Climate, Food, Trade

Where is the Policy Nexus?

Kenya

1963 2012 CUTS International

#1302

About the Book

The East African Community has seen climate change, through the increasing intensity and frequency of extreme weather events, altering its agricultural and trade patterns that play a crucial role in ensuring food security for millions of East Africans. This trend shows the complex interrelationship existing between trade, climate change and food security; a three-dimensional relationship that seems to lack representation in the various policies addressing these issues. Yet, the absence of such important policy linkages, coherence and coordination might cause additional large-scale hunger in the region. Harnessing the potential of trade and putting in place appropriate policies to ensure affordable food for millions of people in the face of climate change has therefore become the need of the hour.

This research study, undertaken by a multi-disciplinary team of three Kenyan experts, aims to fill the current knowledge gaps on this three-dimensional relationship and to provide recommendations for more holistic policy responses to the challenge of climate-related hunger, including through trade. To do so, the authors reviewed the existing literature and relevant policies in place in all three areas of food security, trade and climate change, before examining existing and missing links between them. This work was supported by field visits and interviews of relevant stakeholders who helped understand the actual situation at the grassroots level.

Besides the already well-documented relationship between climate change and food security, the study provides an intriguing insight into the climate change-trade nexus that had received less attention before. The study shows how carbon trading has been used to mitigate the increasing emissions of trade-induced greenhouse gases, examines how climate change has directly affected trade in various ways through its impacts on various sectors of the economy, and explores the food security implications of Kenya's dependence on food imports in the context of high international food prices. While the authors make clear that most linkages between trade and climate change provide opportunities for win-win solutions, they also stress that this is conditioned to an inclusive approach to policy responses.

This research study was undertaken as part of CUTS International Geneva's “Promoting Agriculture-Climate-Trade Linkages in the East African Community” (PACT EAC) project, under which it will carry out a number of networking, training and advocacy activities. The study itself immensely benefitted from the insights of a variety of stakeholders from the government, farmer, academic, media and civil society representatives through dialogues and other activities of the PACT EAC project.

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Foreword

Among the East African countries, Kenya is the largest and most diversified economy; it is the economic engine in the region providing financial and transportation systems. The agriculture sector also plays an important role in the overall economy contributing about 23 percent of GDP. However despite these achievements, the country is still faced with high poverty rates and is yet to attain the long term goal of food self-sufficiency.

Climate change and its effects have had devastating effects in the country. Frequent droughts in some parts of the country have exposed a sizeable part of the population to chronic food insecurity that has at times necessitated emergency food aid. This is where the CUTS International, Geneva initiative on "Promoting Agriculture-Climate-Trade Linkages" under which this publication was commissioned, makes an important contribution to the country's efforts in dealing with these challenges.

The linkages between climate change, food security, and trade require understanding given their effects on each other. With the right set of policies, trade could play an important role in mitigating the damages of climate change and ensure food security as elucidate in this study.

This publication offers evidence-based policy recommendations supported by ground research, and will be critical in ensuring that the national and regional policies adopted are not only relevant, but also that they are implementable in synergy with other existing policies at the national and regional level.

The study will be a basis for all relevant stakeholders to develop and implement holistic responses to the challenges of climate change and the resulting threat to food security, through trade. It comes up with important recommendations for various stakeholders that will have to be considered in order for the country to overcome chronic food insecurity.

I take this opportunity to sincerely express my gratitude to CUTS International, Geneva for initiating this novel and yet timely project aimed at redressing the effects of climate change on food security in Kenya and the rest of East Africa. I trust that the findings in this study will contribute immensely to the national, regional and international efforts to address climate change, food security and trade challenges.

Prof. Jasper Okelo
WTO Chair's Programme
University of Nairobi

Preface

The importance of tackling the impacts of climate change on food security cannot be overstated, and here the role that trade can play in redressing these impacts becomes critical. With this in mind, CUTS International, Geneva, with funding support from the Swedish International Development Cooperation Agency (SIDA), conceived the project "Promoting Climate Change-Food Security-Trade linkages in the East African Community" (PACT EAC).

This 3-year project was launched on 1 October 2011 and builds on CUTS' previous work in Africa including in the five EAC member countries of Burundi, Kenya, Rwanda, Tanzania, and Uganda. Among previous projects that were successfully implemented issues, such as, inclusiveness in trade policy formulation and implementation; trade and food security; equitable agriculture development; and inclusive regional integration processes were addressed.

PACT EAC seeks to attain the following objectives:

- Identify the negative and positive elements of climate change that hamper or enhance food security in the project countries
- Identify the negative and positive elements of trade in goods and services that hamper or enhance adaptation to climate change
- Identify the positive linkages where trade can minimise the negative impacts of climate change on food security
- Investigate interactions of climate change-trade-food security policies with a view to further develop and implement relevant short and long term holistic policies at the national and regional level
- Increase understanding and capacity of a wide spectrum of stakeholders on these issues, and
- Arrive at policy recommendations that will lead to adaptation and mitigation of climate change caused challenges through trade.

In implementing the PACT EAC project, the CUTS' tried and tested RAN (holistic Research-Advocacy-Networking activities) model is applied. The inclusive and grassroots-linked methodology for research has facilitated sustained capacity building of stakeholders and ensured ownership of the outcomes.

The five country research studies under this project have been undertaken by teams of country experts in the three areas of climate change, food security, and trade. In fact this was the first time that the experts from the three areas came together to undertake these studies. Creating sustainable capacities of local researchers has been the leitmotif of CUTS working philosophy; thus creating stronger local ownership.

The research process commenced with desktop research, outcomes of which were presented at National Reference Group (NRG) meetings, which brought together all the relevant stakeholders including policy makers, academics, farmers' representatives, CSOs, media, among others. Thereafter field research was undertaken and incorporated into revised and complete drafts that were presented and discussed at the second NRG meetings, as well as at a Regional Meeting held in Kigali, Rwanda. The regional meeting brought together both national and regional stakeholders including high level participation by the EAC Secretariat. In addition, the drafts of research studies were reviewed by the members of the PACT EAC Project Advisory Committee, external country reviewers, and CUTS team. These processes have greatly enriched the research studies and ensured both national and regional ownership as well as high quality.

I trust that through these studies policy makers at the national and regional level will be better prepared in formulating targeted and holistic policies to tackle climate change impacts on the region's food security, particularly through trade. I am also confident this research will generate the necessary awareness among critical stakeholders on the linkages between climate change, food security, and trade thus facilitating them in undertaking their respective tasks.

I take this opportunity to thank all those who are associated with this very important project including the funding partner Swedish International Development Cooperation Agency, country researchers, partner Organisations in the project countries, and members of the Project Advisory Committee (PAC) and National Reference Groups (NRGs). I am also thankful to my colleagues in CUTS Jaipur, Geneva and Nairobi for successfully organising the research component. I am sure they will continue with the same zeal and commitment to implement all project activities.

Pradeep S Mehta
Secretary General CUTS
Jaipur, India

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Through this acknowledgement, the research team would like to express their gratitude to all the people who have been helpful in making this research possible and worthwhile. We are thankful to the former Director Ramamurti Badrinath who initiated this project, to the current Director of CUTS International in Geneva, Rashid S. Kaukab who has provided his much appreciated guidance, and to current and former PACT EAC project management team members in Geneva, Nairobi, and Jaipur, Clement Onyango, Julian Mukiibi, Rijit Sengupta, Julien Grollier, Krista Joosep, Grace N. Muriithi, Munu M. Luther, Victor O. Ogalo, and Frederick Njehu. We are equally grateful for the direction and management provided by CUTS African Resource Centre in Nairobi.

We are also thankful to the experts, colleagues, and friends that have contributed to the success of this study. In particular we would like to acknowledge the PACT EAC project National Reference Group members in Kenya for providing comments during various phases of the study as well as to the Project Advisory Committee members Jamie Morrison, Peter Kiuluku, Christophe Bouvier, Ambassador Joakim Reiter, Moses Marwa, Timothy Wesonga, and Dr Matern Lumbanga.

The study has also benefitted from the valuable editorial assistance by interns Emma Syrat and Hannah Cho; editorial work by Purity Njeru and peer-reviews by Booker Owour and Paul Kere. We thank Manbar Khadka and Suresh P Singh (colleagues at CUTS Centre for International Trade, Economics & Environment) for providing valuable inputs to the study; and CUTS International Publications Team at Jaipur for carrying out the process of editing, formatting and printing.

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Obadiah K. Mungai is a career economist who holds M.A Economics from University of Nairobi, Kenya. He has professional interest and cumulative over 5 year's experience in environmental economics, trade and regional integration both in the private and the public sector. Among many other areas he has played a key direct role in the development of "Draft National Policy on Carbon Finance and Emission Trading" and "Climate Change Financing Mechanisms" in the recently concluded Kenya Climate Change Action Plan for the implementation of the National Climate Change Response strategy for Kenya. Mungai is also a Certified Public Accountant and Certified Securities and Investments Analyst (CSIA).

Victor Ogalo is a Senior Trade, Investment and Infrastructure Programmes Officer at Kenya Private Sector Alliance. Previously, he worked at CUTS Africa Resource Centre, Nairobi for six years since 2006 and earlier for two years with Kenya's Ministry for Planning and National Development. He has a Bachelor's and Masters Degrees in Economics both from the University of Nairobi. He has specialisation and professional interest in international economics, economic integration, utility regulation, and competition policies. He has had several professional engagements with institutions such as the WTO, European Commission, DFID, GTZ, Commonwealth Secretariat, the Royal Embassies of Denmark and The Netherlands, Africa Union, COMESA, EAC, Trust Africa, and the UNECA. He has sufficient international exposure and country experiences through conferences, study tours and consultancies in several countries in Africa, Europe and Asia as well as the US.

Acronyms

AAP	Africa Adaptation Programme
AAU	Assigned Amount Unit
AFDB	African Development Bank
ARD	Agriculture and Rural Development
ASALS	Arid and Semi-Arid Lands
CBDR	Common but Differentiated Responsibilities
CDKN	Climate and Development Knowledge and Network
CDM	Clean Development Mechanism
CER	Certified Emissions Reduction
CFCs	Chlorofluorocarbons
CFU	Carbon Finance Unit
CIGs	Common Interest Groups
COMTRADE	United Nations Commodity Trade Statistics
COP	Conference of the Parties
DANIDA	Danish International Development Agency
DFID	Department for International Development
EIAs	Environmental Impact Assessments
EMCA	Environment Management Coordination Act
ENSO	El Niño Southern Oscillation
ERS	Economic Recovery Strategy
ETS	Emission Trading Scheme
EPA	Economic Partnership Agreement
FAR	First Assessment Report
FAO	Food and Agriculture Organisation
FFS	Farmer Field School
GDP	Gross Domestic Product
FEWSNET	Famine Early Warning Systems Network
FGD	Focus Group Discussion
FADC	Focal Area Development Committee
GHG	Greenhouse Gases
GoK	Government of Kenya
HCFCs	Hydro Chlorofluorocarbons

HDI	Human Development Index
IAASSTD	International Assessment of Agricultural Science and Technology for Development
INC	Intergovernmental Negotiating Committee
ITCZ	Inter-Tropical Convergence Zone
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
KARI	Kenya Agricultural Research Institute
KFSSG	Kenya Food Security Steering Group
KFS	Kenya Forest Service
KMD	Kenya Meteorological Department
MOP	Meeting of the Parties
NAMAs	Nationally Appropriate Mitigation Actions
NCCRS	National Climate Change Response Strategy
NFNP	National Food Security and Nutrition Policy
NIB	National Irrigation Board
NRG	National Reference Group
NRMP	Natural Resource Management Programme
OECD	Organisation for Economic Cooperation and Development
OPM	Office of the Prime Minister
RAM	Regional Annual Meeting
REDD	Reduced Emission from Deforestation and Degradation
RMU	Removal Unit
SEI	Stockholm Environment Unit
SIDS	Small Island Developing States
SLM	Sustainable Land Management
SP	Strategic Plan
SRA	Strategy for Revitalising Agriculture
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
VER	Voluntary Emission Reduction
WARMA	Water Resources Management Authority
WFP	World Food Programme
WMO	World Meteorological Organization

Chapter 1
Introduction

Climate change is altering agricultural and trade patterns through increasing the intensity and frequency of extreme weather events in the East African Community (EAC). This might cause additional large scale hunger in the region. Harnessing the potential of trade and putting in place appropriate policies to ensure affordable food for millions of people is the need of the hour. Therefore, it is urgent to develop an understanding of how climate change, food security, and trade interact and build the capacity of all relevant stakeholders to develop and implement holistic responses in the context of relevant international regimes, particularly those related to trade and climate change. For this to take place, the following areas need to be addressed:

- Improving understanding of the climate change, food security, and trade linkages among stakeholders to enable holistic policy response at the sub-national, national and regional levels;
- Building multi-stakeholder networks to facilitate development and implementation of holistic policy responses in consultation and collaboration with the relevant stakeholders in the countries and the region; and
- Developing the capacity of stakeholders to devise and implement holistic policies in the context of relevant international trade and climate change regimes.

Currently, there is no regional policy that addresses the linkages between trade, climate change, and food security in an inclusive manner. The EAC Secretariat has limited capacity to comprehensively examine these three areas, hence development of adequate and holistic policy responses through consultations with relevant stakeholders is hampered.

1.1. About the Study

This research study undertaken as part of the PACT EAC project aims to fill the current knowledge gaps related to the linkages between trade, climate change, and food security in order to promote holistic policy creation in the respective countries as well as in the EAC Secretariat. The main objectives include:

- To identify very specifically the negative and positive elements of climate change that hamper or enhance food security in the countries;
- To identify very specifically the negative and positive elements of trade in goods and services that hamper or enhance adaptation to climate change;
- To identify the positive linkages where trade can minimise the negative impacts of climate change on food security;
- To study interactions of climate change-trade-food-security policies currently in place in the EAC countries and to help further develop and implement relevant short and long term policies by the EAC Secretariat;
- To increase understanding and capacity of a wide spectrum of stakeholders on climate change-trade-food security-linkages by following an inclusive and collaborative research methodology; and
- To arrive at policy recommendations that help adapt and mitigate climate-change caused challenges (food security) through trade.

Given the objectives, the research study focuses on four issues. First, is to understand Kenya's policy context and frameworks relevant to the climate-trade-food security linkages (for example policies, strategies and action plans related to climate, food security, trade and investment) and their overall interactions. Similar to the national context, the research seeks to understand the regional and international policy frameworks relevant to the climate-trade-food security linkages and their implications for the national policy framework. Thirdly, it seeks to identify the negative and positive impacts created by climate change in agriculture and overall food security, and the roles trade can play to improve food security. Lastly, the research seeks to identify and articulate the viable solution elements that will holistically combat climate-change caused food insecurity when employing trade.

The research placed emphasis on an inclusive and outcome-based methodology. First, desktop literature and relevant documents were reviewed to expand and annotate research questions, and secondary data was also collected from various sources including the meteorological department, Kenya National Bureau of Statistics and various ministries including trade, agriculture, northern and arid lands development, special programmes, environment and finance and various parastatals.

Field work was also undertaken by the authors through the Organisation of focused group discussions (FGDs) and key informants interviews in five districts namely, Namanga, Kilifi, Bomet Garissa and Narok. These districts were purposely selected on the basis of their great significance to climate change, trade and food security. Key informants were also interviewed in Nairobi in the various relevant government ministries, parastatals, non-governmental Organisations and the private sector. In this regard, the research has benefited from immense information and feedback from the members of the Kenya National Reference Group (NRG), a multi-stakeholder network constituted under the PACT EAC project.

1.2. Overview of the Economy, Climate Change and Food Security Indicators

Kenya has the largest and most diversified economy in the East African region, with an estimated GDP of US$35.8bn in 2011/2012 (Economic Survey, 2012). In comparison, GDPs of neighbouring countries like Uganda, Tanzania, Rwanda and Burundi were US$17.6bn, US$23.3bn, US$6.1bn, and US$2.3bn, respectively. Kenya's financial sector and transportation system is the economic engine for much of East and parts of Central Africa.

Despite this advantageous position, national poverty rates are still high in Kenya, although these fell from 56 percent in 2001 to 46 percent in 2007 (Kenya Integrated Household and Budget Survey-KIHBS, 2006). Of the total population, 49 percent of the rural population is considered as absolutely poor (Kenya National Bureau of Statistic-KNBS, 2007). Most recent statistics show that in 2011 the poverty prevalence did not change from the 46 percent. With such statistics in poverty, there has also been a marked increase in food insecurity in the past few years.

The agricultural sector plays an important role in the overall economy in Kenya. Years with impressive growth in the agricultural sector have been accompanied with impressive growth in GDP and vice versa. Currently, the sector directly contributes about 23 percent of the GDP and an additional 27 percent through linkages with manufacturing, distribution and service sectors. During the second half of the 1980s for example, the annual growth in GDP peaked in 1986 at 5.5 percent. In that year, the agricultural sector grew at an impressive rate of 4.9 percent, similar to the early years of independence. In 1991, agricultural output fell by 1.1 percent and GDP declined to 2.3 percent.

In 1992, it fell by 4.2 percent and GDP slipped to the lowest level of 0.4 percent. Within the 1980-1990 period, the average economic growth declined to 3.5 percent, closely associated with dwindling agricultural performance. In 1990-2000, average economic growth declined to 1.3

percent in tandem with the agricultural growth rate. However, the period 2000-2010 saw an improvement of economic growth levels averaging 4.8 percent and agricultural growth rates increasing by 5.9 percent (Economic Surveys, various issues).

Despite growth of the agricultural sector, Kenya's long term goal of food self-sufficiency (producing everything consumed in the country) remains unmet. Compounding this challenge is that of climate change. Frequent droughts have precipitated requests for emergency food aid to mitigate the ravages of famine, especially in the arid and semi-arid regions populated largely by pastoral communities. In a population of more than 40 million people, it is devastating when about 10 percent is chronically food insecure. In 2011, the country witnessed the worst food insecurity crisis which saw over four million people put on food aid. This was partly due to drought in the northern arid and semi-arid areas (ASALs) and poor marketing and distribution of produce from surplus to scarce areas (Famine Early Warning Systems Network - FEWSNET, 2011).

Some economic sectors in Kenya are particularly exposed to risks linked to climatic variations. For instance, sectors that rely on natural resources and weather such as agriculture, fisheries and forestry including wildlife or services derived from these sectors such as hydro-electric power and tourism, may negatively affect the entire economy when they are hit by causal effects of climate change. Furthermore, Kenya does not produce sufficient food to meet its requirements and as such, the deficit is imported. Kenya is the largest import market for food and agricultural products in East Africa, and most trade in consumables and other food commodities, especially grains, take place with other EAC countries predominantly Tanzania, Uganda, Rwanda and Sudan (Otieno, 2011).

Kenya's main export products include horticulture, tea, coffee and fish mainly to the EU. To ensure there is capacity to import food deficits, the country must increase its export capacity in order to earn the foreign currencies with which to pay for imports. However, major indicators of international trade show that trade deficit is widening for Kenya. This means the country's capacity to pay for its food imports is also weakening. There is no doubt that the leading export sectors of the country are those sectors directly impacted by climatic conditions. While the value of domestic exports increased by 14 percent in the 2009-2011 period, the value of imports grew relatively fast at a rate of 16 percent (Economic Surveys, various issues).

Climate change impacts food self-sufficiency through many ways. First, it diminishes agricultural productivity, however other causal effects include unprofitable prices (poor price and cost disincentives) and incoherent policies in the agricultural sector. The productivity-related negative impacts are due to the fact that much of agricultural production in the country is rain-fed, hence production is highly sensitive to variations in rainfall. ASALs, which comprise 80 percent of Kenya's total land surface, are prone to floods despite their low levels of rainfall (between 300 and 500 mm annually). Usually levels between 850-1,500mm in the central highlands and rift valley are sufficient for the production of most crops (Harding and Devisscher, 2009).

In the past three decades, Kenya has been experiencing major droughts every decade and minor ones every three to four years, however more recently droughts have been experienced on alternating years. Given inadequate agricultural irrigation, rain-fed agriculture is and will remain the dominant source of staple food production and the livelihood foundation of most of the rural poor in Kenya. Weather pattern variability resulting from climate change will continue affecting production. Future climate variability model simulations under a range of possible greenhouse gas (GHG) emission scenarios suggest that the median temperature increase for Africa, Kenya included, will be 3-4° C by the end of the 21st century. This is roughly 1.5 times the global mean temperature rise (Harding and Devisscher, 2009).

In addition, climate change and human activities lead to forest depletion, reducing the area suitable for cultivation and increasing the desert size. For pastoralists and farmers, reductions in the area suitable for cultivation in the order of 15 to 30 percent in the sub-humid and semi-arid provinces significantly increase the number of people with inadequate resources for sustainable agriculture (ibid). Almost 7 million people in Kenya already live in food insecure households in these zones, where most of the 4 million chronically food insecure people derive from (Famine Early Warning Systems Network FEWSNET, 2012).[1]

Food security in Kenya has several dimensions: regional dimensions due to the differing climatic conditions and agro-ecological zones of the country; and poverty dimensions which are related to socio-economic variables of employment, incomes and purchasing power. Statistics from the KNBS (2010) reveal that only 47 percent of the entire Kenyan population is food secure. Furthermore, poverty in Kenya correlates with high food poverty so that regions with the highest poverty incidences also have high proportions of food insecurity, over 75 percent (KNBS, 2010).

This study highlights the linkages between trade, food security and climate change and how these affect various socio-economic, institutional and political factors in Kenya. The study uses a novel approach which involves investigating the linkages between trade, food security and climate change and mapping the inherent effects to determine various scenarios for Kenya. The study also uses various case studies to explain different phenomena that occur due to these changes and suggests how they can be mitigated.

Chapter 2

Setting the Scene: *Climate Change, Food Security and Trade in Kenya*

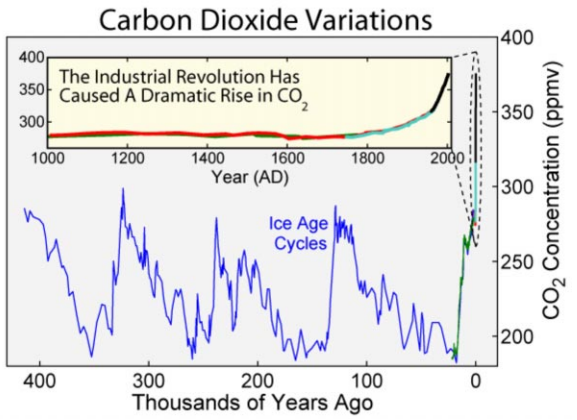
2.1. Climate Change

Climate change refers to a change of climatic patterns which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere, in addition to natural climate variability observed over comparable time periods.[2] It is caused by the greenhouse effect of a range of greenhouse gasses (GHG) that are produced either naturally or through human activities. Water vapour is the main GHG that occurs in natural conditions and has less impact on climate change. Other GHGs include carbon dioxide (CO_2), methane (CH_4), CFCs, Hydro chlorofluorocarbons (HCFCs), nitrous oxide (NO) among others. These are primarily produced from human activities including deforestation and industrial activities. They are more important for climate change.

The increase of these GHGs has been significant since the beginning of the industrial revolution or about 150 years ago (Figure 1). Understanding that this increase would grow parallel to the growth in consumption of the fossil energy, and considering the central role that CO_2 plays in enhancing the effect of the GHG, increased energy consumption will increase CO_2 significantly, resulting to rise in temperatures. Climate change is now recognised as a major economic, environmental and social challenge, and a subject of national and international importance. Kenya is highly vulnerable to impacts of climate change, particularly on economic growth and food security. The Stockholm Environment Unit (SEI) estimates that the costs of climate change in the country could be equivalent to a loss of almost 3 percent of GDP by 2030. This would impact heavily and negatively on the long term growth prospects of the country (World Bank, 2010).

The Intergovernmental Panel on Climate Change (IPCC) estimates that of the 7 billion tonnes of CO_2 equivalent released yearly by human activities, about 4 billion tonnes remain in the atmosphere without being recycled. The accumulation of carbon dioxide has been the main cause of the reported increase in GHG concentration from 280 parts per million (ppm) in pre-industrial times to 430 ppm today. At the present level of human activities and emissions, the concentration increases by four ppm every year. This increasing concentration is consistent with the observed average atmospheric warming of +0.7° C since the pre-industrial era albeit with significant spatial variability.[3]

Figure 1: CO_2 Emissions Increase due to Industrial Revolution



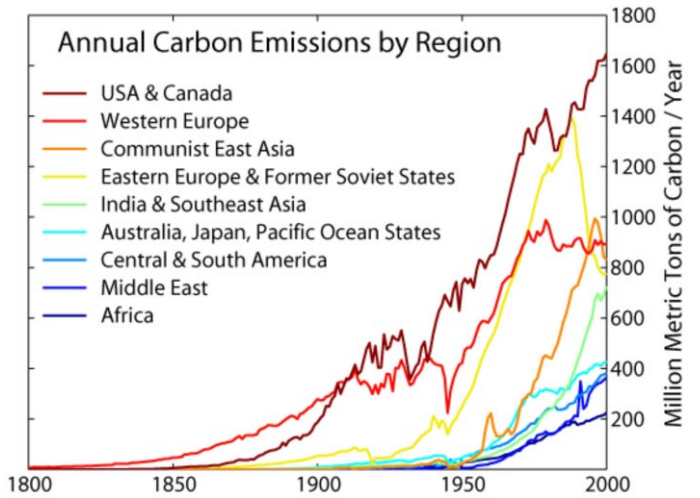
Source: Intergovernmental Panel on Climate Change, 2007

Kenya currently has relatively low emissions of greenhouse gases (total and per capita). The Kenyan government is in the process of establishing a GHG inventory system to establish both the stock and the changes in GHG emissions across the various economic sectors. Moreover, Kenya has already introduced a range of low carbon options across many sectors including renewable energy in the electricity sector, more efficient use of biomass and sustainable land use management.

The effects of climate change resulting from global warming are already being experienced around the world. The challenge is reducing the impact and embarking on a sustainable path. Industrialised countries and major emerging economies have been identified as the major contributors to the climate change problem accounting for over 80 percent of cumulative emissions of greenhouse gases (GHGs). This is attributable to their increased energy consumption, industrialisation, technological and land use changes that contributed to wealth creation to their population.

According to IPCC (2007), Africa is one of the regions of the world that is most severely and negatively impacted on by the effects of climate change. This is because Africa lacks capacity in relation to economic development and institutional support required to adequately respond to the challenges of climate change.

Figure 2: Annual Carbon Emissions by Region



Source: Intergovernmental Panel on Climate Change, 2007

Impacts of climate change have the potential to constrain progress made in improving the socio-economic well-being of developing countries. The negative impacts include widespread poverty, human diseases and high population density, which are estimated to double the demand for food and water within the next thirty years (Davidson, D. J., Williamson T., and Parkins J. R. 2003.).

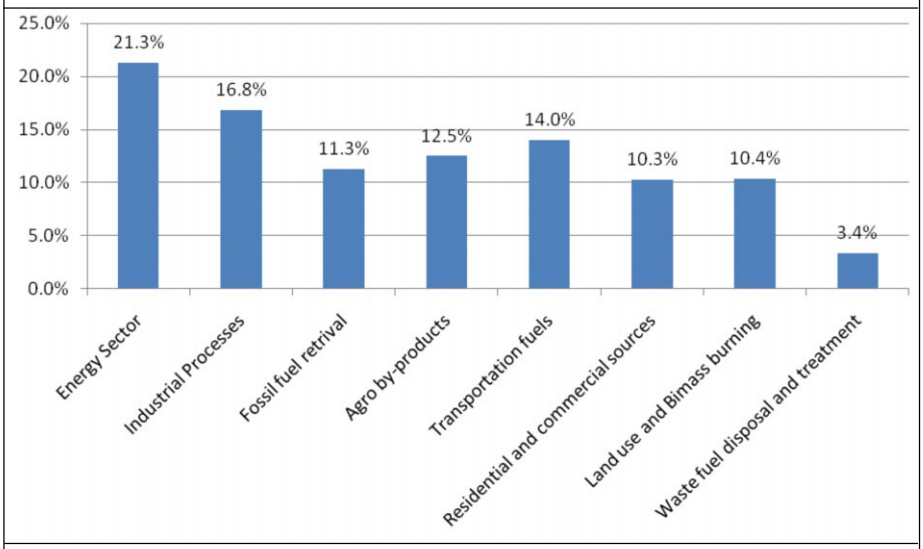
Recent IPCC (2007) climate change scenarios show that the long term rain seasons will become longer, while the short term rain seasons will become much shorter. These patterns will interfere with cropping systems impacting on yields and food security. Anticipated floods will destroy farms and crops, while long droughts will increase livestock mortality due to famine and related diseases. The impacts on the ecosystem will include enhanced fragility and less productivity. In the long term, local communities will be the most vulnerable to extreme weather events, due to lack of resources to adapt, mitigate or manage the consequences. In the case of Kenya, climate change is projected to retard socio-economic development. The country is at high risk due to proximity to the equator and Indian Ocean cyclones.

2.1.1. GHG Emissions by Sector

Global emissions of GHGs can broadly be divided into eight categories. About 21.3 percent of the emissions are produced by the energy sector; 16.8 percent by industrial processes; 11.3 percent by fossil fuel retrieval, processes and distribution; 12.5 percent by agriculture by-products; 14.0 percent by transportation fuels; 10.3 percent by residential and commercial sources; 10.0 percent through land use and biomass burning; and 3.4 percent through waste disposal and treatment (Figure 3).

According to SEI (2009), the current plans across the economy (or for some sectors, the lack of plans) could 'lock-in' Kenya into a higher emission pathway. The increases from the

Figure 3: GHG Emissions by Sector



Source: Intergovernmental Panel on Climate Change, 2007

transport, agricultural and electricity sectors, and the associated increase in national emissions, would occur at exactly the time when there is likely to be greater economic opportunities for international carbon credits, particularly if national level GHG mechanisms emerge. Following these, higher carbon pathways will therefore lead to an opportunity loss for Kenya. They could also lead to other economic, social and environmental costs: an example would be the increased congestion, higher fuel costs, greater fuel imports and higher air pollution that would occur unless private car transport is tackled in Nairobi.

2.1.2. Kenya's Climate Settings and Recent Trends

Kenya is located in East Africa, at latitudes of 6° S to 6° N. Its climate is tropical, but moderated by diverse topography in the west. Kenya's topography rises from the coastal plains to the eastern edge of the East African Plateau, and the Great Rift Valley. The central highland regions are substantially cooler than the coast, with the coolest (highest altitude) regions at 15° C compared with 29° C on the coast. Temperatures vary little throughout the year, but drop by around 2° C during the coolest season (McSweeney, New and Lizcano, 2012).

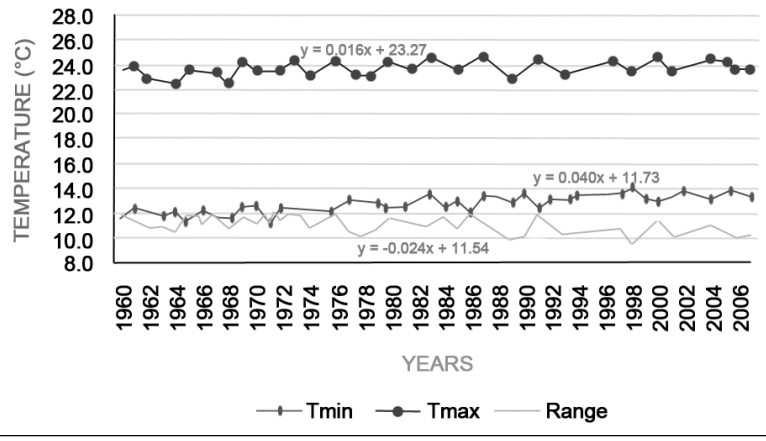
Seasonal rainfall in Kenya is driven mainly by the migration of the Inter-Tropical Convergence Zone (ITCZ), relatively narrow belt of very low pressure and heavy precipitation that forms near the earth's equator. The exact position of the ITCZ changes over the course of the year, migrating southwards through Kenya in October to December, and returning northwards in March, April and May. This causes Kenya to experience two distinct wet periods, the short rains in October to December and the long rains in March to May. The amount of rainfall received during these seasons is generally 50-200 mm per month but varies greatly, exceeding 300 mm per month in some localities (McSweeney, New and Lizcano, 2012).

The onset, duration and intensity of these rainfalls also vary considerably from year to year. The movements of the ITCZ are sensitive to variations in the Indian Ocean sea-surface temperatures and vary from year to year. One of the most well-documented ocean influences on rainfall in this region is the El Niño Southern Oscillation (ENSO). El Niño episodes usually cause greater than average rainfalls in the short rainfall season, whilst cold phases (La Niña) bring a drier than average season (McSweeney, New and Lizcano, 2012).

a) Temperatures

According to McSweeney, New and Lizcano (2012), the mean annual temperature has increased by 1.0° C since 1960, an average rate of 0.21° C per decade. There have also been significant increase frequency trends of hot days[4], and much large increase in the frequency of hot nights. The average number of hot days per year has also increased by fifty seven (an additional 15.6 percent of days) between 1960 and 2003.

Figure 4: Temperature Trend for Nairobi from 1960 to 2005



Source: Kenya Meteorological Department (KMD)

According to collected metrological data, the average number of hot nights per year increased by 113 (an additional 31 percent of nights) between 1960 and 2003, while the frequency of cold days decreased significantly in annual records. The frequency of cold nights, however, decreased more rapidly and significantly in all seasons. The average number of cold[5] days per year decreased by 16 (4.4 percent of days) between 1960 and 2003 and the average number of cold nights per year decreased by 42 (11.5 percent of days).

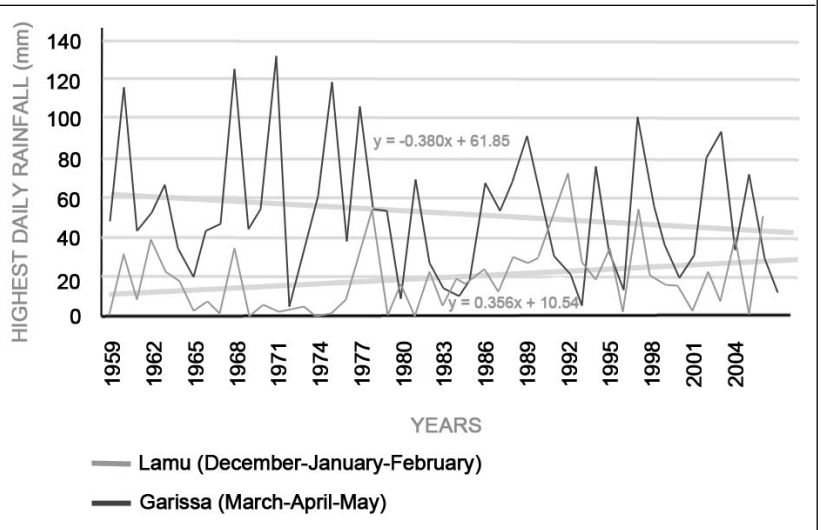
Kenya's minimum temperature has risen generally by 0.7-2.0° C and the maximum by 0.2-1.3° C, depending on the season and the region. In areas near large water bodies, the maximum temperatures have risen much like in other areas, but the minimum temperatures have either not changed or become slightly lower. As an example, the changing temperature trends for Nairobi are shown in figure 4. The figure shows increase in both minimum and maximum temperatures, but decrease in diurnal range of temperature.

b) Precipitation

As regards rainfall, the most visible feature is the increased variability year to year, and during the year. There is a general decline of rainfall in the main rainfall season of March-May (the long rains). Drought during the long rains season is more frequent and prolonged. On the other hand, there is a general positive trend (more rains) during September to February. This suggests that the short rains (October-December) season is extending into what is normally the hot and dry period of January and February. Moreover, measured by the volume of rainfalls in a twenty four hour period, more intense rainfalls occur, and more frequently over the coastal strip and the northern parts of the country during the September-February period. This means frequent occurrence of severe floods in those areas. No significant trends in the twenty four hour rainfall amounts are observed in other areas of the country. Figure 5 shows changes in rainfall patterns in Lamu and Garissa.

Observations of rainfall in Kenya since 1960 do not show statistically significant trends. Trends in the extreme indices based on daily rainfall data are mixed. There is an increasing, but no statistically significant trend in the proportion of rainfall occurring in heavy events.[6]

Figure 5: Rainfall Trends over Lamu and Garissa over the Past Half Century



Source: Kenya Meteorological Department

2.1.3. Consequences of Climate Change within the Kenyan Context

The impacts of climate change occur through the increase in average temperatures and its effects on physical systems and biodiversity. The increased temperature increases both the magnitude and frequency of extreme weather events such as heat waves and severe droughts. IPCC (2007) observations note that the melting of the ice as a result of increase in average temperatures and varied weather frequencies including storms, will result into rise in sea levels.

It is important to recognise the vulnerability of various unique ecosystems (for example snow-capped mountains, coral reefs, mangroves, tropical forests, wetlands among others) to climate change. Increasing effects of climate change could result into loss and/or extinction of important biodiversity, hence increasing social marginal costs due to increased vulnerability, severe health problems and reduced incomes.

Changes in temperature and rainfall patterns have potential implications for key economic sectors such as agriculture, forestry, water, fisheries, energy, transport and tourism. Although some cool temperature zones such as the highlands may experience increased crop productivity due to longer growing seasons, reduced rainfall and increased rates of evaporation will lead to greater risk to food production in lower latitudes where rainfall is already limited for productive agriculture. Water supply will also be affected with implications for agriculture and human settlement.

In Kenya, climate change has manifested itself through extreme weather conditions such as prolonged droughts and dry seasons, unreliable rainfall (*El-Niño* type wet seasons) and significant changes in weather variability over the past decade. In addition, the increase in extreme weather such as floods, storms, outbreaks, biodiversity degeneration and droughts has a negative impact on human health.

Due to recent increase in temperatures, malaria is emerging as a threat in highlands and cooler areas in the rift valley such as Eldoret, Bomet, Narok and cooler central highlands like Kirinyaga-areas which were not originally high malaria zones. There is also an observed effect on plant and animal diseases such as the recent Maize Lethal Necrosis (MLN) virus which attacked maize crop in the rift valley, Kenya's bread basket that led to huge economic losses to farmers. The emergence of foot and mouth and wildebeest catarrh which is affecting livestock is also being attributed to climate change causing weather variability and migration of wildlife. These and other phenomena have consequently affected food security and trade as will be discussed in other sections of this report.

Furthermore, higher temperatures increase the use of energy in air conditioned places like Mombasa, Malindi, Lamu, Kisumu, Garisa, Lodwar, Wajir and Mandera among other humid areas. On the positive side higher temperatures reduced the need for heating and risk of cold related health impacts. The implications of combined impacts of reduced water supply, loss of agricultural production and severe weather in a low resilient society might be limited to higher food and water prices.

However, higher vulnerability could potentially result into desertification, hunger, mortality risk and even migration and conflict; all of which have recently been observed in various parts of Kenya: in Narok-human-wildlife conflict; and in Tana River Delta and parts of Eastern and North Eastern Provinces-human-human conflict and the Baragoi incident where Samburu cattle rustlers killed forty six police officers after stealing animals from the Turkana people. Water supply could also be affected with implications for agriculture, human settlement, electricity generation and related energy supply and/or consumption.

a) Economic Impacts of Climate Change in Kenya

Periodic floods and droughts (extreme events) already cause major socio-economic impacts and reduce economic growth in Kenya. Recent major droughts occurred in 1998-2000, 2004-

05 and in 2009. Major floods occurred in 1997-1998 and 2006. The economic costs of droughts affect the whole economy. The 1998-2000 event was estimated to have economic costs of US$2.8bn from the loss of crops and livestock, forest fires, damage to fisheries, reduced hydro-power generation, reduced industrial production and reduced water supply (SEI, 2009).

According to SEI (2009), the 2004 and 2005 droughts affected millions of people and the recent 2009 drought has led to major economic costs from restrictions on water and energy. The 1997/1998 floods affected almost one million people and were estimated to have total economic costs of US$0.8 to US$1.2bn arising from damage to infrastructure (roads, buildings and communication), public health effects (including fatalities) and loss of crops. The more recent 2006 event affected over 723,000 people in Kenya.

The continued annual burden of these events leads to large economic costs (possibly as much as US$0.5bn per year, equivalent to around 2 percent of GDP) and reduces long term growth. There is some indication that there has been an intensification of these extreme events over recent decades, and they may reflect a changing climate already. However, these impacts also have to be seen in the context of changing patterns of vulnerability, for example from changing land–use patterns and rising populations, among others. Nonetheless, a key finding is that Kenya it is not adequately adapted to deal with existing climate risks.

2.1.4. International Agreements on Climate Change and the Current Institutional Frameworks in Kenya

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by the World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP) with the objective of providing comprehensive reports and updates on the state of scientific knowledge to guide policy makers. IPCC (1990) published the First Assessment Report (FAR) on climate change confirming that climate change was real and a threat to the survival of human beings and biodiversity. The IPCC report stimulated the international community to act and develop policy options and strategic solutions necessary to reverse the effects of climate change.

The United Nations General Assembly responded to the IPCC report in December 1990 and started formal negotiations on the United Nations Framework Convention on Climate Change (UNFCCC). The negotiations were enacted by resolution 45/212 and this led to the establishment of the Intergovernmental Negotiating Committee (INC) for conducting the negotiations.

As a party to the UNFCCC and its KP, Kenya is obligated to take part in international climate change events including participation in the yearly Conference of the Parties (COPs) to the Convention. Kenya successfully hosted the 12th COP to the UNFCCC, which ran during November 06-07, 2006. The COP's main outcome was the Nairobi Framework, an initiative meant to help developing countries, especially those in sub-Saharan Africa, participate effectively in the Clean Development Mechanism (CDM). Kenya has also participated in the 3rd Special Session of the African Ministerial Conference on the Environment (AMCEN) whose main theme was climate change. The meeting, held on May 29, 2009, was called to, among others, develop a single African voice in Copenhagen (at the 15th COP) and advance the continent's interests in negotiations for the climate change regime beyond 2012, the expiry date of the KP.

Kenya has made remarkable move in prioritising and engendering environment and climate change in its development agenda. However, the coordination and governance of the same remain spread across different government ministries and agencies. Five key government ministries are currently involved:

- The Office of the Prime Minister (OPM) which houses the National Climate Change Committee (NCCC) charged with the overall climate change coordination and provision of guidance on climate

change activities to the implementing sectors and the stakeholders;

- Ministry of Environment and Mineral Resources where the National Climate Change Response Strategy (NCCRS) Secretariat sits with the wider mandate of implementing the NCCRS and coordinating sectoral climate change activities. Other agencies within this ministry include the National Environmental Management Authority (NEMA) with the responsibility of approving carbon mitigation projects under the Clean Development Mechanism (CDM); and the Kenya Meteorological Department (KMD) whose mandate is research, prediction and dissemination of climate change information as well as issuing early warnings with regards to extreme weather events;
- Kenya Forest Service (KFS) which falls under the Ministry of Forest and Wildlife is in charge of the REDD+ Readiness Plan;
- Ministry of Finance whose Carbon Finance Unit (CFU) is tasked with climate change policy on financing and investment and enhancing public and private participation in carbon projects; and
- Ministry of Planning, National Development and Vision 2030 whose planning division has the mandate of mainstreaming climate change in development plans.

2.1.5. Climate Change Finance and Governance in Kenya

In Kenya, there are different sources and windows of climate change finance. These are largely intertwined with other development funds. Climate change adaptation and mitigation in Kenya is funded by two main sources; that is the Government of Kenya exchequer and donors through grants and loans. These funds are received and dispatched in most of the government departments. The amount varies from department to department with the Ministry of Energy receiving the highest amount of funding for climate change programmes. Kenya therefore is a beneficiary of a number of international funds that have been set up through international or bilateral agreements. These include but are not limited to climate change investment funds like the Scaling up Renewable Energy Programme (SREP).

2.1.6. Climate Change Strategy and Action Plan for Kenya

To address the challenges posed by climate change in a systematic manner, the Government of Kenya formulated and published a NCCRS, 2010. To operationalise the NCCRS, the Government of Kenya, through the Ministry of Environment and Mineral Resources and other key stakeholders, initiated an ambitious process to develop a National Climate Change Action Plan.

The action planning process is being supported by the UK Department for International Development (DFID), the Climate and Development Knowledge and Network (CDKN), the Common Market for Eastern and Southern Africa (COMESA), the Danish International Development Agency (DANIDA) through the Natural Resource Management Programme (NRMP) and the Africa Adaptation Programme (AAP) which is funded by Government of Japan through UNDP, among other development partners. The action plan process is intended to be completed by end of 2012 and has nine distinct subcomponents which are closely linked and interrelated:

- **Long term national low carbon development strategy:** This is intended to facilitate reflection and mainstreaming of climate change aspects in the country's long term development planning and budgeting. It also seeks to identify key elements of the country's low carbon and climate-resilient growth.
- **Enabling policy and regulatory framework:** It is aimed at reviewing international, regional and national policy legislative instruments relating to climate change with a view to developing a policy and/or legislative framework that promotes coherence, coordination and cooperative governance of climate change issues at various levels.

- **National adaptation plan:** This is intended to identify and prioritise immediate, medium, and long term adaptation actions for implementation.
- **Nationally Appropriate Mitigation Actions (NAMAs):** This is intended to identify and prioritise internationally and domestically supported NAMAs that will enhance sustainable development and also identify priority reduced emissions from deforestation and forest degradation (REDD+) activities.
- **National technology action plan:** This is intended to identify the technology development and transfer required to enhance implementation of adaptation and mitigation actions.
- **National performance and benefit measurement:** This will help develop a national climate change measuring, reporting and verification system, and performance indicators.
- **Knowledge management and capacity development:** This is intended to design appropriate knowledge management systems of the various actors.
- **Finance:** This is designed to position the country to access finances from various sources by developing an innovative financial mechanism that includes a climate fund, investment strategy/framework and carbon trading platform.
- **Coordination**. This brings additional support to achieve the desired levels of coordination and integration.

2.2. Trade Overview

2.2.1. Foreign Trade Profile

Kenya's foreign trade in both goods and commercial services is very important to the country. It represents 65 percent of the country's GDP (2010), with imports value alone equivalent to 39 percent of GDP in 2010 (Table 1). The country's trade is highly liberalised. Liberalisation has been pursued through membership in the World Trade Organization (WTO), the Common Market for Eastern and Southern Africa (COMESA) and the East African Community (EAC). In addition, the country continues to negotiate with the European Union (EU) to establish a free trade Economic Partnership Agreement (EPA). Furthermore, two of the economic blocs to which Kenya is a member, COMESA and EAC, already have tariff and quota free trade arrangements even as these two blocs pursue an open trade arrangement with the Southern Africa Development Cooperation-SADC (AfDB 2010)[7].

Kenya imports more merchandise goods than it exports. This has translated into a largely deficit goods trade balance highlighted in table1. Nonetheless, services exports have remained higher than services imports and this has had a neutralising effect on the overall deficit trade balance of the country. According to table 2, agricultural exports form an integral part of Kenya's export profile at 55 percent with top destinations being EAC and EU. This implies that with the ever changing climate, trade, may be

Table 1: Kenya's Foreign Trade Profile

Foreign Trade Indicators	2005-2010	2007	2008	2009	2010
Merchandise *imports,* c.i.f. (million US$)	16	8, 989	11, 128	10, 202	12, 090
Merchandise *exports* fob (million US$)	9	4, 081	5, 001	4, 463	5, 151
Imports of services (million US$)	14	1, 479	1, 663	1, 634	1, 816
Exports of services (million US$)	14	2, 409	2, 520	2, 198	2, 920
Imports of goods and services (annual % change)	7	11	7	-0	3
Exports of goods and services (annual % change)	3	7	7	-7	6
Trade balance (million US$)		-4, 256	-5, 649	-4, 989	-
Current account (million US$)		-1, 032	-1, 983	-1, 661	-
Foreign trade (in % of GDP)		63	69	64	65
Imports of goods and services (in % of GDP)		37	42	38	39
Exports of goods and services (in % of GDP)		26	28	25	26

Source: WTO-World Trade Organization; World Bank, Last available data

Table 2: Breakdown in Kenya's Total External Trade (2010)			
Exports	**% share**	**Imports**	**% share**
Merchandise Trade			
By main commodity group (ITS)		*By main commodity group (ITS)*	
Agricultural products	55.5	Agricultural products	13.1
Fuels and mining products	6.0	Fuels and mining products	22.8
Manufactures	32.8	Manufactures	59.2
By main destination		*By main origin*	
EAC (4)	24.7	European Union (27)	18.6
European Union (27)	23.9	China	12.6
United States	5.5	United Arab Emirates	12.1
United Arab Emirates	4.6	India	10.8
Sudan	4.6	South Africa	6.2
Commercial Services Trade			
By principal services item		*By principal services item*	
Transportation	53.5	Transportation	51.4
Travel	27.4	Travel	11.7
Other commercial services	19.1	Other commercial services	37.0
Source: UN Comtrade website			

negatively affected as it is evidently dependant on agriculture, which itself relies on climate.

a) Merchandise Trade

The major destinations for Kenya's goods exports are Uganda, the UK, Tanzania, Netherlands, and the US, in that order; while the major suppliers of Kenya's imports are China, United Arab Emirates, India, South Africa and Japan, in that order (Table 3).

Moreover, agricultural products constitute the largest share of Kenya's merchandise exports, while manufactured products are its main imports. In 2010, for instance, Kenya's exports were composed of 55.5 percent as agricultural products, 32.8 percent as manufactured products and 6 percent as fuels and mining products. On the import side, manufactured products are the leading import products at 59.2 percent, followed by fuels and mining products at 22.8 percent and agricultural products at 13.1 percent.

Table 3: Kenya's Main Trade Partners, 2010 (in %)			
Uganda	12.7	China	12.6
UK	9.8	United Arab Emirates	12.1
Tanzania	8.1	India	10.8
Netherlands	6.6	South Africa	6.2
United States	5.5	Japan	6.1
United Arab Emirates	4.6	UK	5.2
Sudan	4.6	US	4.1
Egypt	4.4	Saudi Arabia	3.4
Pakistan	4.4	Singapore	3.3
Somalia	3.2	Indonesia	2.8
Democratic Republic of Congo	3.1	Germany	2.8
Afghanistan	2.9	South Korea	2.1
Rwanda	2.6	France	1.9
India	2.1	Netherlands	1.9
Germany	1.9	Egypt	1.9
Burundi	1.3	Finland	1.5
France	1.3	Italy	1.2
Zambia	1.1	Switzerland	1.2
Yemen	1.1	Tanzania	1.1
Russia	1.1	Russia	1.0
Source: UN Comtrade, Last available data			

Table 4: Kenya Main Export and Import Products, 2010 (% of total)			
Main exports (% of exports)	Share of total	Main imports (% of imports)	Share of total
Tea, whether or not flavoured	22.5	Petroleum oils and oils obtained from bituminous...	13.6
Cut flowers and flower buds of a kind suitable for...	7.7	Petroleum oils and oils obtained from bituminous...	7.6
Coffee, whether or not roasted or decaffeinated;...	4.0	Powered aircraft "e.g. helicopters and aeroplanes...	3.7
Petroleum oils and oils obtained from bituminous...	4.0	Palm oil and its fractions, whether or not refined...	3.7
Other vegetables, fresh or chilled (excl. potatoes...	2.9	Motor cars and other motor vehicles principally...	2.9
Gold, incl. gold plated with platinum, unwrought...	2.2	Electrical apparatus for line telephony or line...	2.6
Carbonates; per oxocarbonates "percarbonates";...	1.8	Medicaments consisting of mixed or unmixed...	2.2
Cement, incl. cement clinkers, whether or not...	1.8	Flat-rolled products of iron or non-alloy steel,...	2.2
Cigars, cheroots, cigarillos and cigarettes of...	1.8	Transmission apparatus for radio-telephony,...	1.9
Palm oil and its fractions, whether or not refined...	1.6	Wheat and meslin	1.8
Flat-rolled products of iron or non-alloy steel,...	1.5	Motor vehicles for the transport of goods, incl....	1.5
Leguminous vegetables, shelled or unshelled, fresh...	1.5	Automatic data processing machines and units...	1.4
Articles for the conveyance or packaging of goods,...	1.3	Cane or beet sugar and chemically pure sucrose, in...	1.4
Soap; organic surface-active products and...	1.2	Polymers of ethylene, in primary forms	1.4
Vegetable products, n.e.s.	1.2	Electric generating sets and rotary converters	1.1
Medicaments consisting of mixed or unmixed...	1.2	Tractors (other than tractors of heading 8,709)	1.0
Fruits, nuts and other edible parts of plants,...	1.1	Mineral or chemical fertilisers containing two or...	1.0
Live plants incl. their roots, cuttings and slips;...	1.1	Rice	0.8
Sugar confectionery not containing cocoa, incl....	1.0	Spark-ignition reciprocating or rotary internal...	0.8
Fish fillets and other fish meat, whether or not...	0.9	Insecticides, rodenticides, fungicides, herbicides...	0.8
Source: Comtrade, Last available data			

In 2010, the top three exported products were tea, flowers and coffee which all together accounted for 34.2 percent of exported goods. Looking at table 5, the majority (64.7 percent) of exports to the UK were in the category of food, live animals, beverages and tobacco (SITC sections 0+1). The same pattern was observed by Pakistan (96.2 percent), Sudan (47.1 percent)

Table 5: Kenya's Exports by Top 10 Destinations and SITC Sections, 2009									
Country	Total value (million US$)	Shares by SITC sections (% of country total)							
		0+1	2+4	3	5	6	7	8	Total
World	4,463.4	41.9	16.0	4.2	10.2	12.3	5.2	9.6	100
Uganda	598.3	15.8	4.6	9.3	21.5	29.6	10.9	8.2	100
UK	498.1	64.7	29.6	0.0	0.1	1.8	0.6	3.3	100
Tanzania	389.3	13.1	7.9	5.5	21.3	26.4	13.6	12.2	100
Netherlands	340.7	21.6	78.1	—	0.0	0.1	0.1	—	1,000
USA	226.7	23.5	2.0	—	0.3	0.8	0.3	73.1	100
Pakistan	196.3	96.2	0.1	—	2.2	1.5	0.0	0.0	100
Sudan	165.1	47.0	7.4	1.2	9.7	14.1	13.9	6.7	100
Egypt	153.8	96.6	0.5	—	0.2	2.1	0.3	0.2	100
DRC	146.5	12.7	10.4	3.1	13.1	31.3	2.9	26.6	100
Somalia	145.1	23.3	38.4	0.8	5.5	7.7	10.4	13.8	100

Note: Standard International Trade Classification (SITC), Rev.3

0-Food and live animals; 1-Beverages and tobacco; 2-Crude materials, inedible, except fuels; 3-Mineral fuels, lubricants and related materials; 4-Animal and vegetable oils, fats and waxes; 5-Chemicals and related products, n.e.s.; 6-Manufactured goods classified chiefly by material; 7-Machinery and transport equipment; 8-Miscellaneous manufactured articles; 9-Commodities and transactions not classified elsewhere in the SITC

and Egypt (96.6 percent). Interestingly, the largest component of the leading exports to all the four countries was tea. The Netherlands was mainly high as a destination for horticultural products like vegetable and inedible oil. The US continues to be the leading destination for Kenya's articles of apparel and clothing accessories, attributable to AGOA trade relations between the US and African countries.

2.2.2. Agricultural Trade in Kenya and Implications of a Changing Climate

Agriculture continues to be one of the leading sectors in the Kenyan economy in terms of its contribution to real GDP. It contributed 36.6 percent of GDP in the period 1964-1974, 33.2 percent in 1974-1979, 29.8 percent in 1980-1989, 26.5 percent in 1990-1995 and 24.5 percent in 1996-2000, and an average of 23.8 percent between 2000-2010. Only 12 percent of Kenya is considered to have for farming or intensive livestock production. A further 5.5 percent, which is classified as medium potential, mainly supports livestock, especially sheep and goats. Only 60 percent of this high and medium potential land is devoted to crops (cereals, coffee, tea and horticultural crops among other) and the rest is used for grazing and forests (Economic Surveys, various issues).

This implies that medium and low potential zones will bear the brunt of global warming in Kenya. A study by CEEPA (2006)[8] projects that income losses are estimated to be up to US$178 per hectare by the year 2030 for these zones compared to losses of only US$32 for high potential zones and US$117 for the whole country. This means that perhaps livestock production and some parts of the country where maize is produced, will suffer more severe losses from climate change.

Kenya's agricultural exports can be divided into traditional and non-traditional. Traditional exports include tea and coffee, while non-traditional exports include horticulture produce. Over the last three decades, the horticulture sector has grown tremendously at an average rate of 6 percent per annum becoming the third most important foreign exchange earner after tourism and tea (Onjala and Otieno, 2010)[9]. Tea exports are still the largest agricultural export earner. Moreover, most of tea, coffee and horticulture production are rain-fed. Only 13 percent of horticultural production, 3 percent of tea production and less than 1 percent of coffee production is under irrigation (Economic Survey, 2011). As such, the effects of reduced precipitation may affect agricultural exports, foreign exchange earnings and ultimately farmers' incomes.

2.3. State and Trends of National Food Security in Kenya

2.3.1. Trends in National Food Security

In the recent years, and especially starting from 2008, the country has been facing severe food insecurity problems. These are depicted by a high proportion of the population having no access to food in the right amounts and quality. Estimates as of 2011 indicate that over ten million people in Kenya are food insecure with majority of them, over 4 million, living on food relief. Households are also incurring huge food bills due to the high food prices (FEWSNET, 2010).

Maize being staple food due to the food preferences is in short supply and most households have limited choices of other food stuffs. The annual national consumption stands at 38 million bags against a production of 24 million bags. This means there is a deficit of fourteen million bags which should be imported. The shortfall in production is highlighted by the fact that 75 percent of the total maize production in the country is done by small scale farmers, who produce on average 8 bags per acre. The large-scale farmers make up the other 25 percent producing, on average, 18-20 bags per acre.

The current food insecurity problems are attributed to several factors, including the frequent droughts in most parts of the country, high costs of domestic food production due to high costs of inputs especially fertilisers, displacement of a large number of farmers in the high potential agricultural areas following the post-election violence which occurred in early 2008, high global food prices and low

purchasing power for a large proportion of the population due to high level of poverty and regional disparity in production with a failure to redistribute food from high surplus to deficit problems (Otieno, 2011).

Furthermore, climate-related factors such as droughts, floods and seasonal variability coupled with land fragmentation and lack of strategic planning on the part of government are to blame. Twenty years ago, Kenya's population was around 25 million, the population today is almost double at slightly over 40 million people. Otieno (2011) also cites regional disparities in production and infrastructural differences where a bumper harvest in one surplus region and famine in another deficit region largely occasioned by poor physical infrastructure offers disincentives to traders to distribute the staples. These governance issues, infrastructure, both physical and soft, insecurity of goods while on transit, lack of storage facilities and lack of agricultural insurance facilities, have made the situation much worse.

Most farmers do not have the knowledge of proper post-harvest handling techniques which has led to cases of contamination of staple foods and huge post-harvest losses. The poor prices offered to farmers for their produce has made farming unattractive to the youth, who prefer moving to the urban centres to look for formal employment, thus creating a big gap and driving by the average age of a Kenyan farmer to 58-60 years.

2.3.2. Trends in Food Production

Trends in food production indicate that over the years there has been a considerable decrease in per capita food production. Table 6 shows that the aggregate measures of the country's food security (that is per capita food production, self-sufficiency ratio, ratio of food imports to agricultural exports and ratio of imports to total exports) have generally worsened since 1993 (post-liberalisation period). During the pre-liberalisation period (before 1993-1994), Kenya generally had a higher food self-sufficiency ratio

Table 4: Trends in National Food Security Indicators (1992-2011)

Year	Per capita food production (Kg/yr)	Food self sufficiency ratio	Cereal self sufficiency ratio	Ratio of food imports to agricultural exports	Ratio of food import to total exports
1992	626.42	0.98	0.91	0.21	0.16
1993	604.90	0.96	0.81	0.11	0.08
1994	615.45	1.00	1.00	0.29	0.19
1995	624.17	0.97	0.88	0.09	0.06
1996	602.93	0.94	o.71	0.14	0.09
1997	582.15	0.93	0.71	0.28	0.19
1998	612.41	0.95	0.76	0.22	0.15
1999	616.92	0.93	0.69	0.15	0.11
2000	561.69	0.91	0.65	0.18	0.15
2001	579.72	0.93	0.78	0.41	0.22
2002	569.88	0.91	0.71	0.20	0.11
2003	572.76	0.92	0.73	0.22	0.13
2004	581.98	0.93	0.79	0.37	0.21
2005	566.21	0.91	0.66	0.34	0.20
2006	560.76	0.90	0.67	0.33	0.19
2007	558.30	0.88	0.64	0.39	0.24
2008	554.78	0.87	0.60	0.42	0.29
2009	550.12	0.85	0.59	0.49	0.27
2010	549.78	0.82	0.57	0.48	0.25
2011	547.30	0.80	0.56	0.48	0.25

Source: FAOSTAT, Statistical Abstracts, various issues

(>0.96) than during the post-liberalisation period (when the ratio has generally been less than 0.95). Cereal self-sufficiency has deteriorated from 0.95 in 1990 to 0.71 in 2002, and currently stands at 0.57 which is very low. Food imports have therefore become an important component of food security.

From table 6, it is evident that Kenya is a net importer of food. The biggest deficit in absolute terms has been in coarse grains such as maize, millet, rice and wheat which are the leading staple foods in the country. However, not all the imports are likely to be met from official sources, there exists substantial informal cross-border trade between the neighbouring countries (Uganda and Tanzania in particular), especially in maize.

By 2003, the country relied more on imports to meet the food needs and used about 25 percent of the value of agricultural exports and 14 percent of the total value of exports to import food. Food imports do not necessarily help the poor, when it comes to household food security considerations, because the poor may not have the resources to enable them access/buy imported food. The communities in arid and semi-arid lands of the country are particularly vulnerable to food insecurity because of the recurring natural disasters of drought, livestock diseases, animal and crop pests, and limited access to appropriate technologies, information, credit and financial services (Nyangito *H. Nzuma J. And Odhiambo W.*, 2004). As such, these communities have continued to rely on food aid.

Kenya's dependency on food aid has continued to rise over the years and is observed to have high peaks in 1993, 2001 and 2007, largely due to drought in those years (Otieno, 2011). Prior to 1992, that is the period before market liberalisation, Kenya was not receiving emergency food aid, and generally the total levels of food aid received were lower. Some experts in the Ministry of Agriculture attribute this phenomenon to liberalisation of markets, especially in the year 1991-1992 which led to removal of subsidies to farmers, high costs of production and subsequent unstable markets and prices coupled with drought that led to food insufficiency.[10] Since then, Kenya has continued to depend on food aid.

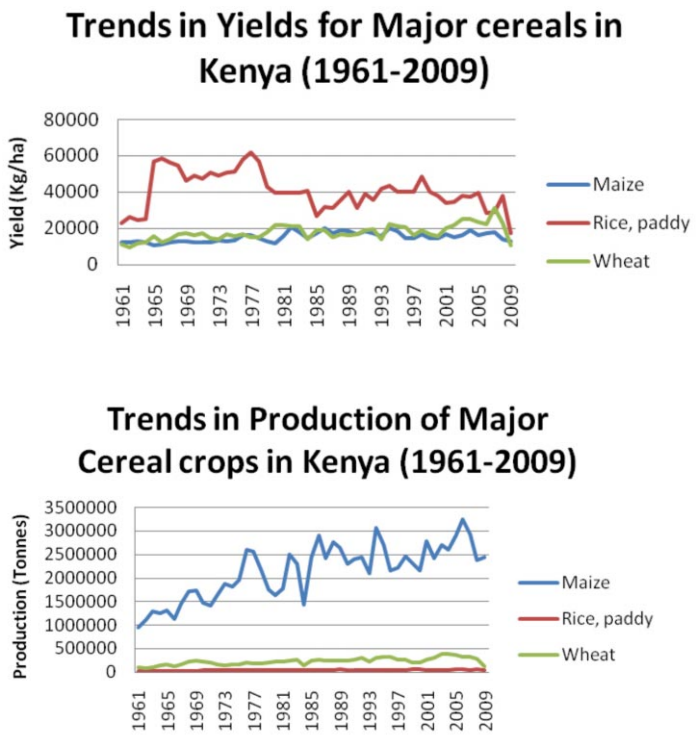
As of the year 2009, the World Food Programme was feeding a total of 4.2 million people in Kenya because of drought, including 3.1 million people who received monthly rations and over 1 million children who were given school meals through the school feeding programme. In some areas, such as Marsabit and Turkana, households relied on relief food for 60 percent of their needs. The worst food crisis was witnessed in July 2011 which caused a number of deaths in the arid and semi-arid lands. This food crisis saw a total of seven million people receive food aid.

2.3.3. Contributions of Various Food Supply Sources to National Food Security

Maize is the main staple food in the country. The annual national consumption stands at 38 million bags against a production of 24 million bags in the year 2010-2011. This means Kenya had a deficit of 14 million bags which had to be imported. Other cereal crops which are of great importance to food security are wheat and rice. Productivity of these grains has not increased significantly since independence with an increasing population, there is always a deficit which makes Kenya a net food importer. Figure 6a shows that productivity in terms of yields in kg/ha has not increased over the years. In the past this was attributed to the slow adoption of new production technologies and the failure to adopt the green revolution. Figure 6b shows that production has remained fairly constant for wheat and rice, indicating that the area under production for these two crops has not increased significantly, however for maize, the production has increased steadily over the years.

Maize production increased from 2.4 million tonnes in 2002 to 3.2 million tonnes in 2006, and this reduced to 2.9 million tonnes in 2007. Maize production was affected by the post-election violence in 2008, which led to a drop in production by about 7.8 percent and a marginal increase by 3.2 percent in the year 2009/2010 (Figure 6b). Wheat production has declined gradually over the years dropping from 4.1

Figure 6 (a) and (b): Trends in Productivity and Production of Major Cereals in Kenya, 1961-2009



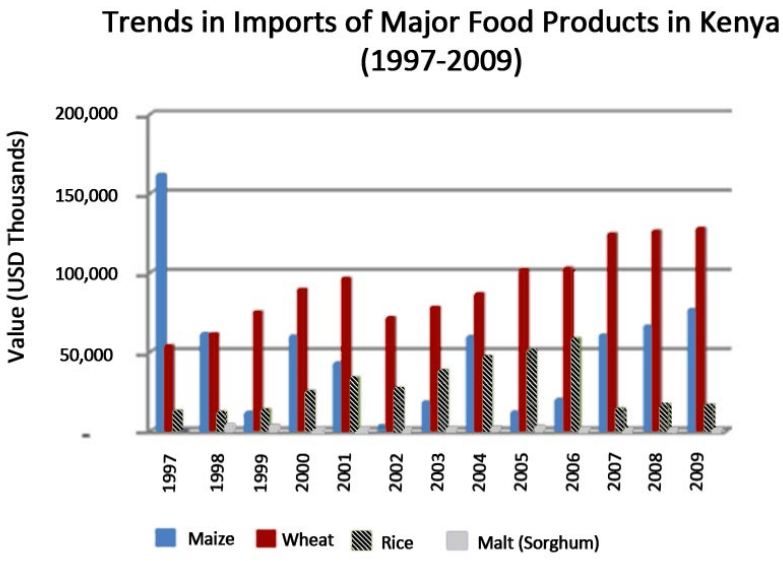
Source: FAOSTAT database

million bags in 2005 to as low as 2.4 million bags in 2009 attributed to climatic conditions, unpredictable producer prices and high input prices. The production of rice almost doubles from 437,628 bags in 2006 to 844,036 bags in 2007 due to a 30 percent increase in the area under cultivation, but this saw a drop in production levels in 2009/2010 due to climatic conditions as well (Economic Surveys, various issues).

As such, the country has had to import key grains to supplement the local production which has been hampered by, among other factors; adverse weather, high production costs, poor producer prices and crop failure owing to diseases. The country has had to import rice largely from Pakistan, Thailand, China, India and Vietnam to help meet the local production deficit. Other grains imported include unmilled wheat, unmilled maize and wheat flour. These imports are mainly from the US and Australia. However, maize imports are largely from EAC and COMESA regions. Figure 7 gives trends in imports of major cereals in the period 1997-2010. From the figure, imports of wheat have continued to surpass those of other grains over the years. Imports of maize, on the other hand, have been fluctuating and were highest in the years 1997, 2000-2001 and in 2007 and 2010 which can be attributed to drought and poor weather conditions. Rice imports have been increasing over the years mainly because of lower production and the closure/collapse of many rice irrigation schemes such as Ahero and rising demand for consumption of rice.

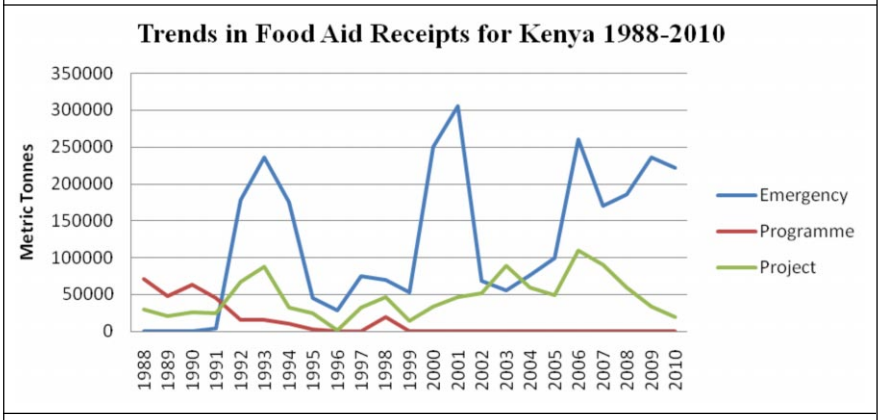
With increasingly poor people in marginalised areas such as ASALs, the implication is that many people are not able to afford food even when available. This has led to a reliance on food aid which had been increasing over the years and has now become the norm (Figure 8). Kenya's dependency on food

Figure 7: Trends in Imports of Major Grains, 1997-2009



Source: Economic Surveys, various issues

Figure 8: Trends in Food Aid Receipts for Kenya



Source: WFP Database

aid has continued to rise over the years and is observed to have high peaks in 1993, 2001 and 2007, 2010 and 2011 largely due to drought in those years.

2.3.4. Determinants of Food Security for Various Subgroups

According to FAO (2003), food security encompasses access to sufficient, safe and nutritious food to meet dietary needs for an active and healthy life. As poverty levels rise, households' food insecurity rises in the same proportions. Families with financial resources rarely suffer chronic food insecurity, while poor families often suffer chronic hunger and are the most vulnerable during times of crisis such as droughts (FAO, 2003). The main determinants of food security at the household and individual level are therefore generally related to issues that impact on availability of food (production, productivity and proximity to markets) and access to food (availability in markets and the power to purchase food). Food security of a population can also be determined by economic risks that might affect the population's purchasing power such as rising food prices, market distortions and labour market development; and other risks affecting food production such as natural disasters, climate change and variability, wars and conflict and pests and diseases.

The way a household copes with and withstands economic shocks depends on the options available in terms of capabilities, assets (including both material and social resources) and activities, that is on the household livelihood strategy (1996; Ellis, 1998)[11]. This is important both from a positive and normative viewpoint. In fact, households belonging to different socio-economic groups have different strategies to earn their own living which, in turn, may ensure different levels of resilience to food insecurity. As a result, households belonging to different socio-economic groups (for example, a farmer's household vs. a household whose main income source is public sector employment) require different interventions.

In Kenya, the determinants of food security takes two main dimensions: poverty and incomes related to type of livelihoods; and regional and agro-ecological zones related to different climatic conditions and vulnerabilities.

a) Poverty, Incomes and Livelihoods as a Determinant of Food Security in Kenya

According to a study by Allinovi L., D'Errico M., Mane E, & Romano D.(2010),[12] the Kenyan population can be broken down into six different livelihood strategy groups: pastoralists, agro-pastoralists, small holder farmers, large-holder farmers, entrepreneurs and wage employees.

Agro-pastoralists largely depend on both crop and livestock, as expected, urban households are relatively poorly represented, they are to be found in areas across Nyanza, Rift Valley, Western province, Eastern and North Eastern provinces. Within this cluster; the mean Total Land Units (TLU) is 5.62 ha and the mean owned land is 3.20 ha; the share of people whose income from livestock exceeds 50 percent of total income is 12.8 percent.

Small-holder farmers earn their own livelihood mainly from farming, they own farming land less than 2 ha each (mean equal to 1.03 ha); mean

TLU is equal to 1.23; and more than 87 percent of the cluster is made by rural households who are concentrated in areas around Central province, Western, Nyanza, Rift Valley and Eastern provinces. They heavily depend on rain-fed agriculture and produce mostly for subsistence. They sell their surpluses in the markets and are vulnerable to vagaries of weather, pests and diseases. They are also relatively food secure but are at risk in times of drought and natural disasters. They are net buyers, they sell what they produce and later go back to the market and buy at higher prices for their household consumption.

Large-holder farmers earn their own livelihood mostly from farming as a commercial enterprise, owning not less than 2 ha each of farming land (mean equal to 10.02 ha); mean TLU is equal to 3.34 and more than 91 percent of the cluster is made by of rural households. They are relatively food secure as they earn relatively higher incomes and some of them are able to meet their subsistence food needs. Even in times of drought, they can be able to purchase their food requirements.

Entrepreneurs are households that who earn almost 60 percent of their total income from self-employment activities, mainly commerce; owned TLU and land are negligible and the amount of received transfers are on average smaller than in other clusters. Their average income is the highest across the surveyed population (Ksh 119,454) and they are the most food secure as they purchase their food needs.

Finally, wage employees are mostly urban households employed in the service sector, and earn the second-highest income (Ksh 109,612); they have the lowest mean livestock and land per household (0.39 TLU and 0.11 ha, respectively). However, they also exhibit high inequalities ranging from high and middle class urban households with a higher purchasing power (and relatively food secure) to the urban poor households living in slums and who are relatively food insecure.

Table 7: Proportion of Income from Various Sources by Livelihood in 2010

Livelihood	Characteristics	Source of Income		
		Crop	Livestock	Off-farm
Pastoral	Low rainfall, poor crop productivity, dependence on livestock, poor access to markets, hence most food insecure and at least 65 percent of food needs are purchased.	5	78	17
Agro-pastoral	Moderate but highly variable rainfall. Over 50 percent of incomes from livestock production and 30 percent from other crops. Food purchases account for about 60 percent of total food needs.	31	50	19
Marginal agricultural	Low erratic rainfall, low productivity and drought prone. At least 30 percent of income is derived from remittances.	41	30	29
High potential (mixed farming)	High rainfall, high population density and small holdings 1-5 acres. Predominantly fruit and vegetable growers for commercial purposes such as horticulture.	50	31	19
High potential (cereal and dairy)	Maize is the predominant crop, highly productive with high rainfall. Considered most food secure with surplus for sale	60	28	12
Urban (casual wages, trading)	Incomes mainly from wages and trade. More than 40 percent of urban households are food insecure. They purchase more than 95 percent of their food needs.	9	10	81

Source: Kenya Food Security Steering Group-KFSSG, 2009

b) Agro-ecological Livelihood Zones and Food Security Dimensions

Kenya's rural livelihoods can be categorised into the following: the pastoral, urban, agro-pastoral, marginal agricultural, high potential mixed farming and the high potential cereal and dairy. Over 80 percent of Kenya's 580,000 km^2 land area falls within the pastoralist, agro-pastoral and marginal agricultural livelihood zones, traditionally the most food insecure zones. Table 7 summarises the main livelihood and economic activities in the different agro-ecological zones and its implications on food security. From the table, it is evident that for most of the livelihood zones, incomes from agriculture alone are not sufficient to meet food needs, hence purchase of food is still predominant. Recent studies (Nyangito H., Nzuma J., and Odhiambo W., 2004) also indicate that the regions where farms are the least significant sources of income are the poorest, and subsequently the most food insecure. This demonstrates the very important role that farm activities play, particularly in providing food and alleviating poverty in Kenya.

Chapter 3

Missing Links, Real Impacts
Interface between Climate Change, Food Security and Trade

The debate on climate change, trade and development remains controversial and this paper is not about to resolve those controversies. However, it remains an important debate, hence many efforts, including this research, are trying to develop literature and facts around it. Focus in this paper is given to the three aspects of development: trade, food security and climate change. This section seeks to build a conceptual framework explaining the multiple series of complex relations of the three variables as both cause and effect of each other. Greater attention, however, is paid to the dual interactions between climate change and trade each as both a cause and effect of the other.

Similar dual interactions are also analysed for climate change and food security as well as for trade and food security. These interactions should be fully understood to enable policy makers address them holistically, if the challenge of food security arising from climate change is to be addressed effectively in the long-run and how trade is to play a critical part of the solution.

So as to understand the contours of this debate, a working definition of food security needs to be founded and its elements disentangled so that avenues through which either trade or climate change will impact food security can be seen clearly. The standard definition of food security which this paper adopts is provided by the UN's Food and Agriculture Organisation. Accordingly, food security is said to exist when all people at all times have physical or economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. Generally, food security is guaranteed by the stability of its three pillars: availability, access and utilisation. Food security involves the availability of good quality, nutritious food from local production or regional and international sources either as imports or food aid. In addition to production, food availability is also ensured through food processing, water management on farms and trade (imports).

With respect to food accessibility, food security involves the physical and economic access to adequate food for an active, healthy life. This is ensured through marketing, transportation, purchasing power, food safety and quality. Finally, food security involves the stability of food supplies (availability), access to that food and the utilisation of the food consumed. Anything that interrupts food supply and access or interferes with the utilisation of food will lead to food insecurity. Therefore, to achieve food security, access to food must be physically available, for example food must be available in the region. But in order to guarantee that a family will have access to it, the food must be economically accessible, which is largely determined by family income. The food supply must also be stable and shortfalls in the months before the next harvest, avoided.

To build this debate into a schematic conceptual framework of the tripartite interactions between the three variables, the paper will commence by analysing the relationships of each pair of the three variables. Thus, in the sub-sections below, analysis is made of the dual relationships between climate change and food security; climate change and trade; and, lastly trade and food security before the three can be put together in a schematic view.

3.1. Climate Change-Food Security Linkages

3.1.1. Climate Change-Food Security Linkages in Kenya: Causes and Impacts

The links between climate change and food security have to date been explored in relation to impacts on crop productivity, hence food production and food security (Gregory, 1999). Food security is concerned not only with food availability but also with access to and utilisation of food, so that studies, which focus only on the interaction between climate change and food production, provide a partial assessment of food security and climate change relationships (Gregory, Ingram and Brklacinch, 2005). Over 75 percent of Kenya's population earn their living from agriculture, which in turn depends on rainfall (UNEP and GoK, 2000).

Due to the vast areas being prone to drought, Kenya's vulnerability to food insecurity is highest among pastoralists and small scale agriculturalists in the Arid and Semi-Arid Lands (ASALs) of the country. Extreme weather and climate change influence the entire economy, which depends majorly on agricultural products like cash crops, food crops and animals (Government of Kenya, 2003).

The recently changing food prices and the issue of climate change have resulted in negative implications for food security in Kenya and the world at large. Over the years, Kenya has experienced environmental degradation due to urbanisation, development and deforestation. This has contributed to climate change as well as food insecurity in some parts of the country. As already mentioned in previous sections, agriculture is the mainstay of the economy in Kenya supporting over 75 percent of the population directly or indirectly. As such, agriculture is highly vulnerable to the increased frequency, severity and unpredictability of extreme weather-related events caused by climate change (droughts, floods and rising sea levels). To the extent that these effects of climate change affect agricultural production, water systems and infrastructure, they have a compounded effect on food security, given the multi-dimensional view of food security.

The average annual temperatures in Kenya increased by 1.0° C between 1960 and 2003 and the country has experienced both prolonged droughts and intense flooding every year since 2000 (Darling, Ingram and Brklacinch, 2010). The country has also experienced an increase in extreme weather events, permanent impacts are also becoming evident (for example the glaciers around Mount Kenya have disappeared), leading to the drying up of river streams in its watershed. Further, observations showed that the sea level rose, on average, at 1 mm per year at Mombasa and Lamu between 1986 and 2004 and climate change has now been shown as the dominant cause of coral loss in the Western Indian Ocean, off Kenya (Darling, Ingram and Brklacinch, 2010).

The UNDP estimates that under current projections, Kenya's average annual temperature will rise by between 1° C (the lowest estimate) and 5° C (the highest estimate) during the next century. This is in comparison to an estimated 2° C rise in global temperatures by 2100. The 5° C increase would mean global temperatures were at levels not seen for more than 30 million years (Stern, 2006.) Up to 2100, rainy seasons in Kenya are likely to remain the same as now (both the short and long seasons), but each rainy season will become wetter, particularly the short rains (October to December). Global climate models predict an increase of 40 percent in rainfall in northern Kenya by the end of the century, whilst a regional model suggests that there may be greater rainfall in the west of the country.

All models show that globally, by 2100, there will be more intense rainfall during the wet seasons. Floods will be more common and severe. This is presently being experienced countrywide. The frequency of droughts is likely to be more severe due to the rise in overall temperatures. This, according to the predictions in the UNDP (2007) report, has caused the reduction in crop volumes and diversity, and impacted on livestock.

As a result of these changes, the country has been experiencing harvest losses and food shortages, a loss of biodiversity, landslides and soil degradation. The range of pests for humans, plants and animals are increasing and a reduction in the number of cold days and nights is also contributing to a wider range of malaria across the country, impacting negatively on the work force that is essential for food production. Diminishing water sources and decreasing and sometimes erratic rainfalls have also reduced the availability of water, a very important element in food production and consequently food security.

Subsequently, our recent survey reveals various effects of climate change on food security elements such as availability, accessibility and stability in Kenya (Table 8).

a) Food Availability

Visits in various parts of the country reveal that due to changing climate, food production has reduced tremendously because of; reduced production and yields; lack of storage and post-harvest preservation; inefficient processing and distribution particularly in the livestock sector; and, limited exchange of food. Various scenarios are presented:

- Persistent drought (in the northern and north eastern areas) has led to deaths of animals and therefore loss of livestock, lower livestock productivity, lack of pasture and subsequent migration of people with their animals.
- Floods in the rift valley and coastal lowlands have led to crop losses, specifically wheat in rift valley, maize and cashew nuts in coastal lowlands which has seen a reduction in yields and loss of livelihoods. Box 1 attempts to show the unprecedented losses that may arise from flooding, especially in arid areas where little rain is expected.
- Frost in the central highlands and parts of the rift valley has resulted in losses of crops, potatoes, maize and horticultural produce thereby impacting on exports.

One positive aspect on food availability has been the emergence of sorghum, millet (including their crop wild relatives) and cassava as important drought-resistant varieties used in mitigation of hunger in areas where there have been increased incidences of drought and seasonal varieties.

b) Food Accessibility

This aspect presented itself in various dimensions, both market and non-market. Due to loss of crops and livestock, livelihoods and incomes have been lost and, as a result, households whose livelihoods depend entirely on agricultural production have sunk deeper into poverty. Their purchasing power eroded nearly completely and they are not able to buy food or produce it. Moreover, the changing climate and changing availability of certain foods led to increased prices. For instance, Kenya's food crisis in July 2011 saw a three-fold increase in basic food items such as maize, sugar, rice and milk, essential commodities which impacted negatively on accessibility of food to rural and urban poor households (News Reports, various).

Food utilisation is mainly affected by availability and accessibility, as seen in most drought-affected areas in the northern parts of the country, low incomes and lack of food (availability) resulted in the inability of households to diversify their diets, those households depending entirely on maize which is donated as food aid had a high tendency of children with malnutrition and increased morbidity among them, which in turn impacted on labour productivity and the ability to work in the farm.

c) Food Stability

Persistent droughts and poverty in the northern parts (ASALs) of the country have meant that these populations are vulnerable to chronic food

Table 8: Causes and Impact of Climate Change on Food Security in Kenya						
Drivers and catalysts	**Consequences**	**Impact on productivity and assets**	**Impact on food system activities and livelihoods**	**Impacts on food security outcomes**	**Livelihoods strategies adopted**	**Suggested mitigation and adaptive responses**
DEMOGRAPHIC • Population pressure • Human activities–deforestation and charcoal burning • Industrialisation and pollution • Migration and encroachment	• Loss of biodiversity and diversified crops, hence low food security • Pollution and destruction of environment • Prolonged drought • Encroachment–human wildlife conflict–Maasai and lions conflict • Human-human conflict in Eastern province • Human and livestock migration in search for water and pasture	• Loss of livelihoods and incomes • Low productivity • Poverty–cyclic with productivity and assets	• Impact on access to food • Impact on food prices • Impact on tourism • Changing farming systems and changing diets	• Low access to food • Stunting and wasting • Low labour productivity	• Reliance on food aid especially in the ASALs • Livelihood diversification such as burning charcoal • Migration of people and animals • Water harvesting for irrigation • Use of drought resistant crops in some areas • Diversification of diets	• Harsher regulation on cutting down trees for charcoal burning • Harsher regulation for polluter of environment • Intensive irrigation and water harnessing technology • Provision of alternative livelihoods through investments in other sectors
TECHNOLOGICAL • Carbon emissions due to industrialisation • Low levels of technology such as water harvesting and irrigation • Low levels of technology for post-harvest and preservation • Poor agricultural practices and low mechanisation	• Environmental degradation and destruction of biodiversity • Changing weather patterns • Prolonged drought and floods • Poor storage and preservation	• Low productivity • Crop losses hence loss of incomes and livelihoods • Migration of people and animals • Human wildlife conflict • Human-human conflict	• Changing farming systems and changing livelihoods • Low productivity • Impact on tourism • Migration and loss of livelihoods • Urbanisation and increase of slums • Increased poverty	• Lack of diversified food basket • Nutrition insecurity due to stunting and wasting in children • Food insecurity • Lack of proper storage and strategic food reserves	• Migration of human and animals to more productive areas • Adoption of other livelihood strategies such as burning charcoal or trade in wildlife skins and parts • Changing farming systems and diversified crop varieties e.g. farming in wetlands • Encroachment in forest reserves and deforestation	• Government to provide proper legal and regulatory services on emissions and other industrialisation activities • Investment in carbon trading · Investment in technology and mechanisation of agriculture e.g. irrigation and water harvesting, preservation and storage of foods

Contd...

Drivers and catalysts	Consequences	Impact on productivity and assets	Impact on food system activities and livelihoods	Impacts on food security outcomes	Livelihoods strategies adopted	Suggested mitigation and adaptive responses
ECONOMICAL • Poverty • Unemployment and loss of livelihoods • Livelihoods that are not environmental friendly e.g. charcoal burning	• Destruction of biodiversity in search of alternative incomes and livelihoods • Destruction of biodiversity for example through farming of wetlands • Loss of incomes and livelihoods • Poor access and utilisation of food • Low labour productivity	• Low productivity and poor harvests • Low accessibility to nutritious food due to low incomes • Lack of markets for produce especially when people do not have the financial capacity to buy the food	• Poor access to food that is diversified and nutritious • Low labour productivity due to malnutrition and illnesses • Migration and loss of livelihoods • Persistent and cyclic poverty leading to dependence on food aid and/or hand outs	• Low access to food • Stunting and wasting • Low labour productivity • Lack of diversified nutritious diets and malnutrition	• Rural urban migration in search of jobs • Non-farm livelihoods to provide incomes • Encroachment in forests and wetlands • Deforestation and subsequent destruction of environment • Persistent dependence on food aid rations	• A need for policies that directly tackle poverty and unemployment • A need for mitigating measures for areas prone to droughts and floods • A need for a strong strategic grain reserve • Reduction on reliance on food aid • Policies and regulation to tackle environmental degradation through encroachment and human activities
SOCIO-POLITICAL • Inadequate investments in irrigation • Inadequate research into diversified food crops such as drought resistant varieties • Inadequate government intervention on the strategic grain reserves • Inadequate infrastructure • Inadequate policy, legal and regulatory frameworks to address climate change, food security or any mitigating factors • Poor planning • Inequitable access to land	• Low productivity • Loss of biodiversity and environmental degradation • Loss of incomes and livelihoods • Poor national food security and subsequent over reliance on food aid and food imports • Difficulty in achieving food self-sufficiency and subsequent dependence on food imports • High food prices	• Low capacity to buy food, hence affecting access • High food prices • Persistent poverty and food poverty • Poor planning and redistribution of food from surplus to deficit regions	• Persistent food and nutrition insecurity • Persistent poverty and food poverty • Low labour productivity and poor health outcomes • Reliance on wage income which may further deepen on poverty, especially in the agriculture sector	• Persistent food and nutrition insecurity • Persistent poverty and food poverty • Low labour productivity and poor health outcomes • Reliance on wage income which may further deepen poverty especially in the agriculture sector	• Reliance on food aid	• Strengthening investments in irrigation • Land reforms to address poverty and landlessness • Proper legal and regulatory frameworks to address climate change • Proper institutional frameworks to address climate change

insecurity, consequently these populations depend on food aid every year and therefore a long lasting solution is needed to ensure stability of food production and accessibility in those areas.

Furthermore, the spectra of climate change in Kenya, together with other global environmental changes such as water unavailability, reduced land cover, altered nitrogen availability and cycling that are all strongly influenced by human activities, has increased concerns about achieving food security, especially among the poor people and particularly in the developing countries (Gregory, Ingram and Brklacinch, 2005).

3.1.2. Mitigating Climate Change Effects on Food Security: The Case of Narok North and South Districts in Kenya

A project was initiated that extends the successful Farmer Field School (FFS) approach by applying it to address land degradation problems in the ASALs of Kenya in order to link sustainable land management (SLM) to increased agricultural productivity in agro-pastoral and pastoral landscapes. The project works in landscape units in four ASAL districts, Garissa, Kyuso, Mbeere and Narok, that reflect four different land use systems in a changing socio-economic environment.

Box 1: Case Study of the Damages Caused by Unprecedented Floods in Garissa District

Garissa district of North Eastern Kenya covers an area of 1,791.4 km² with an estimated human population of 127,672 persons (as per 2009 population census). The district has three administrative divisions namely Central, Sankuri and Korakora. People in this region are largely pastoralists but they also practice minimal crop agriculture largely dependent on rainfall and minimally on irrigation from the Tana River. The North Eastern region where Garissa is located is categorised as an arid land. According to reports from the Ministry of Agriculture and Livestock, the region receives good rainfall once every 6-7 years. A survey reporting the impact of unprecedented flooding in the district in January 2012 estimated significant damages and loss which small scale farmers in that area had incurred. According to the report, most of the annual crops had been destroyed by floods and very little harvest was expected. A summary of the loss in the three divisions is provided. Note that by the time this survey was undertaken, most of the farms were still affected by floods and a more precise estimate is expected after the floods.

No.	Crop	Acreage/ Units	Value(Ksh) millions
1	Tomatoes	515	184.587
2.	Onions	109	34.472
3.	Capsicum	127	59.576
4.	Mangoes	109.375	8.876
5.	Paw paws	192	31.5
6.	Bananas	293.5	81.948
7.	Water melons	63	71.221
8.	Sweet melon	24.5	1.8
9.	Maize	57	0.695
10.	Hot pepper	15	74.8
11.	Green grams	59.5	3.01
12.	Citrus/Guavas	60	3.6
13.	Sweet potatoes	4.25	0.8
14.	Pump sets submerged	8	0.4
15.	Lost pump sets (Lister two piston)	2	1.6
16	Lost pump sets (Honda)	3	0.24
17.	Pipes and accessories	-	0.6
18	Assorted farm hand tools	-	0.941
19.	Livestock (Cows)	3	0.034
20.	Goats	19	0.038
21.	Donkey carts	41	0.8
22	Bee hives	51	0.314
23	Knapsack sprayer	71	0.5
Grand total Ksh			**669.8915**

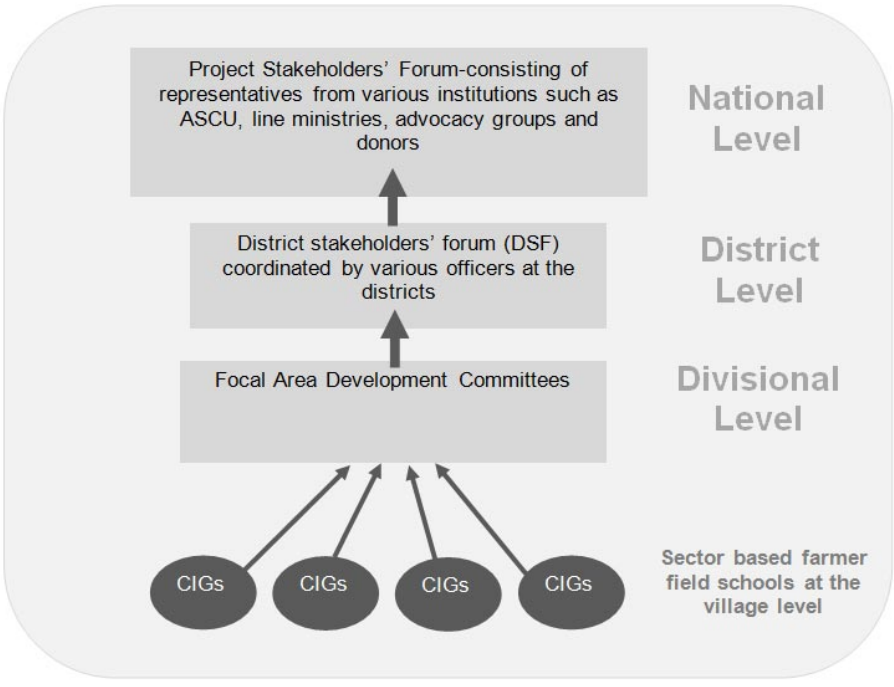
In Narok North and South districts, low productivity is compounded by inadequate application of Sustainable Land Management (SLM) techniques in dry land production, driven by low levels of skills of land users and weak capacity of the extension service. In view of this, the project aims to address the barriers to capacity on sustainable agricultural practices by working in line with the District Focus to Development Policy; each district government in Kenya is responsible for the protection and sustainable management of natural resources within their administrative boundaries. Each district has representatives from the line ministries and environmental agencies that oversee, for example, environmental impact assessments, support to rehabilitation of degraded land and re-afforestation efforts.

The project's objectives include: (i) to ensure that SLM policies, successful practices and innovative mechanisms are mainstreamed into cross-sectoral national and district decision-making processes, targeting agro-pastoral land users; (ii) strengthening capacity, through FFS experiential learning, to apply sound and viable land use management practices among agro-pastoralists in target landscapes and ecosystems; and (iii) strengthening outreach, public awareness, and Organisational and leadership capacities for promoting community based SLM at the landscape level.

Institutions involved include: development partners such as UNDP, but also government line ministries, the ministry in charge is the Ministry of Livestock Development in collaboration with Ministry of Environment and Natural Resources, Ministry of Agriculture, Ministry of Water and Irrigation, Ministry of Development of Northern Kenya and Arid Lands. Other institutions involved include: (i) parastatals including National Environmental Management Agency (NEMA), forestry department, National Irrigation Board (NIB), Water Resources Management Authority (WARMA), Kenya Agricultural Research Institute (KARI), Kenya Strategic Investment Framework, TerrAfrica steering committee and land forum; (ii) advocacy groups such as Pastoral Network of Kenya, Kenya Livestock Producers Association and Kenya Land Alliance; and (iii) community-based organisations, i.e. Farmers organised in their respective sector groups or village-level working groups and they belong to various producer organisations that are linked to the project through the Focal Area Development Committee (FADC).

To achieve the objectives, the project uses a sector-based-community-level approach in which farmers from specific sectors growing similar crops or keeping livestock come together at the village level to form their Common Interest Groups (CIGs). These groups become part of other groups at the divisional level and they conglomerate into a FADC also presented at the

Figure 9: Sustainable Land Management (SLM) Project Approach



district level. These district level FADCs are coordinated by the District Development Officer in conjunction with District Agricultural Officers, District Environmental Officers, District Livestock Officers, District Extension Officers and District Trade Officers (Figure 9) which then report to the Project Steering Committee. This kind of approach has ensured grassroots' participation at the local level, while at the same time tapping into the local knowledge of eco-systems and biodiversity including cultural practices that would help in sustainable agriculture.

Some outcomes for the projects have included:

- Capacity building of farmers through farmer field schools on sustainable land practices–soil conservation, water harvesting and tree planting;
- The introduction of irrigation and water harvesting techniques along Mosonik river in Narok for horticulture farming;
- Diversification of pastoralists livelihoods to include farming;
- Training of farmers on the right animal stocking practices to prevent overstocking and over grazing;
- Through the district stakeholders forum and the FADC, charcoal rules have been introduced and include a centralised kiln for burning charcoal and a regulation of the amounts and frequencies of charcoal burning activities in the two districts;
- The introduction of 10 percent on farm tree planning for every farm whether small or large-scale holdings; and
- Introduction of agro-forestry near the Mau forest.

However, the project has faced several challenges, especially institutional and policy-related. Interviews from various government officers in the two districts pointed out poor enforcement of rules and regulations as an impediment to their work, especially legislation on charcoal burning, as well as the lack of clear policy and regulatory framework on climate change, environment or bio-diversity. They also mentioned the lack of trained staff to handle issues related to climate change, environment and bio-diversity, poor knowledge base of existing staff especially in relation to climate change issues, and poor coordination of concerned ministries.

3.2. Trade and Climate Change

The scientific evidence on climate change and its impact is compelling and continues to evolve. Trade, climate change, and the policies addressing the two areas, interact in many important ways that link climate change to trade. These interactions can be classified into four categories:

- Climate change physically affecting trade (patterns and volume);
- Trade affecting climate change (directly international transport contributes to GHG emissions and indirectly, trade-induced growth affects production and policy priorities); climate change affects various sectors in the economy that are important for trade and foreign exchange, for example agriculture and tourism; climate change affects food availability, production and subsequently food prices which may impact negatively on food imports;
- Climate change policies affect trade; and
- Trade policies as a mechanism to address climate change.

First, biophysical climate change impacts can be expected to alter the productive capacity of countries worldwide. Impacts on agriculture, fisheries, and societies will alter the comparative advantages that determine countries' export specialisations and trade patterns. In addition, an increase in extreme weather events related to climate change threatens the infrastructure necessary for trade. Thus, climate change affects trade and alters trade patterns as countries react, adapt and adjust to the current or potential impacts. Climate change will be particularly serious for the agricultural sector, raising food security and economic development concerns for many countries, especially in the developing world.

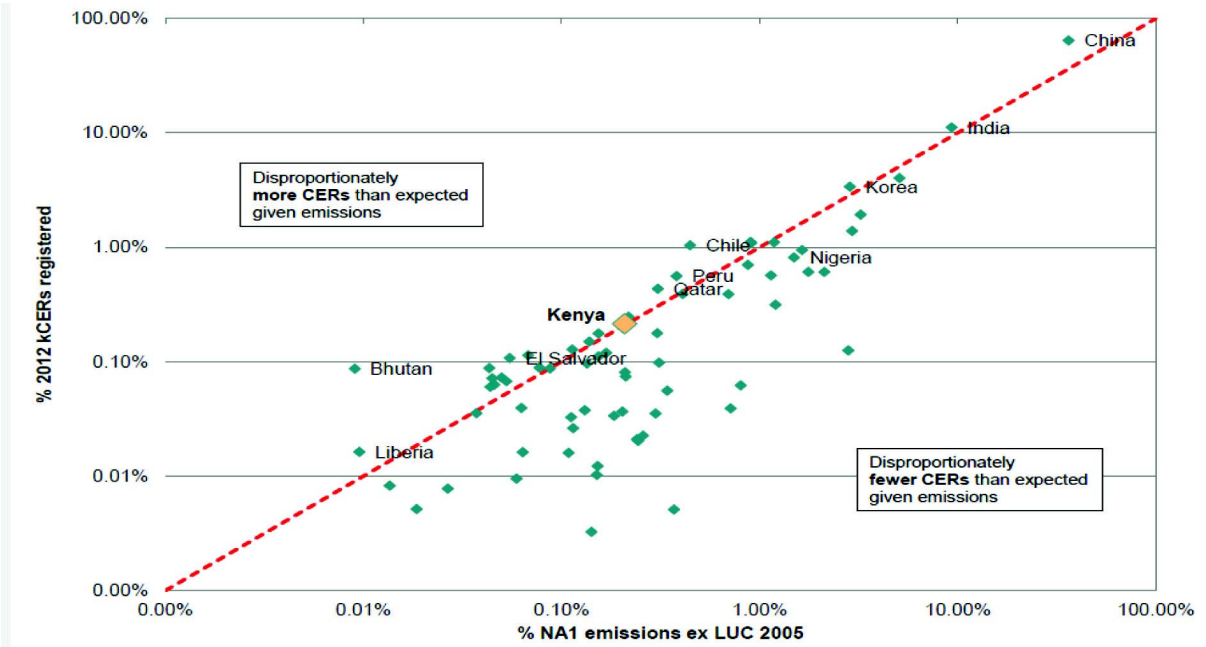
Secondly, trade can directly and indirectly affect climate change. For example, international transport, an essential component in trade, is a

Table 9: Linkages between Climate Change and Trade in Kenya				
Drivers and catalysts	**Consequences**	**Impact on trading systems and income patterns**	**Strategies adopted**	**Suggested mitigation and adaptive responses**
Demographic • Population growth and pressure • Unemployment	• Rural urban migration • Exit from agriculture • Rise in food prices • Rise in insecurity	• Higher demand for goods, hence creation of a market • High food prices impacts negatively on food accessibility and access to food imports	• Food imports • Reliance on food aid • Food diversification	• Subsidised and targeted food for rural poor, vulnerable and urban poor households that cannot afford food • A percentage of strategic grain reserves to be used for providing food to vulnerable groups • Diversified production and consumption. Other foods are good as well
Technological • Growth in manufacturing especially SMEs • Infrastructure • Services sector	• Exit from agriculture • High demand for food • Rise in food prices	• Diversification of livelihoods and incomes • Low productivity in agriculture	• Migration of human and animals	• Government to provide proper legal and regulatory services on emissions and other industrialisation activities • Investment in carbon trading
Economic • Growth of the export sector • New trading opportunities • Trade liberalisation • Growth of manufacturing	• Rise in exports at the expense of food sector • Rise in food prices • Employment creation through trade and expansion of the service sector • Climate change may negatively affect agriculture thereby affecting exports and incomes	• Improved livelihoods and incomes • Climate change effects could negatively affect export sector	• Rural urban migration in search of jobs • Non-farm livelihoods to provide incomes • Encroachment in forests and wetlands • Deforestation and subsequent destruction of environment • Persistent dependence on food aid rations	• A need for policies that directly tackle poverty and unemployment • A need for a strong strategic grain reserve • More budgetary allocation to SGR from the 4 million bags to the suggested 8 million bags and a shift of policy from maize as the only food to other cereals/staples as real food as well
International and regional trade rules and regulations • Trade liberalisation • Domestic taxes • EAC and COMESA common markets • WTOs • EPAs • Carbon trading initiatives	• Better access to cheaper food imports • Opportunities to export and import food from the regions such as Tanzania and Malawi	• Increased cross border trade at an EAC level • Improved livelihoods	• Trade facilitation, especially for movement of goods across borders • Carbon trading initiatives which can be economically exploited for the benefit of the country	• Proper legal and regulatory frameworks to address climate change • Proper institutional frameworks to address climate change and carbon trading initiatives • Capacity building of policy makers and stakeholders on global issues and policies affecting climate change

Box 2: Case Study of Carbon Trading in Kenya

Kenya's relative performance in the international carbon markets to date has been reasonably good in comparison with its partner states. In the Clean Development Mechanism (CDM) market (compliance credits), as of April 2012, seven Kenyan projects had been registered by the CDM Executive Board. As shown in figure 10, when account is taken of Kenya's relatively low level of emissions, this performance looks relatively strong. In addition to the seven registered projects, there is one further project requesting registration and no fewer than eighteen projects at validation. Consistent with this, Carbon Africa[13] estimates that CDM may facilitate project financing of more than US$1.5 bn in Kenya by 2020 with voluntary market activity additional to this. The voluntary carbon market is much smaller (though growing much faster) globally than the CDM, and voluntary market activity in Kenya has also been strong. For instance, Kenya was the first country to have reducing emissions from deforestation and forest degradation (REDD) project issued Verified Carbon Standard (VCS) and Verified Carbon Unit (VCU) certificates (Kasigau corridor).

Figure 10: Kenya has Generated as Many Credits as Might be Expected Given its Emission



Note: As of April 2012

Source UNFCCC, WRI CAIT v. 8.0 and Vivid Economics

However, future market conditions are likely to be much tougher as new Kenyan projects may be cut off from a principal source of demand for international offsets after 2012.[14] Further, as shown in figure 11, the price of Certified Emissions Reduction (CER) has fallen significantly and most market forecasts also suggest that credit prices will remain close to the low levels seen today of around •3-4/tCO2. On the one hand, this makes maximising whatever opportunities are available and designing appropriate institutions to achieve this even more important. On the other hand, it also means that Kenya should be cautious in investing too many resources in trying to access a source of climate finance that is likely to diminish (significantly) in the short to medium term.

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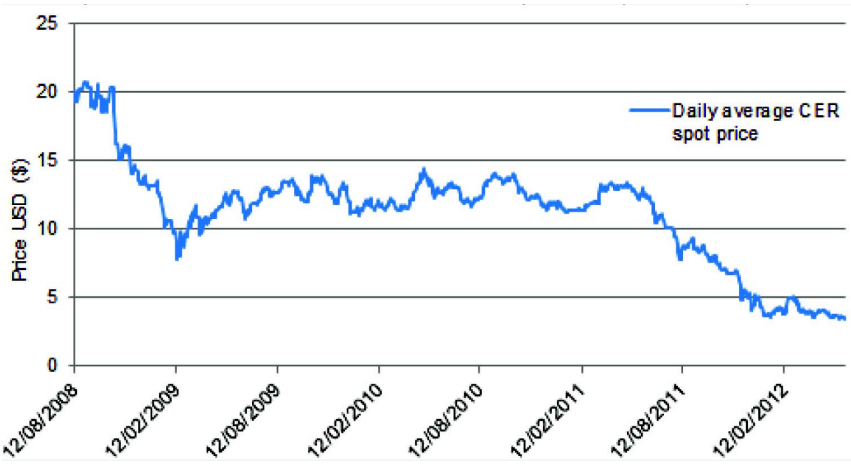
Figure 11: The Price of CERs has Fallen Significantly in Recent Years



Source: Adam Smith International. Kenya Climate Change Action Plan 2012: Financial component.

Kenya's Ministry of Finance has developed the National Policy on Carbon Finance and Emissions Trading (NPCFET) that aims at providing a national policy framework to guide and support carbon inflows and management, clean technologies, and carbon trading in the country so as to allow Kenya to become a competitive carbon finance destination. This policy statement has developed a number of laudable policy goals in terms of, for instance, developing a governance and institutional framework that maximises the opportunities for carbon finance and emissions trading and facilitating the implementation of initiatives to reduce carbon emissions and generate carbon credits through the regulatory and voluntary markets.

direct contributor to GHG emissions; even business as usual in this sector will increase emissions as consumption continues to grow worldwide. Moreover, trade-induced growth, with resulting production and consumption is associated with greater GHG emissions that contribute to climate change. It may be concluded that these dual causal and effect relationships suggest a possible trade-off between supporting more trade and promoting climate change mitigation. However, free trade policies, apart from promoting exports, can also enhance greatly a country's access to green technologies as well as promote trade in environmental goods and services. In addition, at some stage of increased economic growth, populations start to demand better environmental protection. This can constructively alter policy priorities and compel governments to address sustainable development issues. These indirect effects are extremely important, but also very complex and therefore heavily debated.

Thirdly, policies designed to address climate change can affect trade. Examples of such policies are carbon taxes, emissions trading schemes, border carbon adjustments, the allocation of emission allowances free of charge, national promotion of low-carbon technologies and clean energy, technical requirements, standards and labelling schemes, and the regulation of bunker fuels (see Box 2 on Kenya's participation in carbon trading schemes). However, it should be noted that these policies, through their effects on trade, if not appropriately designed, can have negative social and economic consequences for trading partners.

Lastly, and very importantly, trade policies can be used to address climate change, both from an adaptation and a mitigation perspective. For example, the removal of trade barriers with respect to climate-friendly goods and services will make these available at lower prices and stimulate the diffusion of climate-friendly technologies, thereby strengthening the ability of countries to mitigate and adapt to climate

change. In addition, intellectual property rights promote innovation in the transfer of climate-friendly technologies. Table 9 summarises the linkages between climate change and trade.

3.2.1. Carbon Taxes and Emissions Trading Schemes

Mitigation measures designed to put a price on carbon, such as carbon taxes and emissions trading schemes, can alter trade flows if they result in differing carbon costs around the world. These differing carbon costs can distort the competitive positions of emissions-intensive industries between countries. The degree of impact on trade depends on a number of factors: the price of carbon, the degree of competition from firms facing a lower or no carbon cost and the policy actions taken by other countries. These possible effects on competitiveness raise the related environmental concern that production, and thus emissions, will move to regions with no or lower carbon costs, a concept referred to as carbon leakage.

As of June 2012, there were eight registered CDM projects in Kenyan bringing into Kenya hundreds of millions of Kenyan shillings annually. Numerous other projects are at various stages of the registration process.

3.2.2. Border Carbon Adjustments

Border carbon measures are a way of addressing the concerns of competitiveness distortions and carbon leakage. These measures can take the form of either a carbon tax at the border or of an obligation for importers to buy emission allowances. Either way, the goal is to introduce a carbon cost at the border that is equal to the domestic carbon cost. Such adjustments can significantly affect the exports of countries targeted by the measures, thereby altering important sources of income and employment. This is also true for developing countries. There is uncertainty as to whether such border measures are compatible with the World Trade Organization's law. This would, among others, depend on the specific design and implementation of the measures. In addition, these measures raise questions with respect to how the UNFCCC principle of common but differentiated responsibilities (CBDR) would be incorporated.

3.2.3. Allocation of Emissions Allowances Free of Charge

Another way of addressing the competitiveness and carbon leakage concerns arising from an emissions trading scheme, is by allocating a proportion of the emissions allowances free of charge. When inadequately designed, this allocation of allowances free of charge could negatively impact the trade of third parties. In this case, the measure would risk impairing the economic and social development of the third parties. Certain rules related to the free allocation of allowances can render them, economically speaking, into subsidies. Potential adverse effects on trade caused by subsidies to domestic industry could possibly have an impact on all other countries, beyond exports.

3.2.4. National Promotion of Low Carbon Technologies and Clean Energy

Climate change mitigation measures in the form of subsidies and other incentives to support the development and deployment of low carbon technologies and clean energy may distort competition by changing the cost structure of production. As a result, exporting countries' access to the market of the subsidising country may be reduced and exports from the subsidising country may increase, distorting competition also in third countries. Thus, subsidies can affect not only the domestic market of the subsidised entities, but any market they operate in. For other countries, this means that not only their exports but also their domestic sales can face competition from subsidised entities.

3.2.5. Technical Regulations, Standards and Labelling Schemes

Mandatory technical regulations, voluntary standards and labelling schemes can be used to differentiate or filter products on the basis of, at best, their carbon footprint. The fulfilment of the related requirements may have an impact on conditions of competition, and therefore on international trade. On the one hand, consumers may prefer products produced in a climate friendly way in accordance with climate-related

standards or carrying a climate label. On the other hand, regulations, standards, labels and their related conformity assessment procedures may act as a barrier to trade, in particular, when they differ from country to country or from one retailer to another.

3.2.6. Bunker Fuels

The regulation of bunker fuels is crucial for mitigating climate change, not only because maritime and especially aviation transport are major drivers of climate change, but also because the regulation can be an important source of finance for adaptation and mitigation efforts in developing countries. However, such regulations can have impacts on trade, and consequently on the social and economic development of countries. The regulation of bunker fuels would most likely raise the costs of moving goods and people around the globe. Developing countries situated in remote locations, such as Small Island Developing States (SIDS), and developing countries with large trade exposure, would be particularly affected by higher prices. Certain service sectors such as tourism, a crucial source of revenue for many of these countries, would be particularly affected by the costs of emission cuts in the international transport sector.

This study established that Kenyan Government was, through the Climate Change National Action Planning, in the process of developing a climate change financing mechanism that would enable Kenya to take advantage of some of the mentioned linkages.

This process is designed to position the country to access finances from various sources by developing an innovative financial mechanism that includes a climate change fund, an investment strategy or framework, options for scaling up carbon finance as well as initiatives to improve the domestic capacity to absorb climate finance, and a carbon trading framework.

3.3. Food Security and Trade

Trade liberalisation is regarded as a win-win situation where all parties gain from the efficiency and dynamic benefits that come as a result of greater commercial integration. One such illustration involves a case where a country may be reliant on imported food to meet its food security needs such as the case in Kenya. In such a scenario, food availability would increasingly be dependent upon the country's ability to produce and export goods to earn foreign exchange, which in turn would be used to purchase food from the global markets. This process may be greatly facilitated by trade liberalisation through the progressive elimination of trade barriers and enabling access to markets for exported products. In as much as long term welfare gains are expected to result from trade liberalisation, it can also be disastrous to low productive sectors of the domestic economies of low income countries in the short to medium term.

Developing countries which are uncompetitive can experience a sudden surge of imports following reductions in trade barriers. Such surges in food imports can adversely affect the local food production in these countries, and as a consequence, lead to negative impacts on their food security, particularly for the poor populations of their societies.

Moreover, countries that are dependent upon trade for their food supplies rely on the stability of those supplies. Hence, dynamics in the international food prices become key influencing factors. In such cases, liberalised trade regimes could enhance the vulnerability of these domestic markets to the vagaries of global markets. On the other hand, trade liberalisation that promotes international trade can also lead to stronger economic growth, higher employment levels and higher incomes, which eventually may boost households' purchasing power and enhance their capacity to access food.

In many of the developing countries, liberalisation policies have left them both susceptible to import surges and without the tools to cope with them. In Kenya, the liberalisation process was initiated in the early 1990s following the introduction of the Structural Adjustment Programmes (SAPs). This called for the elimination of important

government support systems for farmers and the subsequent decline of the agricultural sector and food production. Liberalisation also called for the opening up of the Kenyan market to cheap food imports, which have led to significant falls in domestic food prices and therefore food production (Nyangito, 1999).

In the Kenyan scenario, many aspects of trade are increasingly shaping the economy as well as livelihoods and food security. This is mainly because close to 70 percent of the Kenyan population relies on the market and is net purchaser of food. This population largely constitutes the urban, pastoral and marginal agricultural households. The unmitigated rise in prices is adversely affecting the poorest, thereby accelerating the decline in their already precarious food security. Skyrocketing food prices have worsened the long term structural problem of widespread poverty and inequalities in rural and high density urban areas of Kenya. This skewed market however, favours the producers and traders, while poor households continue to suffer from the price shocks. Therefore, trade impacts food security, either positively or negatively, in three ways by influencing livelihoods and incomes, food production and availability, and prices.

3.3.1. Trade and the Availability of Food in Kenya

Food security at individual country level does not necessitate the achievement of food production self-sufficiency. In the international arena, however, food security is viewed as a state affair, and discourses tend to concentrate on adequate imported food supplies. As a result, in accordance with individual countries' factor endowments, a more beneficial and perhaps even safer option would be the production and export of high-value crops or manufactured goods, and the purchase of some amount of national staple food requirements from the international markets. Conversely, due to uneven distribution of food within countries, a country may be food self-sufficient at the national level, but also have some segments of its population that are food insecure (Stevens C., Greenhill R., Keenan J. and Devereux s., undated). In Kenya, for instance, a study by Otieno (2011) revealed that this inequality in food security from region to region is worsened by several factors, which include:

- Food prices in the world market making poor developing country farmers less competitive and acting as a disincentive to produce. Rising food prices may mean that even if food is available in the market, many poor households do not have the purchasing power in order to access adequate levels of food;
- Different agro-ecological zones have different levels of agricultural productivity, hence different levels of food security. The drier and more arid areas of Eastern, North Eastern and Coastal provinces are often prone to droughts and experience chronic food insecurity, while the wetter regions of Central and Rift Valley provinces have higher levels of rainfall, higher levels of productivity and therefore tend to be more food secure;
- Poor planning and lack of proper functioning markets have led to failure of produce and grains, especially maize to reach the required markets. This coupled with under developed physical infrastructure and opaque markets, have over time hampered the efforts of traders in terms of staple food distribution from surplus regions to deficit areas;
- Poor infrastructure in the northern areas such as Turkana and Marsabit increase transport and transaction costs for traders making them less profitable markets;
- Failure to provide proper redistributive mechanisms from areas of surplus to areas of deficit and failure to have proper storage and post-harvest preservation to ensure there is enough for the lean season also worsens the food security situation at the national level; and
- Poverty and low incomes diminishes the purchasing power of many individuals, especially the urban and rural poor.

Food accessibility is therefore viewed as physical access or availability of food in markets as well as the ability of countries to purchase food in quantities that are sufficient to meet food

consumption needs of populations (Gilson, 2004). Unfortunately, the ability to buy food is determined both by incomes and food prices.

3.3.2. Affordability of Food: Trade, the Market and Food Prices

Trade and trade-related policies can have a great impact on food prices. Policies which promote subsidies may affect supply and demand for food in the international markets. The fundamental reason for skyrocketing food prices is a growing gap between supply of food and demand for it. Supply of food is affected by rising energy prices operating through energy-intensive supply chains, diversion of grains to bio-fuels production in response to concerns over global warming, drought in key producing countries (and the prospect of future 'climate shocks') and declining productivity in food production (accompanied by decreasing stocks). Demand, on the other hand, is influenced by population growth in Asia, particularly the rapidly growing urban middle classes in China and India who increasingly consume grain-fed meat products. The result has been an abrupt and persistent rise in prices of major grain products in the international markets which perpetually leads to food security challenges, particularly in low income countries (Panagariya, 2002).

The main link between trade, markets and access to food is the level and change of the food prices in comparison with whatever individuals are able to exchange it for. Retail food prices at a point in time and their changes over time are dependent on several factors which include:

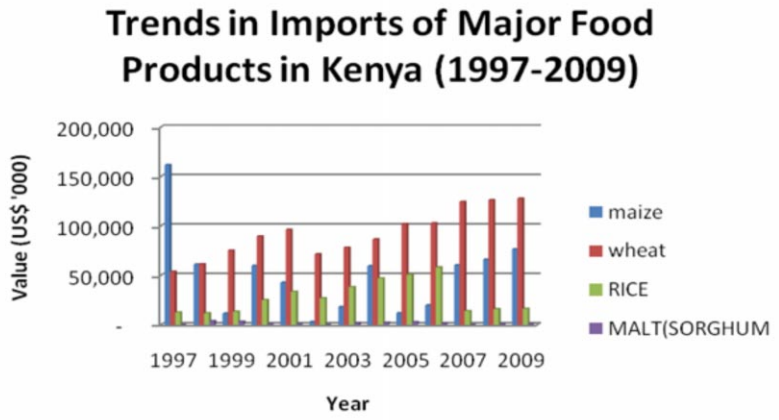
- The total supply of food as determined by production and imports;
- The level of market integration (determined by infrastructure and marketing) that will affect the degree to which variability in production or imports is transmitted into price changes in different areas;
- Government price controls and/or subsidies;
- International supply and demand in cases where food is imported; and
- Transport costs (domestic and international) that will be determined, *inter alia*, by infrastructure and the existence and performance of marketing agents, whether private or public (Stevens C., Greenhill R., Keenan J. and Devereux s., undated; Panagariya, 2002; Otieno, 2011).

3.3.3. Kenya's Increasing Dependence on Food Imports

Kenya's main food crops consist principally of maize, rice, wheat, beans and potatoes, which are the most significant foods in terms of food security. Thus, food trade is centred around the grain market which primarily consists of cereals, that is wheat, rice and most importantly maize, including other grains such as sorghum, millet and beans.The country has had to import key grains to supplement the local production which has been hampered by, among other factors, adverse weather, poor farmer prices and crop failure owing to diseases.

The country has had to import rice largely from Pakistan, Thailand, China, India and Vietnam to help meet the local production deficit. Other grains imported include unmilled wheat, unmilled maize and wheat flour. These imports are mainly from the US and Australia. However, maize imports are largely from EAC and

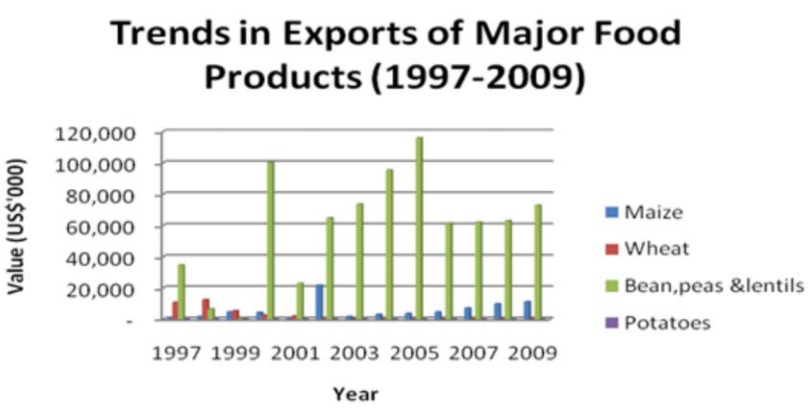
Figure 12: Trends in Kenya's Imports of Major Food Products in US$000 (1997-2009)



Source: FAO database

COMESA regions. Figure 12 gives trends in imports of major cereals in the period 1997-2007. From the figure, imports of wheat have continued to surpass those of other grains over the years. Imports of maize on the other hand, have been fluctuating and were highest in the years 1997; 2000/2001 and in 2007 which can be attributed to drought and poor weather conditions. Rice imports have been increasing over the years mainly because of lower production and increasing demand.

Figure 13: Trends in Kenya's Exports of Major Food Products in US$'000 (1997-2009)



Source: Statistical Abstracts, various issues

Kenya's exports of grains, on the other hand, have been declining even as imports are increasing. This is mainly attributed to drought and poor weather conditions which have continued to persist over the years. From figure 13, Kenya's grain exports have largely consisted of raw maize and wheat products. The period between 1999 and 2001 saw Kenya export less than 50,000 tonnes of maize, with most of the produce being consumed locally. In 2002, Kenya's exports of maize grew but declined again due to drought and food shortages. In the year 2007-2008, the main destination for maize and wheat products exports was southern Sudan, with some of the exports being re-exports as confirmed by officials from the Ministry of Agriculture. Rice is another important grain which is relevant to food security. Kenya has been a net importer of rice mainly from Asia, which is why rice exports are not reflected. Beans and lentils are a major foreign exchange earner, especially in the European Union, hence the relatively high value depicted in figure 13.

3.3.4. The Implications of Trade Policy on National Food Security

As already discussed, trade can have both positive and negative effects on food security. Kenya is a net importer of most food commodities. Furthermore, food availability, security and markets are largely dependent on regional disparities in production determined by substantial variability in agro-climatic, socio-economic, infrastructural, geographic and cultural characteristics. The Rift Valley and Central regions of Kenya enjoy favourable agro-climatic conditions and key primary markets in Kenya are concentrated around these production areas which have surplus. Maize, specifically, moves from surplus to deficit markets. Therefore, deficit markets (largely arid areas and urban centres) source their produce from surplus markets as well as through cross border trade and trade with other EAC countries, especially Uganda and Tanzania.

The past few years have seen an increase in food prices, a phenomenon which was not only global but national and regional as well. Continued high prices in Kenya could be attributed to a combination of factors, including:

- Sustained high level of effective demand in the country, especially in main urban centres;
- Accelerated appreciation of the Kenyan currency in recent years;
- The impacts of increased internal production costs, given the increasing cost of inputs and other production outlays;
- The overall rise in inflation;
- Overwhelming dependence on maize as the key staple for the majority of the population;
- Land fragmentation;
- Poor infrastructure and poor planning; and

- Climate change and related weather variability.

As is evident, Kenya's trade policy was originally based on the need to safeguard local agriculture and domestic manufacturing sector against adverse competition. This trade regime tended to unfairly tax agricultural exports, thus denying the country vital foreign exchange with which it could access food imports (Nyangito, 1999). Even after the trade regime was liberalised, the government has under-invested in infrastructure that could be vital to encouraging cross-border trade in food commodities, which can reduce food insecurity (Ackello-Ogutu *et al*., 1997).

Until recently, the high tariff regime on intra-regional trade reduced the potential of regional trade to help in alleviating food insecurity through food imports from the region. However, with the implementation of both COMESA and EAC agreements, tariffs that originally affected regional trade have been removed, and this will invariably lead to stimulation of imports from the region, a phenomenon which has the advantage of providing cheap food, hence ensuring food security. However, this also has the disadvantage of discouraging local production of food stuff.

Despite the removal of tariffs and the setting up of duty-free quota-free trade both under COMESA and EAC, there still exist numerous Non-Tariff Barriers (NTBs) that hinder trade in the region. These barriers include cumbersome administrative procedures and licensing requirements, cumbersome customs formalities that lead to delays, unnecessary police road blocks that harass traders, and lack of information to exporters and importers. These NTBs invariably raise the costs of doing business which is consequently transferred to the consumer, making the prices of goods higher and less affordable, especially for the poor.

3.3.5 Trade Policy and Food Security: Gaps and Opportunities

From the study, it is also emerging that there are many issues at the national level that have led directly or indirectly to the problem of food security.

First, it is important to note that there are regional disparities in food security, hence leading to areas of plenty against areas of deficit. Poor planning, poor infrastructure and lack of incentives to farmers have created lack of redistributive element for food, especially from the central highlands and rift valley to the ASALs.

Secondly, food aid which has become a habit in the ASALs has also tended to hinder production and has lowered prices acting as a disincentive for redistribution and marketing of produce in those areas.

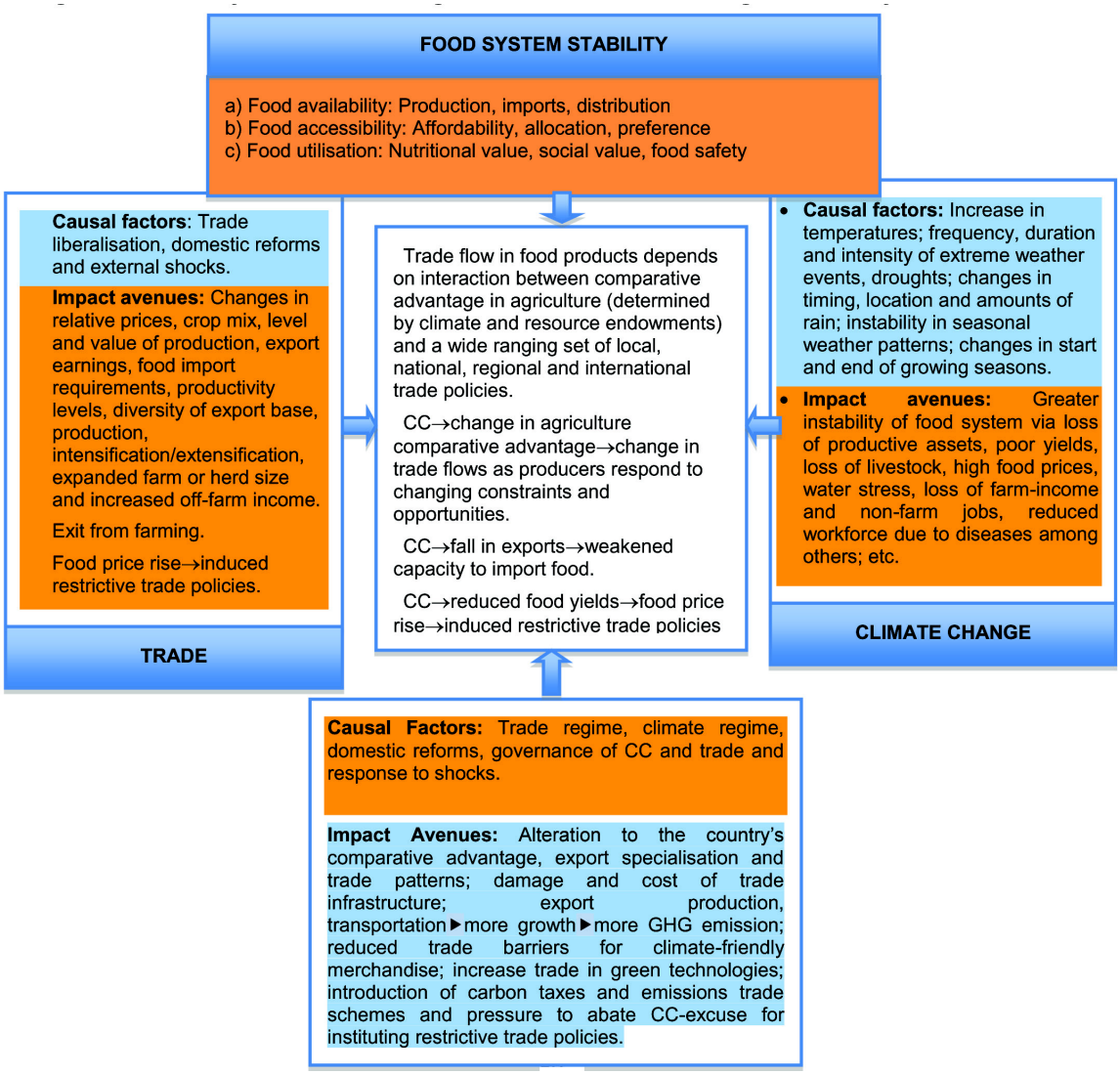
Thirdly, the Kenyan government has continued to liberalise its trade through the SAPs since the 1990s. These reforms have led to the collapse of parts of the agricultural support system and the invasion of the country by cheap imports acting as a disincentive for production. In the past ten years, there has been an intensive pursuit of export-oriented policies which has seen the rise of the horticulture sector, which although successful, has led to a shift from food production to horticulture production. These policies have created imbalances in the food system, leading to higher prices due to lower supply.

Finally, other government policies have also tended to exacerbate the situation. For instance there seems to be a disconnect between trade policies and food security policies, a phenomenon that is clearly evident by the lack of representation of the Ministry of Trade or any other trade-related institution in the policy and round table discussions on food security. This is detrimental as it tends to ignore the fact that food security is highly dependent on imports, which are an integral part of trade. Food and trade policies also do not directly tackle the issue of rural livelihoods.

3.4. Towards and Inclusive Policy and Institutional Framework

From the preceding sub-sections, it is clear that several controversies remain on the linkages between climate change, trade and overall development, which include issues of food security. However, the discussions advanced in

Figure 14: Summary: The Climate Change – Trade Interactions Affecting Food Security



this study can now allow us to have a clearer and better understanding of the sort of interactions (whether positive, negative or neutral) that exist between climate change, trade and food security. Figure 14 presents a schematic framework that summarises the three inter-linkages of climate change-trade-food security. Appropriate policies will be explored in this last section of the paper, after undertaking an overview of the institutional policy framework in the context of Kenya and the external world.

3.4.1. Institutional Frameworks

The main player in food security policy formulation and implementation is the Ministry of Agriculture together with the Kenya Food Security Steering Committee (which has a number of institutions both governmental and non-governmental) whose main aim is to achieve a sustainable national food security. The Ministry of Livestock Development has the responsibility of overseeing sustainable livestock production to ensure food security in the ASALs. Other institutions involved are Kenya Agricultural Research Institute (KARI), which conducts research into various crops, adaptability and drought-resistant varieties that can help achieve food security in the context of a changing climate; and the National Irrigation Board and the Ministry of Water which are concerned with issues related to irrigation and food self-sufficiency in the ASALs.

There are a number of institutions in Kenya currently working on climate change issues. These include government ministries and

institutions such as the Ministry of Environment and Mineral Resources (MEMR), Ministry of Forestry and Wildlife (MoF&W), the National Environmental Management Authority (NEMA), the Climate Change Coordination Unit (CCCU) at the Prime Minister's Office (PMO), and several government parastatals and departments; international Non-Governmental Organisations (NGOs), United Nations (UN) and related bodies; regional NGOs and corporations; national NGOs and Community Based Organisations (CBOs); development partners; the private sector; CSOs; and research and academic institutions. However, the efforts of these organisations towards addressing climate change have so far not been coordinated, leading to and among others, duplication of efforts. Therefore, there is a need to establish a mechanism that would coordinate climate change activities in the country. The just completed National Climate Change Response Strategy (NCCRS) has proposed the creation of a dedicated Climate Change Secretariat at the Ministry of Environment and Mineral Resources to oversee and coordinate the country's climate change activities.

3.4.2. Cross-cutting Aspects of Food Security Policies

A number of policies and institutions, locally and globally, have been developed to look into the linkages between food security, trade and climate change. This is geared towards keeping the food security in the world at balance. In recent years, the government has put in place key policies and strategies that provide the needed thrust in the Agriculture and Rural Development (ARD) sector. These key strategies include the Strategy for Revitalising Agriculture (SRA) 2004-2014 and the Ministry's Strategic Plan (SP) 2006-2010 and now the Vision 2030 strategy as a successor to the Economic Recovery Strategy for Wealth and Employment Creation. Vision 2030 particularly recognises that agriculture will continue to play a crucial role towards the achievement of a sustained GDP growth rate of 10 percent annually. The Ministry will make its contribution through implementation of several flagship projects identified including including the development land master plan, passage of a consolidated agricultural policy reform and legislation, implementation of a three-tiered fertiliser cost reduction programme, emphasis on value addition to agricultural produce in order to increase farmers' incomes.

Among the policies is the maize subsidy and marketing policy that the government adopted as a continuation of the policy on free maize marketing. The government is developing an effective and well-targeted subsidy scheme for the vulnerable. This scheme has been broadened to include the vulnerable groups in urban centres and those scattered in pockets in the high potential rural settings. This is also incorporated in the National Food Security and Nutrition Policy (NFNP) which highlights the nutritional effects on a population primarily fed on maize and advocates diversification of eating habits. This emphasises the need for increased efforts to produce more of the other food crops in addition to cereals, which are more resistant to climate change.

In the Kenyan food policy scene, food security strategies have been geared towards the attainment of self-sufficiency: feed the nation from local production; attain self-sufficiency in each region; limited consideration to the urban poor and rural landless; grain importation and trade taken negatively; and food security synonymous with maize security. This is being supported by the objectives in Economic Recovery Strategy (ERS) and the Strategy for Revitalisation of Agriculture which includes raising household incomes, creating wealth and employment, reducing poverty by half by 2015 or reducing the number of poor and hungry people, ensuring food and nutritional security, and increasing access to markets.

Further, the country has been formulating a number of trade policies which have impacted on food security. Trade policies hurt the low income households who are net grain importers, thereby undermining policies to reduce poverty and increase food security. Raising grain prices through market intervention, restriction of trade or negotiations for safeguard implies transfer of income from rural and urban households to a

small proportion of prosperous large-scale farmers, undermining the policy of raising incomes, and improving income distribution. Interventions on the market could have contributed to price stabilisation which is consistent with the food security policies. Staple price distortion policies interfere with domestic and regional markets, thereby reducing access to markets by local producers.

3.4.3. Cross-cutting Aspects of Climate Change Policies

Globally, the UNFCCC and the Kyoto Protocol stand out as the most active body and policy respectively, towards the issues of climate change, food security, and trade. International policy conditions also have an important impact on food production, hence food security, especially for the marginal rural smallholder farmer communities and those of pastoralists and fisher folk. As international policies set binding conditions for national policies, it is the combination of national and international policy frameworks, along with local situations, that together play a crucial role for the situation of these groups.

The only policy in the country that has significant climate change provisions is the yet-to-be-approved draft National Environmental Policy. Even then, the policy cannot be said to have strong provisions on climate change adaptation and mitigation. Its main and probably the strongest provision is a proposal that Kenya develops a climate change response strategy. This has since been implemented.

The other environmental policies are equally weak (the energy policy, the forest policy and the ASAL policy) as they lean towards environmental management, yet climate change is a concern that is beyond environmental management. Although the formulation of the National Climate Change Response Strategy is a positive step towards addressing climate change, there is need for strong policies that address mitigation and adaptation, giving guidelines on various institutional frameworks required. Furthermore, the Climate Change Authority Bill has gone through the second reading in the Parliament. The mitigation and adaptation issues have been raised in conjunction with climate change related laws–a first of its kind in the African continent. Once this bill is passed into law, it will guide the implementation of the Climate Change Response Strategy which has already been prepared by the Ministry of Environment.

In response to these issues, a policy on food security by FAO takes a 'twin-track approach' for fighting hunger. It combines sustainable agricultural and rural development with targeted programmes for enhancing direct access to food for the most needy.

The first track addresses recovery measures for establishing resilient food systems. Factors that affect food system resilience include the structure of the food economy as a whole, as well as its components such as agricultural production, technology, the diversification of food processing, markets and consumption.

The second track assesses the options for providing support to vulnerable groups. Vulnerability analysis offers a forward-looking way of understanding food security dynamics, calling for explicit attention to risk and the options for managing it. Both tracks are intended to be mutually reinforcing, and the positive interaction between them should reinforce the path to recovery.[15] For example, managing risks goes beyond assisting those affected by a particular shock in addressing their immediate food needs. A range of options are available for addressing long term food security, through sustainable agricultural and rural development aimed at preventing or mitigating risk.

Drawing on the twin-track conceptual framework, the following principles underline the overall policy of FAO (Stamoulis and Zezza, 2003):

- Focusing on food security to ensure that food security objectives are incorporated into national poverty reduction strategies which consider impacts at the national, sub-national, household and individual

levels, and have a particular emphasis on reducing hunger and extreme poverty;
- Fostering broad-based sustainable agricultural and rural growth to promote environmentally and socially sustainable agricultural development as a cornerstone for economic growth;
- Addressing the entire rural space so as to look beyond farming to include off-farm income opportunities;
- Addressing the root causes of food insecurity to promote not only productivity growth, but also resource access, land tenure, returns to labour and education;
- Addressing the urban dimensions of food insecurity to address the unique factors behind increasing urban poverty and improving food security in terms of availability and access, market development, management of natural resources and access to basic services;
- Addressing cross-cutting issues to take into account national and international policies and issues that affect implementation and impact; and
- Encouraging the participation of all stakeholders in the dialogue leading up to the elaboration of the national strategies to ensure a broad consensus on issues, goals and solutions.

From the foregoing, it is evident that despite the fact that many policies have been formulated to address food security issues directly or through agriculture, the country cannot be said to have made adequate efforts to formulate policies and legislations to address climate change and/or climate-related food security issues. There is a conspicuous absence of policy to address climate change affecting food security and even mitigating factors.

3.4.4. Cross-cutting Aspects of Trade Policy

Trade policy rules have become increasingly binding for many countries since the World Trade Organization (WTO) was created in 1995. Particularly, they not only set the terms for tariffs, but are also signed as agreements that set stringent conditions and regulations for national policies. From food safety and security regulations to geographical indications and intellectual property, from agricultural subsidies to price support for basic staple foods, the WTO regulations are still deeply affecting national policy frameworks.

On the other hand, the industrialisation of agriculture policy is contributing to the trend that leads to a consolidation of agricultural land and assets in the hands of big land owners, agribusiness, and other large commercial entities. The most fertile and extensive areas of land remain in the hands of a decreasing number of producers, and in many countries, small-holders are being excluded and forced onto unproductive or potential land (IAASTD, 2008). Moreover, reduced resources and increased poverty force small-holders, in many places, to cultivate the land more intensively and to abandon more environmentally sustainable agricultural methods.

One trade policy tool available to increase the spread of climate-related technologies is the promotion of trade in climate-friendly goods and services. In practice, this involves the elimination of tariffs and non-tariff barriers on environmental goods and services, which include climate-friendly goods. Such reductions in trade barriers could facilitate access to cheaper climate friendly goods and services, contributing to the fight against climate-change. Moreover, trade liberalisation of climate-friendly goods and services would provide incentives to producers to expand production and export of these goods and services, thus increase their availability. With appropriate complementary measures, it could also help increase local capabilities for domestic innovation and adaptation of technology, thereby strengthening the mitigation and adaptation potential.

In general, the global economy is inevitably being affected by climate change. Sectors such as agriculture, forestry, fisheries, tourism and transport infrastructure, which are critical for developing countries, are more specifically affected. These impacts will often have implications for trade. Opening up trade through policies and combating climate change can be

mutually supportive towards a low carbon economy. Trade and trade opening can have a positive impact on emissions of greenhouse gases in a variety of ways, including accelerating the transfer of clean technology and the opportunity for developing economies to adapt the technologies to local circumstances. Rising incomes, linked with trade opening, can also change social dynamics and aspirations with wealthier societies having the opportunity to demand higher environmental standards including greenhouse gas emissions. In addition, more open trade together with actions to combat climate change can catalyse global innovation, including for new products and processes that can stimulate new clean tech businesses.

National policies, from traditional regulatory instruments to economic incentives and financial measures, have been used in a number of countries to reduce greenhouse gas emissions and to increase energy efficiency. In recent years, there has been a proliferation of technical requirements (voluntary standards and labelling) related to climate-friendly goods and energy efficiency. Likewise, financial support programmes for the use of renewable energies have also increased recently. There are extensively two particular types of pricing mechanisms that have been used to reduce greenhouse gas emissions, that is taxes and emissions trading systems and as such, there are also policies aimed at preventing carbon leakage and protecting competitiveness, including on border measures.

Overall, there is a scope under WTO rules for addressing climate change at the national level. However, the relevance of WTO rules to climate change mitigation policies, as well as the implications for trade and the environmental effectiveness of these measures, depends on how these policies are designed and on the specific conditions for implementing them.

Chapter 4

Conclusion and Recommendations

This study has exposed not only the stark realities, but also the complexities underlying the linkages between climate change, food security and trade. Evidence from the study suggests that climate change has and will continue to affect food security in various ways. First, climate change effects of increased temperatures and drought have continued to affect productivity in both crops and livestock; lower productivity has resulted not only in increased food insecurity, but also loss of livelihoods and incomes for many farmers and pastoralists. As a result, increased demand for scarce food has led to an increase in food prices and this has ultimately affected access to food not only in the rural areas, but also for urban poor households.

Recent hunger in the ASALS has also resulted in overdependence on food aid, which suggests that achieving the stability of food supply in these areas remains a tall order. A more worrying phenomenon has been the cyclic drought and floods episode coupled with heavy rains which have caused unprecedented amounts of loss in crops and livestock productivity, thereby weakening food supply and security in these areas. Further evidence from the study suggests that strategies to mitigate these effects have evolved around migration of people with their animals, and sometimes encroachment of people and their livestock into game reserves leading to human-wildlife conflict and human-human conflict, a situation which further exacerbates the food security situation.

There is no doubt that the climate change-trade nexus is even more intriguing. Climate change has affected trade in various ways directly through the effects on various sectors of the economy that are important to trade such as agriculture and exports (tea and horticulture) and tourism (through death of wildlife or human wildlife conflicts). Trade has also affected climate change through greenhouse gas emissions occurring as a result of exports being transported by aeroplanes and as such carbon trading has become a mitigating factor for this problem. Lastly, the rise in food prices has affected food imports by creating a situation where imported food is very expensive and inaccessible.

Trade and climate change continue to affect food security both positively and negatively. Whichever dimension it takes, it can affect food security positively by creating markets for farmers and livestock producers thereby acting as an incentive for more production which would invariably drive down food prices. It can also affect food security negatively, when farmers lose their ability to export or sell surplus in domestic markets because of climate change-induced low productivity, therefore losing their livelihoods and incomes and their ability to cope. Further, many of the linkages between trade and climate change provide possibilities for win-win solutions. Not adequately addressing the linkages could raise important obstacles to reaching an efficient and effective global response to climate change, as well as hamper the opportunities of trade to contribute to sustainable development.

At the policy level, the relationship between trade and food security is not always straightforward and making the right policies can

be problematic. If trade policy reforms that encourage openness improve food security, is it for developed or developing countries? Kenya is increasingly becoming a net importer of food, hence food prices on the international market are important movements that Kenya keeps an eye on as it will directly affect its food security. The review of Kenya's participation in trade liberalisation has revealed, that free trade has led to negative externalities that have affected food production in Kenya. For instance, import surges and food aid have discouraged local food production and increased dependence on external supplies. Yet, removal of trade barriers has promoted Kenya's exports, especially in horticulture, tea and coffee, which improved the country and households' incomes and livelihoods.

Similarly to the difficult policy choices arising from the complex interactions between trade and food security, the inter-linkages between trade and climate change is also not straightforward. Trade-induced economic growth has led to increased production, consumption and transportation. These positive results of growth have led to more GHG emissions and militated against efforts to mitigate climate change. Yet, increasingly, free trade appears to be encouraging more trade in climate-friendly goods and enabling easier access to green technologies.

The importance of addressing climate change issues at present in order to prevent food insecurity in the long run is usually greeted with least seriousness. But this paper has presented vividly how the interaction between trade and climate change can also directly affect food security. One such case is when demands to abate climate change become an excuse to institute restrictive trade policies that have a bearing on food prices on the international markets. These inter-linkages between trade and climate change add a third dimension of challenges for policy makers to consider in this complex framework. A further analysis of the policy and institutional frameworks to address climate change issues in the country reveals that the policy options available are to address environmental issues affecting climate change and are not sufficiently suitable to address the resulting impacts and effects of climate change. For instance, there is lack of policy coherence between climate change and food security policy and even climate change and trade policy. Subsequently, the institutional frameworks in place are not sufficient to address the nexus.

Currently, there is an increasing awareness and concern among stakeholders about the trade and climate change inter-linkages. However, at an international governance level, a natural forum for debating and deepening the understanding of the issues is currently lacking. This is partly due to the lack of clarity as to which agency would be best suited or mandated to provide this. Although trade issues have been touched upon in the UNFCCC negotiations, this has not been done in a systematic way. Other multilateral forums such as the World Trade Organization, World Intellectual Property Organisation, and World Meteorological Organization, mostly differ from UNFCCC and take guidance from there.

Finally, results from the study reveal that even though there is increasing awareness among stakeholders about climate change issues, its inherent linkages and nexus with food security and trade are still not clearly understood by the policy makers, government officials and even district-level government officers and as such, enforcing any climate change policy and legal frameworks will in future prove difficult. Stakeholders do not have relevant understanding and information about the international scene and any international rules that might affect climate change policy, food security policy and even trade policy.

A number of recommendations therefore arise from this study:

- The need for a proper understanding of climate change-food security and trade nexus by concerned stakeholders in various government ministries, policy makers and other concerned stakeholders and this can be achieved through training and capacity building and/or sensitisation

workshops that target both policy and grassroots stakeholders.

- The need for a clear and coherent policy framework on climate change that incorporates food security and trade issues and addresses the international requirements at the national level.
- The need for proper and clear institutional frameworks both at the national and regional level to address climate change and food security, climate change and trade and subsequently trade and food security.
- The need for a joint secretariat of the three ministries, Ministry of Agriculture, Environment and Trade to continuously discuss, address, disseminate and implement issues arising from the three intertwined human concerns.
- The need for a proper dissemination of information in simple and clear manner so that stakeholders at the grassroots, that is farmers and pastoralists, can be able to understand and grasp issues related to climate change and this can be achieved through formation of district focus groups on climate change as is seen in the pilot project on Sustainable Land Management in Narok. This can be replicated in other districts as well.
- There is need for faster, efficient and effective implementation of land use policy in Kenya. Land sizes are becoming uneconomical and use of mechanisation is greatly curtailed and this invites more food insecurity woes. Implementation of enforcing 10 percent land to forest cover is long overdue and effects of climate change continue to bite. Effects of unabated climate change continue to erode gains made in physical infrastructure adding to reduced trade and increased food insecurity in many parts of the country.
- Need for strengthening Kenya Meteorological Department (KMD) to discharge its duties with accuracy and professionalism in order to increase food security, avert human and livestock mortality and generally increase disaster preparedness in the country. Producers have had huge losses as a result of poor prediction of climate, especially the onset and cessation of rains together with predictions on intensity of rains. Stakeholders must be prepared to hold KMD responsible in cases of inaccurate predictions.
- There is need for more budgetary allocation to the Ministry of Environment to address the effects of climate change through adaptation and mitigation, more allocation also to Ministry of Agriculture for increased food production and elevated levels of National Strategic Grain Reserves for increased trade and food security.

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Glossary

Climate adaptation refers to the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damage, to take advantage of opportunities, or to cope with the consequences. The Inter-governmental Panel on Climate Change (IPCC) defines adaptation as the adjustment in natural or human systems to a new or changing environment. It may also refer to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

Climate change is a phrase used to signify alterations in the Earth's pattern of weather, meaning the averages, the extremes, the timing, the spatial distribution not only of hot and cold, but also of cloudy and clear, humid and dry, drizzles and downpours, snowfall, snow pack, snowmelt, blizzards, tornados and typhoons.[16]

Climate mitigation is any action taken to permanently eliminate or reduce the long term risk and hazards of climate change to human life and property. The IPCC defines mitigation as an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases.

Food security is the availability, accessibility and stability of food. It exists when all people at all times have physical or economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. To achieve food security, all four of its components must be adequate. These are: availability, stability, accessibility and utilisation[17].

Trade is the transfer of ownership of goods and services from one person or entity to another by getting something in exchange from the buyer. Trade is sometimes loosely called commerce or financial transaction or barter. A network that allows trade is called a market. The original form of trade was barter, the direct exchange of goods and services. Later one side of the barter had the metals, precious metals (poles, coins), bill and paper money.

UNFCCC: United Nations Framework Convention on Climate Change is the international agreement for action on climate change and was drawn up in 1992. A framework was agreed for action aimed at stabilising atmospheric concentrations for greenhouse gases. The UNFCCC entered into force on March 1994 and currently has 192 signatory parties. The UNFCCC in turn agreed to the Kyoto Protocol in 1997 to implement emission reductions in industrialised countries up to 2012.

Verified Emissions Reductions or Voluntary Emissions Reductions (VER) refer to the emerging market for carbon credits outside the Kyoto Protocol compliance regime. The voluntary market may at present be smaller and less liquid than the compliance market, however, general market opinion is that the wider scope of the voluntary market, and growth led by the private sector, not public policy, means that it has a strong potential to outstrip the mature market size of the compliance regime.

Endnotes

1. Famine Early Warning Systems Network (FEWSNET, 2012) Kenya Food security outlook
2. United Nations Framework Convention on Climate Change, 1992
3. Greater warming at the poles with less warming at the equator and mid-latitudes.
4. Hot day or hot night is defined by the temperature exceeding 10 % of days or nights in current climate of that region and season.
5. Cold days or cold nights is defined as the temperature below which 10 % of days or nights are recorded in current climate of that region or season.
6. A heavy event is defined as a daily rainfall total which exceeds the threshold that is exceeded on 5percent of rainy days in the current climate of that region and season.
7. Obtained from AfDB report http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Kenya%20Case%20Study_final.pdf, pp 24.
8. *www.**ceepa**.co.za/docs/POLICY%20NOTE%2012.pdf*
9. Onjala J. And Otieno G. (2010): Exports Supply response Capacity Constraints in Kenya: A synthesis of Horticulture and Livestock Products, an African Economic Research Consortium Collaborative Research Project
10. Based on stakeholder interviews.
11. Ellis, F. (1998) 'Survey article: Household strategies and rural livelihood diversification'. The Journal of Development Studies. Vol.35, No.1, pp.1–38.
12. Allinovi L., D'Errico M., Mane E, & Romano D. (2010) Livelihoods Strategies and Household Resilience to Food Insecurity: An Empirical Analysis to Kenya
13. Carbon Africa Limited is a company based in Africa that develops carbon projects that are meant to generate real and verifiable emission reductions for the compliance and voluntary markets in Africa.
14. Under Article 11 (a) (4) of Directive 2009/29/EC of the European Union Emissions Trading System (EU ETS) in the event that a project is registered by the CDM Executive Board after 2012, it will only be eligible for compliance purposes in the European Union Emissions Trading System (EU ETS), if it comes from a Least Developed Country (LDC). However, Article 11 (a) 5 also states that 'in the event that the negotiations on an international agreement on climate change are not concluded by 31 December 2009, credits from projects or other emission reducing activities may be used in the Community scheme in accordance with agreements concluded with third countries.' Kenya is no longer a Least Developed Country (LDC).
15. Pingali, Alinovi and Sutton, 2005
16. Holdren, 2008
17. International Conference on Organic Agriculture and Food Security, Rome 03-05 May 2007

PACT EAC Project and CUTS International

In East Africa, where about 40 million people are undernourished, food security is further challenged by extreme weather conditions. In the next decades, the situation is expected to aggravate as climate change worsens in a region were as much as 80 percent of people rely on agriculture for their living. If sub-Saharan Africa is not to become the home of an additional 600 million hungry people, early action and adoption of sound and coherent policies, and harnessing the potential role of trade is a must. From October 2011 to September 2014, with funding support from the Swedish International Development Cooperation Agency (SIDA), CUTS International, Geneva and its partners in each East African Community (EAC) partner state will contribute to this process through a project entitled "Promoting Agriculture-Climate-Trade Linkages in the East African Community" (PACT EAC).

The PACT EAC project focuses on human and institutional capacity building of East African Community (EAC) stakeholders to take better advantage of trade for their food security, growth and development, particularly in the context of climate change. The two-tiered project focuses on issues related to trade-climate change-food security linkages in the EAC and on enhanced participation of the EAC WTO negotiators in the WTO discussions and negotiations in Geneva. Through research-based advocacy, training, networking and by linking grassroots with Geneva, the project is in a position to assist EAC stakeholders in better understanding and dealing with the critical challenges regarding the interlinking of the three issues.

CUTS International, Geneva, as part of the CUTS family of organisations, represents a pro-trade, pro-equity southern NGO voice in the multilateral, regional, and national processes on trade, development and related issues. It aims to contribute to the achievement of development and poverty reduction through trade in its economic, environmental, social and political dimensions. Prior to the PACT EAC project, and in collaboration with CUTS Nairobi and Lusaka offices, CUTS International, Geneva has implemented several projects in the East African Community.

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