CLIMATE, FOOD, TRADE: WHERE IS THE POLICY NEXUS?

LESSONS FROM THE EAST AFRICAN COMMUNITY

CUTS International

ABOUT

The East African Community has experienced climate change through the increasing intensity and frequency of extreme weather events, altering 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 coordinated and holistic representation in the various policies addressing these issues. Yet, in 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 monograph is a synthesis of five country research studies, undertaken by a multi-disciplinary team of experts in Burundi, Kenya, Rwanda, Tanzania, and Uganda. The studies aimed at filling the current knowledge gaps on this three-dimensional relationship and to provide recommendations for more holistic policy responses to the challenge of climate-related - food insecurity, including through trade. To do so, the authors reviewed existing literature and relevant policies in place that address the three issues before embarking on examination of existing and missing links between food security, trade and climate change, this was complimented with field research carried out through interviews of relevant stakeholders at the grassroots level.

The research studies were undertaken as part of CUTS International, Geneva's "Promoting Agriculture-Climate-Trade Linkages in the East African Community" (PACT EAC) project. Regular multi-stakeholder meetings with insights from government, farmer, academia, media and civil society representatives in each Member State anchored the project to the ground realities. The studies inform CUTS networking, training and advocacy activities for a holistic approach on the three issues in the region.

CLIMATE, FOOD, TRADE: WHERE IS THE POLICY NEXUS?

LESSONS FROM THE EAST AFRICAN COMMUNITY

PUBLISHED BY

CUTS International, Geneva
37-39, Rue de Vermont
1202 Geneva, Switzerland
Ph: +41.22.734.6080 | Fax:+41.22.734.3914
Email: geneva@cuts.org | Web: www.cuts-geneva.org

FUNDING SUPPORT

Swedish International Development Cooperation Agency (Sida)
Address: SE-105 25 Stockholm, Sweden
Visiting address: Valhallavägen 199.
Ph: +46 (0)8-698 50 00 | Fax: +46 (0)8-20 88 64.
Email: sida@sida.se | Web: www.sida.se

Cover: IRRI/flickr

TABLE OF CONTENTS

PREFACE

The importance of tackling the negative impacts of climate change on food security cannot be overstated. It is in this context that trade plays a key role in addressing these adverse effects. With this in mind, CUTS international, Geneva, with the funding support of the Swedish International Development Cooperation Agency (SIDA), conceived the project "Promoting Climate Change-Food Security-Trade linkages in the East African Community" (PACT EAC).

The 3-year project was launched on 1 October 2011 and builds on CUTS' previous works in the five East African Community (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 process were addressed.

PACT EAC project sought 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 minimize the negative impact 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 climate change adaptation and mitigation mechanisms through trade.
- In implementing the PACT EAC project, the CUTS' tried and tested holistic RAN (Research-Advocacy-Networking) activities model was applied. The inclusive and grassroots-linked research methodology

and trade. This is in line with the leitmotiv working philosophy of CUTS to

creating sustainable capacities of local researchers for stronger local ownership.

The research process commenced with desktop research, outcomes of which were presented at the National Reference Group (NRG) meetings, which brought together all the relevant stakeholders including policy makers, academics, farmers' representatives, CSOs, media, among others, in all of the five countries. 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 the Regional Annual Meeting- held in Kigali, Rwanda in 2012. The regional meeting brought together both national and regional stakeholders including high level representation of the EAC Secretariat. In addition, the draft research studies were reviewed by members of the PACT EAC Project Advisory Committee, external country reviewers, and CUTS team. These processes are believed to have enriched the content and quality of the research studies; and ensured both national and regional ownership.

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 ineluctable linkages between climate change, food security, and trade.

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

Pradeep S. Mehta

Pradeep S. Mehta
Secretary General
CUTS
Jaipur, India

ACRONYMS

ARDP	Agricultural and Rural Development Policy
ASALs	Arid and Semi-Arid Lands
ASDP	Agricultural Sector Development Programme
CCIO	Climate Change and International Obligations
CC-FS-T	Climate Change, food security and trade
CBD	Convention on Biological Diversity
CDM	Clean Development Mechanisms
COPB	Cereals and Other Produce Boards
CSOs	Civil Society Organisations
EAC	East African Community
EACCCP	East African Community Climate Change Policy
ENSO	El Nińo-Southern Oscillation
EU	European Union
FAO	Food and Agriculture Organisation
GDP	Gross Domestic Product
GHG	Greenhouse Gases
IIDS	Integrated Industrial Development Strategy
KFS	Kenya Forest Service
NAPAs	National Adaptation Programmes of Action
NBSAP	National Biodiversity Strategies and Action Plans
NCCAP	National Action Plan on Climate Change
NCCC	National Climate Change Committee
NCCRS	National Climate Change Response Strategy
NDP	National Development Plan
NGO	Non-Governmental Organisation
NTBs	Non-Tariff Barriers
PACT	Promoting Agriculture, Climate Change and Trade Linkages
REMA	Rwanda Environmental Management Authority
SEU	Stockholm Environment Unit
TALP	Tanzania Agriculture and Livestock Policy
TNBC	Tanzania National Business Council
TPRS	Tanzania Poverty Reduction Strategy
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
UAE	United Arab Emirates

INTRODUCTION

There is no such thing as policymakers with blinders. Holistic policy approach is crucial in addressing various but intertwined issues, instead of adopting an atomistic approach that might lead to contradictory and at times undesirable results. For this reason, awareness promotion on the inter-linkages among issues, based on evidence from the ground, act as removing those blinders. The nexus between climate change, food security and trade may not be evident at first glance; but for regions like the EAC that are already vulnerable to food insecurity, adverse climate changes and unfavourable terms of trade, it is critical to understand the nexus in order to pursue economic growth, development and poverty reduction.

The main objective of the PACT EAC project was, therefore, to assist the region's stakeholders in better understanding and dealing with the critical challenges of climate change, food security and effective participation in the multilateral trading system. Furthermore, through research-based advocacy, training and networking, the project aimed at building the human and institutional capacity in the EAC.

In the EAC the agricultural sector remains to be dominant, albeit with dwindling prominence, by contributing directly to GDP from 21 percent to 34 percent in the concerned countries; while the sector employs 60 percent to 90 percent of the region's population. Despite vast potential for surplus production, the EAC countries remain to be - net food importers, and prone to food insecurity.

The EAC region has witnessed the adverse effects of climate change, through - increasing intensity and frequency of extreme weather, altering agricultural and trade patterns- the two most important sectors that play a crucial role in ensuring food security for millions of East Africans. The complex relation between climate change, trade and food security necessities holistic and coherent policies approach for development and poverty reduction.

The national studies highlight the linkages between trade, food security and climate change and how these affect various socio-economic, institutional and political factors in Burundi, Kenya, Rwanda, Tanzania and Uganda. In line with the objective of the PACT EAC project, the studies aimed at filling the knowledge gap on the three-pronged development challenges of the region by suggesting country-specific recommendations.

SECTION 1

SETTING THE SCENE

CLIMATE CHANGE

In the past three decades, EAC countries have been experiencing major droughts every decade and minor ones every three to four years; however, more recently droughts have been experienced on alternating years. Undesirable weather pattern variability resulting from climate change is expected to continue affecting food production.

In addition, the duration and intensity of seasonal rainfall vary considerably from year to year, depending on variations in the Indian Ocean sea-surface temperatures. One of the most well-documented ocean influences on rainfall in the EAC region is the El Nińo-Southern Oscillation (ENSO), causing episodes of greater than average rainfalls in the short rainfall season. This usually affects adversely agricultural production, infrastructure, trade logistics and transportation.

. Unfavourable climate change impacts have far reaching implications on various livelihood sectors, ecosystems and key economic sectors including agriculture, fisheries, forestry, tourism, livestock, water, energy, health and transport. In the last two decades, reports indicate that there has been increase in malaria resurgence in the East Africa region. Because of the increase in average temperatures, there have also been plant and animal diseases as a result of increase in temperature, leading to huge economic losses to farmers.

Higher temperatures increase the use of energy in typically air conditioned humid places. On the positive side higher temperatures reduce the need for heating and risk of cold related health impacts. However, 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. Higher vulnerability in turn could potentially result into desertification, hunger, mortality risk and even migration and conflict. Water supply could also be affected with implications for agriculture, human settlement, electricity generation and related energy supply ands consumption.

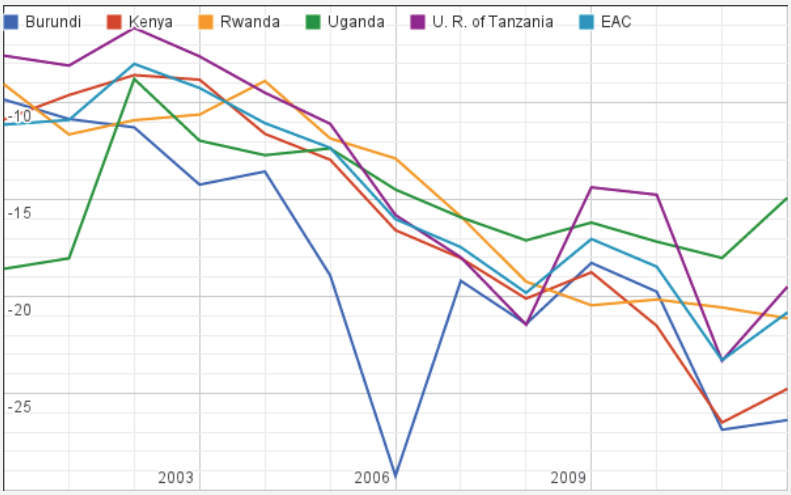
With regard to existing policy framework, EAC countries have taken commendable steps in the policy realm towards ensuring improved environmental sustainability Cognizant of climate change as a development issue, the region has adopted the East African Community Climate Change Policy (EACCCP). Additionally, Kenya, Uganda, and Tanzania are signatories

of the Protocol on Sustainable Development of Lake Victoria Basin. EAC Member States have supplementary policies and programmes to complement their international commitments. Kenya designed its National Climate Change Response Strategy (NCCRS) in 2010 followed by the National Action Plan on Climate Change (NCCAP) (2013-2017) to implement the NCCRS. In Tanzania, the Tanzania Agriculture and Livestock Policy (TALP), Tanzania Poverty Reduction Strategy (TPRS), and Integrated Industrial Development Strategy (IIDS) work in tandem to achieve the goal of sustainable development and food security. Rwanda designed its National Adaptation Programmes of Action (NAPA) in 2006, Climate Change Low Carbon Growth Strategy in 2011, and climate change is component among many different strategies. In Burundi a number of codes have been enacted including in environment, forestry, water, mining, petroleum and health sectors. Burundi designed its NAPA in 2008; National Communication on Climate Change (2010); and the National Agricultural Strategy 2008-2015 that has taken into account the preservation and sustainable management of the environment. Uganda is in the process of finalising its National Climate Change Policy cognizant of the regional framework and efforts to customise them in the national documents. The Uganda NAPA also identified the main human vulnerabilities and livelihood impacts of climate change in 2007. With regard to international commitments, all the five countries are signatories to the United Nations Framework Convention on Climate Change (UNFCCC); National Adaptation Programmes of Action (NAPAs); the Convention on Biological Diversity (CBD); National Biodiversity Strategies and Action Plans (NBSAP); and the United Nations Convention to Combat Desertification (UNCCD).

TRADE

The trade composition of the EAC region indicates that exports are dominated by primary goods, with little or no value addition; while imports are mainly manufactured goods; machinery and transport equipment, all with high value addition. In terms of trade directions, although there is an encouraging trend in intra-regional trade, the countries remain dependent on the West market both as export destination and import origin. -, the EAC countries exhibit trade deficits and for the most part import foodstuff, which is a worrying trend that needs to be addressed, particularly in relation to food security as the countries are net-food importers.

FIGURE 1: TRADE BALANCE IN PERCENTAGE OF GDP



Source: UNCTADstats

As shown in Figure1, all the EAC countries' trade balance were in deficit, during the period of analysis, as high as 19percent to 26 percent of GDP in the concerned countries. During the past decade, the share of EAC's trade deficit doubled, suggesting a deeply anchored problem, perpetuating food dependency and under industrialisation.

Table 1: TRADE PROFILE OF EAC COUNTRIES

	Main Exports	Export destination	Main Imports	Import Sources	Merchandise Trade balance (2012)
Burundi	Highly dependent on trade in agricultural products (for exports and imports). Main exports are primary products: Coffee (77% o); tea, cotton; fruit and vegetables.	U.A Emirates, Switzerland, Kenya, D.R. Congo, Germany , Belgium	Processed and finished products, including food stuff	Italy, Belgium, China, Tanzania, Kenya, Uganda, India, USA EAC	- $650 million
Kenya	Export items dominated by agriculture products (55.5%), including: tea; cut flowers; coffee, petroleum, vegetables. Exports of manufactured products constitute; 32.8%; and 6% of fuels and mining products.	Uganda, United-Kingdom, Tanzania, Netherland, USA, Pakistan, Sudan, Egypt, DRC, Somalia	Manufactured products are the leading import products at 59.2%, followed by fuels and mining products at 22.8% and agricultural products at 13.1% Maize, Wheat Rice (Largest import market for food in the EAC)	China, U.A.E, India, Saudi Arabia, South Africa, USA, United Kingdom, Germany	- $10,163 million
Rwanda	Coffee, tea, minerals,	Switzerland, D.R. Congo, Kenya, Belgium, France, United-Kingdom, Hong-Kong, Sudan	Manufactured goods; chemicals and related products; machinery and transport equipment etc; as well as agricultural commodities.	Uganda, China, Kenya, India, Tanzania, U.A. Emirates, Japan, USA, South Africa, Belgium	-$1,530 million
Tanzania	Minerals (gold, gemstones, diamonds, coal e.t.c.), coffee, cotton, cashew nuts, tea, sisal, tobacco, pyrethrum and cloves. Main imports are machinery and transport equipments, textiles and clothing, petroleum products. Agriculture is about 30% of total exports.	Switzerland, China, South-Africa, Kenya, Congo, Japan, U.A. Emirates. Netherland, Germany, , Burundi	agricultural machinery, implement and pesticides, industrial raw materials, machinery and transportation equipment, petroleum and petroleum products, construction materials, consumer goods (Maize, Rice…)	China, India, Japan, Switzerland, South Africa, Germany, U.A. Emirates, Kenya, Netherland, D.R. Congo	-$3,516 million
Uganda	Coffee, fish and fish products, tea, tobacco, and maize	United-Kingdom, U.A. E, Switzerland, Kenya, Sudan, Netherlands	Machinery and transport equipment, food products, fuels and chemicals; Cereals, Dairy products, vegetables	India, China, Kenya, U.A. Emirates, Japan, South Africa, Saudi Arabia, Indonesia	-$ 5,614 million

Source: www.intracen.com

FOOD SECURITY SNAPSHOTS

BURUNDI

Main cultivated crops: Cassava, potatoes, maize, rice, wheat, sorghum (energy), beans, cow peas, soya, peanuts, palm oil for protein and oil, diverse fruits and vegetable for vitamin and minerals

OPPORTUNITIES

There is high potential for value addition in the case of sunflower, which tends to be highly drought resistant

CHALLENGES

Demographic: very high population growth; youth migration; high pressure on arable land; high proportion of inactive population (41.7%);

Livelihood: 94.3% of the population depends on subsistence agriculture

Climate Change: Torrential rains accompanied by hail storms have been affecting cereals production; recurring droughts, floods and diseases such as severe cassava mosaic;

Socio-Political Crisis: reintegration of war returnees has exacerbated pressure on available resources;

Other: limited access to seeds, fertilisers, and credit; high level of illiteracy; soaring food prices.

KENYA

Main cultivated crops: Horticulture, tea, coffee, and fish

OPPORTUNITIES

Cultivation of sorghum, millet, and cassava are identified as important drought-resistant varieties used for mitigation

CHALLENGES

Kenya is a net food importer, the largest in the EAC. These food imports mostly take the form of coarse grains such as maize, millet, rice, and wheat. The reliance on imports and food aid can be attributed to persistent droughts. Some of the factors exacerbating the state of food insecurity are:

Climate Change: mainly recurring droughts; floods, and seasonal variability coupled with land fragmentation;

Soaring Food Prices: High costs of domestic food production associated with high costs of inputs; and high global food prices;

Political Instability: Following the post-election violence in 2008, a large number of farmers were displaced from the high potential agricultural areas.

RWANDA

Main cultivated crops: Maize, rice, bananas, potatoes, cassava, sorghum, beans, Onions, cabbage, dodo, gourds, eggplants, Coffee, Tea, sugarcane

OPPORTUNITIES

The government adopted the Crop Intensification Programme (CIP) that is believed to have improved access to seeds and fertilizers; as well as consolidated land use, providing extension services, improving post-harvest handling and storage mechanisms. Efficiency gains from CIP have led to 30% increase in production of rice and beans.

CHALLENGES

Low productivity: Mainly due to low use of inputs, low incomes, farmers de-capitalisation.

Food affordability: People with low incomes are more food insecure

TANZANIA

Main cultivated crops: Maize, beans, wheat, vegetables

OPPORTUNITIES

Though agricultural production has stagnated and dwindled in recent years, livestock productivity has actually increased. Additionally, food processing has seen notable improvements after much investment. Thus, other than horticulture/agriculture, Tanzania seems to be headed to the right direction.

CHALLENGES

Structure of Agriculture: Overdependence on rain-fed agriculture; 85% of Tanzania's population depends on maize as an income generating commodity; Livestock is by far the most important asset of a majority of the people" (in Longido district) massai nomads

Institutional: Inadequate extension agents; low R&D spending; lack of farmers education; and inadequate infrastructures

UGANDA

Main cultivated crops: Coffee, cotton, tea, and tobacco; potatoes, cassava, yams, maize, millet, sorghum and legumes

OPPORTUNITIES

In response to food insecurity, the government adopted the following policies:

The National Development Plan (NDP); Food and Nutrition Policy 2003; Food and Nutrition Strategy and Investment Plan 2004; Nutrition Action Plan 2011 to 2016; Agriculture Sector Development Strategy and investment plan 101/11 to 2014/15

CHALLENGES

Malnutrition: the average per capita calorie intake is below the WHO recommended amount.

Demographic: Food production has not matched increasing population; Youth migration to urban areas

Institutional: poor state of infrastructure;

High food prices: associated high production costs and

Climate Change: unpredictable weather variations leading to crop damage.

Low Productivity: due to Poor farming practices resulting in low crop and animal yield.

SECTION 2

MISSING LINKS, REAL IMPACTS

CLIMATE & FOOD: THE LINKAGES

Food security is said to exist when people have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs. 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).

The links between climate change and food security have 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).

Projections made for most developing countries show reductions of about 5 to 10 percent in the yields of major cereal crops. This rate may go up to 50 percent by 2020, with net incomes from crop falling as much as 90 percent by 2080. - World Bank (2008) indicates that in developing countries reduced rainfall or rainfall variations (changes in seasonal timing and intensity) would have direct implications on farmer's income and livelihoods.

Climate change is also reflected in seasonal cycles. Shortened rainy seasons and extended dry seasons are more and more commonly observed, while certain locations are experiencing reduced rainfall and one drought after another.

THE IMPACT OF CLIMATE CHANGE ON FOOD SECURITY

With climate change and increasing climate variability, seasons become more unpredictable and distribution of rainfall unreliable, making it difficult for farmers to plan their farming and marketing activities.

Notably in the last few decades, the EAC region continues to experience the brunt of global climate change manifested through increased food insecurity. The effects are felt by the poor-particularly, smallholder farmers, pastoralists, and fishermen who rely mostly on agriculture for their livelihood. Rainfall has increasingly become less reliable in each passing year, resulting in seasonal planting and harvesting disruptions, leading to huge economic losses to farmers.

For a region- where rain-fed agriculture is the primary source of food and income, erratic rainfall coupled with droughts and floods have had adverse effects that are insurmountable. In each of the five countries, the agricultural sector absorbs the labour force overwhelmingly; in Burundi agricultural employment is 90%; Rwanda 80%; Tanzania 79%; Kenya 75% and in Uganda 60%, indicating that a large proportion of the region's population is directly affected by unpredictable climate and weather.

While the West and countries such as Brazil, Russia, India, China, Indonesia, Mexico and other emerging countries continue to emit more than 80 percent of Greenhouse gases, the EAC region, and Africa as a whole, have been affected significantly and continue to be highly vulnerable to climate change due to the nature of their economies. In the likely event of El Nińo-Southern Oscillation (ENSO) heavy rains and severe floods in the region, millions continue to face food shortage.

Climate change has an even greater impact in the arid and semi-arid lands (ASALs). In Kenya, where 80 percent of the total land surface is identified as ASAL, according to the Stockholm Environment Unit (SEU), the future economic costs of the impacts of climate change on market and non-market sectors might be close to 3 percent of GDP per year by 2030. The other country with large ASAL is Tanzania, which has come to terms with the realities of water scarcity as the wetlands of Vinyungo and Njombe are drying up. It is stated that, before the 1960s, the country had never experienced drought but recent reports indicate food shortage to be one of the major problem.

A further impact of climate change is in exacerbating scarcity of non-renewable natural resources such as land and water. In recent times, exodus of people in search for arable land and water has led to displacement of people and creating social instability, as has been the case in Uganda and Kenya. Drought has reduced the availability of water sources, particularly in the 'cattle corridor' that stretches from the Uganda-Tanzania border to the Karamoja region. Climate change has also been the cause of melting ice caps such as Mount Kilimanjaro's, of which 82 percent has melted since 1912, further exacerbating flooding.

EFFECTS OF FOOD SYSTEMS ON CLIMATE CHANGE

The impact of food systems on climate change in EAC can be summarised as follows (UNFCC, 2012):

- Overexploitation of land due to the high density of the population is linked to the reduction of vegetation and forestry (release of the carbon sequestered by vegetation and forestry); on the other hand, this is also one of the causes of soil erosion (agriculture practice in sloppy hills and mountains where agronomic techniques of soil protection are not applied);
- Crop intensification with use of inorganic fertilisers is linked with the emission of nitrous oxide (NO2) in the atmosphere. This is one of the direct gases which contribute to global warming potential, 310 times more than carbon dioxide (CO2).
- Farming and zero grazing techniques with better manure management is linked with enhanced resilience to climate change and reduced methane (CH4) emissions in atmosphere
- Practice and intensifying of agro-forestry linked with enhanced CO2 sequestration, soil protection and improvement of livelihood (adaptation to climate change).

High population density in EAC has led to overgrazing, soil erosion, deforestation and other environmental problems. While the use of organic farming practices could be less hazardous environmentally, the use of such practices remains underutilized in the EAC region. On the other hand, traditional land clearing practices such as slash and burn practices for the purpose of increasing arable land are common are common in the region. . The approximately 19 million cattle in Tanzania alone are believed to emit large amounts of methane; while the use of fossil fuels for transport, processing, and for power generation contribute to more Green House Gas (GHG) emissions to the atmosphere.

Various coping mechanisms and technologies are available but remain inaccessible to farmers as funding for climate change adaptation mechanisms in the region is limited; where stakeholders, particularly the private sector are largely not involved, either due to lack of sensitization or limited profit prospects.

ADDRESSING FOOD SECURITY CONCERNS IN RESPONSE TO CLIMATE CHANGE

Even with limited available fund, EAC Member States have designed and implemented various grassroots-oriented projects to mitigate the effects of environmental issues on food production. For instance, Kenya implemented the Farmer Field Schools Projects in the ASALs to establish sustainable land management in order to bolster agricultural productivity in the face of negative climate change effects. The project resulted in an improvement of irrigation and water harvesting techniques, agricultural diversification, and dissemination of sustainable agricultural techniques.

In Tanzania, farmers are incentivised to switch from maize production to sorghum, which is drought resistant, and diversify their income sources. Apart from adaptation mechanisms, Trias, a Tanzania-based NGO developed a warning system in Longido district to warn herdsmen against droughts. The Tanzanian National Business Council (TNBC) together with the Agricultural Sector Development Programme (ASDP) in order to improve agricultural productivity and herald in a green revolution for the country.

In Uganda, the Ministry of Agriculture, Animal Industries and Fisheries seeks to provide farmers with access to better information and technologies, particularly through promotion of climate resilient crops and animal varieties. The government has also enacted policies on Food and Nutrition (2003), Modernisation of Agriculture, Population (1994), Forestry (2001), National Water (1995), Disaster Risk Reduction, Energy (2002), Agriculture, Health (2000-2001), and Environment (1995), which all have linkages to food security and climate change.

In addressing climate variability and change at the policy level, the main challenge remains incoherence, where responsibilities are spread across numerous lines of ministries, as the issue is inherently cross-cutting. In response to this challenge, Kenya formulated the NCCRS in 2010 for a concerted and systematic response to climate change, under the direction of the Ministry of Environment and Mineral Resources. In Rwanda, the National Adaptation Programme of Action (NAPA) was launched in 2006 prioritizing and spearheading climate change as a thematic issue. Additionally, under the Rwanda Environmental Management Authority (REMA), the Department of Climate Change and Obligations was established in order to specifically focus on tackling problems of climate change, including its linkage to food security.

CLIMATE & TRADE: THE LINKAGES

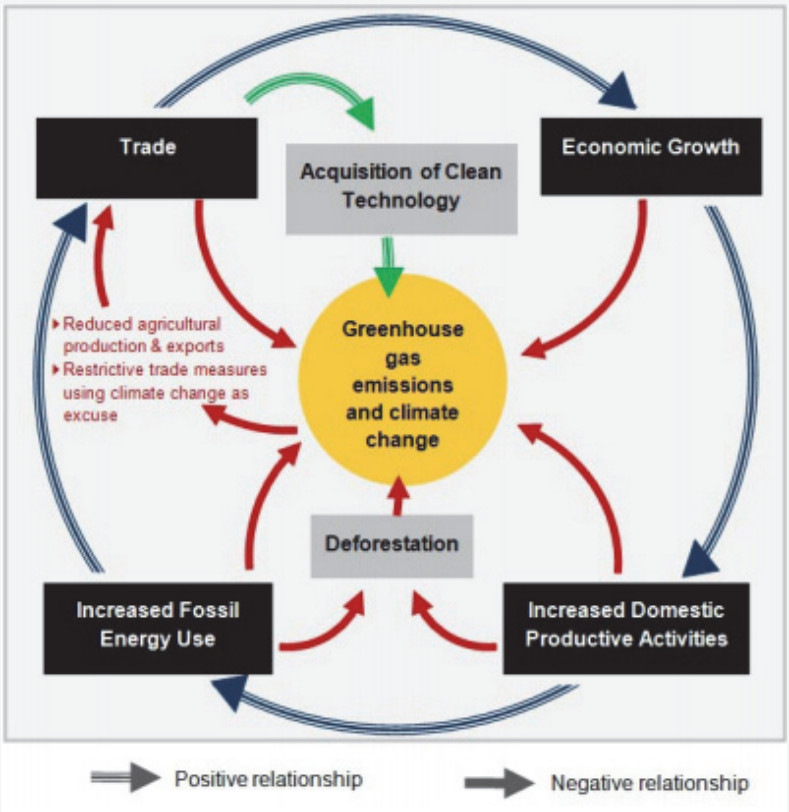
THE EFFECTS OF CLIMATE CHANGE ON TRADE

In addition to jeopardizing food security, climate change also impedes trade. Primarily and most apparently, this is because climate change compromises food production by hampering farmers' abilities to export agricultural products. If unfavourable climate persists for an extended period of time it can also ultimately discourage farmers, prompting them to either abandon agricultural activities altogether for extended periods of unemployment, or spur them to assume work in another sector. Climate change can also affect trade by altering the comparative advantage and input costs of a country's specific products. However, climate change does not necessarily entail a negative effect on food production; in some regions it may actually have a positive impact. For instance, the southern region of Tanzania has seen food production improve as a result of warmer temperatures and more rains. Nevertheless, the aggregated impact of climate change in the EAC is a net negative—on food security as well as on trade.

From another perspective, climate change can also affect trade by disrupting transportation, supply chains, and logistics. Floods, landslides, and other extreme weather patterns may contribute to increased costs and delays for exports and imports, not only hindering agricultural trade, but also other sectors that utilize geographically extensive supply chains. For example, in 2007, flooding in Uganda destroyed several infrastructures in the country—including bridges, roads and buildings—negatively impacting trade competitiveness.

This situation calls for better, more efficient infrastructure to offset the higher costs imposed by climate change. For instance, the Rwanda Crop Intensification Programme is developing infrastructure for post-harvest food storage and crop irrigation (hermetic storage cocoons, valley dams, and water reservoirs). For Uganda, in addition to the scarcity of land, the lack of modern technology impedes intensive production and leads to dependence on agricultural trade.

FIGURE 2: CONCEPTUAL FRAMEWORK DEPICTING CLIMATE AND TRADE LINKAGES



THE EFFECT OF TRADE ON CLIMATE CHANGE

Conversely, trade can also affect climate change. Most obviously, this occurs due to the increase in GHG emissions (especially through air transportation), and thus significantly contributes to climate change; however, this is not the only way through which trade can impact climate change. A large increase in trade of non-traditional goods such as maize in Uganda is said to be largely responsible for the substantial loss of the country forest cover, which has drastically declined over the past 20 years, intensifying extreme weather conditions. Uganda as well had promoted the production of upland rice, which led to much deforestation and soil erosion. In Tanzania, exporting logging, lumber, and charcoal had become an attractive and remunerative activity, leading farmers and even other individuals to clear lands for exports. Tree cuts for trade are becoming hazardous, threatening sustainability of ecosystems, particularly in rainforests where biodiversity is huge.

CLIMATE CHANGE POLICY AND ITS IMPLICATIONS

Because the EAC relies tremendously on agriculture, which is threatened by climate change, addressing climate change issues would lead to improve both food security and trade in all the five countries of the community. Policies designed to address climate change can affect trade and vice versa (policies designed to address trade can affect climate change). For example the carbon tax mechanism can affect trade by internalising the cost of carbon in the production process, possibly resulting in increased competitive discrepancies amongst trading countries. There is therefore a need for more sustainable practices like consolidating organic agriculture, mitigating and adapting to climate change.

Rwanda for instance had implemented 22 Clean Development Mechanisms (CDM) defined by the Kyoto protocol.

In Tanzania, the Cereals and other Produce Boards (COPB) aims to take adaptive measures to climate change, enhance competition, purchase and sell cereals at competitive price, imports and exports, provide warehousing services, provide grain services like cleaning, drying, weighing, grading, and packaging. Several campaigns in Dodoma, Manyara, and Arusha have been initiated for instance tree planting campaigns (every household was supposed to plant trees around their house); enhancing cultivation of drought resistant crops (millet, cassava); fostering use of modern methods like fertilizers and improved seeds; establishing environmental conservation by laws and society responsible for proper management; encouraging women involvement in non-agricultural activities, encouraging youth to pursue alternative employment opportunities in townships; channelling water for irrigation; abiding to forest conservation regulations and laws; and mixed farming. Government has also created village natural resources and environmental committees in almost all villages in Tanzania.

In Uganda climate change and trade policies are both accounted for in the National Development Plan (NDP), which seeks to promote trade whilst curtailing its effect on climate change. For example, the NDP promotes a low carbon development path. However, the NDP does not specifically address the inter-linkages between trade and climate change. For example, it does not look into the implications that the use of clean technology would have on trade competitiveness, nor is trade promoted as a useful tool in the adoption of mitigation strategies against climate change. The NDP does not prioritise the mainstreaming of climate change into development plans. Lack of policy, regulation, legislation and guidelines with regards to mainstreaming climate change

into development policy, are noted in the NDP to be significant barriers to achieving desired goals to mitigate climate change.

FOOD & TRADE: THE LINKAGES

Many EAC countries import a large portion of their calories. Such imports mainly take the form of cereal grains, such as rice, wheat, and maize. Since these grains are staples in many EAC citizens' diets, securing food sufficiency becomes inextricable from trade policy. By importing much of these primary grains, consumers actually increase vulnerability of threats to food security, since availability is not solely affected by weather and soil conditions anymore, but also exchange rate fluctuations, foreign exchange reserves, tariffs, Non-Tariffs Barriers (NTBs), etc. Major imports of such grains actually occurred when most EAC countries liberalised their economies. The result was massive inflows of grains and decline in domestic production of them. Thus, nowadays EAC nations must ensure that they have a sufficient amount of foreign exchange reserves to be able to feed their populations. The only way to sustain large levels of foreign exchange reserves is to ensure that they are running trade surpluses and/or selling foreign bonds. At the same time, these countries have a comparative advantage in the realm of agriculture and could actually benefit greatly from the increased trade with demand engines like Asia, where a massive population call for food products.

FIGURE 3: CONCEPTUAL FRAMEWORK DEPICTING RELATIONSHIP BETWEEN TRADE AND FOOD SECURITY

Source: IISD, 2011

If a country is reliant on imports because it cannot produce enough food internally to feed its population, then foreign trade becomes an especially vital component of food security and the country's consumers are beholden to international trade forces—such as legalities, NTBs, political issues, exchange rates, etc. for the insurance of their caloric livelihoods.

Rwanda, for instance, relies on imports for rice, sugar and wheat imports. By depending on imports for products that compose their dietary foundations, Rwandans expose themselves to increased risk in the realm of food security. Therefore, developing agriculture is perhaps the only way to ensure and sustain food security in Rwanda and elsewhere. In general, food imports are dominated by regional trade, for example, Rwanda imports palm oil from Burundi; rice, sugar and wheat flour from Tanzania; and industrial food from Kenya. Thus, promoting regional agro-industrial value chains could facilitate product transformation, value addition, and augment food security.

Burundi relies on rice, maize, cassava, bean, and potato imports. But limited export capacity due to lack of financial resources and low purchasing power of the poorest impede food security.

During the 1990s, Structural Adjustment policies were enacted in Kenya, liberalising several sectors. Because agriculture was sponsored heavily by the government prior to the adjustments, the sector suffered greatly in the aftermath. This occurred since markets were opened up to cheap food imports, which led to a decrease in domestic production, and increased the country's reliance on imports in several agricultural sectors, negatively affecting consumers while positively affecting trading producers. Increased demand for food products from Asia, combined with high transport costs due to deteriorating infrastructures in Kenya have driven up prices of imported food products. As a consequence, food insecurity and vulnerability have increased, especially in remote areas.

Uganda has suffered similar ailments as Kenya; Trade liberalisation, WTO rules, and other trade agreements are blamed to have decreased domestic production of cash crops and other agricultural products.

Evidences from Tanzania shows that regional trade has increased in volume, especially with Kenya. Trade—both official and unofficial— takes place between the two countries. For example, despite bans on maize exports in Tanzania, trade of the commodity still occurred through non-official routes. In general, trade between the two countries has amplified thanks to improvement in infrastructure.

INTERNATIONAL TRADE POLICIES & FOOD SECURITY

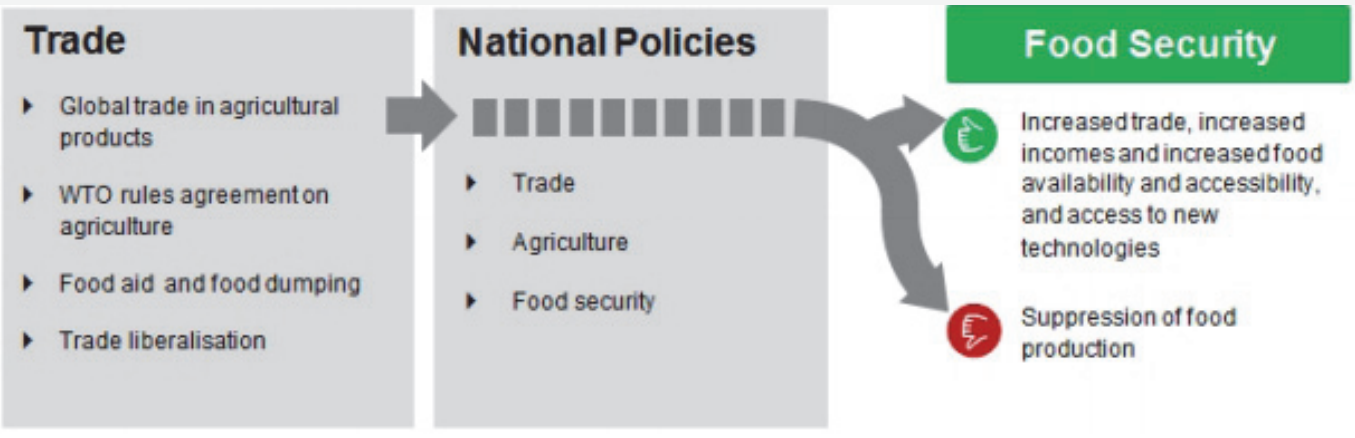
While climate change may increase the incidence of food insecurity, trade has the potential to counteract the effect by delivering agricultural goods to areas experiencing a decline in productivity. There is also a need to mitigate climate change by adapting with investments in infrastructure and increasing competitiveness.

In Burundi, there is a problem of insufficient knowledge with regard to international norms, standards, processing, and market access, impeding trade flows. Lacking knowledge and expertise, producers have tended to be disorganised, with insufficient resources to increase production and to trade efficiently. Experts have stated that trade could potentially improve food security and curtail environmental issues in several ways for instance by increasing the availability of fertilisers and modern technological tools, which in turn would significantly increase production and enhance food security; trade can also promote the use of environmental goods such as solar and wind technologies; importing more food could also potentially reduce deforestation since it would reduce the need to produce food locally.

In Kenya, more coordination and cooperation is necessary amongst the various actors (ministries, NGOs, UN-affiliated bodies, farmers, etc.). The government has formulated a number of policies that address food security namely: targeted subsidy schemes for those most in-need, integration of food security issues into national development plans, and reworking of trade policies so as to protect those most vulnerable. With regards to CC policies, the government has taken a two-pronged approach in conjunction with FAO recommendations that strive to tackle both environmental and FS problems through establishing socially sustainable agricultural development as a cornerstone for economic growth.

Finally, trade policies can be used to maximize the spread of climate-related technologies through elimination of tariffs and NTBs on environmental goods and services.

FIGURE 4: THEORETICAL FRAMEWORK ILLUSTRATING TRADE-FOOD SECURITY LINKAGES



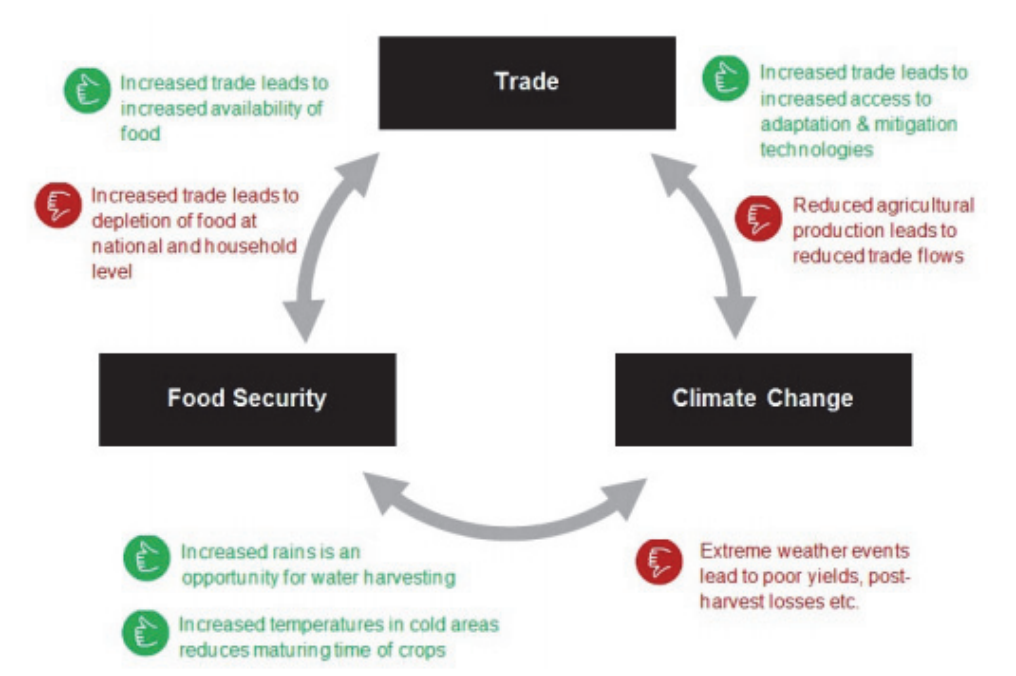
SECTION 3 CLIMATE, FOOD, TRADE : THE NEXUS

THEORETICAL FRAMEWORK

Food security, climate change, and trade all directly correlated. The detrimental impact of climate change on food security can be mitigated through sound trade policy climate change has a potentially detrimental effect on food security, trade policy can be formulated so as to mitigate this. However, using trade as an instrument to bolster food security is by no means an easy or passive procedure, the key players must take active roles in formulating and shaping trade policies and mechanisms in order for food security to be reinforced.

By maintaining sufficiently high levels of exports, EAC nations may sustainably import foodstuffs so as to address their requisite nutritional needs, which have otherwise been hampered by environmental issues. If EAC nations import more than they export, as has been the case, they will be stuck with an unsustainable current account deficit. Additionally, countries must ascertain that they are not relying too heavily on imports so that their domestic industries suffer. The strategy is to use imports counter cyclically, increasing its volume during times of particularly low yields and drawing back imports when productivity is relatively higher.

FIGURE 5: A THEORETICAL FRAMEWORK OF THE RELATIONSHIP BETWEEN TRADE, CLIMATE CHANGE AND FOOD SECURITY WITHIN THE EAC CONTEXT.



THE CLIMATE-FOOD-TRADE NEXUS: STORIES FROM EAST AFRICA

The nexus between food security, climate change and trade can be observed in many places of the EAC countries. Following, are a few examples which illustrate how the three issues have an impact on each other. For all of them, the necessary policy recommendations can be directly derived.

BURUNDI: DROUGHS MAKE EXPENSIVE IMPORTS THE ONLY CHOICE

The Kirundo area of the Bugesera region was renowned as the source for production and trade of beans and sorghum on which other regions such as Bujumbura, Gitega, Mwaro, Ngozi and Rumonge were dependent. However, with the onset of recurrent droughts, this has since changed. With local production becoming insufficient, regional trade has come into play with these crops now being imported at higher prices from neighbouring Tanzania and Rwanda. Unfortunately, the import capacity is very limited due to lack of financial resources and low purchasing power of the vulnerable and poorest people.

As far as Burundian traders are concerned, they have diversified from trade in beans and sorghum to new items including beer, coffee and others. In fact, some of the warehouses that were originally used for storage of beans and sorghum, which were plenty, have been transformed to accommodate the new market for coffee beans.

POLICY COORDINATION IN BURUNDI

Climate change, trade and food security issues are dealt with by different institutions that do not always result in coordinated policies or modes of addressing the challenges therein. This often results in conflicting strategies that could have been avoided through well-coordinated institutional framework. The other challenge lies in the lack of implementation of agreed strategies. This has been mostly due to lack of resources. An example is the Diagnostic Trade Integration Study (DTIS) of 2004 that included an

action plan pointing out programmes that needed to be undertaken, but have largely remained undone.

These coordination and implementation issues are partly due to the fact that the National Environment Commission is made up of several ministries including agriculture, environment, finance, education, interior and security. Transferring the mandate of dealing with environmental issues to a permanent and more centralised Technical Commission on Food Security, Climate Change and Trade (FSCCT) may help improving coordination. The Commission should be autonomous and well-endowed with necessary resources and in charge of designing holistic policies and overseeing their implementation.

KENYA: HOW TO SAVE THE GRAIN SECTOR?

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 on 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. 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.

In order to adjust the local production of food to the changing environment, investment in technology and mechanization of agriculture e.g. irrigation and water harvesting, preservation and storage of foods, is necessary. These kind of innovations may help to avoid environmental degradation and destruction of biodiversity, low productivity, crop losses and hence loss of incomes and livelihoods, migration of people and animals and hence urbanisation and increase of slums, increased poverty, lack of diversified food basket and food insecurity.

Towards this end, the first step would be for the new government to deliver on its Maputo commitment to dedicate 10% of its budget to this sector. Unfortunately, the current national budget slashed 3.5 billion shillings from initial allocation to the current 38.07 billion shillings (representing only 4 per cent of the National Budget).

CREATIVE SOLUTIONS FOR RWANDAN COFFEE

Coffee, which is drought-resistant, but not fully drought-proof, is the main export product in Rwanda. Since it has also long yields it is often intercropped with food crops and can act as a risk reduction in terms of food security. Extended dry seasons in certain areas of Rwanda have put pressure on production levels and decreasing yields are starting to be observed. Nevertheless, it has been indicated that growing coffee and plantain/bananas could help reduce the effects of climate change on coffee. The beneficial effects are i) the provision of shadow to coffee plants; ii) the reduction in temperate and drought problems; iii) the production diversification that generates up to 50 percent higher incomes for farmers; and iv) subsequently the improvement of food security.

Thus, a shift in agricultural practices needs to be a central part of a future strategy: there is need for additional investment in agriculture, infrastructure (irrigation and stock facilities), water management (for harvesting and drainage), road infrastructure maintenance, hedge risk schemes and insurance, and the introduction of climate change readiness systems. Furthermore, public as well as private research is required to ensure innovation and dissemination of new technologies, so is an improved policy framework to provide incentives for mitigation in the agricultural sector.

TANZANIA: CROP LOSSES FROM LACK OF ADAPTATION

Among the observed effects of climate change in the central part of Tanzania (Dodoma region) unpredictable/irregular patterns of rainfall were viewed as one of the major effects. This situation has actually been occurring for the past ten years and made it impossible for farmers to harvest enough quantity of crops as rains come late during the seasons, last for very few weeks and stop. In this case, these rains leave crops half grown and once the long dry season sets in, these crops dry out. As a protection against erratic rainfall and inaccurate predictions, villagers look at a certain tree known in their native language as Mgani once the tree starts blooming with flowers and they become green they know the rains are about to come. Crop and business loss was caused by sticking to this traditional knowledge with changing rainfall patterns.

In order to enable Tanzanian farmers to adjust to the changing weather patterns, an effective weather forecasting technology needs to be acquired and deployed. It is crucial for the authorities to deliver information to agricultural stakeholders about when the season will begin, when to prepare/till farms and deliver inputs, and when to plant,

which will minimize crop and business loss. Moreover, a comprehensive adaptation strategy needs to be developed and implemented and cost effective and appropriate adaptation options for different areas need to be identified. This may happen through: the strengthening of management plans and effective disaster prevention, development of early warning systems, communication, response systems, organisations, and governance structures providing these services.

UGANDA: FARMING AND SENSITIVE ECO-SYSTEMS

In the livestock sector, the frequent droughts in Uganda's cattle corridor have contributed to the reduction in milk and beef production which normally trigger high prices. This makes it difficult, especially for the poor, to access these products in the quantities required, thus contributing to food insecurity. Traders normally seize the opportunity to import milk and beef products to benefit from the high prices.

In farming, the commercialisation of food crops in order to diversify household incomes has created a necessity for increased production which requires opening up more land, especially the sensitive eco-systems like wetlands and forests which are important carbon sinks. Commercialisation of food has been a double edged knife as it has on the one hand led to increased food availability on the market, while on the other it has led to increased food insecurity, especially among poor families.

SECTION 4

THE WAY FORWARD

Agriculture sector in the EAC remains to be the backbone of Member countries' economies. Apart from determining food availability, it is the main source of income and employment for a majority of East Africans- two variables that strengthen food security. Change and variability in climate continue to threaten the sustainability of the sector by disrupting production, exchange and distribution.

Given this context, it is imperative that the five countries implement policies that address food security, trade, and climate change holistically. The country studies have shown that understanding of the interactions of these issues is important to develop effective policy responses..

Three areas of recommendations emerge from the mapping and diagnoses undertaken in the country studies, namely: (i) ways to enhance policy coordination amongst a multitude of players and areas; (ii) priority areas for policy action in each country so as to mitigate the effects of climate change on food security and leverage the potential of trade; and (iii) the need for better implementation of existing regional policies at the EAC level.

POLICY COORDINATION: COMMON CHALLENGE, DIFFERENT SOLUTIONS

Establishing sound working relationship among the relevant ministries such as ministries of trade, agriculture, environment and EAC, water, irrigation- to name but a few, is imperative in order to ascertain policy coordination and coherence. Lack of cooperation and coordination could only policies result in conflicting and undesirable outcomes, rather than addressing the challenges at hand.

In **Burundi**, the National Environment Commission comprising ministries of agriculture, environment, finance, education, interior and security has been to be ineffective in carrying out its mandate with regard to environmental issues. Thus, it is proposed that a Technical Commission on Food Security, Climate Change and Trade should be established to take over the mandates; and to design and oversee the implementation of holistic policies.

The Commission should be autonomous, with necessary resources, supported by the government and development partners. It should start off by carrying out a baseline

assessment of laws, policies and administrative measures, on-going programmes; and identification of existing constraints and opportunities. Policies and programmes should address capacity building in FSCCT issues of all stakeholders, advocacy campaigns, monitoring mechanisms monitor policy implementations; and involve direct beneficiaries such as farmers.

In **Kenya** it is recommended that a joint Secretariat of the three Ministries of Agriculture, Environment, and Trade be established to continually address, disseminate, and implement issues arising from the three intertwined issues. The Secretariat should be led by the Office of the Deputy President for effective coordination of line ministries.

In **Rwanda,** a climate change strategy is already in place. Thus, implementation should be aligned to mainstreaming climate change adaptation and mitigation in key sectors and activities of stakeholders. In addition, the national study calls for integration of food security, nutrition, and disaster management into poverty reduction programmes in order to design a strategy for vulnerability reduction.

In **Tanzania** structural weaknesses in the policy and institutional landscape may minimise the efficiency to address Climate Change challenges. The country study reveals that the country's trade policy is not aligned to climate change challenges. In order to address the climate change issues effectively, trade and investment opportunities must be channeled towards environmental friendly innovations and technologies.

In **Uganda** the National Planning Authority is called upon to provide for a clear framework that strengthens inter-linkages between the three issues and inter-institutional coordination mechanisms supporting implementation. The capacity of policy makers and technocrats at both at national and EAC levels, should be strengthened in order to ensure clear understanding of the nexus between climate change, food security and trade, their inter-linkages can then be translated into policies and negotiation positions in the various forums such as UNFCCC and WTO.

Advocacy on the inter-linkages between climate change, food security and trade is paramount. This should be done at both the regional and national levels, and targeting all stakeholders including farmers so that they are equipped with the knowledge to adapt to the climate change and variability.

PRIORITIES FOR NATIONAL ACTION

BURUNDI: FARMERS NEED ACCESSABLE AND CONSUMABLE WEATHER INFORMATION

Evidence from the ground show that there has been drastic reduction of sorghum and bean production in the Bugesera region due to farmers' inability to anticipate rainfall, or the lack of it, which is one of the main challenges of Burundian agriculture. There is lack of weather data and databases to alert producers against the effects of climate change; whereas the limited data that do exist are not readily digestible. Ideally, broadcasting services should exist to regularly disseminate this information in rural areas, preferably in vernacular languages.

In terms of adaptation, the government of Burundi and its development partners should put in place viable irrigation schemes to counter the weather vagaries, and prevent encroachment of cultivation on lake shores and river banks. This is critical in preserving natural ecology and limiting degradation of the environment.

KENYA: LIVING UP TO THE PROMISE

In Kenya there is need for the - government to deliver on its Maputo commitment to dedicate 10 percent of its budget to the agriculture sector. This allocation increase should primarily aim at:

- Strengthening the Kenya Meteorological Department (KMD) to discharge its duties with accuracy - in order to increase food security, avert human and livestock mortality and generally increase disaster preparedness in the country;
- Spurring and increasing investment in technology and mechanization of agriculture, such as irrigation and water harvesting systems; and
- Supporting agricultural insurance mechanisms in the event of crop failures. This ought to enhance the ability of farmers to secure agricultural financing since it would substantially reduce the risks associated with farming hence attracting financial institutions to offer credit to farmers.

RWANDA: INFRASTRUCTURE DEVELOPMENT IS MOST URGENT

In Rwanda, transformation of agricultural practices through infrastructure development needs to be the central part of a future strategy: there is need for additional investment in agriculture, infrastructure (irrigation and stock facilities), water management (for harvesting and drainage), road infrastructure maintenance, hedge risk schemes and insurance, and the introduction of climate change readiness systems. Public as well as private research is required to ensure innovation and dissemination of new technologies, so is an improved policy framework to provide incentives for mitigation in the agricultural sector.

Moreover, it is important to note that trade has the potential to counter the increase in the incidence of food insecurity resulting from climate change, as a distribution channel to regions prone to food shortage. The adaptive capacity of rural population may be increased by developing technologies at various levels of the value chain of different commodities and develop the small and medium industry that creates more off-farmers employment.

TANZANIA: WEATHER FORECASTING AND AFFORESTATION

In Tanzania, the example of farmers' indigenous knowledge of using *Mgani* tree to forecast weather shows the need for encouraging the **adoption of effective weather forecasting technologies**. Authorities should be in a position to deliver accurate information to shield farmers from crop and business losses.

Moreover, cutting down of trees to meet energy and farm land needs has worsened the effects of climate change on rural communities. Efforts to strengthen the financing and **implementation of reforestation and afforestation programmes** should be systematic and sustainable. In addition, policy interventions should be introduced that aim to mitigate deforestation (tree cutting for firewood and charcoal), such as reducing the price of widely used energy sources like kerosene. Awareness creation campaigns need to be carried out for environmentally friendly attitudes including tree planting and good farming practices.

UGANDA: PRIORITY TO FOOD SOVEREIGNTY

In Uganda, efforts should gear towards **developing sustainable low-impact food production that promotes food sovereignty**, protects family farms, and uses seasonal food to provide first and foremost for local needs, together with changing dietary habits. Although access to food mainly depends on the purchasing power of households other infrastructural supports like transportation, market structures and food distribution systems are play vital role in ensuring food security. Production practices need to ensure significant reduction in greenhouse gas emissions and help farmers cope with climate variations.

IMPLEMENTATION OF REGIONAL POLICIES

Regional policies, strategies and action plans at the EAC level to deal with climate change, food security and trade within the region are in place. However these need to be synchronized in order to tackle the three issues holistically. There is also need to harmonise and integrate the regional policies within individual Member Countries' national policies and action plans for their effective implementation. This calls for proper and clear institutional frameworks both at the national and regional level.

For instance operationalizing the 2007 East African Trade Negotiation Act that mandated creation of a Joint Trade Negotiations Commission tasked with driving the regions trade regime, harmonizing negotiation positions and conducting negotiations with third parties, would strengthen Members stance. In addition it would enable the pooling limited resources towards better outcomes from trade negotiations and ensuring the regions offensive and defensive interests are achieved.

REFERENCES

ABN Digital 2011. East African business report. South Africa

Ackello-Ogutu, C. and Echessah P. (1997). *Unrecorded cross-border trade between Kenya and Uganda: Implications for food security*. A USAID SD Publication Series; Office of Sustainable Development Bureau for Africa. Technical Paper No. 59. Washington, DC: USAID

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

African Development Bank (AfDB) 2010, Trade report for Kenya

Agricultural Organisation of United Nation's Global Forest Resources assessment 2010

Allinovi L., D'Errico M., Mane E, & Romano D. 2010. Livelihoods strategies and household resilience to food insecurity: An empirical analysis to Kenya'. Paper prepared for the conference on promoting resilience through social protection in sub-saharan Africa. European Report of Development in Dakar, Senegal. 28-30 June 2010.

Bamikole A, J.K Musango, & W. Stafford 2011: "Biofuels and Sustainability in Africa" : Journal : Renewable and Sustainable Energy Review Vo. 15, No.2 PP 1360-1372

Bamwenda G. R. and Roshan A. 2011. 'The strengths, weaknesses, opportunities and challenges of the agricultural research system in Tanzania'. In the Proceedings on the technical discussions on the formulation of the Tanzania Agricultural Research Strategy. Tanzania Academy of Sciences and Ministry of Agriculture, Food Security and Cooperatives. Millennium Sea Breeze Hotel, Bagamoyo. 14-16 February

Bamwenda G.R. 2008. The impact of global warming on Tanzania's food security. MBA Thesis, Eastern and Southern Africa Management Institute-Maastricht School of Management. February.

Bamwenda G.R. and Roshan A. 2012. Tanzania tea industry strategy. Tea Board of Tanzania (TBT). April.

Beddington J. 2011: 'Achieving food security in the face of climate change'. Summary for policy makers from the commission on sustainable agriculture and climate change; CGIAR Research Program

Benson T, S. Mugarura & K. Wanda 2008: 'An assessment of the likely impact on the Ugandan households of rising global food prices.' A report to the Uganda Offices of the World Food Programme, UNICEF and the Food and Agriculture Organisation .

Burundi Economic Studies and Statistics Institute «ISTEEBU», 2010 and 2011. Statistics Annual 2009 and 2010. Bujumbura.

Burundi. 2012. Second National Poverty Reduction Strategy - PRSPII. Bujumbura.

Cancun Agreement. 2010. 'Target agreed UNFCCC COP 16 at Cancun in 2010.'

CARE International 2011. 'Adaptation and food security'. *Climate change brief*. April.

CGIAR (2011): A strategy and Results Framework for the Consultative Group on International Agriculture Research- A submission to the CGIAR Funders Forum.

Consultative Group on International Agriculture Research 2011

CUTS International (2011). Agriculture in development of select African countries: Linkages with trade, productivity, livelihood and food security. Geneva: Switzerland.

Darling, E. S, McClanahan, T. R, and Côté, I. M. 2010. 'Combined effects of two stressors on Kenyan coral reefs are additive or antagonistic, not synergistic'. *Conservation letters*. Vol. 3, Issue 2, pp 122–130. April.

Davidson, D. J., Williamson T., and Parkins J. R. 2003. 'Understanding climate change risk and vulnerability in northern forest-based communities'. *Canadian Journal of Forest Research* 33: 2,252–2,261.

Department for International Development-DfID. 1999. Sustainable livelihoods guidance sheet.

East African Community Secretariat 2005. Agriculture and rural development policy for the East African Community (EAC). Arusha: Tanzania.

East African Community Secretariat 2006. Agriculture and rural development strategy for the East African Community 2005–2030. Arusha: Tanzania.

East African Community Secretariat 2010. The customs union protocol and common market protocol. Arusha: Tanzania (Forthcoming).

East African Community Secretariat 2011. East African Community food security action plan 2011–2015. Arusha: Tanzania.

East African Community Secretariat 2012. EAC Industrialisation policy and strategy. Arusha: Tanzania (Forthcoming).

East African Community Secretariat 2010. East African Community climate change policy. May.

East African Community Secretariat. October 2011. East African Community Facts and Figures. Arusha.

Economic and Social Research Foundation 2010. Feasibility and justification for a common strategy for food security in the EAC. Dar es Salaam.

Economic and Social Research Foundation 2012a. Preliminary analysis of price incentives and dis-incentives for maize in Tanzania. Dar es Salaam.

Economic and Social Research Foundation 2012b. Preliminary analysis of price incentives and dis-incentives for paddy in Tanzania. Dar es Salaam.

FAO 2005. 'Poverty impacts of agricultural trade reforms.' *The state of food and agriculture 5.*

FAO 2007. *Organic agriculture and stability of food su*pply. pp 32. 5 May.

FAO. 1983. 'World food security: A reappraisal of the concepts and approaches'. General Managers report. Rome.

FAO. 2003. *World agriculture: Toward 2015/2030,* Chapter 13. Rome, Earthscan

FAO. 2009. 'Rapport panorama I sur les statistiques agricoles et alimentaire au Rwanda.' Project GCP/GLO/208/BMG, Countrystat pour l'Afriquesubsaharienne.

Food and Agriculture Organisation (FAO). 2009. Global agriculture toward 2050. Rome.

Françoise C. P., Alain C. P., Albert L. 1979. Géographie du Burundi: Le pays et Les hommes. Strasbourg: EDICEF.

Gilson I. (2004): *Developed Country Cotton Subsidies and Developing Countries: unraveling the Impacts on Subsidies*. ODI Briefing Paper July 2004

Glibetson T. and Oscar R. 2006 : Carbon trading: How it works and why it fails.

Government of Kenya 2003a. 'Economic recovery strategy for wealth and employment creation 2003-2007'. Nairobi.

Government of Kenya 2003b. *Economic survey*. Kenya National Bureau of Statistics

Government of Kenya 2004.*Statistical abstract*. Kenya National Bureau of Statistics.

Government of Kenya 2007. 'Interim draft report-National trade policy'. Ministry of Trade and Industry. August.

Government of Kenya 2008. *Economic survey*. Kenya National Bureau of Statistics.

Government of Kenya 2008. *Statistical abstract*. Kenya National Bureau of Statistics.

Government of Kenya 2010. 'Agricultural sector development strategy 2010-2015'.

Government of Kenya 2011. *Economic survey*. Kenya National Bureau of Statistics.

Government of Kenya 2012. *Economic survey*. Kenya National Bureau of Statistics.

Government of Rwanda. 2007. Economic development and poverty reduction strategy (2008-2012). September 2008.

Government of Rwanda. 2011. Rwanda national export strategy.

Gregory, P. J. 1999. '*Managed production systems',* in Walker, B., Steffen, W., Canadell, J., Ingram, J. S. L. (eds.), pp. 229-270. Cambridge: Cambridge University Press.

Gregory, P. J., Ingram, J. S. L., & Brklacinch, M. 2005. 'Climate and food security', *Phillos Trans R. Soc. Lond B. Biol Sciences* 360(1,463): 2139-2148. The Royal Society.

Hamza K. F. S. and Kimwer E. O. 2007. 'Tanzania's forest policy and its practical achievements with respect to community based forest management in MITMIOMBO'. Working Papers of the Finnish Forest Research Institute 50: 24–33.

Harding B. & Devisscher T. 2009. *Review of the economic impacts of climate change in Kenya, Rwanda and Burundi: Ecosystems chapter Kenya*. Unpublished.

Hepworth, N. D. 2010: Climate change vulnerability and adaptation preparedness in Uganda. Nairobi: Heinrich Böll Foundation.

Holdren, J. P. 2008. 'Meeting the climate change challenge'. John H. Chafee Lecture Memorial Lecture on Science and the Environment.

IAASTD press release 2008. 'Intergovernmental report aims to set new agenda for global food production'. 31 March.

Imani Development. 2005. 'A preliminary assessment of Rwanda's regional integration options.' March.

Intergovernmental Panel for Climate Change 2011. 'Renewable energy sources and climate change mitigation: A summary for policy makers and technical summary', Special Report of the Intergovernmental Panel for Climate Change, WHO and UNEP.

Intergovernmental Panel Group on Climate Change -IPCC. 2007. 'Climate change 2007', Synthesis report, pp 104. Geneva.

Intergovernmental Panel on Climate Change-IPCC 1990. 'Climate change 1990: First assessment report: Scientific basis, impacts, adaptation, and vulnerability and mitigation'. New York: Cambridge University Press.

International Energy Agency (2012). CO2 emissions from fossil fuels: Highlights.

International Institute for Tropical Agriculture-IITA. 2011. Towards climate smart agriculture lessons from a coffee plus banana case.

International Union for Conservation of Nature 2008 Report.

IPCC (1995, 2001, 2007): Intergovernmental Panel on Climate Change 2nd, 3rd, and 4th Assessment Reports

IPCC 2007. 'Special report on emissions scenarios'. A special report of IPCC Working Group III.

IPCC. 2007b. 'IPCC fourth assessment report: Climate change 2007 (AR4).' Working Group II and III.

ITC. 2008. 'Overview of organic agriculture in Rwanda, and options for policy and trade development.' A technical paper.

Kagera River Basin: Strategies and Policies – Uganda. FAO Land and Water Division

Kaggwa, M. 2011: 'The role of technology policy in leveraging Africa growth act benefits to the Common Market of Eastern and Southern African market'. Paper written for COMESA Secretariat

Kaoneka, A. R. S. 1990. 'Measures to contain the problem of encroachment in natural forests'. Proceedings of joint seminar/workshop on management of natural forests of Tanzania. Sokoine University of Agri¬culture and Agricultural University of Norway. Olmotonyi, Arusha. 5–10 December 1988.

Kathiresan A. 2011. Strategies for sustainable crop intensification in Rwanda: Shifting focus from producing enough to producing surplus. MINAGRI.

Kenya National Bureau of Statistics 2007. 'Basic report on well-being based on the Kenya

Kenya Official Population Census 2009. 'The 2009 population and housing census results'. Presentation by Hon. Wycliffe Ambetsa Oparanya, Minister of State for Planning, National Development and Vision 2030. 31 August, 2010.

Kessy et al. 2006. 'Moving out of poverty: Understanding growth and democracy from the bottom up'. A regional synthesis report submitted to the World Bank, Washington.

Larson, D. 2011. 'Agriculture and the clean development mechanism.' Policy research working paper 5621. The World Bank.

Lengnick-Hall, C. 1992: 'Innovation and competitive advantage: What we know and what we need to know'. Journal of Management Vol. 18, No. 2, pp. 399-429.

Maghembe J. 2011. 'The preliminary national sample census agricultural and livestock sector report.' National Bureau of Statistics. March.

Marketing Development Bureau 1997. Industry review of maize, rice and wheat. Dar es Salaam.

McSweeney C., New M. and Lizcano G. 2012. *UNDP climate change country profiles (Kenya).*

Meltzer, J. and Sierra, K. 2011. 'Trade and climate change: Mutually supportive policy'. Harvard International Review, Fall, pp. 64-69.

Meyer-Ohlendorf, N. and Gerstetter, C. 2009 : 'Trade and climate change: Triggers or barriers for climate friendly technology transfer and development?' Occasional paper, Berlin: Friedrich-Ebert-Stiftung.

MINAGRI. 2004. Strategic plan for agricultural transformation in Rwanda-Phase II (PSTA II). Kigali. October.

MINAGRI. 2009. Strategic plan for agricultural transformation in Rwanda. February. Kigali.

MINAGRI. 2011. 'Annual report FY 2011/2012'.

MINAGRI. 2011. 'National post harvest staple crop strategy'. Kigali. October. Available at http://amis.minagri.gov.rw/content/national-post-harvest-staple-crop-strategy

MINAGRI. 2011. Strategies for sustainable crop intensification in Rwanda: Shifting focus from producing enough to producing surplus. Kigali.

Ministry of Agriculture and Animal Resources-MINAGRI. 2010. Agricultural mechanisation strategies for Rwanda: Shifting from subsistence agriculture to market oriented agriculture. Kigali. 14 June

Ministry of Communal Development and Planning, Macroeconomic Planning Service. August 2011 Burundi Economy 2010. Bujumbura.

Ministry of Environment and Territory Development. August 2001. Convention Framework on Climate Changes. First National Communication. Bujumbura.

Ministry of Finance and Economic Planning (MINECOFIN). 2000. 'Rwanda Vision 2020'. Kigali. July.

Ministry of Finance and Economic Planning (MINECOFIN). 2006. National Plan of Action (NAPA) for climate change adaptation. Kigali

Ministry of Finance and Economic Planning. 'Rwanda vision 2020'. July.

Ministry of Finance. December 2010, 2011. Budget laws 2010 and 2011. Bujumbura.

Ministry of Livestock and Agriculture, FAO, WFP and UNICEF. 2011. 'Assessment of the crops, the food supply and the nutrition situation for 2011 season B.' Bujumbura.

Ministry of Livestock and Agriculture, FAO, WFP, UNICEF. 2010. 'Assessment of the crops, the food supply and the nutrition situation for season 2010B .' Bujumbura.

Ministry of Livestock and Agriculture, FAO, WFP, UNICEF. 2011 and 2012. 'Assessment of the crops, the food supply and the nutrition situation for season 2011 B and season 2012 A.' Bujumbura.

Ministry of Livestock and Agriculture, FAO. 2009. Food Security National Programme 2009 - 2012. Bujumbura.

Ministry of Livestock and Agriculture. July 2008 : National Agricultural Strategy 2008-2015. Bujumbura.

Ministry of Trade and Industry (MINICOM). 2009. Strategic Plan 2009-2012.

Ministry of Trade and Industry and MINAGRI. 2008. 'Rwanda national coffee strategy'.

Ministry of Trade and Industry. 2010. 'Rwanda trade policy'. Kigali. June.

Ministry of Trade and Industry. 2010. Rwanda industrial policy and master plan 2010-2020: Achieving global competitiveness. September.

Ministry of Water and Environment 2007 : National adaptation programme of actions. Government of Uganda

Ministry of Water, Environment, Territory Development and Town-Planning. 2009. Second National Communication on Climate Changes, pp 147. Bujumbura.

Ministry of Water, Environment, Territory Development and Town-Planning. January 2007. National Adaptation Plan of Actions on Climate Changes. Bujumbura.

MINITERE. 2006. National Adaptation Programme of Action (NAPA).

Mutabazi, A. 2010. Assessment of operational framework related to climate change in Rwanda. Kigali.

Mutabazi, A. 2011. Rwanda country situational analysis: EAC climate change master plan. April.

Mxolisi E. S. 2010. 'Projected changes in mean and extreme precipitation in Africa under global warming, Part II: East Africa,' Journal of climate. November 22.

Myaka, F. A. 2011. 'The state of agricultural research and development in Tanzania'. In the proceedings on the technical discussions on the formulation of the Tanzania agricultural research strategy. Tanzania Academy of Sciences and Ministry of

Agriculture, Food Security and Cooperatives. Millennium Sea Breeze Hotel, Bagamoyo. 14-16 February.

National Agricultural Export Board-NAEB. 2012. 'NAEB data January-December 2011'.

National Development Plan; Government of Uganda 2010/2011-2014/2015

National Institute for Nature Conservancy and Environment «INEC». 2010. Development Plan for Bugesera protected landscape du paysage protégé du Bugesera. Gitega.

National Institute of Statistics Rwanda-NISR. 2009. Rwanda comprehensive food security and vulnerability analysis and nutrition survey. July.

National Planning Authority November 2011 Thematic working paperNational Agricultural Research Organisation (NARO) Report 2010

Nhamo, G. 2010 : Green economy and climate mitigation: Topics relevant to Africa. Pretoria: AISA.

NISR. 2012a. EICV3 thematic report: Agriculture. August.

NISR. 2012b. The third integrated household living conditions survey (EICV3): Main indication report.

NISR. 2013. 'Quarterly external trade statistics (Q4)'.

Nyangito H. Nzuma J. And Odhiambo W. 2004. *Impact of agricultural trade and related policy reforms on food security in Kenya*. Nairobi: Kenya Institute for Public Policy Research and Analysis.

Nyangito, H.O. 1999. "Agricultural Sector Performance in a Changing Policy Environment". In Kimuyu, Wagacha and Abagi (Editors). Kenya's Strategic Policies for 21st Century: Macroeconomic and Sectoral Choices. Institute of Policy Analysis and Research (IPAR), Nairobi.

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

Otieno G. 2011. 'Regional trade and rural livelihoods implications for Kenya's food security', in *Agriculture in development of select African countries: Linkages with trade, productivity, livelihood and food security.* CUTS International, Geneva.

Panagariya, Arvind, (2002). " *Why India Lags behind China," Economic Times*, May 22

PEAP revision/Preparation of the 5 year National Development Plan: Government of Uganda 2007.

PELUM Uganda Study 2010 : 'Towards enhancing small-scale farmers' livelihoods and food security through indigenous climate change adaptation'.

Pingali, P. Alinovi, L. & Sutton, J. 2005. 'Food security in complex emergencies: Enhancing food system resilience'. *Disasters.* Vol. 29. June.

Praveen, J. 2005 : Climate change and its implications: Which way now? New Delhi: Centre for Economic Studies and Planning, Jawaharlal Nehru University.

Regional Secretariat–Kagera Region (2010). Investment profile for Kagera region. Bukoba.

Republic of Burundi, Central Bank. 2011. Annual Report 2010 and the December bulletin 2011. Bujumbura.

Republic of Burundi, FAO. December 2008. 'Food Security National Programme (PNSA) 2009-2015.' Bujumbura.

Republic of Burundi/Enhanced Integrated Framework (EIF). July 2012. Burundi Diagnostic Trade Integration Study (DTIS) Update. Volume 1, Main report. Bujumbura.

Shephard A. et al 2011. 'Hidden hunger in rural Tanzania-What can qualitative research tell us about what to do about chronic food insecurity', in Kessy F., Mashindano O. and Shephard A. (eds). Translating growth into poverty reduction. Oxford: James Curry.

Stephen Devereux 2001: "Sen's Entitlement Approach: Critiques& Counter Critiques" Oxford Development Studies Vol. 29, No. 3, 2001

Stephen, C., Kevin, V. 2007: 'Global warming', in Cutler J. C. (ed). Encyclopia of Earth. Environmental Information

Stern N. 2009. The global deal: Climate change and the creation of a new era of progress and prosperity. New York: Public Affairs.

Stern, N. 2006. 'Stern review on the economics of climate change'. UK treasury.

Stern, Nicholas (2006): The Stern review report on the economics of climate change. Cambridge University Press, Cambridge, UK

Stevens C., Greenhill R., Keenan J. and Devereux s. (undated). "The WTO Agreement on Agriculture and Food Security". A DFID Funded Study

Stockholm Environmental Institute-SEI 2009. 'Economics of climate change on Kenya'. Projects report.

Tamra G. & Oscar R. 2009. 'Carbon Trading, How It works and why it fails'. Critical currents 7. November 2009

Tanzania Private Sector Foundation 2011. 'Tanzania national competitive report'. Dar es Salaam.

The Guardian (2009). Atlas of pollution: The world in carbon dioxide emissions. Graphs based on data from the International Energy Agency (IEA).

The State of Food Security in the World 2011

The Uganda National Policy on Food Security

Trias V. Z. W. 2011. Tanzania pastoralists arm themselves against drought. Brussels.

Turkenburg, W. C. 2000. 'Renewable energy technologies', in Goldemberg, J. (ed). World Energy Assessment. New York, USA: United Nations Development Programme.

Uganda Bureau of Statistics and Statistical Abstracts 2009 2010 2011

Uganda Demographic and Household Survey, 2006

Uganda Poverty Status Report, 2012

UN FAO Reports 2003, 2005, 2010 & 2011

UNCTAD. 2012. Rwanda's development driven policy framework. New York and Geveva.

UNEP & GOK 2007. *Devastating drought in Kenya, environmental impacts and resources*. Nairobi.

UNEP/OECD/WTO. 2007. Aid for trade case story: The EAC organic standard.

UNFCC 1992. 'Key definitions of the convention'. http://unfccc.int/resource/docs/convkp/conveng.pdf. Accessed 3 April 2011.

UNFCCC: 2010. 'Second national communication'.

United Nations COMTRADE 2011. The United Nations commodity trade database.

United Nations Framework Convention on Climate Change (UNFCCC) 2011. Kyoto protocol to the United Nations Framework Convention on Climate Change. http://unfccc.int/essential_background/kyoto_protocol/items/1678.php.

United Nations Framework Convention on Climate Change (UNFCCC) Hand Book

United Nations. 1992. United Nations Framework Convention on Climate Change

United Republic of Tanzania 1990. National health policy. Ministry of Health. Dar es Salaam.

United Republic of Tanzania 1997. Vice President's Office, National environmental policy. Dar es Salaam.

United Republic of Tanzania 1997. Agriculture and livestock policy. Ministry of Agriculture. Food Security and Cooperatives. Dar es Salaam.

United Republic of Tanzania 1998. National forest policy and regulatory framework. Ministry of Natural Resources and Tourism. Dar es Salaam.

United Republic of Tanzania 1998. National wildlife policy. Ministry of Natural Resources and Tourism. Dar es Salaam.

United Republic of Tanzania 1999. National tourism policy. Ministry of Natural Resources and Tourism. Dar es Salaam.

United Republic of Tanzania 2002. National water policy. Ministry of Water and Livestock Development. Dar es Salaam.

United Republic of Tanzania 2002. Small and medium enterprise development policy–2002, Ministry of Industry and Trade. Dar es Salaam.

United Republic of Tanzania 2003. National trade policy. Ministry of Industry and Trade. Dar es Salaam.

United Republic of Tanzania 2004. National food security policy. Ministry of Agriculture, Food Security and Cooperatives (MAFC). Dar es Salaam.

United Republic of Tanzania 2005. National water sector development strategy. Ministry of Water. Dar es Salaam.

United Republic of Tanzania 2007. National Adaptation Programme of Action (NAPA), Vice President's Office. Dar es Salaam.

United Republic of Tanzania 2007. National water policy. Ministry of Water. Dar es Salaam.

United Republic of Tanzania 2008. Agricultural marketing policy. Ministry of Industry, Trade and Marketing. Dar es Salaam.

United Republic of Tanzania 2009a. The 2008/2009 preliminary food crop production forecast for 2009/10 food security. Ministry of Agriculture, Food Security and Cooperatives (MAFC). Dar es Salaam.

United Republic of Tanzania 2010. The Comprehensive Africa Agriculture Development Programme CAADP in Tanzania: Brochure No. 1. Ministry of Agriculture, Food Security and Cooperatives. Dar es Salaam.

United Republic of Tanzania 2010a. The 2009/2010 preliminary food crop production forecast for 2010/11 food security. Ministry of Agriculture, Food Security and Cooperatives (MAFC). Dar es Salaam.

United Republic of Tanzania 2011. Budget speech 2011/2012.

United Republic of Tanzania 2011. The Tanzania five year development plan 2011/12 – 2015/16: Unleashing Tanzania's latent growth potentials. Dar es Salaam.

US Bureau of the Census; United States Agency for International Development, International Development Center (U.S.) -1998

Van A. et al. 2011. 'Agronomic and economic benefits of coffee-banana intercropping in Uganda's small holder farming systems'. Agricultural systems, 104(4). April.

Vice President's Office-United Republic of Tanzania (VPO-URT) 2007. National Adaption Programme of Action. Dar es Salaam.

Walkenhorst, P. 2005. 'Trade policy developments in Tanzania: The challenge of global and regional integration. MPRA Paper No. 23399.

Willer, H. and Kilcher, L. (eds). 2012. The world of organic agriculture-Statistics and emerging trends. Bonn: Research Institute of Organic Agriculture (FiBL), Frick and International Federation of Organic Agriculture Movements (IFOAM).

World Bank 2010. 'World development report 2010: Development and climate change'.

World Bank. 2008. 'MDGs and the environment: Agenda for inclusive and sustainable development'. Global monitoring report, pp 290. Washington DC.