

Program Plan Summary  
CGIAR Research Program on Climate Change,  
Agriculture and Food Security (CCAFS)

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**Lead Center:** Centro Internacional de  
Agricultura Tropical (International Center for  
Tropical Agriculture – CIAT)



CLIMATE  
CHANGE  
AGRICULTURE AND  
FOOD SECURITY





Cover Image



**Farmer in Central Kenya.** Photo: Neil Palmer (CIAT)

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# Introduction

Achieving sustainable food security in a world with a growing population, changing diets and a changing climate is a major challenge. We need more food in the future but climate change means less food production potential and poor people will be hit the hardest. Climate-related crop failures, fishery collapses and livestock deaths already cause economic losses and undermine food security, and these are likely to become more severe as global warming continues.

Agriculture and related activities also contribute to global warming by generating greenhouse gas (GHG) emissions and altering the land surface. It is essential that agriculture releases less GHG emissions in the future and the challenge is to mitigate these emissions without compromising food and livelihood security, particularly of the poor rural majority. The relationships among climate change, agriculture and food security are complex and dynamic. A report by the World Economic Forum (WEF) warns that: "food security will become an increasingly complex political and

economic problem over the next few years".<sup>1</sup> Food production may need to increase by as much as 70% by 2050, when the global population will likely number 9 billion.

Responses need to come quickly. A new research initiative that integrates and applies the best and most promising approaches, tools and technology is urgently needed. This initiative can only be realised with improved interactions among scientists, researchers, policy makers, civil society, and those who depend on agriculture for their livelihoods. We need both local and global action to accelerate sharing of lessons on institutions, practices and technologies for adaptation and mitigation, with serious commitment to working in partnership, enhancing capacity and addressing societal differences. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is working across research disciplines, organisational mandates, and spatial and temporal scales to help address these pressing challenges.

## Our Vision

CCAFS contributes to improved agricultural, natural resource management and food systems (See Figure 1 for how the Program's research themes come together to tackle both synergies and trade-offs). CCAFS takes its mandate from the CGIAR vision which is "To reduce poverty and hunger, improve human health and nutrition, and enhance ecosystem resilience through high-quality international agricultural research, partnership, and leadership".<sup>2</sup> Impacts are sought in three dimensions:

- (a) environmental, in particular related to reducing emissions and improving carbon storage;
- (b) enhancing rural livelihoods by reducing vulnerabilities, increasing adaptive capacity, securing assets and raising incomes; and
- (c) improving food security.

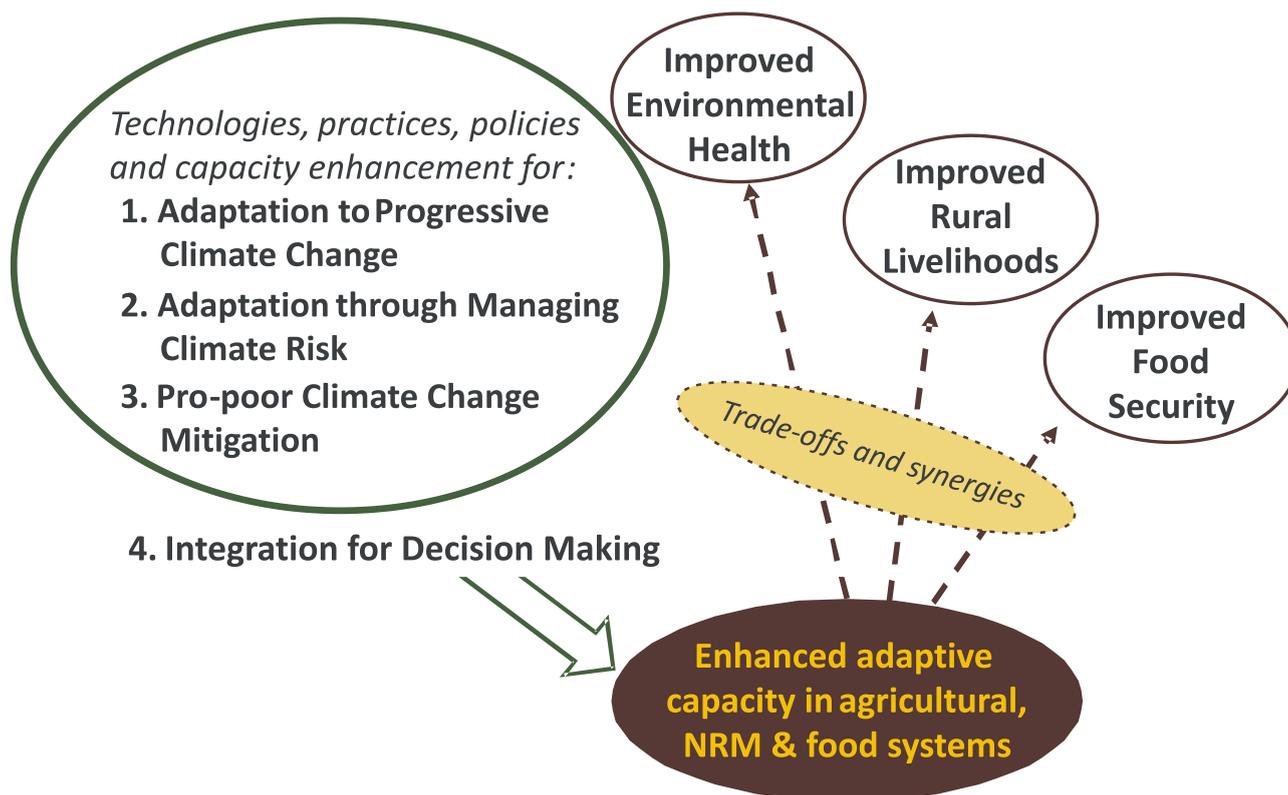
The three dimensions in which CCAFS seeks impact correspond to different groups of ultimate beneficiaries. For impact on livelihoods, the ultimate beneficiaries are resource-poor farmers and other members of the rural and peri-urban poor associated with the agricultural sector. These groups will benefit through reduced vulnerability, raised adaptive capacity and higher incomes. For impact on food security, CCAFS seeks to help not only the rural poor but also the urban poor that number among the world's 1 billion undernourished.

For impact on environmental health and carbon storage there will be both local beneficiaries and a global public goods benefit. Although the notion of securing win-win-win outcomes for these three dimensions is appealing, we have to recognize the possibility of trade-offs among these dimensions.

1 World Economic Forum (WEF). (2008). *Global Risks 2008. A Global Risk Network Report*. A World Economic Forum Report in collaboration with Citigroup, Marsh & McLennan Companies (MMC), Swiss Re, Wharton School Risk Center and Zurich Financial Services. WEF. Geneva.

2 CGIAR Science Council (2008) *The role of systemwide initiatives in implementing the CGIAR's research agenda: An assessment of current systemwide and ecoregional programs (SWEPS)*. Science Council Secretariat, February 7, 2008.

# Climate Variability and Change



NRM – natural resource management.

Figure 1. Scope of the CGIAR Research Program on Climate Change, Agriculture and Food Security. The four research themes are designed to work together to develop adaptive capacity that is expected to have impacts on livelihoods, hunger and environmental health.

By achieving impacts on livelihoods, hunger and environmental health, CCAFS, along with the other CRPs, will contribute directly to the Strategy and Results Framework (SRF) for the CGIAR, which establishes measurable targets. The vision of success for CCAFS includes being recognized, together with

partners, as the foremost global source of relevant research results that lead to options and strategies for tackling food insecurity in the face of climate change. In terms of the new CGIAR, CCAFS seeks to become a hub that facilitates collective action across all centres and CGIAR Research Programs.

## Program design

Linear, predetermined pathways to impact are the exception rather than the rule. CCAFS has a clear strategy for impact. The program seeks to fuse good research with partnership development, scaling-up,

cross-disciplinarity, capacity enhancement and enabling governance and policy rather than hypothesis-led, isolated science, and CCAFS has planned for 12 key outcomes, to be achieved by Year 10.

Figure 2. Cornerstones of successful research for development that achieves widespread impact<sup>3</sup>).



The planned outcomes cover an interwoven package of technologies, approaches and policies for both adaptation and mitigation and are targeted at various levels, from the farm to the global policy arena. CCAFS has defined impact pathways tailored to specific opportunities, working back from the outcomes desired to the outputs needed to achieve those outcomes, the partners needed to deliver on the outputs and critical

actors who can help foster the outcomes. CCAFS is designed to help deliver impacts at global, regional and national levels cost-effectively, with strong emphasis on capacity enhancement, inclusiveness—particularly of women and other marginalized groups—and pragmatic recognition and evaluation of trade-offs among food security, poverty alleviation and environmental health objectives.

3 Campbell, B.M., Hagmann, J., Stroud, A., Thomas, R., Wollenberg, E. 2006. Navigating amidst complexity: Guide to implementing effective research and development to improve livelihoods and the environment. Center for International Forestry Research (CIFOR), Bogor, Indonesia. 82 pp.

# The global themes

CCAFS is structured around four closely interlinked global themes (see Figure 1).

Three of these involve field-level work in benchmark sites in the target regions (initially West Africa, East Africa and the Indo-Gangetic Plains):

Theme 1: Adaptation to progressive climate change

Theme 2: Adaptation through managing climate risk

Theme 3: Pro-poor climate change mitigation

These 'place-based' themes will work together to identify and test (through adaptive research) technologies, practices and policies, and will enhance capacity to reduce the vulnerability of rural communities

Themes 1 and 2 identify and assess adaptation pathways at different time-scales. Theme 1 tackles decadal time periods (mostly 2020 to 2050), while Theme 2 addresses current risks associated with climate variability. Collectively, these three themes will assess and demonstrate the feasibility and effectiveness of strategies for advancing food security, rural livelihoods and environmental goals; identify and prioritize institutional and policy options for overcoming obstacles to implementing these strategies; and ensure that appropriate practices and technologies become available to farmers.

Theme 4 Integration for decision making provides an analytical and diagnostic framework for the whole of CCAFS. It ensures effective engagement of rural communities and institutional and policy stakeholders and grounds CCAFS in the policy context. In assessing vulnerability and building integrative ex ante assessment tools, this theme sets the agenda for the place-based themes; as such it will also provide support to other CGIAR Research Programs. Theme 4 will provide information relevant to key research questions such as the downscaling of climate and global socio-economic processes to the local level and the upscaling of case-study results to broader, regional and cross-regional domains. Theme 4 also provides the framework and tools for baseline diagnoses and ongoing monitoring and evaluation.

## Theme 1: Adaptation to progressive climate change

Future farming and food systems will face substantially

modified environments as they struggle to meet the demands of a growing global population. This will be exacerbated by a range of additional abiotic and biotic stresses resulting from a progressively changing climate characterized by higher temperatures, altered precipitation patterns and rising sea levels. Adaptation will benefit from integrated research that includes analysis of current farming systems and how they are likely to change; identification of technologies and practices; and understanding processes of institutional learning and adaptation.

### *Objectives*

The aim of this theme is to build adaptive capacity and food systems that are more resilient to progressive climate change through the provision of technologies, practices and policies. Promising adaptation techniques will be identified and evaluated. Its objectives are to:

1. Analyse and design processes to support adaptation of farming systems. A key new component will be the development of improved choices, and integration of crop, livestock, fish, agroforestry and natural resources management approaches. The intended outcome is to develop agricultural and food security strategies that are adapted towards predicted conditions of climate change, promoted and communicated by the key development and funding agencies (national and international), civil society organizations and private sector in at least 20 countries.
2. Develop breeding strategies for addressing abiotic and biotic stresses under future climate change, including changes in the mean and variability of climate. The intention here is to stay ahead of future change and for these strategies to be used in addressing abiotic and biotic stresses induced by climate change, variability and extremes, including novel climates, mainstreamed among the majority of the international research agencies who engage with CCAFS and by national agencies in at least 12 countries.
3. Integrate adaptation strategies for agricultural and food systems into policy and institutional frameworks. The intention here is to examine the enabling environment for on-the-ground adaptation to progressive change, focusing on three levels: local level institutional supporting functions; national level policies and strategies; and international level genetic resources policy to enable movement of seed material.

## Theme 2: Adaptation through managing climate risk

Managing the risk associated with current climate variability is crucial for adapting agriculture and food systems to a changing climate. This theme enables promising innovations for managing climate-related agricultural risk at local and regional levels, addresses gaps, and supports improvements to climate information products and services that enable agricultural risk management interventions. It targets the many immediate climate-sensitive decisions that farmers, humanitarian-response organizations and other private- and public-sector actors in the food system routinely make and that influence vulnerability to a changing climate in the longer term.

### *Objectives*

The overall aim of Theme 2 is to bring promising innovations in climate risk management to bear on the challenges of food security and rural livelihoods in the face of a variable and changing climate. Its objectives are to:

1. Develop and evaluate innovations that enable rural communities to manage climate risk and build resilient livelihoods. The intended outcome will be improved support for farm- to community-level risk-management actions that buffer against climate shocks and enhance livelihood resilience in at least 20 countries.
2. Enable and test strategies to better manage food delivery, trade and crisis response in the face of climate fluctuations. The intended outcome is better climate-informed management by key international, regional and national agencies, of food-crisis response, post-crisis recovery, and food trade and delivery in at least 12 countries.
3. Support risk management through enhanced prediction of climate impacts on agriculture, and provision of enhanced climate information and services. The intended outcome is enhanced use of climate information services by resource-poor farmers, particularly vulnerable groups and women, in at least 12 countries.

## Theme 3: Pro-poor climate change mitigation

Although agriculture contributes to climate change by producing 10-12% of total global anthropogenic emissions of greenhouse gases, agricultural practices

can also significantly reduce emissions by sequestering carbon in the soil or above ground biomass (for example in agroforestry or woodlots) or by reducing nitrous oxide or methane emissions, especially if large numbers of farmers take up these practices. If the poor, many of whom depend on agriculture and related natural resources, are to contribute to climate-change mitigation, there is a need for mitigation options that have a positive impact on livelihoods, otherwise unacceptable trade-offs may occur. Carbon markets are unlikely to provide significant benefits to smallholder farmers in the near term and are highly uncertain but livelihood options that also offer mitigation benefits and carbon finance schemes that provide additional incentives should help farmers to meet both livelihood and environmental objectives.

### *Objectives*

The aim of Theme 3 is to identify mitigation strategies that reduce poverty among the rural poor in developing countries. Special attention will be given to the trade-offs and synergies among mitigation, food security and poverty alleviation, while ensuring that the strategies maintain the health of water, land and ecosystems at various scales (for example farm, landscape, seascape and food value chain). Understanding strategies appropriate to different groups of the poor (including men and women) and assessing the impacts of mitigation strategies on different groups will be important to developing sustainable mitigation approaches.

The objectives are to:

1. Inform decision makers about the impacts of alternative agricultural development pathways. The intended outcome is enhanced knowledge about agricultural development pathways that lead to better decisions for climate mitigation, poverty alleviation, food security and environmental health by national agencies in at least 20 countries.
2. Identify institutional arrangements and incentives that enable smallholder farmers and common-pool resource users to reduce greenhouse gas emissions and improve livelihoods. The intended outcome is improved knowledge about incentives and institutional arrangements for mitigation practices in use by resource-poor smallholders (including farmers' organizations), project developers and policy makers in at least 10 countries.
3. Test and identify desirable on-farm practices and their landscape-level implications, with the outcome that key agencies will deal with climate mitigation in at least 10 countries, promoting technically and economically

feasible agricultural mitigation practices that also benefit resource-poor farmers, particularly vulnerable groups and women.

#### **Theme 4: Integration for decision making**

The research undertaken in this theme provides an analytical and diagnostic framework that is grounded in the policy environment, incorporates biophysical effects, quantifies uncertainty where possible and ensures effective engagement of rural communities and institutional and policy stakeholders. It will address the need for methods, models, databases and system metrics aimed at two broad challenges: (1) enhanced assessment of the likely impacts of climate change on agricultural systems, particularly in the context of other social and economic changes; and (2) improved methodologies to assess the likely impacts of different policy and program interventions to foster adaptation and mitigation in terms of poverty alleviation, food security and environmental health.

##### *Objectives*

Theme 4 provides a critical integrative function for CCAFS. It will generate standardized global datasets with location-specific elements through multi-site data collection; collate and disseminate existing and new global datasets; and undertake scenario research to provide plausible futures and guide the development of new technologies and policies in the other themes of CCAFS. It will also create mechanisms to integrate work conducted by Themes at regional and global levels and

will act as a major conduit for two-way information flow between CGIAR institutions, the ESSP and other international research organizations. Finally, it will provide methods to involve stakeholders in agenda setting for Themes 13 and communicate their individual and integrated outputs. Its research objectives are to:

1. Explore and jointly apply approaches and methods that enhance knowledge-to-action linkages with a wide range of partners at local, regional and global levels.

The intended outcome is appropriate adaptation and mitigation strategies mainstreamed into national policies in at least 20 countries, in the development plans of at least five economic areas (for example The Economic Community of West African States (ECOWAS), East Africa Commission (EAC), South Asia) covering each of the target regions, and in the key global processes related to food security and climate change.

2. Assemble data and tools for analysis and planning, resulting in improved frameworks, databases and methods for planning responses to climate change used by national agencies in at least 20 countries and by at least 10 key international and regional agencies.

3. Refine frameworks for policy analysis. The outcome will be new knowledge on how alternative policy and program options impact on agriculture and food security under climate change incorporated into strategy development by national agencies in at least 20 countries and by at least 10 key international and regional agencies to a variable and changing climate.

## **Engagements, partnerships and communication strategy**

CCAFS seeks to become the place key stakeholders go to find relevant evidence, knowledge and tools to formulate strategies for tackling food insecurity in the face of climate change. CCAFS will have an ambitious, well-resourced, proactive communications strategy. A focus of the research strategy will be developing and implementing innovative approaches to strengthen the links between research, policy and practice. Partnerships will be essential, especially with organizations that communicate directly with farmers and with global and local media to capture the attention of policy makers and interested public, private and civil-society sectors.

CCAFS will use outreach tools geared to specific audiences to communicate knowledge, evidence, tools and other outputs and to maintain a two-way conversation with stakeholders and to achieve a good balance between indirect communication from a basic platform (website), direct communication (newsletters, briefings, AgClim Letters and journal articles) and dialogue among stakeholders (events, webinars, blogs). Particular effort will be put into a dynamic Agriculture and Rural Development Day (ARDD) at the annual Conference of Parties (COP) to the UNFCCC, aimed at raising the visibility of agriculture and food security in the global climate dialogue and advancing the position of agriculture in the negotiations. Communication will go beyond CCAFS products, drawing

in all noteworthy advances in science that link climate change, agriculture and food security. Building relationships with the media will be a strong focus, with a systematic approach to preparation, timing and networking carried out in close co-operation with the Consortium Office communications team, the ESSP communications office and the communications teams of the participating centres and partners.

CCAFS will reach its ultimate beneficiaries through different sets of carefully selected proximate

beneficiaries for each theme and objective. Proximate beneficiaries will include public, private and civil society sectors and will range from global bodies through to national and local organizations such as farmers' groups, research stations, insurance companies and government departments. Stronger links to the private sector are key to impact yet fraught with challenges; thus a key strategy will be to work closely with industry platforms, where many private-sector companies have already come together to address global food security concerns.

## The regional approach



Map of CCAFS benchmark sites in 2011

Much of the place-based research will be undertaken within so-called target regions and will share common research sites and infrastructure where appropriate. CCAFS activities will be fully integrated with CGIAR Research Program on Integrated Agricultural Production Systems for the Poor and Vulnerable in Dry Areas in shared target regions. The three initial focus regions are East Africa, West Africa and the Indo-Gangetic Plains. Criteria for selecting the initial focus regions were:

- poverty and vulnerability: high degree of vulnerability to climate, large poor and vulnerable populations, drivers of vulnerability that extend beyond the focus region;
- complementary set of social, cultural and institutional contexts;
- complementary climatic contexts, with different temporal and spatial scales of climate variability

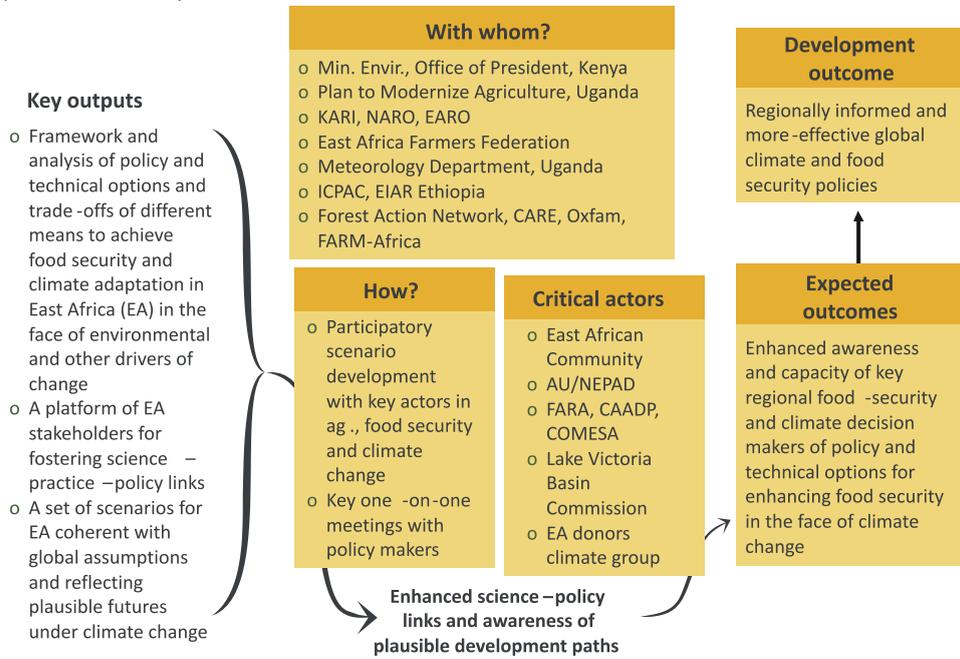
and degrees of predictability;

- significant but contrasting climate-related problems and opportunities for intervention;
- security, governance and institutional capacity that favour the likelihood of scaling out results.

Work will not be conducted exclusively in target regions; a series of global comparative analyses are planned within themes, where site selection has been guided by thematic and impact considerations. In the regions some specific activities, such as mitigation studies, may use other sites that are better suited for the objectives.

Data availability and quality will not be equal in all regions and this will limit, for example, CCAFS's capacity to design and run models at the regional or site level where data are poor. The overlap of themes and regions will help to provide tools with wide geographic applicability. Integrated impact pathways have been developed for national and regional levels, as illustrated in Figure 4.

Figure 4. Empowering national and regional stakeholders for meeting the adaptation and mitigation challenges to agriculture under climate change. This example is for India (the Indo-Gangetic Plains target region). While the impact pathways are similar from region to region and country to country, there are some specific differences and, of course, the actors differ.



AIC Agricultural Insurance Company of India; AU African Union; CAADP Comprehensive Africa Agriculture Development Programme; CGIAR Consortium of International Agricultural Research Centres; COMESA Common Market for Eastern and Southern Africa; EA East Africa; EARO Ethiopian Agricultural Research Organization; EIAR Ethiopian Institute of Agricultural Research; FAI Fertiliser Association of India; FARA Forum for Agricultural Research in Africa; FICCI Federation of Indian Chambers of Commerce and Industry; IARI Indian Agricultural Research Institute; ICAR Indian Council of Agricultural Research; ICICI Lombard Insurance Company; ICPAC IGAD Climate Prediction and Applications Center; IITM Indian Institute of Tropical Meteorology; IMD India Meteorology Department; KARI Kenyan Agricultural Research Institute; MOEF Ministry of Environment and Forests; NARES national agricultural research and extension system; NARO National Agricultural Research Organization, NBPGR National Bureau of Plant Genetic Resources; Uganda; NEPAD The New Partnership for Africa's Development

Given the regional focus of much of the place-based work, CCAFS will engage key regional research, development and policy organizations working in the agriculture and climate change sectors. Producing outputs and outcomes at national level requires a diversity of strategic national partners and in the target regions partners will comprise government departments, farmers' organizations, agricultural research and extension services, business associations, meteorological services and central statistics offices.

CCAFS will implement a global engagement strategy through which key organizations will be invited to develop partnerships from a set of targeted groups, spread across government, private and civil-society sectors. These groups include: scientific assessment secretariats and their technical support units; sponsors and managers of adaptation and mitigation funds; global development and food security agencies; farmers' organizations and platforms; industry platforms; carbon-market players and regulators; and environment and development NGOs. A major multi-agency partnership has already been developed through ARDD 2009 and 2010 (including the Food and Agriculture Organization of the United Nations [FAO], the Global Forum on Agricultural Research [GFAR], Global Donor Platform for Rural Development, the International Fund for Agricultural Development [IFAD], International

Federation of Agricultural Producers [IFAP] and ACP-EU Technical Centre for Agricultural and Rural Co-operation [CTA]); this will be further developed at future ARDDs. These global partners will provide accountability to the ultimate beneficiaries of CCAFS; create widespread positive change in policies and strategies; ensure deep science- policy dialogue; help set research agendas; share communication channels; interrogate scientific methods and results; and combine knowledge to generate best-bet policy options.

Linking scenarios and assessments of local, regional and global agricultural development and food security is a unique and exciting challenge that CCAFS will address. Empowering regional bodies with their own such assessments to feed into the global climate processes will be important progress; all global assessments, including the Millennium Ecosystem Assessment and the International Assessment of Agricultural Knowledge, Science and Technology for Development, point to the need for this. Bringing together the 'climate world' and the 'agriculture for development world' will happen at all levels (for example involving national and regional climate and meteorological agencies and their agricultural counterparts). Several partnerships will include global activities as well as on-the-ground case-study activities (for example, with FAO and CARE).

# Cross-cutting elements

## Capacity enhancement

CCAFS will make a lasting difference through a strategic focus on capacity enhancement. The two related areas in which CCAFS needs to raise capacity are: (1) researchers' capacity to generate knowledge on managing agriculture and food security under climate change; and (2) multiple stakeholders' capacity to demand, shape and use this knowledge effectively to develop, implement and review policy and technical options in a dynamic environment.

Three principles will guide capacity enhancement within CCAFS. The first is to add value through partnership, by complementing existing capacity enhancement programs rather than establishing new programs, and undertaking joint activities that build on comparative advantages and provide mutual benefits and working with networks rather than single stakeholder groups. The second is to take a systems approach, acknowledging that capacity enhancement requires institutional investment, not just training packages for individuals, and that agriculture and food security need innovation in governance and institutional change as well as technical agricultural advances to cope with the challenges of climate change. The third is to promote integration of capacity enhancement activities rather than additional activities, ensuring that development of new tools, knowledge and evidence within the research themes includes strategies and resources for enhancing the capacity of researchers and stakeholders to use, adapt and critique these outputs.

Each of the four research themes includes attention to capacity enhancement outcomes that will be achieved by working closely with partners. START (the global change SysTem for Analysis, Research and Training) will be a key partner. START is a non-governmental research organization within the ESSP that assists developing countries to build the expertise needed to understand and respond to global and regional environmental change. Other key partners include the community-based adaptation network AfricaAdapt, women's organizations such as Women's Environment and Development Organization (WEDO) and university networks such as the Regional Universities Forum for Capacity Building in Agriculture and the African Network for Agriculture, Agroforestry and Natural Resources Education. FAO will also be engaged in capacity-enhancement activities.

In enhancing researchers' capacity, CCAFS will focus on mid-career scientists and postgraduate students, working with partners to provide opportunities for

researcher capacity development in ways that also contribute to the research goals of the Program. CCAFS will work strategically with partners to reach a wide spectrum of stakeholders, working with associations and organizations rather than attempting to reach many thousands of individual farmers.

## Gender and social differentiation

Gender matters in how we transform our farming and food systems. Any effort to increase productivity, adapt to climate change, manage climate risks better or mitigate agricultural emissions must address the differences in how women and men manage their assets and activities. In particular, we need to redress historical tendencies to underplay the role of women, especially as women have special capacity as agents of change in the face of climate change: they manage many of the world's agricultural resources and commonly have primary responsibility for raising children. Activities that increase the productivity and well-being of women will benefit children, families, households and communities, in this and future generations.

CCAFS has an explicit goal of gender impact. The Program's four research themes will analyse the underlying drivers of gender differences, formulate strategies to tackle these disparities and provide inclusive access to emerging investments, tools and policies that deal with climate change. CCAFS is committed to spending one-third of its research budget on understanding and responding to social differentiation, including gender, wealth and age. These commitments apply particularly to the three place-based research themes that use participatory field research to address on-the-ground technical and institutional challenges.

The CCAFS goals for gender and social differentiation have strong implications for how research and policy engagement are carried out, and with whom. Special effort must be made to include those who may be politically marginalized (for example women in UNFCCC processes) and those least likely to have access to functioning markets and services (for example smallholders' access to carbon markets). Partnering with civil-society women's organizations is key to our strategy. They include the Gender and Climate Change Network (GenderCC), the Women for Climate Justice Network and Women's Environment and Development Organization (WEDO). Identifying women entrepreneurs in private food processing, trading and retailing will be important, as many own or run huge enterprises in both the informal (in West Africa, for example) and formal sectors (in India, for example).

Achieving sustainable food security in a world with a growing population, changing diets and a changing climate is a major challenge. Successful mitigation of and adaptation to climate change will entail changes in behaviour technology, institutions and food-production systems. These changes cannot be achieved without improving interactions among scientists, policy makers and civil society. This CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) will build on the new strategic collaboration between the Consortium on International Agricultural Research (CGIAR) and the Earth System Science Partnership (ESSP). CCAFS will become a hub that facilitates collective action across multiple CGIAR Centers and partners. This document outlines the 10-year plan for the CCAFS program.



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