

Support of the Finnish Ministry for Foreign Affairs to research and development projects on climate change and food security



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Introduction


Ending hunger and achieving food security and improved nutrition is at the core of the sustainable development goals. At the same time, climate change already has an impact on agriculture and food and nutrition security and will make the challenge of ending hunger and malnutrition even more difficult. In spite of considerable progress, almost 800 million people are chronically undernourished, mostly in southern Asia and sub-Saharan Africa. At the same time, 2 billion people lack the essential micronutrients, vitamins and protein needed for healthy lives. Population growth, increasing incomes and urbanization are changing consumption patterns and driving increasing demand for food and fodder. FAO¹ estimates that, to satisfy the growing demand driven by population growth and diet changes, food production will have to increase by at least 60 percent by 2050.

The effects of climate change on our ecosystems and food security are already severe and widespread. While some of the problems associated with climate change are emerging gradually, action is needed now in order to allow enough time to build resilience into ecosystems and production systems of agriculture, forestry and fisheries. Four out of the eight key risks identified by the 5th Assessment Report of the Intergovernmental Panel on Climate Change² have close relations with food security:

- Loss of rural livelihoods and income
- Loss of marine and coastal ecosystems, and livelihoods
- Loss of terrestrial and inland water ecosystems, and livelihoods
- Food insecurity and breakdown of food systems

¹ FAO 2016. Climate change and food security: risks and responses. Food and Agriculture Organization of the United Nations. Rome. Italy.

² PCC. 2014. Climate change 2014: impacts, adaptation, and vulnerability. Part A: Global and sectoral aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. C.B. Field, V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea & L.L. White, eds. Cambridge, UK, and New York, USA, Cambridge University Press. 1132 p.



Climate change has an impact on agriculture and on all dimensions of food and nutrition security. At the same time, the agriculture sector is among the largest emitters of greenhouse gases (GHG): agriculture alone produces 12% of gases and with forestry and land use change up to 24%. Deforestation and forest degradation, livestock production, land management, paddy rice cultivation, and chemical fertilizers are among the main sources of greenhouse gases in the agriculture, forestry and land use sector. At the same time, agriculture and forestry can be part of the solution to climate change as they have huge potential to reduce their emissions and sequester carbon in soils and biomass.

In the past, sustaining food security in Africa has been mainly based on the expansion of agricultural land through clearing of forests, woodlands and wetlands that are rich in carbon and sources of energy, water, biodiversity and other ecosystem services. The process has been driven by population growth as well as low levels of investment in agricultural lands resulting in low productivity and loss of soil fertility. To revert such trends increased agricultural productivity and sustainable management of forests and agroforestry systems are vital as the loss of tree cover is a major contributor of GHG emissions and land degradation in sub-Saharan Africa. Investments in woody vegetation and sustainable management of agricultural and rangelands provide the most significant possibilities for reduced emissions and carbon sequestration in rural landscapes.

Agricultural systems need to be transformed and reoriented to support development and food security effectively and sustainably under a changing climate. Climate-smart agriculture (CSA) is a rather new approach to simultaneously address climate change and food security. It is composed of three main pillars of 1) sustainably increasing agricultural productivity and incomes, 2) adapting and building resilience to climate change, and 3) reducing and/or removing GHG emissions where possible.

Selection of measures for transforming agricultural systems and value chains for increased productivity, resilience and adaptation and reduced emissions needs to be based on evidence. Since 2010, the Finnish Ministry for Foreign Affairs has supported six climate change and food security focused research and development projects and programs in 13 African countries with diverse agro-ecological and socio-economic conditions and climate change scenarios for the future. These interventions have engaged a number of actors from international, national and Finnish research institutions, international and local non-governmental organizations, and UN Agencies. Allocating funds to such work is based on the 2012 and 2016 Development Policies of the Government of Finland³ which define food security and climate change among the priority areas.

³ MFA 2012. Finland's Development Policy Programme. Ministry for Foreign Affairs of Finland. <http://formin.finland.fi/public/default.aspx?contentid=251855&nodeid=49542&contentlan=2&culture=en-US>

MFA 2016. Finland's Development Policy. One World, Common Future – Towards Sustainable Development. Ministry for Foreign Affairs of Finland. <http://formin.finland.fi/public/default.aspx?contentid=341918&nodeid=49540&contentlan=2&culture=en-US>

Highlights of the six research and development projects and programs

1. Climate change impacts on ecosystem services and food security in Eastern Africa - Increasing knowledge, building capacity and developing adaptation strategies (CHIESA)

The Project, which was implemented in 2011–2015 by International Center for Insect Physiology and Ecology (ICIPE) with Helsinki, York, Sokoine and Dar es Salaam universities and numerous local institutions in Ethiopia, Kenya and Tanzania, emphasized the importance of healthy ecosystems for climate change adaptation. Ecosystems provide services, including fresh water, habitat, pollination and biological control, food, raw materials and genetic resources which enhance adaptation. Healthy ecosystems themselves are also more resilient to climate change and recover easier from extreme weather events. Ecosystem-based adaptation was at the core of the Project.

The Project's research results highlight e.g., that warming conditions allow insects to grow and reproduce faster and shift to new suitable habitats. This is likely to result in escalated insect invasion in e.g., mountainous areas, which will create new problems to fruit and crop producers. The Project identified and disseminated Integrated Pest Management as a solution to the growing pest problem for agricultural production.

These and other research findings have been shared through consultations, seminars, international conferences and workshops organized in the sites. CHIESA has also made substantial investments in capacity development e.g., by sponsoring the studies of 15 African PhD and 15 MSc scholars. One of the Project's main achievements is the AFRICLIM 2.0 high resolution climate projections for Africa which were published and made freely available for download from the University of York website. These data turned out to be very popular with a high number of views and downloads within a short period of time.

The innovativeness of CHIESA was demonstrated in the development of community-based adaptation action plans. Their development started by identifying and integrating locally prioritized adaptation needs into national and regional development plans and strategies and further, installing some technical solutions such as small-scale drip irrigation systems to the farms in Kenya and Tanzania. Additional demonstrations were organized on conservation agriculture and roof rain water harvesting. Discussions with stakeholders and beneficiaries highlighted the need for urgent actions for integrating land and water management measures. The adaptation action plans were discussed with the stakeholders and authorities and policy makers at local and national levels. The Project's aim was that the process would result in Adaptive Management Frameworks which would guide local decision-making related to climate change adaptation in each of the target areas.

A decision has been made to extend the Project with two years. The new phase, called AFERIA, will focus specifically on translating the project results into user-friendly messages and disseminating them to a wide audience. <http://chiesa.icipe.org/>



2. Adaptation Learning Program for Africa (ALP)

This five-year program (2010-2015) financed by Finland, UK, Denmark and Austria and implemented by CARE International has developed the concept and practices for community-based climate change adaptation and promoted its adoption in the target countries: Ghana, Kenya, Mozambique and Niger. ALP has generated practical experience and knowledge of adaptation and influenced climate policies in Africa. The program has created space for learning on good adaptation practices among a range of local to Africa-wide actors. It is estimated that 1.6 million climate-vulnerable individuals have benefited from adoption of one or more community-based adaptation approaches and strategies promoted by ALP as a direct or indirect result. Within this number, 28,000 rural people have benefited from active engagement in community-based adaptation planning and implementation. The share of female beneficiaries varies between 32–74% depending on country in question. The program has resulted in e.g., diversified livelihoods, improved agricultural practices and access to resources, protection of key assets, and shifts in gender dynamics.

The work in each target location started with a gender-sensitive vulnerability and capacity analysis, followed by participatory community adaptation planning, improving rural people's access to climate information, and integrating community-based adaptation into local development plans. The program has promoted a wide range of possible adaptation strategies, including improved seeds, dryland livestock, village savings and loans, conservation agriculture, dry season farming, income generating activities, fish management, disaster risk reduction and early warning systems.

One of the success stories of ALP is the development of Participatory Climate Scenario Planning Systems (PSP). The aim of designing PSPs is to make climate information more accessible and usable to farmers. PSPs use seasonal forecasts and combine knowledge sources, both community knowledge and scientific knowledge, to collectively interpret the meaning of seasonal forecasts. Climate information is found to become more useful when it is communicated with expected levels of risk and uncertainty and is translated into scenarios that can be used in decision making. For farmers it is important to understand what the climate occurrences mean for a local area. PSP brings together community members, meteorology experts, local government actors and local organizations to jointly analyze the forecasts and downscale them to fit the agro-climatic zones of the region. <http://careclimatechange.org/our-work/alp/>

3. Making agriculture part of the solution to climate change - Building capacities for agriculture mitigation (MICCA)

The Finnish-funded project (2010-2016) was part of FAO's Mitigation of Climate Change in Agriculture (MICCA) program. While the other parts of MICCA focused on generating a global database of GHG emissions from agriculture, forestry and land use, the Finnish-funded project worked on other aspects of climate change mitigation and climate-smart agriculture: identifying and testing different agricultural practices in smallholder systems with CARE International and East Africa Dairy Development Program in Kenya and Tanzania; generating and sharing knowledge on climate-responsible management of peatlands; developing tools for life cycle assessment of GHG emissions from livestock production; developing tools to support planning and implementation of nationally appropriate mitigation actions in the agriculture sector; preparing guidance for better gender mainstreaming in climate change work; and investing strongly in communication, information sharing and online learning on agriculture and climate change topics.



The Project's collaboration with the World Agroforestry Center (ICRAF) resulted in data on GHG emissions from smallholder agricultural systems in Kenya and Tanzania. The results show, for example, that GHG emissions can be influenced by land management practices, crop type and environmental conditions. Further, they show that conservation agriculture with leguminous trees or small quantity of nitrogen fertilizer significantly increase maize yields and reduce GHG emissions per kilo of maize produced. As regards land management, improved fallows were found to have potential to increase carbon stocks and restore degraded lands.

The results of the Project were widely spread, thanks to working through partnerships (national and international research and development institutions, NGOs and CSOs, national governments, development programs, and networks) and allocating resources to disseminating research results and lessons learned. The Project prepared and distributed a variety of reports, guidebooks, videos, posters, policy briefs, scientific articles, and workshop and conference presentations on different climate change topics. Communities of practice and webinars were effectively used to trigger information sharing and online discussions. Finally, the Project supported and contributed to the international climate change negotiations (UNFCCC) by writing background papers, organizing side-events, sponsoring participants from developing countries, and preparing policy briefs for the use of the negotiators. www.fao.org/in-action/micca

BOX 1: Gender, food security and climate change

There is a wide consensus that climate change affects rural men and women differently and that men and women farmers also perceive the changes differently. This is caused by the differences in men's and women's access to land and water, financial and productive resources, decision-making processes, knowledge, information and technology, advisory services and markets, and institutions which exist for many assets, inputs and services. An ultimate goal of integrating gender in climate change-related work is to reduce gender inequalities and ensure that men and women, boys and girls can equally benefit from interventions that adapt and build resilience of agriculture to climate change and reduce and/or remove greenhouse gases.

All the climate change and food security projects funded by Finland have made efforts to integrate gender issues in their work. The depth of their gender-responsiveness depends e.g., on the nature of the project. FAO's Making agriculture part of the solution and CARE's Adaptation Learning Program for Africa are good examples of projects which have specifically invested in advocacy and information sharing on gender issues as well as in developing gender analysis tools and guidelines for gender mainstreaming. They both have also included gender-responsive actions in their field work and ALP specifically developed gender-specific indicators to better track shifts in gender dynamics and gender-equitable project implementation. In BIODEV, gender responsive activities (processing and marketing non-wood forest products, market gardening etc.) have been developed with the local communities.



4. Building biocarbon and rural development in Western Africa (BIODEV)

This on-going four-year Project (2012–2016) is a joint effort of the World Agroforestry Centre (ICRAF), Center for International Forestry Research (CIFOR), Helsinki and Eastern Finland universities and national research and development institutions of the target countries. It combines research on high-value biocarbon approaches with rural development initiatives in Burkina Faso, Sierra Leone, Mali and Guinea. During its implementation, the field level activities of the Project have faced many challenges due to political unrest and the Ebola outbreak in the target countries. In spite of these challenges, the Project initiated, for example the production and planting of half a million tree seedlings in Burkina Faso and Sierra Leone. Moreover, BIODEV helped establishing Rural Resource Centers and Innovation Platforms in four villages which create a space for the villagers to jointly analyze problems and identify opportunities for sustainable management of natural resources. The science components of the Project have produced a number of scientific papers based on research on governance, markets, extension, charcoal production, fuel wood, soil carbon stocks, aboveground and belowground biomass computations, and height-diameter modeling of trees, agroforestry and ecosystem services, climate trend and variability and crop yield. The Project has also produced tree density maps in the target areas and improved online Soil Carbon Stocks calculator of ICRAF. Many of the research results have also been disseminated by writing technical and policy publications.

In addition to providing training to farmers around the Rural Resources Centers, BIODEV has invested in capacity development of the partner institutions, including the local universities. Training has been organized in e.g., landscape carbon measurement and field data collection. Six PhD students and eleven MSc students mainly from the partner countries have studied in the partner universities, including the University of Helsinki. Additionally, BIODEV scholarships have enabled the participation of the partner institution representatives in international seminars and summer schools. At the national level, short-term trainings have been organized e.g., in project preparation and fund mobilization. Finally, the climate change focal points and other delegates of the climate change negotiations as well as the national REDD+ coordinators have received capacity development from BIODEV. Both capacity development and research actions are still on-going and will be finalized by the end of 2016. <http://www.worldagroforestry.org/project/biocarbon-and-rural-development-biodev>

5. Promoting adaptation to climate change by reducing weather and climate-related losses through improved services in Sudan (FISU I)

This Project (2012-2015) provided capacity development to the Sudan Meteorological Authority and towards its end also to the South Sudan Meteorological Department through a twinning arrangement with the Finnish Meteorological Institute. In addition, other national ministries and authorities of Sudan and South Sudan benefited from the Project. FISU I comprised hands-on staff training provided by the Finnish Meteorological Institute experts, sponsored participation in international events, upgrading of the necessary infrastructure, equipment and software, and study tours. Improved capacity of the national meteorological institutions e.g., to design and manage meteorological observation networks and tailor weather and climate services to respond to end-users needs, enhances food security through improved quality of services and farmers' access to weather forecasts and warnings. Better and more reliable weather and climate forecasts and other products foster different economic sectors, for example improve harvest prospects and reduce crop losses caused by weather hazards.

Thanks to the equipment and trainings, the capacity of the national staff and institutions increased in the use of real-time weather observations and numerical weather predictions in making new weather products and improved short-term and medium-term weather warnings. Recently, a three-year second phase of the Project (FISU II) has been launched. <http://en.ilmatiетеenlaitos.fi/project-references>


Box 2: Science to support food security in the face of climate change

Generating evidence is a must for scaling up sustainable agriculture and forestry management practices in the face of climate change. Four of the six projects supported by Finland had research components aiming at adding on information on climate change, agriculture, forestry, agro-forestry and food security. The research actions have been centered around GHG emissions from climate-smart practices in smallholder agriculture in Kenya and Tanzania (MICCA), underlying causes of vulnerability of agriculture to climate change in different parts of Senegal (FoodAfrica WP 3), pests, land cover and land use change mapping and high-resolution climate projections in Kenya, Tanzania and Ethiopia (CHIESA) and agroforestry and ecosystem services, charcoal production, soil carbon stocks, aboveground and belowground biomass computations, land cover mapping and height-diameter modeling of trees in Burkina Faso, Sierra Leone, Mali and Guinea (BIODEV). The research results have been shared with wide audiences through tens of scientific articles, technical and policy briefs, conference posters and presentations, and webinars.

6. Economic analysis on technologies and targeted policies to reduce vulnerability and build resilience in Senegal (Work Package 3 of FoodAfrica Program)

This work package is part of FoodAfrica (2012–2016), a regional research for development program, which brings together African, CGIAR and Finnish research institutions around an effort to develop new knowledge and tools for reducing absolute poverty and improving food security. FoodAfrica is implemented in six countries: Benin, Cameroon, Ghana, Kenya, Senegal and Uganda. The seven work packages (WP) of FoodAfrica target different aspects of food security. The WP 3 focuses on climate change and food security issues, namely on economic analyses on technologies and targeted policies to reduce vulnerability and build resilience to climate change in Senegal.

In the WP 3, the International Food Policy Research Institute (IFPRI) and Natural Resources Institute Finland (LUKE) working in close collaboration with the agricultural research institute of Senegal (ISRA), have developed customized models for analyzing underlying causes of vulnerability to climate change in different regions of Senegal. The results show that the rainfed regions with reliance on staple food crops and groundnuts are more vulnerable and have fewer adaptation options than areas that can exploit irrigation potential. Changing planting dates and cultivated crops, conserving soil moisture and transhumance are means of adapting to variations in rainfall, and thus to variations in yield and feed availability. The regions with water in underground aquifer



fers are better buffered from rainfall variability. Proper aquifer management, however, is critical to ensure continued access to water for irrigation. In addition to adopting improved technologies and natural resources management practices, the market-level analyses show the importance of lowering transaction costs to enhance the competitiveness of agriculture in more remote regions of the country. This comprises maintaining roads and key marketing and irrigation infrastructures, for example, to facilitate other investments. Gender issues have also been addresses.

Despite its small size, the Project has significantly invested in capacity development by e.g., supporting three PhD scholars. Further, training has been provided to university students and ISRA staff on modelling techniques and other quantitative research methods. Local seminars and workshops have been organized, and the Project work has been presented in international scientific meetings. https://portal.mtt.fi/portal/page/portal/mtt_en/projects/foodafrica/Workpackage3

BOX 3: Climate change, food security and capacity development

The transition towards more climate resilient and low-emission agriculture and forestry is a knowledge-intensive learning process involving multiple stakeholders. Due to the uncertain and dynamic nature of climate change impacts, this transition requires socio-institutional learning processes with a strategic approach to skills development at various levels including strong engagement of national and local formal and informal education and training institutions. Strengthening agricultural innovation systems with public and private research, extension and advisory services plays a key role in generating, documenting and sharing indigenous and scientific knowledge as well as facilitating learning processes and network-based development and innovation.

All Finnish-funded food security and climate change-related projects have focused on capacity development of rural men and women farmers, agriculture extension agents and researchers or national, regional and global decision makers. In order to strengthen the capacity of the partner countries in climate-relevant research, 50 PhD and MSc students from the partner countries have received financial or other type of support for their studies and research projects (CHIESA, BIODEV, WP 3 of FoodAfrica). Institutional capacity development has taken place e.g., through collaboration and study tours between the Finnish and partner country research institutions (FISU, CHIESA, BIODEV). Through field level capacity development, new information and knowledge on climate change adaptation and mitigation has been shared with men and women smallholder farmers in Kenya, Tanzania, Mozambique, Niger, Ghana, Ethiopia, Sierra Leone and Burkina Faso (ALP, MICCA, CHIESA and BIODEV). Moreover, research findings and lessons from the field have been fed in the national, regional and global policy and climate change negotiation processes (ALP, MICCA, BIODEV, CHIESA).

The experiences and evidence generated by these research and development projects and programs inform the policy planning processes and food security project design in the Ministry for Foreign Affairs of Finland. For additional information contact KEO-20@formin.fi.



Project	Years	MFA financing in Euro	Countries	Implementers and main partners	Main results
CHIESA: Climate change impacts on ecosystem services and food security in Eastern Africa – Increasing knowledge, building capacity and developing adaptation strategies http://chiesa.icipe.org/	2011–2015	4,9 mil Euro	Kenya Tanzania Ethiopia	International Center of Insect Physiology and Ecology ICIPE Universities of Helsinki, York and Dar es Salaam, Sokoine University of Agriculture, 25 national, regional and international research and other organizations	<ul style="list-style-type: none"> • community-based adaptation action plans developed • climate projections for Africa computed and made freely available • studies conducted on climate change impact on insect populations and their control
ALP: Adaptation learning program for Africa http://careclimatechange.org/our-work/alp/	2010–2015	Total 11,2 mil Euro of which 2,176 mil from Finland	Ghana Kenya Mozambique Niger	CARE International Numerous government, NGO, CSO, research and other partners in the target countries	<ul style="list-style-type: none"> • the concept and practices for community-based climate change adaptation developed and their adoption successfully promoted • Participatory Climate Scenario Planning System developed and practiced in target communities
MICCA: Making agriculture part of the solution to climate change – Building capacities for agriculture mitigation www.fao.org/in-action/micca	2010–2016	6,4 mil Euro	Pilot projects in Kenya and Tanzania, otherwise global approach	UN Food and Agriculture Organization FAO pilot projects with World Agroforestry Center ICRAF, CARE International and East Africa Dairy Development Program, other partners e.g., Tanzanian Ministry of Agriculture, Livestock and Fisheries, CGIAR CCAFS program, ILRI, UNFCCC	<ul style="list-style-type: none"> • climate-smart agriculture practices piloted and studied on smallholder farms • knowledge on gender, climate-smart agriculture and mitigation in agriculture (e.g., livestock, peatlands, nationally appropriate mitigation actions) generated and disseminated
BIODEV: Building biocarbon and rural development in Western Africa http://www.worldagroforestry.org/project/biocarbon-and-rural-development-biodev	2012–2016	10 mil Euro	Burkina Faso Sierra Leone Mali Guinea	World Agroforestry Center ICRAF International Forestry Research Institute CIFOR Universities of Helsinki and Eastern Finland National research institutions, universities and other partners in the target countries	<ul style="list-style-type: none"> • several scientific papers produced on governance, markets, extension, agroforestry and ecosystem services, ecosystem services in national adaptation strategies, climate trend and variability and crop yield, charcoal production, fuel wood, soil carbon stocks, biomass and height-diameter modeling of trees • research and project planning capacities of the national partner institutions improved

Project	Years	MFA financing in Euro	Countries	Implementers and main partners	Main results
FISU: Promoting adaptation to climate change by reducing weather and climate-related losses through improved services in Sudan and South Sudan http://en.ilmatiiteenlaitos.fi/project-references	2012–2015	0,5 mil Euro	Sudan, South Sudan	Finnish Meteorological Institute Sudan Meteorological Authority South Sudan Meteorological Department (ICI Cooperation)	<ul style="list-style-type: none"> • capacity of the national meteorological agencies improved to design and manage meteorological observation networks and tailor weather and climate services to respond to end-users needs
FoodAfrica WP3: Economic analysis on technologies and targeted policies to reduce vulnerability and build resilience in Senegal https://portal.mtt.fi/portal/page/portal/mtt_en/projects/foodafrica/Workpackage3	2012–2016	approximately 0,64 mil Euro for WP 3	Senegal	International Food Policy Research Institute IFPRI, Natural Resources Institute Finland LUKE Agriculture Research Institute of Senegal ISRA	<ul style="list-style-type: none"> • customized models developed for analyzing underlying causes of vulnerability to climate change in different regions of Senegal (rainfed areas & areas with irrigation potential)

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