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# Food security in the context of climate change: from knowledge to action

Since 2006, IFAD and the European Union have partnered to invest over EUR 230 million in agricultural research programmes carried out through the CGIAR system. This collaboration aims to support research and scientific innovation with the active involvement of smallholder farmers themselves. Thus, the European Union-IFAD financing has produced solutions that are demand-driven and context-specific, leveraging the agricultural research capacity of the CGIAR system to advance both food security and climate change adaptation.

## Context, challenges and opportunities

The relationship between climate change, agriculture and food security is complex, and it encompasses socio-economic, macroeconomic and political factors. The effects of climate change on natural resources and the agricultural sector are well known: they also disproportionately affect rural people, who depend on natural resources

### QUICK FACTS

**PROJECT** Climate Change, Agriculture and Food Security (CCAFS)

**FOCUS REGIONS**  
East and West Africa

**LEAD IMPLEMENTING INSTITUTION**  
CCAFS Program Management Committee and International Center for Tropical Agriculture (CIAT) – CGIAR partnership

**GOAL** Improving rural livelihoods by identifying and testing pro-poor adaptation and mitigation practices, technologies and policies, and by promoting reciprocal inclusion of climate change issues in agricultural policies and reflection of agricultural considerations in climate change policies

**BENEFICIARIES** Resource-poor rural and peri-urban farmers

**DATES** 2009-2014

**FINANCING** EUR 14.57 million

and lack alternative income sources. Rural livelihoods, particularly those of smallholder farmers across the developing world, are increasingly threatened by factors such as unpredictable weather, floods, droughts, water scarcity, inland salinity, pests and disease. But because agriculture can also contribute to climate change – for example, when improper use of fertilizer creates greenhouse gases – efforts to increase food production to meet the world’s growing demands must also include adaptations to a changing climate.

These challenges are pronounced in East Africa, where agricultural systems are mainly rainfed and highly vulnerable to climate variability. Climate-related risks such as prolonged dry seasons, droughts and floods have become more frequent and severe, with negative impacts on agricultural livelihoods and food security. These challenges are likely to be compounded by high rates of poverty and population growth, declining plot sizes and poor market access. Scientific research is an essential tool for solving technical challenges, but also a way to explore context-specific approaches to produce more food in a sustainable manner, which means minimizing the climate effects of agriculture itself while enhancing farmers’ resilience.

## Setting objectives

The **Climate Change, Agriculture and Food Security (CCAFS)** programme adopted a twofold approach of identifying and testing pro-poor adaptation and mitigation practices and technologies while also addressing the important policy aspects. With the support of the European Union and IFAD, the programme supported climate-risk management with innovative solutions such as enhancing weather prediction and climate-information services.

Building on evidence emerging from field implementation, CCAFS worked with regional, national and local governments to use this knowledge to support policymaking. CCAFS informed decision makers about alternative agricultural development pathways, identified institutional arrangements and incentives that enabled smallholders to reduce emissions from farming, and explored approaches and partnerships to better link knowledge to action. The programme also aimed to inform global policy processes related to gender equality, food security and climate change. South-South collaboration (e.g. across India, Colombia and various African countries) significantly advanced lessons learned and drove major changes. Numerous research institutes in Europe contributed to developing the institutional and technical solutions illustrated below.

## Solutions and results

The CCAFS research programme carried out detailed baseline surveys in its five target regions, involving 21 countries and 6,300 households. Results showed that 13 per cent of households (32 per cent in East Africa) were food-insecure, experiencing six or more hunger months per year.

CCAFS focused on increasing food security through adoption of sustainable agricultural practices. This involves both knowledge and technology. Climate-smart food production systems require not only tools and inputs, but also innovation and knowledge at the ground level. To achieve this, CCAFS scientists worked directly with farmers and community groups to jointly explore and identify the most suitable climate-smart practices and technologies for different contexts and conditions. This approach allowed building on local knowledge and keeping a demand-driven focus. Farmers, together with scientists, identified better agronomic practices and tested improved bean, maize and potato varieties that are climate-ready and more resistant to diseases. Some significant results were the overall increase in maize yields by up to 400 per cent and the threefold increase in potato yields in 2016. Through community-based organizations, at least 83 per cent of the farmers can now easily access and use improved seed varieties.

Exciting results can also be drawn from local examples. In Lushoto, Tanzania, the dissemination of improved seeds significantly facilitated year-round farming, prompting a threefold increase in smallholder yields. In Nyando, Western Kenya, about 90 per cent of the farmers adopted improved crop varieties and now use certified seeds. Nyando farmers, the majority of whom are women, also started to invest in water harvesting, with close to 30 per cent of farmers constructing improved water harvesting pans with capacities of 48,000-100,000 litres per household.

In the livestock sector, CCAFS focused on disseminating climate-smart feeding and husbandry practices among 600,000 farmers. This contributed to increases in income for 179,000 dairy farmers in East Africa, of which 50 per cent were women. In addition, CCAFS introduced sheep and goats herds that are better adapted to the increasingly dry environment and emerging diseases. As a result, in 2011, 35 per cent of households owned improved herds, rising to 57 per cent in 2015. This led to a significant reduction in food shortages. In the Nyando district, for example, the number of households experiencing hunger months in a year dropped from 83 per cent in 2011 to only 9 per cent in 2015.

CCAFS also took important steps in the agroforestry sector, working with farmers to set up nurseries that supply seedlings for tree planting. These nurseries

became an important source of income, particularly for women. In Kenya's Nyando basin, where women own about 60 per cent of the nurseries, farmers saw an increase in on-farm tree cover by at least 500,000 trees between 2015 and 2017, with important environmental benefits. Similar results were achieved in Lushoto, Tanzania, where private tree nurseries were able to supply nearly 250,000 tree seedlings in the past three years.

CCAFS was able to inform policy processes, enhance capacity at different levels, and promote and scale up climate-smart agricultural practices through the establishment of a vast network of partnerships with national agricultural research and extension systems, farmers' organizations, NGOs, the private sector and governments. Since 2011, CCAFS scientists have been working with policymakers in East Africa to identify suitable policy and institutional frameworks that support evidence-based policy and programme development. Based on scientific findings, several African countries have proactively adopted policies and strategies for climate adaptation and mitigation within their agricultural plans. In Ghana, for example, CCAFS technical support through the national science-policy dialogue platform contributed to the launch of Ghana's first National Climate-Smart Agriculture and Food Security Action Plan (2016-2020). Similarly, in Senegal, the CCAFS platform was instrumental for the technical analysis of two key national policies (the Programme for Accelerated Agricultural Development [PRACAS], and the Emerging Senegal Plan [PSE]), with the objective of mainstreaming climate change. In addition, as a result of CCAFS collaboration with governments, development partners, research institutions and the private sector, pilot climate-smart agriculture country framework plans were developed for Botswana, Kenya, Namibia, Tanzania and Uganda. This and other CCAFS work has contributed to driving US\$250 million of new investment in climate-smart agriculture in Kenya.

In the area of adaptation through climate risk management, CCAFS's research and findings have helped inform around US\$18 million of new investments in climate information services in Africa. Through enhanced access to seasonal forecasts, farmers significantly reduced inputs costs by making informed decisions on their farms and adapting their farming practices. In Senegal, CCAFS and its partners have made climate information available to over 7 million rural people. With CCAFS support, the national meteorological services of six African countries (Ethiopia, Ghana, Madagascar, Mali, Rwanda and Tanzania), covering 167 million rural people, have produced gridded historical climate data and provided online access to a range of derived climate information products relevant to farm decision-making. The project has also worked

with farmers, insurance companies and development partners to develop new products and programmes that help risk-averse farmers access credit, adopt improved technologies and recover from extreme weather events.

## Innovations

CCAFS brought many innovations that were instrumental in turning scientific knowledge into action and promoting the uptake of innovative techniques. In particular, the establishment of climate-smart villages became an important tool for scientists and farmers to jointly develop and test new climate-smart agriculture approaches and activities. The latter encompasses interventions in the area of capacity-building, farming practices and social inclusion. Within climate-smart villages, smart farms adopt integrated solutions, combining climate-smart agriculture technologies, climate information services, index-based insurance and local adaptation planning.

## From research results to impact

Many of the innovations and measures implemented through CCAFS had a visible impact on rural livelihoods. For example, the establishment of climate-smart villages brought significant improvements to food security. Across all five regions where it operates, CCAFS established at least 36 climate-smart villages in 20 countries. In the Nyando district of Kenya, in 2011, only 1 per cent of households were food-secure all year, and over 80 per cent of the households surveyed were experiencing up to two hunger months in a year. Following the establishment of climate-smart villages, the number of food-secure households rose to 7 per cent, and the number of households experiencing hunger months dropped to around 23 per cent. The new activities supported in these villages, such as greenhouse farming and fish farms, have provided smallholders with alternative sources of income and nutrition.

The implementation of the climate-smart village approach improved rural women's livelihoods too. Women who were engaged in season gardening at the Daga-Birame village in Senegal could learn and access improved farming technologies, such as rainfed gardens during the rainy season, and the use of clean energy (solar powered) irrigation during the dry season. Since 2015, local women's groups started to produce watermelon, okra plant, mint and pepper. In Nyando, through training, women farmers are increasingly diversifying their portfolio to include poultry, improved small ruminants, horticulture and small businesses.



These practices have significantly increased farmers' incomes and contributed to diversifying household diets, therefore achieving better nutrition.

While more work is needed to assess the economic impact of climate services, the expected benefit of widespread adoption of timely and accurate seasonal forecasts by farmers has been estimated at US\$113 million per year across five countries in eastern and southern Africa, with benefits generally favouring the relatively poor. The project's work on insurance has directly benefited more than 2 million of the 38 million farmers globally (outside of China) who have some form of insurance.

In the Daga-Birame climate-smart village in Senegal, farmers receive timely seasonal forecasts and climate advice by SMS and via community radio. Through this service, Ramatou Diouf, leader of the women's farmers' group in this village, and her peers have been able to increase their yields by being prepared for those uncertain climate conditions that are now made more predictable for rural smallholders. The project has helped her and the members of the group in Daga-Birame village to access improved irrigation methods that have made it possible to preserve water during droughts. Better harvests and preparedness, in turn, have brought benefits to the entire community by increasing incomes and expanding financial benefits and employment opportunities. In addition, through protecting baobab trees in the village, the women's group was able to undertake the processing of baobab fruits (which became more abundant) and sell the powder, therefore generating income while also improving the nutrition of children (the baobab fruit powder is a vitamin-rich product used for juices and cakes). Work piloted in this climate-smart village on improved climate information services is now reaching 7 million Senegalese farmers through CCAFS partnerships.

Rose Koech is a dairy farmer from Bomet in Kenya. The project has supported her in diversifying her activity by introducing her to high-yielding dairy cows, drought-resistant crop varieties and new practices for agroforestry, and conserving soil and water. This has allowed her to increase her fodder production, diversify her sources of income, and train other women in the community on animal feeding and dairy production.

## Future directions

Currently, 30 per cent of most food commodities in sub-Saharan Africa, South Asia and South-East Asia are produced on very small farms (less than 2 hectares). It is estimated that the number of smallholder farms will increase from 560 million today to perhaps 750 million by 2030, the vast majority in Africa and Asia. Climate change will have far-reaching consequences for agriculture and natural resources, and CCAFS projections indicate declines in crop yields by the 2030s, as well as a higher degree of inequality in farm incomes, sizes, technologies and market linkages. In this scenario, CCAFS research will need to distinguish more carefully among farming systems and households to provide policy-relevant outputs, including a range of adaptation options that in some cases go beyond agriculture.

In order to encourage improvements in climate-smart agriculture, food systems and landscapes, CCAFS will be developing decision-making support tools at the local and national levels. One example is the work of CCAFS with the CGIAR Research Programs on Agriculture for Nutrition and Health (A4NH) and Policies, Institutions and Markets (PIM) to develop climate-related food-security scenarios to guide policymakers through the trade-offs and synergies implicit in the nutritional and environmental challenges posed by "sustainable diets". Another activity will be developing methods to tailor historic and seasonal climate information to agricultural needs and reshaping climate-informed safety nets in response to increased frequency of extreme events.

In order to reduce agriculture-related greenhouse gas emissions, CCAFS will work with partners to identify opportunities to mitigate emissions across all subsectors in developing countries, especially among smallholders. It will also work with the Climate and Clean Air Coalition to develop regional strategies for scaling up best practices, while working with national, regional and international partners to facilitate the adoption of locally relevant technical solutions in the different countries.

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