





Theme 7 – Climate Smart Agriculture

Background Paper

Conference "Research & Policy: two peas in a pod? A dialogue for food security impact"

Climate-smart agriculture (CSA) for resilient agriculture, food security and inclusive business growth in East Africa

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Context

Climate variability and change poses significant threats to sustained economic growth and agricultural development, poverty reduction, food security and political stability globally. The threats are compounded by repeated food price spikes, a growing food crisis in many parts of the world, high fossil fuel and fertilizer prices, and increasing environmental degradation and competition for food and water1. Notably, food insecurity is a threat multiplier; it is hardly ever the only and direct cause of conflict, but in combination with other factors can greatly influence conflict. Africa has been identified as the most vulnerable continent to climate change and variability3. It is estimated that by 2050, the combined effect of increasing temperatures, declining rainfall, frequent floods and droughts could result in average reduction of yields of major crops (14% for rice, 22% for wheat, and 5% for maize), and food availability in Sub Saharan Africa will average 500 calories less per person, translating into a 21% decline4.

Impacts of climate change differ by region and farming system, social group, and gender. In many lowincome countries, smallholder farms produce over 80% of the food consumed5. Gender disparities on the effect of climate change are attributed to the social position and roles of women within families and communities. Climate change affects the factors most essential to women's means of subsistence - food, water and energy supply. For the youth, lack of employment, livelihood and income opportunities and hunger are forcing them to migrate in search of better livelihood opportunities.

Moving forward, it is essential to integrate climate change adaptation and mitigation throughout the agricultural value chain and evaluate systems-level effects and interactions to develop targeted solutions (i.e. a food systems approach). This includes production, harvesting, post-harvest processing, marketing, consumption, and disposal of food and food-related items taking into consideration social, economic, political and environmental contexts, with different actors playing diverse and linked roles, and includes producers, service providers, policymakers and regulators and consumers6.

At global, regional and national levels, discussions on adaptation and mitigation are ongoing, with national governments putting in place climate change adaptation and mitigation strategies, policies and programs all of which are likely to substantially affect agriculture and the food systems. The recently concluded 23rd session of the Conference of the Parties (COP 23) to the UN Convention on Climate Change (UNFCCC) held in Bonn marks a milestone for negotiations on agriculture. A key feature of the decision is that while so far negotiations have remained in the technical body of the UNFCCC (SBSTA), the COP has now asked SBSTA and the UNFCCC's implementation body (Subsidiary Body for Implementation – SBI) to jointly address issues related to agriculture through the Koronivia Joint Work on Agriculture. This will bring greater focus on implementing climate actions in the sector as opposed to negotiations focused on scientific and technical aspects only. The momentous decision on agriculture at COP23 opens the door to bold, transformative action to make farmers' livelihoods and food supply more resilient, while mitigating climate

¹ The Montpellier Panel, 2012. Growth with Resilience: Opportunities in African Agriculture. London, UK. Agriculture for Impact.

² Chen, L. 2016. From Food Security towards a resilient society, the Food & Business Knowledge Platform. Available at: http://knowledge4food.net/wp-content/uploads/2016/05/160518_fbkp-article_fs-resilientsociety.pdf

³ IPCC, 2014. Summary for policy makers. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Farahani, E., Kadner, S., Seyboth, K., Adler, A., Baum, I., Brunner, S., Eickemeier, P., Kriemann, B., Sovolainen, J., Schläümer, S., von Stechow, C., Zwickel, T., and Minx, J.C. (eds.)). Cambridge University Press, Cambridge.

⁴ IFPRI, 2009. Global Hunger Index: The challenge of hunger: Focus on Financial Crisis and Gender Inequality. Bonn, Washington D.C., Dublin.

⁵ FAO, 2009. The State of Food and Agriculture: Livestock in the balance. Rome.

⁶ Meridian Institute, 2017. Climate Change & Food Systems: Assessing Impacts and Opportunities







change7. During the COP, the CGIAR Centers and research programs, shared the best bet transformative innovations for adaptation in agriculture, which can help achieve food security under a changing climate, while also delivering co-benefits for environmental sustainability, nutrition and livelihoods8.

Climate change and agriculture in East Africa

Projections indicate that East Africa will experience an increase in average temperatures ranging from 4 to 6 °C by 2100, accompanied by more frequent heat waves and stress. Changes in mean precipitation over the same period are less certain, ranging between -10 to +40%, but periods of heavy rainfall interspersed with periods of drought are also expected⁹. Approximately 75.5 million people in East Africa are economically involved in agriculture, either in full-time employment or as a main livelihood activity. About 95 percent of the food in the region comes from rain-fed agriculture that is highly vulnerable to adverse weather conditions such as droughts, dry spells and variable rainfall¹⁰. We briefly summarize country level information below:

Ethiopia

- About 80 percent of the country's population depends on agriculture for their livelihoods;
- Agriculture contributes up to 42 percent of national GDP;
- Chronic food insecurity affects 10 percent of the population, and these households partly rely on food aid to meet their food and nutrition needs even in average rainfall years ⁹;
- Annual GHG emissions estimated at 150 MtCO₂e in 2010;
- About 50 percent of GHG emissions are from agriculture, with forestry contributing another 37 percent;
- Livestock production accounts for over 40 percent of the GHG emissions from agriculture.

Kenya

- Agriculture is mainly rain-fed and dominated by small-scale farmers, especially in the medium to high-potential and semi-arid areas;
- Agriculture contributes over 25 percent to the GDP, accounts for over 65 percent of total exports and provides more than 18 percent of formal employment;
- GHG emissions from agriculture estimated at 20 MtCO₂e in 2010 (baseline) and is expected to rise to 27 MtCO₂e by 2030;
- Forestry accounts for GHG emissions of 19.6 MtCO₂e in 2010, approximately 32 percent of national emissions⁹.

Uganda

- Agricultural production is mainly rain-fed, where about 95 percent of the farmers are smallholders;
- Agriculture contributes 21 percent of the GDP, supports the livelihoods of 73 percent of households and 80 percent of foreign currency earnings;
- Fisheries also play a major role in the food system and economy of the country;
- Agriculture is a major source of GHG emissions, currently contributing 57 percent of national emissions;
- The largest proportion of emissions result from enteric fermentation in livestock and manure left on pasture⁹.

Tanzania

⁷ CCAFS blog story: A Step Forward for Agriculture at the UN Climate Talks – Koronivia Joint Work on Agriculture http://bit.ly/2A4ZXdT

⁸ Dinesh D, Campbell B, Bonilla-Findji O, Richards M (eds). 2017. 10 best bet innovations for adaptation in agriculture: A supplement to the UNFCCC NAP Technical Guidelines. CCAFS Working Paper no. 215. Wageningen, The Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Available online at: www.ccafs.cgiar.org

⁹ IPCC, 2014. Summary for policy makers. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Farahani, E., Kadner, S., Seyboth, K., Adler, A., Baum, I., Brunner, S., Eickemeier, P., Kriemann, B., Sovolainen, J., Schläümer, S., von Stechow, C., Zwickel, T., and Minx, J.C. (eds.)). Cambridge University Press, Cambridge, UK.

¹⁰ FAO, 2016. Eastern Africa Climate-Smart Agriculture Scoping Study: Ethiopia, Kenya and Uganda. By Njeru, E., Grey. S. and Kilawe, E. Addis Ababa, Ethiopia.







- Agriculture accounts for about half of GDP and export earnings, employs 77.5 percent of the population, provides livelihood to more than 70 per cent of the population and contributes about 95 percent of the national food requirements¹¹;
- Published inventory for 1994 for Tanzania shows very low total (1.3 tonnes of CO₂e) and per capita (0.1 tonnes CO₂e) GHG emissions;
- If land use changes and forestry (including deforestation) are included, the per capita emission estimates increase to 2.67 tonnes (all GHGs) and 1.65 tonnes (CO₂ only);
- Key sectors contributing to GHG emissions include forestry (deforestation), and agriculture, primarily from livestock (enteric fermentation) and others (mainly (N₂O) from animal manure left on pasture, burning savannah and cropland;
- Tanzania has high sequestration potential for GHG due to existing extensive forest cover;
- Addressing the drivers of deforestation and forest degradation will enhance the contribution of the forest sector to global GHG mitigation¹⁰.

Unpacking climate-smart agriculture for food security and inclusive business growth in East Africa

Recognizing the vulnerability of East African agriculture to climate change, and significant contribution of agriculture and land-use sectors to GHG emissions, agriculture and other land-uses offer the greatest potential to reduce emissions and support countries to develop their economies along low emission development (LED) pathways through more efficient agricultural production systems—enabling these countries to meet their Nationally Determined Contribution (NDC) to United Nations Framework Convention on Climate Change (UNFCCC) in accordance with the Paris Agreement. *Climate-smart agriculture (CSA) offers unique opportunities to meet the multiple objectives of improving food and nutrition security, enhance adaptation to climate change and reduce GHG emissions at local scales¹².*

Since its origin in 2010, international and regional organizations, and countries, are implementing policies, strategies and programs promoting and upscaling CSA¹³. Since 2011, for example, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) scientists have been working with policy makers and other stakeholders in East Africa to identify suitable policy and institutional frameworks that support uptake of CSA technologies and practices. This entails making available both the technology and evidence from research to support policy development and implementation across scales through continued engagement with policy makers in Ministries of Environment and Agriculture to ensure emerging policies and strategies on climate change, agriculture and food security are informed by scientific evidence¹³. Through this process, country CSA framework programs (CSA-FP) have been prepared in Kenya, Uganda and Tanzania, including Botswana and Namibia, in collaboration with Common Market for Eastern and Southern Africa (COMESA), East Africa Community (EAC) and the Southern Africa Development Community (SADC).

CSA-FPs are expected to deliver multiple benefits; (i) food productivity and nutrition security, and incomes; (ii) building resilience in agriculture and adaptive capacity of farmers; and (iii) contributing to reducing GHG emissions from agriculture and land use. The CSA-FPs are expected to catalyze increased public-private sector investments in regional and national CSA programs with a target of reaching over 100,000 agricultural service providers benefitting 10 million smallholder farmers (including women and youth) and small-scale food producers by 2025¹⁴. In Ethiopia, climate change has been mainstreamed into various national policies, strategies and programs, such as the Climate Resilient Green Economy (CRGE) initiative supported by the Green Economy Strategy (GES) and the Climate Resilience Strategy (CRS) focuses on improving crop and livestock production practices for greater food security and better income for farmers, while reducing emissions¹².

Building on experiences in East Africa, this discussion paper highlights key issues and entry points for consideration within the context of inclusive and sustainable scaling of CSA technologies and practices for agricultural transformation in East Africa. Using the upcoming projects from CCAFS, the Food and Business

¹² FAO. 2013, Climate-Smart Agriculture: Sourcebook. Rome, Italy: Food and Agriculture Organization of the United Nations

¹¹ United Republic of Tanzania, 2017. Climate-Smart Agriculture Guideline. Ministry of Agriculture, Livestock and Fisheries.

¹³ Dinesh D, Aggarwal P, Khatri-Chhetri A, Loboguerrero Rodriguez AM, Mungai C, Radeny M, Sebastian L, Zougmoré R. 2017. The rise in Climate-Smart Agriculture strategies, policies, partnerships and investments across the globe. Agriculture for Development 30:4-9.

¹⁴ Mungai C, Radeny M, Nyasimi M, Atakos V. 2016. Integrating climate change in agriculture and food security policies and strategies: Experiences and lessons from East Africa. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).







Challenges Program (GCP) and the Applied Research Fund as examples, the paper also explores what current and future institutional and policy frameworks are necessary to climate-proof inclusive business and food systems in Africa from smallholder production and value chain to agro-processing, supply and distribution. Based on CCAFS and partners research experience in the region, this background paper highlights promising approaches and practices to strengthen farmers'/farming system's resilience/adaptive capacity. The paper also demonstrates how CSA technologies and practices can be linked to national mitigation targets by providing evidence and country specific data on emissions from the agriculture sector.

The CSA background paper aims to answer the following questions:

- 1. How can emerging CSA innovations, policies and programs lead to increase in rural incomes and enhanced food security and nutrition in East Africa?
- 2. Can blending science and traditional knowledge and practices enhance adaptation to climate change and ensure food security and nutrition amongst communities in East Africa?
- 3. How can the private sector support the uptake and scaling of CSA technologies and practices in East Africa?
- 4. Which innovative sources of public and private financing and enabling policy frameworks are available for CSA upscaling in East Africa?

Rural agricultural transformation in the face of a changing climate is critical: Of the more than 500 million smallholder farms globally, 80 million are in Sub-Saharan Africa¹⁵. Majority of these smallholder

The GCP project on "Understanding and scaling Organizations for SMAIIholder REsilience" (OSMARE) seeks to understand when and how the organization of new business models linking farmers to markets leads to resilience of smallholders, in particular youth and women. The project will assess resilience in terms of development of farmers' adaptive capacity and their engagement with other stakeholders in the system. Through personal and group trainings, smallholders, their representatives and stakeholders will exchange knowledge and reciprocally foster their capacities.

farmers do not generate sufficient income from agriculture to meet their basic needs—nutrition, health, education or living conditions for their families—let alone to re-invest in their farms. For effective rural transformation that ensures increased incomes and food security, policymakers need to ensure that national agricultural research systems involve farmers fully as partners in development of appropriate agricultural practices, and that the research is geared towards addressing production challenges farmers face. A farmer-centered approach is therefore needed, to ensure farmers have access to climate information and products— such as the best-adapted crop seed varieties and livestock breeds, land, water, knowledge, inputs, insurance and credit. Rural infrastructure also needs to be in place to allow for increased input and output market access. Farmer organizations have a vital contribution to make to the development of agriculture and rural communities. Unless small-scale farmers are organized, they will remain politically and economically powerless and disadvantaged.

Integrating traditional and scientific knowledge: Millions of farmers use traditional knowledge to produce food in a wide range of ecosystems, that increases productivity, improves local food systems, enhances socio-environmental sustainability and resilience. These practices can also be applied in innovative ways to help tackle today's problems¹⁶. However, traditional knowledge faces many challenges that include erosion from failure to pass on from generation to generation, changing land use, climate variabilities and change, migration and bio-piracy. With increasingly frequent and intense extreme weather events such as drought, traditional coping systems are not responding fast enough, therefore more robust and transformative responses including climate informed agro-advisory services are needed that provide early warning, manage and reduce the risks and improve preparedness to climate-related disasters and emergencies affecting food and agriculture. The benefits and challenges of integrating traditional knowledge have led to extensive discussions over the past decades, and much work is still needed to facilitate the articulation and co-application of the two types of knowledge.

¹⁵ IFAD, 2013. Smallholders, food security, and the environment. International Fund for Agricultural Development (IFAD). Rome, Italy.

¹⁶ FAO, 2009. The State of Food and Agriculture: Livestock in the balance. Rome, Italy.







The role of technological advancement in agriculture: Uptake of new agricultural technologies is an important pathway out of poverty, yet often very slow among farming and pastoral communities in East Africa. The digital revolution provides an opportunity to integrate digital channels such as Short Messaging Services (SMS), Interactive Voice Response (IVR), low-cost video and digitally delivered financial services to transform agricultural production in the context of a changing climate. Successful cases of agricultural transformation across the globe have been largely attributed to (i) improved climate smart practices and technologies such as identification of nutrient and yield gaps, efficient application of organic and inorganic fertilizers, breeding strategies to develop varieties resistant to climate shocks, effective soil and water conservation including capture and retention of rainfall, water use efficiency measures, and supplemental irrigation, (ii) climate-smart systems approach including diversification of products, climate-proofing of key value chain stages to improve adaptive capacity, improved access to finance to leverage and accelerate climate smart investments, de-risking inclusive businesses and food systems, as well as (iii) fostering an enabling environment and policies with considerations to gender, youth inclusiveness and social inequities that create incentives for adopting CSA, encompassing index insurance, access to credit and weather and climate information, favorable input and output pricing policies, property rights, research and extension services and safety net programs. Building on the above practices, digitization of farming systems and using digital channels to enhance farmers and other stakeholders connectivity along the value chain is critical for climate change adaptation and mitigation.

Countries need up-to-date data on emissions from the agriculture sector and where possible, reduce the contribution of GHG emissions from this sector as part of their NDC. This requires the development and application of cost effective and efficient measuring, reporting and reporting (MRV) technologies that can be used to measure emissions. At the same time, researchers need to develop effective and socio-economically viable low emission technologies and approaches that can be used to reduce emissions from the agriculture sector. The livestock NDCs being developed with contribution from CCAFS and other CGIAR centers and programs in Kenya and Ethiopia create a great opportunity to demonstrate this. Countries also need support to implement their National Adaptation Plans (NAPS) which seek to reduce vulnerability to the impacts of climate change, by building adaptive capacity and resilience.

The newly funded GCP4 2017 projects on "Inclusive Low-Emission Development (i-LED): East African dairy, Scaling climate-smart nutrient management tools in Africa and Promoting climate resilient maize varieties in Uganda" aim to assess how such CSA technologies and practices can be used to address food security while providing an opportunity to engage in inclusive business. Through engagements with governments, leading dairy firms, service providers and male and female livestock keepers in research-driven dialogues, these projects will design a portfolio of context-sensitive LED-approaches for reducing emissions intensity while enhancing socio-economic inclusivity.

Innovative financing mechanisms: Innovative financing mechanisms (IFMs) that blend climate and agricultural finance and investments from public and private sectors are a key means of implementing CSA. Climate financing instruments such as those under the Green Climate Fund could be a way of spurring sustainable agricultural development. In addition, mobilizing private sector finance for climate action in agriculture, impact investment funds, and mainstreaming climate-resilient practices into financial institutions and investors' operations are approaches to scale up financing for the sector. There are strong indications that private investment still lays way behind its potential in most developing countries (and particularly in Africa), because investors and banks show little interest for a sector associated with high climatic, price and counterpart risks, and market failures¹⁷. For small-scale farmers, efficient cooperatives have the potential to provide financial services and are essential for partnering with private investors. Another important tool for countries to manage climate finance is a National Climate Fund (NCF)¹⁸. NCFs are nationally-driven and nationally-owned funds that help countries to pool climate finance from a variety of sources, and account for them. In this way, countries are in control and can make informed choices for how to direct resources toward targeted activities that deliver results on the ground and as informed by national priorities.

¹⁷ International Expert Report, 2012. Innovative Financing for Agriculture, Food Security and Nutrition. Report of the High-level Expert Committee to the Leading Group on Innovative Financing for Agriculture, Food Security and Nutrition. Food Security Task Force. 18 UNDP, 2011. Blending Climate Finance through National Climate Funds: A Guidebook for the Design and Establishment of National Funds to Achieve Climate Change Priorities. United Nations Development Program.







The newly funded GCP4 project on "**Upscaling climate smart agriculture via micro finance**" aims to provide practical and conceptual insight in the appropriate combinations of business training (through Farmer Field & Business Schools - FFBS) and financial services (through Village Savings & Loans Associations – VSLA) that support community-based adaptation (CBA) action plans in Tanzania.

Developing a new paradigm to integrate private sector to climate-proof inclusive business and food *systems:* Historically, geographic distance and diseconomies of scale have made the cost of doing business with smallholder farmers prohibitively high. Except for producers of major traditional and some high-value export crops, most African smallholders are isolated from agricultural value chains for a variety of reasons—their small scale, geographic isolation, and lack of capital. The few cases where these problems have been overcome involve linking farmers to public or private sector firms or operators who have provided a bridge to other value chain actors. These firms provide some degree of credibility to smallholders as business partners to input dealers, technology providers, traders, financial services providers, processors, and exporters¹⁹. The private sector has a critical role to play in transforming the food system in Africa. But inclusive transformation requires that governments support and guide the transformation. Governments should work with the private sector and non-governmental organizations (NGOs) in undertaking targeted interventions to help commercialize many more smallholders, and assist the development of SMEs along value chains¹⁸.

The "Climate-Smart Financial Diaries for Scaling in Kenya" and "Business models Ethiopian and Kenyan dairy chains" GCP4 projects aim to describe business models of chain actors and supporters to identify opportunities for scaling up good climate-smart practices. The projects will support upscaling of business models addressing three challenges: (1) designing a conducive financial environment, (2) identifying additional value chain partners, and (3) identifying constraints, opportunities and required policy interventions at landscape level. The project will be implemented in Kenya and Tanzania.

Gender and social inclusion: Reaching women and youth farmers requires removing the barriers they face in access to essential agricultural inputs such as land, machinery and loans. For instance, to improve women's and youth access to credit, support is needed in securing land rights through legally recognized documentation. Ensuring that women and youth farmers receive equal access to technical support may require reforming extension services to ensure their needs are met, such as gender sensitivity training for extension workers. Countries have made attempts to include gender issues in their policies and programs, however implementation is still a challenge. For example, the Ethiopian government's Agricultural Growth Program attempted to address the needs of women farmers. It set a 30 percent target at the outset for women's involvement; however, the budget did not specify how funds were to be allocated to women's participation, or how to measure whether farmers or women have participated²⁰. This demonstrates the need for more capacity building for policy makers and project developers on the skills, knowledge and tools that can be used to ensure gender and social inclusion issues are integrated at policy and implementation levels.

¹⁹ AGRA, 2017. Africa Agriculture Status Report: The Business of Smallholder Agriculture in Sub-Saharan Africa (Issue 5). Nairobi, Kenya: Alliance for a Green Revolution in Africa (AGRA). Issue No. 5

²⁰ Oxfam, 2017. Financing Women Farmers: The need to increase and redirect agriculture and climate adaptation resources. Oxfam briefing paper.







Conclusions

Essentially, policies and programs need to be adjusted in order to respond to instability and conflicts, with the primary objective of ensuring they 'do no harm', or preferably 'do good' from a root causes perspective²¹. Implementing an inclusive CSA approach which focuses on rural development and transformation, integration of local and scientific knowledge, application of sustainable and efficient technologies will stabilize the ecosystem and contribute to reducing conflict. With the increase in climate change and climate variability impacts, policy-makers at national, regional and global levels need reliable and timely information on the incidence and causes of food insecurity, malnutrition and vulnerability. This information is important for improving policy and program formulation, targeting, and monitoring of progress of interventions aimed at reducing poverty and hunger. The role of science in providing evidence can therefore not be overlooked. While the growth in regional and national initiatives, strategies, policies, partnerships and investments is positive and creates a favorable enabling environment for CSA, these need to be complemented with targeted implementation on the ground, sustainable financing, institutional coordination and metrics to measure the efficacy of interventions.

As countries move towards implementing their NDCs, NAPs and other climate change related policies and programs, it is anticipated that an inclusive business orientation to climate-smart agriculture will stimulate sustainable agribusiness development while delivering tangible impact and food security for the rural poor. Through inclusive business, companies can create employment and other income opportunities for the poor. They do this either directly or through value chains as suppliers, distributors, retailers or service providers. Inclusive businesses can develop business models that increase access to development enablers such as energy, communications, financing and insurance. Or they develop ways to supply affordable products and services that help the poor meet their basic needs. Inclusive business models create synergies between business operations and development goals.

The concept of CSA is evolving and there is no one-size-fits-all blueprint for how it might be pursued. CSA is an approach that involves different elements embedded in local contexts and relates to actions both on-farm and beyond the farm to catalyze and help create transformational partnerships to encourage the three pillars of CSA – productivity, adaptation and mitigation. CSA recognizes that the implementation of options will be shaped by specific country contexts and capacities, as well as enabled by access to better information, aligned policies, coordinated institutional arrangements and flexible incentives and financing mechanisms. Moving forward it is critical to note that the CSA concept now has wide ownership among governments, regional and international agencies, civil society and private sector. Emerging global (Global Alliance for Climate-Smart Agriculture - GACSA) and regional Alliances on Climate-Smart Agriculture (ACSA) provide inclusive, voluntary and action-oriented multi-stakeholder platforms for shared learning, collaboration and partnership building, while also providing a space for dialogue and debate among all interested parties in Africa.

²¹ Food & Business Knowledge Platform. 2017. Can food security improve doing good in unstable countries? Draft