bleaching and changes in ENSO, events which could eventually cause the states to submerge in the ocean.

Climate change may induce migration on large scale. In general, communities are usually resilient and will adjust accordingly to cope with extreme occurrences. If however, the changes occurring in climate continue to be more persistent, the frequency and intensity of extreme events may increase, causing effects such as enhancement of soil degradation, contamination and depletion of water, damaging of housing, and infrastructure, thus rising insurance costs, and even causing death. This may stretch communities to limit, giving them little choice but to migrate. The rise of the level of the sea in particular is expected to induce large scale emigration from islands in the longer-term, as their land faces the danger of submersion in the future. One example of an endangered area is the Ganges Delta in Bangladesh where it has been estimated that should the rise in sea-level reach 45cm, the 5.5 million inhabitants will be forced to relocate either inland within Bangladesh, or to neighbouring India and Pakistan. Such migration has previously caused violence and tension within the region. The role that the ocean plays in preserving biodiversity is vital. It also

[69] Ibid. pg 15

regulates climate and weather patterns, ensuring food provision as well as provision of livelihood for people. These roles will be significantly compromised through climate change.[70]

It is an acknowledged fact that immigration of refugeesinto an area can create tension that is significant enough to cause violent conflict. Migrations especially when on a large scale often strain the environment in the receiving communities as the population suddenly increases, forcing the areas into supporting more people, than it may have the capacity to. This may intensify competition for resources, thus accelerating environmental degradation and further reducing the capacity of the environment to sustain the people depending on it. This may trigger violent conflict among the communities involved. It is worthwhile to note however that there has not been undoubtable provision ofthe connection betweenviolent conflict andtension with environmental change, as qualitative environment conflict research has not conclusively isolated environmental factors as exclusive drivers of conflict.

Environmental insecurity is also likely to compromise health security. The absence of adequate safe drinking water and adequate food, enhances disease causing microorganisms, especially water borne microorganisms to thrive, leading to possible life threatening illnesses. Similarly unavailability of water will cause undue competition, and subsequent resource based conflicts. Climate change has caused weather pattern changes in many areas. The novel and erratic rainfall patterns, temperature ranges, floods, and/or desertification have the potential of influencing agricultural systems with the result of possible changes in the

[70]Niloy R. Biswas *Is the Environment a Security Threat? Environmental Security beyond Securitization in*, in International Affairs Review Vol. XX, No. 1: Winter 2011 pp 14

demographic patterns of an area. This research will explore empirically the recent rainfall and temperature patterns, to determine the climate induced changes that may have occurred.

Environmental insecurity has the potential of causing political disorder, especially if communities blame the government in power for the stress they may be facing. In so doing, communities may deny allegiance to a government and support opposing groups, which in some extreme situations may be violent. This can lead to civil strife which can develop into an insurgency. Darfur for examplefaced persistent desertification over several decades. This led to the degradation of the environment as surface soil was extensively eroded, and eventually could not sustain agricultural production in its greater arable lands particularly in the north. The population in the north relocated to the southof Sudan seeking sustenance. This displacement and relocation brought about land related and resource sharing tensions, and generateda continued threat to peaceful coexistence and social cohesion of Darfur, in the end igniting violent resource-based conflicts around February 2003.

Existential threats caused by environmental change may be manifested in anvariety of probable referent security objects. Other threats of environmental change include stratospheric ozone depletion, and global warming. The worst stratospheric ozone depletion has been reported over the Antarctica, where depletions have been reported to be even complete in some elevations in the stratosphere during spring, although the depletion is seasonal and regains to some levels later. It is however a concern since the depletion continues increasing. Similar depletions are also taking place over the Arctic, but at lower levels than the Antarctica. Stratospheric Ozone losses have also been reported in the northern and southern hemispheres, beyond 35^0N and 35^0S, to average about 3–14% loss.

Environmental security has created so much concern that some of the larger nations have started to incorporate climate change issues in their strategic defense plans. The nations

which include Australia[71] and the U.S.A,[72]anticipate that in the near future, there may be calls foraextensive humanitarian assistance and greater levels of disaster relief undertakings. Their projections are made as a result of observed increasing severity and number of incidences of natural disasters that are attributed to climate change. These include floods, and on the other extreme droughts, tropical cyclonesand hurricanes. All these lead to potentialfood insecurity, availability of clean water and infrastructure. The level of stress these events cause on vulnerable nations which may lack adequate abilities and resources to respond effectively to issues render them very susceptible and in need of external help.

Alarmingly, anthropocentric climate change in factis taking place and is irreversible already to a certain level, as outlined by the IPCC report, 2007. There is need therefore for measures to enable adaptation to the change and mitigation from further damage. As long as humankind continues to neglect their responsibility for sustenance of the globe's environment eco-systems that support life through consistent production and maintenance of water systems, food, medicine, and clean air, the impacts will continue to be felt now and more severely by future generations.

2.5 International Climate Change, Environmental Security Regimes and Institutions.

2.5.1 Climate Change Institutions

The United Nations Environment Programme (UNEP)

UNEP was established as a coordinating body for the environment in the Stockholm Conference in 1972. At the time environmental issues focussed on regulating short term and acute forms of pollution such as spillage of oil and dumping of hazardous wastes at sea, most

[71]AustraliaDepartmentofDefence,Defending Australia in the Asia Pacific Century: Force 2030 (2009):39-40, http://defence.gov.au/whitepaper/docs/defence_white_paper_2009.pdf.

[72]U.S. DepartmentofDefense,2010 Quadrennial Defense Review Report (February2010):84-88, http://www.defense.gov/qdr/images/QDR_as_of_12Feb10_1000.pdf.

of which were reversible.UNEP works directly with National Governments. Its works include publishing, monitoring and reporting on the situation within the global environment and on global policy responses to environmental concerns. It is also secretariat to several major international environmental agreements.[73] Other institutions in climate change include the following:

Global Environment Facility

The Global Environment Facility (GEF) is mandated to fund developing states as the world endeavours to meet the goals agreed on in conventions. It is the central funding body for environment related projects, and partners with other UN organizations, such as UNEP, the World Bank and the UNDP, in implementing its projects. It has thus far committed $2.7 billion to projects that are related to the climate, estimated to have reduced GHG by one billion tons.[74]

The US and other major emitters work in smaller, more or less informal frameworks, which offer more flexibility. These include the Major Economies Forum (MEF) which was launched in the year 2009, the Group of 8 (G8) and the G20. These institutions are not obliged to make binding decisions.They have however beenvery instrumental and significant fora in the coordination of policy. As an example, the G8+5 collectively agreed to halve global emissions by mid-century; an agreement that has provided a reference point for global discussions. The G8, for exampleKorea, China, and India have also triggered the establishment of the International Program on Energy Efficiency Cooperation (IPEEC), to provide for the exchange of energy efficiency best practices.

[73]These include the Ozone secretariat, the Multilateral Fund of the Montreal Protocol, the Convention on Biological Diversity, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the Convention on Migratory Species, the Basel Convention on the Transboundary Movement of Hazardous and Other Wastes, the Stockholm Convention on Persistent Organic Pollutants, among others.

[74] "GEF Fact Sheet on Climate Change," http://www.gefweb.org/uploadedFiles/Publications/ClimateChange-FS-June2009.pdf.

The seventeen-member MEF, which brings together countries responsible for the highest level of emissions, which together are estimated to collectively emit 80 percent of the global emissions, sets an arena for the states to formulate viable strategies to solve tricky climate related issues. These niche fora can play a very important role, although they are also susceptible to political manipulations over strategies towards meeting legally binding emissions cuts.Accomplishments of MEF and G20 are varied and include the basic consensus on eliminating progressively the now recognized inefficient subsidies on fossil fuel and the establishment of a Global Partnership on Clean Energy Technologies and.

Climate change issues are also addressed by other international organizations who have different general mandates but who nonetheless support climate change mitigations in one way or the other. These include UN development focused institutions which include World Food Programme (WFP), Food and Agriculture Organization (FAO), World Health Organization (WHO), and the World Bank which is instrumental in funding climate adaptation and mitigation activities and several other UN agencies.

Other institutions include regional organizations like the European Union (EU), the Asia-Pacific Economic Cooperation Forum (APEC), sectorally focused Institutions like the International Civil Aviation Organization (ICAO), and the International Maritime Organization (IMO) which help to cut their sectors' emissions. The International Atomic Energy Agency (IAEA), which regulates Nuclear Power production. Energy related institutions including the International Energy Agency.

Regional Development Banks although operating independently, are also instrumental in mitigating climate change impacts. They include the Africa Development Bank (AfDB), Asian Development Bank (ADB)and the European Bank for Reconstruction and Development (EBRD). These institutions are often preferred for their efficiency, realised as a

result of their comparative flexibility when deciding on adoption of innovative programs. They can sometimes also provide smaller loans and grants, an addition to tailoring efforts to achieve the best fit in the regional specific requirements.

The widespread use of many agencies is indicative of the complexity of climate change, and its connection to several sectors such as finance, agriculture, security, health, and development.

2.5.2 Climate Change Regimes

An international climate regime is aninternational framework that regulates how human activity interacts with the climate system, in the global undertaking to mitigateclimate change effects. Serious international discourses concerning the environment and climate change begun in the late 1960s, discussing in general terms about global warming. These discussions culminated in the Stockholm Conference held in June 1972, which is often referred to as the First Earth Summit. The summit adopted a declaration that enacted principles geared towards preservation of the human environment, and developing an action plan which also contained recommendations for action in addressing international environment issues.

Trans-boundary Air PollutionProtocol

The protocol was established to protectthe Ozone Layer, specifically through ensuring sulphur emission reduction by 30 per cent. It was adopted in the 1985 Vienna Convention.

The Environmental Perspective to the Year 2000 and Beyond.

This framework which was adopted at the 1987 UN General Assembly was set to guideand set standards on domestic action and worldwide cooperation on formulated policies and programmes for achieving environmentally sound development.

The Montreal Protocol

The protocol came into force in 1989, and aimed at reducing substances that are destructive to the Ozone Layer. The treaty, which has already been signed by 195 UN member states, commits states to put an end tothe production and use of about a hundred chemicals that have been found to contribute to ozone layer destruction. The protocol set a time frameto phase out these substances and requires annual reports on the progress of their elimination, their importation and exportation by each of the states. The protocol will be made fruitful by a Multilateral Fund, which was created in 1990, for the purpose of compensating developingcountries whatever they spend in complying with the requirements. The protocol has been successful and has achieved significant payoffs in the mitigation of climate change, with its projects helping to reduce GHGs by several billion tons,measured in CO2 equivalent, since its inception.

The United Nations Framework Convention on Climate Change (UNFCCC), effected in 1992, at the UN Conference on the Environment and Development in Rio, Brazil, was the first designed attempt to deal with the threat of global climate change. The Convention aimed to keep atmospheric GHG concentrations at stable levels to prevent dangerous consequences for the climate system[75]. The Convention does not set any specific targets however, leaving that step to subsequent protocols.

The Kyoto Protocol which was formulated in 1997, and came to effect in 2005, differentiates industrialized countries, from developing countries, and provides emission targets for the developed countries. The targets are legally binding. In the requirement, developed countries will be expected to reduce their combined GHG emissions to below the levels measured in 1990, by the year 2012. The targets range from an eight percent decrease from the base level for European Union countries to a ten percent decrease for

[75]UNFCCC, 1992: Note 1, Article 2

Iceland.[76]Unfortunately, the protocol does not provide meaningful targets for emerging emitters like China, and the US and Canada are not party to the commitments.

The Copenhagen Accord, in which industrialized, developed countries promised to avail $100 billion by 2020 to developing countries for climate change actions. There were also voluntary emissions reductions commitments by parties at this Accord which have become the *de facto* global climate regime.

The Durban Platform for Enhanced Action (Durban Platform), COP-17 was held in December 2011 and made agreements on structures for operationalizing the Green Climate Fund (GCF) which had already been established. The fund addresses pledges to fund climate change problems, agreements on structures for reporting mechanisms, and emission reduction goals for specific countries. The platform however failed to establish an enforcement framework to follow through on the agreements. Unfortunately, the US, China and India rejected their set reduction targets, casting doubt on whether other countries will be committed to working towards meeting their own targets. The Durban Platformalso had the UNFCCC parties commit to negotiate auniversal postKyoto accord that is legally binding.

In the December 2012 UNFCCC COP-18, it was agreed that the Kyoto commitment period, which were to expire on 31st December that year, be extended to 2020 and that negotiations begin for a post Kyoto Protocol treaty in 2015. However, some parties did not agree to the secondset of commitments and some like Canada and Japan, some of the counties that emit the highest proportion of GHGs opted out.

The Paris Agreement entered into force on 4th November, 2016 following the ratification of the required 55 states. Today, 160 members have ratified the agreement. The agreement

[76]UNFCCC, 1992: Annex B.

commits members to work towards making sure the rise in worldwide temperature does not go beyond 2^{o}C higher than pre-industrial levels by taking measures to each reduce GHG emissions in their individual states. The agreement also commits states to embrace green energy sources, with developed nations pledging to provide funds to developing nations to assist them to effectively adopt the green energy sources. The agreement also urges cooperation among all states in putting in place measures to cope with climate change impacts, since it is apparent that climate change cannot be completely eliminated.

The Paris agreement set a framework to begin emission reductions in 2020, with each country submitting a long-term plan for these emissions. The plans will be reviewed every five years in the effort to ensure the goal of below 2^{o}C increase is maintained.

On the local front, the country has developed some laws and policies that enable the country manage climate change and environmental security. Among the laws in place include the Climate Change Act of 2016. The act was enacted to "provide for a regulatory framework for enhanced response to climate change; to provide for mechanism and measures to achieve low carbon climate development, and for connected purposes."[77]

In addition, there are also various polices pertaining to environmental sustainability, with a focus on climate change, which include the **Vision 2030,** which is Kenya's national blue print for the year 2030. The policy addresses several environmental challenges, but has a focus on 'green' environmental issues, and pays less attention to 'brown' issues. Brown issues are of major concern in Kenya, as they are expected to intensify as rural-urban migration, which is projected to rise from 21 per cent in 2007 to 33 per cent by 2030, increases. The Vision's overemphasis on "green" issues is regarded as a contradiction to the fact that biomass is

[77]Laws of Kenya, Climate Change ActNo. 11 Of 2016 (The National Council for Law Reporting, Nairobi, Kenya)

currently the dominant energy source in Kenya. Vision 2030 also acknowledges the fact that institutional arrangements for addressing environmental issues are not robust at present:

The **National Climate Change Response Strategy (NCCRS)** and the **National Climate Change Action Plan (NCCAP)** are the de facto policy documents on climate change and environment for the country. The NCCRS aims at integrating issues concerning climate within development priorities, government planning and budgeting[78]. The NCCRS identifies key needs for adaptation and mitigation in the various sectors and details specific implementation actions, for the various sectors.[79] Kenya is developing a national catchment management policy, where agricultural landscapes will be managed both for agriculture and watershed management objectives, together with climate related concerns like food security, climate adaptation and biodiversity conservation.[80] The NCCRS includes indicative budgets and plans for line ministries, with full implementation of the strategy projected to cost US$3 billion annually, and an additional annual requirement of about US$100 million for adaptation and mitigation measures in agriculture[81], which is almost 20% of the government expenditures planned for agriculture and rural lands for the 2012-2013 fiscal year.[82]

The NCCAP was developed to operationalize NCCRS through provision of analysis and enabling mechanisms for successful implementation.

Climate change response policies in Kenya are also captured in the **Second Medium Term Plan 2013-2017** and manifested in various strategies within specific sectors, including agriculture sector strategies such as Agricultural Sector development Strategy (ASDS), 2010-

[78] Government of Kenya, National Climate Change Response Strategy, Nairobi, 2010 pp 7

[79]Ibid

[80]Emelie César Anders Ekbom Wilfred Nyangena*Environmental and Climate Change Policy Brief Kenya*, Sida's Helpdesk for Environment and Climate Change www.sidaenvironmenthelpdesk.se pp 8

[81] Government of Kenya, National Climate Change Response Strategy, Nairobi, 2010

[82] Kenya National Assembly, 2012

2020, the Kenya Forestry Master Plan 1995-2020, which provides for an overarching framework for forestry development in the country for the period up to 2020. It recognizes the environmental role of forests including water values, biodiversity values, climate change values through carbon sequestration and other environmental services. Water Act, 2002, which provides for the overall governance of the Water Sector. The Threshold 21 (T21) is a policy designed to support comprehensive, integrated long-term national development planning through integrating risk analysis and climate change impacts across major sectors of the society. Other relevant policies include the Energy Policy and Act, which encourages implementation of indigenous renewable energy sources and provides for mitigation of climate change, through energy efficiency and promotion of renewable energy. The National Disaster Management Policy, 2012 institutionalizes disaster management and mainstreams disaster risk reduction in the country's development initiatives. The policy aims to increase and sustain resilience of vulnerable communities to hazards[83].

2.5.3 Challenges

There is a general lack of consensus in a number of issues in these protocols. Some countries disagree about how the climate should be monitored and on the agreed financial stipulations in the Kyoto Protocol as well as other legally binding accords. Other countries disagree on the set targets, and some states refuse to be party to some of the protocols, for instance, the US and China are not party to the Kyoto protocol. Similarly, although it had signed the Paris Agreement, recently the US declared intention to withdraw, setting the realization that it cannot be depended upon to be party to the resolutions.The absence of the US and other big industries from these protocols is a concern since they are the largest emitters of GHG

[83] Government of Kenya, National Climate Change Action Plan 2013 – 2017 (2013) pp 10

worldwide, and lack of cooperation would diminish the overall effect of emission reductions by other parties in the global arena.

Climate frameworks always find it difficult to effectively measure and monitor GHG outputs, especially in the developing world, where most countries do not have the national capacity to record, monitor and audit their emissions effectively. In addition, some developing countries hesitate to report findings fearing that they may be pressured to reduce their emissions, which translate into reduction in production which they cannot afford to do considering their state of development. Other states, for example China, resistthe requirement contending that states have sovereign right to decide on what is good for their interests, and international monitoring is an infringement on sovereignty. They also maintain that developing states should be allowedsome level of emissions to enable them reach acceptable levels of economic development.

Climate regimes lack in adequately addressing the sources fundsrequired to enable adaptation and management of climate change. While the COP-17 made an effort to indicatehow the Green Climate Fund would operate and disperse funds, there is little actual monetary support allocated to the mechanism.

2.6 Conclusion

In this chapter, there was an effort to determinehow climate change and environmental security relate. In order to determine the relationships, it was imperative to understand what environmental security entails and how it affects the wellbeing of the states and humanity in general. The research also aimed to understand the specific effects of climate change impacts on the environmental security.

Activities that cause climate change render the environment, which is the basic platform upon which all living things depend less secure. Increased Climatic change factors like temperature and the erratic nature of rainfall and extreme events may degrade the environment, leading to reduced environmental security and subsequently, reduced inability to sustain life. The chapter also looked into the various international regimes that have been put in place in the effort to manage climate change. While there have been attempts at managing these issues through climate change regimes and institutions, these too face challenges and have not been very effective as yet, owing to various national interests. There is need therefore for better global cooperation towards climate change adaptation for a comprehensive global success in climate change mitigation and adaptation. The chapter also recognised that there have been efforts at enacting local laws to manage climate change. It is apparent however, that there still are challenges in the management of climate change and in the effort to adapt to its impacts. It is therefore incumbent upon all states to endeavour to put in more effort for effective management of climate change and environmental security.

CHAPTER 3

CLIMATE CHANGE AND ENVIRONMENTAL SECURITY CHALLENGES IN KENYA

3.0 Introduction

Climaticchange effects have created an impact across the globein different forms and intensity. While Africa in general, and Kenya in particular have contributed insignificantly towards climate change by emitting negligible levels of greenhouse gases (GHG) to the atmosphere, incomparisonwith other regions, such as the developed world, the continent isseriously susceptible to climate and environmental change, with the manifestations of the change already being experienced in the people's economic undertakings and livelihoods[84]. These impacts are unfortunately projected to continue being experienced, since there are no expectations of a cessation or reduction in the level of emissions being released, consideringthe continued increase in population growth, industrialization and economic growth.[85]

This chapter examines major climate change led environmental security challenges that Kenya anticipates in the coming years and their impact on the community. In addition, in pinpointing the exact effects of the challenges, the chapter endeavours to highlight the importance of proactively taking steps to prevent the expected impacts from reaching fruition.

3.1 Climatic Change and Temperature variation in Kenya

Climate change is demonstrated in the form of variations in temperature, rainfall and extreme events. From UNDP records, average annual temperature in Kenya has been increasing progressively since 1960, to the current1.0°C more than it was then. This translates to around

[84]Government of Kenya (2012) National Climate Change Action Plan 2013 - 2017 Executive Summary, Nairobi pp 1

[85]Ibid pp 6

0.21°C per decade. Going by this trend, it is estimated that temperature increase will bebetween 1.0°C to 2.8°C by thetime we reach the 2060s. It has also been noted that a wider variation is recorded in the warm season and less variation in the cool season.[86]Further, data obtained from Kenya Meteorological Department indicates that the trend in temperature points to the fact that there has been general warming through time. This increase has been observed to vary in the sense that the rise in minimum temperature, that is, temperature taken at night or early morning has been higher than the rise in maximum temperature, which is that taken at daytime. This leads to a reducing daily temperature range[87].

This trend differs however in areas near large water bodies more so around the coastal area where it has been observed that the minimum temperatures tend to either remain the same or to decrease while on the other hand, maximum temperatures continuously increase as years go by. This has led to days becoming hotter while nights and early morning temperatures remain the same or reduce marginally[88].

It has also been observed that temperature rise is relatively higher in the northern parts of the country, which are generally arid, compared to other parts particularly in the season covering October to February. Further, in the northern parts of the coast region, minimum temperatures have been found to decrease at a relatively faster pace than further south within the coastal region at similar periods. For instance, it was observed that temperatures in north coast based Lamu, dropped from an average temperature of 24.5°C recorded in the early 1960s to 23.5°C recorded in the recent ten years, a drop of 1°C, while Mombasa located in the south coast

[86]Emelie C A, Ekbom W. Nyangena, Environment and Climate Change Policy Brief, Kenya (Sida's Helpdesk for Environment and Climate Change) www.sidaenvironmenthelpdesk.se

[87] National Climate Change Response Strategy, Government of Kenya, Ministry of Environment and Mineral Resources, 2010. pp 30

[88] Ibid pp 31

dropped from 23°C recorded in the 1960s to 22.7°C recorded in the recent ten years, which is a drop of about 0.3°C.

These trends are depicted in the Table below.

Temperature Growth Trend (both Minimum and Maximum), from 1980 (Data from Kenya Meteorological Department)

REGION	**MINIMUM INCREASE**	**TREND**	**MAXIMUM INCREASE**	**TREND**
Western	0.8 – 2.9	Increase	0.5 – 2.5	Increase
North and North Eastern	0.7 – 1.8	Increase	0.1 – 1.3	Increase
Central	0.8 – 2.0	Increase	0.1 – 0.7	Increase
South Eastern Districts	0.7 – 1.0	Increase	0.2 – 0.6	Increase
Coastal Strip	0.3 – 1.0	Decrease	0.2 – 2.0	Increase

3.2 Climate Change and Rainfall Patterns in Kenya

Rainfall Patterns and trends in Kenya since the 1960s are determined by studying daily and monthly rainfall records. From the records, it has been observed that generally, the annual rainfall trend has been decreasing slightly in many areas. This implies that on the whole, the annual highest rainfall recorded and the measured intense rainfall levels over 24-hour period are comparatively lower in recent years than those recorded in the 1960s. The recorded

values reduce progressively, showing a negative trend with time.[89] It has been observed however that the highest rainfall decline is mostly recorded in the rainfall season of March-May, commonly referred to as the 'Long Rains' and which contributes the highest amount of rain measured as annual rainfall in most areas.

In the short rainy season, which mainly occurs in the period between September and February, an increase in the level of precipitation has been recorded in recent years compared with the early 1960s, extending into the usually hot, dry January and February period in most areas. This has among other reasons, been attributed to the El-Niño occurrences that have been observed to be more frequent in recent years. In addition, the increasing precipitation can also be attributed to warmer sea surface temperatures (SSTs) that are manifested in the western Indian Ocean, which is situated along the coast of East Africa coupled with the cooler SSTs in the easternside of the Indian Ocean.[90] This SSTs have been found to be favourable for the increasing tendency of precipitationin the country in the short rains and can causeunusually heavy precipitation in the 'Short Rains' period as was experienced in 1961-62 and more recently, 2006-07 rainfall events, even without the presence of El-Niño conditions.

It has also been observed that in September-October-November, (SON) and December-January-February (DJF), periods which constitute the drier seasons, rainfall is more intense and frequentin the coast and in northern Kenya in recent years than it used to be in the 1960s.[91]

Further, in the period since 1960, records indicate increased variability in rainfall patterns during the DJF season. Some years recorded negligible rainfall during the season, and others

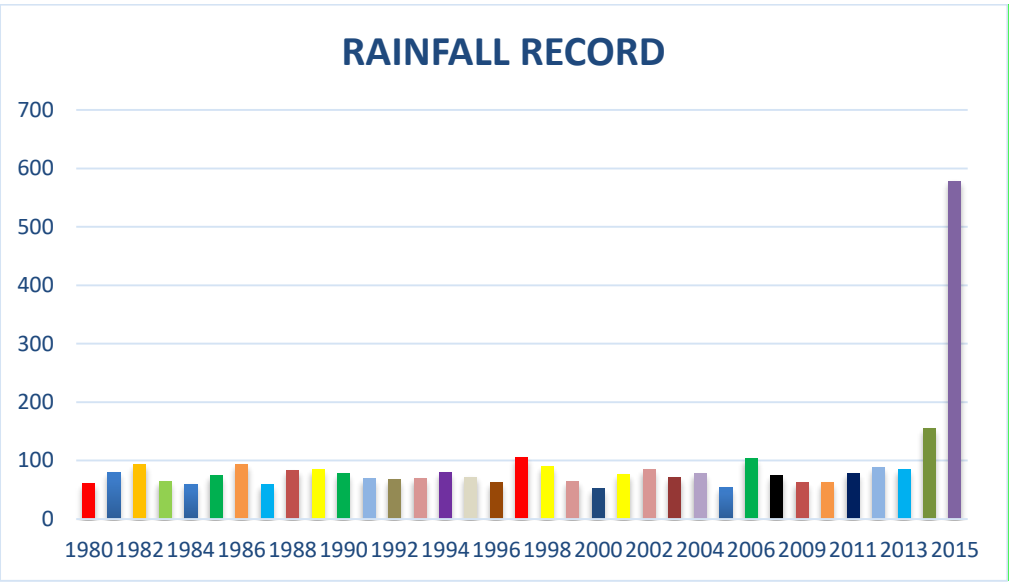
[89] National CCRS 2010 PP 28

[90] National Climate Change Response Strategy, Government of Kenya, Ministry of Environment and Mineral Resources, 2010. PP 29

[91] Ibid pp 30.

had more rainfall than the normal average.[92]Rainfall patterns have been more unpredictable and erratic since the 1980s with drier years manifesting more frequently and more severely.

The trends are as represented in the Figure below.



With regard to other aspects of rainfall, runoff has been recorded to range between 0.07 to 0.2 cubic meters with more significant variation occurring between seasons. It is noted that runoff during the long rains is much lower than the short rains runoff.[93]

Run off has been attributed in part to forest cover depletion with research showing that the removal of mature trees triggers greater stream flow than the removal of immature trees.[94] This is because the natural process of evapo-transpiration, in which trees absorb water, later releasing it by evaporation mainly through the leaf surface, and to a lesser extent

[92] D. Walubengo, *Community Led Action to use Forestry in Building resilience to Climate Change, A Kenyan Case Study, Forest Action network, Njoro, Nakuru,* p, 11.

[93]Mariara, J. K and Kabara M. *Climate Change and Food Security in Kenya in Environment for development* Discussion Paper Series, (March 2015)

[94] J. M. Bosh and J. D. Hewlett, '*A Review of Catchment Experiments to Determine the Effect of Vegetation Changes on Water Yields and Evapo-transpiration'* Journal of Hydrology, 55, 1982, pp. 3-23.

through other parts of the tree, is hindered when severe deforestation takes place, as the trees that would transpire are depleted. This leaves a lot of rainwater on the ground surface with no other outlet rather than freely flowing by gravity towards the close-by streams and rivers causing flash floods, when in large quantities.[95]

The country has also had manifestations of extreme events. Since the ushering in of the 21st Century, there has been continued erratic precipitation patterns that have resulted in drought periods together with heavy rains and floods. The level of regularity and intensity of the extreme events have been recorded to have increased, in the last 30 years. Droughts have particularly been more frequent and intense in Eastern Africa[96] and more especially in some parts of the country as abrupt rise in temperature has been recorded from time to time since the mid-1980s to early 1990s.On the other hand, the country experienced El Nino led rains in 1988-89 and nine years later in 1997-98. The El Nino rains triggered flash floods which disastrously impacted the affected areas with heavy losses in terms of life and wealth destruction. The initial five years of the new Millennium recorded a moderately wet pattern, while the latter five years were less wet with a severe drought being witnessed in 2009. In 2010, 2011, and 2012, the precipitation was considerably heavy and more than average.

These observed changes in the weather conditions have a profound impact on Kenya's socio-economic sectors, especially those which heavily rely on natural systems and are therefore climate-sensitive. The key sectors that are most affected include agriculture; rangelands on which Kenya's nomadic and pastoralist communities rely heavily, forestry, wildlife and tourism; water resources; aquatic and marine resources; health; as well as physical and social infrastructure.

[95] Ibid

[96]FAO STATISTICS Database, United Nations Food and Agriculture Organisation, Rome, (2000)

Droughts in particular have had a seriousnegative effect in Kenya, where a vast proportion of the land comprising 80% is arid or semi-arid (ASAL). They reduce the already low levels of water used for both domestic and agricultural purposes, leading to serious food insecurity and prevalence of disease thus causing great suffering among the people.

One main observation in this study is that Kenya is already negatively experiencing the ravages of climate change as manifested by among other occurrences the increased prevalence and geographical spread of diseases as well as the increased frequency and intensity of extremitiesof weather. The impacts indicate a worsening and perturbing future which requires concerted global and national efforts aimed at reversing atmospheric Green House Gas (GHG) emissions which catalyse global warming.

3.3 Major Challenges to Environmental Security in Kenya

The major challenges to environmental security in Kenya include among other phenomena, climate change, degradation of land and forests, scarcity of water, loss of biodiversity and ecosystem services, and poor waste management and pollution.

It has already been determined that in general, most of the ASALs, which where the bulk of land in Kenya lies, have been experiencing increased droughts, water scarcity, and unpredictable climate variability with a huge negative impact on people living in these regions. Kenya has experienced these extremes in various places, with the counties that were most highly affected in 2016being the arid counties of Turkana, Isiolo, Marsabit, Tana River, Garissa, Mandera, Wajir, Samburu and Baringo. As a result of unpredictable and erratic rains, some non–ASAL counties were also affected including ElgeyoMarakwet, Kakamega, Kisumu, Busia, Homa Bay and some parts of Central Kenya[97].Furthermore, the agricultural

[97]National Drought Management Authority (NDMA's) report, Nairobi, January 2017

sector, which is affected in a fundamental manner by this state of affairs, is a mainstay of more than 80%of Kenyans not only for their food requirements and livelihood, but is also the major source of income in most households. A negative change in the sector therefore is a main source of the very survival of the affected communities. This makes it crucial to find ways of mitigating and adapting to the impacts of these extreme climatic events, a process that could cost the economy up to US$500 million (about 2.6 per cent of the country's GDP).[98]per annum.

Actions directly affecting environmental insecurity such as degradation of forests, land degradation and pollution in Kenya pose serious threats to water security, biodiversity conservation, and economic development.

Other major challenges to environmental security is population growth and reliance on wood fuel by a majority of the population as it inevitably leads to large-scale deforestation and forest fragmentation, subsequently accelerating land degradation and threatening water catchment areas. There is need to increase forest cover by reducing reliance on fuel wood consumption and seeking alternative energy sources.[99] Forests ultimately are the natural climate regulators, owing to the wide ranging role they play in the environment. To begin with, forest coverattract clouds thus ensuring that rainfalls. In so doing, they ensure availability of water and assists in slowing down the spread of deserts Forests also serve as a carbon 'sink' which is a natural reservoir that accumulates and stores some carbon-containing chemicals such as carbon dioxide for an indefinite period of time. This helps to absorb some of the excess atmospheric carbon dioxide, which is known to contribute significantly to global warming.Forests also help to protect the soil by reduction of runoff, thus playing a major role in soil conservation. Although the several benefits of forest cover are known, there

[98]GoK, 2013a

[99] United Nations Environmental Program Annual Report, 2009

is limited effort to control deforestation and it continues unabated. This is witnessed to a larger extent in developing countries compared to developed countries. There are therefore fears that effects of climate change will not only continue to be experienced, but will increase as deforestation continues. The IPCC reports that deforestation accounts for nearly 20% of the recorded global annual GHG emissions.[100]

Studies also indicate that Kenya's soils arehighly erodible in nature, and it is therefore feared that above 20 per cent,30 per cent and 10 per cent of cultivated land, forests, and grasslands are at high risk of degradation. This has the potential of causingan increase in poverty and food insecurity as a direct result of reduction in productivity of crop and pasture as well as reduced availability of forest products including fuel wood and other non-timber products. Other effects of damaged soil include loss of habitat by vulnerable species,reduce biodiversity and water shortages, which are all likely to lead to negative impacts to ecosystem services and eventually, affect the economy negatively.[101]

Other challenges to environmental security include pollution as well as insufficient and inefficient waste management. Increasing urbanization and subsequent consumption upsurge in urban areas inevitably intensifies waste generation, thus calling for proper waste management. Inefficient waste management due to lack of proper infrastructure, poor management, lack of planning and lack of articulate urban policies,[102]leads to pollution to air, water and land leading to environmental problems and vulnerability to diseases. Another

[100] Government of Kenya National Climate Change Response Strategy, Government of Kenya, Ministry of Environment and Mineral Resources, 2010. PP 30

[101] United Nations Environmental Program 2009 annual report

[102] Government of Kenya, Ministry of Environment and Natural Resources report, 2013

emerging challenge in Kenya is the absence of appropriate structures to guide the disposal of e-waste which is highly hazardous to the populace.[103]

With growing population, there is reduced water supply which can severely impair agricultural activities, lower economic growth, reduce livelihoods, and increase food insecurity. Other changes in the climate especially in relation to rainfall variability have led to significant disturbance in the biodiversity of habitats and forests. Over the years, Kenya has lost massive vegetation cover and trees, which are critical for the ecological sustainability and natural habitat for animal life, due to encroachment and deforestation. Human settlements and population influx near protected forests also threatens the existence of wildlife as some human activities, such as poaching and human-wildlife conflicts manifest. Major costs of such activities include loss of life, both human and animal, loss of property in terms of livestock and crops and loss of natural ecosystems, which maintain socio-economic fabric between humans and biodiversity.

In addition, deforestation leads to severe reduction or drying up of underground water tables causing water stress in the surrounding areas. There may also be a reduction in soil infiltration and soil protection capacity of the montane forests, leading to soil erosion, siltation, and sedimentation. As a consequence, a substantial reduction in river flow during dry seasons is experienced because of the lower quantity of water retained by the soil during this time. Another cause of low levels of water retention in the soil is the greater and more ferocious water run-off experienced on the deforested land during the long and heavy rains. This compromises absorption of water by the soil, significantly lowering the availability of underground water[104].

[103] Government of Kenya, 2013b

[104] United Nations Environmental Programme, *The Role and Contribution of Montane Forests and Related Ecosystem Services to the Kenyan Economy*, (Nairobi, 2012). pp. 25-26.

One other challenge in managing and tackling climate change is that availability of information on the level of vulnerability that the country might be subject to as a result of climate change impacts is extremely limited. Similarly, accurate and verifiable knowledge regarding the status of major natural resources in the country such as lakes, rivers, important ecosystems which include forests, mountains such as Mt. Kenya and its glaciers, water towers including the Mau Forest Complex, and Mount Elgon is not available.

On the issue of monitoring and reporting on GHG emissions in Kenya, there is a lack of capacity for continuous acqusition of data, monitoring of GHG emissions in the country,[105] since there isno Kenyan institution that has the capacity to measure, monitor and report on GHC emissions on a continuous basis throughout the country. Data available in the country on the GHG emissions has been availed from the International Energy Agency (IEA), who periodically provide data. The Kenya Meteorological Department has a mobile equipment which can measureGHG emissions, but does so only on specified locations, and on a limited area size.It therefore only carries out such measurements on request. Data available in Kenya indicatesthat in 2007, the country's GHG emissions were 11.43 MtCO2eq.which is categorised as low by international standards.

In the ocean, there is evidence that there is increasing acidity,and the sea level continues to rise.It is reported that Global sea level rose by approximately 17 centimeters(6.7 inches) in the last century, but the rate of rising levels in the last decade, almost doubles the rise recorded in the last century.[106]These phenomena bring about events and situations that lead to the deterioration of the ecosystem, human systems, and other systems that are useful to mankind including infrastructure, financial systems and security, leading to a threat to environmental security.

[105]Bwari E, Interview with Ms Christine Mahonga, Kenya Meteorological Department, Nairobi August, 2017.

[106]Church, J. A. and N.J. White, A 20th century acceleration in global sea level rise, Geophysical Research Letters(2006)

The vulnerability of Kenya to the impacts of climatic change and environmental security poses several and various impacts, some of whichare herein discussed.

3.3.1 Food security

The concept of food security was articulated during the World Food Summit (WFS) in 1996.Food security can be defined as *"Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life"*[107]*, according to definition by FAO.* Kenya is reliant on Agriculture for its food needs. This is a challenge however as only 16% of the Kenyan land has high agricultural potential, while the remainder (84%) is classified as ASAL with low agricultural potential.

With irrigation, the ASAL has the potential to enhance agricultural production both in the livestock and crop sectors, which can go a long way towardsmaking the country food secure. Food security has however been hard to achieve in Kenya as the country has limited resources. Currently, the agricultural sector provides about half the food requirements in the country, and the remaining requirements have to beimported, a challenge considering the country's limited resources. The reliance of Agricultural production on direct rainfall has been a critical challenge more so, in recent years as rainfall has been inconsistent and unreliable leading to reduced yields.

With climate change, inadequate, inconsistent production will continue persist as long as the mode of agricultural production does not change to reduce its reliance on direct rainfall. In addition, Kenyan farmers facegrowing challenges ofsoil erosion, deforestation,

[107]http://www.fao.org/docrep/005/y4671e/y4671e06.htm, Food security: concepts and measurement. Accessed at 1035 hrs on 15 January 2017

water pollution and desertification,[108] creating fear that the quality of the soil will be compromised if mitigation measures to alleviate climate change effects are not quickly identified and adopted. This will also lead toa production decline.

Food security is also compromised in Kenya and in other regions by extreme events such as floods and drought whenever and wherever they occur.Both of theseextreme are attributable to climate change. The extreme events have often caused hunger in some communities, impaired nutritional status, as well as reducing community resiliencewhich leads to insufficient coping strategies that consequently cause further destruction of the environment. There is also the effect of decreased opportunities to the people's livelihood and eventual creation of a cycle of more complicated lives. Climate change in Kenyans has in recent years been characterized by erratic rainfall, and extreme eventsboth of which have affected food production as a whole. As an example the number of people who required food assistance increased from 650,000 in 2007 to 3.8 million in 2009/2010. The current number of people believed to be food insecure may reach approximately 1 million people. The number has been aggravated by the fact that among the Kenyan rural poor who rely directly on the natural resources and subsequently, the environment for their livelihood, more than 36%inhabit marginal lands.These constitute areas like floodplains, coastal areas, and degraded hillsides or parched areas which remain in that condition for the larger part of the year, and tend to be open to the degradation of the environment. Production in these areas is greatly affected by erratic rainfall patterns and they produce lower yieldseven in normal circumstances.[109]

3.3.2 Waterand Sanitation

[108]Environmental Sustainability Opportunities in Kenya.
http://www.fsdinternational.org/country/kenya/envissuesaccessed on 8November2016 at 2229 hrs
[109]Emelie César, et al Sida helpdesk for environment and climate change, (2013) pp ii

The most obvious manifestations of climate change are variations in temperature and rainfall, which then cause impacts such as the availability of water, recurring droughts, growing deserts and increasing floods both in magnitude and frequency. According to the 2008 IPCC report,the next century will experience changes in the rainfall patterns, river flows and sea levels all over the world, as a result of climate change.[110]Temperature increase will also affect water availability as it increases the melting of glaciers into the sea thus reducing theamount of fresh water globally.In Sub-Saharan Africa, it is predicted that the precipitationmight drop by 10%by the year 2050 causing a monumental water shortage.[111]Kenya's water scarcity in particular is expected to progressively increase due to an increasing demand against an expected reduction in per capita availability of 393 m^3 by 2030. From analysis of data obtained in 2010, Kenya is categorized as a water scarce country with per capita available water resources of 586 m^3 per person, which is below the internationally acceptable threshold of 1000 m^3. This limited availability is aggravated further by rapid population increase and climate variability. In addition to direct rain, the country's main sources of fresh water stem from its six major drainage basins consisting of Lake Victoria North which covers 18,374 km^2; Lake Victoria South which covers 31,734 km^2; Rift Valley covering 130,452 km^2; Athi covering 58,639 km^2; Tana which covers 126,026 km^2; and EwasoNg'iro North which occupies 210,226 km^2. All these cumulatively, cannot cater for Kenyans to the recommended levels.

As a commodity, water is very valuable and is used in several sectors which include domestic, agricultural, tourism, livestock, inland fisheries, energy sectors, and in industry which consumes up to 22% of fresh water globally. Production in all levels of industry relies

[110]IPCC. 2008. Climate change and water, Intergovernmental panel on climate change technical report IV. June 2008.

[111]Maarten de Wit, Jacek Stankiewicz**Changes in surface water supply across Africa with predicted climate change**Science, 311 (2006), pp. 1917-1921

on water, which is used as raw material, transport agent, coolant, solvent, and also as an energy source. With increase in population and industrialization, there are escalated demands for fresh water causing rapid depletion of the available water resources.[112] Research findings concludethat the total number of states which are faced with water stressed conditions have been steadily increasing, with the projection that two thirds of the world population is likely to face water stress by the year 2050.[113] In Kenya, the sector that will require the highest water resources is irrigation which is expected to utilize up to 50 per cent of the country's water, as Vision 2030 seeks to expand irrigable land by 1.2 million hectares, particularly in the Tana and EwasoNg'iro catchments that serve the ASALs region.

Energy production especially electricity generated by hydropower, depends entirely on running water which must not only be available but must be available in quantities that are large enough and sufficient to produce energy. Water is also critical in sanitation at all levels including household, and within the community at large. Water supply is the heart of sanitation processes, which are critical for sustained public health. Lack of proper sanitation, and water pollution has been a cause of several respiratory and contagious illnesses, some with fatal outcomes.

Kenya's agriculture, like that in the majority of Sub-Saharan Africa is rain-fed, and mostly under smallholder management. In addition, a large area of Kenya, like most African countries belongs to the intermediate range, where drainage density increases with rainfall. This is an indication that reduced rainfall, expected to be caused by climate change directly affects drainage density and availability of water.

---

[112]W.N.N.W. Arnell Adger, E.L. Tompkins, *Successful adaptation to climate change across scales Global Environ. Change Part A,* (2005), pp. 77-86

[113]A.K. Gosain, Sandhya Rao, DebajitBasuray*Climate change impact assessment on hydrology of Indian river basins*Curr. Sci., 90 (3) (2006), pp. 346-353

It is appreciated that Kenya has been more progressive in providing clean water to its growing population since 1990than other sub-Saharan countries in general. In Kenya's urban areas, however, the percentage of people who can access safe drinking water is reported to decline, mostly attributable to the growing populations who are migrating to the urban areas coupled with reducing levels of water in the dams supplying water tothe urban populationdue to reduced rainfall, and water levels in the rivers.The national target of halving the number of Kenyans lacking clean water to drink by 2015 as envisioned within the Sustainable Development Goals (SDGs) however has been elusive and a lot of effort needs to be employed to achieve this in the coming years.[114]

Despite the shortcomings however, urban dwellers have on the whole been able to access clean water sources better than rural dwellers at an average of 82%, compared to 52% of rural dwellers who have managed to access clean and improved water sources[115]. There is however a large variation in ability to access clean water depending on the region, ranging from a high of 96% availability of water in Nairobi to as low as 15% in Mwingi district of the eastern region.

3.3.3 Health security

Another challenge of climate change and environmental security is health security. The challenge, which may be associated with lack of safe water for drinking among several other reasons, such as poor sanitation is very serious as it renders the people open to disease attacks and illness, often causing death. Diseases that may prevail when people consume contaminated water and when there lacks access to basic sanitation are the water borne diseases which are also usually diarrheal. In Kenya, estimations for prevalence of diarrheal

[114] UNEP, 2009

[115] Disparity exists between districts and regions. For example, access to safe water varies from a high of 96 per cent in Nairobi to as low as 14 per cent in Mwingi District. UNEP,2009

diseases in children aged below five years old are 17%[116]. Prevalence of disease is also caused by other factors including air pollution, which clogs the air making it conducive for development of diseases that attack the respiratory system, such as asthma. More than 14,000 Kenyans are estimated to lose their lives every year as a result of indoor air pollution, with the categories most exposed to this threat being women, children andthe elderly.[117]Similarly, warm surface temperatures as caused by GHG emissions and climate change are suitable for the multiplication of disease causing microorganisms, rendering environments disease prevalent, and the people highly vulnerable to disease attacks and illness.

3.3.4 Population, urbanization and Housing

Kenya's population is around 47 million as at 2017[118], and growing at 2.7%, as projected from the 2009 census. Already the country is food insecure, and the increasing population is expected toaggravate the situation. Population growth in rural areas increases pressure on land, leading to over cultivation. There is also a high likelihood of encroachment into the forests as people seek more land for cultivation, in the process cutting down trees as they clear the land for agricultural use, for settlement and also to obtain fuel wood. This is bound to causeland degradation with attendant consequences.

The country is expected to be predominantly urbanized by the year 2030 as rural-urban migration increases. Urban population increase will most likely cause an increase of the slum dwellers, currently estimated at 55%. Slums are poor informal urban settlements which lack proper infrastructure and are therefore quite susceptible to external shocks, including floods and droughts. In addition, there is poor sanitation in the slums, with only about 32% of the urban population estimated to have proper sanitation facilities. This exposes

[116] The World Bank Annual report, 2013
[117]GoK, 2013b

[118]Worldometers, 3/02/2017

the settlements to degradation of the environment due to water and air pollution, further rendering the inhabitants susceptible to disease attacks and health insecurity.

An increase in the urban populationis also expected to reduce the availability of clean drinking water, worsen the sanitation situation, reduce availability of energy, increase water and air pollution thus causing food and health insecurity. With increasing climate change, extreme events are likely to escalate, aggravating the negative impacts of climate on the population. Population growth and urbanization are therefore a challenge to Kenya which would be worsened by climate change.

3.3.5 Energy provision

A country's economic development is very dependent on the availability of energy. Energy availability in Kenya is a challenge as the country has traditionally relied on hydroelectric power for most of its electricity needs. While hydroelectric power is rated as a relatively clean energy source, its availability is wholly dependent on the availability of water, which in turn is reliant on the rainfall, and vulnerable to not only drought, but also the unreliability of rainfall. In recent years, the rains have been infrequent and scarce and on the whole there has been less rainfall produced, leading to reduced water levels. This has forced the Kenya Power and Lighting Company, the company charged with power distribution in Kenya, to ration power leading to unreliability of energy for industrial and other economic processes in addition increased electricity bills. This has had a negative impact on the country's economic growth, since it is directly related to the level of industrialization, and the level of attraction to investors willing to finance projects in the country. The alternative source of power, thermal oil power plants produce electrical energy through burning fossil fuels, which are known to be the highest producers of GHGs in addition to being dearer.[119]

[119]NEMA publication, (Nairobi, 2011)

Domestically, and especially in the rural areas, where up to 75% of the total population live, the major source of energy is fuel wood and charcoal. This means that there is over-reliance on fuel wood which leads to massive deforestation and forest fragmentation, in turn accelerating land degradation and threatening water catchments.

3.3.6 Land degradation

Kenya's land is highly susceptible to degradation, posing a serious challenge as degraded landstrangles agricultural development. It is estimated that annualeconomic losses attributed to land and environmental degradation is about 3% of the country's GDP. Land in Kenya is susceptible to degradation whether located in the highlands or the lowlands. In the highlands, land experiences erosion of the top soils because of excessive rainfall. In the lowlands, erosion is caused by wind and infrequent floods.

Soil erosion has a substantial negative effect on crop and livestock production, as the rich top soil is carried away together with its nutrients, leaving the sub soil which is not as rich nor as well adapted to sustain crop production. Similarly, top soil is habitat to many small organisms, some of which are very instrumental in breaking down organic substances into nutrients for agriculture, further enriching the soil. Land degradation ends up destroying their natural habitats, and/or relocates the species depriving the land of important useful animal species. As a whole, research has determined that rangelands and marginal agricultural areas are more prone than higher potential areas to climate change effects.

3.3.7 Conflicts over natural resources

One major climate change impact is that it plays a significant role in the reduction of already scarce resources. This, coupled with increasing population growth breeds competition, often causing violent tensions. Extreme climate events also lead to food insecurity, and destruction of homes sometimes forcing people to move thus resulting in the displacement of

communities to other areas, which are sometimes unable to adequately cater for the migrants leading to competition related tension. Pastoralists havebeen particularly embroiled in conflicts with the communities they encounter in their pastoral nomadism, over natural resources.[120] Such conflicts have been witnessed between different pastoralist groups, pastoralists and farmers, upstream and downstream users, humans and wildlife, among others.[121]

In addition, there is also human wildlife conflict, which continues to be a serious challenge for wildlife conservationin Kenya. Wildlife sometimes destroycrops andkill livestock, creating great losses. Wildlife often attack people as well, sometimes with loss of lives. In response to this, people sometimes resort to killing the wild animals withlosses in both divides.[122]

Climate-related impacts are a challenge for Kenya and are expected to worsen as climate change continues to manifest. Extreme events in particular which include, hailstorms, receding lake levels, a high rate of drying of rivers and wetlands result not only in massive economic losses but it also severely reduces food security in addition to people's livelihoods.

3.3.8 Biodiversity loss

Kenya, which is ranked the second highest state in African in the rich abundance of bird and mammal species continues to lose biodiversity alarmingly partly due to deforestation, changes in land use, in addition to human population pressure. Climate variability has also caused overgrazing, destruction of habitats, deforestation, air and water pollution, unsustainable harvesting, as well as the presence of invasive species. This has the effect of reducing ecological resilience, impacting negatively on biodiversity, livelihoods, food

[120]GoK, 2013a
[121]UNEP, 2009
[122]MENR, 2013

security and the economy. Forests have been found to have the ability of absorbingalmost one-tenth of global carbon emissions into their biomass, through to the soil and the products and storing them predominantly and for eternity. This is a benefit which will be lost with land use variation and forest depletion. Kenyan tourism industry, for instance depends on the richness of the country's species. These emerging issues threaten the tourism sector which employs around 10% (2015 estimate) of formal employment force and contributes up to around 11.5% of GDP.[123]

3.4 Inadequate structures and resources for adaptation to climate change.

Kenya lacks adequateand appropriate structures that it can apply in the effort to adapt to climate changeeffects. These include structures to mitigate extreme events, such as arresting of the rain water and storing it by building or erecting appropriate storage tanks and control of flooding through the construction of dams. Drought can be mitigated by ensuring proper water storage whenever it rains heavily, investment in harvesting ground water for use such as that which has been discovered in Turkana county, reforestation and conservation of the forests in place, and ensuring that the level of forested areas is maintained, this can extend to the ASALs.

Other mitigation processes involve building of irrigation infrastructure to improve agricultural production. Other mitigationefforts that can reduce climate change effects include ensuring that people receive appropriate services, especially sanitation services in the slum areas, provision of safe drinking water and provision of adequate health care and health education.

There is lack of proper infrastructure for appropriate waste management particularly in urban areas, leading to pollution to air, water and land. Urban environmental shortcomings

[123] Rochelle Turner, WTTC Travel & Tourism Economic Impact 2015, (London, 2015)

in as far as waste disposalis concerned are brought about by poor management, inadequate planning and lack of coherent and well-coordinated urban policies.This is worsened by the increasing rate of urbanization and consequent increased level of waste generation. Besides improper waste management, an emerging challenge for Kenya is also the inappropriate disposal of e-waste. To meet these requirements, substantial financial resources are urgently required thus the need to prioritize environmental issues.

3.5 Climate Change and Environmental Security Management

The earth's climate is changing primarily because of the emission of high amounts of GHGs, which ordinarily trap the heat that radiates from the sunin the earth's atmosphere. While the progressive increase in atmospheric GHGs in the atmosphere occurs naturally, the current unprecedented increase of GHGs is an effect of human processes, executed in the bid to industrialize the world, rather than natural processes.The unprecedented increase has the potential of causing climate change and progressively destroying the environment with serious negative impacts, including the ultimate effect of risking the extinction of all life forms as basic access to food, water, and health as well as maintaining livelihoods and occupation for the local people are undermined.Kenya is therefore called upon to use innovation, cooperation, and self-discipline to determine ways of managing climate change impacts and environmental security.

Two strategies are normally used to deal with and manage climate change. Mitigation, which targets measures to prevent or stop further warming, and Adaptation, where ways are identified and adopted forsurvival in the increasingly warming world.

3.5.1 Climate mitigation

Climate mitigationrefers to any action that is taken with the intention of either reducing or eliminating long term risk or hazards posed by climate change to human life. The IPCC

defines mitigation as: “An anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases."[124] This means that mitigation addresses causes of climate change, and endeavours to reduce the rate at which the climate is changing, by reducing the amount of greenhouse gases that are present within the atmosphere. This is done either by removing greenhouse gases from the atmosphere by methods such as, increasing the number of trees within the environment to absorb CO_2 from the air, or stopping greenhouse gases getting into the atmosphere. Preventing GHGs from getting to the atmosphere can be accomplished by reducing energy use or using energy sources that do not release greenhouse gases. The use of technologies like solar, geothermal and wind power, ensures energy production without releasing GHGs, while and the use of carbon sinks, carbon credits, and taxation, development of coherent policies, implementation of regulations and standards, tradable permits, financial incentives, voluntary agreements, information instruments, and research and development (R&D).aim to absorb the gases in the atmosphere thus countering greenhouse gas emissions directly.

Generally therefore, mitigation lowers the level of climate change impacts that must be adjusted to, as well as reducing the level and number of risks to prepare foras climate change continues to affect the environment. This implies therefore that the more vigorously the elements of mitigation are employed, the less the climate change impacts that will be experienced, and thus the less the adaptability that will be required.

3.5.2 Climate Adaptation

Climate adaptation can be defined as the capability of a system to modify itself to cope with climate change and climate variability and extremes so thatpotential damage is moderated, ability to take advantage of opportunities presented by the change, or to cope with consequences. The IPCC defines adaptation as the “adjustment in natural or human systems

[124] IPCC, 2014: contribution of 3rd Working Group to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, edited by Pachauri R, K, et al, 2014, pp 4.

to new or changing environment[125]. Adaptation to climate change therefore refers to steps and modification that any systemin place makes in order to favourably respond to real or projected climatic stimuli, so as to ensure that harm caused as a result of this stimuli is moderated, or can be lived with or exploit the beneficial opportunities that may be availed as a result of the stimulus. For example, for protection against sea level rise and increased flooding, a community might build seawalls to prevent the water reaching their settlements, or may relocate buildings to higher ground. There are varying types of adaptation. These include anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation."[126]

Societies have always had ways of coping with the impacts of weather and climate related events, but the magnitude with which these events have recently been taking place are too overwhelming for an individual society to manage on its own. It is therefore necessary for additional and novel adaptation measures to be adopted in due course, to reduce those climate change impacts that may be harsh and unfavourable, notwithstanding that mitigation measures may have already been undertaken.

Additionally it has been determined thatlife systemsare facing several other sources of stress and these might increase the vulnerability of systems to the effects of climate change and reduce the ability to cope without assistance. These include poverty, the ongoing climate hazards, and inability to obtain and access resources, leading to among other consequences, food insecurity, possible conflicts and disease outbreaks such as HIV/AIDS. Globalization trends and its effects are also a major current source of stress.

[125]IPCC, 2007: Contribution of Working Group II of the 4th Assessment Report of the Intergovernmental Panel on Climate Change, edited byParry M. L., et al, 2007, (Cambridge University Press, Cambridge and New York, 2007)

[126] AMCEN, 2011: *Addressing Climate Change Challenges in Africa; A Practical Guide Towards Sustainable Developmen*t. pp33

A society's ability to adapt is known as adaptive capacity and refers to its ability to adjust and ensure that negative impacts are minimum and benefits from changes to climate are maximized. It is highly determinant on the society's capital assets and productive base, both natural and man-made, in addition to being influenced by prevailing changing environmental conditions.[127] It is also influenced by the society's rightsandsocial networks, human capital and institutions, governance, economic capability, health and technology. Climate change impacts affect all societies whether they are highly adaptive or not, and all societies have to remain alive to the fact that they need to continually mitigate climate change. Adaptation is therefore a continuous process that must go on being modified and not a one-time action. [128]

Most governments have put in place several and various policies and instruments, in addition to international protocols to encourage and drive mitigation and/or adaptation action. Their applicability and success will depend on national circumstances, the will to continuously adapt and sectoral context, the level of development of a community both socially and economically, It therefore goes without saying that adaptive capacity is uneven not only across but also within societies.

Whileefforts can be made to reduce the GHGs being released to the atmosphere, it is not possibleformitigation efforts to clear extra GHGs in the atmosphere and completely halt climate change,therefore both adaptation measures and mitigation processes must be combined for effective reduction and management of climate change impacts. Various strategies in combination, ranging from individual, local, as well as national and global

[127]Kates, R.W: "*Cautionary Tales; adaptation and the global poor", Climatic Change*, Vol 45 (1), (2000) pp: 5–17.

[128] Ibid pp 53

efforts need to be engaged together to manage climate change.[129] Effective implementation also depends on cooperation at all levels and can be enhanced through integrated responses that link various fields such as technological advances, other societal objectives.[130] The two methods of mitigation and adaptation are therefore normally used in combination with each other.

3.5.3 Mitigation strategies for climate Change in Kenya

In the year 2000, Kenya's GHG emissions were 54,955 Gg CO_2 equivalent, which is approximately 55 million tons of CO_2 equivalent from the various sectors such as Energy, Agriculture, Land use, land-use change and forestry (LULUCF), Industry and waste. Among all the sectors measured, the LULUCF was the highest emitter, contributing approximately 20,000 Gg CO_2 equivalent which is about 37.55 per cent of the total emissions. In comparison to overall global emissions, these rates are not significant, and Kenya is not listed as one of the countries required to make reductions on its emissions. The country is extreme vulnerable however to climate change effects which pose grave threats to the country's socio-economic development. These effects, and in particular those that are caused by droughts and floods, are projected to cost Kenya 2.6 % of annual GDP by 2030. Kenya therefore considers mitigation of climate change an important contributor to sustainable development, and has developed the following strategies on each of the identified sectors to mitigate climate change.

Energy: An analysis of some low carbon development methods of electricity production gave an indication that the option that would give the largest abatement potential is geothermal power, which also provides cheaper base load generation. Geothermal power can also facilitate economic activity and development, in addition to providing an option of

[129] IPCC, 2014: contribution of 3rd Working Group to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, edited by Pachauri R, K, et al, 2014, pp 26.

[130] Ibid pp 26.

reducing reliance on hydropower, which is the country's current major source of electrical energy; in the process enhancing climate resilience.

Wood and charcoal are the most commonly used domestic fuel source in the country providing 70% of the cooking energy demand. As a form of mitigation, enhanced cooking stoves that require minimal fuel have been developed for future use. In addition, liquefied petroleum gas is earmarked to replace wood for cooking. Another substitution that is anticipated is kerosene lamps for available renewable lighting technologies.

On transport, carbon emissions can be reduced by replacing the current city transport system with mass transit, both rail and bus, to reduce the number of automobiles on the road. Another mitigation potential can be the use of cleaner fuel such as biodiesel.

Energy Infrastructure

This includes investing in other energy producing systems that emit less CO_2 such as Solar energy which can be effectively used for street lighting and power for public institutions; the state can increase small hydropower generation plants for provision of electricity to the local community and businesses in the rural areas. There is also need to invest in rehabilitation of water catchment areas in order to enhance consistency in the flow of water in the rivers that feed hydro dams, hence even out power generationand ensure more reliability. Geothermal resources development should also be improved to work as an alternative to the dominant hydro-electric power generation.

Industrial Processes: Up to 95% of emissions caused by industrial processes in the country are produced by either cement manufacturing or charcoal manufacturing. Emissions caused by cement manufacturing may be lowered by using alternative materials for the clinker mixed in the cement. Another important low carbon development opportunity is using efficient kilns for charcoal production.

Agriculture: Agricultural emissions are mainly caused by livestock methane emissions and changes in the use of land. Reduction of carbon emissions released through agricultural processes can be done through agroforestry enhancement in order to increase farmland carbon stock, and improve climate resilience. Agroforestry will also assist the government in attaining its Vision 2030 goal of reaching a national 10 % tree cover.[131] Other low carbon development methods identified that should be adopted include conservation tillage and fire avoidance in land management.

Forestry and Land Use processes: Deforestation is the main cause of emissions in this sector. This can be mitigated by restoring forests, conserving them and engaging in sustainable forest management interventionsas well as soil conservation. The government has put measures in place to mitigate climate change, embarking on projects such as Reducing Emissions from Deforestation and Forest Degradation (REDD+). Among these projects is Kasigau Wildlife Corridor Project, which issues voluntary forestry carbon credits. There are other REDD+ projects in the pipeline includingthe MikokoPamoja mangrove restoration project situated in Kwale.

Waste Management: Landfills and sewage treatment plants generate GHG emissions through the production of methane. Measures should be takento achieve Methane gas capture at landfills and at treatment plants.

Policies

The major policy and legal documents and instruments in this sector are the National Forest Policy, 2014 and the Forests Act 2005. The policies mainly focus on encouraging progress towards the attainment of the target 10 per cent forest cover through industrial plantations, agroforestry, urban forestry and activities implemented by local forest authorities. These include the development of a national strategy aimed at reducing activities that lead to deforestation and Forest Degradation as these activities have an effect of slowing down

[131]Government of Kenya, National Climate Change Action Plan 2013 – 2017 (2013) pp 63

emission reduction. It is therefore imperative to embrace activities that nurture conservation, foster sustainable forest management, and enhance carbon stocks such as REDD+. This is aimed atgivingincentivesto encourage activities aimed at meeting the tree cover goal of Vision 2030.

3.5.4 Adaptation Strategies for climate change management in Kenya

The UNFCCC recommends that national adaptation planning should be guided by identified development needs of a country and its climate vulnerability. This implies that adaptation actions should aim at addressing climate and socio-economic development gaps. This makes it possible to integrate national development planning and implementation with climate risk adaptation. In Kenya, the National Action Plan on Climate change (NAPCC) outlines priorities for climate change adaptation based on the Adaptation Technical Action Report (ATAR).

In these plans, Kenya seeks to mainstream climate change adaptation to counties as precursors of development plans earlier developed with leadership from the District Development officer, who coordinates development activities at the district level. The plans have been mainstreamed in all the forty seven counties in the specific sectors.

Agriculture

The various adaptation strategies identified in the agricultural sector include data collection and data banking of all relevant agriculture information that is related to climate change. Promotion and bulk production of drought tolerant traditional high value crops will help the vulnerable people to have food security irrespective of weather changes that affect agricultural production. In order to reduce reliance on rain for agriculture the country has begun developing infrastructure to facilitate water harvesting and storage for improved crop production, mostly through technologies such as irrigation. These projects are being piloted

in the ASALs, which usually experiences the hardest impact from reduction of rains and extreme events, which have been recorded in recent years with high frequency.The programs will be later rolled out to other regions for enhancement of national development. A number of otheradaptationstrategies have been adopted and these include Index-based weather insurance; Agro-forestry; integrated soil fertility management; promotion of climate-smart agriculture in Kenya, as well as development and application of measurement methodologies that promote adaptation, mitigation and development. The Agricultural Sector sets climate change adaptation as a priority, with details on how the programs are prioritized being captured by the NCCRS. Some priorities includeenhancement of weather information systems, research on and adoption of drought tolerant crops and varieties, among others.

On the mitigation front, emphasis on agricultural mitigation is geared towards innovative initiatives that target land-based carbon projects, such as Agroforestry's Agricultural Carbon Program, whose main aim is to ensure viable agricultural practices can be convertedto carbon credits, and programs such as those on biogas development. Other mitigation plans include organic farming, proper and efficientagricultural waste management and selected biotechnologyapplication.

The NCCRS, is operationalized by the National Climate Change Action Plan (NCCAP), which was developed through a consultative process, by the provision of the analysis and enabling mechanisms and frameworks to drive the implementation successfully. The NCCAP also keeps in its line of sight the relevant requirements to ensure the Kenya Constitution 2010 implementation and the Vision 2030attainment. The planadditionally encourages inclusive development which ispeople-centered, in its efforts to make climate change actions propel the state into attainment of long-term development goals. Some of the action points of the NCCAP in particular includesummary of mitigation and adaptation options,establishment of low carbon climate resilient development pathway; development

ofsystems for knowledge management, capacity development, technology requirements andsetting out of viable financial mechanism.it also recommends appropriate actions.

Livestock

Adaptation in livestock includes establishment of frameworks that guarantee resilience even in adverse conditions such as development of appropriate grazing management systems, establishment of adequate long-term fodder banks and setting up of strategic livestock feed reserves for use during drought, setting of price stabilization schemes and establishing strategic food reserves from livestock products. It also encompasses the selection of breeds of animals that are adaptable to climate change for raring, livestock diversification by raring emerging livestock such as quails, guinea fowls and ostriches,camels, bees,indigenous poultry, and rabbits. Other adaptation methods adopted are capacity building for farmers and maintenance of inventory on indigenous knowledge, establishing and embracing early warning systems, proper maintenance of records on stocking rates, vaccination campaigns, and disease control.

Water Management

Adaptation strategies in water management include extensive water conservation action such as rehabilitating and restoring the major water towers in the country; enhancing the supply of clean water for domestic use and availing sewage services in urban areas to prevent water borne diseases together with attendant social and economic impacts. Other adaptation methods that can be adopted include enhancing effective trans-boundary water resource management,in collaboration with other stakeholders. Kenyaalso needsto develop capability to perform water resources assessment, and document, maintain and databank; and then, when the need arises, disseminate information to stakeholders. Other adaptation methods include monitoring of water quality, de-silting rivers and dams thus preventing loss of water

and conserving surface water. Kenya also intends to invest in recycling facilities especially at the county levels, inbuilding water harvesting infrastructure, developing capacity for monitoring river flows through establishment ofhydrometric network and build structures for issuance of warning on floods. Farmers are also individually adopting various innovative rainfall harvesting mechanisms to cope with recurrent droughts.[132]

Sustainable livelihoods

Kenya can achieve climate Change adaptability by supporting sustainable livelihoods in drought prone ASAL. Similarly, Kenya needs to intensify afforestation efforts to ensure more carbon is retained in the atmosphere, and to enhance conservation of the soil and water towers. The country has already begun implementing its strategy to increase the tree cover to the envisioned 10% by the year 2030, which will increase land conservation; reduce soil erosion and the risk of floods.

3.5.5 Strengthening Institutions dealing with Environment management

Strengthening the capacity of institutions charged with climate change coordination can greatly enhance adaptability to climate change. These include institutions dealing with climate-related data collection, processing and management such as the Meteorological Department. Ministries responsible for implementation of the National Disaster Risk Management Response Plan and the National Environment Action Plan (NEAP)also need to be supported in their implementation endeavours. The improvement and strengthening of climate change information management systems is also critical and requires institutional capacity. Other aspects of climate change that should be enhanced includetraining of stakeholders to create climate risk awareness, management and opportunities.

[132]Ngigi, S.N., H.H.G. Savenije and F.N. Gichuki,: *Hydrological Impacts of Flood Storage and Management on Irrigation Water Abstraction in Upper EwasoNg'iro River Basin*, (2008) pp 22

3.6 Institutions Relevant to Climate Change in Kenya

Government ministries and related Institutions

The Ministry directly involved in management and regulation of climate change activities in Kenya is the Ministry of Environment and Natural Resources (MENR), which is responsible for formulating policies in the sectors of environment and natural resources, analysing and reviewing environment activities, as well as promoting, monitoring and coordinating those activities and enforcing compliance of environmental regulations and guidelines. To assist MENR to achieve its mandate it has a number of Semi-Autonomous Government Agencies (SAGAs) and departments, among them National Environmental Management Authority (NEMA), the Kenya Forest Service (KFS) and Kenya Meteorological Department (KMD).

In the fulfilment of their mandate, other ministries perform functions that may be find themselves being directly or indirectly related or affected by the climate and/or the environment. Other ministries are stakeholders in the management of the environment. These include the Ministries of Planning and Devolution; Housing and Urban Development; Land, Water and Irrigation; Agriculture Livestock and Fisheries; Tourism; Health, and Energy and Petroleum. The county Governments are also major players in cross cutting climate change related activities, in some of the devolved functions such as agriculture and forest conservation.[133]

Some of the relevant activities to environmental security that MENR is engaged in include policy research on Reduced Emissions from Deforestation and Forest Degradation (REDD). In addition, KFS represents government in the global negotiations which examine and decide onGHG emissions that are occasioned by land use and land use change and forestry (LULUCF).

[133] Government of Kenya, National Climate Change Action Plan 2013 – 2017 (2013) pp 12

The KMD is required to perform functions which include provision of meteorological and climatological data and services and maintenance and provision of relevant data to various relevant government and public institutions, as well as the private sector institutions that mayrequire their data in order to enable efficient exploitation and utilization of natural resources. In order to do so the KMD collects and maintains data relevant to weather across the nation.

For the purpose of coordination, Kenya established the National Climate Change Activities Coordination Committee (NCCACC). NCCACC comprises 25 members to assist it coordinate relevant matters effectively. These are drawn from all relevant sectors to ensure inclusivity including ministries such as Agriculture, Energy, Environment and Natural Resources, Planning, Finance, Industry, and Research and Technology, local authorities, private sector and universities. The NCCACC's primary role is to ensure all stakeholders are involved in activities on climate change and ensuring the various activities are well coordinated for efficiency. NEMA and MENR constitute the secretariat of the committee. For efficiency in operations, and to conform tothe working structure that is employed in Kenya's national communications on climate change,the NCCACC established, four technical working groups. These groups include vulnerability; education, training and public awareness covering cross cutting issues and all stakeholders, mitigation and adaptation; and Green House Gas (GHG) inventory.

3.7 Conclusion

This chapter enumerated the various challenges bedeviling Kenya's environmental security due to climatic change and endeavoured to address Mitigation and Adaptation strategies applicable in addressing climate change. Climate change is transnational and is felt beyond borders. These challenges are real to Kenya and constitute real environmental security threats. Given that a large percentage of the Kenyan populace, more so those who live in rural

areas depend directly on the environment and natural resources, environmental security is paramount to the country's people's wellbeing. "Approximately 75% of the Kenyan population dwell in rural areas and derive their living directly or indirectly from agriculture."[134] Urban dwellers also constitute a population that is very vulnerable to climate change; more so those who live in the informal slums, and are susceptible to extreme events such as flooding and drought. Since they lack safe drinking water, experience water scarcity, and live in structures that have poor sanitation, they are also susceptible to disease attacks. The country therefore needs to formulate strategies to deal with the challenges in an endeavor to mitigate them and ensure security of its people. Kenya generally does not emit significant levels of GHGs and indeed it is not in the category of the countries required to reduce its emissions, but nonetheless the country however struggles with climate change effects.

[134]Nicodemus Nyandiko [et al..] (2015), *Food Security and Climate variability in Kenya's semi-arid lands.* Chapter one, Page 1.

CHAPTER FOUR

ROLE OF NATIONAL ENVIRONMENTAL MANAGEMENT AUTHORITY IN MANAGING CLIMATE CHANGE AND ENVIRONMENTAL SECURITY IN KENYA

4.0 INTRODUCTION

Chapter four seeks to analyse the major constraints that Kenya faces in tackling climate change and environmental security, and the role that the National Environmental Management Authority (NEMA),which is the authority responsible for the management, supervision and coordination of all matters related to the environment in Kenya and is the recognised principal instrument of the Government of Kenya in the implementation of policies relating to the environment,[135]plays in this management. The chapter examines in detail the various functions of NEMA as it endeavours to meet its legal mandate, and goes further to detail the various initiatives that it has put in place in its efforts to tackle climate change and seeks to determine their effectiveness. The chapter examines the specific challenges that have so far contributed to hindering smooth management of climate change and environmental security, achievement of optimum results, and how this has affected the general management of climate change and environmental management.

4.1 The National Environment Management Authority and its Mitigation and Adaptation strategies

The National Environment Management Authority (NEMA) is a semi-autonomous government agency (SAGA) responsible for the overall supervision and coordination of matters relating to the environment in Kenya. It is also responsible for the process of

[135] NEMA publication 2017
http://www.nema.go.ke/index.php?option=com_content&view=article&id=2&Itemid=137

preparation of Kenya's national communications on environmental issues. NEMA is established under the Environmental Management and Coordination Act (EMCA) No. 8 of 1999, as the principal instrument of government in the implementation of all policies relating to the environment.[136] The authority, which is a SAGA under MENR, develops programmesguided by Article 42 of Kenya's Constitution 2010 which provides that every person has the right to clean and healthy environment[137] and Article 70 which provides for the right to protect the environment for the benefit of present and future generations through legislative and other measures.[138]

The authority's core functions include, "co-ordination of the various environmental management activities being undertaken by the lead agencies and promotion of the integration of environmental concerns into development policies, plans, programmes and projects; assessment of natural resources, their utilization and conservation for proper management of the environment; examination of land use patterns to determine their impacts on natural resources and use of this information to formulate land use guidelines; advising the government on the implementation of relevant regional and international environmental conventions, treaties and agreements to which Kenya is a party and those to which Kenya should be a party; mobilisation and monitoring of the use of financial and human resources for environmental management; identification of projects and programmes, plans and policies that require environmental auditing and monitoring; development of procedures and safeguards for the prevention of accidents, which cause environmental degradation and recommend remedial measures, monitoring and assessing activities being carried out by lead

[136] Environmental Management and Coordination Act (EMCA) No. 8 of 1999, Article 9 sub-article 1

[137]The Constitution of Kenya, available at http//www.Kenyalaw.org. accessed on 20th July, 2017 at 2130hrs(National Legislative Bodies, Nairobi, 27 August 2010.)

[138]Ibid

agencies to ensure that the environment is not degraded, environment management objectives are adhered to and adequate early warning on impending environmental emergencies are given; enhancing environmental education and public awareness in collaboration with lead agencies on the need for sound environmental management as well as enlisting public support; publishing and disseminating manuals, codes or guidelines and rendering advice and technical support where possible to entities engaged in natural resources management; preparation of annual state of environment reports and the periodic environment action plans."[139]

4.2 Specific Functions carried out by NEMA

As the entity responsible for overall supervision and coordination of matters relating to the environment in Kenya, NEMA plays a major role in the management of climate change and environmental security in Kenya, and has put in place a number of measures and programmes aimed to mitigate against climate change and build adaptation to the negative impacts of climate change. This is based on various assessments that have been done, to determine the gaps within the country that prevent it from mitigating effectively as well as coping with climate change impacts. In response tothefindings of the assessments, and in particular the assessments by NEMA's Climate Change National Capacity Needs Self-Assessment (NCSA), which was carried out against the country's policy and development goals,[140]the authority prioritized adaptation as the best suited response urgently required to building resilience towards climate change. The gaps identified can be classified as systemic, where a capacity need was identified for a well-managed, adequately-funded and integrated network of all stakeholders, committed to sharing information, raising awareness and ensuring climate issues are brought to mainstream policy making. The other gap is institutional, and here theNCCACC was acknowledgedas the 'central agency' responsible for directing and coordinating climate related

[139]Environmental Management and Coordination Act (EMCA) No. 8 of 1999, Article 9 sub-article 2a
[140] National Environmental Management Authority Publication, 2005

programs and spearheading developments both in research and policy, with NEMA as the secretariat, and lead coordinating agency. This sets mechanisms for coherent coordination ofall climate related activities in all ministries and agencies.The third gap identified in the assessment is the individual gap, where it was acknowledged that there was a need for capacity building so as to acquire specialized knowledge within individuals concerned.

In implementing its role in the management of climate change and environmental management, NEMA is regarded as the Designated National Authority (DNA) which is mandated with the responsibility of granting approvalsto projects aimed at Climate change mitigation through the Kyoto protocol. The DNA relies heavily on National Clean Development Mechanism (CDM) Clearing House and other related ad-hoc working groups operating with the NCCACC. CDMactivities and programs are however extremely limited in scale and scope as a result of resource and capacity limitations. The National CDM Clearing House draws its members from the NCCACC.

The Clearing House combinesits functions with those of the Global Environmental Facility (GEF) National Task force which is charged with reviewing proposed GEF projects to determine whether they comply with national legislation and other requirements, and whether they pass the sustainability testbeforeapproving them. According to the 2001 Guidelines on CDM, the Clearing House is responsible for setting the criteria for approving CDM projects, recommending CDM project proposals for approval by the NCCFP, processing the proposals, together with stakeholders, monitoring and evaluatingthe projects, ensuring efficient coordination of CDM projects,ensuring the establishment of a national database for CDM projects and finally, giving advice to the government about issues concerning CDM. This framework ensures that projects are assessed and approved based on the minimal level of GHG emissions they are expected to emit.

So farKenya has registered two projects under CDM. The Mumias Bagasse cogeneration project, and Olkaria III phase Two geothermal expansion project. More projects due to be set up include the Redevelopment of Tana Power Station Project, 130.3 GWh, Kipevu Combined Cycle Power Project, 223 GWh and SonduMiriu Power Project, 330 GWh, projected to generate a total of 1,040 GWh once completed. Implementation of these projects will lead to displacement of 665,790 tons of CO_2.

There are other interested actorsin the CDM projects, and these include the Kenya Greenbelt Movement Reforestation Bio-carbon Project. All in all, performance in CDM is very poor in Kenya still poor and shouldbe stepped up. In particular,there are many opportunities in forestry and waste management, which can be taken Kenya's poor performance can be attributed in part to corruption, a noted lack of awareness of CDM potential especially in the private sector, more so in financial organizations.

NEMA is one of the National Implementing Entities (NIE) that has been accredited by the Adaptation Fund Programme(AFP) which is an international fund that was agreed upon by members to theKyoto Protocol. Under the UNFCCC the AFP aims to assist developing countries to manage climate change through financing concrete adaptation projects and programmes[141]that aim at minimizing unfavourable climate change effects facing communities, countries, and sectors within third world countries who are parties to the Kyoto Protocol. The AFP accreditation mandates NEMA to vet, approve and supervise projects financed by the AFP. NEMA has so far received KSh 1 Billion from the AFP to implement the Kenya Climate Change Adaptation Programme (KCCAP) proposal. In utilizing this fund, NEMA seeks applications from parties that are interested in implementing projects that are focussed on climate change adaptation, assesses them and awards funds to

[141]Operational policies and guidelines for Parties to access resources from the Adaptation Fund

those projects that best meet the criteria set. The authority then monitors these projects to ensure compliance.[142]As the NIE therefore,NEMA plays a major role in determining which projects qualify for funding by the AFP, and thus have a strong leeway in ensuring programs implemented meet the overall national goal of mitigation and adaptation to climate change.

With the funding recently received from AFP, NEMA initiated a programme called the Integrated Programme to build Resilience to Climate Change and adaptive capacity of vulnerable communities in Kenya. In essence, the programmeaddressed five thematic areas namely, Food security, water management, coastal management, disaster risk reduction and knowledge management.

The programmehas been focused on nine areas cutting across the nation and involving different communities most of which have differing and diverse cultures but sharing the commonality of having livelihoods that are mostly derived directly from the environment and therefore feel the brunt of climate change effects. The chosen locations are all significantly water deficit and therefore their inhabitants are more to climate change, than inhabitants of other areas. Some of the specific actions that have been taken by theprogramme include, the adoption of drought tolerant and high value food crops, diversified alternative livelihood sources, provision of drip irrigation equipmentto selected farmer groups so that they can use water efficiently. The programme has also provided 100,000 seedlings and facilitated their planting and management to enable the rehabilitation of livestock watering points, and riparian ecosystemsrestoration. In addition, the programme has facilitated the establishment of appropriate physical assets and infrastructure to ensure efficient and reliable water harvesting and storage. It has also established Information Management System for taking and maintaining records of the programs, their implementation processes, their progress and outcomes, best practices learnt and adopted as well as lessons learnt.

[142]Bwari E, Interview with Dr. Anne Omambia, NEMA, August, 2017

The authority is using threemajor executing entities, namely Coast Development Authority (CDA), assigned to implement projects in the coastal area. Kenya Forestry Research Institute (KEFRI) and Tana and Athi River Development Authorities (TARDA and ARDA).The three entities are working with eight other executing groups as implementing entities who are mandated to execute the programme in the different locations identified.

NEMA is also accredited as a NIE by the Green Climate Fund (GCF), which is a finance body established under UNFCCC, to help fund projects related to climate change adaptation and mitigation in the developing countries. With the accreditation to the Green Climate Fund (GCF), NEMA intends to develop country priority projects in line with the Kenya 2030 vision, and integrate it with national strategies on green growth and climate response, and the KCCAP. NEMA's priorities are to be developed in line with the national strategies which identify six priority sectors chosen due their perceived potential to be effective in mitigating GHG emissions by 2030. The sectors are forestry, electricity, transportation, energy, agriculture and industrial sectors. Accreditation to the GCF allows NEMA to initiate and manage programs that can drive proactive action aimed at embracing low emission and climate resilient development processes.

Other programmes that NEMA is working on include increased resilience and adaptation to sea level rise, changes on the shoreline and the effects of these changes through Integrated Shoreline and Mangrove Ecosystem, rehabilitating and protecting Coral Reefs, stabilizing the shorelines, and controlling erosion and accretion and disaster risk reduction among vulnerable communities. Disaster risk reduction can be achieved constructingAutomatic Weather Stations (AWS) and locating them in programme sites selected to ensure they are able to collect as much of the relevant information as possible and making sure they are well equipped, documenting weather information properly to ensure

continuous availability of relevant data in order to facilitate timely decisions on disaster preparedness and risk reduction.

NEMA also continues to address waste management and pollution through its Environmental Impact Assessment programme where the organisation assesses all projects, to which ensure the processes do not bring a negative impact on the environment before issuing authority to proceed.[143]

In addition, NEMA works in collaboration with other organisations and institutions in its endeavour to fulfil its mandate. These include the UNEP which it works with in conjunction with the Kenya Marine and Fisheries Research Institute (KEMFRI) in programmes geared towards implementingcapacity building projects for climate change management. Further, UNEP is fronting the formation of Global Climate Change Adaptation Network.Other organisations and institutions working on climate change in Kenya include Parastatals; International NGOs such as UN bodies like UNEP, UNDP,among other bodies; regional and national NGOs; the Private Sector; Civil society organizations; research institutions, donors; development partners and academic institutions, which are now playing a major role by initiating and offering courses related to the environment, energy and natural resources management.[144]

In addition to its role as an environmental regulatory body, NEMA implements its own projects, some of which it co-implements with local and international organizations, among them UNEP, UNDP, UNFCC, World Bank, and DANIDA to achieve its vision of being a world class Environmental Management Authority.

[143]Bwari E, Interview with Dr.Omambia, NEMA, Nairobi, August 2017.
[144]Emelie César Anders Ekbom Wilfred Nyangena Environmental and Climate Change Policy Brief Kenya, Sida's Helpdesk for Environment and Climate Change www.sidaenvironmenthelpdesk.se pp 9

Another major role that NEMA plays in the management of climate change and environmental security in Kenya is the coordination of climate change activities, which is specifically undertaken by the National Climate Change Focal Point (NCCFP) located in NEMA. The specific role of NCCFP is to coordinate national climate change activities; liaise with the UNFCCC Secretariat on relevant issues, perform secretariat functions to the NCCACC and its technical working groups, thus coordinating activities among all ministries and departments involved in climate change and environmental related activities.

The institutions mandated to manage and coordinate environmental issues are however not adequately equipped in terms of human or physical resources, structure or capacity to manage climate change effectively. The country depends to a greater part on external resources, which are not only inadequate but also come late, thus making it difficult to combat climate change. This is one of the reasons why poor coordination has been seen to prevail in this area.

4.3 Challenges in managing Climate Change and Environmental Security.

One of the most important strategic environmental constraintin Kenya is policy formulation and implementation. Issues of climate change and the environment are widely cross cutting, and touch various sectors such as land and land use, agriculture, urban development, water and irrigation, forest conservation among others. Policy issues in Kenya are however usually sectoral and thus initiated and managed by the lead agency in charge of a specific issue. The lead agency in the formulation of environmental policies is the MENR,[145]and other ministries lead in issues involving their ministries, and are not under obligation to consult the MENR as they formulate their policies, even when these policies affect environmental security. This often creates a general lack of harmony between the various sectoral policies and laws which

[145]Bwari E, Interview with Dr. Diana Mobagi, NEMA, August, 2017

concern the various sectors and have implications on the environmentthus decreasing policy coherence at national level; fragmenting the management and affecting the coordination of strategic activities between different actors whose activities affect the other in one way or another and thus compromising the effectiveness of implementation of the policies and plans. In general, there lacks an integrated and ecosystem-based approach to natural resources management rendering the policies insufficient in addressing environmental challenges. Further, where good policies exist, there is weak enforcement and lukewarm implementation. This can sometimes be attributed to cross-sectoral influence on action rather than professional and objective decision making which often come into play resulting in compromising of policy priorities and compliance with legislation.

Kenya also has a challenge of climate change institutions, occasioned by tension, overlapping mandates and perceived lack of consultation between various institutions responsible for climate change, as well as unhealthy competition among institutions. This can effect implementation by creating unnecessary delays in projects that are beneficial and generate mistrust among players leading to and sub optimal results in tackling climate change.

Kenya's government is committed to embracing green economy to operationalize sustainable development due to its potential benefits and focus on practical implementation. The transition towards a green economy however requires substantial financial resources, which adds to the strained Government budget. Currently, the funds dedicated specifically to activities geared towards managing climate change in various sectoral projects such as agricultural projects are limited. Even donor funds specifically earmarked to tackle climate change take time to reach and are inadequate to address the required need. There is therefore a serious challenge in accessing financial resources to effectively manage climate change, and environmental security.

Funding of projects aimed at tackling climate change, is often affected by challenges in coordination mechanisms and procedures within the donor community and Kenya, as these have been found to be weak and fragmented. As a result, there are uncoordinated project approaches in managing development assistance. In this regard, it has been noted that the various International donor communities that support Kenya through financing the country's plans on environmental security, have individual approaches with each donor group supporting projects through different ministries. For instance, the donor group comprising of groups that include Britain's Department for International Development (DFID), USAID and COMESA, holds meetings under the chairmanship of MEMR to discuss and consider critical needs in implementing the NCCRS. On another front, the World Bank assists Kenya to upscale climate smart agriculture in Kenya through institutional capacity building within the Ministry of Agriculture (MoA) through the Climate Change Unit (CCU) which is one of its units. The World Bank also supports the development of a monitoring, verification and reporting (MVR) mechanism at national level.

NEMA is the designated NIE for the Adaptation Fund Program, which was established under the Kyoto Protocol, and similarly the Designated Authority under the Green Climate fund, both of which fund projects aimed at assisting developing countries to cope with climate change mitigation and adaptation. Some funds have been provided under the Adaptation Fund, but the same is yet to be realised under the Green Climate Fund.[146]These funds, together with funds provided in the national budget are not adequate to address climate change challenges in Kenya.[147] Therefore due to lack of reliable funding for environment related projects, planning and implementation of plans may not be consistent and coherent.

[146]Bwari E, Interview with Dr.WangariKirumba, NEMA, August, 2017.

[147]Bwari E, Interview with Dr. Dinah Mobagi, NEMA, August, 2017.

The other challenge is devolution. The Devolution of rights and responsibility for decision making in forest, agriculture and land management from the national to the county level, present a potential for both synergies and failures. Initiatives aimed at addressing problems concerning the climate and environmental at the county level face significant challenges of integrating national climate change responses into county development plans, strategic policies and regulatory frameworks. Failures are also occasioned by insufficient capacity by the county governments to carry out the decision making process effectively, to coordinate activities and work together productively, especially where action involves more than one county, as is a common scenario in programs addressing Climate change. Self-interest and self-determination among implementers, and sometimes lack of political goodwill, also often compromises effective implementation of plans and programs.

Climate change brings about impacts such as alterations in the pattern, duration and level of rainfall, an expansion in the range of pests and pathogens, and potential increase in attacks by invasive species that affect some tree species. These may have an effect in the normal growth, composition of species in the forests and their regeneration capacity. Invasions that have occurred in the past include *Prosopisjuliflora* ('mathenge'), which once dominated ecosystems in some semi-arid locations of the country such as Baringo, Tana River and Garissa. In addition, there has been unprecedented growth in some species of trees for example *Acacia reficiens* (acacia) normally growing in North-Eastern Province (NEP), whose excessive growth was observed after the 1997 El-niño rains, suppressing growth of certain important species which form grasslands for food for wildlife and livestock. The due changes in the ecosystem is a major challenge in tackling climate change.

Another major constraint that National Environmental Management Authority (NEMA) faces as it endeavours to tackle the effects of climate change and environmental security include staff capacity challenges. There are inadequacies in staff capacity both in

terms of numbers and skill both within the authority and in the lead agencies. This leads to inability to effectively deal with the arising issues as required.

A major challenge in sustaining forests as a measure of climate change adaptation is population growth, which in addition to povertycreates a surge from communities seeking space for growth of crops and habitation, energy, with many poor people going for wood fuel, and material for construction. This in part is caused by the unavailability or prohibitive cost of alternatives. Thetotal dependency on forests makes these very poor people extremely vulnerable whatever slightnegative effect on the forest resource.

The country does not possess and is not able to adequately obtain and maintain the required national and local information on how climate elements of temperature rise, precipitation changes, extreme weather events, sea level rise and other seasonal shifts, are able to affect phenomena such as water shortages (supply and quality), air quality, human health, and habitat loss. In other words, there is little information on exactly how vulnerable the country is to climate change effects. The KMD has forty weather stations across the country which monitor weather changes continuously.[148] Not all counties however have weather stations, and the data provided from the stations in place, though representative, could be more accurate and reliable if it covered more areas.Lack of designated local institutions that can provide comprehensive information on climate change, poses a major constraint towards developing actionable and cost effective plans and strategies that will effectively mitigate and enable the country adapt to climate change effectively.

4.4 Policies and Legislation governing NEMA

[148]Bwari E, Interview with Christine Manyonga, the Kenya Meteorological department, Nairobi August, 2017.

The National Environment Management Authority was created through an Act of parliament called the Environment Management and Coordination Act No. 8 of 1999 (EMCA 1999),[149] which also it provides the main environmental law in the country. However, the country lacks a policy on environment. In normal circumstances, national legislation is reflected from government policy frameworks which then give a projection from which the law is extrapolated. It has also been observed that while NEMA plays a big role in implementation of policies, it plays no role in formulation of the policies.[150]

Although EMCA 1999 is the legal framework for environmental concerns within Kenya, it has been realised that it has a very minimal focus on management of climate change through adaptation and mitigation. The act is particularly silent on the pastoral and agricultural communities. It however gives provision for the formulation and issuance of regulations addressing coastal erosion and mangrove conservation, which can be used to draw guidelines for the issue in that ecological zone. The EMCA also provides opportunities for mitigation by using incentives or disincentives in section 57, and reduction of emissions in the provisions for the establishment of air quality standards, provisions for emissions requirements provided for in Part VIII, environmental impact assessment requirements as provided for in Part VI; environmental restoration orders and environmental conservation orders provided for in Part IX.

Another weakness of EMCA is that it fails to effectively address issues such as the establishment of national inventories addressing anthropogenic emissions of GHGs by source and removal of GHGs by sinks. It also fails to address development of a national framework for carbon finance;guidelines to establish national and regional programmes to mitigate climate change by addressing anthropogenic emissions by source; promotion of education,

[149] Environmental Management and Coordination Act (EMCA) No. 8 of 1999 article 7.

[150]Bwari E, Interview with Dr.Omambia, NEMA Nairobi, August, 2017

training and awareness on climate change; appropriate technology transfer arrangements and their authorization, and access to environmentally sound technologies.

While the country is relatively ill equipped to mitigate and adapt to climate change, steps have been taken through NEMA to increase its resilience and adaptability to climate change especially in the area of food security in the most water scarce areas. The government has also made efforts with the help of the international community, to meet challenges such as obtaining resources to fully manage climate change and to enhance adaptation for as many people as possible. With its new found partners, NEMA is set to drive the country's efforts in meeting its requirements in achieving the required adaptability against climate change impacts in the country.

4.5 Conclusion

From this chapter, it can be concluded that Kenya appreciates the gravity of the impacts of climate change in the country today and in the future on the economic and social wellbeing of the nation as a whole and the citizen in particular, and has set up legislation and institutions to deal with the menace. In addition, Kenya continues to underscore the importance of joining hands with other nations in the effort to slow down these effects and to cushion its people against the impacts of climate change. Through the efforts of various institutions and more so NEMA, which is the institution charged with managing and coordinating environmental issues in Kenya, the country has taken various initiatives to mitigate and adapt to the problem. Among the measures taken, the country has formulated various policies and set up institutions to drive the identified processes. Despite these efforts, there have been numerous constraints that have hindered the achievement of the required results for which solutions are desired. Among the major constraints affecting efficiency and effectiveness in the war against climate change, there is a lack of proper coordination in policies formulated to tackle climate

change. There is also a lack of proper coordination in the implementation and also funding of programs designed against climate change. The various institutions also lack synergy and cohesiveness and therefore work individually leading to duplication of functions and actions. Policy cohesion is required urgently to ensure all players are united in purpose. There are also capacity challenges with regard to resources and human capacity to effectively implement plans and strategies. There is therefore need to get workable solutions in order to succeed in mitigating and adapting to climate change.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter lays down a summary of the Key findings of the study, and gives recommendations by the researcher on what can be done to answer the research questions and the objectives. The study also provides the theoretical links with the study. The chapter also depicts the fact that there exist challenges to tackling climate change and environmental security, and outlines the need to do something about it considering that environmental security touches on the very core of human existence.

5.1 Key Findings

The study findings acknowledge that NEMA is the body given the responsibility for the overall coordination and management of issues relating to the environment in Kenya. In its coordination role, NEMA deals with lead agencies, comprising of ministries and departments under whose docket specific projects fall, and who are therefore responsible for the actual implementation of the various projects aimed at mitigating or adapting to climate change. The challenge that NEMA has in this role is that it does not have the capacity to fully monitor and ensure compliance especially among the lead agencies that do not depend on the authority to initiate and fund their projects.[151] These include projects under other ministries which have a bearing on the environment, such as the Ministry of Agriculture and Lands. While the Ministries have their own mechanisms of attempting to mitigate and adapt to climate change, they may however follow through on their own without the involvement of NEMA or any other body of the MENR, thus creating the challenge of lack of coherency.

[151]Bwari E, Interview with Dr. Dinah Mobagi, NEMA, August, 2017.

The lack of coherence is also reflected in the funding of projects from the various donor groups, which provide funds in projects under different Ministries, such as Agriculture or Lands. NEMA, or any other agency does not have the framework to monitor and assess projects under other ministries, thus creating the element of lack of coherence. The findings therefore are that due to incoherent and uncoordinated project implementation processes, climate change mitigation and adaptation strategies risk being compromised by uncoordinated project implementation, due to lack of unity of purpose in implementation, probable duplication of efforts, potential inadvertent undermining of one agency by another, undue competition by various agencies, and even inconsistency and undue ineffectiveness in national climate change adaptation strategy.

The Study findings also identify that policy formulation is mostly sectoral and therefore policies that guide certain processes in various sectors are developed by the affected sector, each sector leading its own process. Some of these policies have an impact on the environment and therefore have a bearing on environmental security, affecting all the sectors that have a bearing in the environment, but there lacks a framework that can bring the sectors together and develop wholesome policies which would form a blue print for all the concerned sectors in as far as environmental security is concerned. In addition, NEMA does not participate in the formulation of policies in any of the programmes and services it is involved in, contrary to expectations of its mandate. These are done by the MENR and cascaded down to NEMA to implement. This state of affairs also creates significant incoherence which may curtail the important contribution of an implementing agency.

The study findings also recognised that there are there are limited resources to cope with the requirements of mitigation and adaptation to climate change.[152] The overall budget for environmental security which includes the national budget's allocation and other funds

[152]Bwari E, Interview with Dr.Omambia, NEMA, August, 2017.

provided from the donor community, through the Kyoto Protocol frameworks for example the Adaptation Fund Programme which funds and the Green Climate Fund, to fund the Kenya Climate Change Adaptation Programme (KCCAP), as well as the NCCRS, and the NCCAP. The first instalment of the Adaptation Fund has been disbursed to implementing entities and taken root in eight counties, constituting 17% of the counties constituting 36% of the total counties. There are other counties and projects that need to be funded but which have to await further funding.

Kenya does not have the capacity to collect data related to climate change, such as GHG gas emissions on a continuous basis. While it has capacity to collect periodically through mobile stations, it would be more effective to record the relevant data in a continuous basis to enable an accurate record that can be used to make decisions related to mitigation and adaptation of climate change. This however requires very expensive equipment and a lot of investment in terms of capacity building of its human resources, and time, which the country lacks at present.[153]Similarly, data that is collected through its KMD such as temperature, precipitation, radiation are recorded at the established meteorological stations which are not located in every county throughout the country, even though the areas covered represent all specific climatic zones.[154]

Study findings identify that NEMA manages the quality of the environment by minimising air and water pollution, through its Environmental Impact Assessment ((EIA). It does this by minimising any expected adverse impacts on the environment, by assessing all projects in construction and manufacturing, forestry related activities and waste management,

[153]Bwari E, Interview with Mr. S Kahuha, Kenya Meteorological Department, August, 2017.

[154]Ibid

to determine their likely impact on environmental pollution, on a yearly basis through its licencing function.[155]

5.2 Recommendations

Environmental security is core to life itself as it is forms the surroundings in which human beings exist. Climate change has been found to have an adverse impact on the environment, with its effect on temperature and rainfall, as well as its effect on extreme events. Environmental security and climate change therefore are very important in the very sustenance of life. Considering the importance of this, it is very critical that measures are taken to maintain a secure environment, by mitigating to climate change. In the event that mitigation efforts are not implemented or are ineffective, adaptation to climate change must be embraced to maintain sustenance and continuity of the very core of life.

To do this, issues of climate change and environmental security should be accorded priority status to enable measures that would guarantee environmental security to be put in place. Similarly, allocation of resources towards the cause should be prioritized. To do this, there may be need to securitize the issue, considering that it is core to the very existence of not just human beings but other living things as well.

While there has been an attempt for funding from the developed world to assist developing countries to mitigate and adapt to climate change, the funding has been late coming to most states and some parties do not honour their commitments. It is a fact that climate change knows no boundaries as the theoretical framework indicates, and the effects cut across the entire globe. All states and non-state actors therefore must of necessity pull together through the international organisations and the various regimes to ensure that the environment is secure in the entire globe.

[155]Bwari E, Interview with Dr.Omambia, NEMA, August, 2017

On the domestic front, policies that ensure this takes place in a coherent manner are very important. To this end, it is imperative to consider formulating the relevant policies that will drive the agenda of securing the environment in an inclusive manner, to ensure all stakeholders give their input. In addition, to achieve coherence there may be need to consider having a permanent body, which takes full responsibility for all matters dealing with climate change and the environment, from planning, implementation and monitoring. The agency must take the lead with all other relevant agencies coordinating with it in all matters that concern the environment and climate change mitigation and adaptation. NEMA has been found to focus on the implementation of various environment related policies, and should it be the organisation charged to take the lead in this issue, it needs to be given more authority and more autonomy to be effective.

There is need to put in place mechanisms for regular data collection and monitoring across the country to provide relevant information that will guide decision making. It was found that the equipment required for effective data collection is very expensive to acquire and to maintain[156]. Kenya can consider involving other countries within the region and acquiring the equipment as a region to belong to the region and provide data for all the countries in the region, in line with the theoretical framework which encourages international cooperation. In addition, in consideration of the fact that climate change impacts do not respect any boundaries and will create an impact across the borders, there is need to consider the development of regional institutions to deal with issues of climate change in the region. This will ensure that progress made in Kenya or any other country is replicated in other neighbouring states, with the effect of overall benefit to all.

[156]Bwari E, Interview with Samuel Kahuha Kenya Meteorological Department, Nairobi, August 2017

5.3 Recommendations for Future Research

Evidently, there are challenges in tackling climate change in Kenya due to a number of reasons as articulated in the document. Potential future researchers could look into wider use of regional institutions and regimes to tackle climate change, where regional institutions could have more say into the affairs of the individual countries on matters to do with the environment. This could determine the effectiveness of using regional institutions and the extent to which individual states must deal with the issue on their own.

Another area that could be considered in future research could be the determination of the actual relationship between the elements of the climate, that is, to what extent does temperature and rainfall actually affect issues like food productivity, water availability bio-diversity and what is the actual impact to the local climate in Kenya. What indeed is the relationship between these variables and environmental security, especially considering the long period of time it takes to record a change in the variables..

Future studies can also concentrate on policies and determine ways to most effectively formulate and manage policies considering that this issue defies confinement to one agency, to one county and state, and cuts across several sectors as well as geographical boundaries. There may be need to determine the amount of leeway and level of autonomy that an institute that is given the authority to take the lead should take in its coordination and its management role in order to become effective.

BIBLIOGRAPHY

AMCEN: Addressing Climate Change Challenges in Africa; A Practical Guide Towards Sustainable Development, 2011

Australia Department of Defense, Defending Australia in the Asia Pacific Century: Force 2030 (2009)

Axelrod. R. S., et al, The Global Environment: Institutions, law and policy. (Washington: Congress Quarterly Press, 2005) second edition.

Barnett Jon *Security and Climate Change*,Working Paper No. 7, Macmillan Brown Centre for Pacific Studies, University of Canterbury, New Zealand (j.Barnett@pacs.Canterbury.ac.nz) (October 2001)

Baylis J, *et al*, *The Globalization of World Politics*, An Introduction to International relations, Fifth Edition, (Oxford University Press, Oxford, 2011).

Bodansky D., O'Connor S. D.*The Evolution of Multilateral Regimes: Implications for Climate Change*, College of Law Arizona State University, Elliot Diringer PewCenteron Global Climate Change, December 2010

Bosh J. M. and Hewlett J. D, *A Review of Catchment Experiments to Determine the Effect of Vegetation Changes on Water Yields and Evapo-transpiration* Journal of Hydrology, 55, 1982

Brauch H. G. *et al*, *Coping with Global Environmental Change, Disasters and Security*, Hexagon Series on Human and Environmental Security and Peace, (2011).

Briggs. Chad Michael,*Environmental security, abrupt climate change and strategic intelligence*GlobalEESE (Global energy and environment Strategic Ecosystem), (February 15, 2009)

Bulkeley, Harriet and Peter Newell,*Governing Climate Change*. (London: Routledge, 2010).

Burchill, S., et-al, *Theories of International Relations*, Palgrave Macmillan, (New York, 2005)

Butts, Kent Hughes. "*NATO's Contributions to European Environmental Security"* (1993) Available atBurchill S, *et al, Theories of International Relations*, (Palgrave Mac Millan, New York, 2005)

http://www.dtic.mil/dtic/tr/fulltext/u2/a275918.pdf accesses 22/01/2017

Buzan, Barry, Ole Wæver and JaapdeWilde. *Security: A New Framework for Analysis*. Boulder, CO: Lynne Rienner, (1998).

Chalecki Elizabeth L, *Environmental Security: A Case Study of Climate Change. Pacific Institute for Studies in Development, Environment, and Security pp 2*

Chaudry, S, The impact of Climate Change on Human Security; A case study of Mau Forest Complex, (Palgrave, UK, December, 2016)

Cheng.,F, Climate Change & Environmental Security: The Dynamics of the U.S. and Chinese Policies of Combating Climate Change, Panel Climate Change Policy in Comparative Perspective (II): National and Cross-National Comparisons, IPSA XXIInd World Congress, July 8-12, 2012, (Madrid, 2012)

Church, J. A. and N.J. White, *A 20th century acceleration in global sea level rise, Geophysical Research Letters*, (2006)

Commission on Human Security. *Human security now: protecting and empowering people. New York: Commission on Human Security; (2003).*

Dabelko, G.D. *"Ideas and the Evolution of Environmental Security Conceptions."* Paper presented at the International Studies Association Annual Meeting, (San Diego, CA, April 1996).

Dau-Schmidt KG**,***An Economic Analysis of the Criminal Law As a Preference-Shaping Policy*, DukeL.J.(1990).

David Mitchel, *Environmental Security in a Globalizing World, Stimson Spotlight*, (2015).

Djoghlaf, A. Dodds, F. (edited) *"Biodiversity and Ecosystem Insecurity: A Planet in Peril"*,(London, Earthscan, 2010)

Dodds, F. Bartram, J. (edited) "*The Water, Food, Energy and Climate Nexus: Challenges and an agenda for action"*,(London, Routledge, 2016)

Dodds, F. Pippard, T. (edited) *"Human and Environmental Security: An Agenda for Change*,(London. Earthscan, 2005).

Dodds, F. Higham, A. Sherman, R. 2009. (edited) "Climate Change and Energy Insecurity: The Challenge for Peace, Security and Development", London. Earthscan

Economic Survey, 2006. CBS, Government of Kenya, (May 2006).

Education Center – Arctic Climatology and Meteorology. NSIDC National Snow and Ice Data Center*"Glossary – Climate Change";*Glossary, in IPCC TAR WG1 2001.

Emelie César, *et alEnvironmental and Climate Change Policy Brief Kenya*, Sida's Helpdesk for Environment and Climate Change www.sidaenvironmenthelpdesk.se

Environmental Management and Coordination Act (EMCA) No. 8 of 1999

Ehrlich, P.R., and A.H. Ehrlich. *The Environmental Dimensions of National Security.*(Stanford Institute for Population and Resource Studies,1988).

European commission publication http://ec.europa.eu/clima/change/consequences, accessed on 23/01/2017 at 1745hrs.

FAO (Food and Agriculture Organization), *The state of food insecurity in the world, 2006*: Eradicating world hunger, taking stock 10 years after the World Food Summit. (Rome, 2006).

FAO Statistics Database, United Nations Food and Agriculture Organization(Rome, 2000)
Floyd, R *'Can securitization theory be used in normative analysis? Towards a Just Securitization Theory' Security Dialogue*, (2011)

Floyd, R 'The Environmental Security Debate and its Significance for Climate Change' *The International Spectator*,(2008) 43(3)

Githeko, A.K. and Ndegwa, W. *Predicting malaria epidemics in the Kenyan Highlands using climate data: a tool for decision-makers*. Global Change and Human Health, (2001).

Gleick, P H. "*The Implications of Global Climate Changes for International Security." Climate Change* 15 (October 1989).

Gleick, P.H.*."Environment, resources, and international security and politics."* In E. Arnett (ed.) Science and International Security: Responding to a Changing World. American Association for the Advancement of Science Press, (Washington, D.C. 1990).

Government of Kenya: *Addressing Climate Change: Success Stories from Kenya*, Government of Kenya, November 2015

Government of Kenya, Second National Communication to the United Nations Framework Convention on Climate Change, A publication of the National Environment Management Authority, (NEMA, Kenya), 2015

Government of Kenya, National Climate Change Action Plan 2013 – 2017 (2013) pp 10

Government of Kenya, National Climate Change Response Strategy, Nairobi, 2010

Homer-Dixon, Thomas. F, *Environmental scarcities and violent conflict: evidence from cases*, International security, Vol.19, No.1

Kenya National Assembly, 2012

Kobtzeff, Oleg. 2000. *"Environmental Security and Civil Society"*, in- Gardner, Hall, (ed.) Central and South-central Europe in Transition, (Connecticut: Praeger, 2000).

Lozet F. and Edou K., *Water and Environmental Security for Conflict Prevention in Times of Climate Change* (Global Water Institute, 2013)

Ikenberry, G. J. *Liberal Internationalism 3.0: America and the Dilemmas of Liberal World Order. Perspectives on Politics* (2009).

Institute for Environmental Security Horizon 21, *Advancing Global Environmental Security Science · Diplomacy · Law · Finance · Education*

IPCC (Intergovernmental Panel on Climate Change) *Climate Change 2014 Synthesis Report Summary for Policy Makers.* (Cambridge University Press, Cambridge, 2014).

Intergovernmental Panel on Climate Change, Working Group II Report. "Impacts, Adaptation and Vulnerability" in *IPCC Fourth Assessment Report*, (2007).

IPCC. Summary for policymakers: in Climate Change 2001: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. (Cambridge University Press, Cambridge, 2001).

IPCC (Intergovernmental Panel on Climate Change). *Special Report on Emissions Scenarios.* (Cambridge University Press, Cambridge, 2000).

"The United Nations Framework Convention on Climate Change". 21 March 1994.

Kamweti, D., D. Osiro, and Mwiturubani. 2009. *Nature and Extent of Environmental Crime in Kenya*. Pretoria, South Africa: Institute for Security Studies.

Kates, R.W: "*Cautionary Tales; adaptation and the global poor", Climatic Change*, Vol 45 (1), (2000).

Keohane, R., P. Haas, et al. *'The Effectiveness of International Environmental Institutions'*. (1994).
Institutions for the Earth: Sources of Effective International Environmental Protection Cambridge, (Massechussetts, MIT Press, 1994) pp3-25.

Mariara, J. K and Kabara M. *Climate Change and Food Security in Kenya in Environment for development Discussion Paper Series,* (March 2015)

Michonski K., Levi M.A. *Harnessing International Institutions to Address Climate Change* This publication is part of CFR's International Institutions and Global Governance program.Council on Foreign Relations, (New York,March 2010.)

Mohamed Latheef, "*Climate Change and the Maldives: Adaptation, Mitigation, and Innovation" (speech to the United Nations General Assembly, 2007), statements/ statement Maldives.pdf.*

Morgenthau, H. J.(1948), *Politics among Nations: The Struggle for Power and PeaceFifth Edition*, Revised, (New York: Alfred A. Knopf, 1978).

Mugenda O and Mugenda A., *Research methods-quantitative and qualitative approaches* (Acts press, Nairobi, Kenya, 1999).

Musarat Amin, RizwanNaseer, and TilakIshtiaq, *Realism Dominating Theory in International Relations: An analysis*, Berkeley Journal of Social Sciences, Vol. 1, No. 7, 2011.

Mutimba. S., et al, *Climate Change Vulnerability and Adaptation Preparedness in Kenya*, (Heinrich BöllStiftung, East and Horn of Africa, Berlin, 2010)

Mwagiru, Makumi, *African Regional Security in the Age of Globalisation*, Nairobi, Heinrich Boll Foundation, (2004).

Myers Norman, *Consultant in Environment and Development,* Special Advisor tothe Hague Conference on Environment, Security and Sustainable Development, (2004).

National Drought Management Authority (NDMA's) report, Nairobi, January 2017

National Environmental Management Authority, 2005

Ngigi, S.N., H.H.G. Savenije and F.N. Gichuki,:*Hydrological Impacts of Flood Storage and Management on Irrigation Water Abstraction in Upper EwasoNg'iro River Basin*, (2008)

Niang I, et al in: *Climate change 2014*: *Africa: Impacts, adaptation and vulnerability*. Contribution of Working Group II to the Fifth Assessment Report of the IPCC. (Cambridge University Press, Cambridge, 2014)

Niloy R. Biswas Is the Environment a Security Threat? Environmental Security beyond Securitizationin,*International Affairs Review* Vol. XX, No. 1: Winter 2011

Nicodemus Nyandiko et al., *Food Security and Climate variability in Kenya's semi-arid lands.*(2015)

Nzau Vincent Mutie, *Mainstreaming climate change resilience into development planning in Kenya,* published by IIED, (London, 2013)

O'Neill, K. *The Environment and International Relations*, (Cambridge University Press, 2009)

Putnam, R. *Diplomacy and domestic politics: the logic of two-level games.International Organizations* (1988):

Svensson, U., "*Environmental Security: A Concept."* Presented at the International Conference on Environmental Stress and Security, the Royal Swedish Academy of Sciences, (Stockholm, Sweden, December 1988).

Spooner, B, *Climate Change and Conflict in Africa: Implications for Pan-Africa Strategy, A Desk-Based Study Commissioned by the Department for International Development Africa Regional Department and Africa Conflict and Humanitarian Unit*, (Kent: Global Impacts Limited, 2010).

Thornton P K, et al,*Agriculture and food systems in sub-Saharan Africa* (2011).

Waha K, et al *Adaptation to climate change through the choice of cropping system and sowing date in sub- Saharan Africa.* Glob Environ Change (2012).

Wilson T, *Global climate, world politics and national security*, in Nanda, V, (Ed), World Climate Change: The Role of International Law and Institutions. (Westview Press, Boulder, 1983)

The World Bank Annual report, 2013

United Nations, *Population Distribution, Urbanization, Internal Migration and Development: An International Perspective*, (2011).

UNEP, "*Linking Environment and Security" Regional Office for Europe: Key Activities*. 2013.

United Nations Environmental Programme, The Role and Contribution of Montane Forests and Related Ecosystem Services to the Kenyan Economy, Nairobi, 2012.

UNFCCC, 1992: Note 1, Article 2

Yingyi Situ, and David Emmons Environmental Crime: *The Criminal Justice System's Role in Protecting the Environment*(Sage Publications, 1999).

Appendix 1

QUESTIONAIRE

1. What programs has NEMAprioritizedin the effort to help Kenya achieve environmental security especially with regard to preventing scarcity of resources and environmental degradation?

2. How does NEMA ensure that implementation of programs to manage climate change and environmental security in the counties are in line with national government plans, considering that there may be variations with regard to county priorities and capacity (both human and resources)?

3. How can you assess the success of the projects that are being implemented by NEMA towards enhancing Kenya's capacity to cope with climate change?

4. How is NEMA able to meet requirements on training and awareness on climate change to the public and technology transfer arrangements and their authorization?

5. What in your opinion can be done to improve Kenya's mitigation and adaptation capabilities to climate change?
6. As the National Implementing entity for Adaptation Fund Program, how do you manage unity of purpose and ensure coherent implementation of policies among the various sectors to meet national objectives effectively?

7. What has been the challenge in approving projects through the Green Climate Fund considering that Kenya has so far not benefited from the fund?

8. From your experience, how can the progress of projects funded by Adaptation Fund, Green Climate Fund and any other related projectsbe enhanced?

9. What in your opinion can be done to improve Kenya's mitigation and adaptation capabilities to climate change?

10. Do you have weather stations in every county in Kenya?

11. What elements of the weather do you collect data on?

12. Do you have capability of measuring GHG emissions in Kenya?

13. What institution in Kenya has capability to measure GHG emissions in Kenya?

Appendix 2

AUTHORITY FOR RESEARCH FROM NACOSTI

NATIONAL COMMISSION FORSCIENCE, TECHNOLOGY ANDINNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax: +254-20-318245,318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No **NACOSTI/P/17/86028/18035**

Date: **4th July, 2017**

Evelyn Bwari Motari
National Defence College
P.O. Box 24381-00502
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Challenges of tackling climate change and environmental security in Kenya: A case study of National Environmental Management Authority,"*** I am pleased to inform you that you have been authorized to undertake research in **all Counties** for the period ending **4th July, 2018.**

You are advised to report **to the Director General National Environmental Management Authority, the County Commissioners and the County Directors of Education, all Counties** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The Director General
National Environmental Management Authority.

The County Commissioner
All Counties.