World's largest coalition of researchers on climate change, agriculture and food security gears up!

CLIMATE CHANGE
AGRICULTURE AND FOOD SECURITY

CGIAR Challenge Program on Climate Change, Agriculture and Food Security (CCAFS)

CGIAR

Earth System Science Partnership

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A farmer in Ghana's Upper West Region, which has suffered failed rains and rising temperatures. Photo from the Two Degrees Up photofilms available at www.ccafs.cgiar.org. Photo: N. Palmer (CIAT).

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Techniques such as micro-dosing, which helps to optimise the use of fertiliser, are essential for supporting farmers in the CCAFS regions. Bouwere Village, Mali. Photo: P. Casier

1 Summary and context of the Program

Objectives and background

From mid 2009 through 2010, the Consultative Group on International Agricultural Research (CGIAR) initiated the Challenge Program (CP) on Climate Change, Agriculture and Food Security. Almost immediately the change process in terms of the new CGIAR research programs was initiated and one of two fast-tracked CGIAR Research Programs was also entitled Climate Change, Agriculture and Food Security (CCAFS). The CP team spent a good portion of 2010 preparing for the new program by leading the drafting of the proposal and conducting a number of stakeholder meetings for input into the research design. Many research activities were conducted on the CP in the period 2009–2010 and these now form an essential part of the start-up of the new program. The new program, some six-times the size of the CP, started in January 2011.

The overall goal of the CP was to overcome the additional threats posed by a changing climate to achieving food security, enhancing livelihoods and improving environmental management. The three objectives of the program were:

1. To close critical gaps in knowledge of how to enhance – and manage the trade-offs between – food security, livelihood and environmental goals in the face of a changing climate.
2. To develop and evaluate options for adapting to a changing climate to inform agricultural development, food security policy and donor investment strategies.
3. To enable and assist farmers (both men and women), policy makers, researchers and donors to continually monitor, assess and adjust their actions in response to observed and anticipated changes in climate.

The CP covered six Themes:
- Diagnosing vulnerability and analysing opportunities;
- Unlocking the potential of macro-level policies;
- Enhancing engagement and communication for decision making;
- Adaptation pathways for managing current climate risk;
- Adaptation pathways under progressive climate change;
- Poverty alleviation through climate change mitigation.

CCAFS is a joint program of the Consultative Group on International Agricultural Research (CGIAR) and the Earth Systems Science Partnership (ESSP). The research-for-development program builds on ongoing CGIAR and national research infrastructure and research sites. The ESSP is especially important to the partnership because of its expertise in global change. For instance, it is crucial to the work of downscaling climate change models to scales that are relevant for agricultural research and planning.

The work started in mid 2009 with the appointment of the Director. Subsequently seven Theme Leaders were appointed in late 2009 (there is joint leadership of one of the Themes). The Secretariat staff was recruited in early 2010 and Regional Program Leaders (either substantive or interim) were in place by mid 2010. The Secretariat is based at the University of Copenhagen, while the Theme Leaders and Regional Program Leaders are based at six CGIAR centres (CIAT, ICRAF, ICRISAT, IFPRI, ILRI, IWMI) and three universities (Columbia, Leeds, Vermont) (Annex 1). A Steering Committee (Annex 2) guides the strategic development and implementation of the program.

All Themes were initiated in 2009 and the first results have now been achieved. Global engagement in key policy processes is well developed, and many regional engagement activities have been completed in the three target regions (West Africa, Eastern Africa and the Indo-Gangetic Plains). Most of the planned activities have been completed as per the Workplan and Budget for 2009 and 2010 (see www.ccafs.cgiar.org) for detailed information on the activities conducted.

In 2010 a series of major stakeholder events were held to ensure the close interaction of researchers and stakeholders in defining the agenda. After carefully mapping potential partners, partnership engagement strategies have been developed, and now some 50+ partners are working on specific components of the work. These include Advanced Research Institutes (e.g. University of Oxford), international agencies (e.g. START – the capacity-building arm of the global change community), regional agricultural agencies (e.g. CORAF, ASARECA), regional climate centres (e.g. ACMAD, AGHRYMET) and civil society organizations (e.g. FANRPAN, CARE). As part of the stakeholder engagement, CCAFS developed strategies for capacity-enhancement, communications and mainstreaming gender and social differentiation.

Some significant achievements

Organizational change
- World's largest coalition of scientists working on the nexus between agriculture and climate change.

Partnerships, capacity-enhancement and communications
- Several stakeholder meetings convened to drive a user-driven research agenda;
- Significant coalitions developed with non-research partners and capacity enhanced for uptake and impact;
- Several major initiatives initiated to enhance capacity for research delivery (e.g. CLIFF Ph.D. network; major training conducted on baseline survey implementation);
- Communication strategy implemented with good media outreach for various research products and for major events;
- Ag-Clim Letters established and reaching 1000+ significant decision makers.

Pro-poor and gender focus
- Gender and social differentiation mainstreamed into all work, with some significant outputs in 2010;
- Farmer perspectives highlighted through video and other communication platforms.

Breakthroughs in cutting-edge science
- Models for delivering climate information assessed;
- Downscaled climate data available;
- Analogue method allows learning about future climates.

Establishing a rigorous framework for monitoring and evaluation
- A baseline survey was conducted in 12 countries (5000+ households).

Knowledge to action from local to global levels
- Action research helps project developers implement agricultural mitigation projects;
- CCAFS synthesises current knowledge on climate-resilient agriculture and responds to user demands for specific knowledge;
- Arguably the largest coalition of actors united together to put agriculture on the UNFCCC agenda;
- Scenario modelling helps decision makers plan for climate change.

2 Achievements and results of the Program

World's largest coalition of scientists working on the nexus between agriculture and climate change

2010 saw the culmination of the most significant reform of the CGIAR system in its some 40 years of existence. A key element of this reform was the reorganization of the CGIAR around research programs that cut across Centres. One of the new research programs is on climate change. Because the Challenge Program was well positioned in terms of having initiated work on climate change, it was asked to lead the process of developing an expanded climate change program, one of only two fast-tracked programs. The climate change portfolio in the CGIAR is now expected to at least treble in size in 2011.

The partnership in the new program represents the largest coalition of scientists working on the nexus between agriculture and climate change. All 15 international Centres are involved, as well as numerous partners. Already in 2010 the new way of working across Centres was evident. For example, a book on pro-poor agricultural mitigation was initiated and will be published by Earthscan in mid 2011. This involves scientists from multiple Centres (and external partners). Another example is the baseline survey (further described below) which involved inputs from six Centres and scores of partners.

Reaching out through partnerships, capacity-enhancement and communications

Partnership engagement

Through 2010, CCAFS hosted several major stakeholder events, including the Nairobi Conference on Climate Change, Agriculture and Food Security (Box 1), the Venice executive meeting for leaders in private and public sector, and three regional dialogues (for East Africa, West Africa and the Indo-Gangetic Plains). These, and other activities, have ensured deep engagement of non-research stakeholders in CCAFS, in order to facilitate a user-driven research agenda.

Box 1: Nairobi Conference and Planning Workshop

In May 2010, 172 people attended the Nairobi Conference on Climate Change, Agriculture and Food Security. Participants came from the public and private sector, and from international, regional and national agencies. The climate and agricultural communities were present and covered the entire research-development continuum. Keynotes were delivered by the Director General of UNEP, and the Senior Policy Officer in Agricultural Research for Development, DG Development, European Commission. These were followed by presentations on particular themes and on particular regions. Discussion centred on the major themes that have to be tackled in the next decade. Ninety-five participants then proceeded to a three-day workshop to discuss the details of research planning for the program. Participants identified research questions, means of achieving impacts and options for mainstreaming gender and capacity-enhancement throughout the program.

More details:

www.ccafs.cgiar.org/events/04/may/2010/building-food-security-face-climate-change

www.ccafs.cgiar.org/events/05/may/2010/ccafs-planning-workshop-2010

Significant coalitions have also been developed with non-research stakeholders to ensure that there is an uptake of research products and eventual impact. A diverse range of such stakeholders has been engaged, including policy-related institutions, agencies delivering services to farmers, private sector players and international agencies. Box 2 gives an example of one such engagement activity.

Box 2: Engagement with the World Food Program (WFP)

To improve the policy-level impact of CCAFS research related to food security, CCAFS work on climate risk management has built a partnership with the WFP at its headquarters, and in Africa and Asia. In East Africa, CCAFS collaboration with WFP on institutional arrangements associated with climate forecasting and the use of forecasts at national and regional levels contributed to the CCAFS strategy for engagement with regional food security stakeholders, and contributed to the jointly sponsored Climate and Society Report No. 3 on "A Better Climate for Disaster Risk Management". This was facilitated along with the IRI, WFP, IFRC, Red Cross/Red Crescent Climate Centre and OCHA. In Asia, the WFP has made a request to include CCAFS as a future partner in the rollout of the Integrated Food Security Phase Classification (IPC), which will provide a direct pathway for the incorporation of CCAFS research into regional and national-level food security initiatives in the IGP.

The WFP partnership positions CCAFS to develop demand-driven action research and link it with action in the area of managing climate risk through the food system. The partnership is helping CCAFS identify and engage regional and national partners that partner with WFP. It has already led to joint efforts to mobilize resources for CCAFS-related food security work in South Asia.

A woman farmer talks about the lack of water and how it made life fragile: the youth are leaving the village and she abandoned her land and has to work as day labourer with great uncertainties for the future. Jamnapur Village, Bihar, India. Photo: P. Casier

Capacity-enhancement for research and impact

CCAFS aims to make a lasting difference through a strategic, fully embedded focus on capacity-enhancement. To achieve its overall goals, 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 effectively use this knowledge to develop, implement and review policy and technical options in a dynamic environment. These stakeholders include members of farmers' organizations and other community-based organizations; frontline extension agents and development workers; policy makers in civil service departments, parliaments and funding agencies; opinion-formers in civil society, research organizations, national meteorological services (NMS), university networks and the media; and managers and strategists in businesses and NGOs.

Numerous capacity-enhancement activities were initiated with researchers to build their capacity to generate research that is directly useful to, and accessible by, policy at multiple levels, with sustainability beyond the span of the CCAFS program. Among the more formal activities are the CLIFF Ph.D. network (Box 3), training in areas such as modelling and survey techniques, such as for the baseline survey (Box 4) and paid placements, internships and studentships (e.g. post-doc positions at the University of Leeds and CIAT). In addition, CCAFS has provided many less formal, ad hoc opportunities for early-career and mid-career scientists from the three CCAFS regions, such as any support they may need to attend CCAFS and non-CCAFS meetings or to contribute policy findings from previous research. For example, three young researchers were selected and supported in each of the regions to participate with more senior colleagues in the scenarios development exercises (described for East Africa in Box 16).

Box 3: The Climate Food and Farming Research Network (CLIFF)

CLIFF is a Ph.D. network initiated by CCAFS in collaboration with the Faculty of Life Sciences, University of Copenhagen. The aim of the network is to generate new and rigorous knowledge, and facilitate the sharing of knowledge on climate change mitigation and related adaption activities in small-scale farming and food systems in developing countries. The aim of the CLIFF network is thus to provide a platform for knowledge sharing and knowledge building for researchers and doctoral students working within the following core research themes:

1. Mitigation potential: Research to evaluate and document the potential technically and economically feasible GHG abatement potential of various agricultural practices and technologies and their synergies with adaptation.
2. Monitoring and measuring: Standardized, widely accepted, credible and scientifically sound methodology to measure and monitor reduced GHG emissions at farm and landscape scale.
3. Incentive systems: Research to investigate how institutional arrangements and incentives available through the trade of carbon and other GHGs can benefit poor farmers.

GHG emissions data for agricultural systems in developing countries are notoriously difficult to come by, and universities and students are ideally placed to collect and analyse such information. By establishing a network of such students and universities the aim is to collect data from a diverse range of farming systems in developing countries.

Eight Ph.D. students working on the three themes in China, India, Indonesia, Kenya, Tanzania, Zimbabwe and Brazil have, on a competitive basis, received small grants towards their fieldwork. The students will convene, together with a range of interested parties from Advanced Research Institutions, in late 2011, to share learning on research methods and deliberate on the next steps for the network. www.cliff.life.ku.dk/

Box 4: Building capacity to implement the baseline survey

Survey teams from 12 local partner organizations in three regions, and involving more than 50 individuals, were trained to implement the CCAFS baseline household survey. The partners included NGOs, national research agencies and regional research agencies. Training was directed at supervisors, enumerators and data clerks, and covered implementation, data cleaning, data management, and analysis. The survey was then implemented by those partners in 36 sites (252 villages) with 5040 households in 12 countries in East Africa, West Africa and the Indo-Gangetic Plains.

A baseline household survey training manual for supervisors was developed and used to guide the implementation of the survey. Methods and training materials were made freely available on the website, and there have been requests by other agencies to use the materials in their own study regions.

Household baseline training in Mali. Photo by W Foerch.

Capacity-enhancement activities with non-research stakeholders are crucial to facilitate uptake and impact. Multiple demand-driven activities were undertaken in 2010. For example, in Ethiopia, CCAFS worked with a national meteorological agency to improve the delivery of climate time series data, which is a crucial element needed for better climate forecasting and ultimately improved climate risk management by farmers (Box 5). CCAFS also worked with media to increase their capacity in amplifying messages coming out of research (Box 6). In Niger, following the country's drought and flood crises in 2010, CCAFS supported START to convene a science-policy dialogue on the crises to share knowledge and insights about the ever-increasing risks of climate change to Niger's – and, more broadly, the Sahel region's – agriculture and food security, and to examine measures, technologies, policies, and approaches for managing current climate risks and adapting better to future climate change.

Box 5: Strengthening capacity for meteorological data quality control in Ethiopia

Seven staff members from the National Meteorological Agency (NMA) of Ethiopia were trained on quality control of daily climate time series. The training course covered methods for checking temporal homogeneity of daily rainfall and temperature data; incorporating station metadata; using reference stations; and identifying and adjusting for breakpoints in a time series. A follow-up workshop provided support for ongoing analyses, addressed problems encountered while working on their data, and enabled NMA staff to master the quality-control routines.

Using the methods in which they had been trained, NMA staff prepared a set of quality-controlled, long-term stations, provided project partners with daily rainfall data from over 500 stations; and initiated an effort to combine these with historic METEOSAT rainfall estimates. NMA is also preparing to redesign its web page to provide analyses based on combined station-satellite records, and has proposed follow-up activities around agricultural applications of the new data sets.

Box 6: Enhancing the capacity of communicators

Dr Ousmane Ndiaye has worked with CCAFS on various issues related to climate change and climate risk management. He then represented CCAFS as a resource person for a three-day media training workshop: "Getting it right: reporting climate change for sustainable development in Africa". The workshop drew media representatives from west, central, northern and southern Africa and took place as a pre-event to the seventh African Development Forum (ADF), held in October 2010, with the theme: "Acting for Climate Change for Sustainable Development in Africa".

The training workshop informed African media about the threats and opportunities presented by climate change, built the capacity of African media to analyse and report more effectively on climate change concerns, familiarized African media about the process so far and the issues that required targeted awareness in the lead-up to the Cancun negotiations, and supported the prioritization of Africa's agenda, priorities, initiatives and programs in the news media. www.uneca.org/adfvii/documents/PreADF/ReportTraining-unitar.pdf

Communications and outreach

Part of the vision of success for CCAFS is that it becomes the 'go-to' place for key stakeholders seeking relevant evidence, knowledge and tools to formulate options and strategies for tackling food insecurity in the face of climate change. A focus of the research strategy is on developing and implementing innovative approaches to strengthen the links among research, policy and practice, and this inevitably rests on a sound communications and outreach strategy that is intimately connected to partnership and capacity-enhancement. 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 general interest groups in public, private and civil society sectors. Examples of some of these activities that were carried out in 2010 are given below.

CCAFS audio briefing
CCAFS organized an audio briefing, successfully providing a number of high-level journalists with background and the latest research findings on climate change and food security. Sixteen journalists attended, including reporters from Associated Press, Reuters, *Nature*, Science News, *The Economist*, and *The New York Times*. Immediate media coverage included pieces by Reuters, Bloomberg, and Voice of America, all of which mentioned or referenced the new program.

Global Conference on Agriculture, Food Security and Climate Change
CCAFS was highly visible at this conference in the Hague, having produced a background paper for the conference, hosted a booth with climate publications from across the CGIAR, and held a side event about the Commission on Sustainable Agriculture and Climate Change. www.ccafs.cgiar.org/events/05/nov/2010/plans-new-international-commission-sustainable-agriculture-and-climate-change

Agriculture and Rural Development Day
There were over 40 journalists at the Agriculture and Rural Development Day 2010 in Cancun (ARDD 2010) event, a remarkable increase from the ten journalists who attended Agriculture Day in 2009. Journalists came from over 15 different nations, the majority of them from the developing world, and several from prominent international outlets, including Deutsche Welle Radio, Reuters, Public Radio International, Bangkok Post (Thailand), and Le Figaro (France). Several individual interviews were also arranged throughout the day, and these included *Bangkok Post* (Thailand), Independent Newspapers (South Africa), Mercury Newspaper (South Africa), Public Radio International, Reuters, Trans World Radio (Kenya), UN IRIN, and Voice of America. At least ten stories mentioned Agriculture and Rural Development Day, including UN IRIN, Inter Press Service, the Bangkok Post (Thailand), and Voice of America's "Nightline to Africa".

1000 promotional postcards for the photo films were distributed in Cancun.

2-Degrees photo essays
The Two Degrees Up series of short climate change photo films highlight the possible impact of rising temperatures on smallholder agriculture in Colombia, Ghana and Kenya. They were made so as to highlight farmer perspectives on climate change. The films were produced by Neil Palmer and Andy Jarvis at CIAT, and were disseminated in partnership with CCAFS, IFPRI, ICRAF and other CGIAR centres. In collaboration with these partners, the CCAFS communication team promoted the films during Agriculture and Rural Development Day and throughout UNFCCC COP16 in Cancun, including the CGIAR booth and the Development & Climate film festival. One of the films was used in the ARDD keynote presentation of Inger Andersen, Vice President, World Bank. The films were also published on YouTube and promoted online, and were featured on prominent blogs, including Tree Hugger, the Chicago Council on Global Affair's "Global Food for Thought" Blog, Science Blog's "Tomorrow's Table" and Oxfam's blog "From poverty to power". According to YouTube statistics, together the videos have received over 6500 views so far.
The films are available from www.ccafs.cgiar.org/resources/video/two-degrees-climate-change-photofilms

Sir John Beddington launches the International Commission on Sustainable Agriculture and Climate Change in the Hague, Nov 2010. Photo by V Meadu

Ag-Clim Letters

Agriculture-Climate Letters is a monthly email that introduces a key policy topic via an interesting recent paper on a specific subject in the field of climate change, agriculture and food security (http://ccafs.cgiar.org/blog/category/ag-clim-letters). The bulletin is sent to the CCAFS contacts list, which includes policy makers, researchers, development professionals and other stakeholders worldwide. The first issue of Ag-Clim (December 2010) was sent to 1327 recipients. It was viewed in some 60 countries.

Website and social media

The CCAFS website launched on 5 July 2010 and has been generating increasing traffic as more information becomes available. The launch of the CCAFS blog (www.ccafs.cgiar.org/blog) on 18 October 2010 has been particularly important in encouraging traffic to the site. The blog features stories from across the program, with contributions from all key partners, including farmer testimonials, stories from ongoing research, opinions and commentary, news updates, and features on related topics.

In November 2010, CCAFS took over the @cgiarclimate twitter account from the CGIAR Fund Office, in order to further amplify blog stories, engage with partners and NGOs online, and stay abreast of new developments in agriculture, climate and food security. There was a near 20% increase in followers in the two months following the CCAFS takeover.

Specific research products

A dissemination strategy is produced for each significant research product that CCAFS produces. The strategy could include targeted distribution lists, targeted side events, specific media outreach activities, and so on. During the course of 2010 there were good media successes around a number of products produced, two of which are highlighted here (Box 7, Box 8).

Box 7: Reducing carbon hoofprints and increasing tropical farming incomes

Philip Thornton and Mario Herrero published a paper in the journal *Proceedings of the National Academy of Science*, entitled "Potential for reduced methane and carbon dioxide emissions from livestock and pasture management in the tropics". The paper presents estimates of the potential reductions in methane and carbon dioxide emissions from different livestock and pasture management options in mixed and rangeland-based production systems in the tropics and calculates the impacts of adoption of different management options.

On the basis of the paper the authors contributed to the Global Food Security Blog. The paper resulted in media coverage across Africa and Europe in at least six languages, including English, Japanese, Chinese, Indonesian, Spanish, and Italian. Original wire stories were written by three agencies; original online stories were written by one newspaper and SciDev.net; and online pick-up occurred with various radio stations and newspapers (e.g. *The Independent* (UK), Radio Netherlands). www.foodsecurity.ac.uk/blog/index.php/2010/11/reducing-carbon-hoofprints/

Box 8: Food security wanes as world warms

The Future of Food and Farming program of the UK government and CCAFS generated combinations of quantitative drivers that were selected to generate three scenarios: a baseline scenario that is "middle of the road"; a pessimistic scenario that chooses driver combinations which, while plausible, are likely to result in more negative outcomes for human well-being; and an optimistic scenario that is likely to result in improved outcomes relative to the baseline. Each of these overall scenarios was combined with five climate scenarios. Finally, in order to test the sensitivity of the scenario outcomes to the choice of underlying parameters, a series of simulations were performed on the baseline – the "middle of the road" scenario. These experiments provide a perspective on possible policy and program innovations that might make a sustainable future for food and farming more likely.

A press call and briefing was held in conjunction with the release of the report "Food Security, Farming, and Climate Change to 2050". A policy seminar in Cancun was held with a panel consisting of Andrew Steer (VP, World Bank), Sam Bickersteth (DFID) and Lloyd Le Page (CGIAR CEO) to launch the report and several sub-Saharan African country studies. Media coverage included:

- *Guardian* (UK): "Climate change could push staple food prices up 130% – study";
- Associated Press: "UN Climate Conference: Global Warming Could Double Food Prices";
- Science News: "Food Security Wanes as World Warms";
- IRIN: "Staple food crops do not want global warming";
- VOA: "Climate Change: Alleviating Poverty Helps Developing Countries Adapt".

In a separate but related initiative, country reports were prepared for 30 countries. CCAFS provided the data and standard analysis for each country based on the above scenario analysis, with combinations of quantitative drivers resulting in baseline, pessimistic, and optimistic scenarios. Partners from each country provided narrative and additional data and analysis as appropriate and a national stakeholder meeting was held in each country to make the report most useful to national policy makers. The national reports have already been used in program and policy formation. In East Africa, the national meeting in Tanzania was chaired by the Director of National Food Security, and was closed by the Director of Agriculture Environment from the Office of the Vice President. The Ministry of Agriculture, Food Security and Cooperatives in Tanzania has regarded the country report as important and it is recognized as a government document. The country author in Tanzania was invited by the Prime Minister's office to make a presentation at the East African Community climate change policy meeting.

Farmers can no longer rely on floods for irrigation. Water levels are decreasing, and farmers in Jamnapur village, Bihar, are demanding electrical infrastructure so they can use water pumps and to irrigate the fields. Photo: P. Casier

Ensuring a pro-poor, gender-differentiated focus

CCAFS research aims to improve understanding of the underlying drivers of social differentiation and gender disparities as influenced by climate change, formulate strategies to tackle these, and provide inclusive access to emerging investments (e.g. carbon payments), as well as information and policies that deal with climate change. Gender matters in how we transform our farming and food systems in response to climate change. Any effort to increase productivity, adapt to climate change, better manage climate risks, or mitigate agricultural emissions, must address the differences and relationships in how women and men manage their assets and activities. In particular, we need to redress historical tendencies to underplay the roles of women.

Gender and social differentiation are tackled in CCAFS through mainstreaming them in all Themes. Some significant outputs were achieved in 2010:

- Gender and social differentiation was captured in the baseline survey of 5000+ households. For example, results of the baseline survey in western Kenya showed that women tend to receive more weather-related information than men, although male-headed households have greater access to new technologies such as mobile phones. In the Lower Nyando benchmark location, this may reflect women's higher day-to-day involvement on the farm, with many men periodically leaving for off-farm activities and employment. Preliminary results from another baseline village in coastal Bangladesh suggest a very different pattern. In a village within the Khulna district, men are the predominant contributors to labour in the household's agricultural fields. Women tend to be responsible for poultry and other activities located closer to the home.
- Farmer perspectives were highlighted through photo films, video testimonials and other communication platforms (Box 9). The 31 video testimonials covered gender-specific adaptation and mitigation strategies, coping mechanisms and adaptive capacity. In India, a local woman was part of the film crew and carried out the interviews.
- To reach the vulnerable and disenfranchised often means understanding the power dynamics among key players and knowing who the influential individuals and institutions are. The Advocates Coalition for Development and Environment (ACODE) carried out a study in Uganda to identify such influential actors. Similar work will be conducted in other countries now that the method has been trialled.
- Equity was one of the criteria examined in a set of studies of ICT-based and institutional models for disseminating information to rural communities (see next section).
- How equity is tackled has been examined for a number of mitigation projects in Africa. The action research relies on a dialogue process that engages a range of smallholder institutions, interest groups, governments, and other institutions to evaluate what is meant by benefits, who benefits and how. The results have been and will be used to feed back into project design so that projects are more focused on pro-poor outcomes.

Box 9: Socially differentiated farmers' voices heard through the Adaptation and Mitigation Knowledge Network (AMKN)

A central outcome of the first year of CCAFS has been the development of an Adaptation and Mitigation Knowledge Network (AMKN), which manages and connects knowledge from farmer through to researcher, and vice versa (www.amkn.org). This ambitious and comprehensive portal is to become the 'go-to' place to share and access adaptation and mitigation knowledge in agriculture. The platform brings together location-specific evidence on farmers' realities on the ground and links them with scientific research outputs. AMKN builds on the vision that the way forward for researchers and smallholder farmers facing both current and imminent challenges lies in learning from each other while sharing knowledge and experiences to ensure the transfer of promising measures that may benefit other communities.

During this initial development a knowledge network has already started to be established through collaborations with diverse stakeholders across Africa and IGP that are interested in sharing and applying climate change research to agricultural development and food security. Those include: Kenya Agricultural Research Institute (KARI), The International Small Group and Tree Planting Program (TIST, project jointly implemented by the Institute for Environmental Innovation and Clean Air Action Corporation), Kenya, NAAM - Farmers Union (Burkina Faso), International Fertilizer Development Center (IFDC), Ghana, Ministry of Food and Agriculture (MOFA-AGRIC), Ghana; Institue d'Economie Rurale (IER), Mali; Association Malienne d'Eveil au Développement Durable (AMMED), Mali; Action for Food Production (AFPRO, Indian NGO), SPARK (Indian NGO) and CG centres (CIP, ICRAF, CIAT).

A first version of the platform (developed in partnership with the ICT-KM Program of the CGIAR and the AGCommons program, and with the technical partnership of ESRI) was released in December. The user interface is an interactive map application which aggregates CCAFS geo-referenced web content and media, namely the location and description of the 36 CCAFS benchmark sites, 31 three- to five-minute video testimonials on gender-specific farmers' adaptation and mitigation strategies and coping mechanisms collected across the three CCAFS regions (East Africa, West Africa, the Indo-Gangetic Plains), 13 stories reflecting realities on the ground and 18 photo sets (>400 photographs). The platform architecture allows the organization and visualization of the information gathered with a location-specific criterion and is designed to guarantee data openness so that data can be exported, retrieved, queried, syndicated and reused.

The goal of the AMKN is ambitious and in 2011 content will expand towards including climatic, socio-economical (baseline survey data) and agricultural information and tools, as well as links to external sources for more complex analysis and the development of a more comprehensive user interface. At this early stage the platform serves as a public awareness channel for research on adaptation and mitigation themes on the basis of farmers' stories and solid science. Over time, however, the platform will expand and its community of users will be developed from that of information users into one of information providers that generate new knowledge in the form of data, videos and stories.

Village Baseline Study Pre-Test, Kenya. Photo by W Foerch.

More resilient seeds and fertilizing with manure will help improve harvests. Kabaune Village, Makengi, Kenya. Photo: P. Casier

Breakthroughs in cutting-edge science

As is evident in Section 2 and in the publications list (Annex 3) a wide variety of research products have been initiated and completed. Here we focus on three different kinds of research products that consider (a) information needs of farmers and how these can be met (Box 10 – models for delivery of climate information); (b) information needs of researchers and agricultural planners (Box 11 – downscaled climate change data); and (c) farmer-to-farmer learning about likely future climates and farming systems (Box 12 – analogue method).

Box 10: Models for delivering climate information and services to rural communities

CCAFS commissioned studies of institutional and ICT-based models for delivering climate-related information and advisory services to rural communities in East Africa, West Africa and South Asia. They provide detailed descriptions of many existing initiatives for delivering information and advice to rural communities, as well as a critical assessment of their potential to support climate risk management from the standpoint of salience, equity (in terms of gender and social differentiation), scalability, transferability and sustainability. The studies identify organizations that are working to empower women through enhanced access to information, and highlight the implications for women of the ongoing transition toward more ICT-based and 'demand-driven' models for delivering agricultural advisory services.

This work helped understand the factors that may prevent poor and marginalized farmers from accessing or using climate information, and helped to identify other kinds of support that poor farmers need for climate information to be of use. Many warned that increasing emphasis on 'demand-driven advisory services' and diminished face-to-face interactions between farmers and extension agents in favour of ICT might be increasing the information access gap along equity lines. Five of the eight case studies that were examined had components that specifically targeted women who would otherwise face barriers to information access. Although such innovative use of ICT has potential for reducing the access gap, remote and socially marginalized farmers are often the last to be provided with services, are most likely to lack the necessary skills for using ICT, and are least likely to be informed of existing ICT-enabled information services.

Box 11: Downscaled climate data for downloading

A suite of downscaled climate data for the three GHG emission scenarios of the IPCC's Fourth Assessment Report (scenarios A1B, A2 and B1) for climatologies for the 2030s, 2050s and 2080s was developed. The dataset was generated by a generalized downscaling and data generation method that takes the outputs of a General Circulation Model and allows the stochastic generation of daily weather data that are to some extent characteristic of future climatologies. Such data can then be used to drive any impacts model that requires daily (or otherwise aggregated) weather data. These climate data grids provide a consistent product that can be applied in many different ways.

Two hundred and eleven users have registered and downloaded the data. These users were CGIAR Centres, universities, research centres, meteorological departments, and NGOs. Users were from North America, South Asia, South-East Asia, East Asia (including China), Latin America, Europe, Africa, and Australasia. People who downloaded the data had intentions of using them in many different ways: these include crop modelling and adaptation studies, agricultural impacts analysis, human disease burden studies, amphibian population modelling studies, flood management, terrestrial and marine biodiversity studies, forestry modelling, and academic teaching.

This work was implemented by Waen Associates, ILRI and the Potsdam Institute for Climate Impact Research. It was supported by CIAT, ILRI, Potsdam Institute for Climate Impact Research, IFPRI, HarvestChoice, CCAFS, and Integrated Pest Management Collaborative Research Support Program (IPM-CRSP). The data and a report on the methods used are available at www.futureclim.info

Unpredicatable rainfall is impacting maize and bean crops, but sweet potatoes are still yielding well. Karwe Village, Makengi, Kenya. Photo: P. Casier

Box 12: Initial development of an analogue methodology and proof of concept for identifying and mapping spatial and temporal analogue sites across the globe

CCAFS has supported the first phase of the development of an analogue methodology and proof of concept for identifying and mapping spatial and temporal analogue sites across the globe based on multiple climate projections. A beta version of the analogue tool is now available. The climate analogue tool calculates measures of climatic dissimilarity between a projection of a future climate at a user-specified location and the current climate globally. The tool is therefore designed to identify areas of the globe that are presently analogous in some way to the projection of a future climate at the user-specified location.

In 2011 the second phase of this project will include the validation of the tool and the development of a web-based platform. Its implementation will provide insights into the vulnerability of crops to climate change and facilitate on-the-ground evaluations of agricultural adaptation options for 2030 and beyond. Furthermore, it will also be a key instrument that will allow the transfer of farming practices to areas that may face similar climate conditions in the future. This tool will be a key feature of the future farmer-to-farmer exchange program that will be trialled in 2011. It allows farmers to go to 'analogue sites' that represent what their future climate may be like, and to learn from current practices at those sites.

Establishing a rigorous framework for monitoring and evaluation

A globally common set of appropriate baseline indicators on agricultural productivity, rural livelihoods, and biogeophysical attributes, as well as the key variables that CCAFS research is likely to impact on, has been collected at the selected study sites, so that monitoring and post-impact assessment can be carried out (see description in Box 4). This baseline survey has also helped to characterize current farmer practices, and the ability to adapt. The statistics unit at the University of Reading was engaged to help design and implement the baseline survey so that a rigorous framework was established for future monitoring and evaluation.

Knowledge to action – from local to global

CCAFS is becoming known for delivering useful user-driven research products, and as such is receiving many requests for products from diverse agencies (farmers' organizations, international development agencies, civil society organizations, advanced research institutes). For example, CCAFS has been approached by a regional farmers' organization to prepare the

At a research station in Cinzana, Mali, CCAFS research partners select different crop varieties, test them and then give them to farmers to test their adaptability, productivity and resistance to different diseases. Photo: P. Casier

background paper setting out the major issues at the interface of climate change and agriculture, a paper that will be used as the basis for the organization's development of their messaging for UNFCCC.

A hallmark of CCAFS research is that it invariably takes an 'action research' perspective, whereby the research is undertaken with partners – from design to analysis. This approach is practised from field to global levels. Examples of local action research are the farmer-based experimentation network (Box 13) and the work with CARE and other partners in Western Kenya (Box 14). Examples at the global level include Agriculture and Rural Development Day (Box 15) and the Commission on Sustainable Agriculture and Climate Change, which was launched at the end of 2010. At intermediate levels, action research is also practised. The key example is the scenario development activities by regional stakeholder groups (Box 16). Action research ensures that research meets the needs of potential users.

CCAFS has made an extensive survey of current CGIAR science and projects and how they can contribute to solving issues at the climate-agriculture nexus. This includes a detailed database for ongoing projects in the three target regions. The database includes information on partners and helps identify who is doing what in the regions. This work, published as a booklet, and then synthesised as one of the background papers for The Hague Conference on Climate Change and Food Security, is important to identifying gaps in the current climate-related agricultural research and development and to identify where synergies can be achieved through the development of the CCAFS portfolio. Most importantly, the work also highlights options that can be immediately tested in the context of early action in climate change adaptation and mitigation. We have the knowledge right now to make vast improvements to agricultural systems – improvements that can compensate for the negative impacts of climate change. Decision makers are urged to take the steps needed to put this research into action.

This dairy farmer in Raipur Gujra, Punjab, India has experienced decreasing milk production due to lack of water and water infrastructure. Enhancing the adaptive capacity of livestock owners in the Indo-Gangetic Plains sites will be crucial. Photo: P. Casier

Box 13: Establishment of a farmer-based experimentation network in the Indo-Gangetic Plains region

A farmer-based experimentation network of 40 farmers has been established in the Indo-Gangetic Plains (IGP) region in the frame of a pilot project for on-farm participatory climate change adaptation and visualization, led by Bioversity International. This pilot project, set up across four Indian sites (Karnal, Haryana; Ludhiana, Punjab; Pusa, Bihar; and Varanasi, Uttar Pradesh), seeks to investigate whether a wider range of diversity in key crops important for food security (e.g. wheat) enhances the adaptive capacity of farmers in areas experiencing climate variability and change. The project utilizes a participatory approach, allowing farmers to freely experiment with the supplied crop diversity during the on-farm trials. Farmers are permitted and encouraged to manage the crop selection for the trials, according to their own preferences and needs.

At each of the four project sites ten farmers have been selected to carry out field experiments to test the performance of ten wheat varieties – procured by the Directorate of Wheat Research (DWR), India – relative to four landraces.

The final objective of this participatory project is to understand the role of seed systems in enabling adaptation under changing production constraints, to understand the social and cultural barriers to adoption of adapted landraces and varieties, and to explore effective means of introducing new varieties, taking into account these barriers. The project is also addressing gender, engaging both male and female farmers in the on-farm trials and in project implementation. Disaggregated analyses of results will also be produced based on gender.

More: www.ccafs.cgiar.org/our-work/research-themes/progressive-adaptation/farmer-based-experimentation-network

Box 14: Action research helps project developers implement agricultural mitigation projects

CCAFS, in partnership with EcoAgriculture Partners, implemented a series of activities in Africa with staff from six carbon projects. The work focuses on institutional arrangements and incentives for smallholder mitigation. At a workshop, project representatives shared their experiences through presentations based on a set of questions sent to them beforehand. Participants also discussed and finalized the research methodology that was subsequently implemented during field work in the following months by the EcoAgriculture team and CCAFS, in collaboration with staff from participating projects. The agencies/projects that participated in the workshop included: The International Small Group Tree Planting Program (TIST) in Kenya; World Vision, the Humbo Assisted Natural Regeneration Project in Ethiopia; Environmental Conservation Trust (EcoTRUST, Uganda), Managing Trees for Global Benefits (TGB) Program; Vi Agroforestry (Kenya), African agricultural and soil carbon finance project; and CARE, a carbon-financed agriculture, forestry and other land use (AFOLU) project in Western Kenya. Field work was conducted where each project was visited by a team from EcoAgriculture and CCAFS.

The workshop and subsequent field work has initiated a process of reflection in the projects that has strengthened the outlook of each initiative, through learning how other projects have navigated different circumstances to succeed. It also highlighted training needs, analysed the different conditions for smallholder participation in C projects and benefits sharing, and drew useful lessons for taking some initiatives to scale. One of the participating agencies, CARE, is using the process of this research to roll out a new initiative in Nyando District of Kenya. CARE is partly depending on this work to ensure smallholders share benefits equitably.

More: www.ccafs.cgiar.org/our-work/research-themes/pro-poor-mitigation/agricultural-carbon-projects-africa

Box 15: Agriculture and Rural Development Day

A coalition of agricultural interest groups presented Agriculture and Rural Development Day (ARDD 2009) at COP15 in Copenhagen, and a similar coalition then put on ARDD 2010 at COP16 in Cancun. This coalition is arguably one of the largest in the agricultural world, comprising international agencies, research providers, national governments agencies, private sector players, NGOs and farmer organizations. For example, at COP16 the partnership involved 19 organisations. CCAFS and the Global Donor Platform for Rural Development were the lead organizing agencies at both COP15 and COP16.

As the Platform reported after COP15, significant progress was made inside and outside the UNFCCC negotiations in relation to agriculture, forestry and food security, even though the overall outcome from COP15 was extremely disappointing. ARDD brought together the "biggest names on the global agriculture scene" as *The Ecologist* reported (Dec 14). ARDD was the first full-day focus on agriculture in conjunction with a UN Climate Change Conference. Jeff Sayer, The International Union for Conservation of Nature (IUCN), noted: "Agriculture day was playing catch-up and used science to argue – apparently successfully – for remedying the present lack of attention given to agriculture in the climate change negotiations". ARDD aimed to build consensus on ways to fully incorporate agriculture into the post-Copenhagen climate agenda and to discuss strategies and actions needed to address climate change adaptation and mitigation in the agriculture sector.

ARDD is not a once-off event but rather the culmination of a process leading up to the ARDD. For example, in 2010, CCAFS made a significant contribution to an issues paper of the Global Donor Platform for Rural Development. This set out the agenda for policy engagement in 2010. Then in June 2010 a side event was held in the Bonn meeting of the UNFCCC that set the scene for future work towards ARDD 2010. A number of relevant research papers were also commissioned in order to feed into the deliberations on ARDD 2010. In a follow-up activity CCAFS has launched the "Commission on Sustainable Agriculture and Climate Change", led by the UK chief scientist (Professor Sir John Beddington), and comprising eminent scientists from 13 nations.

More: www.ccafs.cgiar.org/events/04/dec/2010/agriculture-and-rural-development-day-ardd-2010

Participants at Agriculture and Rural Development Day 2010, Cancun. Photo: N. Palmer

Box 16: Regional scenarios for East Africa

Scenario analyses conducted at the regional level help to systematically explore policy and technical options for improving food security in the face of environmental and other stresses. They provide a suitable framework for (i) raising awareness of key environmental and policy concerns; (ii) discussing viable adaptation options; and (iii) analysing the possible consequences of different adaptation options for food security, livelihoods and environmental goals – the three areas of interest for CCAFS.

Working closely with regional partners and in close collaboration with ASARECA, CCAFS has developed a set of prototype scenarios for researching the interactions between food security and environmental change at the East African regional level.

Through stakeholder consultation workshops involving regional scientists and policy makers, participants developed sets of key variables for the region in terms of food security, livelihoods and environment. They identified key drivers of regional development pathways by 2030 as (1) the extent of regional integration (both political and economic): 'Status Quo' or 'More Integrated' and (2) the proactive/reactive stance of governments (and other regional actors) at the regional level in relation to environmental management and food security. From these came four storylines, each with different implications for major regional and national concerns such as food affordability.

The key outputs of the exercise so far are raised awareness by researchers, policy makers and other stakeholders of interactions between multiple goals in the context of climate change, a systematically structured debate relating to environmental issues and food security and a science-policy regional 'team' built on shared vision, understanding and trust. Preliminary analyses of food security, environment and livelihoods outcomes for a range of plausible futures will next be quantified, with reference to future climate scenarios, and further interrogated by wider regional groupings.

More: www.ccafs.cgiar.org/our-work/research-themes/integration-decision-making/future-climate-scenarios

Annex 1: List of CCAFS staff

Coordinating Unit

- Bruce Campbell, Director
- Torben Timmermann, Head of Program Coordination and Communications
- Sonja Vermeulen, Head of Research
- Misha Wolsgaard-Iversen, Program Manager

Theme Leaders

- Philip Thornton, Theme Leader 1, ILRI
- Gerald Nelson, Theme Leader 2, IFPRI
- Patti Kristjanson, Theme Leader 3, ICRAF
- James Hansen, Theme Leader 4, Columbia University
- Andrew Challinor, Theme Leader 5a, University of Leeds
- Andrew Jarvis, Theme Leader 5b, CIAT
- Eva Wollenberg , Theme Leader 6, University of Vermont

Regional Program Leaders

- Pramod Aggarwal, Regional Program Leader, Indo-Gangetic Plains (IGP), IWMI
- James Kinyangi, Regional Program Leader, East Africa, ILRI
- Robert Zougmoré, Regional Program Leader, West Africa, ICRISAT

Annex 2: List of Steering Committee members

- Thomas Rosswall (Sweden), Chair.
- Takeshi Horie, National Agricultural and Food Research Organization (NARO) (Japan)
- Pramod Joshi, National Academy of Agricultural Research Management, Hyderabad (India)
- Thierry Lebel, Laboratoire d'étude des Transferts en Hydrologie et Environnement (LTHE) (France)
- Holger Meinke, Tasmanian Institute of Agricultural Research (TIAR) and the School of Agricultural Science at the University of Tasmania (UTAS) (Australia)
- Mary Scholes, School of Animal Plant & Environmental Sciences, University of the Witwatersrand, (South Africa)
- Rashid Hassan, University of Pretoria (South Africa), resigned in late 2010 on appointment to the newly formed Independent Science and Partnership Council (ISPC) of the CGIAR Funders Council
- Rik Leemans (Netherlands), ex officio, ESSP
- Stephen Hall (UK), ex officio, CGIAR

Annex 3: List of publications by CCAFS staff in 2010

Scientific papers, books and book chapters

Aggarwal PK, Baethegen WE, Cooper P, Gommes R, Lee B, Meinke H, Rathore LS, Sivakumar MVK. 2010. Managing climatic risks to combat land degradation and enhance food security: Key information needs. *Procedia Environmental Sciences 1*: 305–312.

Bhatia A, Pathak H, Aggarwal P K, Jain N. 2010. Trade-off between productivity enhancement and global warming potential of rice and wheat in India. *Nutrient Cycling in Agroecosystems* 86 (3): 413–424.

Boomiraj K, Chakrabarti B, Aggarwal PK, Choudhary R, Chander S, 2010. Assessing the vulnerability of Indian mustard to climate change. Agriculture, *Ecosystems and Environmen*t *138*: 265-273.

Brussaard L, Caron P, Campbell BM, Lipper L, Mainka S, Rabbinge R, Babin D, Pulleman M. 2010. Reconciling biodiversity conservation and food security: scientific challenges for a new agriculture. *Current Opinion in Environmental Sustainability 2*: 34–42.

Byjesh K, Naresh Kumar S, Aggarwal PK. 2010. Simulating impacts, potential adaptation and vulnerability of maize to climate change in India. *Mitigation and Adaptation Strategies for Global Change 15* (5): 413–431.

Chakrabarti B, Aggarwal PK, Singh SD, Nagarajan S, Pathak H. 2010. Impact of high temperature on pollen germination and spikelet sterility in rice: comparison between basmati and non-basmati varieties. *Crop and Pasture Science 61* (5): 363–368.

Challinor AJ, Simelton ES, Fraser EDG, Hemming D, Collins M. 2010. Increased crop failure due to climate change: assessing adaptation options using models and socio-economic data for wheat in China. *Environmental Research Letters 5* (3): 034012.

Doherty RM, Sitch S, Smith B, Lewis SL, Thornton PK. 2010. Implications of future climate and atmospheric CO2 content for regional biogeochemistry, biogeography and ecosystem services across East Africa. *Global Change Biology 16* (2): 617–640.

Ericksen P, Stewart B, Eriksen S, Tschakert P, Sabates-Wheeler R, Hansen J, Thornton PK. 2010. Adapting food systems. In: Ingram J, Ericksen P, Liverman D, eds. *Food Security and Global Environmental.* London, UK: Earthscan. p. 115–143.

Herrero M, Thornton PK, Gerber P, Van der Zijpp A, Van de Steeg J, Notenbaert A, Lecomte P, Grace D. 2010. The way forward for livestock and the environment. In: Swanepoel F, Moyo S, Stroebel A. *The Role of Livestock in Developing Communities: Enhancing Multifunctionality.* The Netherlands: Wageningen Academic Press.

Herrero M, Thornton PK, Notenbaert A, Wood S, Msangi S, Freeman HA, Bossio D, Dixon J, Peters M, Van de Steeg J, Lynam J, Parthasarathy Rao P, Macmillan S, Gerard B, McDermott J, Seré C, Rosegrant M. 2010. Smart investments in sustainable food production: revisiting mixed crop-livestock systems. *Science 327* (5967): 822–825.

Jarvis A, Ramirez J, Anderson B, Leibing C, Aggarwal PK. 2010. Scenarios of climate change within the context of agriculture In: Reynolds MP, ed. *Climate change and crop production.* Wallingford, UK: CAB International. p. 9–39.

Jarvis A, Touval JL, Castro M, Sotomayor L, Hyman G. 2010. Assessment of threats to ecosystems in South America. *Journal for Nature Conservation 18* (3): 180-188.

Kaitibie S, Omore A, Rich K, Salasya B, Hooten N, Mwero D, Kristjanson P. 2010. Kenyan dairy policy change: Influence pathways and economic impacts. *World Development 38* (10): 1494–1505.

Kristjanson P, Mango N, Krishna A, Radeny M, Johnson N. 2010. Understanding poverty dynamics in Kenya. *Journal of International Development 22* (7): 978–996.

Laderach P, Lundy M, Jarvis A, Ramírez J, Pérez PE, Schepp K, Eitzinger A. 2010. Predicted impact of climate change on coffee-supply chains. In: Leal Filho W. ed. *The Economic, Social and Political Elements of Climate Change*. Berlin, Germany: Springer Verlag.

Li S, Wheeler T, Challinor AJ, Lin E, Ju H, Yinlong X. 2010. The observed relationships between wheat and climate in China. *Agricultural and Forest Meteorology 150* (11): 1412–1419.

Li, S, Wheeler T, Challinor AJ, Erda L, Yinlong X Hui J. 2010. Simulating the Impacts of Global Warming on Wheat in China Using a Large Area Crop Model. *Acta Meterologica Sinica 24(1)*: 123–135.

Lilja N, Kristjanson P, Watts J. 2010. Rethinking impact: Understanding the complexity of poverty and change – overview. *Development in Practice 20* (8): 917–932.

Misselhorn A, Challinor A, Jones J, Plocq-Fichelet V, Schaldach R, Thornton PK. 2010. Surprises and possibilities: addressing risk in food systems. In: Ingram J, Ericksen P, Liverman D, eds (2010): *Food Security and Global Environmental Change.* Earthscan, London, UK. p. 318–341.

Mulligan M, Rubiano J, Hyman G, White D, Garcia J, Saravia M, Gabriel Leon J, J. Selvaraj, Guttierez T, Saenz-Cruz L. 2010. The Andes basins: biophysical and developmental diversity in a climate of change. *Water International 35* (5): 472–492.

Nelson GC. 2010. The perfect storm: food security and nutrition under climate change. *Significance 7 (1)*: 13–16.

Notenbaert A, Mude A, Van de Steeg J, Kinyangi J. 2010. Options for adapting to climate change in livestock-dominated farming systems in the greater horn of Africa. *Journal of Geography and Regional Planning 3 (9)*: 23–239.

Nyangaga J, Smutylo T, Romney D, Kristjanson P. 2010. Research that matters: Outcome mapping for linking knowledge to poverty-reduction actions. *Development in Practice 20 (8)*: 972–984.

Pathak H, Jain N, Bhatia A, Patel J, Aggarwal PK. 2010. Carbon footprints of Indian food items. *Agriculture, Ecosystems and Environment 139*: 66–73.

Pell A, Stroebel A, Kristjanson P. 2010. Livestock development projects that make a difference: What works, what doesn't and why. In: Swanepoel F, Moyo S, Stroebel A. 2010. *The Role of Livestock in Developing Communities: Enhancing Multifunctionality*. Wageningen, Netherlands: Wageningen Academic Press.

Petheram L, Campbell BM. 2010. Listening to locals on payments for environmental services. *Journal of Environmental Management 91 (5)*: 1139–1149.

Petheram L, Zander KK, Campbell BM, High C, Stacey N. 2010: Strange Changes: Indigenous perspectives of climate change and adaptation in NE Arnhem Land (Australia). *Global Environmental Change 20 (4):* 681–692.

Porter JR, Challinor AJ, Ewert F, Falloon P, Fischer T, Gregory P, Van Ittersum MK, Olesen JE, Moore KJ, Rosenzweig C, Smith P. 2010. Food Security: Focus on Agriculture. *Science 328 (5975)*: 172–173.

Ramirez J, Khourg C, Jarvis A, Debouck DG, Guarino L. 2010. A gap analysis methodology for collecting crop genepools: a case study with *Phaseolus* beans. *PLos one 5(10)*: e13497.

Reid RS, Bedelian C, Said MY, Kruska RL, Mauricio RM, Castel V, Olson J, Thornton PK. 2010. Livestock in a Changing Landscape: Global Livestock Impacts on Biodiversity. In: Steinfeld H, Mooney HA, Schneider F, Neville L E, eds. *Livestock in a Changing Landscape*, Volume 1, Drivers, Consequences, and Responses. Washington, DC: Island Press. p. 111–137.

Sandker M, Campbell BM, Ruiz-Pérez M, Sayer JA, Cowling R, Kassa H, Knight AT. 2010. The role of participatory modelling in landscape approaches to reconcile conservation and development. *Ecology and Society 15(2)*: 13.

Sandker S, Kofi S, Forster J, Collier N, Shepherd G, Yeboah D, Ezzine-de Blas D, Machwitz M, Vaatainen S, Garedew E, Etoga G, Ehringhaus C, Anati J, Quarm OD, Campbell, BM. 2010. REDD payments as incentive for reducing forest loss. *Conservation Letters3*: 114–121.

Sikor T, Stahl J, Enters T, Ribot JC, Singh NM, Sunderlin WD, Wollenberg E. 2010. REDD-plus, forest people's rights and nested climate governance. *Global Environmental Change 20 (3)*: 423–425.

Srivastava A, Naresh Kumar S, Aggarwal PK. 2010. Assessment on vulnerability of sorghum to climate change in India. *Agriculture, Ecosystems and Environment 138*: 160–169.

Thornton PK. 2010. Climate change and livestock keepers in developing countries: what are the prospects? *Agriculture for Development 9*: 6–10.

Thornton PK. 2010. Livestock production: recent trends, future prospects. *Philosophical Transactions of the Royal Society Series B, 365 (1554)*: 2853–2867.

Thornton PK, Gerber P. 2010. Climate change and the growth of the livestock sector in developing countries. *Mitigation and Adaptation Strategies for Global Change 15 (2)*: 169–184.

Thornton PK, Herrero, M. 2010. The potential for reduced methane and carbon dioxide emissions from livestock and pasture management in the tropics. *Proceedings of the National Academy of Sciences 107 (46)*: 19667–19672.

Thornton PK, Jones PG, Alagarswamy G, Andresen J, Herrero M. 2010. Adapting to climate change: agricultural system and household impacts in East Africa. *Agricultural Systems 103 (2)*: 73–82.

Vermeulen S, Cotula L. 2010. Over the heads of local people: consultation, consent, and recompense in large-scale land deals for biofuels projects in Africa. *Journal of Peasant Studies 37(4)*: 899–916.

Walker B, Sayer J, Andrew NL , Campbell BM. 2010. Should enhanced resilience be an objective of natural resource management research in developing countries? *Crop Science 50 (1)*: 10–19.

Wassmann R, Nelson GC, Peng SB, Sumfleth K, Jagadish SVK, Hosen Y Rosegrant MW. 2010. Rice and global climate change. In: Pandey S, Byerlee D, Dawe D, Dobermann A, Mohanty S, Rozelle S, Hardy B, eds. *Rice in the Global Economy: Strategic Research and Policy Issues for Food Security* Los Banos, Philippines: International Rice Research Institute.

Wood S, Ericksen PJ, Stewart B, Thornton PK, Anderson M. 2010. Lessons learned from international assessments. In: Ingram, JSI, Ericksen PJ, Liverman DM. *Food Security and Global Environmental Change*. London, UK: Earthscan. p. 46–62.

Reports and policy briefs

Clark WC, Kristjanson P, Campbell BM, Juma C, Holbrook NM, Nelson G, Dickson N. 2010. *Enhancing Food Security in an Era of Global Climate Change: An Executive Session on Grand Challenges of the Sustainability Transition*, San Servolo Island, Venice. June 6–9, 2010. CID Working Paper 198. Boston, USA: Center for International Development at Harvard University.

Hansen JW, Tippett M, Bell M, Ines AVM. 2010. *Linking Seasonal Forecasts into Risk View to Enhance Food Security Contingency Planning*. IRI Technical Report 10–13. Palisades, New York, USA: International Research Institute for Climate and Society.

Herrero M, Van de Steeg J, Ringler C, Thornton PK, Zuo T, Bryan E, Koo J. 2010. Kenya: *Climate variability and climate change and their impacts on the agricultural sector*. International Livestock Research Institute, Nairobi, Kenya: ILRI-IFPRI World Bank Project Report.

Jarvis A, Zapata CE, Laderach P, Ramírez J. 2010. Incremento en la presión sobre los ecosistemas altoandinos por cambios en la adaptación de cultivos. In: Franco V, CL, Muñoz AM, Andrade GI, Naranjo LG, eds. *Experiencias de adaptación al cambio climático en ecosistemas de montaña (páramos y bosques de niebla) en los Andes del Norte: Memorias del taller regional*. Bogotá, DC: Fondo Mundial para la Naturaleza (WWF) 19–20 February 2009.; Cali, Colombia: Fundación Humedales. p. 55–63.

Laderach P, Kathleen S, Ramirez J, Jarvis A, Eitzinger A. 2010. Impacto del cambio climatico para el cultivo de café en Nicaragua. In: Martinez C. *Adaptación al cambio climático y servicios ecosistemicos en América Latina*. Publicación CATIE 99. Turialba, Costa Rica: Centro Tropical Agronómico Tropical de Investigación y Enseñanza.

Jarvis A, Upadhyaya H, Gowda CLL, Aggarwal PK, Fujisaka S, Anderson B. 2010. *Climate Change and its effect on conservation and use of plant Genetic Resources for Food and Agriculture and Associated Biodiversity for Food Security*. FAO Thematic Background Study. Rome, Italy: Food and Agriculture Organisation of the United Nations.

Laderach P, Hagger J, Lau C, Eitzinger A, Ovalle O, Baca M, Jarvis A, Lundy M. 2010. *Mesoamerican coffee: building a climate change adaptation strategy*. CIAT Policy Brief. Cali, Colombia: International Center for Tropical Agriculture.

Lau C, Jarvis A, Ramirez J. 2010. *Colombian agriculture: adapting to climate change*. CIAT policy brief. Cali, Colombia: International Center for Tropical Agriculture.

Margulis S, Narain U, Chinowsky P, Cretegny L, Hughes G, Kirshen P, Kuriakose A, Lange GM, Nelson GC, Neumann J, Nicholls R, Pandy K, Price J, Schlosser A, Schneider R, Sedjo R, Strzepek K, Sumaila R, Ward P, Wheeler D. 2010. *Cost to Developing Countries of Adapting to Climate Change: New Methods and Estimates*. Washington DC, USA: World Bank.

Nelson GC, Rosegrant MW, Palazzo A, Gray I, Ingersoll C, Robertson R, Tokgoz S, Zhu T, Sulser TB, Ringler C, Msangi S, You L. 2010. *Food Security, Farming, And Climate Change To 2050: Challenges to 2050 and Beyond*. IFPRI Issue Brief 66. Washington DC, USA: International Food Policy Research Institute.

Nelson GC, Rosegrant MW, Palazzo A, Gray I, Ingersoll C, Robertson R, Tokgoz S, Zhu T, Sulser TB, Ringler C, Msangi S, You L. 2010.: *Food Security, Farming, and Climate Change to 2050: Scenarios, Results, Policy Options*. Washington DC, USA: International Food Policy Research Institute.

Nzuma JM, Waithaka M, Mbithi Mulwa R, Kyotalimye M, Nelson GC. 2010. *Strategies for Adapting to Climate Change in Rural Sub-Saharan Africa*. IFPRI Discussion Paper 01013. Washington DC, USA: International Food Policy Research Institute.

Simelton E, Fraser EDG, Termansen M, Benton TG, Gosling SN, South A, Arnell NW, Challinor AJ, Dougill AJ, Forster PM. 2010. *Climate change and the socioeconomics of global food production: a quantitative analysis of how socioeconomic factors influence the vulnerability of grain crops to drought*. Working Paper 29. Leeds, UK: Centre for Climate Change Economics and Policy.

Springate-Baginski O, Wollenberg E, eds. 2010. REDD, *Forest Governance and Rural Livelihoods, The Emerging Agenda*. Bogor, Indonesia: CIFOR Policy Brief. Centre for International Forestry Research.

Vermeulen SJ, Aggarwal PK, Ainslie A, Angelone C, Campbell BM, Challinor AJ, Hansen J, Ingram JSI, Jarvis A, Kristjanson P, Lau C, Thornton PK, Wollenberg E. 2010. *Agriculture, Food Security and Climate Change: Outlook for Knowledge, Tools and Action*. CCAFS Report 3. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security.

Vermeulen SJ. 2010. *Hamburgers or yamburgers? Four-degree futures for food in Africa*. Ag-Clim Letters 1, December 2010. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security. (Available from www.ccafs.cgiar.org/blog/hamburgers-and-yamburgers-four-degree-futures-food-africa

Young scientists at a research site in Bangladesh. Cross-site learning is an important part of capacity-enhancement. Photo: N.A. Omolo

Annex 4: Acronyms and abbreviations

ACMAD	African Centre of Meteorological Application for Development
ACODE	Advocates Coalition for Development and Environment
ADF	African Development Forum
AFOLU	Agriculture, forestry and land use
AFPRO	Action for Food Production
AG	International Advisory Group
AGCommons	Agricultural Geospatial Commons
AgMIP	Agricultural Model Intercomparison and Improvement Project
AGRHYMET	Centre Regional de Formation et d'Application en Agrométéorologie et Hydrologie Opérationnelle
AgroMaps	Mapping of Agricultural Production Systems
AMEDD	Malienne d'Eveil au Développement Durable
AMKN	Adaption and Mitigation Knowledge Network
ARDD	Agriculture and Rural Development Day
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
BASIC	Biotechnology and Biological Sciences Research Council (Homepage abbreviation: BBSRC)
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical (International Centre for Tropical Agriculture)
CIMMYT	International Centre for the Improvement of Maize and Wheat
CIP	International Potato Centre
CIRAD	La Recherche Agronomique pour le Développement
CLIFF	Climate Food and Farming Research Network
CMIP3	Coupled Model Intercomparison Project Phase 3
CORAF	Conférence des Responsables de la Recherche Agronomique Africains et Français
CRP	CGIAR Research Program
CS Pro	Census and Survey Processing System
DFID	Department for International Development
DNDC	DeNitrification-DeComposition
DWR	Directorate of Wheat Research
EA	East Africa
EcoTRUST	Environmental Conservation Trust
ESSP	Earth System Science Partnership
EU	European Union
FANRPAN	Food, Agriculture and Natural Resources Policy Analysis Network
FAO	Food and Agriculture Organisation of the United Nations
FGD	Focus group diiscussion
GCM	Global climate model
GCP	Generation Challenge Program
GDP	Gross domestic product
GHG	Greenhouse gas
GLAM	General large area model
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit, now Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
ICPAC	IGAD Climate Prediction and Applications Centre
ICRAF	World Agroforestry Centre
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT	Information and Communication Technology
ICT-KM	Information and Communications Technology and Knowledge Management
IER	Institue d'Economie Rurale
IFDC	International Fertiliser Development Centre
IFPRI	International Food Policy Research Institute
IFRC	International Federation of Red Cross and Red Crescent Societies
IGAD	Intergovernmental Authority on Development
IGP	Indo-Gangetic Plains
IIASA	International Institute for Applied Systems Analysis
IITA	International Institute for Tropical Agriculture
ILRI	International Livestock Research Institute
IMPACT	International Model for Policy Analysis of Agricultural Commodities and Trade
IPC	Integrated Food Security Phase Classification
IPCC	Intergovernmental Panel on Climate Change

IPM-CRSP	Integrated Pest Management Collaborative Research Support Program
IRI	International Research Institute for Climate and Society
IUCN	The International Union for Conservation of Nature
IWMI	International Water Management Institute
KARI	Kenyan Agricultural Research Institute
M&E	Monitoring and evaluation
METEOSAT	Geostationary meteorological satellites
NASA JPL	National Aeronautics and Space Administration Jet Propulsion Laboratory
NARI	National agricultural research Institutions
NARO	National agricultural research organization
NCRC	Nature Conservation Research Centre
NGO	Non-governmental organization
NMA	National meteorological agency
NMS	National meteorological services
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
REDD	Reducing emissions from deforestation and forest degradation
RFI	Radio France International
SPSS	Statistical Package for the Social Sciences
SSC	Scientific Steering Committee
START	System for Analysis, Research and Training
TIST	The International Small Group and Tree Planting Program
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UN CSD	United Nations Conference on Sustainable Development
UN IRIN	United Nations Integrated Regional Information Network
WA	West Africa
WFP	World Food Program

There are opportunities for livestock owners both to mitigate their greenhouse gas emissions and adapt to climate change, through different management practises. Kabaune Village, Kenya. Photo: P. Casier

Annex 5: Financial highlights – December 31, 2010 and 2009 (USD)

Statement of Financial Position		
	2009	**2010**
Assets		
Current assets		
Cash and cash equivalents		1.691.250
Prepayments to themes and regions		1.535.699
Accounts receivable (funds)	1.700.000	5.565.824
Total assets	**1.700.000**	**8.792.773**
Liabilities		
Other Payables to partners		407.000
Overdraft/Short term borrowings	533.718	2.451.653
Net assets	**1.166.282**	**5.934.120**
Designated		1.535.699
Exchange rate adjustments		-73.752
Undesignated	1.166.282	4.472.173
Total liabilities and net assets	**1.166.282**	**5.934.120**

Statement of Activities

	2009 (5 months)	2010
Revenue and Gains		
Grant Revenue	1.700.000	14.035.207
Other revenue and gains	11.338	79.698
Total revenue and gains	**1.711.338**	**14.114.905**
Expenses and losses		
Themes		3.914.910
Regions		2.593.840
Scenarios Development		108.384
Outreach		686.871
Capacity enhancement		139.384
Administration and governance	545.056	1.422.926
Total expenses and losses	**545.056**	**8.866.314**
Net surplus / (deficit)	**1.166.282**	**5.248.590**
Expenses by Natural Classification		
Personnel costs	367.382	1.994.159
Supplies and services	45.299	1.911.958
Collaborators/Partnership costs	121.979	4.154.381
Operational travel	10.397	805.815
Total	**545.056**	**8.866.314**

Program implemented by:

Program supported by: