



Food and Agriculture Organization  
of the United Nations

# Scoping study on climate-smart agriculture in Kenya

Smallholder integrated crop-livestock farming systems

Mitigation of Climate Change in Agriculture (MICCA) Programme  
Background Report 8



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## **MICCA Programme**

Pilot Project:

Enhancing agricultural mitigation within the East Africa Dairy Development (EADD) Project in Kenya

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**Food and Agriculture Organization of the United Nations (FAO)**

**FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS**  
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## ACRONYMS

<b>4Cs</b>	Common Code for the Coffee Community
<b>ABC</b>	Africa Bio-Carbon Initiative
<b>ACCI</b>	Adaptation to Climate Change and Insurance (Project)
<b>ACRE</b>	Africa Agriculture and Climate Risk Enterprise in Africa
<b>ACT</b>	African Conservation Tillage Network
<b>ADS</b>	Anglican Development Services of western Kenya Region
<b>AEP</b>	Agriculture and Environment Programme (of Homa Bay Catholic Diocese)
<b>AfDB</b>	African Development Bank
<b>AFFA</b>	Agriculture, Fisheries and Food Authority Act
<b>AFOLU</b>	Agriculture, Forestry and land Use
<b>AGRA</b>	Alliance for Green Revolution in Africa
<b>AR5</b>	Fifth Assessment Report (of the IPCC)
<b>ASAL</b>	Arid and Semi Arid Lands
<b>ASDS</b>	Agricultural Sector Development Strategy
<b>ASDSP</b>	Agricultural Sector Development Support Programme
<b>ATAR</b>	Adaptation Technical Analysis Report (of the NCCAP 2012)
<b>AusAID</b>	Australian Aid
<b>BMU</b>	German Ministry for the Environment, Nature Conservation and Nuclear Safety
<b>BMZ</b>	German Federal Ministry for Economic Cooperation and Development
<b>CAADP</b>	Comprehensive African Agriculture Development Programme
<b>CALESA</b>	Climate Change Analogue Locations in Eastern and Southern Africa
<b>CARE</b>	Cooperative for American Remittance to Europe Cooperative for Assistance and Relief Everywhere
<b>CCAFS</b>	The CGIAR Research Program on Climate Change, Agriculture and Food Security
<b>CCAK</b>	Clean Cook Stoves Association of Kenya
<b>CCS</b>	Climate Change Secretariat (of the State Department of Environment, Water and Natural Resources)
<b>CCU</b>	Climate Change Unit (of at the Ministry of Agriculture, Livestock and Fisheries)
<b>CDKN</b>	Climate and Development Knowledge Network
<b>CGIAR</b>	Consultative Group on International Agricultural Research
<b>CIAT</b>	International Center for Tropical Agriculture
<b>CIFOR</b>	Center for international Forestry Research
<b>CIMMYT</b>	International Maize and Wheat Improvement Center
<b>CSA</b>	Climate-Smart Agriculture
<b>CSO</b>	Civil Society Organization
<b>CSTI</b>	Centre for Science and Technology Innovation
<b>DFID</b>	Department for International Development (of UKaid)
<b>DTMA</b>	Drought Tolerant Maize for Africa
<b>EAC</b>	East African Community
<b>EADD</b>	East Africa Dairy Development Project
<b>EC-LEDS</b>	Enhancing Capacity for Low-Emission Development Strategies (of USAID/USDA)



<b>ENSO</b>	El Niño Southern Oscillation
<b>ERS-WEC</b>	Economic Recovery Strategy for Wealth and Employment Creation
<b>ESP</b>	Economic Stimulus Plan
<b>ETP</b>	Ethical Tea Partnership
<b>EU</b>	European Union
<b>FAO</b>	Food and Agricultural Organization
<b>FEWS NET</b>	Famine Early Warning Systems Network
<b>FICCF</b>	Finance Innovation for Climate Change Fund (of StARCK+)
<b>FSD</b>	Financial Sector Deepening
<b>GACCS</b>	Global Alliance for Clean Cook Stoves
<b>GCCI</b>	Global Climate Change Initiative (of the U.S. President)
<b>GDP</b>	Gross Domestic Product
<b>GEF</b>	Global Environmental Facility
<b>GHG</b>	Green House Gases
<b>GIZ</b>	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Technical Cooperation, formerly GTZ)
<b>GTZ</b>	German Technical Cooperation (now GIZ)
<b>GVEP</b>	Global Village Energy Partnership
<b>HIVOS</b>	Humanistisch Instituut voor Ontwikkelingssamenwerking (a Dutch organization for development)
<b>ICCA</b>	Institute of Climate Change and Adaptation
<b>ICPAC</b>	IGAD Climate Prediction and Application Centre
<b>ICRAF</b>	World Centre for Agroforestry
<b>ICRISAT</b>	International Crops Research Institute for the Semi-Arid-Tropics
<b>IFDC</b>	International Fertilizer Development Centre
<b>IFPRI</b>	International Food Policy Research Institute
<b>IIED</b>	International Institute for Environment and Development
<b>IISD</b>	International Institute for Sustainable Development
<b>ILRI</b>	International Livestock Research Institute
<b>IPCC</b>	Inter-governmental Panel on Climate Change
<b>ISAK</b>	Improved Stoves Association of Kenya
<b>ISFM</b>	Integrated Soil Fertility Management
<b>KALRO</b>	Kenya Agricultural and Livestock Research Organization
<b>KARI</b>	Kenya Agricultural Research Institute (now KALRO)
<b>KCCAP</b>	Kenya Climate Change Action Plan (aka NCCAP)
<b>KCCWG</b>	Kenya Climate Change Working Group
<b>KENAFF</b>	Kenya National Farmers Federation
<b>KEPHIS</b>	Kenya Plant Health Inspectorate Service
<b>KEPSA</b>	Kenya Private Sector Alliance
<b>KFS</b>	Kenya Forest Service
<b>KMD</b>	Kenya Meteorological Department (now KMS)
<b>KMS</b>	Kenya Meteorological Service (formerly KMD)
<b>KMT</b>	Kenya Markets Trust
<b>KNAS</b>	Kenya National Academy of Sciences
<b>KSHC</b>	Kenya Soil Health Consortium
<b>LED</b>	Low-Emissions Development
<b>LEDS</b>	Low-Emission Development Strategies

<b>LNGG</b>	Lake Naivasha Growers Group
<b>MALF</b>	Ministry of Agriculture, Livestock and Fisheries (of Kenya)
<b>MAM</b>	March–April–May (Rainy Season)
<b>MEW&amp;NR</b>	Ministry of Environment, Water and Natural Resources (of Kenya)
<b>MICCA</b>	Mitigation of Climate Change in Agriculture Programme of FAO
<b>MoA</b>	Ministry of Agriculture (of the Government of Kenya)
<b>MRV</b>	Monitoring/Measuring, Reporting and Verification
<b>MTIP II</b>	Second Medium Term Implementation Plan
<b>NAFIS</b>	National Farmers Information System
<b>NAMA</b>	Nationally Appropriate Mitigation Action
<b>NAP</b>	National Adaptation Plan
<b>NCCAP</b>	National Climate Change Action Plan (aka KCCAP)
<b>NCCRS</b>	National Climate Change Response Strategy
<b>NEMA</b>	National Environment Management Authority
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>NEPAD</b>	New Partnership for African Development
<b>NERICA</b>	New Rice for Africa
<b>NRM</b>	Natural Resource Management
<b>PAFID</b>	Participatory Approaches for Integrated Development
<b>PES</b>	Payment for Environmental Services
<b>PRESA</b>	Pro-poor Rewards for Environmental Services in Africa
<b>PRSP</b>	Poverty Reduction Strategy Paper
<b>R&amp;D</b>	Research and Development
<b>REDD-plus</b>	Reduced Emissions from Deforestation and Degradation
<b>REFSO</b>	Rural Energy and Food Security Organization
<b>SIMLESA</b>	Sustainable Intensification of Maize-Legume based farming Systems for Food Security in Eastern Southern Africa
<b>SALM</b>	Sustainable Agricultural Land Management
<b>SLEEK</b>	System for Land-based Emissions Estimation in Kenya
<b>SNV</b>	Netherlands Development Organization
<b>SRA</b>	Strategy for Revitalizing Agriculture
<b>StARCK+</b>	Programme for Strengthening Adaptation and Resilience to Climate Change in Kenya (of DFID, Phase II)
<b>TRFK</b>	Tea Research Foundation of Kenya
<b>UNDP</b>	United Nations development Programme
<b>UNEP</b>	United Nations Environment Programme
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>UoN</b>	University of Nairobi
<b>USAID</b>	United States Agency for International Development
<b>USDA</b>	U.S. Department of Agriculture
<b>WG2</b>	Working Group II (of the IPCC)
<b>WRI</b>	World Resources Institute
<b>WRMA</b>	Water Resources Management Authority
<b>WRUA</b>	Water Resource Users Association
<b>WWAP</b>	World Water Assessment Programme
<b>WWF</b>	World Wide Fund for Nature (World Wildlife Fund)

## EXECUTIVE SUMMARY

A national level review and scoping study on climate change policies, programs, projects and activities on Climate-Smart Agriculture (CSA) in Kenya was conducted through a literature review and consultations with stakeholders. A national assessment based on the review of secondary data and results of existing studies was conducted to provide a general overview combined with discussions with researchers, experts and key informant interviews.

The report focuses on the Smallholders Integrated Crop-Livestock/Fish-Tree Farming System (non-ASAL area) in Kenya and on these aspects:

- Climate Change Policies, Low-Emissions Development (LED) strategies and Nationally Appropriate Mitigation Actions (NAMA), in line with the Kenya Vision 2030 and Kenya Climate Change Action Plan
- GHG emissions and climate change analysis, with a focus on the mitigation and adaptation options
- Climate change related programs and projects and other initiatives related with sustainable intensification, adaptation and mitigation and CSA
- Overview of Monitoring, Reporting and Verification systems (MRV) e.g. SALM and Livestock.
- To get a clear picture on the organizations and actors working on CSA
- To gather input of the Government of Kenya through the Climate Change Unit of at the Ministry of Agriculture, Livestock and Fisheries and possibly from the Climate Change Secretariat of the state Department of Environment

This Scoping report provides an overview of the extent of CSA practices in Kenya. The scoping involved an analysis of the current efforts taking place in the non-ASAL counties of Kenya to identify CSA interventions which are building resilience to climate change while at the same time sustaining and/or increasing production. The objectives of the study were to gather as much evidence as possible and map the results of CSA initiatives in Kenya and to examine the extent, range and nature of CSA in the country, including the dimensions of CSA in small-holder farming systems particularly those involving the integration of crops, livestock, fish and/or trees and to understand how Climate-smart Agricultural practices in smallholder farming systems can contribute to the improvement of food security and livelihoods while mitigating climate change in agriculture, where possible. The report documents results from the field and research and response options on the state of CSA in Kenya. The study was undertaken in liaison with the Climate Change Unit (CCU) of the Ministry of Agriculture, Livestock and Fisheries (MALF) in Kenya.

The study considered a range of practices being tested or implemented that are scalable (e.g. conservation agriculture, agroforestry, cover crops, biogas, efficient cook stoves, enhanced fodder quality, changes in plant or animal genetic resources, reduced farm residue burning, intensive on-farm diversification, quantifying the benefits of actions taken to improve CSA etc.); farm productivity and/or economic information (crop, livestock, fish yields, biomass) in integrated farming systems; measures or results of carbon dynamics (e.g. sequestration, biomass production), nutrient dynamics (e.g. changes in nitrogen inputs or effectiveness, biological N fixation, nutrient cycling), land/soil health (e.g. land cover, organic matter changes, soil conservation, soil fertility management), effective water cycles (e.g.

available water holding capacity, water use efficiency, etc.); greenhouse gas emissions estimation (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O); micro-climate changes and adaptation strategies; socio-economic dimensions, household income, gender dimensions, household information on perceptions of climate change or potential for uptake of CSA practices; incentives mechanisms: payment for ecosystem services (e.g. carbon markets); knowledge requirements and capacity development activities; evidence or factors associated with scaling up of CSA activities; outputs of scenarios and other potential impact models among others.

Special attention was directed at bringing out evidence in terms of options for the ‘multiple-win’ concept of CSA: (1) options that can increase productivity and food and nutrition security at the current levels of emissions; (2) options that can increase resilience and reduce emissions at the current levels of productivity and food security; (3) options that reduce post-harvest losses and food wastage along value chains at the current or reduced levels of emissions; (4) options that can achieve all the above simultaneously.

Information collected indicates that many initiatives have in them elements of CSA but are not calling them CSA, nor are they addressing them using a climate change lens. Socioeconomic considerations were found to be more important in making decisions than climatic and environmental perspectives.

Current official position of the government of Kenya is to first increase adaptation/resilience to allow farmers to increase and/or sustain productivity in the face of climate change and where possible and feasible, doing this in a way that also reduces greenhouse gas emissions (Government of Kenya, 2012a). In addressing these objectives the Government of Kenya considers options that can:

- Increase production efficiency or ecosystem resilience while simultaneously reducing emissions, post-harvest losses and food wastage along value chains
- Facilitate the sustainable management of agricultural resources or
- Facilitate the building of local capacity to implement CSA initiatives (or support the facilitation of) CSA knowledge sharing or
- Enable access to markets for CSA products

This study was done in preparation for a national CSA stakeholders’ workshop in Kenya, held on 8<sup>th</sup>/9<sup>th</sup> October 2014. The first part of the workshop was an opportunity for gathering research, practice and policy inputs. This first part brought together key actors from the research, development and policy domains to share relevant results, evidence and experience and to begin to build a coherent set of response options. The second part of the workshop comprised of orchestrated interaction among decision makers at multiple levels with the knowledge generated from different sources in a co-learning approach.



## **1.0 INTRODUCTION**

Agriculture plays a major role in the economy of Kenya in terms of contribution to food security, stimulating industrial growth, generating income, creating employment, earning foreign exchange and reducing poverty. The sector directly contributes about 25.4 percent<sup>1</sup> of the country's Gross Domestic Product and another 27 percent indirectly via linkages to agro-based industries and the service sector, giving an overall 52 percent contribution to Kenya's GDP (Government of Kenya, 2012b). The recognition of the role a vibrant agricultural sector can play in Kenya's economic growth is emphasized in various government policy documents such as the Poverty Reduction Strategy Paper (PRSP) of 2001, Economic Recovery Strategy for Wealth and Employment Creation (ERSWEC) of 2003, the Strategy for Revitalizing Agriculture (SRA) of 2004 and the Kenya Vision 2030 of 2008 among other policy blueprints. One of the agricultural subsectors playing an important role in Kenya's socio-economic development, including household food and nutrition security, is livestock. The livestock sub-sector alone contributes about 12 percent of Kenya's Gross Domestic Product (GDP), 40 percent to the agricultural GDP and employs 50 percent of agricultural labour force. About 40 percent of Kenya's livestock herd is found in the non-arid-and-semi-arid land (non-ASAL) areas, which constitute about 15–17 percent of the country.

The goal and purpose of the Ministry of Agriculture Livestock and Fisheries (MALF) in Kenya is to lead in the conservation, protection and management of agricultural, livestock and fisheries resources for socio-economic development. The Ministry aims to ensure food security through promotion of a competitive, commercially oriented crop, livestock and fisheries farming and the sustainable management of agricultural livestock and fisheries resources.

FAO, in August and September 2014, conducted an analysis of the current efforts taking place in Kenya's agriculturally high production zones, comprising non-ASAL counties (Figure 1).

This effort was meant to identify CSA interventions. The target region occupies 10.45 percent of Kenya and supports 61.19 percent of the population, according to records of 2009 national population and housing census.

### **1.1 Objectives of the Scoping Study**

The study was undertaken

- To identify and analyze CSA Initiatives taking place in Kenya, including policies and laws, strategies, programs, projects and actions and
- To gather examples of CSA practices in non-ASAL smallholders integrated crop-livestock farming systems

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<sup>1</sup> This is the contribution computed after the rebasing of Kenya's GDP in September 2014

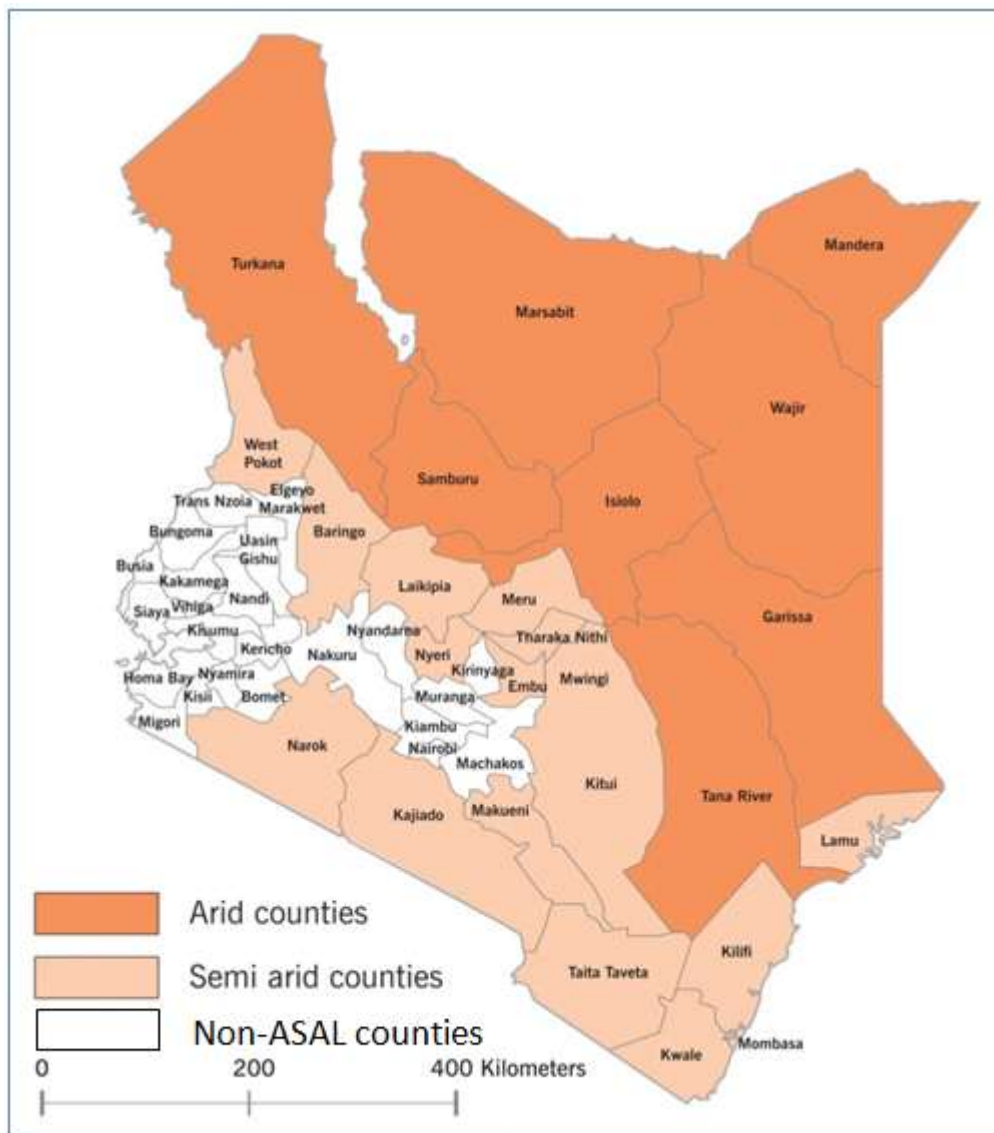


Figure 1: Map of Kenya showing non-ASAL counties (un-shaded part).

Source: Adaptation Consortium Secretariat, Nairobi, Kenya.

## 1.2 Integrated Farming Systems in Kenya

Farming in Kenya is primarily small-scale, with about 75 percent of total agricultural output produced on rain-fed agricultural lands on farms averaging 0.3 to 3 hectares in size (Government of Kenya, 2012a). Variants of small scale integrated crop-livestock/fish-tree farming systems in Kenya include crop-livestock systems; crop-tree systems; crop-livestock-tree systems; rice-fish integrated systems and fish-poultry systems. The integration is a strategy for increasing productivity and sustaining income in the face of increasing human population pressure, particularly in the densely populated areas of Kenya (Thorpe et al., 2000). In livestock-based systems three of these sub-systems stand out among farmers in Kenya:

### **Large-Scale Mixed Crop-Livestock-Tree Farming**

These are commercially well-equipped farm lands using modern technology. Improved dairy herds grazed on improved pastures are common in this system in Kenya, with fodder conservation and supplementary feeds used to varying degrees. Pasture-legume mixtures are also found here. Hay and purchased feeds are commonly used.

### **The Medium Scale Semi-Zero Grazing Systems**

This system of production is more prevalent where population pressure is medium to high with higher land ratios per household or per capita. Individual land holdings in this system vary from 5 to 15 ha in Kenya and are closely linked to the settlement schemes. The predominant method in use is natural grazing and/or with limited planted fodders and pastures. Substantial beef and shoat meat are provided here.

### **Smallholder Zero-Grazing Systems**

Zero-grazing is the most intensive livestock production system in practice, involving the 'cut-and-carry' method of feed management. This system is characterized by ownership of 1-2 dairy livestock units and it is found in many parts of agroecologically medium to high potential areas of Kenya. Agro-ecologically these zones are also characterized by the growing of coffee/tea/potato.

## **1.3 Climate change in Kenya**

The state of climate change in Kenya is documented in the Farm Management Handbook of Kenya (Jaetzold et al. 2009), the Atlas of Kenya's changing environment (UNEP, 2009), The National Climate Change Response Strategy (Government of Kenya, 2010b), The State of Environment Outlook (NEMA Kenya, 2010), The National Climate Change Action Plan (Government of Kenya, 2012a) and the Draft National Climate Change Framework Policy (MEWNR, 2014a) among others. An analysis of trends in temperature, rainfall patterns, extreme events and severe, slow onset events points to clear evidence of climate change in the country, with a clear indication that temperatures have generally risen throughout the country.

Proceedings of an Outreach Workshop on the Fifth Assessment Report (AR5) of Intergovernmental Panel on Climate Change (IPCC) organized by the Climate and Development Knowledge Network (CDKN) for Kenya held on 31<sup>st</sup> July – 1<sup>st</sup> August 2014 gave a clear overview of the climate change situation in the country. The change signals that have been observed include: temperature rises (Table 1); indications of changes in seasonal rainfall patterns (onset and cessation dates); general decreasing annual rainfall trends at many locations; melting and retreat of mountain glaciers (e.g. on Mt. Kenya and Mt. Kilimanjaro); and increasing frequency of ENSO events (extreme climate events). According to evidence adduced in the workshop, rainfall is the most important climatic parameter in Kenya. It is ranked as the number one climatological parameter which has the highest degree of variation in both space and time. Temperature is the other most important climatic parameter in Kenya. It affects evapotranspiration, soil moisture and water availability among other effects. However, it is less variable compared to rainfall.



Seasonal rainfall trends have been found to give mixed results, with some locations indicating increasing trends while others show no significant changes. Seasonal rainfall patterns indicate an overall increasing trend in locations of western Kenya, with a decreasing trend in first rains and an increasing trend in second rains. However, in central and Eastern Kenya the overall trend is decreasing. An analysis of trends in temperature, rainfall patterns, extreme events and slow onset events points to clear evidence of climate change, with a clear indication that temperatures have generally risen throughout the country (Table 1).

**Table 1: Temperature Patterns (Tmax) and Magnitude of Change in Kenya (1960-2012)**

• Region of Kenya	• Minimum (night) Temperature		• Maximum (day) Temperature	
	• Trend	• Magnitude/ °C	• Trend	• Magnitude/ °C
• Western	• Increase	• 0.8 – 2.9	• Increase	• 0.5 – 2.1°C
• Northern	• Increase	• 0.7 – 1.8	• Increase	• 0.1 – 1.3°C
• North-Eastern	• Increase	• 0.7 – 1.8	• Increase	• 0.1 – 1.3°C
• Central	• Increase	• 0.8 – 2.0	• Increase	• 0.1 – 0.7°C
• South Eastern	• Increase	• 0.7 – 1.0	• Increase	• 0.2 – 0.6°C
• Coast	• Decrease	• 0.3 – 1.0	• Increase	• 0.2 – 2.0°C

Source: Government of Kenya, 2010b; 2012a and Kenya Meteorological Service presentation at the CDKN/IPCC AR5 Outreach Workshop 31<sup>st</sup> July – 1<sup>st</sup> August 2014

An analysis of the first (MAM) rains by FEWS NET indicates that the high rainfall zone is shrinking (Figure 2). A declining trend is evident in the long-rainy (main growing) season in the high and medium rainfall areas of Kenya and variability in amount and timing is increasing. Areas of ‘west-central’ Kenya receiving 500+mm of rain has shrunk since 1960 and is likely to keep shrinking. Seasonality of rainfall, heat stress, intermittent dry spells and frequent drought years is heavily impacting rain-fed agriculture. Poor natural resource management (NRM), especially on water and soil, but also on biological resources such as useful plants and animals, has increased the vulnerability and decreased the adaptive capacity of communities and ecosystems. Cropped area per-capita is declining due to the shrink in potential but is also compounded by population pressure and physical development in agriculturally productive areas.

Observations made in the Farm Management Handbook of Kenya (Jaetzold et al., 2009) and the Atlas of Kenya’s changing environment (UNEP, 2009) show that Kenya’s average annual temperatures increased by 1°C between 1960 and 2003 while temperatures in western Kenya rose by 0.5°C between 1981 and 2004. In the drier parts of Kenya it went up by 1.5°C through the same period.

**1.3.1 Climate change impacts in Kenya**

Analysis of climate change impacts in Kenya indicates that it is already taking a heavy toll on the economy. Government of Kenya (2012a, p.5) states that “The continued annual burden

of the extreme climatic events could cost the economy as much as US\$500 million a year, which is equivalent to approximately 2.6 percent of the country’s GDP with implications for long-term growth”. Resource poor farmers and communities or individuals with substantial exposure to climate change elements are rendered vulnerable, often facing serious crop failures, income losses and livelihood collapses. Rain-fed agriculture, which accounts for 98 percent of the agricultural activities in the country (WWAP, 2006; WRI, 2007; UNEP, 2009; NEMA Kenya 2010; UNDP, 2012), is very vulnerable to increasing temperatures, droughts and floods, which reduce agricultural productivity. Increasing temperatures are also likely to affect the growing of major crops in the country and threaten the livelihoods of farmers. The warming trend and changes in precipitation patterns are expected to continue into the 21st century (IPCC 2013).

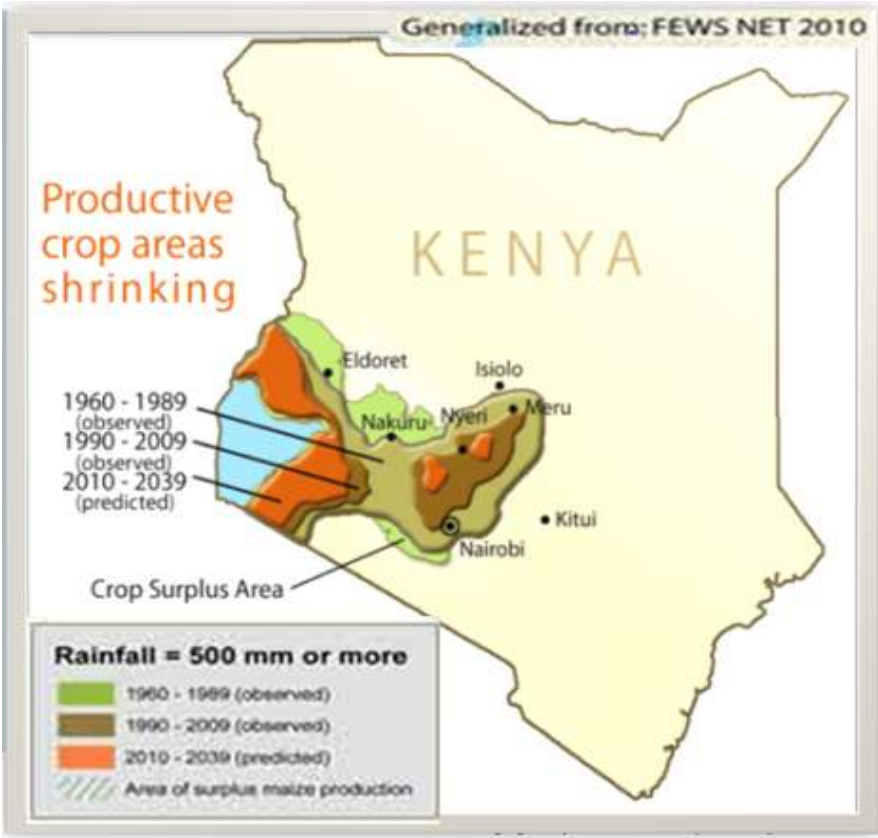


Figure 2: Climate Scenarios for High and Medium Production Areas of Kenya

Source: FEWS-NET Kenya August 2010

Some of the challenges include increased droughts, flooding, excessive and erratic rainfall, storms, intensified natural resource degradation, pest-and-disease epidemics, risk of resource use conflicts, reduced agricultural production and increased food insecurity among others. Most parts of the region are projected to undergo contraction of growing periods although limited parts of the highlands may see expansion of growing periods. Crop and grassland simulations predict overall decreases in yields to the 2030s and 2050s, severe in some places. Shift in season start dates are also likely, in addition to shifts in length of growing periods. Increases in extreme events and in climate variability are very likely, with direct impacts on livelihoods and food security. Widespread negative impacts on forage

quality are predicted, as well as negative effects of increased temperature on feed intake, reproduction, performance across all livestock species, increasing climate variability on downside risk (= the probability that an asset will fall in price; or the measure of the possible loss from that decline). Limits (tipping points) to agronomic adaptation are predicted, beyond which agricultural transformations will be needed.

Based on many studies covering a wide range of regions and crops, negative impacts of climate change on crop yields have been more common than positive impacts (IPCC, 2014). IPCC AR5 WG2 predicts shifts in production areas of food and non-food crops across the world. The agricultural sector in Kenya is also heavily impacted by climate change (Ketiem et al., 2008). Kenya Agricultural Research Institute (KARI)'s Desert Margins Research Program, supported by UNEP/GEF, shows that there are many areas of Kenya where growing of maize is increasingly becoming unviable due to the impacts of climate change, often failing in 3 out of every 5 years (Onyango et al., 2011). A study by International Food Policy Research Institute and Climate Change, Agriculture and Food Security (IFPRI/CCAFS) observes that the maize growing zones in Kenya are shifting due to the impacts of climate change (IFPRI, 2013).

Agriculture sector is among the most vulnerable sectors to the impacts of climate change, yet it is also major emitter of greenhouse gases globally (Figure 3). Agriculture, Forestry and land Use (AFOLU) emits in total 24.87 percent of greenhouse gases (mainly CH<sub>4</sub> and N<sub>2</sub>O). In low-income countries total emissions are dominated by trends in AFOLU.

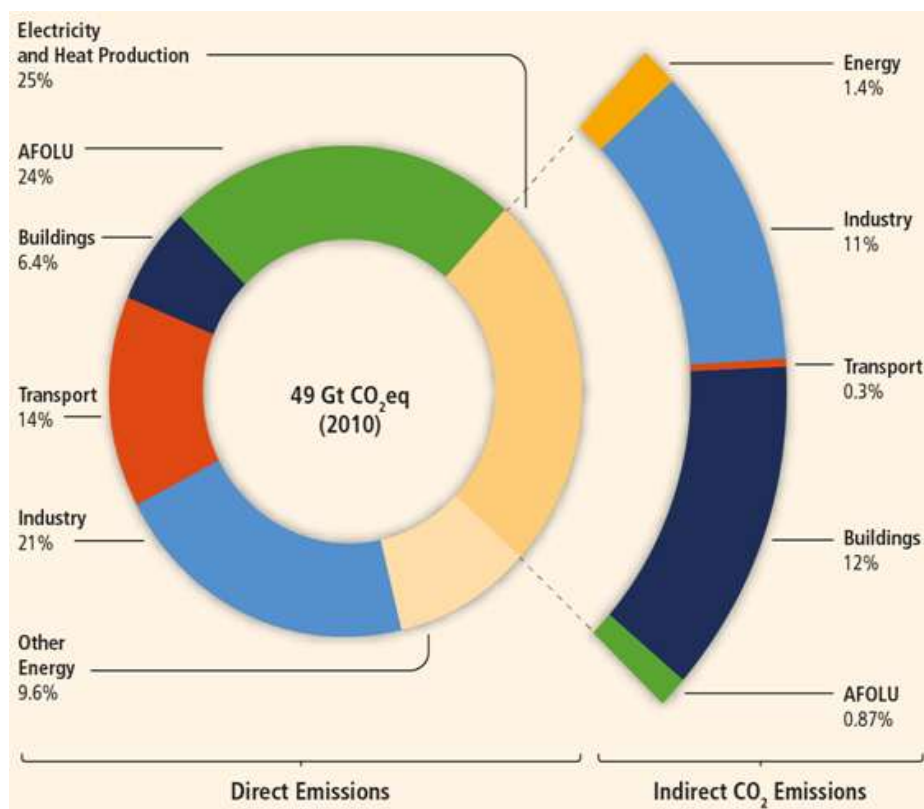


Figure 3: Total anthropogenic GHG emissions by economic sectors worldwide

Source: IPCC AR5 WG3 SPM Figure 2 (2014).

In Kenya, the major GHG emissions sources in agriculture include enteric fermentation (56 percent) and manure left on pasture (38 percent) (FAOSTAT 2014).

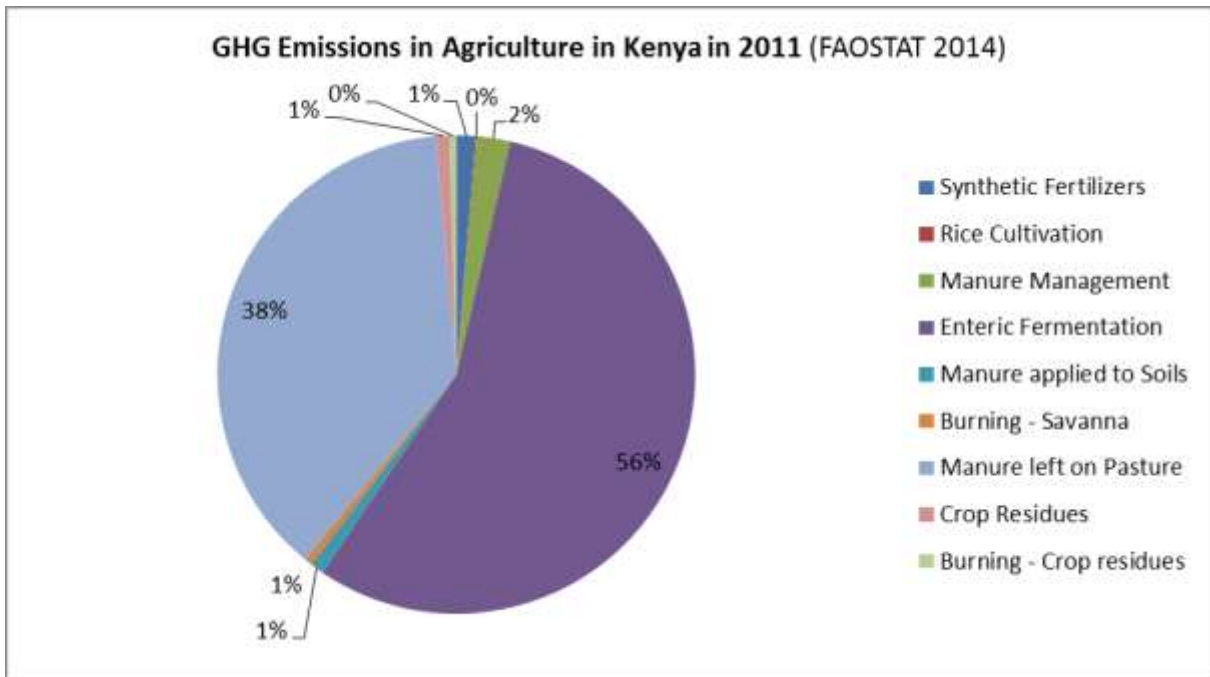


Figure 4: GHG Emissions in Agriculture in Kenya in 2011 (FAOSTAT 2014).

### 1.3.2 The Climate-Smart Agriculture Solution

CSA as defined by FAO is composed of three main pillars: sustainably and efficiently increasing agricultural productivity and incomes (adaptation); enhancing the achievement of national food security and development goals (resilience, synergies and trade-offs; poverty reduction); and reducing and/or removing greenhouse gas emissions (mitigation) *where possible* (FAO 2010, 2013). It is also considered as an approach to developing the technical, policy and investment conditions to achieve sustainable agricultural development for food security under climate change. CSA efforts revolve around weather, soil, tillage, water, pest/ vector, crop/ livestock, biodiversity, harvest and post-harvest interventions. The key message in the CSA concept is to conserve and produce suitable varieties and breeds; to adopt an ecosystem approach and to work at landscape scale. What makes CSA innovative is that it provides a framework for discussing tradeoffs between productivity, resilience building and Low-Emissions development and for bringing the issues to the forefront of agricultural planning decisions.

## **2.0 CLIMATE CHANGE RELATED POLICIES, LAWS AND STRATEGIES IN KENYA**

The Government of Kenya has over the years developed policies and strategies to enhance agricultural growth, natural resource management and climate change interventions. Some of the policies are summarized in this section. The policies are arranged by order of hierarchy where one policy is of a higher order than the other and by date where the policies are deemed to be at the same level.

### **2.1 The Constitution of Kenya 2010**

Chapter V of the Constitution of Kenya, on Land Environment, provides for sustainable approaches to natural resource management, which is in line with the principles of CSA (National Council for Law Reporting, 2010). Section 60(1) states that land in Kenya shall be held, used and managed in a manner that is (...) productive and sustainable and in accordance with (*inter alia*) (c) Sustainable and productive management of land resources; (e) Sound conservation and protection of ecologically sensitive areas. Section 69(1) states that the State shall (*inter alia*)

- (a) ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources and ensure the equitable sharing of the accruing benefits;
- (b) work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya;
- (c) protect and enhance intellectual property in and indigenous knowledge of, biodiversity and the genetic resources of the communities;
- (d) encourage public participation in the management, protection and conservation of the environment;
- (e) protect genetic resources and biological diversity;
- (f) establish systems of environmental impact assessment, environmental audit and monitoring of the environment; and
- (g) eliminate processes and activities that are likely to endanger the environment.

### **2.2 Comprehensive African Agriculture Development Programme Framework**

Kenya, in July 2010, adopted the New Partnership for African Development's (NEPAD) Comprehensive African Agriculture Development Programme (CAADP) Compact Framework for agriculture and food security strategies and investment plans. CAADP was adopted by the AU Heads of State in June 2003 (Maputo Declaration). It operates under four pillars covering (1) land water management, (2) capacity building, (3) food security and (4) research and technology dissemination/adoption. In 2006 the Framework was expanded to include livestock, forestry and fisheries sub-sectors. The Framework has also been expanded to

include incorporating CSA into national and local programs under the NEPAD Climate Change Adaptation-Mitigation Framework, focusing on land water management as priorities while integrating climate change aspects. Key components of the CAADP CSA analytical framework include sustainable intensification and resiliency of production systems and the reduction of greenhouse gas emissions caused by agriculture. However, whereas CAADP is continental in scope, implementation is at the national level, formalized through a CAADP Compact agreement signed by all key partners. The implementation of CAADP at the national level entails various complementary roles of different players-the government, development partners, private sector, NGOs, community-based organizations, research institutions, producers and civil society. Kenya's CAADP Compact is therefore a strategy document that commits the government to implementing the common vision of the sector, as described in the Agricultural Sector Development Strategy (ASDS) (Government of Kenya, 2010a), to address the agricultural development agenda in the country.

The aims of CAADP include environmentally sound agricultural production and a culture of sustainable management of natural resources in Africa. Key among these CAADP's strategies is the requirement for Governments to invest 10 percent of national budgets in the agricultural sector and achieving a 6 percent growth in the agricultural sector. However, by the time of compiling this scoping report Kenya had neither attained the 10 percent budget allocation nor the 6 percent agricultural growth rate, despite this commitment. Kenya's Economic Survey/Review of 2013 indicated that agriculture grew by 2.9 percent and livestock subsector grew by 5.0 percent over the same period.

### **2.3 East African Community Climate Change Policy**

The East African Community Climate Change Policy was developed as a result of a directive by the Heads of State of the East African Community (EAC) Partner States in November 2009 to address the adverse impacts of Climate Change in the region (EAC, 2010). The policy emphasizes the need for an integrated, harmonized and multi-sectoral framework for responding to Climate Change in the EAC region. The policy aims at strengthening meteorological services and improving early warning systems, increasing preparedness for disaster risk management, scaling up of efficient use of water and energy resources, irrigation, crop and livestock production, protection of wildlife and key vulnerable ecosystems such as wetlands, coastal, marine and forestry ecosystems, improving land use, soil protection, tourism, infrastructure and human settlement; intensify diseases, vectors and pests control. Mitigation measures prioritized in this Policy include afforestation, reforestation, promotion of energy efficiency, efficient crop and livestock production systems and efficient transport systems, waste management while capturing opportunities in emission reductions in the region. However, the blueprint emphasizes that such actions should not compromise the region's social and economic development. In order to fully implement this policy, each Partner State shall develop a national policy, strategies and institutional arrangements to operationalize the provisions made in this policy.



## 2.4 Kenya Vision 2030 Blueprint

In 2008, Kenya launched Vision 2030 as the country's long term development blueprint, to replace Economic Recovery Strategy (ERS) for Employment and Wealth Creation blueprint of 2003. Kenya Vision 2030 identifies agriculture as a key sector through which increased economic growth rates can be achieved. Under the Vision, smallholder agriculture is to be transformed from subsistence activities, marked by low productivity and value addition, to 'an innovative, commercially-oriented, internationally competitive and modern agricultural sector'. Vision 2030 aims to transform Kenya into a newly industrializing middle-income country by 2030. The document captures environmental issues in general but does not put into consideration the issue of climate change in particular. However, climate change blueprints developed after it take cognizance of its environmental considerations and the Medium Term Implementation Plans factor in these climate change issues captured in the national climate change policy documents. As Kenya moves to achieve its development aspirations, greenhouse gas (GHG) emissions will rise. In view of this, Government of Kenya (2012a) has put in place mitigation plans which include transitioning to a low-carbon development pathway to ensure that the country's contribution to global emissions remains low.

## 2.5 The National Land Policy (of Kenya)

The National Land Policy, Sessional Paper №3 of 2009 (Ministry of Lands, 2009), encourages sustainable intensification of use in high-potential, densely populated areas, through the application of efficient methods; improvement of the condition and productivity of degraded lands and through application of cost-effective irrigation methods.

## 2.6 National Climate Change Response Strategy

National Climate Change Response Strategy (Government of Kenya, 2010b) highlights various measures for adapting agriculture to climate change and for mitigating the emissions of greenhouse gases in agriculture. Some of the strategies proposed include adoption of a range of innovative methodologies, processes and adaptive agricultural technologies from analogue environments, crop diversification, mixed cropping, tree planting, irrigation and diversification of livelihoods, enhancing early warning systems with drought monitoring and seasonal forecasts. Adaptation measures suggested for agriculture in NCCRS include the prevention, tolerance or sharing of losses; changes in land use or activities; changes of location; restoration of degraded ecosystems; provision of downscaled weather information and farm inputs; water harvesting for irrigation; protection of natural resource base (soil and water conservation techniques); research and dissemination of superior (drought tolerant, salt-tolerant, pest and disease resistant) crops.

## 2.7 Agricultural Sector Development Strategy

Agricultural Sector Development Strategy: Sustainable Land Natural Resource Management – borrows heavily from the NCCRS (Actually implements it)

Consistent with Kenya Vision 2030, NCCRS and with NEPAD-CAADP Compact, the Agricultural Sector Development Strategy envisages a food secure and prosperous nation (Government of Kenya, 2010a; Republic of Kenya, 2010). CAADP implementation is about ensuring coordination and alignment of its principles with country-level plans and processes. Accordingly, in Kenya CAADP is implemented through the ASDS institutional framework, using existing ministries and institutions to implement activities specified in the strategy. The ASDS has six thematic areas while CAADP has four pillars. In the ASDS, the CAADP pillars are the equivalent of its thematic areas (Table 2).

**Table 2: Table CAADP Pillars and ASDS Thematic Areas**

	CAADP Pillars	ASDS Thematic Areas
1	Land Water management	Environment, Sustainable Land Natural Resource Management
2	Capacity Building – of private entrepreneurs including commercial and smallholder farmers	Agribusiness, Value Addition and Marketing
3	Food Security: Policy and regulatory actions, infrastructure development, capacity building, partnerships and alliances	Food and nutrition security policy and programmes
4	Research and Technology Dissemination/ Adoption	Research and Extension
5		Inputs and Financial Services
6		Legal, Regulatory and Parastatal Reforms

The ASDS is the overall national policy document for the agricultural sector, envisaging a food secure and prosperous nation. The natural resource management interventions proposed in the Strategy borrows heavily from the Government of Kenya (2010b). The Strategy specifically outlines the implementation of the NCCRS, noting in part that climate fluctuations have a bearing on the way the environment and natural resources are managed and the effect has been unpredictable weather that in turn has affected agricultural activities.

**2.7.1 National Food and Nutrition Security Policy**

The National Food and Nutrition Security Policy of (Government of Kenya, 2011c) recognizes climate change as an emerging issue for food and nutrition security and advocates for adaptation interventions that enhance farming communities’ resilience to climate change induced effects. It also recognizes the role of mitigation in addressing climate change.



## 2.7.2 National Agribusiness Strategy

National Agribusiness Strategy 2012 recognizes the “context of rapidly changing climate and environmental degradation” and the need to “improve risk management capabilities and insurance schemes”, along with better information on risks (climate, diseases, market trends etc.) and how to overcome them (Government of Kenya, 2012b).

## 2.7.3 The National Disaster Management Policy

This policy, formulated in 2012, institutionalizes disaster management and mainstreams disaster risk reduction in the country’s development initiatives. The policy aims to increase and sustain resilience of vulnerable communities to hazards. The National Drought Management Authority (NDMA) was created under this policy to coordinate all matters relating to drought management in Kenya and. It has to ensure the delivery of all the policies and strategies that relate to drought management and climate change adaptation.

## 2.8 The Agriculture, Fisheries and Food Authority Act

The AFFA Act, № 13 of 2013, while replacing a significant part of the repealed Agriculture Act (Chapter 318 Laws of Kenya), also borrowed heavily from the latter to maintain continuity of its good provisions (Republic of Kenya, 2013). This borrowing is captured in Part IV of the new Act, dealing with “Policy Guidelines on Development, Preservation and Utilization of Agricultural Land”. The title and spirit of the repealed Act was “An Act of Parliament to promote and maintain a stable agriculture, to provide for the conservation of the soil and its fertility and to stimulate the development of agricultural land in accordance with the accepted practices of good land management and good husbandry”. The Act provided rules for good agricultural practice and in particular rules for appropriate use of agricultural land, aiming at development and preservation of land the preservation of the soil and its fertility. Three subsidiary legislations stood out to support the principles of CSA:

- The Agriculture Act (Land Preservation) Rules, L/N. №492/1956, L/N. №352/1963
- The Agriculture Act (Basic Land Usage) Rules, L/N. №26/1965
- The Agriculture Act (Farm forestry Rules) L/N. № 166/2009

The regulation for repealing subsidiary legislation under AFFA means that these legal notices are still in force. However, their letter and spirit are also captured under Sections 22 (Rules on preservation, utilization and development of agricultural land) and 23 (Land preservation guidelines) of AFFA Act, 2013. "Agriculture" in the AFFA Act means cultivation of land the use of land water for any purpose of husbandry, aquaculture and food production and includes: (a) cultivation of crops and horticultural practice within the meaning of the Crops Act; (b) breeding of aquatic animals and plants in the Kenya fishery waters and sea ranching and fish farming in the sea as provided for in the Fisheries Act; (c) the use of land, meadow land, market gardens or nursery grounds; (d) fish harvesting within the meaning of the Fisheries Act; and (e) the use of land for agroforestry, when that use is ancillary to the use of land for other agricultural purposes; (f) transgenic and microbial formulations for use and application in agricultural systems.

The AFFA has provisions for (i) afforestation or re-forestation of land; (ii) the drainage of land, including the construction, maintenance or repair of drains, gullies, contour banks, terraces and diversion ditches; (iii) salinization, acidification and salification of soil. Such guidelines could apply to CSA because:

- afforestation of land could be implemented using the climate-smart agricultural practice of agroforestry;
- land management practices, such as terracing and water harvesting, to prevent soil erosion can be defined as climate-smart agricultural practices because they provide adaptation, mitigation and productivity benefits; and
- actions to improve soil health, or avoid negative productivity effects from poor soil conditions such as salinization, could involve CSA practices (e.g. changing crop varieties, crop rotations, intercropping with nitrogen-fixing legumes, conservation agriculture and use of manure fertilizer).

### **2.8.1 Land Preservation Rules**

These Rules, made under the Agriculture Act, empower the Director of Agriculture to issue a land preservation order, with the approval of the district agricultural committee concerned, to any owner or occupier of land for any of the purposes set out in section 48 of the Act. Such order may require acts or things to be performed or done or prohibit acts or things from being performed or done to the satisfaction of the Director, imposing conditions upon any such requirement and prescribing periods and dates upon, within or before which such acts or things shall be performed or done or such conditions shall be fulfilled. An order shall be in the form as set out in the Schedule to these Rules. Principal elements of these rules are captured in the Integrated National Land Use Guidelines (NEMA Kenya, 2011).

### **2.8.2 Basic Land Usage Rules**

These Rules introduce various prohibitions regarding use of sloping land introduce other measures regarding the prevention of soil erosion on such land. They shall apply to all land in Kenya except plots of not more than two acres used for residential purposes within a municipality, a former township or a township shall not apply to lands used for recreational purposes. Cultivation, cutting or destroying vegetation or depasturizing of livestock on slopes exceeding 35 percent is declared to be an offence if not authorized by the appropriate officer who may also prohibit these activities on other specified sloping land or judge if adequate measures against erosion are taken. Principal elements of these rules are captured in the Integrated National Land Use Guidelines (NEMA Kenya, 2011).

### **2.8.3 Farm Forestry Rules**

These Rules, made by the Minister for Agriculture in 2009, require farmers to establish and maintain farm forestry (i.e. woodlots) on at least ten percent of every agricultural land holding. Principal elements of these rules are captured in the Constitution of Kenya 2010. One of the objectives of the Rules is to preserve and sustain the environment and to combat global warming and climate change. Other declared objectives include: the conservation of water, soil and biodiversity; the protection of riverbanks, shorelines, riparian and wetland areas; and the sustainable production of wood. The Rules state that the species of trees or

varieties that are required to be planted must not be those that can have adverse effects on water sources, crops, livestock, soil fertility and the neighborhood and must not be of invasive nature. The Rules also require Agriculture Authorities at the district (now county) level to identify land at risk of degradation and establish measures necessary for ensuring its conservation including planting of trees.

#### **2.8.4 Crops Act 2013**

The Crops Act 2013 is an important piece of new legislation for the agricultural crops sector in Kenya, establishing sustainable and environmentally friendly production as the standard for all land cultivation (Republic of Kenya, 2013). It outlines the role of County governments in implementing national policies and laws, including the responsibility for soil and water conservation. The provisions requiring farmland users to cultivate and make the land economically productive in a “sustainable and environmentally friendly manner” could support uptake of CSA because climate-smart agricultural practices are intended to increase productivity whilst supporting sustainable agriculture. County governments’ responsibility for soil and water conservation would be applicable to CSA in the same way it would apply to other forms of agricultural production, but climate-smart agricultural practices could make it easier for farmers to meet established soil and water conservation standards because climate-smart agricultural practices are intended to reduce impacts on natural resources.

### **2.9 National Climate Change Action Plan**

A National Climate Change Action Plan (Government of Kenya, 2012a) was developed to implement the NCCRS. During the NCCAP process it was found a lot was already beginning to take place since 2008, which could benefit the objectives of climate change adaptation or mitigation or both. Some of the initiatives found going on in agriculture which could qualify as CSA included efforts in coffee and tea subsectors, which started as mitigation projects under the Kyoto Protocol but later embraced adaptation concepts under the Cancun Agreement. Other initiatives included promoting irrigated agriculture; conservation agriculture; value addition to agricultural products, developing weather indexed crop insurance schemes; support for community-based adaptation including provision of climate information to farmers, enhanced financial and technical support for drought resistant crops. Under livestock and pastoralism efforts were going on to breed animals tolerant to local climatic conditions; weather indexed livestock insurance; establishment of fodder banks; documenting indigenous knowledge; provision of water for livestock and humans; early warning systems for droughts and floods; and vaccination campaigns for emerging disease epidemiology problems. Under water resources, efforts were oriented to enforcement and/or enactment of laws for efficient water resource management; increasing capture and retention of rainwater; water quality monitoring; de-silting rivers and dams; protecting and conserving water catchment areas; investing in water recycling facilities; campaigns on water harvesting; developing hydrometric network to monitor river flows and flood warning. Under forestry, efforts were being made to promote agroforestry-based alternative livelihood systems and promoting alternative energy sources, including the promotion of improved cook stoves.

NCCAP 2012 reports that a number of climate change adaptation interventions have been proposed in strategic plans of ministries and some are currently being implemented by government, civil society and/ or the private sector. These include: seasonal forecast provision to vulnerable communities; support for community-based adaptation strategies, conservation agriculture, developing weather indexed livestock and crop insurance schemes, climate change relevant agricultural research and extension services; promoting heat tolerant and adaptive livestock breeds; establishment of fodder banks for dry season feeding and institutionalizing early warning systems.

Suggestions made in the Adaptation Technical Analysis Report (ATAR) of NCCAP for building adaptive capacity included: mainstream climate resilience into agricultural finance and financial mechanisms for adaptation e.g. credit, grants, subsidies, import duty, support up-scaling of successful mechanisms; build enabling policy environment for development of crop, livestock, fisheries, insurance; develop framework for up-scaling successful insurance initiatives; build on existing market access improvement activities to ensure Kenyan small scale farmers can deliver crops at a fair price to market in the face of a variable and changing climate; strengthen demand-driven Research and Development (R&D) to generate climate resilient information, technologies, methodologies; contribute to development of climate information sharing and knowledge management systems; strengthen collaboration between Ministry of Agriculture (MoA), Kenya Meteorological Department (KMD, now KMS) and others; enhance capacity for agro-meteorological information provision and ensure effective service delivery mechanisms including climate-smart extension.

**2.9.1 Draft National Adaptation Plan**

Proposed actions in the Government of Kenya (2012a) informed the drafting of a comprehensive National Adaptation Plan, assisted by the Department for International Development (UKaid). However, the NAP process is yet to be completed. Adaptation Options Proposed in the NCCAP include but not limited to agroforestry; conservation agriculture and integrated soil fertility management; drought tolerant crops; water harvesting; drip irrigation; price stabilization scheme for livestock; strategic food reserve; index-based weather insurance; climate information. The prioritized sector-based adaptation actions under the draft NAP are summarized in Table 3.

Table 3: Prioritized Adaptation Actions by Sector

MTP Theme	Sector	Priority Actions
<b>FOUNDATION PILLAR</b>	<b>Meteorological Services</b>	Improve observational network and establish climate information centers in every county
		KMD (in partnership with other organizations and research institutions) to provide an assessment of baseline climate and future climate change at county level to inform the process of developing county adaptation plans
		Expand existing climate change modelling work by KMD through collaboration with other international research organizations

MTP Theme	Sector	Priority Actions
	<b>Science, Technology and innovations</b>	Strengthen the implementation and enforcement of existing intellectual property laws to promote climate resilient technology development and transfer.
	<b>Public sector reforms</b>	Re-orient the curricula of the Kenya School of Government to include Climate Change Adaptation as a cross cutting issue
	<b>Human Resource Development, Labour and Development</b>	Provide support to the informal sector to ensure that the sector is climate-proofed and thus able to open up more employment opportunities
<b>SOCIAL PILLAR</b>	<b>Environment</b>	Undertake climate vulnerability & risk assessment on ecosystems and provide guidance on relevant adaptation actions
		Strengthen current tree-planting initiatives and provide guidance on the use of species/cultivars that are more resilient to current and future impacts (drought, temperature change, new pests and diseases etc.)
		Integrate ecosystem-based approach to policies and programs. Integrate diverse programmes and policies to reflect ecosystem linkages and restore degraded systems (including land). Also bring in all relevant stakeholders through a participatory approach.
	<b>Water and Sanitation</b>	Appraise alternative water supply and demand management options and develop a coordinated water management plan at national and county levels meeting the needs of all water users (including trans-boundary) taking into account the impacts of climate change on supply and demand.
		Mainstream disaster risk reduction measures in water sector planning and service delivery, particularly in vulnerable, high risk regions.
	<b>Gender, Vulnerable Groups and Youth</b>	Climate risk and vulnerability assessments for all vulnerable groups
		Develop and implement programmes targeting vulnerable groups (including suitable social protection schemes and diversification of livelihoods)
<b>ECONOMIC PILLAR</b>	<b>Agriculture</b>	Risk and vulnerability assessments of the agricultural value chain (inputs, technologies, extension services, marketing).
	<b>Livestock Development</b>	Risk and vulnerability assessments of the livestock value chain (inputs, technologies, extension services, marketing).
		Promote sharing/ up-scaling of coping mechanisms (risk sharing/transfer mechanisms) for livestock production systems and climate resilient livestock species.

MTP Theme	Sector	Priority Actions
	Fisheries	Risk and vulnerability assessments of the fisheries value chain (inputs, technologies, extension services, marketing).
		Promotion of up-scaling of climate resilient strategies/technologies in fisheries and climate resilient fish varieties.
		Strengthen monitoring capacity and capability to prevent overfishing and unauthorized exploitation in the EEZ.
	Private Sector/ Trade; Manufacturing; Business Process Outsourcing	Risk and vulnerability assessment of significant current and future contributors to the Kenyan economy.
		Develop and implement a standard environmental management and resource efficiency system for manufacturing

## 2.9.2 Nationally Appropriate Mitigation Actions

In the NCCAP Kenya planned for a low-carbon Nationally Appropriate Mitigation Actions (NAMAs) pathway for six sectors, namely energy, transport, industry, agriculture, forestry and waste management, which are already being identified and will be implemented in the context of the country's wider sustainable development strategy and with the aim of moving the economy onto a low-carbon path. The first activity undertaken under the NAMAs process was the analysis of emissions from the forestry and agriculture sectors. Selected practices for mitigation in the NCCAP included restoration of forest on degraded lands; REDD+; agroforestry; increase tree cover to 10 percent of total land area; conservation tillage; limiting use of fire in cropland; rangeland management; improved cook stoves; biogas; management of agricultural wastes. The mitigation potential of each of these low-carbon development options is briefly described (Figure 5):

**Agroforestry** – Implementing agroforestry over 281 000 hectares between 2015 and 2030 would abate 0.28 MtCO<sub>2</sub>e in 2015, rising to 4.1 MtCO<sub>2</sub>e in 2030.

**Conservation Tillage** – Implementing conservation tillage practices across 475 000 ha between 2015 and 2025 would abate 0.1 MtCO<sub>2</sub>e in 2015, rising to 1.1 MtCO<sub>2</sub>e by 2030.

**Limiting Use of Fire in Cropland Rangeland Management** - Preventing 60 percent of current rangeland burning would abate 0.16 MtCO<sub>2</sub>e in 2015, falling to 0.15 MtCO<sub>2</sub>e in 2030. Preventing 60 percent of cropland burning would abate 0.65 MtCO<sub>2</sub>e in 2015, rising to 1.0 MtCO<sub>2</sub>e in 2030.

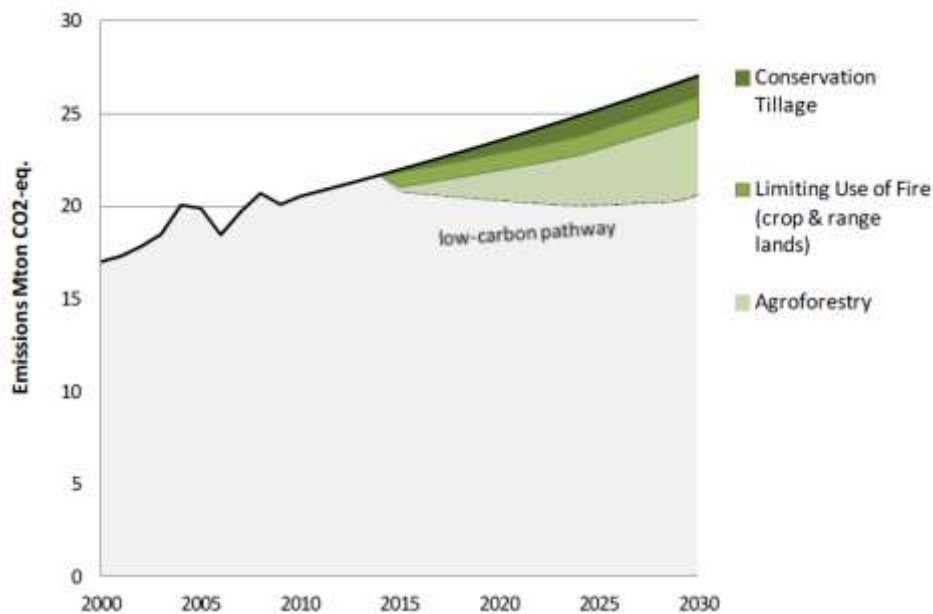


Figure 4: Low-carbon mitigation option wedges in the agriculture sector (MtCO<sub>2</sub>e).

Source: NCCAP 2012.

Institutions identified for further development of these required technologies included Kenya Meteorological Department (KMD, now KMS); IGAD Climate Prediction and Application Centre (ICPAC); Kenya Agricultural Research Institute (KARI, now KALRO); International Livestock Research Institute (ILRI/CIFOR); Institute of Climate Change and Adaptation (ICCA) of the University of Nairobi (UoN); and World Centre for Agroforestry (ICRAF). At the time of this study Kenya already had a geothermal NAMA and a roads NAMA was being discussed. Livestock stakeholders had also come up with the idea of a livestock NAMA. However, there was no agricultural NAMA yet.

### 2.9.3 Low-Emissions Development Strategies

Low-Emission Development Strategies (LEDS) are national development plans that aim at making development climate-compatible by promoting and accelerating sustainable transformative, climate-resilient social and economic development while reducing the rate of greenhouse gas emissions over the medium to long term. However, the aims, purposes and basic elements are not very different from those of similar policy instruments such as Low Carbon Development Strategies, Climate-Compatible Development Plans, or National Climate Change Action Plans. A LEDS outlines the intended overall economic, energy and emissions trajectory for a country and helps to identify entry points for policy intervention (including identifying and prioritizing NAMAs and ensuring coherence between NAMAs and national development goals). At the time of this study Kenya was a partner country in the United States' Enhancing Capacity for Low-Emission Development Strategies (EC-LEDS) program under USAID. The EC-LEDS effort in Kenya was also supported by EU, BMU, UNDP and AusAID. Under the Kenya EC-LEDS initiative the U.S. President's Global Climate Change Initiative (GCCII) has supported climate change solutions such as investing in clean energy solutions and to improve pastoralist resilience to climate variability and change by strengthening early warning systems and improved responses to natural hazards. The USDA



through FAOKE is supporting the CCU of MALF to build the capacity of Agriculture Officers in the counties to implement CSA initiatives.

#### **2.9.4 Medium Term Implementation Plan**

Climate related issues are also raised in the second Medium Term Implementation Plan (MTIP II) 2013 – 2017 (Government of the Republic of Kenya, 2013) for the agricultural sector, recognizing that climate-related destruction of the natural environment is causing concern, as increased flooding and occurrence of landslides have resulted in loss of agricultural land. It is recognized that temperature rises may also affect fish stocks, which means the fisheries sector needs to adapt. Under the fisheries sub-sector diminishing fish stocks are cited as an impediment in realizing the potential of the sector. The Medium Term Expenditure Framework report states that emerging concerns such as the effects of climate change mean that adaptation measures will need to be mainstreamed in the sector's programmes and projects.

Medium-term adaptation outcomes proposed for the agriculture sector include: Farmers and climate adaptive farming practices supported by applied research; Effective communication among farmers and from farmers to government on climate adaptive strategies for the agricultural sector. Actions proposed include: promote scaling up of available climate adaptive inputs, technologies and production strategies including success stories in relevant agro-climatic zones; continue to develop climate change resilient inputs, technologies and strategies and identify adaptation success stories and support scaling up in relevant agro-climatic zones; explore alternative financial instruments for promoting adaptation, e.g. Payment for Environmental Services, carbon finance; recognize and protect emergency drought reserve areas for livestock keeping; develop buffer areas of crop/forage production as part of contingency planning in drought prone regions of Kenya; mainstream geographically specific climate resilience strategies into agricultural extension services delivered by government and its partners (private sector, Civil Society Organizations) across Kenya; undertake initial and regular screening of farming community vulnerability to current climate and use to prioritize response actions in each target area; mainstream climate resilience into agricultural sector laws, new bills being developed, regulations, codes of practice, other quasi-regulatory guidance and policies.

#### **2.10 Draft National Climate Change Framework Policy**

This is the latest in a series of national climate policy blueprints. Draft National Climate Change Framework Policy 2014 provides for policy statements to enhance climate resilience and adaptive capacity; to promote low carbon growth; and to mainstream climate change into planning processes among others and to develop incentives to promote climate resilient actions through appropriate policy reforms.



## **3.0 PROGRAMMES AND PROJECTS IN MINISTRY OF AGRICULTURE, LIVESTOCK, FISHERIES**

### **3.1 Adaptation to Climate Change and Insurance (ACCI) Project**

The first project to specifically address CSA in the State Department of Agriculture was the Adaptation to Climate Change and Insurance (ACCI). Through climate trends (Ambenje et al., 2011) risk and vulnerability assessments, climate modelling, crop simulation (Luedeling, 2011) and good practice filtering, adaptation and mitigation options were identified and implemented in western Kenya (Busia and Homa Bay Counties) for 3½ years from 2011 to 2014 (Government of Kenya, 2014; Knoke, 2014). Strategies implemented included drought escaping (very short duration) crops/species/varieties; drought tolerant traditional crops/varieties, like cassava, sweet potatoes, sorghum; weather insurance for high risk crops; conservation agriculture; agroforestry, on-farm crop diversification; integrated soil fertility management. Good practice filters (criteria for selecting value chain strategies) included income potential/GM; organized market – market demand – availability of strong private sector players; number of producers involved; acreage; resilience in the face of climate change; spatial distribution; possibility of synergy with other stakeholders; potential for index based agricultural insurance; availability of funding for the crop; potential to increase area/yield; gender considerations; availability of suitable adaptation strategies; likelihood of acceptance by farmers; possibility for market linkages. Follow ups done by the State Department of Agriculture in September/October 2014 revealed that adoption is going on. Cassava promotion picked up well. Other players are joining the process, for example in Homa Bay County a stakeholder (Real Solutions) has put up a cassava processing plant. In Busia County it is reported that REFSO is doing well with cassava promotion while Anglican Development Services has scaled up/out Conservation Agriculture.

### **3.2 Other Programmes and Projects**

Many of the initiatives in the State Department of Agriculture since 2001 address elements of CSA although very few of them call them by CSA terms or view them through CSA lens (Ministry of Agriculture, 2010). Many of these initiatives cover large parts of the country and a wide array of crops. There are currently about twenty five (25) initiatives in the SDA (see annex). Many of these initiatives address elements of CSA although very few of them call them by CSA terms or view them through CSA lens. Nineteen of them do not use any climate-smart terminology in their title. Only one of them has the word adaptation in its name; two = climate; one = the full term CSA; two = drought; one = efficiency; one = insurance; two = resilience; none = mitigation. Many of these initiatives cover large parts of the country and a wide array of crops. Some of the CSA issues covered State department of Agriculture is annexed to this report. The principal CSA route in crop-based systems is the promotion of short cycle crop species and varieties, soil fertility and soil moisture management among others.

Like the initiatives in the Ministry, Kenya Agricultural and Livestock Research Organization (KALRO) is also undertaking many research based agricultural initiatives that address elements of CSA although very few of them call them by CSA terms or view them through CSA lens. The Climate Change Unit of KALRO, supported by Rockefeller Foundation, serves as a focal point for climate change related research in KALRO. The objectives of the unit include:

- To mainstream the climate change agenda in all KALRO Programmes;
- To increase the level, awareness, coordination and oversight of climate change vulnerability, adaptation and mitigation relevant research at KALRO; and
- To increase and sustain crop and livestock productivity through adaptation as a response to the effects of climate change.

Further, KALRO has a Seed Unit coordinated from the national level but with sub-units in many regional KALRO Centres, researching on and producing seed relevant to specific agro-ecologies.

Some of the technologies and methodologies developed or being developed at KALRO include a model for weather forecasting and crop simulation to help farmers with agro weather advisories, using water scarcity as an entry point for various technologies that can improve productivity and using weather forecast as a decision support tool; Drought Tolerant Maize for Africa (DTMA); Integrated sorghum and livestock production technologies for adaptation to climate change; Maize yield forecasting for adaptation to climate change in the semi-arid areas; Adapting agriculture to climate change: Developing promising strategies using 'climate change analogue locations' in eastern and southern Africa (CALESA) Project (Kenyan component); Sustainable Intensification of Maize-Legume based farming Systems for Food Security in Eastern Southern Africa (SIMLESA) (Achieng et al., 2011); The crop residues improvement; Innovating for resilient farming systems in semi-arid Kenya; Western Kenya Rain fed Rice Project – adaptability of New Rice for Africa (NERICA); Roots and Tuber Crops programme – bulking of roots and tubers planting materials; Sorghum and Finger Millets Research Programme – Superior lines of sorghum and finger millet cultivars; Drip irrigation kits research; Natural Resource Management Research Programme – developing and promoting uptake of innovative technologies for improving agricultural productivity while conserving environment; Multipurpose legume screening for soil fertility improvement; Sustainable land management that integrates fodder and fruit trees for food security; rain-fed rice/legume based intercropping systems for sustainable food security and income for the farmers; Soil and water management – appropriate soil and water management technologies for more efficient use of land resources

Technologies are developed to address farmer/client needs e.g. early maturing maize varieties, disease/pest resistant maize varieties etc. Farmers/farmer groups are then availed seeds/planting material/improved technologies e.g. medium maturity and high yielding bean varieties, tissue culture bananas, etc. Collaborators that have comparative advantage e.g. marketing are incorporated in the project to provide the market for the farmer groups. In some cases farmers are linked with micro-credit institutions to enable them access the technology e.g. Faulu Kenya, Equity Bank and Family Bank. Other collaborators e.g. KEPHIS are involved in our activities to certify the seeds/planting materials to ensure acceptability by the intended market. Involvement of collaborators with comparative advantages in the

value chains and the availability of novel technologies contribute to increased productivity, commercialization and competitiveness of the agricultural sector.

The State Department of Livestock has about 8 projects running country-wide (annexed). Only two of them use a climate-smart terminology (climate, efficiency, resilience) in their title, yet livestock contributes the highest GHG emissions from the agricultural sector. The principal CSA route in livestock is through the promotion of non-ruminant species and the management of feed and manure in ruminant livestock sub-systems. Breeding for low ruminant emissions may also be explored.

The State Department of Fisheries has about 7 projects running country-wide (annexed). None of them use a climate-smart terminology in their title. Aquaculture development programme is promoting the development of tilapia and catfish. This was supported by Economic Stimulus Plan of 2009 for some time but had since been handed over to the counties. About 80 percent of fishermen are young men, whereas processing and marketing are 80 percent women. In culture fisheries, men own the farms and by extension the ponds, but most of the aquaculture enterprises are practically owned by self-help groups (women or youth). Aquaculture fisher folk are organized into clusters, capture fisher folk are organized into BMUs. A closer scrutiny to identify climate change lens in the Projects and initiatives in the Ministry of Agriculture since 2001 showed that only 20 percent of the programmes had a climate change related term in the title (Table 4). Since integration begins at source, lack of these terms in the titles is reflected in lack of the same terms in the content of the projects.

Table 4: Key CSA terms found in titles of Programmes, Projects & initiatives in MALF

Key CSA words/terms found in their titles	Tally (#times term appears) in the titles of the 53 Initiatives in the Ministry of Agriculture, Livestock and Fisheries
Climate / Weather	4
Adaptation	1
Efficiency	1
Resilience	1
Mitigation	0
Insurance	1
Sustainable NRM/SLM/WH	5
Soil and Water Conservation	1

**These terms were found in only 11 (20.7%) of the 53 Programmes / Projects / Initiatives since 2001, most of the 20.7% being in ASALs: Non-ASAL not effectively addressed**

Drought/ Flood	2
PES (Objective)	1
Green	1
Smart	1
Ecosystem Management	1
Sustainable Intensification	0
<b>Total</b>	<b>20</b>

## 4.0 CLIMATE-SMART AGRICULTURE IN KENYA

Farmers implementing climate-smart agricultural practices in Kenya would first need to comply with the basic rules applicable to all other forms of agricultural practices, such as NRM regulations. Several existing policies support the principles of CSA; namely, the Agricultural Sector Development Strategy, National Food and Nutrition Security Policy, Vision 2030, National Climate Change Response Strategy and National Climate Change Action Plan.

### 4.1 Agricultural GHG emissions estimation and Low-Carbon Scenario Analysis

The case for low carbon climate resilient development in agriculture is demonstrated in the emissions baseline for agriculture in Kenya as summarized in Figure 5 and Figure 6. Total emissions are expected to grow from 20 Mt carbon dioxide equivalents (CO<sub>2</sub>e) in 2010 to 27 Mt CO<sub>2</sub>e by 2030, representing an annual growth rate of 1.6 percent (Government of Kenya, 2012). Agriculture, as a sector, contributes between 20 – 30 percent overall GHG emissions, about 90 percent of which is from livestock based (enteric fermentation) systems, with a 30 – 50 percent margin of error. Agriculture is also a key driver of deforestation and land degradation, which account for an additional 17 percent of emissions. Agriculture, livestock and forestry sub-sectors are the largest emitters, currently accounting for approximately 67 percent of emissions and projected to account for 40 percent by 2030.

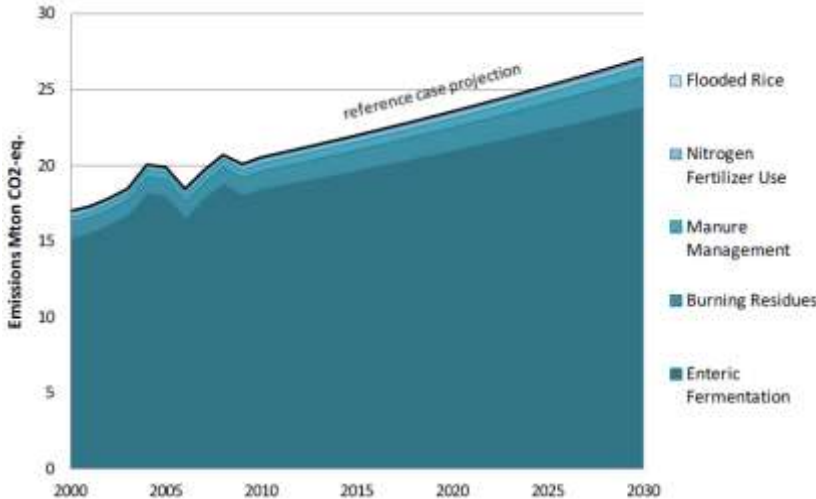


Figure 5: Total reference case emission from agriculture (MtCO<sub>2</sub>e) in 2010.

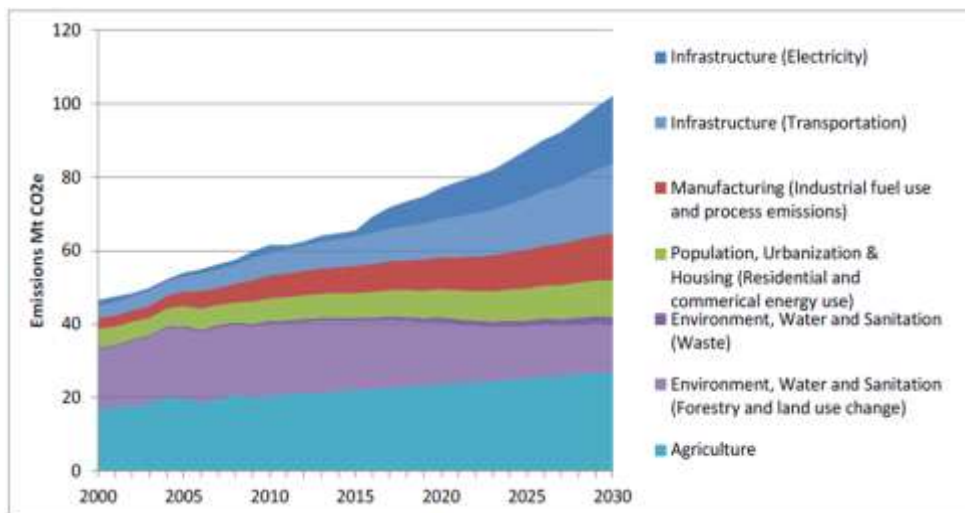


Figure 6: Business-As-Usual GHG Emissions in Kenya between 2000 and 2030.

Source: Kenya NCCAP mitigation analysis report

The most promising priority low-carbon development options proposed in NCCAP for the agricultural sector include:

- Agroforestry;
- Conservation tillage;
- Limiting use of fire in range and cropland management.

Out of the three low-carbon agricultural options proposed, analysis showed that agroforestry has the largest abatement potential, the lowest cost, the most significant sustainable development benefits and the highest increase in climate resilience. Conservation tillage also has important benefits and limiting use of fire in rangeland management could have important benefits in the ASALs. As for livestock-based options, no specific low-carbon development pathway was proposed. However, some mitigation opportunities were suggested as follows:

- Dairy herd management (adaptive breeds and improved feeds);
- Manure management through biogas promotion; and
- Pasture management.

### Carbon sequestration measurements in Kenya

CSA in Kenya started mainly in the coffee and tea subsectors – targeting carbon trading. Work done by FAO MICCA Kenya/ ICRAF (FAO, 2014), CCAFS (Brown et al., 2012), CARE Kenya (Shames and Onyango, 2012; Shames et al., 2012a, 2012b) and Vi agroforestry in Kenya demonstrates that it is possible to measure agricultural greenhouse gas emissions, reduce the greenhouse gas emissions or enhance carbon sequestration while maintaining and even increasing food supply. A good example is where, using the IPCC framework, CCAFS estimated baseline emissions of greenhouse gases from the agricultural sector for four Eastern African countries – Ethiopia, Kenya, Tanzania and Uganda. A CCAFS baseline study estimated GHG emissions in agriculture to be 129 million tCO<sub>2</sub>e/yr, with livestock related activities contributing about 84 percent. For annual quantity of CO<sub>2</sub>e/ha that could be sequestered in soil and vegetation (agro forests and native ecosystems) above business-as-usual CCAFS found that the change in practices that included soil only resulted in carbon

sequestration rates of about 0.4 to 5 t CO<sub>2</sub>e/ha/yr while changes that included soil and vegetation resulted in carbon sequestration rates of about 6 to 22 t CO<sub>2</sub>e/ha/yr.

#### 4.1.1 CSA Initiatives in the Kenyan Coffee and Tea Sub-Sectors

##### Coffee Sub-Sector

A Public-Private Partnership was initiated in 10/2008 – 09/2011 to address climate change adaptation and mitigation in the Kenyan smallholder coffee sector. It was meant to enable (smallholder) coffee producers to face changing climate conditions and to create a link for coffee smallholders to the carbon markets. Adaptation was also emphasized, with synergies to mitigation where possible. Partners included Sangana Commodities Ltd. and GIZ with the 4Cs Association, the World Bank, LTS International and Tchibo GmbH as additional partners; collaboration with Rainforest Alliance.

##### CSA Initiatives in the Kenyan Tea Sub-Sector

“Tea 2030” was a public private partnership (PPP) project, still ongoing, in tea growing areas around Mau Complex to create a more sustainable future for the tea sector. Activities covered included climate simulation, adaptation, mitigation. Partners and collaborators include Ethical Tea Partnership (ETP), Fairtrade International, Finlay’s, ID – The Sustainable Trade Initiative, Rainforest Alliance, SD Coffee & Tea, Tata Global Beverages, Twining’s, Unilever, Yorkshire Tea, FAO, BMZ/GIZ, Rainforest Alliance, TRFK, PASTA, TB, KEPISA, Climate Care, IISD, IIED and CIAT. Projections for coffee and tea, two key perennial cash crops in Kenya by mid-century under an 2A scenario, show increased suitability at high latitudes; decreased suitability at low latitudes, Increased suitability at high latitudes; decreased, suitability at low latitudes (Eitzinger and Laderach, 2011).

#### 4.1.2 Agricultural Carbon Sequestration Initiatives in western Kenya

Agricultural sector also plays an important role in sequestering carbon in soil and trees on farms. Agricultural low carbon development options have the potential to abate in the order of 6 MtCO<sub>2</sub>e per year in 2030 (Government of Kenya, 2012a). The most significant reduction can be achieved through agroforestry, which has an abatement potential of 4 MtCO<sub>2</sub>e per year in 2030. Other low carbon development options include conservation tillage and limiting the use of fire in range and cropland management, with abatement potentials of over 1.1 MtCO<sub>2</sub>e and 1.2 MtCO<sub>2</sub>e per year in 2030 respectively. These three options are elements of a CSA approach.

Measurement of greenhouse gas emissions and carbon sequestration has been piloted in Kenya by CCAFS (Brown et al., 2012), FAO MICCA/ICRAF/EADD (FAO, 2012a), Vi-Agroforestry (Shames et al., 2012a, b) and CARE Kenya among others. The pilots introduce CSA practices to smallholder farmers as well as to analyze soil health and measure the greenhouse gas (GHG) emissions from different land uses and agricultural practices. The MICCA/ICRAF/EADD approach emphasized down-sizing famers’ herds while improving their overall milk productivity on the farm by promoting the concept of zero grazing. The MICCA aim is to reduce the climate change “footprint” of dairy production by lessening the GHG emissions from the whole farm system while improving farm productivity. The pilot used life-cycle analysis to quantify greenhouse gas emissions from the entire agricultural production chain for products such as milk, meat and eggs. The pilot project ended in October 2014 (FAO,



2014) and the implementers shared the lessons learnt with the agriculture sector stakeholders in Kenya, including in particular the Ministry of Agriculture, Livestock and Fisheries through a national stakeholders' workshop.

The workshop brought together resource people and presented results from various CSA and climate change adaptation and mitigation research and development initiatives in Kenya. The aim of the workshop was to learn from the lessons and jointly draw conclusions and policy recommendations for the future work on integrating climate change into the agriculture sector development in Kenya.

Carbon sequestration projects in agriculture in western Kenya have been spearheaded by ICRAF, Vi-Agroforestry/ KALRO and CARE Kenya (AFOLU). The Kenya Agricultural Carbon Project (KACP Soil Carbon) of Vi Agroforestry supported by the World Bank, has successfully stored carbon in the soil and helped farmers to increase their yields through improved soil fertility (Tennigkeit, 2013). About 60,000 farmers are supported on 45,000 hectares. In January 2014 the project issued its first carbon credits under the Verified Carbon Standard (VCS) for sequestering carbon in soil. The credits represent a reduction of 24,788 metric tons of carbon dioxide, which is equivalent to emissions from 5,164 vehicles in a year (Tennigkeit, 2013). Experience from 1,505 farmer groups over three years illustrates how carbon finance can promote the adoption of Sustainable Agricultural Land Management (SALM) practices and open up the carbon market to smallholder farmers. Results so far show that SALM can help increase farmers' yields by up to 15-20 percent (Tennigkeit, 2013).

### **4.3 Biogas and Biomass Fuel Efficient Ceramic Cook Stove Initiatives**

In her Draft National Energy and Petroleum Policy of 2014, The Government of Kenya incorporates strategies to promote the contribution of renewable energy sources such as solar, wind, biogas and biomass that are aligned to the Constitution of Kenya, 2010 and in tandem with Kenya Vision 2030 (Ministry of Energy and Petroleum, 2014).

Biogas technology has been in Kenya since the 1950s (SHELL Foundation, 2007). Notable promoters and supporters for biogas include the German Technical Cooperation (GTZ, now GIZ), Hivos International, Kenya National Domestic Biogas Programme (and HIVOS International), partnering with Africa Biogas Partnership Programme - Kenya, co-funded by The Netherlands Ministry of Foreign Affairs, SNV. SNV and GIZ are also promoting Solar PV technologies. Kenya Forest Service (supported by the African Development Bank (AfDB) also runs biogas plants for Kenyan schools under the Green Zone Development Project. Other promoters of biogas include Kenya National Farmers Federation (KENAFF), Takamoto Biogas Ltd. The KENAFF promotion is funded by HIVO and SNV. All biogas plants up to this moment are small-sized and so produce energy for domestic cooking and lighting. A GIZ computed annual impact on savings and environment showed that benefits include:

- savings of 10,600 tons of fuel-wood (at energy mix of 73 percent wood & 27 percent charcoal) = 67 ha of saved forests;
- Reduction in inorganic fertilizer usage (thus improved soil condition; and
- Emission reduction of 19,500 tons of CO<sub>2</sub> equivalent.



Use of biogas has led to reduced use of charcoal and firewood, reduced destruction of trees and reduced household energy expenses in the long run.

#### 4.4 Ceramic Cook Stove Initiatives

Stakeholders promoting ceramic energy saving cook stove initiatives include GIZ, Global Village Energy Partnership (GVEP) through the Spark Fund Project (Clough, 2012; GVEP International, 2012). Others are United States Agency for International Development (USAID) and Winrock International (Winrock International, 2011). GIZ started facilitating energy saving stoves dissemination in 2006 in collaboration with Kenya's Ministry of Agriculture under a programme called the Promotion of Private sector Development in agriculture (PSDA). The PSDA programme facilitated the formation of Improved Stoves Association of Kenya (ISAK) in 2007. In 2012, Energizing Development Kenya Country Programme (EnDev-K) became a full programme. Global Alliance for Clean Cook Stoves also supports a Clean Cook Stoves Association of Kenya (CCAK).

#### 4.5 Agroforestry

Agroforestry is an important practice in Kenya especially where land is a limiting factor. In Kenya, agroforestry is viewed as a key component of the government's policy to achieve 10 per cent tree cover on all farmland. It is promoted in Kenya as a low-cost solution to maintaining productive land ensuring food security (UNEP, 2014). Agroforestry diversifies and sustains production for increased social, economic and environmental benefits on plots of land of any size. Fodder shrubs and tree legumes used for livestock production are becoming increasingly important because of the beneficial effects accrued to the associated plants and animals. The advantages of shrubs, trees and legumes include their multipurpose uses and their role as fodder banks or natural deferred grazing systems of utilization during the critical feed-deficit period when both the quantity and quality are limiting factors. Fodder tree and shrubs also increase the nitrogen status in the soil and are widely used in soil conservation and land rehabilitation. The high crude protein, mineral content, especially phosphorous and vitamins are essential for efficient reproduction and fertility cycle in most livestock. Though several fodder trees and shrubs have been tested and evaluated in Kenya, the information is still not effectively disseminated for adoption.

#### 4.6 Conservation Agriculture

Conservation Agriculture has been piloted in Kenya for some time, by several players including FAO, Sustainet East Africa; Techno-Serve; Participatory Approaches for Integrated Development (PAFID), African Conservation Tillage Network (ACT), Kenya Markets Trust (KMT), Kenya Climate Change Working Group (KCCWG) AEP (Homa Bay)/ ADS (Kakamega)/ KENAFF/ ACCI among others. Quotes below reflect the current state of the approach:

- Kenya Climate Change Working Group (KCCWG): "Its uptake is very slow";
- Adaptation to Climate Change and Insurance (ACCI) Project: "Its uptake is very slow";
- Kenya Markets Trust (KMT): It is "not a low hanging fruit"; and

- Participatory Approaches for Integrated Development (PAFID): It is “non-ASAL counties that benefit most from conservation agriculture”.

These sentiments do not mean that efforts should be abandoned; they only give room for identifying what is not working, in order to improve the system.

### **Efficient Water Use**

Water harvesting for irrigation supported by KENAFF, International Fertilizer Development Centre (IFDC). Their efforts also include drip irrigation, upland rice and paddy rice.

### **Integrated Soil Fertility Management**

An example of a climate-smart soil fertility management (ISFM) is efficient fertilizer use methods such as Urea Deep Placement and Lime Application method and fertilizer micro-dosing by fractioning the total amount in multiple doses to match nutrients with plant needs. These two approaches are promoted by International Fertilizer Development Centre (IFDC), in collaboration with Athi River Mining (ARM). Integrated soil fertility management is also being promoted by MALF/KARI, ICRAF, CCAFS, Vi-Agroforestry (Soil Carbon), CARE Kenya (AFOLU), KEFRI, Kenya Soil Health Consortium (KSHC), AGRA.

## **4.7 Sustainable intensification – intensive diversification?**

Sustainable intensification is about producing more outputs with more efficient use of all inputs – on a durable basis – while reducing environmental damage and building resilience, natural capital and the flow of environmental services (Montpellier Panel, 2013). Sources consulted agreed that the feasibility of adequate increases in food supply hinges, in part, on more efficient and sustainable use of natural resources (soil, water, biodiversity) for production (Bebe, 2008; Dawson et al., 2014). Sustainable intensification has its critics by both sides agree that expansion would not be a better option (Garnett and Godfray, 2012; Garnett et al., 2013). Many of the presentations made at the FAO MICCA Kenya wrap up workshop in October 2014 rooted for intensive diversification in addition to sustainable intensification. This was found to be supported by literature (Iiyama et al., 2007; Campbell et al., 2014). The call is to intensify management to increase efficiency in order to reduce agricultural expansion. A good example is the AusAID supported project on Sustainable Intensification of Maize-Legume Cropping Systems for East and Southern Africa (SIMLESA) (Mulugetta et al., 2011), promoted by KARI (now KALRO)/Australian AID. Other examples are provided by CCAFS/ILRI/CIFOR/CIMMYT/University of Aberdeen. The practice comprises:

- An ecosystem approach (soil organic matter, water flow regulation, pollination and natural predation of pests;
- Appropriate application of external inputs at the right time, in the right amount to improved crop varieties that are resilient to climate change; and
- More efficient use of nutrients, water and external inputs.

Sustainable use implies that: soil health and productive capacities are maintained even as greater yields are produced; encroachments of production operations on to forested or other environmentally essential lands – especially those that serve as reservoirs of biodiversity – are minimized; water supplies are not exploited at non-renewable levels or polluted through run-off of silt, pesticides, or other chemicals; and financial and

organizational investments in management of resources maintain a continuous flow of ecosystem services at the landscape or eco-regional level.

## 4.8 Weather Forecast downscaling and Agro Weather Advisory Services

Provision of downscaled weather forecasts and agro weather advisory services have been developed and piloted in different parts of Kenya, under Kenya Meteorological Service (KMS, formerly KMD) and supported by the IGAD Climate Prediction and Application Centre (ICPAC), the Institute of Climate Change and Adaptation (ICCA) and Meteorology Department of the University of Nairobi (UoN), Kenya National Academy of Sciences (KNAS), the Centre for Science and Technology Innovation (CSTI), Agricultural Sector Development Support Programme (ASDSP) using the National Farmers Information System (NAFIS) and the World Bank and the Meteorology Department of UoN, Agro-Input Dealers/ Seed Companies (Government of Kenya, 2011; NEMA Kenya, 2012). The main objective of these pilots have been to increase the adaptive capacity of farming communities by improving access to information on weather and climate patterns. Some of the tools used are Short Messaging Service (SMS); Interactive Voice Response (IVR); Seasonal print bulletins and Radio programmes. Expected outcomes include improved farm management capabilities under conditions of climate risk; farmers will plan and manage weather risks; maximize productivity; and minimize the environmental impacts of farming practices. Coverage (content) includes seasonal forecast brief; agronomic practices; postharvest practices; pest and disease control; nutrition; agribusiness; value chain approach; and crop/livestock insurances.

CCAFS/CGIAR calls their project sites Climate-smart Villages, where they pilot “Enhanced use of climate information for farm level planning” in collaboration with World Neighbors; Maseno University; University of Reading; KMS; KALRO; MALF; Vi Agroforestry; KFS; ICRISAT and World Neighbors. In these sites researchers, local partners and farmers collaborate to evaluate and maximize synergies across a portfolio of climate-smart agricultural interventions, aiming to improve farmers’ income and resilience to climatic risks and boost their ability to adapt to climate change. The partners use SMS-platforms and face to face meetings. Technologies implemented include water harvesting, crop diversification and integration with livestock.

## 4.9 REDD-Plus

Reducing Emissions from Deforestation and Forest Degradation Plus (REDD+) is a mitigation process that seeks to address the drivers of deforestation and forest degradation, which includes agriculture. Agriculture is emphasized as an important part of Kenya’s REDD+ planning, which proposes strategy options to address agriculture’s role as a driver of deforestation (Dooley and Chapman, 2014). The REDD+ readiness work in Kenya is linked closely to the work on Natural Resources Management Project (NRMP) as restructured in 2012 and the Forest Carbon Partnership Facility (FCPF), both under the Kenya Forest Service (KFS, 2013). The Constitution, Vision 2030, National Development Plan, The Arid and Semi Arid Lands (ASALs) Policy, the National Land Policy and the National Climate Change

Response Strategy (NCCRS) and Action Plan (NCCAP) all identify areas that need REDD+ interventions. Kenya's National REDD+ goals include realization of constitutional and Vision 2030 objectives of increasing forest cover to a minimum of 10 percent. The Constitution of Kenya obligates the state to work to achieve and maintain a tree cover of at least 10 percent of land area. Priority areas for Reducing Emissions from Deforestation and Forest Degradation plus (REDD+), the role of conservation, sustainable management of forests and enhancement of forest carbon stocks (REDD+) activities were identified under the forest thematic area and some are ongoing, including agroforestry and improved cook stoves, which are relevant to agriculture. At the time of this study the country was developing a National REDD+ Strategy, building on the groundwork developed in numerous forestry initiatives, in order to identify priority REDD+ activities for implementation (Gichu and Chapman, 2014; MEWNR, 2014; Standing and Gachanja, 2014). Priority areas of focus for REDD+ in Kenya include but not limited to reducing pressure to clear forests for agriculture and other land uses.

One of the REDD+ pilot projects going on in Kenya is the Kasigau Corridor in Tsavo East and West National Parks, launched in 2009, to integrate wildlife and community participation for sustainable development in Taita-Taveta area of South-Eastern Kenya (Korchinsky et al., 2011). The project, through Community Ranches, is implementing activities for reducing deforestation while creating local sustainable development opportunities and protecting valuable, fragile ecosystems. The REDD+ readiness achievements in Kenya so far includes ongoing analytical studies, e.g. analysis of drivers of deforestation and forest degradation, grazing management systems, benefit sharing, baseline emission levels, SLEEK program design, forest cover mapping and cover change detection, Forest Policy and legislation alignment to the Constitution, Vision 2030 and Climate Change, National Carbon Investment and Trading Policy etc.

#### **4.9.1 System for Land-Based Emissions Estimation in Kenya**

System for Land-based Emissions Estimation in Kenya (SLEEK) is a Clinton Foundation Climate Initiative for Kenya supported by Australian Aid (AusAID). Its aim is to support Kenya to design and implement a measurement, reporting and verification system for land sector emissions. SLEEK will allow evaluation of different land-use scenarios for sustainable development and inform policy decisions on resource use, including planning for forest restoration, protection of forest resources, improved agricultural productivity and enhanced water availability. SLEEK will build Kenya's technical capacity to provide this information, which in turn will help reduce forest degradation, plan for forest restoration and protection, manage land use and improve food security. Importantly, SLEEK will also contribute to economic growth and food security through improved land management, increased agricultural productivity and better water availability.

#### **4.9.2 Monitoring/Measuring, Reporting and Verification Systems**

Monitoring/Measuring, Reporting and Verification (MRV) is a term used to describe all measures Countries take to collect data on emissions, mitigation actions and the support to compile this information in reports and inventories and to subject these to some form of international review or analysis. In 1992 the UNFCCC (Art.12) set up a system of National Communication and national inventory reports which are to be compiled by Parties and

published by the UNFCCC. However, the term MRV was coined in the Bali Action Plan of 2007, bringing together all aspects pertaining to transparency in the climate regime. Kenya submitted her first National Communication to the UNFCCC in October 2002. Efforts to submit subsequent National Communications have been constrained by several factors, chief among them being shortage of climate funds.

At the time of concluding this study, discussions were still going on, within the framework of SLEEK Programme supported by under the Clinton Foundation, on how best to develop an effective MRV system. This system will have MRV capability with monitoring and reporting occurring at sub-national and local scales using a combination of remote sensing, ground based capabilities and mobile communication networks, including community participation for ground-truthing or where remote sensing techniques are not cost effective.

#### **4.10 Payment for Environmental Services**

Payment for Environmental Services (PES) has been piloted in Lake Naivasha catchment of Kenya by World Wide Fund for Nature (WWF-Kenya) in partnership with CARE Kenya since 2006, under the Pro-poor Rewards for Environmental Services in Africa (PRESA) of World Agroforestry Centre (ICRAF) through Water Resource Users Associations (WRUAs) (Nyongesa, 2011). This dynamic presents an opportunity for downstream water users to support the adoption of better land management practices by upstream farmers through a PES mechanism. Project partners included Water Resources Management Authority (WRMA), UNEP, ICRAF, government line ministries (Water, Agriculture and Livestock), Provincial administration and public schools. Sellers of environmental services were mainly WRUA farmers of Nyandarua area, while buyers of the services were mainly Lake Naivasha Growers Group (LNGG), Ranchers and flower companies around Lake Naivasha. Benefits included reduced soil erosion, increased farm productivity an indicator of improved soil fertility (improved food security), increased income for land owners from different on-farm green enterprises on conserved farms, increased water clarity-confirming silt load reduction, community acquired skills and knowledge on good land management practices to protect land water ecosystems for future sustainable agricultural activities, Over 46 ha of land under different soil and water conservation structures. It is estimated that this effort has improved the quality and quantity of water flowing into Lake Naivasha from the catchment by more than 30 percent. Farmers in the lake's catchment area, especially in Nyandarua County, are also said to have noted improvements in crop production by over 150 percent. This emerged during the project officers' visit to farmers who have benefited from the Programme. Under PES, farmers are advised to conserve soils, plant fodder crops and trees and to leave the riparian mainly along rivers uncultivated. Farmers in the catchment area were getting a token of appreciation from flower farmers in Naivasha.

#### **4.11 Micro-Finance and Micro-Insurance for CSA**

The private sector, especially insurance companies such as UAP, APA and Jubilee are also playing a major role in CSA initiatives, supported by Financial Sector Deepening (FSD). The most active players include Agriculture and Climate Risk Enterprise (ACRE) Limited, formerly Kilimo Salama Project (of Syngenta Foundation for Sustainable Agriculture), in partnership

with UAP Insurance Company Limited. ACRE, a subsidiary index-based agricultural insurance company, formed to assist in the insurance of smallholder farmers against extreme weather events in Africa. By the time of undertaking this study ACRE had established itself as a leader in the field of agricultural micro insurance and was facilitating access to insurance for 180,000+ smallholder farmers in Kenya and Rwanda. The ACRE/UAP partnership has a product for maize, sorghum, cassava, dairy, indigenous chicken and tilapia among others. Jubilee reported doing soil testing and improved input linkage to insurance in Embu, Machakos, Nakuru, Narok, Muranga, Baringo and Meru Counties, using farmer group demo plots to accelerate learning. The crops involved include maize, sorghum, wheat, bananas, cotton and coffee. The project addresses drought.

DFID (UKaid) Kenya has tapped into this opportunity to pilot scaling up/out of Microfinance-Based Private Sector oriented farmer-centered Partnerships for Smallholder CSA in non-ASAL regions of Kenya. The pilot is implemented by DFID (UKaid) Kenya’s Finance Innovation for Climate Change Fund (FICCF) which is managed by the HTSPE (now DAI), Matrix Development and IISD Consortium (Figure 6). FICCF is operating under the broader DFID Programme for Strengthening Adaptation and Resilience to Climate Change in Kenya Plus (StARCK+), running from 2013 to 2017. The major objective of FICCF CSA Initiative is to support low carbon, climate resilient, efficient, productive and sustainable smallholder agriculture and to facilitate scaling up/out of innovative private sector investments in promising CSA adaptation/resilience initiatives and low carbon interventions, services and assets in the agriculturally high production zones of Kenya.

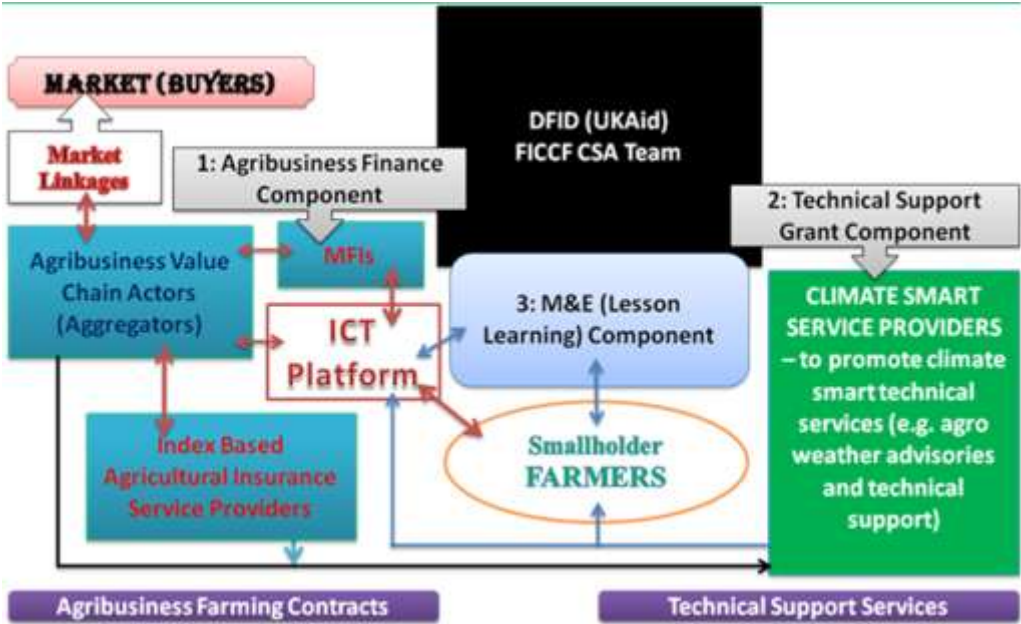


Figure 7: Mechanism of the DFID FICCF CSA Programme.

The objective of this approach is to address the market failure of the reluctance of commercial banks to engage in sound climate change projects due to a lack of familiarity and lack of risk assessment/project finance methodologies. A technical support grant component that provides agro-weather advisories and complementary technical CSA services will run in



conjunction with the loan programme. The process will provide learning points for private sector involvement in CSA among smallholder farmers.

The production systems identified, namely short cycle maize/legume intercroops, sorghum/legume intercroops, cassava, dairy feed systems, indigenous chicken systems and tilapia fish systems, will be supported through approaches across the value chain, as illustrated in Figure 7. The target production systems are considered to be commercially viable based on the analysis conducted by FICCF and the level of interest indicated by the MFIs. Farmers will be contracted by the MFI partnerships and will have the option to take loans to produce the identified commodities.

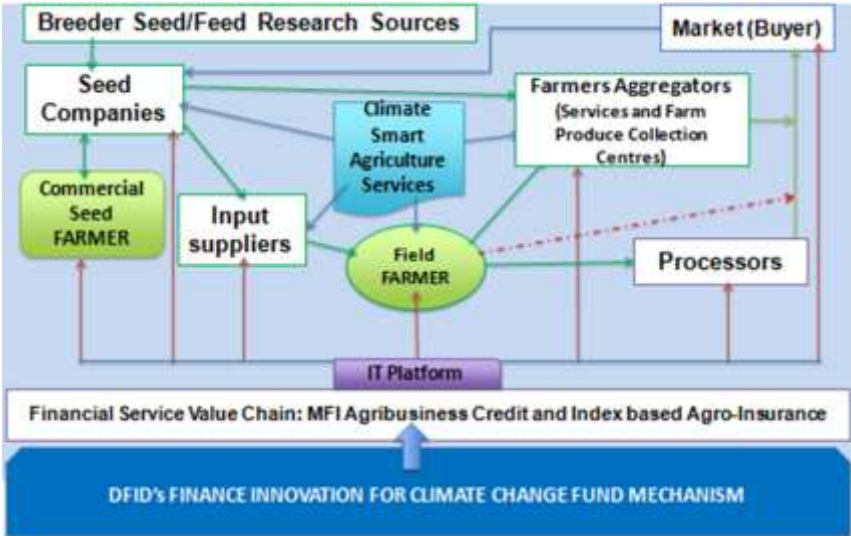


Figure 8: Stages of the value chain where CSA funding support may be required.

The loans to the farmers will be used for investments to promote climate-smart practices, examples of which include the following:

- Production of crop (seed) planting materials, livestock starter materials and the management of feed systems;
- Purchases of appropriate seeds and feed material (in a broad sense – crop seed, day-old chicks, fingerlings, heifer calves);
- Soil testing, analysis and soil fertility management – to shift away from fertilizer recommendation mode to nutrient requirement mode;
- Purchase of nutrients recommended in the soil analysis results;
- Water harvesting/management such as water tank or drip irrigation kit installation; and moisture conservation;
- Farm technologies (structures, machinery, tools, equipment, implements, etc.) for land preparation, planting, IPM, harvesting, post-harvest handling, storage, etc.; and
- Structures, tools, equipment and implements for production, processing and storage;

Provision of payable extension services e.g. land preparation, improved planting/starter materials, crop protection services such as weeding, pest/disease control, farm produce harvesting, farm produce transportation and storage, commodity processing and value addition, improved individual and group marketing etc.

Technical support services will involve building the capacity of farmers to increase ecosystem resilience in the areas of water harvesting and conserving soil moisture, increasing on farm tree cover, increasing soil cover, recycling residues and reducing emissions as a co-benefit. Downscaling of seasonal weather forecasts to the specific counties and the various agro-ecological zones is an essential aspect of this technical services component of the CSA Programme. It is expected that this downscaling will increase adaptive capacity and resilience especially for crop-based interventions and to some extent for dairy forage production. Kenya Meteorological Service is a key player in the provision of agro-weather services in Kenya and it is expected that the MFI partnerships will enter into collaboration with KMS using the technical support funds to downscale seasonal weather forecasting to ensure that the appropriate agro-weather advisory information is available. Some partnerships may also have access to insurance initiatives which are also developing satellite based systems of tracking weather performance vis-à-vis crop phenology. It is expected that all partners will hold at least two field agro-weather advisory workshops with contracted farmers every season to disseminate this information, once at the beginning to plan the season and the other at the end to review the season and plan for the next. That weather information will also be communicated via the IT platform and/or local radio.



## 5.0 Climate-Smart Agriculture Challenges and Opportunities

CSA practices throughout Kenya provide a window for assessing the progress, challenges of and opportunities for CSA promotion in the country. Challenges identified in the course of this CSA scoping study includes limited knowledge of modern CSA systems, limited climate funding opportunities to drive CSA investments, limited access to niche markets for products originating from CSA initiatives (including weak market development strategies). There is a strong case among stakeholders for crop-livestock system integration in CSA approaches but from the programmes and projects analyzed, it was found that crop-oriented initiatives have a very weak crop-livestock integration focus. The IPCC AR5 report documented in Figure 8 appears to confirm this finding, showing that it is possible for a land/crop system to operate through the value chain without a livestock system, but not vice versa. One major lesson learnt from the study is that there is need to pay attention to the farmers interests, even as project objectives are being pursued. A socioeconomic survey in the EADD-MICCA Pilot Project area in Kenya (FAO, 2012) found that many farmers do not join projects for reasons similar to the project objectives, a finding which also needs to be taken into consideration when planning interventions.

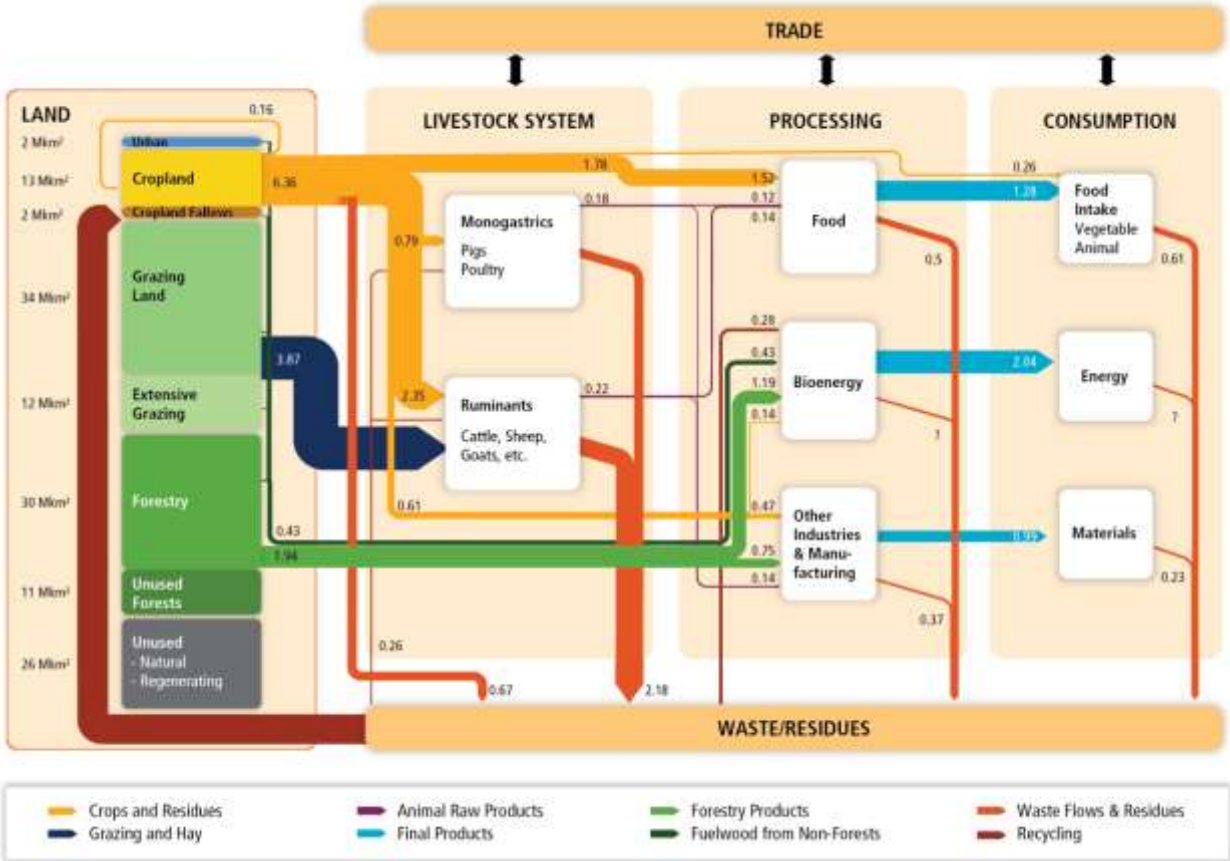


Figure 9: Integrated Crop-Livestock-Tree Farming System.

Source: Smith et al. GCB, 2013. [http://mitigation2014.org/communication/presentations-events/copy\\_of\\_S2\\_6\\_OverviewIPCCWGIII.pdf](http://mitigation2014.org/communication/presentations-events/copy_of_S2_6_OverviewIPCCWGIII.pdf)

Opportunities identified in the course of this scoping study on Climate-Smart Agriculture include intensification, where livestock-based initiatives have a very strong crop-livestock integration approach. A socioeconomic survey in the EADD-MICCA Pilot Project area in Kenya (FAO, 2012) found that many smallholder farmers practice mixed crop-livestock farming, which by default facilitates CSA practices. This opportunity can be built upon to sustain CSA principles. It can be used to show that crop systems and livestock systems can be improved by integration to give the best results and to increase the efficiency and environmental sustainability of both production systems. When asked what makes it CSA and what makes it good for Kenya, workshop participants identified a number of aspects to describe CSA under (1) adaptation and resilience, (2) Low-Emissions development, food security and nutrition and (4) other elements (Figure 10).



Figure 10: What makes it CSA and good for Kenya?

Some of the points mentioned under adaptation/resilience included knowledge and information, technology, diversification, improved breeds, improved feeds, feed conservation and management, manure management, resilient crops, access to finance and insurance, markets, rainwater harvesting, capacity building, energy efficient devices. Low-Emissions development was unpacked as agroforestry, biogas, energy-saving devices, manure management, emissions reduction per unit of product. Food security meant access to land resource, cost-effective production, improved soils, improved germplasm, dietary diversity, food preservation/processing, food availability/accessibility and quality, productivity, increased yields. Among other elements, co-benefits and job creation were also mentioned.

## 6.0 Conclusions and recommendations

This scoping study describes the state of CSA in Kenya. The policy of the government of Kenya related to CSA, as illustrated in this study, is found in a series of national, regional and continental policy blueprints, demonstrating commitment to mainstreaming adaptation and mitigation goals into planning processes and outlining potential measures for achieving them. The scope includes cropping livestock systems, aquaculture, agroforestry and conservation agriculture, on-farm energy management, climate information, index insurance, adaptive capacity development, gender and adoption. It shows that an integrated approach to CSA can advance both climate resilience and low-carbon development pathways in Kenya's agricultural sector.

Initiatives reviewed for this study show that livestock plays an integral role in CSA farming systems but crop-based systems still do not emphasize this integrated crop-livestock system approach, a finding that to move forward, needs looking into. Due to the situation-specific nature of CSA practices, participatory, trans-disciplinary approaches can be used to help integrate and sustain the adapted elements of CSA principles, in order to increase production efficiency while reducing emission rates, in a way that gives better cost/benefit results. Emerging CSA practices may also need to be filtered through the prisms of technical feasibility, economic viability, social acceptability, environmental sustainability and practical relevance (e.g. food security, income generation, employment creation, poverty reduction) in order to determine whether it is good for the local context or not. Lessons learnt highlight the need for continued context-specific approaches to identify appropriate interventions and for enhancing the success of future CSA projects. Study findings consistently pointed to the need for holistic and inclusive approaches, on various spatial scales from farm to landscape and temporal scales on a short to long term basis.

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## ANNEX 1: PEOPLE CONSULTED

Name	Project/ Program/ Initiative	Organization	Acronym
Peter Kuria	Conservation agriculture	Africa Conservation Tillage Network	ACT
James Mutonyi	Farm input marketing	Agricultural Market Development Trust	AGMARK
Erastus Ndege	Index insurance	APA insurance ltd	APA
Maren A. Bwana	Partnerships and Outreach / Agro-Weather Tool and Advisories	Ministry of Agriculture Livestock and Fisheries	ASDSP
Phoebe Odhiambo	ASDSP agro-weather advisory	Ministry of Agriculture Livestock and Fisheries	ASDSP
Shadrack Kipkemoi	Natural resource management	Ministry of Agriculture Livestock and Fisheries	ASDSP
Tom Apina	Conservation agriculture	Sustainet East Africa	ASDSP
Mwende Kusewa	Livelihoods	CARE Kenya	CARE Kenya
Moses Omedi (Eng.)	Climate Change Secretariat	State Department of Environment & Natural Resources/CCS	CCS
Beatrice Ghattuba Akunga	Fisheries development	Climate Change Unit/Ministry of Agriculture Livestock and Fisheries	CCU/MAL F
Janet Oyuke	Agroforestry	Climate Change Unit/Ministry of Agriculture Livestock and Fisheries	CCU/MAL F
Luke Kessei	Livestock development	Climate Change Unit/Ministry of Agriculture Livestock and Fisheries	CCU/MAL F
Maurice Ouma	CSA readiness, mainstreaming	Climate Change Unit/Ministry of Agriculture Livestock and Fisheries	CCU/MAL F
Michael Obora	CSA readiness, mainstreaming	Climate Change Unit/Ministry of Agriculture Livestock and Fisheries	CCU/MAL F
Michael Okumu	Climate Change Unit	Climate Change Unit/Ministry of Agriculture Livestock and Fisheries	CCU/MAL F
Robin Mbae	CSA readiness, mainstreaming	Climate Change Unit/Ministry of Agriculture Livestock and Fisheries	CCU/MAL F
Beatrice Obara	2Scale	International Fertilizer Development Center	FAOKE

Kenda Mwenja	Biogas Promotion	Biogas – GIZ	GIZ
J. B. Mwesigwa	Agro-meteorology	ICPAC IGAD Climate Prediction and Application Centre	ICPAC
Peter Malomba	National cookstoves assn.	Energy Saving Cooking Stoves (EndEv – GIZ)	ISAK
Cyrus Githunguri (Dr.)	Food crops research	KALRO (formerly (KARI) Katumani	KALRO
Donald Njarui (Dr.)	Climate-smart pasture research	KALRO (formerly (KARI) Katumani	KALRO
Mercy Mburu	Biogas	Kenya National Farmers Federation	KENAFF
Rose Akombo	REDD+	Kenya Forest Service	KFS
Barrack O. Okoba	NRM	FAO Kenya	KFS, MEWNR
Peter Omeny	Agro-weather advisories	Kenya Meteorological Service	KMS
Kenneth Ayuko	Agricultural risk management	Agribusiness and Policy Relations	MALF
Mary Mwanzau	Environmental management	Ministry of Agriculture Livestock and Fisheries	MALF
Mary Njuguna	Climate-smart landscapes	Netherlands Development Organisation	SNV
James Sina	Index insurance	World Bank	WB



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