POWER OF PARTNERSHIPS

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Cover photo: Sulaiman Sebuliba and Brenda Makyanzi, technicians at CIAT's Kawanda, Uganda research station, examine bean varieties. G. Smith (CIAT)

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Photo: J. Recha (CCAFS)

IMPACT THROUGH POLICIES AND PARTNERSHIPS

CCAFS research helps shape US$350M investment in climate-smart agriculture in Niger and Kenya

Climate change is affecting the food security situation across Africa, as well as millions of Africans who depend on agriculture for their livelihoods. Many countries are extremely vulnerable to increasing temperatures, variable rainfall and droughts, as virtually all agriculture is rain-fed.

Climate-smart agriculture (CSA) is proposed as a solution to help transform agricultural systems in order to promote food security under the new reality of climate change. Acting from farm to landscape scales and from local to global levels, the CSA approach is a combination of practices, technologies, services, processes and institutional arrangements that sustainably increase productivity, support farmers' adaptation to climate change, and where possible, reduce emissions of greenhouse gases.

CCAFS works closely with partners around the world to help shape and scale up CSA investments. In addition to trialing CSA interventions in learning sites, called Climate-smart Villages (CSVs), it has employed CSA Country Profiles and a Prioritization Framework (developed by CIAT) to assess country priorities. Both the CSV approach and the country profiles give special attention to gender-specific constraints, needs and options.

The World Bank, a key CCAFS partner in many countries, is planning major investments in CSA, and has based the design of its recent US$350 million projects in Niger and Kenya on CCAFS' science.

The World Bank office in Niger used the knowledge generated by CCAFS' agricultural research in the CSV model of Kampa Zarma to inform the design of its 7-year US$111 million project. The Niger CSA project, which is the first World Bank project in Africa designed specifically to deliver CSA, is aligned with the Government's 'Nigeriens Nourish Nigeriens' (3N) Initiative. The objective is to increase agricultural productivity and enhance drought resilience of agro-pastoral systems in 60 targeted communities around the country, benefiting 500,000 farmers and agro-pastoralists in 44 communes.

> "As the first World Bank project designed to deliver on climate-smart agriculture in Africa this project will not only pave the way for resilient growth of the agricultural sector in Niger, it will also shape future climate-smart agriculture projects across the region," Paul Noumba Um, World Bank Country Director for Mali, Niger, Central African Republic and Chad said.

Similarly, in Kenya, CIAT-CCAFS developed a national CSA profile for the World Bank and the Government, which contributed to the design of the US$ 250 million Kenya Climate-Smart Agriculture Project (KCSAP). The objective of this project is to increase agricultural productivity and build resilience to climate change in targeted smallholder farming and pastoral communities. CIAT also developed a set of county-level Climate Risk Profiles to help implement the KCSAP at county level.

Partners

- International Center for Tropical Agriculture (CIAT)
- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
- World Agroforestry Centre (ICRAF)
- World Bank
- Kenya: Kenya Agricultural and Livestock Research Organization (KALRO). Kenya Agricultural Productivity Project (KAPP), Ministry of Agriculture, Livestock and Fisheries of Kenya
- Niger: Ministry of Agriculture National Agricultural Research Institute (INRAN), Nigeriens Nourish Nigeriens (3N)

Read more

- CSA website: CSA Guide.
- Journal article: Campbell BM, Vermeulen S, Aggarwal PK, Corner-Dolloff C, Girvetz EH et al. Reducing risks to food security from climate change. Global Food Security
- Paper: Bayala J, Zougmoré R, Ky-Dembele C, Bationo BA, Buah S et al. Towards developing scalable climate-smart village models: approach and lessons learnt from pilot research in West Africa. ICRAF Occasional Paper No. 25.
- Video: CCAFS Farms of The Future Farmers Video, Nyando, Kenya.
- Photo-story: Kenya's climate-smart farms through a lens.
- World Bank project documents: Kenya - Climate Smart Agriculture Project. and Niger - Climate Smart Agriculture Project

Photo: P. Vishwanathan (IWMI)

IMPACT THROUGH POLICIES AND PARTNERSHIPS

Thousands of villages in South Asia partner with CCAFS to become climate-smart hotspots

Climate-smart agriculture (CSA) is playing a key role in sustainably increasing agricultural productivity, given the mandate of doubling global food production by 2050 to meet the needs of a growing population. CCAFS, in collaboration with partners at multiple levels, is working with rural communities to develop climate-smart villages (CSVs). The CSV approach tests and documents CSA options that

ensure food security, promote adaptation and build resilience to climatic stresses, and reduce greenhouse gas emissions when possible. A strength of the CSV approach is its inclusiveness: CSVs bring together farmers, policy makers, scientists and local organizations to work on a portfolio of locally relevant practices that link to government's existing village development schemes and investments.

In 2011, CCAFS and its partners in South Asia initiated the CSV Agricultural Research for Development (AR4D) approach in 30+ CSVs in different states of Bangladesh, India, and Nepal. Areas of intervention in the AR4D sites include agronomic practices, weather insurance, weather forecasts, agricultural diversification, stress-tolerant crop varieties, community management of soil and water resources, and policies related to water, energy, and carbon management. All three countries are now scaling out CSA: in Bangladesh (Barisal, Khulna, Sylhet), India (Andra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Utter Pradesh), and Nepal (Bardiya, Dang, Gorkha, Mahotari, Nawalparasi).

Today, in South Asia, governments, private sector and development partners are scaling up the CSV approach and related local actions in more than 2,000 villages. This involves building portfolios of interventions together with farmers, in collaboration with National Agricultural Research Systems, CGIAR centers, local universities, non-governmental organizations, the private sector and farmers' groups.

In Nepal, the national government began rolling out the CSV approach as part of its key policies for 2016-17 with the aim to create linkages between farmers, government and private sector. This was catalyzed by learnings from CCAFS projects Nepal and the South Asia region. Focus areas of the government's CSV program are promotion of solar-based irrigation systems, improved seeds, nutrient management, ITC-based climate information and agro-advisory services, and agriculture insurance.

CCAFS has teamed up with Local Initiatives for Biodiversity, Research and Development (LI-BIRD) and an ICT provider to offer mobile and web-based climate information and agro-advisory services to farmers in CSVs. CCAFS has partnered with Practical Action Consulting, the International Finance Corporation and the government to link 15,000 farmers to lead companies in sugarcane, rice and maize in order to enhance the long-term productivity of these key crops.

Expansion of CSVs is also taking off in India, where state governments, NGOs and private sector are using the lessons learned from CCAFS CSV AR4D approach to scale up CSA practices and technologies in 6 different states. In 2016, the State Governments of Bihar and Madhya Pradesh integrated CSVs in its agricultural development plan that targets many districts, helping several hundreds of

thousands smallholder men and women farmers to improve their food, nutrition and livelihoods while coping with climate risks.

CCAFS is also partnering with ITC Limited, a private agribusiness company, to promote the CSV approach in three states of India (Madhya Pradesh, Maharashtra and Rajasthan) in 2,000 communities by 2019.

> "We have seen the weather change to a great extent, low or delayed rainfall has become the norm. This project shows us how in a changing climate, farmers can continue farming with new climate smart technologies." Horil Singh, farmer, Bihar, India

Partners

- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
- International Maize and Wheat Improvement Center (CIMMYT)
- International Food Policy Research Institute (IFPRI)
- Intenrational Rice Research Institute (IRRI)
- International Water Management Institute (IWMI)
- WorldFish
- Bangladesh government: Bangladesh Agriculture Research Institute (BARI), Bangladesh Agriculture University, and Department of Fisheries
- India government: Bihar Agricultural Management & Extension Training Institute (BAMETI), Government of Bihar, Indian Council of Agricultural Research (ICAR), State Department of Agriculture
- Nepal government: Department of Environment (DoE), district and village development offices, Local Initiatives for Biodiversity, Research and Development (LI-BIRD), Ministry of Agricultural Development (MoAD), National Planning Commission (NPC), Nepal Agricultural Research Council (NARC)
- Development and private sector: BAIF Development Research Foundation, farmer cooperatives, ICT service providers, International Finance Corporation (IFC), ITC Limited, LI-BIRD, machine manufacturers, Practical Action Consulting, seed companies, United States Agency for International Development (USAID)

Read more

- Website: CSA Guide
- Article: Khatri-Chhetri A, Aryal JP, Sapkota TB, Khurana R. 2016. Economic benefits of climate-smart agricultural practices to smallholder farmers in the Indo-Gangetic Plains of India. Current Science.
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based systems: A case of untimely excess rainfall in Haryana, India. Agriculture, Ecosystems & Environment.

- Report: Climate-Smart Villages. An AR4D approach to scale up climate-smart agriculture.
- Report: ICRISAT. 2016. Building Climate-Smart Villages: Five approaches for helping farmers adapt to climate change. 2016.
- News: Madhya Pradesh plans to develop 1,100 'climate-smart' villages.
- Blog: Nepal government vows to implement climate-smart village model as part of key policies for 2016-17.
- Blog: Mainstreaming Climate-Smart Villages in India.
- Workshop report: Climate-smart village approach in Nepal: Learning from global, regional and local knowledge.

Photo: S. Kilungu (CCAFS)

IMPACT THROUGH POLICIES AND PARTNERSHIPS

Countries and partners use CCAFS science and analysis to put the Paris Agreement into action

The first analysis of countries' Intended Nationally Determined Contributions to the Paris Climate Agreement, published in November 2015 by CCAFS, demonstrated country-driven demand for mitigation of agricultural emissions. UNFCCC country negotiators, donors, and climate finance investors used this and subsequent sectoral and national analyses – published in papers and data

sets and presented at meetings – to advocate that agriculture is a critical sector for action in climate change adaptation and mitigation.

> "The CCAFS INDC analysis provided a clearer idea about the linkages between adaptation and mitigation in agriculture," Giovanna Valverde Stark, negotiator for Costa Rica, said. "This and additional analyses were extremely useful for SBSTA discussions at COP22."

Vietnam is taking a leading role in committing to adaptation and mitigation in agriculture. With a strong agriculture sector that is very vulnerable to climate change, in 2016 Vietnam's Ministry of Agriculture and Rural Development committed to climate change mitigation through widespread adoption of the alternate wetting and drying (AWD) method for growing irrigated rice in the implementation plan for the country's Nationally Determined Contribution.

Scaling up AWD is already in process. Vietnam's Institute of Agricultural Environment (IAE), and the Institute of Policy and Strategy for Agriculture and Rural Development (IPSARD), in collaboration with CCAFS, the International Rice Research Institute (IRRI), and the Climate and Clean Air Coalition (CCAC) – developed and used climatic AWD suitability maps, analyzed opportunities and barriers of adoption, and contributed to a national working group at Vietnam's Ministry of Agriculture and Rural Development (MARD). MARD is scaling out water saving technologies in rice and regularly sharing key findings with decision-makers.

> "We must take action in response to climate change from now on. The INDC for the 2021-2030 period does not mean that we will wait until 2021 to begin," said Dinh Vu Thanh, Deputy Director of Science, Technology and Environment for Vietnam's Ministry of Agricultural and Rural Development. "We will prioritize solutions of highest feasibility and efficiency and lowest cost."

The United Kingdom Department for International Development (DFID), the United States Agency for International Development (USAID), and World Bank are also utilizing the CCAFS analyses to develop innovative climate change and agriculture solutions. In the report Making climate finance work in agriculture, for example, CCAFS, DFID, and the World Bank explore how to leverage private capital and strengthen links among financial institutions, small and medium enterprises, and smallholder farmers.

Partners

- International Center for Tropical Agriculture (CIAT)
- International Rice Research Institute (IRRI)
- University of Copenhagen
- University of Vermont

- Vietnam: Institute of Agricultural Environment (IAE), Institute of Policy and Strategy for Agriculture and Rural Development (IPSARD), Ministry of Agriculture and Rural Development (MARD)
- Development partners: Climate and Clean Air Coalition (CCAC), Root Capital, United Kingdom Department for International Development (DFID), the United States Agency for International Development (USAID), World Bank

Read More

- Data and maps: How countries plan to address agricultural adaptation and mitigation: An analysis of Intended Nationally Determined Contributions
- Blog: Viet Nam's agriculture sector hastens emissions mitigation, joins global climate deal
- Information kiosk: Mitigation in rice
- Report: USAID. Climate-smart agriculture in Feed the Future programs
- Report: World Bank. Making climate finance work in agriculture
- Paper: Basak R. Benefits and costs of climate change mitigation technologies in paddy rice: Focus on Bangladesh and Vietnam.
- SBSTA event: Targets for mitigation from agriculture: how countries can determine what is feasible, fair, and necessary to limit climate change
- Presentation: Low Emissions Development: Evidence for reducing emissions from food value chains of smallholders in Africa at USAID Global Learning and Exchange Event.

Photo: N. Palmer (CIAT)

IMPACT THROUGH POLICIES AND PARTNERSHIPS

Climate-smart coffee and cocoa value chains on the rise

The global coffee and cocoa industries rely heavily on the production of millions of smallholder farmers, for whom these tropical crops are primary source of income for farmers. They are also key foreign revenue generators for many economies. But cocoa and coffee are particularly sensitive to climate change and variability, so climate change is posing a threat to millions of farmers, to entire countries' national economies of (such as Ghana), and to the global coffee, cocoa and chocolate industries.

To address this challenge, the CCAFS Climate-Smart Value Chain project assesses climate change exposure of coffee and cocoa systems and leverages existing smallholder value chain interventions to translate CCAFS science and site-specific climate-smart agriculture (CSA) practices into actionable strategies,

guidelines, trainings and tools for farmers, businesses and investors. Research and development activities ensure that the best climate-smart science informs farmers and that risks, costs and rewards are shared by everyone in the value chain – from farmers to consumers.

> "The CCAFS initiative brings a lot of value to the work we are doing. They have shared with us the maps and we will make sure that the interesting outcomes are well-articulated in the document we are developing." Yaw Kwakye, Forestry Commission of Ghana on developing a new 10-year policy for climate-smart cocoa.

In 2016, 3 new development and research initiatives were approved for a total of nearly 9 million dollars. USAID Feed the Future provided funding for two climate related initiatives on coffee and cocoa. The Climate-Smart Coffee Consortium – led by the Hanns R. Neumann Foundation and including CCAFS, the International Center for Tropical Agriculture (CIAT), Conservation International, World Coffee Research, Root Capital and the Sustainable Food Lab – focuses on connecting global climate science with plot-level agronomic practices in Central America and East Africa. The Climate-Smart Cocoa Initiative – led by the World Cocoa Foundation and including ACDI-VOCA and private sector companies such as Barry Callebaut, Cargill, Ecom Agrotrade, The Hershey Company, Lindt & Sprüngli, Mars, Inc., Nestlé, Olam International Ltd, and Touton – builds on CCAFS climate exposure mapping and private sector engagement work. Finally, the German government (BMZ) awarded International Institute of Tropical Agriculture (IITA) and partners a large grant to deepen existing work under the Climate-Smart Value Chains project in both West African cocoa systems and East African coffee systems.

> "As the CEO of a leading agribusiness, I have seen climate change rise up the risk register faster than I ever believed possible. And while large-scale farmers and processors such as ourselves are already putting CSA measures in place, it is the world's millions of smallholders providing our daily coffee, cotton and chocolate fix that we have to reach, teach and support. We urge the agri industry and their customers to unite … to help scale the understanding and adoption of climate-smart practices by rural communities." Sunny Verghese, CEO and co-founder of Olam.

The Climate-Smart Value Chain project has begun scaling up successful practices in the pilot countries of Ghana, Nicaragua and Peru in a partnership of CIAT, IITA, Rainforest Alliance, Root Capital, Sustainable Food Lab, and support from government, research and farmer organizations in producing countries, as well as development partners and donors.

In 2016, work was expanded from the three pilot countries to include seven additional countries (Côte d'Ivoire, El Salvador, Guatemala, Honduras, Rwanda, Tanzania and Uganda), guided by earlier work on climate change impact on

agriculture by CIAT-CCAFS. In Liberia and Uganda, for instance, IFAD relied on CIAT-CCAFS science and tools to design and implement cocoa value chain projects as part of their Adaptation for Smallholder Agriculture Programme (ASAP). In Côte d'Ivoire, the world's largest cocoa producer, CIAT engages directly with stakeholders in the Ivorian cocoa supply chain to help the country become more climate smart.

Partners

- International Center for Tropical Agriculture (CIAT)
- International Institute of Tropical Agriculture (IITA)
- ACDI-VOCA
- Conservation International
- Hanns R. Neumann Foundation
- Rainforest Alliance
- Root Capital
- Sustainable Food Lab
- World Cocoa Foundation
- World Coffee Research
- Development partners: Federal Ministry for Economic Cooperation and Development of Germany (BMZ), German Federal Enterprise for International Cooperation (GIZ), United States Agency for International Development (USAID)
- Private sector: Barry Callebaut, Cargill, Ecom Agrotrade, The Hershey Company, Lindt & Sprüngli, Mars, Inc., Nestlé, Olam International Ltd, Touton

Read more

- Data: From site-level to regional adaptation planning for tropical commodities: cocoa in West Africa and Vulnerability to climate change of cocoa in West Africa: Patterns, opportunities and limits to adaptation.
- Story map: Bittersweet chocolate: the climate change impacts on cocoa production in Ghana.
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- Outcome validation report: Nyangaga J. How CIAT's climate research informs and influences decision making in IFAD and the cocoa and coffee sector globally.
- Info note: Dinesh D, Vermeulen SJ, Laderach P, Mwongera C. How can

[we develop value chain programs that address climate risks?]

Photo: N. Palmer (CIAT)

CAPACITY DEVELOPMENT AND INNOVATIVE COMMUNICATION

Weather and climate information, South-South cooperation help farmers in Colombia and Honduras manage climate change

Small-scale farmers in the developing world are particularly vulnerable to the

impacts of climate fluctuations and weather extremes. While these farming communities have survived by adapting to an increasingly uncertain climate, their traditional knowledge and coping practices have been overwhelmed by the recent scale of changes.

Supporting farmers with weather and climate information services for agricultural decision-making is an essential strategy for enhancing food security in already vulnerable areas, and a key component of climate-smart agriculture (CSA). Although existing initiatives have been successful in reaching out to smallholder farmers, the challenge of broadening the impact of climate services for vulnerable communities remains. CCAFS and its partners have used innovative approaches – including site-specific agro-climatic forecasts – to overcome this challenge

In Colombia, CCAFS has worked closely with CIAT and the Ministry of Agriculture and Rural Development to strengthen the adaptive capacity of the agriculture and livestock sectors to climate variability. CIAT-CCAFS' agroclimatic prediction science has profoundly changed how agricultural sector organizations generate and share climate variability adaptation recommendations. Smallholder farmers are provided with agroclimatic information that helps them decide what varieties to plant, when to plant, what pests and diseases might appear and how to reduce their impact in the crop, and how to efficiently manage water and inputs resources.

Organizations from different agriculture sectors regularly meet in Local Technical Agroclimatic Committees (LTACs). Here representatives from government, civil society, local-authorities, meteorological-services and farmers discuss climate forecasts and decide which climate-smart practices to implement. This allows them to use CIAT-CCAFS climate information for their decision-making, and to produce national and regional agroclimatic bulletins.

South-South knowledge exchange programs between CCAFS partner countries have been a key component of this approach and the success in Colombia is now also being replicated in Honduras. Such collaboration introduces farmers to new skills, best practices, and knowledge on how to incorporate local, reliable and timely climate and site-specific information from trusted sources into their planning systems and strategies. In both countries up to 330.000 farmers are now being reached through 9 LTACs, and in Colombia alone, 154,059 farmers are receiving tailored agroclimatic advisory services, and an additional 6,000 have adopted climate-smart practices. In the medium-term, the project is expected to reach 1,588,640 farmers.

Partners

- International Center for Tropical Agriculture (CIAT)
- International Research Institute for Climate and Society (IRI) – Columbia

University
- Centro Agronoꞏmico Tropical de Investigacioꞏn y Ensenꞏanza (CATIE)
- Honduras: Secretariat of Agriculture and Livestock of Honduras (SAG), Permanent Contingency Commission of Honduras (COPECO)
- Colombia: Producers associations, Ministry of Agriculture and Rural Development of Colombia (MADR), Corporación Colombiana de Investigación Agropecuaria (CORPOICA), Fundación Universitaria de San Gil – UNISANGIL, Centro de Investigación de la Caña de Azúcar de Colombia (CENICAÑA), Centro Nacional de Investigaciones de Café (CENICAFE), Federación Nacional de Cultivadores de Cereales y Leguminosas (FENALCE), Federación Nacional de Arroceros (FEDEARROZ), Federación Nacional de Cafeteros (FNC), Asociación de Bananeros del Magdalena y La Guajira (ASBAMA), Instituto de Hidrología, Meteorología y Estudios Ambientales (IDEAM)

Read more

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- Paper: Castro Colina L, Sova CA, Martinez Baron D, Saravia D. Mapeo de la influencia de los actores sociales de diferente nivel para Centroamérica: cambio climático y agricultura.
- Video: Speech of the Honduran President 'La Nueva Honduras' (The New Honduras). 2016. Segment from minutes 6:38 to 7:10.
- Presentation: Helping farmers reduce climate risks.

Photo: CIMMYT

CAPACITY DEVELOPMENT AND INNOVATIVE COMMUNICATION

Open data help countries to act on climate change

If we are to successfully tackle threats to food security, much more robust climate and agricultural data – including data from smallholder farmers in tropical, developing countries – is needed. CCAFS, along with CGIAR, is taking bold steps to make data freely available and usable to scientists and policy makers around the globe.

> "Farmers need to plan for the short and long term, and climate change throws a major wrench in the works," said Andy Jarvis, a senior scientist at CCAFS. "Ten years ago, we struggled to find the data to understand climate change and its implications for agriculture. Today, the challenge is to harness data's power to give farmers real advice on how to manage climate more effectively."

CCAFS maintains 19 open access databases, which were used by 60,000 different users in 2016. Scientists also contribute to scores of other databases and use the CCAFS data management support pack to ensure that information and data products are available for long-term use by partners and the scientific community. Together, the big data forms the basis of increasing numbers of analyses by scientists and policy makers alike.

The CCAFS-Climate portal is a comprehensive portal that provides users with high-resolution climate datasets that can help assess the impacts of climate change on biodiversity, agricultural and livestock production, ecosystem services and hydrology, etc. The portal is freely accessible online and the data is easy-to-use, regularly updated, and widely accessed by policy and decision makers, researchers, donors, and NGOs.

By December 2016, almost 1,700 institutions from 185 countries had used the portal for a range of purposes, including helping countries and institutions.

In Timor-Leste and India, the CCAFS-Climate portal is informing government programs for climate-smart practices.

Timor-Leste, with a population of approximately 1.2 million, is a largely agrarian society where agriculture accounts for one-third of GDP, and where food security is an ongoing country-wide problem. In 2016, the government of Timor-Leste faced an extreme drought during El Niño. Informed by research from the ACIAR-funded Seeds of Life program (and based on data from the CCAFS climate portal), the government allocated US$12million to purchase reserve food stocks and prevent a food crisis.

Similarly, in India the government launched the 'Pradhan Mantri Krishi Sinchayee Yojana' (PMKSY) program that was partly informed by research based on CCAFS' climate data. The PMKSY program focuses on micro-irrigation to obtain 'more crop per drop' and other sustainable practices. Climate information accessed through the CCAFS-Climate portal contributed to assess the future agricultural water demand in different locations, and the results were used to help the Department of Agriculture develop a long-term demand-driven irrigation development plan for all districts in India

Partners

- International Center for Tropical Agriculture (CIAT)
- International Livestock Research Institute (ILRI)
- International Food Policy Research Institute (IFPRI)
- International Water Management Institute (IWMI)
- CCAFS-Climate portal: Harvest Choice, Potsdam Institute for Climate Impact Research (PIK), United States Agency for International Development Feed the Future Innovation Lab for Integrated Pest

Management
- Timor Leste: Australian Centre for International Agricultural Research (ACIAR), Ministry of Agriculture and Fisheries, Ministry of Public Works, Ministry of Social Solidarity, Seeds of Life program
- India: Cabinet Committee on Economic Affairs, Indian Council of Agricultural Research - Indian Institute of Soil and Water Conservation, Dehradun (ICAR-IISWC), Indian Institute of Management, Ahmedabad (IIMA), Indian Institute of Technology Delhi (IITD), state agriculture departments

Read more

- CCAFS-Climate data portal.
- CCAFS tools, maps, models and data.
- CCAFS data management support pack.
- Blog: New daily climate data for crop growth simulation available.
- Journal article: Bacon SA, Mau R, Neto FM, Williams RL, Turner NC. Effect of climate warming on maize production in Timor-Leste: interaction with nitrogen supply. Crop & Pasture Science.
- Paper: Shah T, Verma S, Durga N, Rajan A, Goswami A, Palrecha A. Har Khet Ko Pani (Water to Every Farm): rethinking Pradhan Mantri Krishi Sinchai Yojana inGujarat, India. IWMI-TATA Policy Paper.

Photo: GA Duran

CAPACITY DEVELOPMENT AND INNOVATIVE COMMUNICATION

Costa Rica adopts digital emergency response system in wake of Hurricane Otto

We all know that extreme weather events – droughts, floods, and hurricanes – cause enormous damage. In Costa Rica, extreme events have negatively impacted food production, and the country is taking action to protect its agricultural production and food security.

The Ministry of Agriculture and Livestock is responsible for the government's agricultural emergency response to such extreme climatic events. In the past, the Ministry was unable to respond quickly to such emergencies because it lacked access to local, reliable and timely agro-climatic information to make

decisions.

Throughout 2015, Bioversity International, a CGIAR Research Centre, engaged with the Ministry to showcase its work on agro-climatic risk management undertaken as part of CCAFS' AgroClimas program in Guatemala and to demonstrate its relevance for Costa Rica.

In response to flooding in late 2015, Bioversity successfully piloted a digital system for emergency response data collection and decision-making in partnership with local government in Siquirres. This joint effort built mutual trust among partners and helped validate the system in Costa Rica.

In the wake of Hurricane Otto in November 2016, the Ministry was eager to scale up the pilot. Officials visited farms throughout the country to assess hurricane damage, and were able to collect and send data through a mobile application – the app allowed them to locate farms via GPS and send data to Bioversity servers in real time. Together with the Ministry, Bioversity created a national-scale system that was able to document US$57 million in agricultural losses and help build a detailed response plan in "record time".

The investment in this new digital system helped the government integrate agro-climatic information in its decision-making, allowing for more in-depth data analysis and significantly reducing its emergency response time.

> "We are working with our partners on studies about the damage produced by different climate events and formulation of strategies for adapting the agriculture. Usually there is an immediate response in giving support and aid to farmers when a climatic event happens," explained Dr. Jacob van Etten, the Bioversity International Costa Rica Office coordinator, at the signing of the Technical Cooperation Agreement with the Ministry of Agriculture of Costa Rica in Turrialba in May 2016. "But a strong long-term plan is urgently required because these events are becoming more frequent".

Partners

- Bioversity International
- International Research Institute for Climate and Society (IRI), Columbia University
- Costa Rica: Ministry of Agriculture and Livestock, agricultural extension agents

Read more

- News: Partnering with Costa Rica to help farmers face climate change.
- News: Innovative drought system to help Guatemala better deal with dry spells.
- Paper: Vernooy R, Kiwuka C. Seeds of resilience: novel strategies for using crop diversity in climate change adaptation. Presented at: Tropentag 2016: Solidarity in a competing world – fair use of resources.
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Photo: A. Nyandwi/MINAGRI Rwanda

CAPACITY DEVELOPMENT AND INNOVATIVE COMMUNICATION

Innovative "maprooms" support climate risk management in Africa

Almost 80% of all agricultural production is rainfed, more so in the developing world, where smallholder farmers are particularly vulnerable to the impacts of weather fluctuations and climate extremes. CCAFS has found that farmers need effective climate information and advisory services to help them adapt to climate change and manage climate-related risks. However, good climate information and services depend on the quality of data available, which is often very limited, particularly in Africa.

CCAFS is working with International Research Institute for Climate and Society's

(IRI's) Enhancing National Climate Services (ENACTS) initiative and with other partners to enable African national meteorological services and regional climate centers to strengthen and scale-up such services for agriculture by improving quality, accessibility and availability of climate data tools for decision-making.

> "Farmers are very enthusiastic to attend trainings because they are getting the information that can help them find solutions to their crop losses related to extreme weather events," explained J. D'Amour Nzabandeba, a farmer promoter from Ngororero district, Rwanda during a monitoring and evaluation visit.

CCAFS is working with IRI and the IGAD Climate Prediction and Applications Centre (ICPAC) to support national meteorological services in several African countries in East Africa, and the Agriculture, Hydrology, and Meteorology (AGRHYMET) Regional Center in West Africa to overcome data gaps and provide high quality climate information.

In 2016, CCAFS helped support development and use of the ENACTS approach to create graphical climate information and seasonal forecast products regionally and for countries. Already in action in projects in Ghana, Mali, and Rwanda, these online "maprooms" provide the information that African countries need to provide actionable climate information to rural communities and support both large scale and farmer-level decision-making. CCAFS is also currently helping train staff to use the maprooms effectively. CCAFS also leveraged two projects (WISER-ENACTS and WISER-SCIPEA) within the DFID-funded Weather and Climate Information Services for Africa (WISER) program.

These projects have strong synergies with the two USAID-funded projects – Climate Services for Africa and Rwanda Climate Services for Agriculture – which aim to build capacity for climate services in Rwanda and throughout sub-Saharan Africa.

Partners

- International Research Institute for Climate and Society (IRI), Columbia University
- IGAD Climate Prediction and Applications Centre (ICPAC)
- Agriculture, Hydrology, and Meteorology (AGRHYMET) Regional Center
- United Kingdom Department for International Development (DFID)
- United Kingdom Met Office
- United States Agency for International Development (USAID)
- National meteorological services in several sub-Saharan Africa countries

Read more

- IRI Climate and Society Map Room.
- Blog, webinar, presentation: How can climate services improve the lives of smallholder farmers and pastoralists?
- Blog: Reaching a million farmers in Rwanda with useful climate services.
- Blog: Delivering targeted climate information services and products for farmers in Rwanda.
- Report: Regional Climate Services for Agriculture Project Presentation, and Demonstration and Discussion of Agricultural Maprooms: Launch Events at 44th Greater Horn of Africa Climate Outlook Forum.
- Report: Climate Data Tools Training at AGRHYMET, Niamey, Niger, August 2016.
- Video and report: ENACTS and climate services for farmers video and report

Photo: IRRI

BREAKTHROUGH SCIENCE AND INNOVATION

Agricultural emissions reduction target set; call for ambitious action

In climate change plans submitted to the United Nations in 2016, 104 countries included intentions to reduce emissions in the agriculture sector, but no global target for mitigation from agriculture had been set. To fill this gap, scientists from CCAFS, with partners from 5 CGIAR centers (CIAT, CIFOR, CIMMYT, ILRI, and IRRI) and 15 partner organizations, calculated, for the first time, the reduction in emissions from the agriculture sector needed to limit warming to 2°C in 2100.

Through analyzing an Intergovernmental Panel on Climate Change (IPCC)

scenario that results in a 66% or 'likely' chance of staying below the 2 °C warming limit and comparing it with business-as-usual emissions in agriculture from three integrated assessment models, scientists found that **annual emissions from agriculture must be reduced by 1 gigatonne of carbon dioxide equivalents per year** (GtCO2e/yr) **by 2030 to stay within the 2°C limit.**

Analysis also revealed that currently available interventions – such as sustainable intensification of dairy production, alternate wetting and drying in irrigated rice, and nutrient management for annual crops – to achieve emission efficiencies will be necessary, yet insufficient, to achieve these targets. Scientists found that current interventions in the agriculture sector would only deliver between 21-40% of mitigation required.

> "This research is a reality check," Lini Wollenberg, leader of the CCAFS low emissions development research program and based at the University of Vermont's Gund Institute for Environment, said. "Countries want to take action on agriculture, but the options currently on offer won't make the dent in emissions needed to meet the global targets agreed to in Paris. We need a much bigger menu of technical and policy solutions, with major investment to bring them to scale."

Scientists called for urgent development and implementation of transformative technical options, such as methane inhibitors in the livestock sector and nitrogen inhibitors for major annual crops; innovative policies and standards, including climate finance and government and private sector support for sustainability standards; and support for farmers' capacity to use new practices. They identified the need for more research on sequestering soil carbon, increasing agroforestry and avoiding deforestation, decreasing food loss & waste and shifting dietary patterns.

Setting mitigation targets for agriculture is an issue that has continued to the climate change negotiations. At the meetings in Bonn in May 2016, and with support from the United States Agency of International Development (USAID), delegates from Ethiopia, Viet Nam and Colombia joined scientists from CCAFS, the International Institute for Applied Systems Analysis (IIASA), and the National Wildlife Federation to discuss how countries can determine targets that are feasible, fair, and necessary to limit climate change. Since 2016, the 1 $GtCO_2e$ was also presented at the Eighth SBSTA Research Dialogue.

Partners

- Center for International Forestry Research (CIFOR)
- International Center for Tropical Agriculture (CIAT)
- International Livestock Research Institute (ILRI)
- International Rice Research Institute (IRRI)
- International Maize and Wheat Improvement Center (CIMMYT)

- World Agroforestry Centre (ICRAF)
- Wageningen University and Research Center
- California Environmental Associates
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Food and Agriculture Organization of the United Nations
- Global Research Alliance for Agricultural Greenhouse Gases (GRA)
- International Institute for Applied Systems Analysis (IIASA)
- French National Institute for Agricultural Research (INRA)
- New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC)
- Pacific Northwest National Laboratory
- PBL Netherlands Environmental Assessment Agency
- United States Agency for International Development (USAID)
- The World Bank
- Agricultural negotiators from Colombia, Ethiopia, and Viet Nam

Read more

- Journal article: Wollenberg E, Richards M, Smith P, Havlík P, Obersteiner M, et al. Reducing emissions from agriculture to meet the 2°C target. Global Change Biology.
- Blog: Annual emissions reductions from agriculture must reach 1 GtCO2e per year by 2030 to stay within 2°C warming limit.
- Infographic.
- Event: Negotiators and scientists discuss country emissions targets for agriculture at SBSTA 44

Photo: N. Palmer (CIAT)

BREAKTHROUGH SCIENCE AND INNOVATION

Scientists call for massive transformation in African agriculture by 2025 to protect production of key food crops

Scientists documented in 2016 that climate change represents an enormous threat to food security across sub-Saharan Africa if no adaptation actions are taken. Agriculture in parts of Africa must undergo significant transformation in order to continue to produce key food crops, according to a 2016 CCAFS study published in Nature Climate Change, which was picked up by over 80 media

outlets and trade publications (including BBC, Reuters and ScienceDaily). Given that solutions can take at least 15 years to implement, time is running out to transform agriculture.

> "This study tells where, and crucially when, interventions need to be made to stop climate change destroying vital food supplies in Africa," said Julian Ramirez-Villegas, lead author of the study, working with CCAFS. "We know what needs to be done, and for the first time, we now have deadlines for taking action," he added.

Region-by-region, the study examined the likely effects of different climate change scenarios on nine crops that constitute 50% of food production in sub-Saharan Africa; they found that maize, bananas and beans are most at risk. The research was the first to allocate specific timeframes for changes in policy and practice in order to maintain required production levels and avoid placing food security and the livelihoods of smallholder farmers at risk.

While six of the nine crops studied are expected to remain stable under moderate and extreme climate change scenarios, up to 30% of areas growing maize (Botswana, Namibia, Mozambique, Zimbabwe) and bananas (Benin, Ghana, Togo), and up to 60% of those producing beans (Angola, South Africa, Tanzania, Uganda) are projected to become unviable by the end of the century. In some areas transformations will need to take place as soon as 2025. Transformation could mean changing the type of crop grown in the area in question, improving irrigation systems, or in extreme circumstances, moving away from agriculture altogether.

> "It can take decades to adjust national agricultural development and food security policies," said Andy Jarvis, co-author of the paper and leader of CCAFS research on Climate-Smart Agricultural Practices. "Our findings show that time is running out to transform African agriculture. Solutions will require not only increased funding but also a supportive policy environment. We also need to ensure that the needs of women and marginalized groups are built into adaptation policies, to ensure they can be successfully implemented," he explained.

Adaptation strategies will vary greatly across sub-Saharan Africa, given the highly different local contexts. Extensive research by CCAFS is already informing African governments and policymakers on the technologies and policies that can successfully help farmers to adapt to climate change in these countries.

Partners

- International Center for Tropical Agriculture (CIAT)
- Australian National University
- Commonwealth Scientific and Industrial Research Organization (CSIRO)

- University of Bonn
- University of Leeds
- University of Copenhagen

Read more

- Article: Rippke U, Ramirez-Villegas J, Jarvis A, Vermeulen SJ, Parker L, Mer F, Diekkrüger B, Challinor AJ, Howden M. Timescales of transformational climate change adaptation in sub-Saharan African agriculture. Nature Climate Change.
- Press release: New research exposes urgent need to transform key agriculture regions across Africa by as early as 2025.
- Blog: More action, less talk: African negotiators call for investments in agricultural transformation.

Photo: F. Noy (UN Photo)

BREAKTHROUGH SCIENCE AND INNOVATION

Study finds strong economic case for investing in agriculture under climate change

With the Paris Climate Agreement now in force, agriculture has emerged as an important sector for action among participating countries: more than 80 % of climate pledges propose mitigation actions in agriculture and land-use, while 92 % of adaptation plans prioritize agriculture. Now, more than ever, countries must act on their Paris commitments by giving agriculture a prominent place in

their national climate change plans and programs.

The economic advantage: assessing the value of climate change actions in agriculture, a report produced as part of the IFAD-CCAFS Learning Alliance for Adaptation in Smallholder Agriculture, offers strong evidence of how investments in agriculture can pay off at the country, commodity and farm levels. The study analyzed IFAD's Adaptation for Smallholder Agriculture (ASAP) program and found that all the investments are set to deliver positive returns, with benefit-to-cost ratios of up to 7:1 over the project lifespan of 20 years.

> "There is a strong economic case to be made for investing in agriculture for future food security, even under changing climate conditions," said IFAD's Director of Environment and Climate, Margarita Astralaga. "IFAD's ASAP, the world's largest program for smallholder farmers' adaptation, shows that where investments are made that help farmers adapt to climate change, the returned financial benefit to farmers is much, much higher."

This is good news for private sector investors, public sector funders and governments, as it shows that agriculture does not have to be a risky investment, even under climate change. However, unleashing significant public and private finance requires proposals on agriculture that are supported by credible economic and financial plans. Importantly, the analysis also revealed that investments must cover a spectrum of interventions to be successful.

In Vietnam, for instance, IFAD is investing US$34 million to build the adaptive capacity of communities and institutions in the Mekong Delta. The project is expected to provide additional value across smallholders and other project beneficiaries of about US$1.63 per US$1 spent on an annual basis over a time frame of 20 years. This puts Vietnam in the top two most valuable country investments in the Asia and Pacific Region, representing 37% of the overall regional value generated under ASAP.

If correctly targeted, investments can pay off for farmers and rural development in general. However, the report found that focused activities are often needed to ensure that farmers benefit from investments in an equitable way. In Vietnam, for example, where rising sea levels have spurred farmers to switch from growing rice to growing coconut and sugarcane, research revealed that that only the richest farmers were able to make the transition – the poorer farmers struggled to switch crops and as a result were left behind.

The report thus emphasizes the importance of designing socially inclusive programs. Taking into account the heterogeneity of populations is necessary to ensure that vulnerable groups, including women, youth and the poorest farmers, benefit.

Partners

- International Center for Tropical Agriculture (CIAT)
- International Food Policy Research Institute (IFPRI)
- International Fund for Agriculture Development (IFAD)
- University of Alberta
- University of Vermont

- Report: Vermeulen S, Richards M, De Pinto A, Ferrarese D, Läderach P, et al. The economic advantage: assessing the value of climate change actions in agriculture. International Fund for Agricultural Development (IFAD).
- Info Note: Vermeulen S, Richards M, De Pinto A, Ferrarese D, Läderach P, et al. The economic advantage: assessing the value of climate change actions in agriculture.
- News: UN News Centre. 9 November 2016. Small farmers can earn big returns by investing in climate adaptation, new UN report finds.
- COP 22 side event: Economic Advantage of Agriculture in Nationally Determined Contributions (NDCs). IISD Reporting Services (IISD RS): Earth Negotiations Bulletin (ENB).

Photo: S. Kilungu (CCAFS)

BREAKTHROUGH SCIENCE AND INNOVATION

Future food security in sub-Saharan Africa examined

Given that the population of sub-Saharan Africa is expected to increase by a factor 2.6 by 2050 (another 1.5 billion people), experts estimate that food production must triple by 2050 to maintain the present level of food self-sufficiency. Trends show that cereal yields are growing more slowly than population and demand in almost all countries.

A 2016 CCAFS study published in the journal Proceedings of the National Academy of Sciences of the United States of America (PNAS) shows that future food security depends on a nearly complete closure of the yield gap between current farm yields and yield potential to achieve a large, abrupt acceleration in rate of yield increase. If this acceleration is not achieved, there will likely be a massive expansion of cropland into forests and other areas resulting in

significant biodiversity loss, along with increased greenhouse gas emissions, and a vast dependency on food imports.

However, experts found that closing the yield gap is not enough. The paper, Can sub-Saharan Africa feed itself?, suggests that climate-smart agricultural practices such as sustainably intensifying the number of crops grown on existing croplands, nutrient management, and expanding use of irrigation in a responsible manner, are important, but insufficient. Future food security requires immediate and adequate research and development investments by the public and private sectors, accompanied by government policies that ensure intensification without negative environmental consequences, authors state.

> "With improved cultivars, hybrid seeds, coupled with increased use of irrigation, fertilizers, modern pest management practices and good agronomy, it's possible to achieve accelerated rates of yield gain," study co-author Kindie Tesfaye, a scientist with the International Maize and Wheat Improvement Center (CIMMYT) in Addis Ababa, said. "It's achievable, but we have to break the complacency that we can continue with business as usual ... (and) still feed ourselves" Tesfaye, told CNBC Africa.

A second CCAFS study published in PNAS analyzed the key drivers of household food availability by examining land use and production data from more than 13,000 smallholder farm households in 93 sites in 17 countries across sub-Saharan Africa. The analysis suggests that targeting poverty through improving market access and off-farm opportunities is a better strategy to increase food security than focusing only on agricultural production and closing yield gaps. The study calls for multi-sectoral policy harmonization and incentives, improved interconnectedness of people to urban centers, and diversification of employment sources, rather than a singular focus on agricultural development among smallholder farmers.

> "We need to ensure that farmers have access to markets for their produce and opportunities to diversify their income by working outside the farm... to target poverty and improve food security', co-author Ken Giller, of Wageningen University, said. Much of the focus of agricultural research in relation to rural development in Africa is currently focused on increasing crop yields. While important, it is simply not enough on its own."

At the COP22 climate talks in Marrakesh in November 2016, CCAFS joined experts in launching an action plan for the Adaptation of African Agriculture Initiative.

Partners

- Africa Rice
- International Center for Tropical Agriculture (CIAT)
- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
- International Food Policy Research Institute (IFPRI)
- International Institute of Tropical Agriculture (IITA)
- International Livestock Research Institute (ILRI)
- International Maize and Wheat Improvement Center (CIMMYT)
- Wageningen University & Research Centre (WUR)
- AGRHYMET Regional Centre, Niger
- Bill & Melinda Gates Foundation
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Federal University of Technology Minna, Nigeria
- French National Institute for Agricultural Research
- Institut d'Economie Rurale, Mali
- Institut de l'Environnement et de Recherches Agricoles, Burkina Faso
- Jomo Kenyatta University of Agriculture and Technology
- Lund University
- Ministry of Water and Irrigation, Tanzania
- National Agricultural Research Laboratories,Uganda
- University of Nebraska
- University of Queensland
- University of Zimbabwe
- Adaptation of African Agriculture partners:
- Government of Morocco
- International Center for Agricultural Research in the Dry Areas (ICARDA)
- Agriculture and Climate Risk Enterprise (ACRE)
- Groupe Crédit Agricole du Maroc
- International Fertilizer Association (IFA)
- Syngenta Foundation for Sustainable Agriculture (SFSA)
- Technical Centre for Agricultural and Rural Co-operation (CTA)

Read more

- Journal article: van Ittersum MK, van Bussel LGJ, Wolf J, Grassini P, van Wart J, et al. Can sub-Saharan Africa feed itself? Proceedings of the National Academy of Sciences.
- Journal article: Frelat R, Lopez-Ridaur S, Giller KE, Herrero M, Douxchamps S, et al. Drivers of household food availability in sub-Saharan Africa based on big data from small farms. Proceedings of the National Academy of Sciences.
- Website: Crop Nutrient Gap Project.
- Website: Global Yield Gap Atlas.
- Blog: Foods available to African farm households increase with market

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- Brief: Richards M, van Ittersum M, Mamo T, Stirling C, Vanlauwe B, Zougmoré R. Fertilizers and low emission development in sub-Saharan Africa. CCAFS policy brief no. 11.

Photo: G. Smith (CIAT)

INTEGRATING GENDER AND YOUTH

African countries call for gender-inclusive climate change policies

Given the enormous negative impact that climate change will have on women and youth, the CCAFS Gender and Social Inclusion Strategy calls for the gender gap to be addressed in agricultural and climate change adaptation and mitigation practices, budgets and policies. Currently, the gender gap is perpetuated by a lack of understanding of gender mainstreaming and limited consideration for gender in analysis, budgets, and data. The Gender and Social Inclusion Strategy also calls for women and youth to have a more active role in shaping policy-making and implementation, as their participation is often ignored. Historically, African women tend to lack representation in key leadership roles at levels

where policies decisions are made, and the United Nations Framework Convention on Climate Change has noted fluctuating, but always unequal, participation by women and youth in its global meetings.

CCAFS is partnering with the African Working Group on Gender and Climate Change and the African Group of Negotiators to support the work of the Lima Work Program on Gender to increase participation of women in policy decisions at all levels and advocate for gender-responsive climate change policies.

Prof. Hamilton Simelane, Chairman of the African Working group on Gender and Climate Change, speaks about the importance of gender inclusion in global negotiations.

Since the Lima Work Program on Gender was implemented in 2014: a greater percentage of women are participating in UNFCCC meetings, linkages between climate change and gender have been enhanced, and some delegates have received training in gender-inclusive policy.

> "Since COP20, the Lima Work Program on Gender has provided parties and observer organizations an opportunity for understanding the integration of gender considerations into climate change policies and capacity building," Winfred Lichuma, Commissioner of the Kenya National Gender and Equality Commission, said. "However, continued engagement on gender and climate change in the UNFCCC (that needs to cascade down to national levels) is required. This calls for a longer work program on gender mainstreaming, gender integration, gender enhancement to augment the work that is underway."

The Lima Work Program has been extended for three years till 2019, providing an opportunity for CCAFS and partners to ensure that evidence-based science and technical expertise on gender inform climate change policies, encourage the participation of women and youth in policy decisions and advocatefor gender-responsive climate change policies.

Partners

- International Center for Tropical Agriculture (CIAT)
- International Institute of Tropical Agriculture (IITA)
- University of Copenhagen
- African Group of Negotiators (AGN)
- African Working Group on Gender and Climate Change (AWGGCC)
- Women in Global Science and Technology (WISAT)

Read more

- Paper: Huyer S, Campbell BM, Hill C, Vermeulen S. CCAFS Gender and Social Inclusion Strategy.
- Info note: Mungai C, Radeny M, Nyasimi M, Atakos V. Integrating climate change in agriculture and food security policies and strategies: Experiences and lessons from East Africa.
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- Blog: Africa advancing and augmenting the UNFCCC Lima Work Programme on Gender.
- Blog: Building African women's resilience for a changing climate.
- Blog: More action, less talk: African negotiators call for investments in agricultural transformation.
- Blog: New papers highlight the need for a gendered approach to policy and development.

Photo: N. Palmer (CIAT)

INTEGRATING GENDER AND YOUTH

Closing the gender gap would benefit food security and climate change

Agriculture is the principal employment sector for 60% of women in sub-Saharan Africa, southern Asia, and Oceania, and women make up two thirds of the world's 600 million small livestock managers. Despite this, women's activities in agriculture are characterized by a global gender gap in rights, resources, power and productivity. Climate change exacerbates the gender gap with additional threats, which are not gender-neutral.

In 2016, the journal Gender, Technology and Development (GTD) released a special issue titled 'Gender, Climate Change and Agriculture' that explores

gender-based disparities in resource access and use, how they contribute to production differences between men and women, and potential solutions that can reduce the disparities and increase agricultural productivity. The July 2016 special issue continues the international conversation that started at a March 2015 seminar co-organized by CCAFS, the International Social Science Council (ISSC) and Future Earth.

Closing the gender gap in farming under climate change.

As farmers around the world adapt to climate change, unequal access to assets and resources is likely to prevent women from adapting at the same pace as their male counterparts. Leaving women out of the ongoing climate conversations and not developing gender sensitive climate-smart agriculture technologies and practices will be detrimental not only to women, but to entire communities.

> "We often do not recognize the role of the woman as a farmer, income-earner and contributor to the economy," Dr Thelma Paris, socio-economist and gender specialist with CCAFS, said at a roundtable discussion on enhancing the resilience of smallholder farmers.

Research shows that, in comparison to men, women have limited access to irrigation, information and communication technologies, and agro-advisory and extension services. Further, agricultural technologies do not always take into account the specific needs and priorities of women. Findings presented in the special issue demonstrate how providing women with engagement opportunities and adaptation resources can greatly reduce the gender gap (which ranges from 4 to 25 % globally) between men and women.

Examples highlighted in the special issue indicate the potential of agriculture-based innovation to strengthen and increase women's and their communities' adaptive capacity. As the global community continues to grabble with the challenges of climate change, especially in the agriculture sectors, development and utilization of gender sensitive and gender transformative innovations and technologies should be a key component of global efforts.

Partners

- International Food Policy Research Institute (IFPRI)
- International Livestock Research Institute (ILRI)

- International Maize and Wheat Improvement Center (CIMMYT)
- Future Earth
- Central European University
- International Social Science Council (ISSC)
- National University of Ireland Galway
- World Bank

Read more

- Journal special issue: Huyer S. (ed,) Closing the Gender Gap in Agriculture in a Changing Climate. Gender, Technology and Development. Special issue.
- Blog: New papers explore gender-inclusive climate adaptation strategies.
- Practice brief: Nelson S, Huyer S. A gender-responsive approach to climate-smart agriculture: Evidence and guidance for practitioners. Global Alliance for Climate-Smart Agriculture Practice Brief.
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- Blog: From wives to managers: Tackling climate change with women farmers.

INTEGRATING GENDER AND YOUTH

Youth and teachers embrace climate-smart agriculture in the Philippines

CCAFS and partner Philippine Rice Research Institute (PhilRice) collaborated on a nation-wide Infomediary Campaign that mobilizes high school students and teachers to share information – serving as "infomediaries" – on climate-smart agriculture for rice (CSA4Rice) in their communities.

Infomediary Campaign Teaser.

The campaign engages students through a "read, surf and text" strategy. Students are taught the basics of rice farming and climate change with the help of printed reading materials, and shown how to access information platforms such as the Pinoy Rice Knowledge Bank to get agricultural information that they can pass on to the larger farming communities. In addition, students can access a text center or SMS facility, where they can send questions and receive answers on a variety of topics. In 2016, the PhilRice Text Center received over 2,000 text messages for information requests on issues such as rice varieties, seed availability and pest management.

> "At first, my father would just nod at me when I tell him about our topics on rice production. Nevertheless, I persisted in sharing my lessons learned. It was when we experienced losses in the farm that he tried to apply what he heard from me." Zoila Gracilla, a 15-year old Grade 10 pupils of Corazon C. Aquino High School in Gerona, Tarlac

At the same time, teachers attend expert lectures and field tours and are taught how to integrate PhilRice's various information and social media platforms on CSA4Rice into their curricula.

> "Our teachers learned a lot; they were able to upgrade their knowledge and skills [on climate-smart rice agriculture]. This is also true among students and their farmer-parents". Dr. Perpetua M. Eslava, Principal, Luna National Vocational High School, La Union.

The project is now implemented in 208 high schools (including 81 vocational schools), and 225 teachers have been trained. The campaign directly involved about 9,000 students, and indirectly reached 225,000 students nationwide through various school activities. Many teachers have also s conducted community outreach activities such as technology seminars for farmers.

An unintended (but welcome) result is that the campaign contributed to the increase in agriculture-related modules among participating schools and a 71% increase in enrollment in agriculture-related tracks among randomly monitored schools. The project is helping to promote agriculture as a viable career option.

> We should have the mindset that the youth is a force to be reckoned with when it comes to ensuring a food secure future for generations to come. And this would require the brightest minds in agriculture from the youth sector." Mr. Manalo, Jaime Manalo IV, PhilRice senior research specialist.

Partners

- PhilRice
- Government of the Philippines: Department of Education, Climate Change Commission

Read more

- Website: The Infomediary Campaign.
- Blog: The Infomediary Campaign: Reinventing instruction approaches to win young people's minds.
- Blog: Philippine student journalists primed for climate change reporting.
- Journal article: Manalo IV JA, Balmeo KP, Berto JC, Saludez JD, Villaflor JD, Pagdanganan AM. Integrating climate-smart rice agriculture into secondary-level curriculum: lessons from three high schools in the Philippines. SpringerPlus.
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Photo: V. Atakos (CCAFS)

INTEGRATING GENDER AND YOUTH

Women farmers increase incomes and plant fruit trees after exposure to "farms of the future approach"

Exchange visits among rural communities show farmers how others are adapting and building resilience to climate change. CCAFS uses a "farms of the future" approach and organizes exchange visites for community leaders to places that have a climate that is similar to what their communities' might experience in the future. Farmers are able to see what they can do now and how they can prepare

for the future.

> "We help the community to go and visit what would be their [future] community, according to climate scenarios. And we organize an exchange visit between these two communities so they can learn from the opportunities in the future community and then try to prevent their community from reaching this future scenario." Robert Zougmoré, the CCAFS West Africa regional program leader, explained.

A visit organized for leaders from Daga-Birame – a CCAFS climate-smart village (CSV) in Senegal – showed a path to economic opportunity from agroforestry that they began immediately.

When representatives of Daga-Birame visited Linguère-Dahra, a community a few hours' drive away, to see how people there were coping with drought– a condition that is becoming increasingly likely in Daga-Birame – they were welcomed with fresh baobab fruit juice. Daga-Birame farmers do not regularly use the baobab fruit themselves, so they were impressed that people from the host locality demonstrated both the value of the fruit and its output capacity.

The women farmers from Daga-Birame were inspired to create a "one woman, one fruit tree" juice business to generate income and increase nutrition. If the villagers could make the most of what they had – an abundance of baobab trees – they could create a homegrown solution to increase their income and resilience in the face of climate variability.

Upon return home, the women realized that the available baobab trees had been poorly managed, so they teamed up with the Senegalese Agricultural Research Institute (ISRA), the World Agroforestry Center (ICRAF) and other local partners to protect existing trees and cultivate new ones. They also decided to seek ways to increase the number of local fruit trees in their village. Along the way, they introduced other drought-resistant, fruit-bearing tree crops that offer income-generating opportunities, such as jujube, tamarind, guava and soursop.

> "Tree fruit farmers will tell you that since they started collecting the baobab fruit, and processing it, packaging it, and selling it, they realized that it is also a source of nutrition for their children," said Jules Bayala, ICRAF scientist in West Africa. "It's a complement in terms of vitamins."

In the short term, the "One Woman, One Fruit Tree" project has generated additional income and improved the quality and quantity of food. In the long-term, improved tree biomass in the community will reduce the risk of damage from strong winds, improve soil fertility and thus increase productivity.

Partners

- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
- World Agroforestry Centre (ICRAF)
- Community of Daga-Birame
- Senegalese Agricultural Research Institute (ISRA)
- Agence Nationale de l'Aviation Civile et de la Me□te□orologie (ANACIM)
- Ministe□re de l'Environnement et du De□veloppement Durable, Senegal

Read more

- Journal article: Sanogo D, Ndour BY, Sall M, Toure K, Diop M, Camara BA et al. Participatory diagnosis and development of climate change adaptive capacity in the groundnut Basin of Senegal: Building a climate-smart village model. Agriculture & Food Security.
- Paper: Bayala J, Zougmoré R, Ky-Dembele C, Bationo BA, Buah S, Sanogo D, Somda J, Tougiani A, Traoré K, Kalinganire A. 2016. Towards developing scalable climate-smart village models: approach and lessons learnt from pilot research in West Africa. ICRAF Occasional Paper No. 25.
- Paper: Sanogo D, Dayamba D, Ouedraogo M, Zougmore R, Bayala J, et al. The Climate-Smart Village approach: what research and insights from current implementation in Daga-Birame CSV in Senegal? Case study.
- Blog: How local fruit trees contribute to food security and resilience in the Climate-Smart Village of Daga-Birame, Senegal.
- World Food Programme news: From Senegal to Marrakech: What Climate-Smart Villages Can Teach the World.
- Brochure: Climate-Smart Villages: An AR4D approach to scale up climate-smart agriculture.

Funding and Strategic Partners

Funders

The Program gratefully acknowledges the support of its funders

- CGIAR Fund Donors
- Australia (ACIAR)
- Ireland (Irish Aid)
- Netherlands (Ministry of Foreign Affairs)
- New Zealand
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- Thailand (through the Department of Agriculture
- The UK Government (UK Aid)
- USA (USAID)
- The European Union (EU)

The Program is carried out with technical support from

The International Fund for Agricultural Development (IFAD)

Partners

The CCAFS program is a strategic partnership of CGIAR and Future Earth, led by the International Center for Tropical Agriculture (CIAT)

CCAFS is a collaboration among all 15 CGIAR research centers and work is led by staff at CGIAR centres and at five partner universities

- Leeds University - School of Earth and Environment
- Columbia University - International Research Institute for Climate and Society
- University of Vermont - Gund Institute for Ecological Economics
- University of Oxford - Environmental Change Institute
- University of Copenhagen - Faculty of Science

Read more about our key partners and partnerships approach.

In 2017, CCAFS has begun its second phase of implementation and is working with additional strategic partners.

CCAFS People

The success of the CCAFS program depends on the efforts and dedication of its people. The following staff and scientists contributed to CCAFS in 2016.

Independent Science Panel (ISP)

- Mercedes Bustamente, Departament of Ecology, University of Brasília (Brazil)
- Bruce Campbell, ex officio, CCAFS Program Director, International Center for Tropical Agriculture (CIAT) (Colombia)
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- Charles W. Rice, ex officio, University Distinguished Professor, Kansas State University (USA)
- Ram Badan Singh, National Academy of Agricultural Sciences (India)
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- International Water Management Institute (IWMI), Vladimir Smakhtin and Amarnath Giriraj
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Financials

Financial results for 2016

In 2016, the total budget of CCAFS was USD 70.558 million composed of:

- CGIAR W1&2 funds of USD 23.7 million as per the final revised financing plan;
- USD 42.323 of Bilateral & W3 sources from all CGIAR Participating Centers;
- CGIAR W1&2 carry-over of USD 2.184 million; and
- Additional funding confirmed at the end of year of USD 2.351 million.

Total execution was USD 51.981 million (73.7%). Gender and social inclusion research activities accounted for USD 5.014 million, approximately 10% of the total annual execution. Total W1&2 2016 funds were paid in three tranches, 28% ($7,265 million) in June, 40% ($10,487 million) in September and 32% ($8,299 million) in December. 56% of the funds were W1 (USD 14,502 million), and 44% were W2 (USD 11,549 million).

Table 1 shows budget and expenditures by natural classification. Table 2 shows budget and expenditures by unit, differentiating participating centers from core team units such as flagship leaders, regional program leaders and cross-cutting units.

Table 1: Execution as of 31 December 2016 per natural classification and funding source (thousands of USD)

Budget Categories	Budget	Expenditures	Execution %
Personnel	16,604	14,296	86%
Collaborators Costs - CGIAR Centers	1,967	898	46%
Collaborator Costs - Partners	19,580	15,308	78%
Supplies and services	15,599	11,891	76%
Operational Travel	4,547	3,154	69%
Depreciation	402	63	16%
Contingency	2,462	51	2%
Subtotal	61,159	45,661	75%
Indirect Costs	9,399	6,321	67%
Total - All Costs	70,558	51,981	74%

Table 2: Execution as of 31 December 2016 per unit (thousands of USD)

Unit	Budget	Expenditures	Execution %
AFRICARICE	28	28	100%
BIOVERSITY	7,741	4,635	60%
CIAT CENTER	12,797	8,477	66%
CIFOR	521	828	159%
CIMMYT	7,823	5,691	73%
CIP	310	241	78%
ICARDA	61	61	100%
ICRAF	4,696	4,033	86%

Unit	Budget	Expenditures	Execution %
ICRISAT	4,797	3,080	64%
IFPRI	1,462	1,391	95%
IITA	1,733	1,171	68%
ILRI	3,422	2,438	71%
IRRI	1,211	1,209	100%
IWMI	1,613	1,844	114%
IRI-Columbia University	302	302	100%
Wageningen University	630	630	100%
WORLDFISH	564	564	100%
Total Participating Centers	49,711	36,623	74%
FP1 Leader (CIAT & Leeds U.)	820	803	98%
FP2 Leader (CIAT & Columbia U.)	4,634	1,914	41%
FP3 Leader (CIAT & Vermont U.)	2,499	1,870	75%
FP4 Leader (CIAT & ILRI)	1,032	1,028	100%
Total Flagship Leaders	8,984	5,614	62%
RPL Latin America (CIAT)	842	841	100%
RPL East Africa (ILRI)	846	843	100%
RPL West Africa (ICRISAT)	1,035	1,035	100%
RPL South Asia (CIMMYT & IWMI)	1,631	1,631	100%
RPL Southeast Asia (CIAT & IRRI)	799	799	100%
Total Regional Program Leaders	5,154	5,150	100%
Copenhagen University	1,216	1,216	100%
Gender & Social Inclusion Leader (CIAT)	645	497	77%
Total Cross-cutting research and engagement	1,862	1,713	92%
Global Engagement and Management (CIAT & ILRI)	4,847	2,881	59%
Total	70,558	51,981	73.7%

CCAFS is led by
the International Center for Tropical Agriculture (CIAT)

CCAFS is implemented in collaboration with all CGIAR Centers.

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Fund

Australian Government
Australian Centre for International Agricultural Research

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Ireland's commitment to a world without poverty and hunger

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