Domestication of Multilateral Environment Agreements (MEAs) in Kenya: Case study of United Nations Framework Convention on Climate Change (UNFCCC) in Muranga County

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DECLARATION

This project report is my original work and has never been presented for a degree award in any other University.

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DEDICATION

I dedicate this work to the four men Phil, Chase, Jobs and Lewis who God has entrusted my hands with. And also to the main man, my knight in shining armor, Gerald.

ACKNOWLEDGEMENTS

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LIST OF ACRONYMS

ASALs	Arid and Semi-Arid Lands
CBD	Convention on Biological Diversity
CBOs	Community Based Organizations
CITES	Convention on International Trade in Endangered Species
CMS	Convention on Migratory Species
DTCs	Drought Tolerant Crops
EMCA	Environmental Management and Coordination Act
GIS	Geographical Information Systems
GoK	Government of Kenya
IPCC	Intergovernmental Panel on Climate Change
KIHBS	Kenya Integrated Household Budget Survey
MDGs	Millennium Development Goals
MEA	Multilateral Environmental Agreement
MEMR	Ministry of Environment and Mineral Resources
NCCRS	National Climate Change Response Strategy
NEMA	National Environment Management Authority
NEPAD	New Partnership for Africas Development
NGOs	Non-Governmental Organizations
OECD	Organisation for Economic Cooperation and Development
PIC	Prior informed consent
POPs	Persistent organic pollutants
RAMSAR	Ramsar Convention on Wetlands of International Importance
RCRSM	Regional Centre for Resource Surveys and Mapping
ROTTERDAM	Rotterdam Convention on Prior Informed Consent
SEA	Strategic Environmental Assessment
SEI	Stockholm Environment Institute
SIDA	Swedish International Development Cooperation Agency
STOCKHOLM	Stockholm Convention on Persistent Organic Pollutants
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification

UNCED	United Nations Conference on Environment and Development
UNCHE	United Nations Conference on the Human Environment
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Education, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
UNIDO	United Nations Industrial Development Organization
WCS	Wildlife Conservation Society
WHO	World Health Organization
WMO	World Meteorological Organization
WSSD	World Summit on Sustainable Development

ABSTRACT

Multilateral Environment Agreements (MEAs) have been used to establish management frameworks through which to structure practical international activity with respect to environmental protection and conservation. MEAs represent one of the most outstanding achievements of the global community in the management of the environment. Concerns relating to effectiveness of domesticating these MEAs have arisen particularly in developing countries where there are capacity constraints and strategic assessments are not done to inform the processes of MEA ratification. Kenya is a signatory to several multilateral environmental agreements (MEAs) that address varied sectors of the environment. These MEAs include Convention on Biodiversity (CBD), United Nations Convention to Combat Desertification (UNCCD), the United Nations Framework Convention on Climate Change (UNFCCC), Ramsar Convention, and the Stockholm Convention on Persistent Organic Pollutants (POPS) among others.

Kenya ratified UNFCCC in the year 1994 and this study sought to establish to what extent the implementation/domestication of the commitments spelt out in UNFCCC has taken place. Specifically it investigated farm level adoption of the agriculture related interventions proposed in this treaty. Muranga County located in the central parts of Kenya with a total population of 942,581 people and covering land area of 2,558.8 Km^2 was the area of study. Multistage stratified sampling using the administrative sub county boundaries was used to identify the sample for use in this study. The key research tool employed for data collection was a structured questionnaire. These UNFCCC domestication factors under investigation were; adoption of DTCs, adoption of water harvesting practices, adoption of irrigation farming, adoption of green energy and energy saving technologies, adoption of weather indexed insurance scheme, access to climate data, participation in climate change planning

and participation in climate change training. The hypothesis for this study was Muranga has significantly domesticated UNFCCC.

The data collected was analysed using SPSS and descriptive statistical techniques and the results of frequency analysis were tabulated and graphically represented. Cross tabulation was performed on selected variables of the study to investigate possible association tendencies exhibited by the variables under study. Cross tabulation outputs were then exported to excel platform and formatted for drawing of tables and charts. G-test of independence was used to test the significance of the results. The study established the extent of domestication was 43.7%. However, statistical tests showed that this level was not significant leading to the conclusion that UNFCCC has not been significantly/effectively domesticated in the area under study.

The recommendations given from this study is to review Kenya strategies for UNFCCC domestication with an aim of improving effectiveness, integrate MEAs domestication in development plans for Muranga county, actively participate in UNFCCC negotiations with a view to orienting the commitments towards direct community assistance in domesticating the MEAs, promote strategic environmental assessments for all the decisions to domesticate MEAs before ratification. Other recommendations were research on factors hindering effective domestication of MEAs, vulnerability assessments to climate change in Muranga, capacity needs assessments for domestication of MEAs, knowledge gaps in climate change adaptation and mitigation, sustainable irrigation practices in Muranga and effective MEAs negotiations.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

"Neither environmental resources (such as wildlife species and forests) nor environmental problems (such as air or water pollution), respect the political and administrative boundaries imposed by humans on the Earth that we all inhabit. Many aspects of environmental management are regional or global in nature and need to be governed accordingly. Multilateral environmental agreements (MEAs), otherwise known as environmental conventions or treaties, should be the main vehicles used by governments across the globe in order to achieve this." (Maurice Strong, first Executive Director of the United Nations Environment Programme).

A multilateral environmental agreement (MEA) is a treaty between willing countries with binding international obligations between themselves, in written form and governed by international law. These obligations contain commitments to meet specific environment-related objectives. Binding commitments under MEAs are substantive provisions which oblige a member party to act or not act in a certain way in order to protect, conserve or enhance the environment. These provisions in a MEA may take the form of quantifiable targets, instituting standards or limitations, specific bans and can also focus on processes.

The International Environmental Governance report of 2001 describes most MEAs as legally binding instruments, some as framework conventions that develop protocols while others are independent and work through annexes or appendices (UNEP, 2001). MEAs that are non-legally binding agreements operate through plans of action approved and adopted by the member countries (UNEP, 2001).

MEAs date back to the end of the 19th Century, with the signing of the first ever MEA known as the Convention for Rhine Navigation, at Mannheim on 17th October 1868 (UNEP, 2001).

Most of the MEAs have been developed and adopted after the United Nations Conference on the Human Environment (UNCHE) held in Stockholm, Sweden in 1972. MEAs have evolved over time from sectoral treaties, to framework agreements and related protocols, and eventually to agreements that are regulatory in nature.

MEAs have been developed in response to the recognition that some environmental issues cross national boundaries and international cooperation is required to address them. To illustrate this, parts of the planet such as Antarctica or the global atmosphere are not the sovereign domain of any state. Climate change phenomenon, ozone depletion, persistent organic pollutants are environmental challenges common to humankind without national boundaries. They require global collective action and MEAs are seen as the means to entrench international environmental governance. MEAs therefore have been used as the platform to promote and establish management frameworks through which to structure practical international activity with respect to environmental protection and conservation.

Importantly also is that MEAs are living instruments, constantly undergoing improvements to respond to emerging issues. This is done during annual or biennial meetings of the member countries also known as Conference of Party (COP) meetings, inter-sessional meetings of technical and expert groups and inter-sessional submissions from the participating countries. All parties to an MEA perform their obligations in good faith, known as the rule of '*pacta sunt servanda*' and no party may invoke the provisions of its own domestic law to justify its failure to comply with an MEA obligation.

Domestication of MEAs is categorized into four levels. The highest level of domesticating MEAs is implementation which is the process of translating MEAs obligations and commitments into effective national measures. This takes the form of instituting policies,

laws or regulations. The next level is compliance which relates to participating countries adherence to MEAs provisions and implementation measures, including procedural measures. The other level is that of enforcement and this refers to instituting procedures to compel compliance and mechanisms to deter non-compliance. One form of mechanism to deter non-compliance is application of trade barriers. The fourth level of domestication is effectiveness which points at whether a MEA resolves the problem that caused its creation or not.

Over time several concerns have arisen with respect to implementation of MEAs in individual member states. These concerns relate to aspects on effectiveness, international regulatory congestion, timeliness, efficiency, duplication and overlap of institutional mandates (UNEP, 2001). These concerns arise particularly in developing countries where there are capacity constraints and strategic assessments are not done in determining the ratification of MEAs. A report of United Nations Environment Programme (UNEP) on development of Multilateral Environmental Agreements (MEAs), asserts that ratification of the various conventions and protocols on the environment represent one of the most outstanding achievements of the global community in the environmental field to date. However it goes on to say that *"while the international environmental agenda may indeed be fully covered by international agreements, the sheer quantity of international conventions should not be automatically interpreted as assuming success on the part of those instruments in addressing and resolving the key environmental issues and problems, which prompted their negotiation in the first place"* (UNEP, 2001)*.*

Another study by the European Commission on Development on the challenges of Multilateral Environmental Agreements (MEA) implementation in developing Countries indicates that despite the extraordinary number of MEAs on paper, the actual reality as regards their implementation is rather grim. Developing countries lack the necessary capacity

to ensure the translation of international policy into domestic action. Such lack of capacity is reflected in lack of scientific and technical capacity to assess and develop state of the environment data upon which to develop sound environmental decisions (Johanna, 2001).

Kenya is a signatory to several multilateral environmental agreements (MEAs) that address several sectors of the environment. These MEAs include Convention on Biodiversity (CBD), United Nations Convention to Combat Desertification (UNCCD), the United Nations Framework Convention on Climate Change (UNFCCC), Ramsar Convention, the Montreal Protocol on Substances that Deplete the Ozone Layer, Convention on International Trade on Endangered Species (CITES), Rotterdam Convention on Prior Informed Consent (PIC) and the Stockholm Convention on Persistent Organic Pollutants (POPS) among others. This study investigated domestication of United Nations Framework Convention on Climate Change (UNFCCC) in Muranga County, Kenya.

The UNFCCC is a treaty developed at the Rio Earth Summit in 1992 to address Climate Change and in particular to stabilize greenhouse gases concentration in the atmosphere. Adaptation and Mitigation measures are explicitly provided for under the UNFCCC and are referred to in different articles on the convention. To illustrate this, UNFCCC Article 4.1 states that parties shall "formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to facilitate adequate adaptation to climate change". Further, this article provides for countries to "cooperate in preparing for adaptation to the impacts of climate change". UNFCCC Article 4.4 states that developed country parties shall "assist the developing countries that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects."

Kenya signed to join UNFCCC on 12[th]June 1992 and ratified the treaty on 30th August 1994. However Kenya continues to suffer the effects of climate change especially in relation to loss

of livelihoods and food insecurity. Recurrent persistent droughts and failure in precipitation cause severe crop losses, famine and population displacement in the country. According to Government of Kenya adaptation technical analysis report of 2012, recurrent drought cause immense disaster both to rural livelihoods and the economy as a whole. To illustrate this, in the year 2008, there was a major drought throughout Kenya where 10 million Kenyans were susceptible to starvation (GOK, 2010). In the same year, Kenya's Ministry of Livestock Development warned that more than 6 million cattle, 150,000 camels, and 16 million goats in Kenya were at risk of death because of the droughts in the country. Since the Kenyan economy is largely agrarian based, the recurring droughts of 1991/92, 1995/96, 1998/2000, 2004/2005, and 2008-11 highly impacted Government efforts of ensuring food security in vulnerable marginal areas and consistent increase in food production to feed the increasing population growing at the rate of 1.2 million annually (KIHBS, 2009).

The National Climate Change Response Strategy (NCCRS, 2010) is a Kenya government document developed as part of domestication process of UNFCCC. NCCRS identifies the most vulnerable sectors in Kenya as agriculture, tourism, infrastructure, health, and natural resources especially biodiversity. It acknowledges the need for improving the lives of the poor and vulnerable, who often experience climate change impacts most acutely, the urban poor living in slums that are flood-prone and the rural poor who rely on surface water for water supply and rainfall for food production.

This strategy goes further to identify sectoral adaptation and mitigation needs and interventions for the country. Some of the proposed adaptation interventions to address food production/security threats are providing and promoting drought tolerant crops such as sorghum, cassava, pigeon pea, sweet potato and development of innovative insurance schemes in both agriculture and livestock sectors (NCCRS, 2010).

1.2 Research problem

The fast pace of treaty-making, (especially the negotiation process) may have obscured the fundamental question about whether MEAs, are indeed effective in resolving environmental problems to developing countries like Kenya. UNFCCC has proposed interventions that are meant to assist affected communities to cope with the existing and anticipated threats of climate change. Articles 4 and 6 of UNFCCC contain commitments for member countries. These commitments require member countries to formulate and implement measures to facilitate adequate adaptation to climate change, promote and cooperate in education, training and public awareness related to climate change and encourage the widest participation, promote public access to information on climate change and public participation in addressing climate change. Further Article 4.8 commits parties to 'give full consideration to what actions are necessary under the convention, including actions related to funding, insurance and the transfer of technology, to meet the specific needs and concerns of developing country countries, arising from the adverse effects of climate change.

Kenya ratified UNFCCC in the year 1994 but continues to experience adverse impacts of climate change. In domestication of the provisions of UNFCCC, Kenya developed the National Climate Change Response Strategy (NCCRS) which has explicit provisions on the actions that require to be taken up locally for effective implementation of this MEA. This study sought to establish the extent of domestication of these interventions spelt out in UNFCCC. Specifically the study investigated the extent of farm level adoption of agriculture-related interventions spelt out in Articles 4 and 6 of UNFCCC.

1.3 Research questions

In view of the above, this research sought to answer the following questions:

1. What is the extent of UNFCCC domestication in Muranga County?

2. Are the proposed UNFCCC actions/interventions been significantly adopted in Muranga County?

1.4 Research objectives –

This study's objectives were:

1. To establish the extent of UNFCCC domestication in Muranga, Kenya.

2. To establish whether the farming communities have domesticated the agriculture related UNFCCC interventions.

3. To generate knowledge on MEAs domestication in Kenya.

1.5 Research hypothesis

H.0 Muranga County has significantly domesticated UNFCCC

H.1 Muranga County has not significantly domesticated UNFCCC

1.6 Rationale/Justification

Whereas there is a lot of information on MEAs negotiation processes, there is scarcity of knowledge on benefits and impacts of MEAs ratification and domestication in Kenya. Equally lacking is a methodical analysis of forces that determine MEAs implementation. The extent of domestication and effectiveness of the strategies used by Kenya to domesticate the MEAs is not quantified yet herein lays the question - how beneficial is it for Kenya and other developing countries in ratifying MEAs. While the study points out to the fact that Kenya is party to many MEAs, for purposes of this study the focus will be on UNFCCC.

The importance of this study is evident from the increasing climate change related environmental challenges especially in food security facing the country despite ratification of UNFCCC and other MEAs. There is need for increased focus on effectiveness on compliance

with treaty obligations, along with methods of improving domestic implementation. As no other study has been done before on the positive / negative gains of Kenya having ratified and domesticated the MEAs, my study seeks to fill in this gap which will generate knowledge that can inform policy makers on how to interact with the global processes of MEAs development. It is intended that the information gathered herein will be very useful in determining the vulnerability of Kenya to the current and anticipated threats from climate change.

1.7 Operational definitions

- Adoption: Adoption of an international agreement by a country refers to the process of its incorporation into the domestic legal system, through signature, ratification or any other process required under national law. It also includes uptake of measures defined in the agreement.

- Agreement: Generic term for an international binding instrument.

- Biodiversity: Variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

- Climate Change Adaptation: Actions taken to help communities and ecosystems cope with changing climate conditions in response to climate change or its effects

- Climate Change: a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

- Compliance: Fulfillment by a party of its obligations under an international agreement.

- Gross domestic product: The measure of the total output of goods and services for final use occurring within the domestic territory of a given country, regardless of the allocation to domestic and foreign claims.

- Multilateral Environmental Agreement (MEA): International instruments through which national governments commit to achieving specific environmental goals.

1.8 Scope of study

This study has defined the four levels of domestication of MEAs. These levels are implementation (instituting policies, laws or regulations), Compliance (adherence to MEAs provisions and implementation measures), Enforcement (instituting procedures to compel compliance and mechanisms to deter noncompliance and sometimes this can take the form of trade barriers) and effectiveness level (concrete action to resolve the problem that caused its creation or not). The scope of this study covers the effectiveness level only of UNFCCC domestication. UNFCCC has prescribed both adaptation and mitigation actions for domestication. This study focuses on investigating the parameters that relate to farm level adaptation measures to agriculture.

1.9 Description of the study area
1.9.1 Geographical location

The study area of this research was Muranga County. Murang'a County is in the Central region of the Republic of Kenya and lies between 914 and 3,353 m above sea level (ASL). It is located between latitudes 0° 34' South and $1^0$7' South and Longitudes 36° East and 37° 27' West. The County has a total area of 2,558.8 $Km^{2.}$ The highest areas in the west have deeply dissected topography and are drained by several rivers. Muranga County is bordered to the north by Nyeri County, to the south by Kiambu County, to the west by Nyandarua County and to the east by Kirinyaga, Embu and Machakos counties.
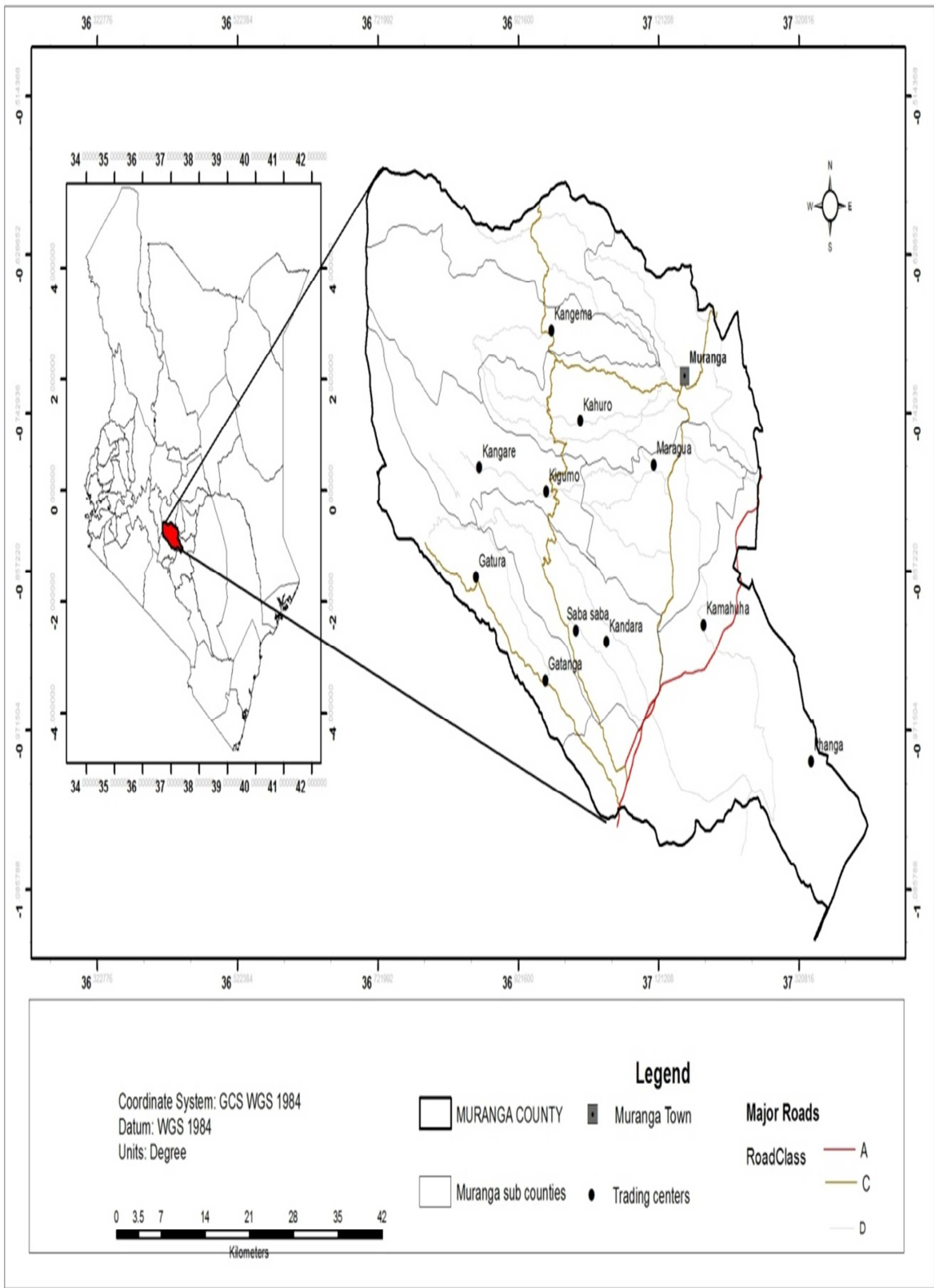
Figure 1: Study area - Muranga County

Source: Created from RCRSM

1.9.2 Population

Muranga County has a transitional population structure due to a shrinking child population, and an increasing youthful population. 15-34 year olds constitute 32% of the total population. The county also has a high proportion of old people in the country (Over 65 years) who form 6.9% of the total population (KIHBS, 2010).

The 2009 population and housing census recorded a population of 936,228 persons for Muranga County consisting of 451,751 males and 484,477 females and a growth rate of 0.4 per cent per annum. This population is projected to rise to 958,969 in 2015 and 966,672 persons in 2017. The population density is 524 people per square kilometer and 29% of the populations live below the poverty line (KIHBS, 2010).

1.9.3 Topography and relief features

Muranga County has land that gradually rises from an altitude of 914m in the East to 3,353m above sea level along the slopes of the Aberdare Mountains. The highest areas to the West have deeply dissected topography and are well drained by several rivers, which include Mathioya North, Mathioya South and Maragwa flowing eastwards to join the Tana River. More than 95% of the land is generally mountainous landscape. There are two rainfall seasons i.e. Long rains (March – May) and Short rains (October - November). The highest potential areas receive an average annual rainfall of between 1400mm and 1600mm. Low potential receive rainfall less than 900mm per annum. Rainfall in high and medium potential areas is reliable and well distributed throughout the year and is adequate for cultivation. However on low potential areas rainfall is unevenly distributed and therefore unsuitable for cash crop production. Temperatures vary with altitude. In the Eastern lower areas the maximum annual temperatures range between 26° C and 30° C while the minimum annual

temperatures range between 14° C and 18° C. Variations in altitude, rainfall and temperature between the highland and lowland coupled with the differences in the underlying geology of both volcanic and basement system rocks give rise to a variety of soil types. Highland areas have rich brown loamy soils suitable especially for tea. Coffee, maize and dairy farming are practiced. Soils in the lower areas are predominantly black cotton clay soils with seasonal impended drainage (GoK, 2010).

The County has three main climatic regions. The western region comprising of Mathioya, Kangema, Gatanga, higher parts of Kigumo and Kandara has an equatorial type of climate. This region is generally wet and humid due to the influence of the Aberdares and Mt. Kenya. The central region has sub-tropical climate and the eastern region comprising of lower parts of Kigumo, Kandara, Kiharu and Maragua constituencies has dry conditions and receives less rain. The long rains fall in the months of March, April and May. The highest amount of rainfall is recorded in the month of April, and reliability of rainfall during this month is very high. The short rains are received during the months of October and November (GoK, 2010).

1.9.4 Climate and land use in Muranga County

Murang'a district is a predominantly an agricultural district and average farm holdings are generally small but vary between the highlands areas, the middle zone and the low areas. Kiharu sub-county falls under the lowland areas with moderate type of climate suitable mainly for food crops and cash crops. The terrain is moderately steep and farm holdings range between 1-3 acres per household .The farmers engage mainly in subsistence production. Gatanga sub-county falls under the transitional/middle zone. The terrain is generally flat and the climate is unsuitable for cash crop production. Kangema and Mathioya sub-counties border the Aberdare forest. The two generally have a steep hilly topography and their climate is suitable for tea production. Average farm holdings are very small with some

households occupying less than an acre of land. There is a higher human settlement along the steep slopes than in the lower flatter terrains.

Some of the adverse effects of climate change experienced in the county include: variation in weather patterns with low rainfall and failed seasons; severe famine and hunger causing food insecurity especially in the ASALs regions like Kambiti, Maragwa Ridge; loss of biodiversity especially at the ecosystems which are fragile like the African elephant (Loxodonta Africana) found at Aberdares that is threatened due to destruction of its habitat and breeding grounds in the forest. Other effects are resources-uses conflicts where Wildlife stray from protected areas to farms in search of water and forage e.g. at Kaseve hills in Murang'a south where there is conflict between the local people and monkeys. The major disasters experienced in Murang'a County include: landslides, drought and famine, accidents related to quarrying, human-wildlife conflict, water pollution, and forest fires.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This section gives a review of existing literature on MEAs. The first section gives an account of philosophical constructs and historical trends in development of MEAs. The section thereafter gives details on how MEAs are categorized and classified. This is followed by detailed literature on UNFCCC and climate change impacts in Kenya. The section goes further to detail the provisions of UNFCCC, the case study MEA of this research. The provisions of this MEA are the parameters investigated in this research study.

2.2 Domestication of MEAs

Developing countries are described as lacking the capacity to participate effectively in global policy making processes as they lack the evidence-based research support, financial resources, and technical and legal advice they need to negotiate and domesticate MEAs effectively (IIED, 2011). An article titled 'Helping vulnerable countries achieve equitable solutions in climate law and policy making processes' by International Institute of Environment and Development (IIED), states that it is essential for developing countries to effectively translate global decisions into national actions by establishing distinctive national actions that run alongside international collective action (IIED, 2011).

In another paper titled 'The Regime Complex for Climate Change', a contributing factor to domestication of MEAs is the founding principles of the MEA itself (Robert, 2012). This paper argues that in MEAs development, states construct international regimes on the basis of their interests and under conditions of complex interdependence, state interests will reflect the interests of the major constituencies that exert influence. The weighting of these interests in determining international outcomes depends on the power resources, relevant to the issue-

area, that are available to the states involved. This paper further argues that power will reflect asymmetrical interdependence and bargaining power will depend both on the impact of one's own decisions on others (a reflection of size) and on favorable asymmetries in interdependence.. However this paper notes that all these-- fundamental features of global power dynamics, interests, power, information, and beliefs – change over time, at different rates in different countries, and on different issues (Robert et al, 2012).

Despite the significance attached to domestication of UNFCCC, there remains a lack of understanding of the key barriers that impede the effective implementation of UNFCCC adaptation strategies (GoK, 2011). Previous assertions suggest that factors that impede domestication are lack of financial resources, lack of information on climate change characteristics, lack of institutional capacity to facilitate agricultural adaptation, social-cultural barriers such as belief systems and local norms, technological barriers and a lack of infrastructural development (Antwi-Agyei, 2013). The risks presented by climate change to the livelihoods of these households are set to increase.

Rain water harvesting has been proposed as an adaptation action to reducing climate change vulnerability in Kenya (KCCAP, 2010). The lack of recognition of rainwater harvesting as an important water management interventions in most water policies and investment plans has been identified as the cause of low uptake of rain water harvesting (SEI, 2010).

In commenting on rain water harvesting, Executive Director of the United Nations Environment Programme was quoted saying ''as we look into what Africa can do to adapt to climate change ... rainwater harvesting is one of those steps that does not require billions of dollars, that does not require international conventions first, it is a technology, a management approach, to provide water resources at the community level''. Further rainwater harvesting

has been attributed to enhancing ecosystem services, and also described as the strategy that the water sector needs to cope with future climate change (Mukheibir, 2008)

To underscore the need for access to climate information, UNDP, in its paper titled 'improving access, understanding and application of climate data and information' states that in many African countries there is limited hardware, software and other technology applications, such as climate models, to generate and distribute climate data and knowledge. Africa has an inadequate number of meteorological stations for climate data collection, and much of the data that exists has not been digitized (UN, 2007). Not only is access to climate data and information limited, but so is the capacity of national institutions, leadership and civil society to determine what climate data and information is needed for adaptation-related decision-making (UN, 2008). Key challenges in determining the needs include limited expertise and training in climate science, the application of climate models and other software (UNDP, 2011). Guidance on how to use existing climate observations and model projections to inform adaptation decisions is currently constrained.

2.4 Historical developments of MEAs

Convention for Rhine navigation, which defines the legal scheme governing the use of Rhine and its estuaries from Basel to the open sea as an inland waterway for navigation, by vessels transporting merchandise was signed at Mannheim on 17[th]October 1868. This is recorded as the first MEA in the history of Environmental governance (UNEP. 2001). The early MEAs were mainly sectoral agreements on how to exploit and share natural resources, and only had environmental protection as a secondary objective. They primarily focused on the exploitation and maintaining economic usefulness of natural resources, rather than protection. The Stockholm conference spurred developments of modern MEAs which are more holistic and advance issues of socioeconomic development.

In its report titled International Environmental Governance dated 2001, UNEP estimates that there are more than five hundred international treaties/agreements related to the environment. This report further states that nearly sixty percent of these MEAs date from the period between nineteen seventy two (1972), the year of the Stockholm Conference, and the present. Most MEAs developed before the Stockholm conferences were restricted in scope to specific subject areas. The emergence of regional integration bodies concerned with the environment in regions such as Central America and Europe have contributed to this trend. In many cases, however, regional agreements are closely linked to global MEAs.

Figure 2 below shows the trends in country participation in MEAs over time.
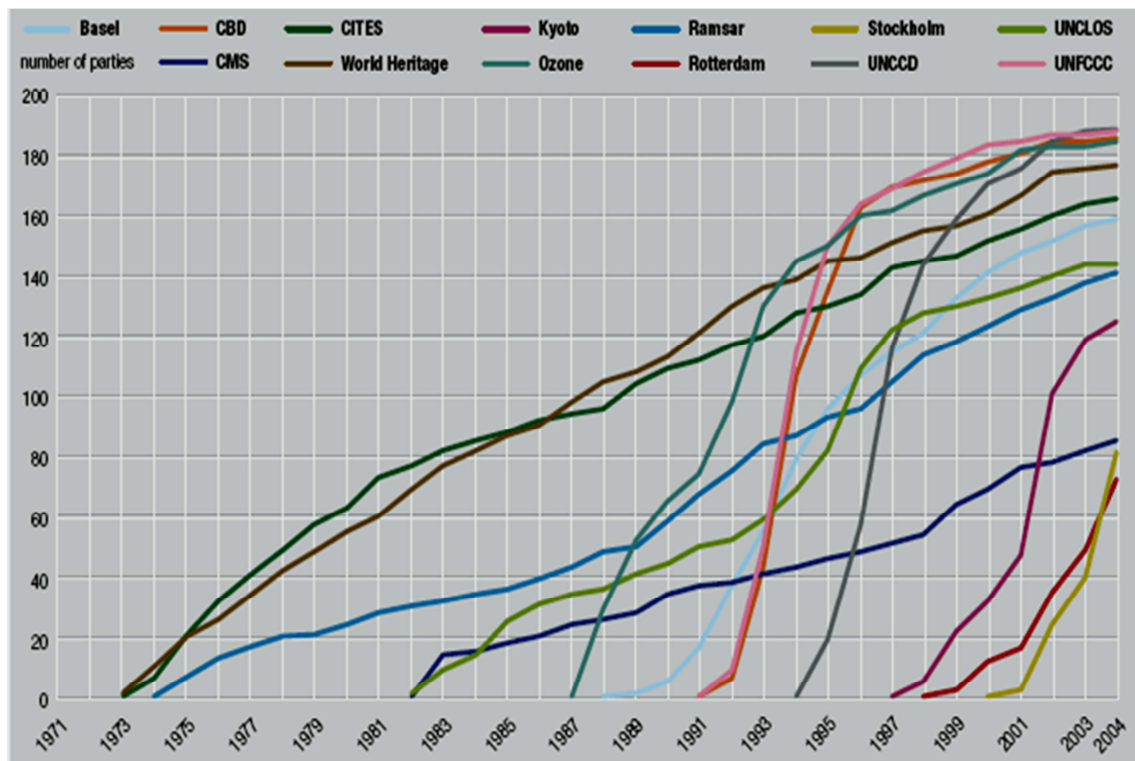
Figure 2: The trends on country participation on MEAS.

Source: GEO Data Portal, compile from MEA Secretariats

The United Nations recognize over two hundred countries in the world and over 50% of these countries are members of MEAs (UNEP, 2001).

The objectives and goals of MEA vary significantly but the cross cutting themes for all MEAs are sustainable development, assessment and management of pollution the sustainable use of natural resources and the environment. Most MEAs are dealing with global issues like climate change, ozone depletion while others are on regional issues like pollution of rivers and seas that are part of several countries. The best known MEAs are those that deal with global problems, affecting more or less all countries in the world. Among these are the United Nations Framework Convention on Climate Change (UNFCCC) with the Kyoto Protocol, the Stockholm Convention of elimination of persistent organic pollutants, and the Basel Convention on hazardous waste.

The United Nations Conference on Environment and Development (UNCED) in Rio (1992) adopted the Rio Declaration and Agenda 21, documents that set out principles and action plan for sustainable development. Outcomes of this meeting stimulated development of MEAs addressing complex inter-linked environmental problems like loss of biodiversity and Climate Change. Some of the MEAs formulated were Convention on Biological Diversity (CBD) and UNFCCC. These conventions were the first MEAs that clearly established interdependence of the environment and social- economic development.

2.5 Clusters of MEAs

The main MEAs are divided into five clusters namely: the biodiversity-related conventions, the atmosphere conventions, the land conventions, the chemicals and hazardous wastes conventions, and the regional seas conventions.

2.5.1 Biodiversity conventions

The Multilateral Environmental Agreements that fall in this cluster are Convention of Biological Diversity (CBD), Convention on International Trade on Endangered Species

(CITES), Convention of Migratory Species (CMS), the Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA), the Agreement on the Conservation of Bats in Europe (EUROBATS), the Agreement on the Conservation of Small Cetaceans of the Baltic and North Sea (ASCOBANS) , the Lusaka Agreement on Cooperative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora, the Convention on Wetlands, the World Heritage Convention, the International Coral Reef Initiative (ICRI), the Cartagena Protocol of CBD, the Agreement on the Conservation of Cetaceans of the Back Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS) and the Nagoya Protocol. These conventions address protection of individual species, the protection of ecosystems and also promote sustainable use of resources.

2.5.2 Atmosphere conventions

The multilateral environmental agreements that fall in this cluster are the Vienna Convention on the Protection of the Ozone Layer and its Montreal Protocol, the United Nations Framework Convention on Climate Change and Kyoto Protocol. These conventions address protection of the environment by eliminating or stabilizing anthropogenic emissions of substances that threaten to interfere with the atmosphere.

2.5.3 Land conventions

The multilateral environmental agreement that fall in this cluster is UNCCD, which aims to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in Africa.

2.5.4 Chemicals and hazardous wastes conventions

This cluster encompasses the following Multilateral Environmental Agreements, Stockholm Convention, Basel Convention and Rotterdam Convention. These MEAs were formed with

an aim to protect human health and the environment from pollution by specific chemicals and hazardous substances by aiming to control trade. The mechanisms used to achieve this are employment of prior informed consent, phase outs, restriction and reduction in production and use of certain chemicals, reduction of production of hazardous wastes and their trans-boundary movements (Basel Convention).

2.5.5 Regional seas conventions and related agreements

This cluster of MEAs addresses the protection and sustainable use of marine and coastal resources. Seventeen regional seas conventions and action plans form a global mosaic of agreements with one overarching objective. These have evolved over the years into multi-sectoral agreements addressing integrated coastal area management, including in several cases links to the management of contiguous freshwater basins; land-based sources of pollution; the conservation and sustainable use of living marine resources; and the impacts of offshore exploration and exploitation of oil and gas. Also included in this cluster is the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities.

As an analysis of the clustering above, the largest cluster of MEAs is related to the marine environment, accounting for over 40 per cent of the total, the most notable being the United Nations Convention on the Law of the Sea (1982), marine pollution conventions and protocols and the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (1995). Biodiversity-related conventions form a second important cluster, which includes the World Heritage Convention (1972), CITES (1973), CMS (1979) and CBD (1992). Three new clusters namely, the chemicals-related and hazardous-waste-related the atmosphere/energy-related conventions have emerged in the recent years. These clusters are mainly of global nature.

2.6 UNFCCC and climate change

2.6.1 Outlook on impacts of climate change

Conclusions from the Stern review on the economics of climate change of 2006 which was commissioned by Gordon Brown, then UK Chancellor of the Exchequer, are that ignoring climate change will eventually damage economic growth. More specifically, the review warned that ignoring climate change could reduce global GDP by 20% by the end of the century. This review further recommended strong adaptation measures as the indications were that 5-6°C warming was a possibility for the next century which would lead to an estimated 5-10% loss in global GDP, with poor countries suffering costs in excess of 10% GDP. The review further compared the potential risks and losses from Climate Change to a scale similar to those associated with the great wars and the economic depression of the first half of the 20th century and recommended that the earlier effective action is taken, the less costly it will be (Stern, 2006).

Scientific findings indicate that concentration of carbon dioxide exceeded by far the natural range over the past 650,000 years and that during the twentieth century, glaciers and ice caps had experienced melting leading to sea level rise (IPCC, 2005). It further stated that the Sub-Saharan Africa will suffer from water stress and reduced crops yields and decline of mountain glaciers is projected to reduce water availability in many regions. The Arctic will suffer ice sheet loss and ecosystem changes making coral reefs, boreal forests, tundra and marine shell organisms very vulnerable.

2.6.2 Climate change impacts in Kenya

Kenya signed to join UNFCCC on 12th June 1992 and ratified the treaty on 30th Aug 1994. This treaty came into force on 28th Nov 1994. Kenya is experiencing impacts of climate change despite its low contribution to the greenhouse gases (GHG) emissions.

The agricultural systems and food production in the entire Sub-Saharan Africa (SSA), Kenya included, primarily relies on rain-fed production that is climate sensitive (IITA, 1993). The risks threaten approximately 70% of rural people living in extreme poverty around the world (OECD, 2001). Developing countries, Arid and Semi-Arid Lands (ASALs) and the poor in society are the most vulnerable and likely to be hit hardest by climate change due to their low adaptive capacity (IPCC, 2000).

Climate change poses a serious threat to food security of millions of communities living in the arid and semi-arid lands of Kenya (GoK, 2000). Analysis of climatic data in the region shows that the coefficient of variation of rainfall in semi-arid tropics can be as high as 50% while most of the annual rainfall often falls in few rainfall events within three to five months of the year. Predictions indicates a more severe crop production declines is expected in many parts of Africa leading to hunger, malnutrition, insecurity and migrations(GoK, 2010). Over 80% of Kenya's landmass is classified as ASALs (Gok, 2007) and prone to drought and other natural disasters. A sustainable livelihood in the region is threatened by climate change related droughts. The region is home to approximately 70% of Kenya's livestock population estimated at 60 million kept under extensive production systems. The Livestock sub-sector is the major enterprise in the ASALs and contributes 40% of the agricultural Gross Domestic Product (GDP) and 10% of Kenya's total GDP (GoK, 2009).

The vulnerability of pastoralists is escalating due to recurrent natural disasters coupled with the increasing population growth and declining carrying capacity of the land (GoK, 2003). Production of pastures/fodder grasses is very low as a result of erratic and low rainfall regimes. Drought resistant grass species have high chances of survival during establishment in ASALs even when planted under conventional tillage methods.

In the ASALs, the livestock subsector employs 90% of the 7 million people and contributes 95% of the family income (GoK, 2003).

The NCCRS and KCCAP acknowledges adoption of drought tolerant crops, water harvesting practices, adoption of irrigation farming, adoption of green energy and energy saving technologies, adoption of weather indexed insurance scheme, access to climate data, participation in climate change planning and participation in climate change training as action areas in domestication of UNFCCC .

2.7 UNFCCC treaty commitments

UNFCCC has twenty six articles most of them dealing principles and governance of the treaty itself. Article 4 and article 6 are the articles that contain commitments for member countries and these are the main objects of this study. Article 4 commits all parties , taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, to among other things, '**Formulate, implement,** publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate change by addressing anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and **measures to facilitate adequate adaptation to climate change;** Promote and cooperate in the **development, application and diffusion**, including transfer, of technologies, practices and processes **that control, reduce or prevent anthropogenic emissions** of greenhouse gases not controlled by the Montreal Protocol in all relevant sectors, including the energy, transport, industry, **agriculture**, forestry and waste management sectors; Cooperate in **preparing for adaptation to the impacts of climate change;** develop and elaborate appropriate and integrated plans for coastal zone management, **water resources and agriculture,** and for the protection and rehabilitation of areas, **particularly in Africa, affected by drought and desertification**, as well as floods;

Promote and cooperate in the full, open and prompt exchange of relevant scientific, technological, technical, socio-economic and legal information related to the climate system and climate change, and to the economic and social consequences of various response strategies; **Promote and cooperate in education, training and public awareness related to climate change and encourage the widest participation in this process**, including that of Non-governmental organizations'.

Further article 4.8 commits parties to '**give full consideration** to what actions are necessary under the Convention, including actions related to funding, **insurance** and the transfer of technology, to meet the specific needs and concerns of developing country Parties arising from the adverse effects of climate change and/or the impact of the implementation of response measures.

Article 6 on Education, Training and Public Awareness commits parties in carrying out their commitments under Article 4, to 'Promote and facilitate at the national and, as appropriate, sub-regional and regional levels, and in accordance with national laws and regulations, and within their respective capacities, the **development and implementation of educational and public awareness** programmes on climate change and its effects, **public access to information on climate change** and its effects, **public participation in addressing climate change** and its effects and developing adequate responses, and training of scientific, technical and managerial personnel.(UN, 1992) These provisions have been translated into defined actions/measures in the implementation level of domesticating MEAs in Kenya.

2.8 Conceptual framework

Developing Countries like Kenya's ability to respond to environmental challenges through policy responses of ratifying MEAs should be anchored on four main aspects namely;

Countries capacity for implementation, appropriateness of proposed Actions, effectiveness of domestication process and technical effectiveness of negotiations. A cause and effect analysis is important in understanding the context in which ratification of MEAs lead to beneficial gains in developing Countries. There is an assumption that beneficial gains are accrued where a country has ratified a MEA.

Sustainable responses to environmental challenges including climate change will require large investments in research and development, building new infrastructures, community participation and subjecting the policy decision of Domesticating MEAs to National Environmental Standards. The expected scenario as demonstrated in the conceptual diagram is that the actions proposed in the MEAs should deliver a reverse of environmental degradation but the actual ground situation does not suggest that. Therefore the object of this study was to investigate this un-matching relationship.

Finally, obstacles to MEA related policy change also include inept participation in MEAs negotiation. This study is based on the premise that the place of MEAs to deliver environmental solutions for developing countries is a subject for intense analysis.

Figure 3 which show that the status of our environment is getting worse even with domestication of most MEAs.

Environmental Challenges	Drivers	**Responses**	Anticipated Impacts/gains
Ecosystem Degradation	Global Industrializati	**Ratification of MEAs**	Ecosystem Integrity
Food Insecurity	Population Increase	**Domestication of MEAs**	Responsive communities
Climate Change	Human Development		Human Socio-development

ACTUAL STATUS ON THE GROUND
Persistent Rampant Droughts, Increased Incidences of Diseases, Food Insecurity, Frequent Flooding, Vulnerable Communities

COMPLICATING CHALLENGES
Capacity for Implementation, Appropriateness of Proposed Actions, Effectiveness of Domestication Process, Effectiveness of Negotiations, application of national standards in implementation

Figure 3: Conceptual Framework.

Source: Researcher, 2013

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the study process and describes how the entire research was executed. It describes the study approach, sampling design, types of data used and their sources, collection tools, data collection process and data analysis used during the study.

3.2 Research process

This study commenced by identifying the field of study and a research subject. A research problem was developed with research questions and the study objectives. Hypotheses were then formulated. This was followed by literature review with intent of comparing how domestication has taken place in Kenya with other countries and also to identify existing gaps in the field of study. At this point it was established that there existed little information on empirical research on implementation of MEAs. Aspects to be investigated were determined. Since this is a domestication study, the research was going to be oriented towards finding out if implementation of MEAs, in this case UNFCCC, had indeed translated into domestic actions at farm level/households.

3.3 Study approach

This study employed various approaches at the various stages of research. Primarily, this is a case study involving intensive descriptive investigation of UNFCCC adoption as a single entity in order to gain insight into larger case. Case study was found most appropriate as the numbers of entities to be investigated were few (no. of active MEAs are less than 50) and an in-depth analysis was necessary in order to investigate the desired aspects. The study investigated domestication of UNFCCC as one of the MEAs ratified by Kenya.

In selecting the study area, purposive sample was employed. Muranga County was identified due to its varying agro-ecologic zones and economic/livelihood clusters, which are representative of Kenya. To determine the respondents in this research, multistage stratified systemic design was employed. The county was first stratified according to its administrative units called sub counties. Muranga has seven sub-counties. In determining the size of the sample, i used the statistical rule that n ≥30. A sample of 140 was determined, and distributed evenly in the seven sub-counties to ensure widest distribution. The questionnaires were administered, one respondent in every cluster of ten households. The clustering was informed by the need to have the most representative sample. Figure 4 illustrates the sampled points in the study area.
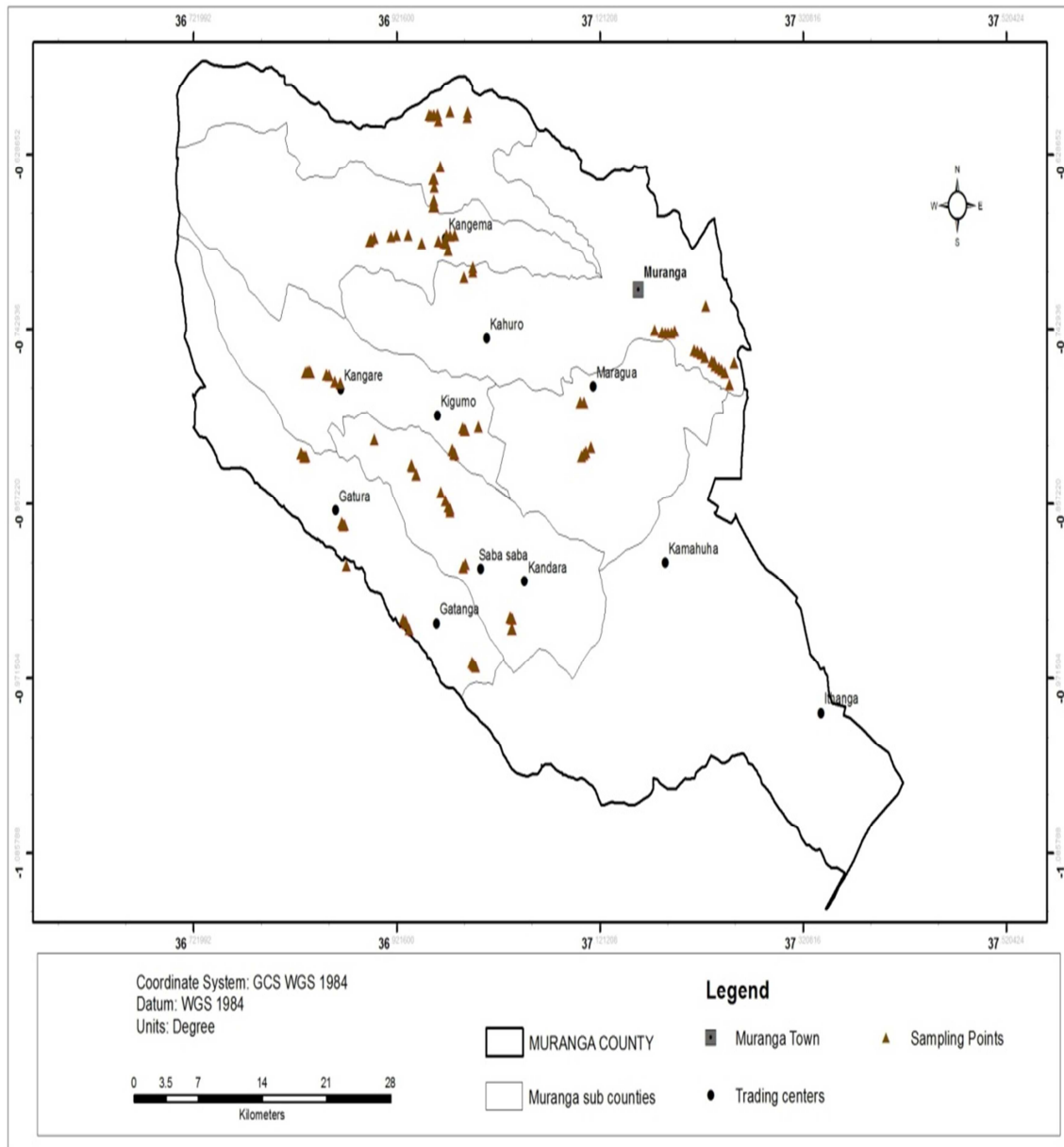
Figure 4: Map showing the sample points

The study used both qualitative and quantitative methods to collect secondary and primary data from the sampled farmers. A questionnaire was developed capturing all the aspects under investigation (adoption of DTCs, adoption of water harvesting practices, adoption of irrigation farming, adoption of green energy and energy saving technologies, adoption of weather indexed insurance scheme, access to climate data, participation in climate change planning and participation in climate change training). These aspects are the agriculture based intervention proposed in UNFCCC and interpreted in Kenya.

This questionnaire was administered to the farmers. The questionnaire sought to find out adoption levels of UNFCCC interventions. Most questions were structured and required the respondents to identify the responses from the questionnaire. In conducting the study, stratified sampling procedure was used.

3.4 Types of data and sources

The study used both primary and secondary data in an attempt to solve the stated problem and address the objectives. The primary data used in this study was sourced from farmers who were sampled as respondents for the questionnaire. The secondary data used during the study were sourced from relevant libraries.

3.5 Sampling design

A sample is a smaller group or sub-group obtained from the accessible population (Mugenda and Mugenda, 1999). This subgroup is carefully selected to be representative of the whole population with the relevant characteristics. Several sampling techniques were used in this study at various levels. To determine the study area, purposive sampling was employed to identify Muranga County as the study area. Stratified sampling was employed to determine the sample respondents. Muranga County was first divided into seven sub counties using the existing sub county boundaries. Within the sub county, 20 clusters of ten 10 households each were picked, and one questionnaire was administered per cluster. To ensure wide representation and balanced distribution of representation in the entire county, each sub county was allocated 20 slots of respondents (20 questionnaires were administered in each county). The study administered a total of one hundred forty (140) questionnaires with respondents drawn from the seven sub counties in Muranga County. The distribution of target population and sample size elements within the county are summarised in Table 1:

Table 1: Distribution of the sample.

S.No.	Name of Sub-county	No. of respondents in the Sub-county
1	Kangema	20
2	Maragua	20
3	Kandara	20
4	Kiharu	20
5	Kigumo	20
6	Mathioya	20
7	Gatanga	20

3.6 Data collection tools and equipment

Data collection was conducted using questionnaires and field observations

3.6.1 Questionnaire

The field questionnaire was the principal tool for this study. According to Mugenda and Mugenda (1999) questionnaires give a detailed answer to complex problems. Questionnaire is a research tool that gathers data over a large sample (Kombo, 2006). In addition questionnaires are also a popular method for data collection because of the relative ease and cost-effectiveness with which they are constructed and administered. Questionnaires give a relatively objective data from a large sample with diverse background and therefore, are most effective.

The questionnaire for this study mainly consisted of structured questions (Appendix 1). The questionnaire had five main sections, the first and second sections were on personal information. The third and fourth sections had factors that affect MEAs domestication. All the identified parameters under investigation (adoption of DTCs, adoption of water harvesting practices, adoption of irrigation farming, adoption of green energy and energy

saving technologies, adoption of weather indexed insurance scheme, access to climate data, participation in climate change planning and participation in climate change training) were listed against their possible responses. The last section was on farmer perception on aspects related to climate change in relation to the subject under study. The questionnaires were adequately administered with 100 per cent response rate.

3.6.2 Geographic Positioning System (GPS)

Geographic Positioning System equipment was used to determine project locations with precision. The data on project site positions were captured in Universal Transverse Mercator (UTM) with the aim of mapping the study area and linking crucial variables to their locations.

3.6.3 Data sheet

A data sheet was developed and used to compile and serialise the questionnaires.

3.7 Data collection procedure

This study used a structured type of questionnaire with close ended questions accompanied by a list of all possible alternatives from which respondents selected the answers that best describes their situations. The questionnaire was administered by explaining the questions contained in to the respondents one farmer at a time. Adequate time was given to the respondents to respond to the questions. The researchers then filled/recorded the responses in the questionnaire. The descriptive data obtained from the respondents as captured by the questionnaire variables were later used to run the frequencies and generate inferential statistics.

3.8 Data processing and analysis

3.8.1 Data processing

Field data were subjected to data processing techniques before analysis commenced as outlined in the steps below;

- All the filled in questionnaires were serialized.

- The serials were compiled to form datasheet

- A book code/ platform in SPSS (version 18) platform were developed to enable entry of data.

- All the variables in the sample data that related to UNFCCC interventions adoption were entered in the frequency analysis model.

3.8.2 Data analysis

The sample data were analysed using descriptive statistical techniques to show the distribution tendencies in the variables. All the variables in the sample data that related to UNFCCCC interventions adoption were entered in the frequencies analysis model. In descriptive statistical technique, frequency analysis was used to show the number of occurrences in order to determine the distribution mode or modal class while graphical technique was used to show proportion of occurrence as a measure of variable roles in a specific event. The outputs of frequency analysis were tabulated and graphically represented (bar charts and pie-charts).

The platform used for data processing and analysis was SPSS (Version 18). In frequency analysis, the frequency results were strictly tendency measures and therefore for description of sample data only. To get in-depth conditions of the variables described by frequency analysis, the study used cross tabulation technique.

3.8.3 Cross tabulation of variables of interest

Cross tabulation was performed on selected variables of the study in order to test association tendencies exhibited by the variables. For instance gender variation was analysed to see if the two genders had significant varied responses with regards to the UNFCCC adoption factors that were under investigation. Also the respondent's level of education and participation in training was used to test if there were significant variances in responses. Frequencies and cross tabulation outputs were then represented in tables and charts.

3.8.4 Significant tests

G- Test of independence of variables was used to test the hypothesis. The variables used to perform the G-test were the percentage levels / values for individual factors of UNFCCC domestication under study. The degrees of freedom were first calculated before the G test was undertaken.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Introduction

This chapter outlines a detailed account of the research findings of this study. It gives descriptive statistics and analysis of all the factors under investigation. The domestication interventions proposed related to agriculture sector in UNFCCC and their interpretation in Kenyan national documents (NCCRS, KCCAP) were used as the parameters for investigation. These were;

1. Adoption of DTC,

2. Water harvesting practices,

3. Adoption of irrigation farming,

4. Adoption of green energy and energy saving technologies,

5. Adoption of weather indexed insurance scheme,

6. Access to climate data,

7. Participation in climate change planning and

8. Participation in climate change training

4.2 Research findings

4.2.1 Adoption of drought tolerant crops (DTCs).

The study established that 71.2% of all the interviewed farmers have not adopted farming of drought tolerant crops. Out of the 28.8% who have adopted, 25% of them have 5 % or less of their land cover under drought tolerant crops. Only 0.8% of the interviewed farmers have more than 20% of their land cover on Drought Tolerant Crops.

The findings are detailed in Table 2.

Table 2: Overall level of adoption of DTC by farmers and farm sizes

	Responses	
% of Acrearage	N	Percent
0-5%	245	25.0%
5.1-10%	19	1.9%
10.1-20%	10	1.0%
20.1-30%	4	.4%
Above 30%	4	.4%
Not adopted	698	71.2%
Total	980	100.0%

In comparing adoption by crop type, improved fruit trees and sweet potatoes had the largest adoption rate at 30.1% and 28.4% respectively of the interviewed farmers. Cowpeas and Sorghum had the lowest adoption level at 3.7% and 3.3% respectively.

Table 3 gives the summary of adoption by crop type.

Table 3: Adoption of DTC by crop type

SN	DTC	Responses		Percent of Cases
		N	Percent	
1	Sorghum	10	3.3%	7.8%
2	Sweet potatoes	85	28.4%	66.4%
3	Cassava	73	24.4%	57.0%
4	Cowpeas	11	3.7%	8.6%
5	Pigeon peas	19	6.4%	14.8%
6	Improved fruit trees	90	30.1%	70.3%
7	Other Drought tolerant crops	11	3.7%	8.6%
	Total	299	100.0%	233.6%

4.2.2 Adoption of water harvesting practices

This study sought to find out the number of farmers who practice rain water harvesting in their farms. 22.1% of the interviewed farmers do not harvest water at all while 53.6% of the

ones who harvest water have less than 10% of their water consumption from rain harvested water. Another 28 % have harvested water at 11% to 30% and only 1 % has more than 60% of their water consumption from rain and harvested water. This is illustrated further in Figure 5.
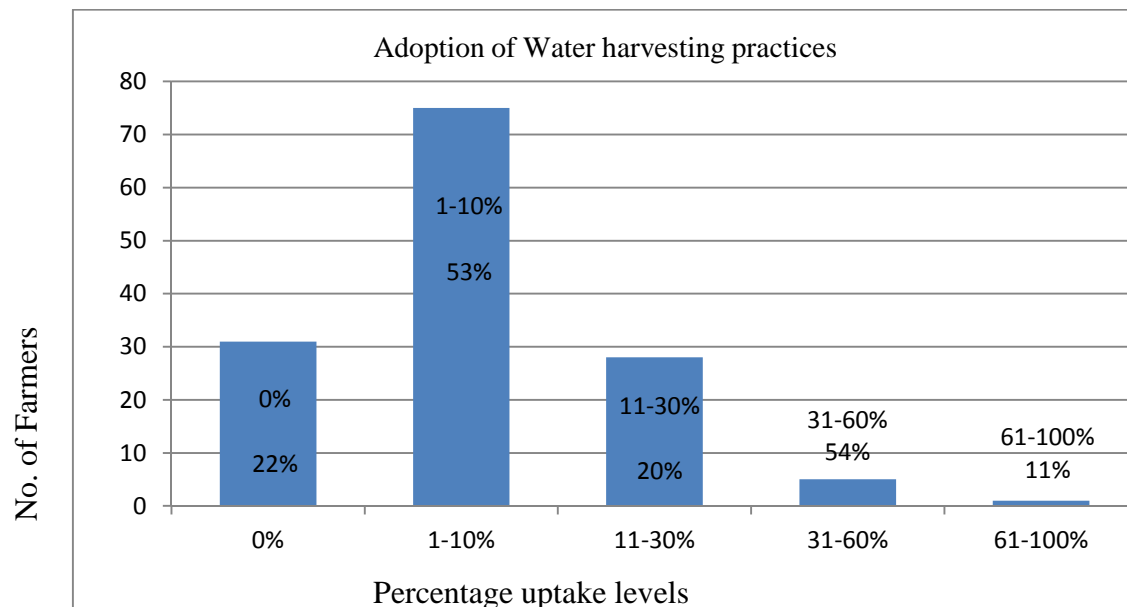
Figure 5: Levels of Water harvesting adoption in the farms

The technologies used for water harvesting identified during the research were mainly roof water harvesting and a few instances of dugout ponds.

4.2.3 Adoption of irrigation farming

This study established that 39.3% of the interviewed farmers do not practice irrigation farming and wholly depend on rain fed agriculture while 37.9% of farmers have less than 10% of their farm production on irrigation. Only 6.4 % of the interviewed farmers have at least 30% of their production under irrigation. This is illustrated in Figure 6.
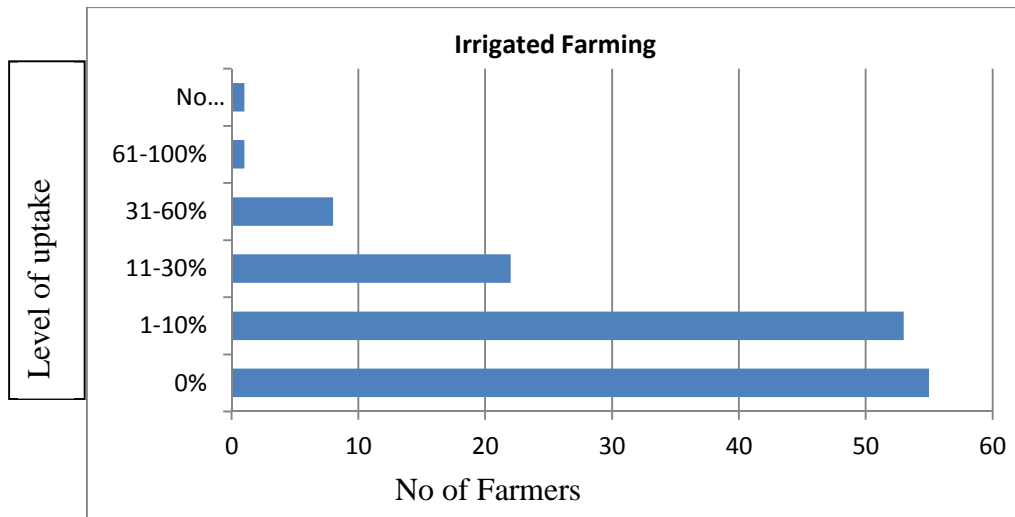
Figure 6: No. of farmers practicing irrigation

4.2.4 Adoption of weather indexed crop and livestock insurance schemes

This study found out that there was 0% weather indexed insurance uptake. However 7.1% of the farmers interviewed have some of their farm assets under ordinary insurance. This is detailed in a Figure 7.
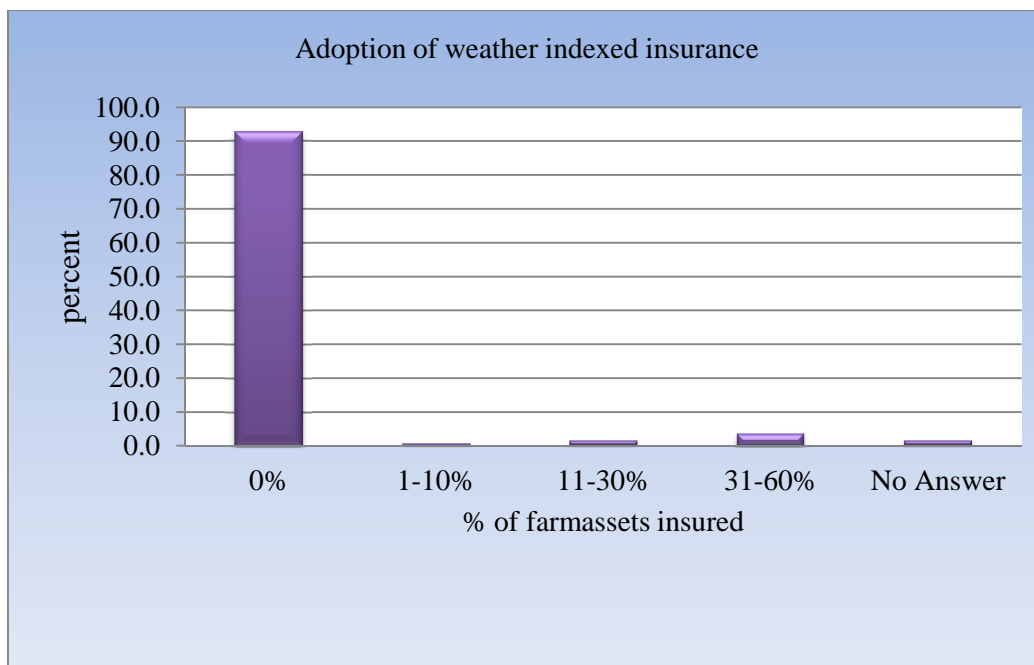
Figure 7: Adoption of Weather indexed insurance

4.2.5 Adoption of green energy and energy saving technologies

The research findings on energy were 71.4% of the interviewed farmers have 0% uptake level of energy saving technologies. 15% have 1-10% of their energy use from green and energy saving technologies. Another 9.3 % of the interviewed farmers have 11-30% of their energy as green and only 1% has over 60% of their energy use as green or energy saving technology. This is illustrated in Figure 8.
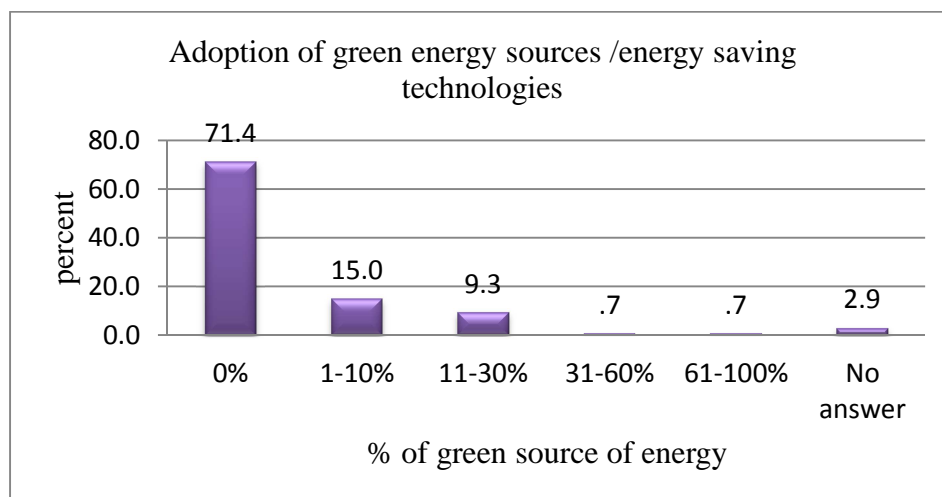
Figure 8: Adoption of Green Energy sources / Energy saving technologies

The types of energy saving technologies identified were energy saving lighting systems, energy saving jikos and few instances of biogas.

4.2.6 Participation in climate change planning meetings

This study established that 80.7% of the interviewed farmers have never participated in climate change planning meeting. Another 12.1 % of the interviewed farmers have participated in only 1 to 3 meetings while only 4.3% have participated in over 6 climate change planning meetings in the past 3 years. This is illustrated in Table 4.

Table 4: Participation in climate change planning meetings

SN	Times of participation	Frequency	Percent
1	None	113	80.7
2	1-3	17	12.1
3	4-6	4	2.9
4	Over 6 times	6	4.3
	Total	140	100.0

4.2.7 Access to climate data

This study sought to find out level of access to climate data and established that 17.1% of the interviewed farmers indicated they have never accessed climate data while 79.3% access this data every day. Another 2.9 % of the interviewed farmers access this data weekly and only 0.7% accesses it monthly. This is illustrated in Figure 9.
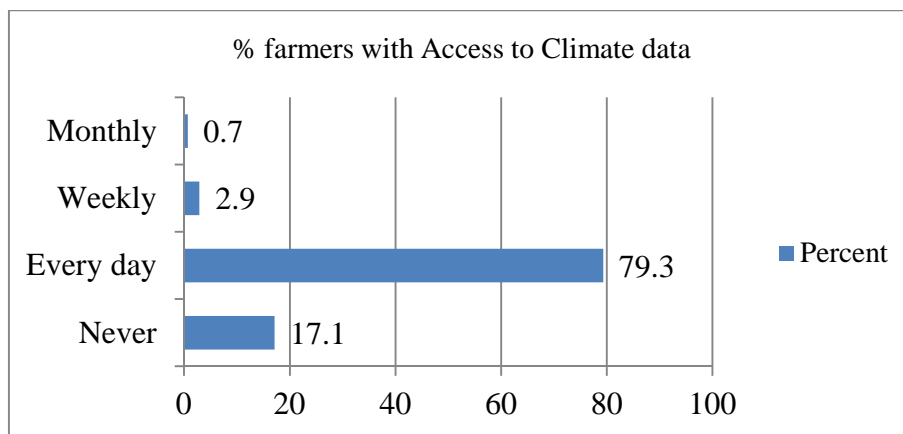
Figure 9: Access to Climate Data

Further this study sought to find out the extent to which farmers use this data to make farming decisions. 34% of the interviewed farmers indicated that the climate data they get

does not influence their farming decisions and 61% indicated that this influenced their farming decisions only to a little extent. This is further detailed Table 5.

Table 5: Extent of use of climate information to determine farming process

SN	Extent of determining the farming process	Frequency	Percent
1	None	34	24.3
2	Little extent	61	43.6
3	Average Extent	30	21.4
4	Much extent	8	5.7
5	Very much extent	5	3.6
6	No answer	2	1.4
	Total	140	100.0

4.2.8 Training on climate change

The findings of this study established that 80.7% of the interviewed farmers have never received any training while 10.7% have had 1 to five trainings in the past three years. Another 2.1 % have been trained between 5 to 10 times and only 2.9 % have been trained more than 10 times. This is illustrated in table 6.

Table 6: No. of climate change related trainings per farmer

SN	No. of trainings	Frequency	Percent
1	0 trainings	113	80.7
2	1-3 trainings	15	10.7
3	3-6 trainings	3	2.1
4	Over 6 trainings	4	2.9
5	No Answer	5	3.6
	Total	140	100.0

4.2.9 Farmer experiences/perspectives on certain aspects which are impacted by climate change

This study sought to find the farmers experiences or perceptions on certain aspects which are directly impacted by the changing climate. With regards to access to food, the study found out that 66% of the interviewed farmers felt that food access had greatly worsened, 24% slightly worsened, 1% felt there was no change, while 6% had the view that food access had slightly improved and only 2% of the interviewed farmers felt there was great improvement. With regards to access to water, the study found out that 18% of the interviewed farmers felt that access to water had greatly worsened, 40% slightly worsened, 4% felt there was no change, while 10% had the view that access to water had slightly improved and only 28% of the interviewed farmers felt there was great improvement. The rest of the responses are illustrated in Figure 10.
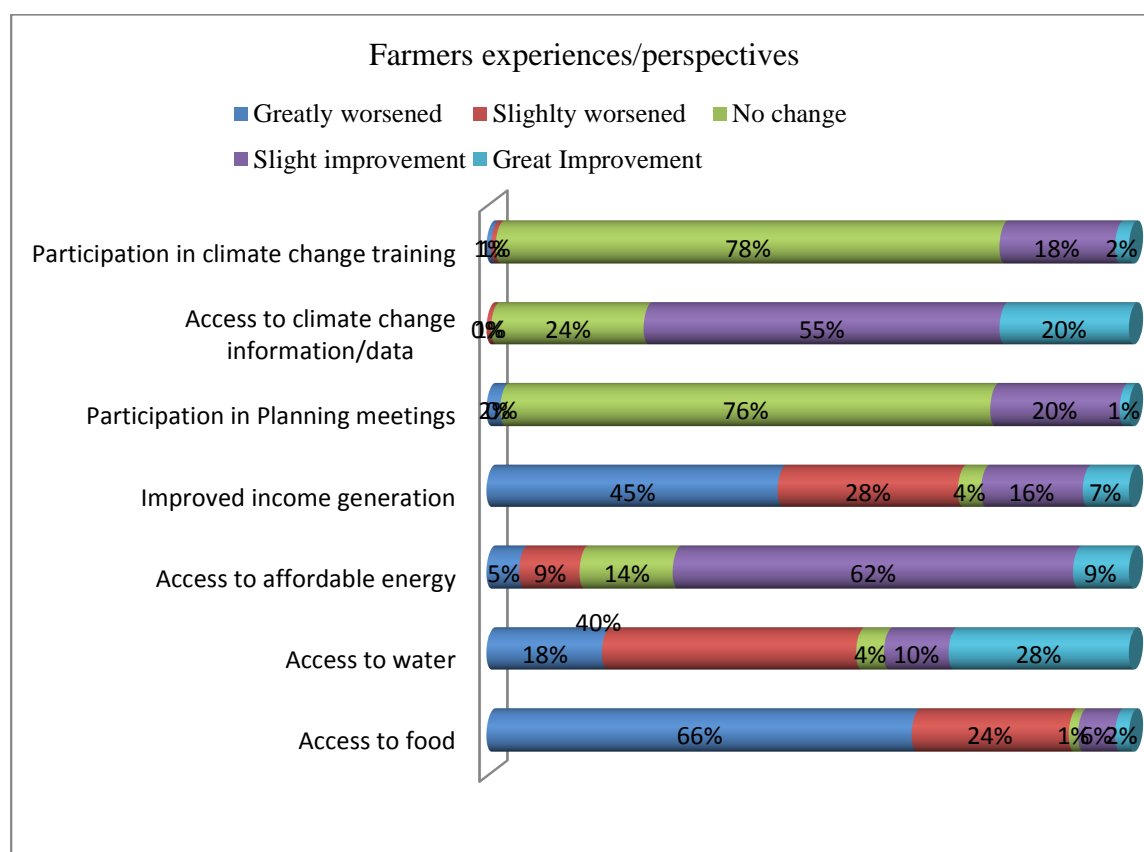
Figure 10: Farmer perspectives on certain livelihood aspects that are affected by climate change

Notable is a total of 90% (66% (greatly worsened) and 24% (slightly worsened)) of the respondents whose experience is that access to food has worsened over time. Equally important to note is 78% and 76% response of no change in climate change training and participation in planning meetings respectively, yet domestication of UNFCCC should have stimulated these activities.

4.3 Cross tabulation – gender based analysis

4.3.1 Gender based analysis – adoption of DTCs

This study analyzed the responses based on Gender and the findings were as follows;

With regards to adoption of DTCs, the study found out that 28.6 % of the interviewed farmers of Male gender were at 1-5 % adoption level compared to 38.6 % of female gender at the same level. Both genders were at 6.5% of farmers whose DTCs adoption is at 30% of their land cover. 10 % of the male respondents have 0% adoption level of DTCs compared to 8.1% of the female gender. Figure 11 illustrates these results.
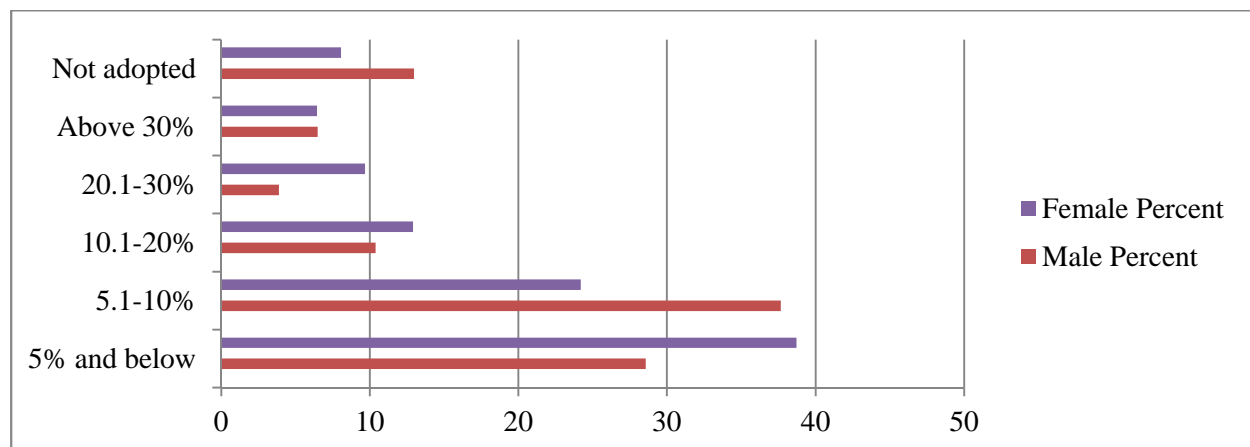
Figure 11: Gender variation/analysis on adoption of DTCs

4.3.2 Gender based analysis – access to climate data

The findings on access to climate data indicated that 13% of the male gender respondents have never accessed climate data compared to 21% of the female gender. 84% of the male

respondent's access climate data everyday compared to 74.2% of the female gender. As to what extent this data influence their decisions on farming, 23.4% of the male gender respondents indicated that it had no influence compared to 24.2% of the female gender. 3.9% of the male gender respondents indicated that this climate data influence their decision to a very large extent compared to 3.2% of the female gender.

Figure 12 illustrates these findings.
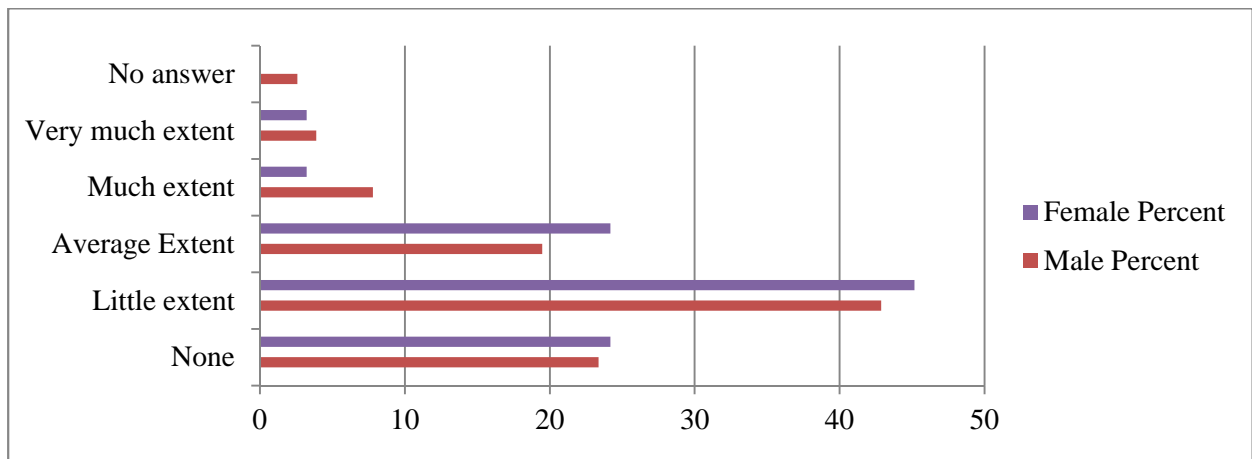
Figure 12: Gender based analysis on the extent to which climate data influence farming decisions

4.3.1 Gender based analysis – climate change training

The gender based analysis on climate change related trainings indicated that 80.5% of the male gender had not received this training compared to 80.6% of the female gender who also had not received any training. 9.1% of the male gender had 1-3 trainings compared to 12.9% of the female gender. This is further illustrated in Figure 13.
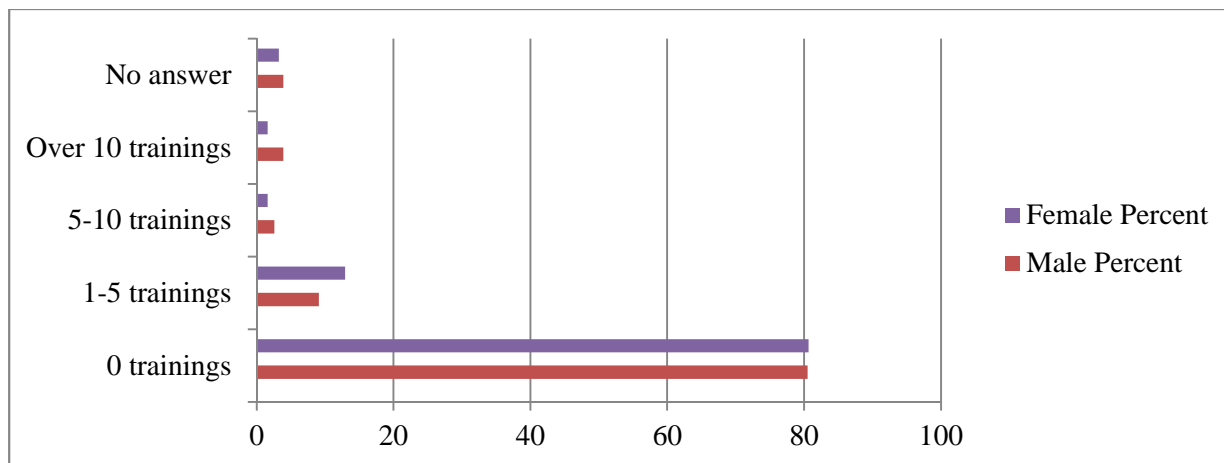
Figure 13: Gender based analysis on climate change related trainings received

4.4 Cross tabulation - education level based analysis

4.4.1 Education level based analysis - adoption of DTCs

The study also investigated the comparisons between Education level and level of UNFCCC domestication and the findings were as follows: With regards to adoption of DTCs, the study found out that 27.0 % of the interviewed farmers with primary level education were at 1-5 % adoption level compared to 39.7 % of respondents with high school education. Also at 1-5 % adoption level were 25% and 50% of the interviewed farmers with College and University level education respectively. The study also found out that 28.6 % of the interviewed farmers with primary level education were at 5.1-10 % adoption level compared to 32.8 % of respondents with high school education. Also at 5.1-10 % adoption level were 37.5% and 50% of the interviewed farmers with College and University level education respectively. This is illustrated in Table 7.

Table 7: Education level based analysis on adoption of DTCs

| | Highest level of education | | | | | | | |
| | Primary | | High school | | College | | University | |
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
5% and below	17	27.0	23	39.7	2	25.0	2	50.0
5.1-10%	18	28.6	19	32.8	3	37.5	2	50.0
10.1-20%	13	20.6	2	3.4				
20.1-30%	6	9.5	3	5.2				
Above 30%	5	7.9	3	5.2				
Not adopted	4	6.3	8	13.8	3	37.5		
Total	63	100.0	58	100.0	8	100.0	4	100.0

4.4.2 Education level based analysis – access to climate data

The findings on access to climate data indicated that 30.2 % of the interviewed farmers with primary level education were had never accessed climate data compared to 3.4 % of respondents with high school education. Also with no access to climate data were 25% and 0% of the interviewed farmers with College and University level education respectively. The study also found out that 65.1 % of the interviewed farmers with primary level education accessed climate data everyday compared to 93.1 % of respondents with high school education. Also at daily access to climate data were 75% and 100% of the interviewed farmers with College and University level education respectively.

This is illustrated in Table 8.

Table 8: Education level based analysis on access to climate data

	Primary		High school		College		University	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Never	19	30.2	2	3.4	2	25.0		
Every day	41	65.1	54	93.1	6	75.0	4	100.0
weekly	3	4.8	1	1.7				
monthly			1	1.7				
Total	63	100.0	58	100.0	8	100.0	4	100.0

4.4.3 Education level based analysis – climate change training

The Education level based analysis on climate change related trainings indicated that 30.2 % of the interviewed farmers with primary level education had not received any training compared to 79.3% of respondents with high school education. Also with no climate change training were 87.5 % and 50 % of the interviewed farmers with College and University level education respectively. The study also found out that 11.1 % of the interviewed farmers with primary level education had received 1 to 5 trainings compared to 7 % of respondents with high school education. Also at 1 to 5 trainings were 0 % and 25 % of the interviewed farmers with College and University level education respectively. This is illustrated in Table 9.

Table 9: Education level based analysis on climate change trainings received

	Highest level of education							
	Primary		High school		College		University	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
0 trainings	51	81.0	46	79.3	7	87.5	2	50.0
1-5 trainings	7	11.1	7	12.1			1	25.0
5-10 trainings			1	1.7	1	12.5	1	25.0
Over 10 trainings	4	6.3						
No Answer	1	1.6	4	6.9				
Total	63	100.0	58	100.0	8	100.0	4	100.0

4.5 Cross tabulation - distance from county headquarters (Muranga town)

This study investigated the relationship between distance from Muranga town and UNFCCC domestication and the finding were as follows;

4.5.1 Distance from county headquarters (Muranga town) – adoption of DTCs

With regards to adoption of DTCs, the study found out that 100 % of the interviewed farmers living between 0- 10kms from Muranga town were at 1-5 % adoption level compared to 30.8 % of respondents who are located at 11-30kms. Also at 1-5 % adoption level was 40.5% and 25% of the interviewed farmers located at 31–50kms respectively. The study also found out that 12.8 % of the interviewed farmers with located at 11-30kms had 0 adoption level compared to 9.5 % of respondents located at 31–50kms. Also at 0% adoption level was 8.3% of the respondents located at over 5kms. This is illustrated in Table 10.

Table 10: Distance from County HQs – Adoption of DTCs

%tage of land size under DTC	Distance from Muranga Town							
	0 - 10 KMs		11 - 30 KMs		31 - 50 KMs		Over 50 KMs	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
5% and below	1	100.0	12	30.8	17	40.5	12	25.0
5.1-10%			18	46.2	13	31.0	11	22.9
10.1-20%			1	2.6	4	9.5	11	22.9
20.1-30%			2	5.1	3	7.1	4	8.3
Above 30%			1	2.6	1	2.4	6	12.5
Not adopted			5	12.8	4	9.5	4	8.3
Total	1	100	39	100.0	42	100.0	48	100.0

4.5.2 Distance from county headquarters (Muranga town) – access to climate data

The findings on access to climate data indicated that 0 % of the interviewed farmers located at 0-10kms from Muranga town had never accessed climate data compared to 2.6 % of respondents located at 11-30kms. Also with no access to climate data were 2.4% and 43.8% of the interviewed farmers located at 31-50kms and over 50kms respectively. The study also found out that 100 % of the interviewed farmers located at 0-10kms accessed climate data everyday compared to 94.9 % of respondents' 11-30kms. Also at daily access to climate data were 95.2% and 52.1 % of the interviewed farmers located at 31-50kms and over 50kms respectively. This is illustrated in Table 11.

Table 11: Distance from County HQs – Access to Climate Data

| | Distance from Muranga Town | | | | | | | |
| | 0 - 10 kms | | 11 - 30 kms | | 31 - 50 kms | | Over 50 kms | |
	N	Percent	N	Percent	N	Percent	N	Percent
Never			1	2.6	1	2.4	21	43.8
Every day	1	100.0	37	94.9	40	95.2	25	52.1
Weekly			1	2.6			2	4.2
Monthly					1	2.4		
Total	1	100.0	39	100.0	42	100.0	48	100.0

4.5.3 Distance from county headquarters (Muranga town) – training on climate change

The findings on access to climate data indicated that 0 % of the interviewed farmers located at 0-10kms from Muranga town had received climate change trainings compared to 84.6 % of respondents located at 11-30kms. Also with no training on Climate Change were 78.6% and 79.2% of the interviewed farmers located at 31-50kms and over 50kms respectively. The study also found out that 100 % of the interviewed farmers located at 0-10kms had received 1-3 trainings compared to 5.1% of respondents' 11-30kms. Also at 1-3 trainings were 16.7% and 10.4 % of the interviewed farmers located at 31-50kms and over 50kms respectively. This is illustrated in Table 12.

Table 12: Distance from County HQs – Climate Change Training

	Distance from Muranga Town			
	0 - 10 KMs	11 - 30 KMs	31 - 50 KMs	Over 50 KMs
	Percent	Percent	Percent	Percent
0 trainings		84.6	78.6	79.2
1-3trainings	100.0	5.1	16.7	10.4
3-6 trainings		5.1		
Over 6 trainings				8.3
No answer		5.1	4.8	2.1
Total	100.0	100.0	100.0	100.0

4.6 Hypothesis testing

The extent of UNFCCC domestication using the level of uptake (adoption percentage levels) of the domestication factors, by farmers was tabulated. This is illustrated in Table 13.

Table 13: Domestication level of the factors under investigation

	Factor of MEA domestication	% Level of domestication	% Level of non-domestication
1	Adoption of DTC	71.2	28.8
2	Water harvesting practices	77.9	22.1
3	Adoption of irrigation farming	60.7	39.3
4	Adoption of green energy and energy saving technologies	28.6	71.4
5	Adoption of weather indexed insurance scheme	0	100
6	Access to climate data	72.9	17.1
7	Participation in climate change planning	19.3	80.7
8	Participation in climate change Training	19.3	80.7

The arithmetic mean level of domestication for all the factors under investigation was calculated. This mean is the sum of the observations divided by the number of observations. The mean level of domestication as calculated using the Farmer adoption percentages, as tabulated in Table 13 above is 43.7%. The finding of this study therefore is that the extent of UNFCCC domestication in Muranga County is 43.7%.

Further, the arithmetic mean percentages of the UNFCCC factors of domestication were subjected to the G-test of independence. To obtain the p value using a G-test of independence, the degrees freedom was first calculated. The degrees of freedom is equal to (number of rows) $-1 \times$ (number of columns) -1. Therefore for this study's test, the degree of freedom is:

(8-1) *(2-1) = 7

The analysis using a G test gave the following values:

$G_{(7, N=16)} = 307.62$, $p=1.42$

When the p-value turns out to be less than predetermined degrees of freedom, the null hypothesis is rejected. In this study the degrees of freedom is 7. The p-value is 1.42. This p-value is lesser than 7. Such a result indicates that the observed result would be highly unlikely under the null hypothesis. The null hypothesis which state that Muranga County has significantly domesticated UNFCCC is therefore rejected.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1: Summary and discussions of findings

5.1.1 Adoption of drought tolerant crops

A shift to cultivation of drought tolerant crops has been prescribed as an adaptation measure in Kenya in implementing Article 4.8 of UNFCCC. This intervention is meant to build resilience to food security threats that arise during the existing and anticipated droughts. Over 71.2% of the interviewed farmers have not adopted farming of drought tolerant crops. Out of the remaining 38.8% who have adopted, 25% of them have 5 % or less of their land cover under drought tolerant crops. The extent of adoption level across the entire population under study is 3.6% shows that Kenya has not significantly domesticated the provisions in this article and therefore this treaty has not resolved the problem that led to its formulation. This minimal adoption levels indicate that farmers have low adaptive capacities and high vulnerability index to food insecurity related to climate change.

This low adoption level points at the UNFCCC treaty's implementation processes and whether capacity needs for effective domestication was factored during its formulation. Communities from developing countries are directly impacted by climate change, though they are insignificant contributors to the anthropogenic factors that cause climate change. There is need therefore to develop and enforce a mechanism within the UNFCCC treaty that ensures communities in developing countries have the relevant capacities to effectively undertake proposed climate change adaptation measures.

5.1.2 Rain water harvesting

Over 75% of the farmers in the study area have less than 10% of their water utilization from rain water harvesting and 22.1% of them do not harvest water at all. According to the Kenya

Climate Change Action Plan (KCCAP), freshwater resources are impacted by inter and intra annual rainfall variability, altered rainfall patterns and higher evapo-transpiration thereby reducing the availability of this resource. This action plan which was developed to implement NCCRS (which was in turn developed to domesticate UNFCCC) further prescribes scaling up of water harvesting practices as a way of adapting to this climate related change. This adaptation measure has not significantly been employed and therefore this community vulnerability index on future access to water is high.

5.1.3 Adoption of irrigated farming

NCCRS proposes promotion of irrigation based agriculture as climate change coping mechanism instead of reliance on rain fed agriculture. This reduces the risks of crop failure and enhances food security and increases the adaptive capacity of the farmers. Dependence to rain-fed agriculture is a key contributing factor to vulnerability to climate change. From the findings of this study irrigation adoption level is still very low. 39.3% of the interviewed farmers are not on any form of irrigation and wholly depend on rain fed agriculture while 37.9% of farmers have less than 10% of their farm production on irrigation. For effective adoption of this intervention appropriate technologies for small farm level irrigation practices need to be developed and a mechanism to enhance access to the same developed.

This study process observed that the irrigation practiced in the study area is intensive horticulture in response to vegetable market demand in the neighboring Nairobi County. This form of irrigation is being practiced along the rivers and the researcher's view is this kind of irrigation can lead to mal-adaptation as it can introduce more water stress in the area due to over-exploitation. Irrigation that is sustainable must address the sources of water and the most appropriate source for irrigation is rain water harvesting during the rainy season. Water harvesting infrastructure must be developed.

5.1.4 Adoption of weather indexed insurance

This study established that weather indexed insurance has not been adopted in the study area. Farmers therefore directly bear the entire burden of climate related losses. According to the UNFCCC Convention (Article 4.8), insurance related actions constitute one of the responses to the adverse effects of climate change, alongside funding and technology transfer. Weather indexed insurance enhances financial resilience to external shocks and provide an opportunity to spread and transfer climate related risks. With the anticipated recurrent losses due to weather variability, the farmers are exposed to having low resilience to financial shocks and this has the potential of complete loss of livelihoods due to climate change.

5.1.5 Adoption of green/energy saving technologies

One of the decisions adopted in the sixteenth Conference of Parties for UNFCCC (COP 16, also known as Cancun Agreements) states that addressing climate change by all countries requires a paradigm shift towards building a low carbon society. Article 4 of UNFCCC treaty is on Commitments and specifies that each party, shall among other things 'promote and cooperate in the development, application and diffusion, including transfer of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases in all relevant sectors, including the energy, transport, industry, agriculture, forestry and waste management sectors'.

The research findings on use of energy were 71.4% of the interviewed farmers had 0% uptake level of energy saving technologies. From this percentage, it is very apparent domestication of this provision is low. Technologies for energy saving need to be promoted so as to reduce over reliance to wood fuel. Issues of costs for such technologies need to be factored in treaty formulation for effective domestication

5.1.6. Participation in climate change planning

Article 6 of UNFCCC treaty is on Education, Training and Public awareness specifies that each party in carrying out their commitments under Article 4 shall promote and facilitate public participation in addressing climate change and its effects .This study established that 80.7% of the interviewed farmers have never participated in climate change planning meeting. Another 12.1 % of the interviewed farmers have participated in only 1 to 3 meetings while only 4.3% have participated in over 6 climate change planning meetings in the past 3 years.

Benefits like use of local and indigenous knowledge perceived in engaging the public, for this case the farmers, and have not been accrued. Effective implementation of this commitment would require institutional structures and platforms/forums to engage the public. During negotiation processes Kenya needs to focus on capacity requirements for implementation.

5.1.7 Access to climate data

Promotion of public access to information on climate change and its effects; is also provided for in Article 6 of UNFCCC. This information is an empowerment kit for improving ones adaptive capacity through improved decision making. For farmers information on weather data and weather predictions is very useful in production planning. 79.3% of the interviewed farmers accessed this data every day and 17.1% of the interviewed farmers indicated they have never accessed climate data.

While a significant percentage indicated that they accessed climate data every day, a further question on the extent to which it influences their decision yielded 34% of the interviewed farmers saying that the climate data they get does not influence their farming decisions and 61% indicating that this influenced their farming decisions only to a little extent. Use of

climate data in making farming decisions is a powerful tool in improving production and averting risks of crop losses due to unfavorable weather.

5.1.8 Access to climate change relates Training

Article 4.1 (i) commits parties to promote and cooperate in education, training and public awareness related to climate change and encourage the widest participation in this process. Further in carrying out commitments under Article 4, parties shall promote and facilitate the development and implementation of educational and public awareness programmes on climate change and its effects. 80.7% of the interviewed farmers had never received any training while 10.7% had one to five trainings in the past three years. This provision of this article has not been significantly domesticated. Training enhances knowledge that improves decision making and capacity to adapt. Lack of training in itself can hinder effective domestication of MEAs. Capacity needs assessment for training should be incorporated in the processes of negotiating MEAs.

5.2: Conclusions

The extent of UNFCCC domestication, as investigated in Muranga County is 43.7%. Statistical analysis and hypothesis testing of the findings did not accept the null hypothesis of this study leading to the conclusion that Muranga County has not significantly domesticated UNFCCC. In order of scale, weather indexed insurance scheme was established to have the lowest uptake level at 0%, followed by participation in climate change planning and training, which both were at 19.3%. This was followed by uptake or adoption of energy saving technologies at 28.6%. The domestication factors found to have the highest uptake level were adoption of drought tolerant crops at 28.8% and uptake of irrigation farming at 60.7%.

Effective domestication of MEAs hinges on effectiveness of governance structures employed by a given country. Effective environmental governance is critical to timely response to environmental challenges and address agreed environmental priorities. Drawing from the research findings, this study can be a basis for informing policy makers the need to formulate effective strategies for MEAs domestication in Kenya.

5.3: Recommendations

5.3.1 Policy Recommendations

From the conclusions above, the study recommends the following policy directions;

- Integrate domestication of UNFCCC interventions in the development plans of Muranga County.

- Review the Kenya strategies for UNFCCC domestication with an aim of improving effectiveness

- Actively participate in UNFCCC negotiations with a view to orienting the commitments towards direct community assistance in domesticating the MEAs

- Adequately facilitate access to knowledge, technology, policy, and financial support for rapid uptake of proposed MEA interventions.

- Promote Strategic Environmental Assessments for all the decisions to domesticate MEAs before ratification.

- Undertake capacity assessments in the process of negotiating MEAs and translate these capacity needs to MEA obligations.

5.3.2 Research recommendations

This study recommends further research on the following aspects;

- Vulnerability assessments to Climate Change in Muranga County

- Factors hindering effective domestication of MEAs

- Capacity needs assessments for domestication of MEAs

- Knowledge gaps in Climate Change Adaptation and mitigation

- Sustainable irrigation practices in Muranga

- Effective MEAs negotiations

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APPENDIX 1

QUESTIONNAIRE:

Assessing Domestication of Multilateral Environment Agreements (UNFCCC Case study) in Kenya

Hello, my name is Wangare Kirumba from University of Nairobi. I am carrying out a project research leading to award of a Master of Arts degree in Environmental Planning and Management. This research is being carried out in Muranga County to assess extent and effectiveness of domestication of Multilateral Environmental Agreements in Kenya. You are kindly requested to voluntarily participate in this important exercise by answering some few questions relating to the subject matter. The information provided will be confidential and strictly used for the purpose of this research only. Please tick appropriately, where it applies.

SECTION A: PERSONAL INFORMATION

a)   Name of the division you come from *(Tick what applies)*

    1. Kangema [ ]   2. Maragua   [ ]
    3. Kandara   [ ]   4. Kiharu [ ]
    5. Kigumo   [ ]   6.Mathioya   [ ]
    7. Gatanga[ ]

b)   Approximate Distance from MurangaTown

    1.   0 – 10 Kms [ ]   3.   30 – 50Kms [ ]
    2.   11 – 30 Kms   [ ]   4.   Over 50 Kms   [ ]

c)   Elevation – Record GPS reading………………………..

d)   Agro-ecological zone

    1. I   [ ]
    2. II   [ ]
    3. III   [ ]
    4. IV   [ ]
    5. V   [ ]
    6. VI   [ ]

SECTION B: PERSONAL INFORMATION

a) Gender of the respondent:

1 Male [ ]   2 Female   [ ]

b) Age of the respondent's

   1. 18-24 years [ ]   4. 45-54 years   [ ]
   2. 25-34 years [ ]   5. 55 years and over [ ]
   3. 35-44 years [ ]

c) Highest level of education attained
   1. Primary level   [ ]   4. University   [ ]
   2. High School   [ ]   5. Other(s)   [ ]
   3. College [ ]

d) For how long have you been a farmer?

   1. Less than 5 years   [ ]   4. Between 15-20years   [ ]

   2. Between 5-10years   [ ]   5. Between 20-25years   [ ]

   3. Between 10-15years [ ]   6. Above 25years   [ ]

SECTION C: FACTORS FOR KENYAN DOMESTICATION STRATEGY OF MEAs(UNFCCC - FOOD SECURITY/AGRICULTURERELATED STRATEGIES)IN MURANGA COUNTY

(i) ADOPTION OF DROUGHT TOLERANT CROPS
   a) How much of your land is under cultivation?
      ………………………………………………

   b) Do you farm the following crops in your farm? (Tick all that apply)
                  1. Sorghum   [ ]
                  2. Sweet potatoes   [ ]
                  3. Cassava   [ ]
                  4. Millet   [ ]
                  5. Cowpeas   [ ]
                  6. Pigeon peas   [ ]
                  7. Improved fruit trees [ ]
                  8. Other Drought tolerant crops… [ ]

   c) For the ones that you have ticked above, how much land size is occupied by the following crops (Fill in the gaps)
                  1. Sorghum   […………]

                  2. Sweet potatoes   […………]

                  3. Cassava   […………..]

                  4. Millet   […………..]

                  5. Cowpeas   […………..]

                  6. Pigeon peas   […………..]

7. Improved fruit trees   [.............]

8. Other Drought tolerant crops   [.............]

(ii) ADOPTION OF WATER HARVESTING TECHNOLOGIES

a) How much of your water consumption in the farm is from water harvesting

   1.   0%   [ ]
   2.   1 – 10%   [ ]
   3.   11 – 30%   [ ]
   4.   31 – 60%   [ ]
   5.   61 – 100% [ ]

b) What forms of water harvesting do you practice in your farm?

   1. Roof water harvesting   [ ]
   2. Dug out ponds   [ ]
   3. Pans   [ ]
   4. Sub - Surface dams   [ ]
   5. None   [ ]

(iii) ADOPTION OF IRRIGATED AGRICULTURE

How much of your land cultivation is done under irrigation?

   1.   0%   [ ]
   2.   1 – 10%   [ ]
   3.   11 – 30%   [ ]
   4.   31 – 60%   [ ]
   5.   61 – 100%   [ ]

(iv) ADOPTION OF DROUGHT INDEXED INSURANCE SCHEME TO MANAGE RISKS OF CLIMATE RELATED LOSSES

How much of your land assets including crops are insured?

   1.   0%   [ ]
   2.   1 – 10%   [ ]
   3.   11 – 30%   [ ]
   4.   31 – 60%   [ ]
   5.   61 – 100% [ ]

(v) ADOPTION OF ENERGY SAVING TECHNOLOGIES

a) How much of your energy sources is green or from an energy saving technology?

   1.   0%   [ ]
   2.   1 – 10%   [ ]
   3.   11 – 30%   [ ]
   4.   31 – 60%   [ ]
   5.   61 – 100%   [ ]

b) Which of the following energy saving technologies do you use in your farm?

   1. Energy saving jikos [ ]

2. Energy saving lighting systems [ ]

3. Biogas production   [ ]

4. None   [ ]

(v) ADOPTION OF ENERGY SAVING TECHNOLOGIES
About which period did you make the changes you have highlighted above?

1. Past 5 years   [ ]
2. Past 10 years   ( )
3. Past 20 years   [ ]
4. Over 20 years   [ ]

SECTION D: DOMESTICATION OF MEAs (ARTICLE 6 0f UNFCCC) IN MURANGA COUNTY

(i) PUBLIC PARTICIPATION IN ADDRESSING CLIMATE CHANGE AND ITS EFFECTS AND DEVELOPING ADEQUATE RESPONSES;
How many times have you participated in climate change planning meeting in the past three years?

1. None   [ ]
2. 1 – 3   [ ]
3. 4 – 6   [ ]
4. Over 6 times [ ]

(ii)ACCESS TO CLIMATE DATA
a) How often do you have access to climate related data, e.g. when to expect rainfall, how much rainfall in a year, drought prediction, flood prediction?

1. Never   [ ]
2. Every day   [ ]
3. Weekly   [ ]
4. Monthly   [ ]
5. Every 3 months [ ]
6. Annually   [ ]

b) If so to what extent does this information determine your farming process e.g. when to plant, where to plant?

1. NONE [ ]   2. LITTLEEXTENT [ ]   3. AVERAGE EXTENT[ ] 4. MUCH EXTENT [ ]

5. VERY MUCH EXTENT [ ]

(iii) TRAINING COMMUNITIES ON CLIMATE CHANGE
How many trainings have you received on Climate Change in the past three years.

1. 0 trainings[ ]

2. 1 – 5trainings [ ]

3. 5 – 10trainings   [ ]

4. Over 10trainings   [ ]

SECTION E: FARMER EXPERIENCES/CHANGES OVER TIME DURING THE DOMESTICATION PERIOD OF UNFCCC IN MURANGA COUNTY

Kenya is a signatory to several multilateral environmental agreements (MEAs) that address several sectors of the environment. KENYA signed to join UNFCCC on 12th June 1992 and ratified the treaty on 30th Aug 1994 and has domesticated this treaty for over 15 years. The ratification and domestication of this treaty was meant to assist Kenyan communities mitigate and adapt to climate change. As a resident of Muranga County, how would you rate the changes in the past 15 years on the following aspects?

YOUR RANKING SCORES / SCALE OF IMPORTANCE

		No change	Slight improvement	Great improvement	Slightly worsened	Greatly worsened
1	Access to food					
2	Access to water					
3	Access to affordable energy					
4	Improved income generation					
5	Participation in Planning Meetings					
6	Access to climate change information/data					
7	Participation in Climate Change training					

Thank you!

FOR OFFICIAL USE ONLY

Name of Enumerator _____

Date of data collection _____

Respondent number: _____

Geospatial Location: N: _____E:_____H:_____

Name of location: _____

Appendix 2

GIS - DATA SHEET MURANGA COUNTY SEPT 2013

S/No	Farmer name	Location	Northings	Eastings	Any special remark