



RESEARCH PROGRAM ON
**Climate Change,
Agriculture and
Food Security**



CIAT
2013 technical report

1. Activity Reporting

Activity 282-2013 (Milestone 1.1.2 2014 (2).) Commissioned

Title: Intellectual support in gender analysis for Theme 1, including for farms of the future, and re-analysis of baseline data for targeting adaptation measures.

Status: Partially complete. Carmen and other professors at UF have been providing intellectual support to Theme 1.

Gender component:

The main objective of this partnership with UF is that then provide gender expertise to CIAT and CCAFS on an advisory basis and facilitate greater integration of gender research projects and proposals between CIAT and the University of Florida focused primarily on climate change but also dealing with other areas requiring gender expertise within the context of CGIAR Research.

Deliverables:

Partners:

UF; CIAT

Locations:

Global

Activity 639-2013 (Milestone 1.1.1 2015 (1))

Title: Brachiaria grasses and tropical forage legumes tolerant to drought or waterlogging integrated into production systems.

Status: Partially complete. Results from an inter-institutional and multi-disciplinary project to identify Brachiaria forage grass genotypes, which combine waterlogging tolerance with high forage yield and quality, for use in agricultural land in Latin America with poor drainage are published in the open access journal, Tropical Grasslands - Forrajes Tropicales. Two Brachiaria hybrids (BR06/1932 and BR06/4054) and two germplasm accessions of Brachiaria humidicola (CIAT 16886, CIAT 16866) with superior level of waterlogging tolerance were identified with participation of farmers in Colombia, Nicaragua and Panama. These new forage options can be integrated into forage-based production systems to improve adaptation to climate change. These results were also presented in two international conferences (Grasslands Congress; ISPA) and the research was recognized with a best poster award at ISPA conference.

Gender component:

Farmer participatory evaluation of Brachiaria cultivars for tolerance to waterlogging in 3 field sites in Colombia, 2 field sites in Nicaragua and 1 field site in Panama had very limited participation of women farmers.

Deliverables:

- NARS researchers in Colombia, Nicaragua and Panama trained.

Six researchers in Colombia, three in Nicaragua and two in Panama were trained in field evaluation of waterlogging tolerance in *Brachiaria*

- Progress report; Conference proceedings.

Cardoso, J. A., J. Jiménez, J. Rincón, E. Guevara, R. van der Hoek, A. Jarvis, M. Peters, J. Miles, M. Ayarza, S. Cajas, A. Rincón, H. Mateus, J. Quiceno, W. Barragán, C. Lascano, P. Argel, M. Mena, L. Hertentains and I. Rao. 2013. Advances in improving tolerance to waterlogging in *Brachiaria* grasses. In Proceedings of the 22nd International Grasslands Congress. Sydney, Australia, pp. 118-121.

- Progress report; PhD thesis on waterlogging tolerance in *brachiariagrasses*.

PhD thesis: Juan Andres Cardoso. 2013. Morpho-physiological mechanisms of adaptation to waterlogged soils in *Brachiaria* spp. University of Granada, Spain. Jiménez, J. C., J. A. Cardoso, G. Fischer and I. M. Rao. 2013. Increased aerenchyma formation and exodermal suberin deposition in nodal roots of *Brachiaria humidicola* contribute to high level of waterlogging tolerance. Paper (poster) presented at the 11th Conference of the International Society for Plant Anaerobiosis. Oct 6 – 11. IRRI, Los baños, Laguna, Philippines. Jiménez, J. C., J. A. Cardoso, G. Fischer and I. M. Rao. 2013. Leaf antioxidant activity and changes in leaf pigments in two contrasting *Brachiaria* grasses in response to waterlogging. Paper (poster) presented at the 11th Conference of the International Society for Plant Anaerobiosis. Oct 6 – 11. IRRI, Los baños, Laguna, Philippines. (Received Best poster paper award). Cardoso, J. A., J. C. Jiménez, J. Rincon, J. Miles and I. M. Rao. 2013. Advances in identification of morpho-physiological traits associated with waterlogging tolerance in *Brachiaria* genotypes. Paper (oral) presented at the 11th Conference of the International Society for Plant Anaerobiosis. Oct 6 – 11. IRRI, Los baños, Laguna, Philippines.

- Progress report; 1 Journal article.

Cardoso, J. A., J. Jiménez, J. Rincón, E. Guevara, R. van der Hoek, A. Jarvis, M. Peters, J. Miles, M. Ayarza, S. Cajas, A. Rincón, H. Mateus, J. Quiceno, W. Barragán, C. Lascano, P. Argel, M. Mena, L. Hertentains and I. Rao. 2014. Advances in improving tolerance to waterlogging in *Brachiaria* grasses. *Tropical Grasslands – Pasturas Tropicales* 1: 197-201. Cardoso, J. A., J. C. Jimenez, J. Rincon, D. Noguera, I. M. Rao. 2013. Morpho-anatomical adaptations to waterlogging by germplasm accessions in a tropical forage grass. *AoB PLANTS* 5:1-14 plt047; doi:10.1093/aobpla/plt047.

Partners:

CORPOICA; INTA; IDIAP

Locations:

East Africa (EA), Latin America (LAM), South East Asia (SEA)

Activity 640-2013 (Milestone 1.3.2 2014.)

Title: Detailed sector level adaptation plans co-developed with national actors in at least 2 countries in LAC, including livestock, water and biodiversity in Colombia and the agricultural sector in a country TBD in Central America.

Status: Complete. We modeled pasture production under present weather conditions and CC scenarios, and estimated CC impact on milk and meat production. SWAT model were used to run for three basins to estimate CC impact on water balance and impact on hydro-energy and agricultural production. CC impact on biodiversity and ecosystem services have been estimated using ecological models.

Gender component:

Deliverables:

Partners:

DNP

Locations:

Latin America (LAM)

Activity 641-2013 (Milestone 1.1.2 2013 (1).)

Title: Develop methodology to assess sensitivity of adaptation strategies to baseline soil condition and landscape position.

Status: Complete. This activity has implemented and developed interdisciplinary tools and methods at the CCAFS benchmark sites in order to better understand constraints and opportunities for implementing improved land management strategies.

Gender component:

We integrated land and soil health surveys with gender participatory data to better understand the socio-ecological landscape at the benchmark sites.

Deliverables:

- Develop a comprehensive database on soil condition and land health for CCAFS benchmark sites surveyed in East Africa.

The land and soil health data for Lushoto and Hoima are organized and cleaned. The CCAFS dataverse team are creating the proper documentation structure for upload onto DATAVERSE.

- Develop models linking soil condition and potential adaptation strategies.

We have developed preliminary models linking soil organic carbon and cultivated areas for the CCAFS benchmark sites. Analyses are presented in the submitted report.

- Host participatory and capacity building workshop with NARES in Arusha, Tanzania.

This workshop was held in June 2013 in Arusha, Tanzania. We hosted technicians and scientists from the seven different agricultural research institutes in Tanzania, as well as two District Officers from Lushoto and farmers from different villages within the Lushoto site. We distributed the LDSF and soil data for Lushoto to all partners,

and used these data in interactive data analysis sessions, using open source statistical software, R. Attached is our workshop report and the blog:<http://dapa.ciat.cgiar.org/kubadilishana-maarifa-knowledge-sharing-in-tanzania/>

- Host data analysis workshop for integrating land health and socio-economic data with CCAFS scientists, Nairobi Kenya.

We hosted a successful meeting in Nairobi, Kenya with CCAFS Scientists active in East Africa. The outcomes of this meeting fed into the development of CCAFS Flagship 4 proposal, led by IITA, which were are now implementing in 2014!

- Submit a peer-reviewed publication linking soil condition and adaptation strategies at the landscape scale, with local relevance for farmers.

One paper was published on soil organic carbon stocks and land use using the LDSF data in 2013 Online at stacks.iop.org/ERL/8/015011. One paper was submitted to PlosOne, titled, "Smallholder Farmers' Attitudes and Determinants of Adaptation to Climate Change in East Africa: Key Entry Points and Implications for Long-term Adaptation". In addition, our abstract titled, "Integrating Interdisciplinary Datasets and Participatory Methods for Accelerating the Adoption of Resilient Farming Systems in East Africa" was accepted at the Resilience and Development Conference in France May 2014.

- Submit co-authored report on initial findings.

We are currently refining our report, but preliminary analysis have been submitted. We have several blogs related to the fieldwork: <http://ccafs.cgiar.org/blog/healthy-soil-tanzania-new-project> and <http://dapa.ciat.cgiar.org/ccafs-ea-fieldwork/>

Partners:

SARI; NARO

Locations:

East Africa (EA)

Activity 642-2013 (Milestone 1.1.3 2014 (1).)

Title: Priority conservation gaps identified for 80 genepools, and support provided to identify key traits for breeding with crop wild relatives.

Status: Complete. The ex situ conservation status of the closest wild relatives of 80 crop genepools (approx. 1000 species) was finished during 2013. All results (maps and suggested urgency for conservation category) are available at: www.cwrdiversity.org/distribution-map/. Publications summarizing all results, and individual cases (i.e. tomato, eggplant, potato, rice, sunflower, carrot and lettuce) are under preparation

Gender component:

Deliverables:

- Global crop wild relatives database.

A global dataset containing 5,647,442 records was created after gathering occurrence data from genebanks, herbariums, experts datasets, literature and visits to herbarium. These records were processed before using them in the gap analysis (i.e. validation of coordinates, re-assignment of coordinates if needed, taxonomy

revision). By far, this is the largest collection devoted to CWR in the world.

- Gap analysis methodology in R.

A set of codes in R were improved from Ramírez-Villegas et al., 2010 for applying the gap analysis methodology for a 80 different crop genepools (code available here: <http://goo.gl/E3600b>). In addition, a document with instructions on input data preparation and use of R code was prepared for external users (available here: <http://goo.gl/z4U53g>)

- Two PhD thesis analyzing the diversity and distributions of crop wild relatives.

Chapters and additional analysis for each thesis is being carried out.

- Collaborative gap analysis on african rice, carrot, eggplant, potato and tomato.

Collaborations between CIAT and partners (ABCIC - Kenya, National History Museum -UK, CGN-Netherlands, CIP-Peru, University Winsconsin Madison - US, University of British Columbia - Canada) were established in order to further analyse a selection of crop gene pools and to publish results obtained.

Partners:

KEW; Global Crop Diversity Trust; University of Birmingham

Locations:

Global

Activity 643-2013 (Milestone 1.1.2 2013 (1).)

Title: Field testing of CIAT germplasm and commercial varieties to evaluation adaptation potential under differing environments.

Status: Partially complete. The evaluation of promising germplasm is being conducted in different regions in Colombia testing multiple planting dates. data corresponding to 2013 season has being collected and being analyzed.

Gender component:

Deliverables:

- Yield from different genotypes tested in a first cycle.

Trials using germplasm from different crops are being evaluated in different regions of Colombia. pictures show some trials.

- Genotypic behavior and adaptability, in terms of yield, of different genotypes tested.

Data from trials established in 2013 collected and being analyzed.

Partners:

FEDEARROZ; FENALCE

Locations:

Activity 644-2013 (Milestone 1.2.1 2013 (2).)

Title: Yield predictions of rice, cassava, beans, maize and potato in a regional scale considering uncertainties under different scenarios of climate change.

Status: Partially complete. This activity was modified according with a new definition of the priorities for the MADR ("Ministerio de Agricultura y Desarrollo Rural") project. Then the MADR project has been focused in seasonal forecasting without take into account climate change and uncertainties. Currently we are testing the models with field data and getting the cultivar parameters using AQUACROP, ORYZA and the model for each crop in DSSAT (CERES, IXIM, CROPGRO).

Gender component:

There is not Gender integration

Deliverables:

- Report of the methodology used to parameterize the varieties/lines and results.

During the year were established different methodologies to collect experimental data in order to define crop parameters and evaluate the performance of the crop. Those methodologies include both destructive and non-destructive strategies. The results with the final parameters will be available until the end of all the experiments to let us evaluate different ambiental conditions during the different growing periods and sites. The methodologies (protocols) and partial result are in the intranet folder of the Activity.

- Training workshop with national institutions about the use of crop models.

We have developed 3 workshops with FENALCE and BIOFUTURO. The first one was held in FENALCE headquarters (Cota-Cundinamarca October 29-30th) with the participation of researchers from FENALCE; the principal topics were: mechanistic models and their usability, necessary inputs, and exercises to create climate and experimental files in DSSAT. The second one was held in Pasto with members from BIOFUTURO (November 21-22nd) where was discussed the use and management of crop models as AquaCrop. The last one was held in FENALCE (November 19th) where was evaluated the performance of the maize simulations doing comparisons with the dataset collected until now. We are planning a workshop with FEDEARROZ in March of this year. All the workshop memories are in the intranet folder of the Activity.

- Data files with all the parameters generated for the varieties/lines.

According with a modification in the MADR project and considering the current status of the cassava model which is under development, we are just creating parameters for beans, maize and rice. Also considering there is not a mechanistic model for climbing beans, the project is getting experimental data useful for further modification of CROPGRO model. We send attached the parameters considering the data collected until now, they are not the definitive parameters because it is necessary to evaluate the information from all the experiments (currently in development).

- Draft paper with the results of yield predictions under different scenarios of climate change considering uncertainties.

This draft paper will be also a result of the Activity 652-2013 considering we are working more in seasonal forecasting than with different scenarios of climate change and their uncertainties.

Partners:

MADR; FEDEARROZ; FENALCE; CIP

Locations:

Latin America (LAM)

Activity 645-2013 (Milestone 1.2.1 2013 (2).)

Title: Assessing CC impact and building a vulnerability index to agriculture sector in the Andean Region (Colombia, Ecuador y Peru) with focus on social, economic and environmental strategic locations, capacity building provided to institutions and actors.

Status: Incomplete. We estimated CC impacts on 15 most relevant crops in the Andean region comparing crop adaptability with current climate conditions vs CC scenarios. Water balance changes have been estimated using water balance to basin level for nine Andean basins. A vulnerability index was built for municipal level using information about CC scenarios, crop modeling results and socioeconomic indicators.

Deliverables:

- One national workshop with different stakeholders about adaptation measures.

We finally did 7 Workshops in different regions of Colombia, Ecuador and Peru

- Policy briefs.

We have one Policy Brief for Colombia and two drafts (one Policy Brief for Ecuador and another for Peru)

- Forums on vulnerability analysis in the Andean Region

We have done 3 forums during 2013

Partners:

UNEP

Locations:

Latin America (LAM)

Activity 646-2013 (Milestone 1.3.1 2014 (1).)

Title: Evaluation of climate security challenges in the Amazon through expert and policy review in 3 countries for food, energy, water and health security.

Status: Complete. The Amazonia Security Agenda (ASA) was a project developed between June 2012 and November 2013, led by the International Centre for Tropical Agriculture (CIAT) and the Global Canopy Programme (GCP). Funded by Climate Development Knowledge Network (CDKN). The project was composed by three major work-streams: Science, Policy and Communications. Regarding the science section, a review of scientific documents was conducted to identify and collect the state of art knowledge about water, food, energy

and health security risks for the Amazon region. For the activities related to the policy section an engagement process was implemented through meetings and workshops. These were planned with different key actors of the Amazon countries (Colombia, Peru, Brazil, Ecuador and Bolivia) in order to provide knowledge and information sharing and stakeholder engagement. The communications work-stream ensured that the findings of the final regional document were broadly disseminated to target audiences via websites and networks. Based on the scientific review of water, food, energy, and health security, as well as through an engagement process with policymakers across the Amazon countries, the ASA project produced a regional document providing the state of the art scientific knowledge and a set of policy recommendations to key stakeholders of the Amazon region. This document was ultimately reported to a senior advisory panel, chaired by Manuel Pulgar, Minister of Environment of Peru. Furthermore did the project produce six scientific reports about water, food, energy and health security issues as well as climatic change and land use change in the Amazon region. Further information on the Project and all published materials can be accessed on the following website <http://segamazonia.org/>

Gender component:

Deliverables:

- Literature Compilation for the 4 securities (health, water, food and energy). A short literature summary report and an online Reference database.

The literature compilation and a short literature summary report can be accessed on the following link <https://drive.google.com/folderview?id=0B8lekWmLLSxBa3c0aU5DS19iSDQ&usp=sharing>

- Land-use status and trends report for Amazon Region: A brief land use report for each country outlining the status, trends and scenarios of land-use change. And Climate variability and climate change report for Amazon region.

The land-use status and trends report for Amazon region can be accessed on the following link http://segamazonia.org/sites/default/files/press_releases/land_use_status_and_trends_in_amazonia.pdf

- Four security reports for health, water, food and energy security in the Amazon Region.

The health security report can be accessed on the following link

http://segamazonia.org/sites/default/files/press_releases/health_security_in_amazonia.pdf

The water security report can be accessed on the following link

http://segamazonia.org/sites/default/files/press_releases/water_security_in_amazonia.pdf

The food security report can be accessed on the following link

http://segamazonia.org/sites/default/files/press_releases/food_security_in_amazonia.pdf

The energy security report can be accessed on the following link

http://segamazonia.org/sites/default/files/press_releases/energy_security_in_the_amazon.pdf

- Three national and a regional policy mapping and policy gaps assessment reports in relation to the four securities for Colombia, Peru, Brazil and the Amazon Region.

The three national and regional policy mapping and policy gaps assessment report can be accessed on the following link <https://drive.google.com/folderview?id=0B8lekWmLLSxBZkktXzc4S044aGc&usp=sharing>

- Amazon Security Agenda Regional Document: Document available online and printed in English, Spanish and Portuguese.

The Regional Document in English can be accessed on the following link

http://segamazonia.org/sites/default/files/amazonia_security_agenda.pdf

The Regional Document in Spanish can be accessed on the following link

http://segamazonia.org/sites/default/files/agenda_de_seguridad_para_la_amazonia_0.pdf

The Regional Document in Portuguese can be accessed on the following link

http://segamazonia.org/sites/default/files/agenda_de_seguridade_para_a_amazonia_0.pdf

- In-country stakeholder engagement on amazon security policy recommendations.

An engagement process was implemented through meetings and workshops. These were planned with different key actors of the Amazon countries (Colombia, Peru, Brazil, Ecuador and Bolivia) in order to provide knowledge and information sharing and stakeholder engagement. Finally this process produced a set of policy recommendations for the key stakeholders of the Amazon region, this policy recommendations were included into the Regional Document.

- Regional Event and high-impact extension materials: Regional Document launched at high level Regional Meeting to share key policy recommendations with decision makers. And Production of short animation.

The Regional Document and the policy recommendations were launched in a sharing and dissemination process with stakeholders of Peru, Brazil and Ecuador. The dissemination process was charge of Yolanda Kakabadse (CDKN). Also an animation video with the key messages of the project's results and the regional document were broadly disseminated to target audiences via websites and networks. The animation video can be accessed on the following link <http://vimeo.com/81851773>

Partners:

CDKN; GCP

Locations:

Latin America (LAM)

Activity 647-2013 (Milestone 1.2.1 2013 (1).)

Title: Develop guidelines for collecting data and build an evidence base regarding gender and adaptation to climate change. This will involve first identifying sex-differentiated vulnerabilities to climate change and then using that information to evaluate adaptation strategies in terms of equality and empowerment of poor women and men farmers.

Status: **Partially complete.** Evidence has been collected in several sites in East Africa and one site in Colombia. Currently the data is being analyzed and evaluated in order to develop appropriate guidelines.

Gender component:

This is a gender-specific activity that will incorporate gender from the beginning. The main objective is to

identify gender-differences and how they are likely to impact adaptation strategies of men and women and/or different types of households.

Deliverables:

Partners:

UF; ICRAF; IFPRI; EcoHabitus; Fundación Procuencia Río Las Piedras

Locations:

Latin America (LAM), East Africa (EA)

Activity 280-2013 (Milestone 1.1.2 2013 (1).) Commissioned

Title: Further development and improved usability of the Agtrials.org interface: incorporation of adding value tools and expansion of the data compiled and integrated into the standardized database.

Status: Partially complete. this activity is moving forward on several levels. We are working with CIMMYT to develop a more user-friendly interface. We just got some new funds to develop stronger collaboration with the AgMIP initiative. We are also working more closely with the South Asia cereals initiative (CSISA). There are now nearly 35,000 trials in the system and our goal is to move closer to 100,000 trials.

Gender component:

Deliverables:

- Improved interface with powerful visualization of the trial data compiled and available.
the date of this deliverable should be changed to 2014. We have set up the planning and projects go for improved interface and usability. But this will not be finished until the end of 2014.
- An online repository and database highly populated that incorporates adding value tools (climate and soil data; the analogue tool) and is linked to the AMKN platform and the CCAFS data product portal. Agtrials interface linked to the AMKN and CCAFS data portals; Analogue tool incorporated into the Agtrials interface
We decided in previous planning documents that we would not develop our own climate in soils tools, but rather link to existing efforts. The links to all existing efforts will be finalized by the middle of 2014.
- Comprehensive analysis of the international bean trials and their implications for climate change adaptation.
this work is moving forward nicely under the direction of Jagath Shantathal from his home base in Sri Lanka. We expected to be finished on time in 2014. A PowerPoint presentation of the principal results was developed and is available for internal review.
- 2 or 3 research projects developed and disseminated to support studentships or thesis topics aiming to e.g. carry out site similarity and GxE analysis, weather data integration.
this is an activity to be carried out in 2014. It will be supplemented with additional funds, which we are currently looking to acquire. We have already talked with colleagues in local universities and are beginning to identify students.
- Improvements of the database search functionality.
some of this work was completed in 2013 but we still have improvements to make. This will be done in conjunction with the improvements to usability and the interface.
- New trial data incorporated into the system through establishment of new partnership.

this deliverable in 2013 was largely met. There are now nearly 35,000 trials in the system. you can find the number of trials on the front page of the application website.

Partners:

AgMIP; CRP 3.4 Roots, Tubers, and Bananas; GCP; CIMMYT

Locations:

Global

Activity 309-2013 (Milestone 1.1.1 2014) Commissioned

Title: Further development and improvement of the Analogue tool.

Status: Partially complete. The new version of the tool is ready with the improvements in user friendliness. The new version is faster as it has been implemented in a new Linux server. This year will make new developments to include new data (CMIP5).

Gender component:

Deliverables:

- New version tool more user friendly and faster.

The new version of the tool is ready with the planned improvements in user friendliness and execution speed. The R package has also been updated and improved.

- Analogue tool improved climatic and agronomical validation performed.

We have advanced in the climatic validation, but we will explore more alternatives for agronomic validation during the first 4 months of 2014.

- Journal paper with the methodology, validation and application of Climate Analogue tool.

After the publication of our first working paper we have discussed the publication plan for analogues. Currently we're focusing on understanding of the basic concepts and differences in set up, and will follow that up with tests with trial data. A methodology is being developed in this respect.

- Link established with other CCAFS platforms and portals (Agtrials, AMKN).

An initial link was done for AMKN, but hasn't been fully finished and/or tested since it is dependent on the updating of AMKN. No link exists yet for AgTrials but we have discussed with Glenn Hyman on how to move forward on this.

- New soil module in the R library and implement it in the online tool.

A visiting researcher developed an initial version using a global soils dataset and a set of rules. We're looking at the moment into collaboration with CIAT's soils program and with some other CGIAR colleagues in Africa so as to plan / develop a more local study where more detailed data can be used to improve the current method.

Partners:

CIAT

Locations:

Global

Activity 214-2013 (Milestone 1.2.1 2013 (2).) Commissioned

Title: Further development of the CCAFS-climate portal.

Status: Partially complete. The CCAFS-Climate data portal has continuously been providing free-of-access data for research purposes. Various changes to the portal have been implemented during the course of 2013 and these can be summarised as follows:- A new and improved user search interface for the easy location of datasets. Includes the option of downloading files by geographic tile rather than the entire globe.- An almost complete set of downscaled IPCC 5th Assessment Report GCM data for 4 RCP, 106 GCM (about 25 models per RCP), 4 future periods, 5 climatological variables and 4 resolutions, the highest at 1 km².- A new standalone version of MarkSim GCM. Includes data from 17 climate models from the IPCC 5th Assessment Report.- Data were migrated from Dreamhost to a new CIAT storage in cluster to increase the storage capacity. The actual size of files is ~14 terabytes hosted.- More than 90,000 new files in the database for diverse downscaling methods. In 2013, more than 14,000 people visited the CCAFS-Climate data portal. Twenty peer-reviewed publications cited use of it data, bringing the total sum of citations since 2009 to almost 90.

Gender component:

No gender

Deliverables:

- CMIP3 climate data fully available.

The CMIP3 downscaling data is fully available on the website for 3 emission scenarios, 7 future periods, 63 Global Climate Models (~20 GCM by scenario) and 5 climatological variables. Additionally was developed a new user friendly search engine for the platform, which includes an option of downloading CMIP3 files by geographic tile. In order to store all CMIP3 files the storage capacity was expanded; currently these files have an overall weight of ~ 7TB.

- CMIP5 RCP4.5 data downscaled and provided online

The CMIP5 downscaled data is fully available on the website for 4 RCPs, 4 future periods, 106 Global Climate Models (~25 GCM by scenario) and 5 climatological variables. Tile-search feature not implemented yet in portal.

- Journal paper on downscaling / bias-correction / perfect sibling.

Paper was not published. The following related article is projected to be finished and submitted during 2014:C. Navarro-Racines, J. Ramírez-Villegas, A. Jarvis, S. Kusunoki. Suitability of the high-resolution MRI Global Climate Model for Agricultural Impacts Research in Latin America.

- Journal paper on CMIP5 climate model skill.

Paper published in Environmental Research Letters, see <http://iopscience.iop.org/1748-9326/8/2/024018>. Citation as follows:Ramirez-Villegas, J, A J Challinor, P K Thornton, and A Jarvis. 2013. "Implications of Regional Improvement in Global Climate Models for Agricultural Impact Research." Environmental Research Letters 8 (2): 24018. <http://stacks.iop.org/1748-9326/8/i=2/a=024018>.The article assess 24 CMIP3 and 26 CMIP5 simulations of present climate against climate observations for five tropical regions (chosen due to their vulnerability to climate change), as well as regional improvements in model skill and, through literature review, the sensitivities of impact estimates to model error. Also, some implications of model errors for agricultural impact assessment

was analyzed, and elucidate some options for using CMIP5 data into impact models.

Partners:

IFPRI; CIP; Waen Associates

Locations:

Global

Activity 651-2013 (Milestone 1.1.2 2013 (1).)

Title: Review and participatory rural appraisal of risks, opportunities and coping strategies related to agriculture and climate change in EA. Developing current risk and opportunity maps in farming systems vulnerable to climate change in EA. On-farm testing and selection of promising adaptation strategies, interventions and technologies for major farming systems, including vulnerable pastoralist communities in East Africa.

Status: Partially complete. Bean based technologies (bean varieties and crop management practices) currently being utilized by farmers to cope with different climate change scenarios were identified and evaluated with farmers.

Gender component:

The objective of this project was to evaluate and adapt farmer-acceptable improved multiple stress tolerant bean genotypes through participatory approaches. Gender was an important aspect of this research project from initiation to completion ensuring that both men and women are involved in decision making and in the implementation of the project. We hence expect that the technologies identified will address both men and women's needs.

Deliverables:

- Risk and opportunity maps, documentation of promising agricultural technologies for up-scaling, case study on rangeland conditions and trends (Borana), Journal articles

A draft final report has been submitted to the EA CCAFS regional office

Partners:

NACCRI; CIAT

Locations:

Activity 652-2013 (Milestone 2.3.1 2013.)

Title: Design of climate and yield seasonal forecasting to climate risk management through the use of ETA climate regional model.

Status: Partially complete. Seasonal climate forecasts for agricultural crop and risk management was jointly developed by the International Center for Tropical Agriculture (CIAT) and the National Institute for Space Research (INPE), Brazil, under the CGIAR Research Program on Climate Change, Agriculture and Food Security

(CCAFS) and Colombia's Ministry of Agriculture and Rural Development (MADR). Within the project, was proposed the development of a methodology that combines the seasonal climate forecasts of the regional climate Eta Model, maintained by INPE, with the Climate Predictability Tool (CPT), developed by the International Research Institute for Climate and Society (IRI), as a starting point to produce seasonal forecasts of crop productivity. The activities focus on the development, testing and functional use of the seasonal climate forecasts based on the combination of Eta model dynamical forecasts with IRI's CPT statistical forecasts, and on the potential uses for crop yield forecasting. The study will thus generate a tool that will enhance our understanding of climate variability in Colombia and contribute to studies on vulnerability, climate risk and adaptation to future climate variability and change. The project developed a seasonal (4.5-month) climate forecast dataset for the period 2001-2010, with 3 members, at 10-km resolution for the domain covering Colombia and Peru using the dynamical Eta model. This model output dataset was delivered to CIAT in hard disk copies. The Eta model seasonal forecasts are the input source to train the CPT tool, which is the statistical tool for crop productivity forecasts. The project had strong contribution to capacity building by undertaking three training activities related to atmospheric modeling and the tool for statistical analyses.

Gender component:

Deliverables:

- Draft paper on the development of a method that allows to combine (crop model and Eta model), and to evaluate the accuracy of the prediction.

1. Report: Seasonal climate forecasting is of paramount importance in order to assess and address vulnerabilities of agriculture to short-term climate variations. However, coupling crop models with seasonal weather forecasts is not an easy task, partly because of our limited understanding of climate and biological systems, access to multi-sites experimental data, the differences in modeling scales. For two experimental sites in the Andes in Peru, I'm exploring the feasibility of the application of the potato crop model R&TCRO over seasonal weather forecasts of the regional model ETA and thus, form the basis for improving models of agricultural production. The comparison of results shows that the Eta model at the experimental station of Santa Ana not captured well the elevation gradient, which led to a marked overestimation of precipitation but, represent good behavior the observed data of maximum and minimum temperature. For Granja Porcon station the anomalies observed average maximum and minimum temperature and precipitation were not significant. The potential yield simulations were adjusted more to the potato variety Unica.2. Report: Combine the Eta seasonal forecasts with the CPT tool to estimate crop yield. Maize was chosen as the crop to test this dynamical + statistical productivity forecast system. This choice was based on the availability of the dataset in Colombia. Maize is a major crop for Colombia where it is cultivate in all different climate conditions and diverse agriculture management. Precipitation forecasts were extracted from the 10-year March-April-May-June (MAMJ) and September-October-November-December (SOND) seasons. These are the two major maize production periods in Colombia. Precipitation forecasts were reformatted to input to CPT. Therefore, in these preliminary tests, seasonal mean precipitation forecast values were input as the predictor, and maize yield as the predictand. The correlation method adopted in these tests was the Canonical Correlation. The CCAt technique is a type of multivariate regression that uses a collective set of predictors for a collective set of predictive data.

- Installation of the ETA model, seasonal climate version in CIAT computer servers.

The project had strong capacity building aspect in which: a) CIAT's team (Diana Giraldo, Felipe de Mendiburu and Carlos Navarro) participated in a one-week training, between 3 and 8 of March 2013, of the mesoscale Eta model

with theoretical and hands-on practice of the numerical modelling, at INPE's premises. b) INPE Researcher Dr Angélica Giarolla received training on the CPT tool at CIAT - Colombia. c) CIAT's team received training on numerical model installation at CIAT's premises. Two experts on the Eta model, Dr Jorge Gomes and Ms Gracielle Siqueira, visited CIAT to carry out the installation of the Eta model in CIAT computers and to provide additional training to CIAT team. This was a five-day course, in which the first two days were given introduction to Linux, GrADS and Fortran languages, and the other three days were given practice to installation and configuration of the model as well routine to include the model in an operational suite. Seven CIAT experts participated in the training, which took place in CIAT premises. This activity can allow the Centre to produce seasonal anomaly forecasts on a regular basis. The 40-km boundary conditions will be provided by INPE as part of its operational activity and therefore at no-extra costs to CIAT.

Partners:

CPTEC; CIP

Locations:

Latin America (LAM)

Activity 653-2013 (Milestone 2.3.1 2013.)

Title: Characterization of agricultural systems for seasonal forecasting.

Status: Partially complete. In cases of Rice, from secondary sources it has been characterized more than 3700 sites (2149 climate, 1250 soils, 397 crop management). For Plantain from primary sources more than 1200 sites (1006 climate, soil 962, crop management 862). For Avocado from primary sources more than 1200 sites too (888 climate, soil 788, crop management 716). For Maiz merging primary and secondary sources more than 1046 sites, most of them crop management and soils. For beans about 160 sites (80 soils, 81 crop management)

Gender component:

Deliverables:

- 200 observations of farmers' production experiences.

For rice. Data from FEDEARROZ secondary sources: Encuesta nacional arrocería and estudios técnicos

- Professionals and technicians with capacity to characterize production systems.

The processes of collecting and analyzing the information has been conducted within a constant dialogue with crop sectors. They have been trained with tools for recording information and currently the crop sectors are seeking for the most suitable candidate for a joint position

Partners:

FEDEARROZ; FENALCE

Locations:

Latin America (LAM)

Activity 654-2013 (Milestone 3.1.1 2013.)

Title: Include social and environmental costs and benefits to best-bets identified for reducing agricultural emissions in Colombia.

Status: Partially complete. Environmental benefits from silvo-pastoral system related to carbon balance, such as carbon in soils and biomass, and GHG emissions from soils and animals are being measured.

Gender component:

Deliverables:

Partners:

Locations:

Latin America (LAM)

Activity 655-2013 (Milestone 3.1.1 2013.)

Title: Assess the potential of tropical fruit trees and silvopastoral systems to reduce GHG in degrading pastures areas.

Status: Partially complete. This project activity was initiated in 2013 and is expected to be completed in 2014. Currently, primary project activities advances are related to measurements of carbon stocks in three prototypes of silvopastoral systems and three type of fruits trees in Colombia. Soil and biomass samples were taken for C-content lab analyses. Also, chambers for measuring GHG emissions from enteric fermentation of cattle has been constructed and are operational.

Gender component:

No

Deliverables:

- Carbon measurements in four silvopastoral systems in Colombia.

Presentation: Project activity advances where presented in November 2013 to Ministry of Agriculture and Rural Development and other academic and farmer organizations. Document: Field visit supervision reports were delivered to Ministry of Agriculture and Rural Development

- Carbon stock measurements of tree types of fruit production systems in Colombia.

Presentation: Project activity advances where presented in November 2013 to Ministry of Agriculture and Rural Development and other academic and farmer organizations. Document: Field visit supervision reports were delivered to Ministry of Agriculture and Rural Development

Partners:

MADR; GASA; CIPAV

Locations:

Latin America (LAM)

Activity 656-2013 (Milestone 3.1.1 2013.)

Title: Economic analysis of implementing agroforestry (fruits trees-based) and silvopastoral systems to mitigate climate change in suitable areas.

Status: Partially complete. Financial costs to reconvert degraded areas into fruit tree based agroforestry and silvopastoral system in different regions in Colombia has been quantified. Benefits have been identified and quantified and CBA matrix established. The economic viability to reconvert degraded pasture to agroforestry and silvopastoral systems has been assessed.

Gender component:

Deliverables:

Partners:

MADR

Locations:

Latin America (LAM)

Activity 657-2013 (Milestone 3.1.1 2013.)

Title: Metrics, climate change resilience and adaptation needs of eco-efficient agriculture in sub-Saharan Africa.

Status: Incomplete. Activity ongoing as planned.

Gender component:

Agronomic assessments have always a gender component. (Simply because male and female household members traditionally have different responsibilities which must be taken into consideration.) Climate change related issues - changes in agricultural management, etc. - will inevitably affect different farm household members differently, depending on their specific engagement (such as, e.g. in Ethiopia: plowing is a men's job, weeding rather a women's job). If e.g. one of the eco-efficient pathways include adoption of Conservation Ag. (zero tillage) this will effect both genders differently. This must be taken into consideration, to address the notion of eco-efficiency in its entirety (including the social domain).

Deliverables:

- Preliminary set of metrics developed.

A set of preliminary metrics have been developed. The respective brief description has been sent to Peter Laderach, hoping that he could upload it for us, as we do not have access to the FTP-server.

- Development of comprehensive eco-efficiency metrics.

To be submitted end of 2014.

- Case study report.

To be submitted end of 2014.

- Peer-reviewed manuscript aimed for Agriculture, Ecosystem and Environment.

To be submitted end of 2014.

- Presentation at ASA-CSSA-SSSA Annual Meetings 2013 Tampa, Florida.

This has been postponed. A presentation on the topic will be given at the 20th WCSS in Korea in June. (Paper accepted.)

- Policy briefs.

Due at the end of 2015.

Partners:

SARI

Locations:

East Africa (EA)

Activity 658-2013 (Milestone 3.3.1 2013.)

Title: Testing the potential of tropical forage options to mitigate climate change through reducing nitrous oxide and methane emissions and enhancing carbon sequestration.

Status: Partially complete. CIAT led a multi-institutional effort including a wide range of partners from both developed and developing countries to present two keynote papers at the International Grassland Congress (IGC) with synthesis of results on the testing and potential of forage options to mitigate climate change. The first one was on the challenges and opportunities for improving eco-efficiency of tropical forage-based systems to mitigate greenhouse gas emissions. The second was on nitrogen management in grasslands and forage-based production systems highlighting the role of biological nitrification inhibition (BNI). In addition three poster papers were presented at IGC summarizing research progress in testing the potential of BNI from Brachiaria pasture in improving nitrogen recovery and grain yield of subsequent maize crop.

Gender component:

Field work and analysis of information on C sequestration were partially done by Ms. Paola Pardo, as part of her BS Thesis. Dr. Aracely Castro participated in the BNI study and led the work on C sequestration.

Deliverables:

- Quantitative differences among pasture systems / management on carbon sequestration and biological nitrification inhibition.

Quantitative differences among pasture systems in accumulation of soil carbon were found in nine farms sampled between Puerto Lopez and Carimagua in the Llanos of Colombia. Soil carbon accumulation was greater in pastures that received maintenance fertilizer (129.5 Mg ha⁻¹ vs 99.8 Mg ha⁻¹ without fertilizer). It appeared that the extent of soil carbon accumulation may also be related to the amount of rainfall during the rainy season with greater accumulation in higher rainfall areas (116 Mg ha⁻¹ vs 94 Mg ha⁻¹ in adequate rainfall areas). The extent of Biological Nitrification Inhibition (BNI) was quantified in a long-term (> 10 years-old) Brachiaria humidicola pasture compared to cropped area and native savanna vegetation. The BNI activity was greater in the long-term pasture and this resulted in greater recovery of nitrogen and grain yield by the subsequent maize crop.

- Progress report; Presentation at an international workshop.

Peters, M., Herrero, M., Fisher, M., Erb, K.-H., Rao, I., Subbarao, G. V, Castro, A., Arango, J., Chara, J., Murgueitio, E., van der Hoek, R., Laderach, P., Hyman, G., Tapasco, J., Strassburg, B., Paul, B.K., Rincon, A., Schultze-Kraft, R., Fonte, S., Searchinger, T. 2014. Challenges and opportunities for improving eco-efficiency of tropical forage-based systems to mitigate greenhouse gas emissions. *Tropical Grasslands – Forrajes Tropicales* 1: 156-167.

Subbarao, G. V., I.M. Rao, K. Nakahara, Y. Ando, K.L. Sahrawat, T. Tsehaye, J.C. Lata, S. Boudsocq, J.W. Miles, M. Ishitani and M. Peters. 2014. Nitrogen management in grasslands and forage-based production systems – Role of biological nitrification inhibition (BNI). *Tropical Grasslands – Pasturas Tropicales* 1: 168-174.

Peters, M., I. Rao, M. Fisher, G. Subbarao, S. Martens, M. Herrero, R. van der Hoek, R. Schultze-Kraft, J. Miles, A. Castro, S. Graefe, T. Tiemann, M. Ayarza and G. Hyman. 2013. Tropical forage-based systems to mitigate greenhouse gas emissions. In: C. H. Hershey and P. Neate (Eds.) *Eco-Efficiency: From Vision to Reality*. CIAT, Cali, Colombia, pp. 171-190.

Peters, M., Herrero, M., Fisher, M., Erb, K.-H., Rao, I., Subbarao, G. V, Castro, A., Arango, J., Chara, J., Murgueitio, E., van der Hoek, R., Laderach, P., Hyman, G., Tapasco, J., Strassburg, B., Paul, B.K., Rincon, A., Schultze-Kraft, R., Fonte, S., Searchinger, T. 2013. Challenges and opportunities for improving eco-efficiency of tropical forage-based systems to mitigate greenhouse gas emissions. In *Proceedings of the 22nd International Grasslands Congress*. Sydney, Australia, pp. 1251-1260 (Keynote paper).

Subbarao, G. V., I.M. Rao, K. Nakahara, Y. Ando, K.L. Sahrawat, T. Tsehaye, J.C. Lata, S. Boudsocq, J.W. Miles, M. Ishitani and M. Peters. 2013. Nitrogen management in grasslands and forage-based production systems – Role of biological nitrification inhibition (BNI). In *Proceedings of the 22nd International Grasslands Congress*. Sydney, Australia, pp. 1468-1472 (Keynote paper).

Arango, J., D. Moreta, J. Nuñez, K. Hartmann, M. Dominguez, M. Ishitani, J. Miles, G. Subbarao, M. Peters and I. Rao. 2013. Developing methods to evaluate phenotypic variability in Biological Nitrification Inhibition (BNI) capacity of *Brachiaria* grasses. In *Proceedings of the 22nd International Grasslands Congress*. Sydney, Australia, pp. 1517-1519.

Rao, I., M. Ishitani, J. Miles, M. Peters, J. Tohme, J. Arango, D. E. Moreta, H. Lopez, A. Castro, R. van der Hoek, S. Martens, G. Hyman, J. Tapasco, J. Duitama, H. Suarez, G. Borrero, J. Núñez, K. Hartmann, M. Dominguez, M. Sotelo, D. Vergara, P. Lavelle, G. V. Subbarao, A. Rincon, C. Plazas, R. Mendoza, L. Rathjen and G. Cadisch. 2013. Climate-smart crop-livestock systems for smallholders in the tropics: Integration of new forage hybrids to intensify agriculture and to mitigate climate change through regulation of nitrification in soil. In *Proceedings of the 22nd International Grasslands Congress*. Sydney, Australia, pp. 1331-1332.

Moreta, D. E., J. Arango, M. Sotelo, D. Vergara, A. Rincón, M. Ishitani, A. Castro, J. Miles, M. Peters, J. Tohme, G. V. Subbarao and I. M. Rao. 2013. Biological nitrification inhibition (BNI) in *Brachiaria* pastures: A novel strategy to improve eco-efficiency of crop-livestock systems and to mitigate climate change. In *Proceedings of the 22nd International Grasslands Congress*. Sydney, Australia, pp. 980-981.

Partners:

CORPOICA; JIRCAS; Purdue University

Locations:

South Asia (SAs), Latin America (LAM)

Activity 659-2013 (Milestone 3.1.1 2013.)

Title: Trade-off analysis between mitigation, adaptation and farmers livelihoods in coffee systems.

Status: Incomplete. The trade-off analysis in Central America has been concluded, one paper is published and the second one in second revision. The activity will continue now through the joint project with IITA in EA on coffee and WA on cocoa.

Gender component:

In the BMZ project gender will be a integral part. We will design the survey and analysis in 2014

Deliverables:

- Trade-off analysis in carbon insetting project.

Paper published: <http://ccaafs.cgiar.org/blog/are-there-synergies-between-climate-change-adaptation-and-mitigation-coffee-production#.Uu0iaGSwLoA>

- Field work trade-off project on coffee and cocoa in Africa.

Due to a delayed approval of the project will the field work only start in April 2014

- Data analysis trade-off project coffee and cocoa in Africa.

2014

Partners:

IITA; CRS

Locations:

Latin America (LAM)

Activity 660-2013 (Milestone 4.2.1 2013 (2).)

Title: Downscaling of AR5 data with new emissions scenarios and provision of data to public.

Status: Partially complete. The CMIP5 downscaled data is fully available on the website for 4 RCPs, 4 future periods, 105 Global Climate Models (~25 GCM by scenario) and 5 climatological variables. See <http://www.ccaafs-climate.org/data> for more info.

Gender component:

Deliverables:

- Downscaled AR5 data partly available in the portal.

CMIP5 data fully downscaled and provided (as global files) in the portal. Tile-search feature remains to be done and will be completed in 2014.

- Downscaled AR5 data fully available in the portal.

CMIP5 data fully downscaled and provided (as global files) in the portal. Tile-search feature remains to be done and will be completed in 2014.

- Working paper or journal paper (TBD) on CCAFS climate databases.

A paper on Nature datasets was discussed with A. Jarvis and P. Thornton. To be developed and submitted during 2014. It is projected as follows: C. Navarro-Racines, J Ramírez-Villegas, A Jarvis, J Tarapues, P Thornton, P Jones.

Development and applications of a CMIP5-based future climate database for agricultural impact assessment.

- Draft paper on uncertainty in downscaling.

To be planned and developed.

- Paper on CMIP5 vs. CMIP3 model skill.

Paper published in Environmental Research Letters, see <http://iopscience.iop.org/1748-9326/8/2/024018>.

Citation as follows: Ramirez-Villegas, J, A J Challinor, P K Thornton, and A Jarvis. 2013. "Implications of Regional Improvement in Global Climate Models for Agricultural Impact Research." Environmental Research Letters 8 (2): 24018. <http://stacks.iop.org/1748-9326/8/i=2/a=024018>. The article assess 24 CMIP3 and 26 CMIP5 simulations of present climate against climate observations for five tropical regions (chosen due to their vulnerability to climate change), as well as regional improvements in model skill and, through literature review, the sensitivities of impact estimates to model error. Also, some implications of model errors for agricultural impact assessment was analyzed, and elucidate some options for using CMIP5 data into impact models.

Partners:

Waen Associates; CIP; ILRI; University of Leeds; IFPRI

Locations:

Global

Activity 661-2013 (Milestone 4.3.3 2013.)

Title: Calibration (and parameterisation when needed) of at least 3 process-based crop models (rice, cassava, beans) with regional varieties.

Status: Partially complete. The parametrization is being developed in Colombia and Brazil. Although we have had contact with colleagues from other countries and institutions (Chile, Uruguay), we have not establish a clear strategy to work together in the field data and calibration. For development and evaluation aspects in the cassava model, we have been in contact with people from Brazil, Ghana, Thailand, India, Venezuela and Australia (APSIM-CSIRO). We have invited them to be part of the cassava Crop Model Improvement Team (CMIT). CMIT will prepare a formal MoU for the people and institutions that are interested to be part of the CMIT Team and wish to provide data for testing or to evaluate or use the model.

Gender component:

Deliverables:

- Trial data collated.

The experimental data are still being collected in all the crops. The growth and development variables for the experiments in 2013 will be available in AgTrials (<http://www.agtrials.org/list>). Most of the trials are already there but we have to define a specific template to upload the information. Review the next links: <http://www.agtrials.org/tbtrial/16271> <http://www.agtrials.org/tbtrial/18224> <http://www.agtrials.org/tbtrial/18234> <http://www.agtrials.org/tbtrial/18239> <http://www.agtrials.org/tbtrial/18240> <http://www.agtrials.org/tbtrial/18241> <http://www.agtrials.org/tbtrial/20547> <http://www.agtrials.org/tbtrial/20548> <http://www.agtrials.org/tbtrial/16280> <http://www.agtrials.org/tbtrial/16283> <http://www.agtrials.org/tbtrial/16284> <http://www.agtrials.org/tbtrial/16285> <http://www.agtrials.org/tbtrial/16286> <http://www.agtrials.org/tbtrial/16287> <http://www.agtrials.org>

<http://www.agtrials.org/tbtrial/16288><http://www.agtrials.org/tbtrial/16290><http://www.agtrials.org/tbtrial/16291><http://www.agtrials.org/tbtrial/20546>

- Cassava module improved.

During 2013 the cassava Crop Model Improvement Team (CMIT) had 2 meetings to work in the improvement of the cassava model both DSSAT and APSIM. As result of the first meeting a separate module for cassava (without CROPSIM- wheat model) was created. The principal modifications were in the subroutines of leaf size (considering photothermal time), crop branching, and nitrogen distribution. The last meeting/workshop was on December to review data from different sources of cassava growth and evaluate the capacity of the CROPSIM-CASSAVA model to simulate cassava growth. It is necessary to evaluate the model with more datasets. A programme for data collection for the cassava model was created as result of the last meeting. Also as result of the last meeting was highlighted the necessity of create a consortium to work in the development of a module that simulates the energy balance of crops taking into account elevated CO₂ levels and variation of VPD; it is a real concern for all the people using mechanistic crop models to help us face climate change in agriculture. Review the next links: <http://dapa.ciat.cgiar.org/cassava-cmit><http://dapa.ciat.cgiar.org/ciat-actively-working-in-the-cassava-model-improvement><http://dapa.ciat.cgiar.org/wp-content/uploads/2013/05/Cassava-crop-model-improvement-team.pdf><http://dapa.ciat.cgiar.org/rethinking-a-cassava-crop-model/>

- Calibrated bean, rice and cassava models.

This deliverable has a relationship with the Activity 644-2013 and the work with EMBRAPA and TPE's project (Target Population environments). Then the files with the parameters for the varieties of rice and beans are also in the Activity 644-2013 (deliverable 3). Due to the current status of the cassava model, there is not calibration of the model (we are in a development phase). Brazil: (Totally calibrated) Curinga, Primavera and Dourado (these are upland varieties and the calibrations were carried out in collaboration with researchers from Embrapa Rice and beans). Colombia: (Partially calibrated) Fedearroz 733, IR64, CT21 (There has been a preliminary calibration of these varieties with experimental data collected at CIAT during December 2012 - May 2013, is expected to increase the number of varieties calibrated with experimental data from different growing regions of Colombia with new information that is being collected under the agreement (CIAT- MARD). There are not experimental data available for another's Latin American countries, that's why have not yet calibrated the model for new varieties. However, we started an important contact with researchers from INIA Uruguay who already have adequate experimental data to perform such calibrations.

- Draft paper on model calibration and evaluation for each crop.

This deliverable has a relationship with the Activity 644-2013 and the document "Ajuste de parámetros de cultivo proyecto MADR" (Deliverable 1). Although we have been in contact with partners from other countries working in crop modeling there are not experimental data available for another's Latin American countries and we have not evaluated the model in other countries.

- Workshop on rice modelling at IRRI.

During March 2013 was carried out a workshop on rice crop modeling at IRRI with the overall goal of familiarize with the basic functionalities and structure of the ORYZA2000 (V3) model, the minimum data requirement, experimental data collection for ORYZA2000 model evaluation, the calibration of parameters, and the use ORYZA2000 on your own dataset. The specific activities realized during the workshop were: • Know the processes of crop growth and development, water use, uptake of water, and nutrients and carbon dynamics can be

simulated. • Make extensive use of “hands on” sessions that apply the ORYZA2000 model to cropping systems in Colombia and Brazil regions of rice production. • Describe procedures for collecting and managing crop, experimental, weather, and soil data for model evaluation. • Work with experimental data collected in previous trials at CIAT, and determine the accuracy of the models for application to specific problems. • Analyze management alternatives for single seasons or over long-term crop rotations. • Know specific applications such as irrigation and nitrogen fertilizer management, assessment of impacts and adaptation and/or mitigation strategies of climate change, and prediction of rice production in various temporal and spatial scales. As the main results of this workshop, we can mention: Varieties from Colombia (Upland rice) and Brazil (Upland rice) calibrated with experimental data collected in each of these countries. For Colombia were partially calibrated the varieties IR64 and CT21, and for Brazil the varieties were Brazil Curinga and Primavera.

Partners:

IRRI; EMBRAPA; INIA; WSU; CSIRO; CMU; CSIR; UCV; CTCRI; UFSM; KKFCRC

Locations:

Latin America (LAM)

Activity 662-2013 (Milestone 4.3.3 2013.)

Title: Assessment of possible futures of tropical agriculture, alternative technologies/management systems, and policy interventions.

Status: Partially complete. The activity was carried out as part of the ongoing Global Futures project from the CRP2 PIM. First runs with IMPACT to analyze the impact of biological control technologies in SE Asia were done. The results were included in the Global Futures report for Phase I. In 2014, a new Phase II of GF started, and the impact caused by climate change will be analyzed utilizing IMPACT, as well as the effect of new technologies in Cassava and Beans production. This activity has received an increase in budget for the year 2014, as part of IFPRI's effort to support the GF project. The new activities, goals and deliverables will be updated in the plan for 2014.

Gender component:

Deliverables:

- Datasets containing socio-economic and biophysical indicators necessary for establishing a baseline for foresight projections.

The datafiles for the IMPACT model were reviewed and updated with relevant information to run the simulations for the technology analyzed

- Qualitative and quantitative analyses providing decision-support for policymakers and practitioners in setting priorities for policies and investments.

A draft paper has been produced and will be submitted in May 2014

- Data, scenario results and other important knowledge products generated from ex ante analyses in Cassava and Beans.

A report on ex ante surplus analysis for some Cassava technologies was submitted to CIP as part of the RTB CRP priority setting exercise. The team will work on beans in 2014.

- Reports, peer-reviewed articles, working papers and/or issue briefs highlighting key findings on agricultural futures and strategic priorities.

1 presentation on surplus analysis was done in Thailand, Nov 2013.1 draft is under revision to be submitted (see above)

- Improved integrated modeling framework developed and validated for impact assessment and priority setting in CIAT.

The new version of the IMPACT model has been programmed and is being used

Partners:

ICRISAT; CIP; CIMMYT; ILRI; IFPRI

Locations:

Global

2. Succinct summary of activities and deliverables by Output level

Output: 1.1.1

Summary:

The “Analogue tool” is ready with improvements in user friendliness. The new version is faster as it has been implemented in a new Linux server; soils data and new climate is being included (CMIP5).

Results of forage grass genotypes, which combine waterlogging tolerance with high forage yield and quality, are published in the open access journal, Tropical Grasslands - Forrajes Tropicales. Two *Brachiaria* hybrids and two germplasm accessions of *Brachiaria humidicola* with superior level of waterlogging tolerance were identified to improve adaptation to climate change. These results were also presented in two international conferences with a best poster award at ISPA conference.

Output: 1.1.2

Summary:

The CCAFS multi-site agricultural trial initiative is developing a user-friendlier interface, stronger links to the AgMIP initiative and the South Asia cereals initiative (CSISA). There are now nearly 35,000 trials in the system and our goal is to move closer to 100,000 trials.

We integrated interdisciplinary tools and methods such as land and soil health, crop modeling, CCAFS baseline surveys and gender participatory data to better understand the socio-ecological landscape at the CCAFS benchmark sites in order to better understand constraints and opportunities for implementing improved land management strategies.

The evaluation of promising CIAT germplasm is being conducted in different regions in Colombia is testing multiple planting dates. Data corresponding to 2013 season has being collected and is being analyzed.

The partnership between CIAT and the University of Florida provides gender expertise to CIAT and CCAFS on an advisory basis and facilitates greater integration of gender research projects and proposals between CIAT and the UF.

Output: 1.1.3

Summary:

The ex situ conservation status of the closest wild relatives of 80 crop genepools (approx. 1000 species) was finished during 2013. All results (maps and suggested urgency for conservation category) are available at: www.cwrdiversity.org/distribution-map/. Publications summarizing all results, and individual cases (i.e. tomato, eggplant, potato, rice, sunflower, carrot and lettuce) are being submitted.

Output: 1.2.1**Summary:**

Evidence has been collected in several sites in East Africa and one site in Colombia to develop guidelines for collecting data and build an evidence base regarding gender and adaptation to climate change.

The CCAFS-Climate data portal has continuously been providing free-of-access data for research purposes. Various changes to the portal have been implemented during the course of 2013. In 2013, more than 14,000 people visited the CCAFS-Climate data portal. Twenty peer-reviewed publications cited its data, bringing the total sum of citations since 2009 to almost 90.

We developed data collection methods, conducted workshops and gathered field data to develop seasonal forecasting models using crop models such as AQUACROP, ORYZA, DSSAT (CERES, IXIM, CROPGRO) for rice, cassava, beans, maize and potato at a regional scale.

We estimated CC impacts on 15 most relevant crops in the Andean region comparing crop adaptability with current climate conditions vs CC scenarios. Water balance changes have been estimated for nine Andean basins. A vulnerability index was built for municipal level using information about CC scenarios, crop modeling results and socioeconomic indicators.

Output: 1.3.1**Summary:**

Based on the scientific review of water, food, energy, and health security, as well as through an engagement process with policymakers across the Amazon countries, science based policy recommendations were reported to a senior advisory panel of the Amazon countries.

Output: 1.3.2**Summary:**

We modeled pasture production under present weather conditions and CC scenarios, and estimated CC impact on milk and meat production. SWAT model were used to run three basins and estimate CC impact on water balance and impact on hydro-energy and agricultural production. CC impact on biodiversity and ecosystem services have been estimated using ecological models.

Output: 2.3.1**Summary:**

A tool for seasonal climate forecasts for agricultural crop and risk management is being developed, that will enhance our understanding of climate variability in Colombia and contribute to studies on vulnerability,

climate risk and adaptation to future climate variability and change.

Characterization of on-farm production systems of maize, rice, beans, avocado and plantain in Colombia were conducted to determine crop performance and better understand the relation of climate and climate variability on crop performance.

Output: 3.1.1

Summary:

Environmental benefits from silvo-pastoral system related to carbon balance, such as carbon in soils and biomass, and GHG emissions from soils and animals are being measured.

Carbon stocks in three prototypes of silvo-pastoral systems and three types of fruit trees in Colombia are being assessed.

Financial costs to reconvert degraded areas into fruit tree based agroforestry and sylvopastoral system in different regions in Colombia have been quantified. Benefits have been identified and quantified and CBA matrix established. The economic viability to reconvert degraded pasture to agroforestry and sylvopastoral systems has been assessed.

A set of preliminary metrics to assess climate change resilience and adaptation needs of eco-efficient agriculture in sub-Saharan Africa have been developed.

A paper on the trade-off analysis between mitigation, adaptation and farmers livelihoods in coffee systems in Nicaragua was published.

Output: 3.3.1

Summary:

CIAT led a multi-institutional effort including a wide range of partners from both developed and developing countries presented two keynote papers at the International Grassland Congress (IGC) with synthesis of results on the testing and potential of forage options to mitigate climate change.

Output: 4.2.1

Summary:

The CMIP5 downscaled data is fully available on the website for 4 RCPs, 4 future periods, 105 Global Climate Models (~25 GCM by scenario) and 5 climatological variables. See <http://www.ccafs-climate.org/data> for more info.

Output: 4.3.3

Summary:

The strategy to calibrate 3 process-based crop models for rice, cassava, beans including regional varieties is defined and the partnership established.

Assessment of possible futures of tropical agriculture, alternative technologies/management systems, and policy interventions using IMPACT are being conducted.

3. Publications

Publication #1

Type: Journal papers

CCAFS Themes: Theme 4.2

Citation: Asseng, S.; Ewert, F.; Rosenzweig, C.; Jones, J.W.; Hatfield, J.L.; Ruane, A.C.; Boote, K.J.; Thorburn, P.J.; Rötter, R.P.; Cammarano, D.; Brisson, N.; Basso, B.; Marthe, P.; Aggarwal, P.K.; Angulo, C.; Bertuzzi, P.; Biernath, C.; Challinor, A.J.; Doltra, J.; Gayler, S.; Goldberg, R.; Grant, R.; Heng, L.; Hooker, J.; Hunt, L.A.; Ingwersen, J.; Izaurralde, R.C.; Kersebaum, K.C.; Müller, C.; Naresh Kumar, S.; Nendel, C.; O'Leary, G.; Olesen, J.E.; Osborne, T.M.; Palosuo, T.; Priesack, E.; Ripoche, D.; Semenov, M.A.; Shcherbak, I.; Steduto, P.; Stöckle, C.; Stratonovitch, P.; Streck, T.; Supit, I.; Tao, F.; Travasso, M.; Waha, K.; Wallach, D.; White, J.W.; Williams, J.R.; Wolf, J. 2013. Uncertainty in simulating wheat yields under climate change. *Nature Climate Change* 3: 827-832

Publication #2

Type: Journal papers

CCAFS Themes: Theme 1, Theme 4.3

Citation: Campbell, B.; Kinyangi, J.; Nersisyan, A.; Leigh, R. A.; Dibb-Leigh, J. A.; Zougmore, R. B.; Seré, C.; Aggarwal, P.; Hoefner, F. 2013. Perspectives: Legislating change. *Nature* 501 (7468): S12-S14.

Publication #3

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Cardoso, J. A., J. Jiménez, J. Rincón, E. Guevara, R. van der Hoek, A. Jarvis, M. Peters, J. Miles, M. Ayarza, S. Cajas, A. Rincón, H. Mateus, J. Quiceno, W. Barragán, C. Lascano, P. Argel, M. Mena, L. Hertentains and I. Rao. 2014. Advances in improving tolerance to waterlogging in *Brachiaria* grasses. *Tropical Grasslands – Forrajes Tropicales* 1: 197-201

Publication #4

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Cardoso, J. A., Jimenez, J. Rincon, D. Noguera, I. M. Rao. 2013. Morpho-anatomical adaptations to waterlogging by germplasm accessions in a tropical forage grass. *AoB PLANTS* 5:1-14 plt047

Publication #5

Type: Journal papers

CCAFS Themes: Theme 4.2

Citation: Challinor, A; Stafford S, M; Thornton, P. 2013. Use of agro-climate ensembles for quantifying uncertainty and informing adaptation. *Agricultural and Forest Meteorology* 170: 2-7.

Publication #6

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Cortés, AJ., Monserrate, FA., Ramírez-Villegas, J., Madriñan, S., Blair, MW. 2013. Drought Tolerance in Wild Plant Populations: The Case of Common Beans (*Phaseolus vulgaris* L.). *Plos One* 8(4): e62898.

Publication #7

Type: Journal papers

CCAFS Themes: Theme 4.2

Citation: Eitzinger, A., Läderach, P., Gordon, J, Benedikter, B., Quiroga, A., Pantoja, A, Bruni, M. 2013. Crop suitability and climate change in Jamaica: Impacts on farmers and the supply chain to the hotel industry. *Caribbean Geography* 2013 18 (1&2).

Publication #8

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Khoury, C., Greene, S., Wiersema, J., Maxted, N., Jarvis, A., Struik, PC. 2013. An Inventory of Crop Wild Relatives of the United States. *Crop Science* vol. 53:1-13

Publication #9

Type: Journal papers

CCAFS Themes: Theme 1, Theme 4.2

Citation: Läderach, P., Martinez-Valle, A., Schroth, G., Castro, N. 2013. Predicting the future climatic suitability for cocoa farming of the world's leading producer countries, Ghana and Côte d'Ivoire. *Climate Change* 119:841–854.

Publication #10

Type: Journal papers

CCAFS Themes: Theme 1, Theme 4.2

Citation: Leibing, C., Signer, J., van Zonneveld, M., Jarvis, A., Dvorak, W. 2013. Selection of Provenances to Adapt Tropical Pine Forestry to Climate Change on the Basis of Climate Analogs. *Forests*. Vol. 4(1):155-178

Publication #11

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Neufeldt, H., Jahn, M., Campbell, B.M., Beddington J.R., DeClerck, F., De Pinto, A., Gullledge, J., Hellin, J., Herrero, M., Jarvis, A., LeZaks, D., Meinke, H., Rosenstock, T., Scholes, M., Scholes, R., Vermeulen, S., Wollenberg, E., Zougmore, R. 2013. Beyond climate-smart agriculture: toward safe operating spaces for global food systems. *Agriculture & Food Security* 2013, 2:12

Publication #12

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Peters, M., Herrero, M., Fisher, M., Erb, K.-H., Rao, I., Subbarao, G. V, Castro, A., Arango, J., Chara, J., Murgueitio, E., van der Hoek, R., Laderach, P., Hyman, G., Tapasco, J., Strassburg, B., Paul, B.K., Rincon, A., Schultze-Kraft, R., Fonte, S., Searchinger, T. 2014. Challenges and opportunities for improving eco-efficiency of tropical forage-based systems to mitigate greenhouse gas emissions. *Tropical Grasslands – Forrajes Tropicales* 1: 156-167

Publication #13

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Rahn, E., Läderach, P., Baca, M., Cressy, Ch., Schroth, G., Malin, D., van Rikxoort, H., Shriver, J. 2013. Climate change adaptation, mitigation and livelihood benefits in coffee production: where are the synergies?. *Mitigation and Adaptation Strategies for Global Change*.

Publication #14

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Porch, Timothy G.; Beaver, James S.; Debouck, Daniel G.; Jackson, Scott A.; Kelly, James D.; Dempewolf, Hannes. 2013. Use of wild relatives and closely related species to adapt common bean to climate

change . Agronomy 3: 433-461

Publication #15

Type: Journal papers

CCAFS Themes: Theme 4.2

Citation: Ramírez-Villegas, J., Challinor, A.J., Thornton, P.K., Jarvis, A. 2013. Implications of regional improvement in global climate models for agricultural impact research. Environmental Research Letters (2013) 024018 (12pp).

Publication #16

Type: Journal papers

CCAFS Themes: Theme 4.2

Citation: Ramírez Villegas, Julián; Jarvis, Andrew; Laderach, Peter. 2013. Empirical approaches for assessing impacts of climate change on agriculture: the EcoCrop model and a case study with grain sorghum. Agricultural and Forest Meteorology 170: 67-78.

Publication #17

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Ramírez-Villegas, J., Khoury, C. 2013. Reconciling approaches to climate change adaptation for Colombian agriculture. Climatic Change. 119(3-4): 575-583

Publication #18

Type: Journal papers

CCAFS Themes: Theme 3

Citation: Subbarao, G. V., I.M. Rao, K. Nakahara, Y. Ando, K.L. Sahrawat, T. Tsehay, J.C. Lata, S. Boudsocq, J.W. Miles, M. Ishitani and M. Peters. 2014. Nitrogen management in grasslands and forage-based production systems – Role of biological nitrification inhibition (BNI). Tropical Grasslands – Pasturas Tropicales 1: 168-174

Publication #19

Type: Journal papers

CCAFS Themes: Theme 4.2

Citation: Vagen, Tor-Gunnar; Winowiecki, Leigh A.. 2013. Mapping of soil organic carbon stocks for spatially explicit assessments of climate change mitigation potential. Environmental Research Letters 8 (1): 1-9.

Publication #20

Type: Journal papers

CCAFS Themes: Theme 1, Theme 4.2

Citation: Vermeulen, S.J., Challinor, A.J., Thornton, P.K., Campbel, B.M. Eriyagama, N., Vervoort, J.M., Kinyangi, J., Jarvis, A., Läderach, P., Ramírez-Villegas, J., Nicklin, K.J., Hawkins, Ed, Smith, D.R. 2013. Addressing uncertainty in adaptation planning for agriculture. Proceeding of National Academy of sciences of the United States of America Vol. 110 (21).

Publication #21

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Warren, R., VanDerWal, J., Price, J., Welbergen, J.A., Atkinson, I., Ramirez-Villegas, J., Osborn, T. J., Jarvis, A. Shoo, L.P., Williams, S.E., and Lowe, J. 2013. Quantifying the benefit of early climate change mitigation in avoiding biodiversity loss. Nature Climate Change. ISSN: 1758-678X EISSN: 1758-6798 DOI: 10.1038/NCLIMATE1887

Publication #22

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Cock, Matthew.J.W.; Biesmeijer, Jacobus C.; Cannon, Raymond J.C.; Gerard, Philippa J.; Gillespie, Dave; Jiménez, Juan J.; Lavelle, Patrick M.; Raina, Suresh K.. 2013. The implications of climate change for positive contributions of invertebrates to world agriculture. CAB Reviews 8 (028): 1-48

Publication #22

Type: Journal papers

CCAFS Themes: Theme 1, Theme 4.2

Citation: Lubbers, Ingrid M.; Groenigen, Kees Jan Van; Fonte, Steven J.; Six, Johan; Brussaard, Lijbert; Groenigen, Jan Willem van. 2013. Greenhouse-gas emissions from soils increased by earthworms . Nature Climate Change 3: 187-194.

Publication #23

Type: Book chapters

CCAFS Themes: Theme 1, Theme 4.2

Citation: Berry, P., Ramirez-Villegas, J., Bramley, H., Mgonja, M., and Mohanty, S. 2013. Regional Impacts of Climate Change and the role of Adaptation. In: Jackson, M., Ford- Lloyd, B., Parry, M. (Eds.) Plant

Genetic Resources and Climate Change. CABI publishing. ISBN:978-1-78064-197-3

Publication #24

Type: Book chapters

CCAFS Themes: Theme 1, Theme 4.2

Citation: Glenn, M., Kim, S. H., Ramirez-Villegas, J., Läderach, P. 2013. Response of Perennial Horticultural Crops to Climate Change. Chapter 2 in: Horticultural Reviews, Vol. 41. Wiley-Blackwell.

Publication #25

Type: Book chapters

CCAFS Themes: Theme 3

Citation: Peters, M., I. Rao, M. Fisher, G. Subbarao, S. Martens, M. Herrero, R. van der Hoek, R. Schultze-Kraft, J. Miles, A. Castro, S. Graefe, T. Tiemann, M. Ayarza and G. Hyman. 2013. Tropical forage-based systems to mitigate greenhouse gas emissions. In: C. H. Hershey and P. Neate (Eds.) Eco-Efficiency: From Vision to Reality. CIAT, Cali, Colombia, pp. 171-190.

Publication #26

Type: Conference proceedings

CCAFS Themes: Theme 3

Citation: Arango, J., D. Moreta, J. Nuñez, K. Hartmann, M. Dominguez, M. Ishitani, J. Miles, G. Subbarao, M. Peters and I. Rao. 2013. Developing methods to evaluate phenotypic variability in Biological Nitrification Inhibition (BNI) capacity of Brachiaria grasses. In Proceedings of the 22nd International Grasslands Congress. Sydney, Australia, pp. 1517-1519.

Publication #27

Type: Conference proceedings

CCAFS Themes: Theme 1

Citation: Cardoso, J. A., J. Jiménez, J. Rincón, E. Guevara, R. van der Hoek, A. Jarvis, M. Peters, J. Miles, M. Ayarza, S. Cajas, A. Rincón, H. Mateus, J. Quiceno, W. Barragán, C. Lascano, P. Argel, M. Mena, L. Hertentains and I. Rao. 2013. Advances in improving tolerance to waterlogging in Brachiaria grasses. In Proceedings of the 22nd International Grasslands Congress. Sydney, Australia, pp. 118-121.

Publication #28

Type: Conference proceedings

CCAFS Themes: Theme 3

Citation: Moreta, D. E., J. Arango, M. Sotelo, D. Vergara, A. Rincón, M. Ishitani, A. Castro, J. Miles, M. Peters, J. Tohme, G. V. Subbarao and I. M. Rao. 2013. Biological nitrification inhibition (BNI) in Brachiaria pastures: A novel strategy to improve eco-efficiency of crop-livestock systems and to mitigate climate change. In Proceedings of the 22nd International Grasslands Congress. Sydney, Australia, pp. 980-981.

Publication #29

Type: Conference proceedings

CCAFS Themes: Theme 3

Citation: Peters, M., Herrero, M., Fisher, M., Erb, K.-H., Rao, I., Subbarao, G. V., Castro, A., Arango, J., Chara, J., Murgueitio, E., van der Hoek, R., Laderach, P., Hyman, G., Tapasco, J., Strassburg, B., Paul, B.K., Rincon, A., Schultze-Kraft, R., Fonte, S., Searchinger, T. 2013. Challenges and opportunities for improving eco-efficiency of tropical forage-based systems to mitigate greenhouse gas emissions. In Proceedings of the 22nd International Grasslands Congress. Sydney, Australia, pp. 1251-1260 (Keynote paper).

Publication #30

Type: Conference proceedings

CCAFS Themes: Theme 3

Citation: Rao, I., M. Ishitani, J. Miles, M. Peters, J. Tohme, J. Arango, D. E. Moreta, H. Lopez, A. Castro, R. van der Hoek, S. Martens, G. Hyman, J. Tapasco, J. Duitama, H. Suarez, G. Borrero, J. Núñez, K. Hartmann, M. Dominguez, M. Sotelo, D. Vergara, P. Lavelle, G. V. Subbarao, A. Rincon, C. Plazas, R. Mendoza, L. Rathjen and G. Cadisch. 2013. Climate-smart crop-livestock systems for smallholders in the tropics: Integration of new forage hybrids to intensify agriculture and to mitigate climate change through regulation of nitrification in soil. In Proceedings of the 22nd International Grasslands Congress. Sydney, Australia, pp. 1331-1332.

Publication #31

Type: Conference proceedings

CCAFS Themes: Theme 3

Citation: Subbarao, G. V., I.M. Rao, K. Nakahara, Y. Ando, K.L. Sahrawat, T. Tsehay, J.C. Lata, S. Boudsocq, J.W. Miles, M. Ishitani and M. Peters. 2013. Nitrogen management in grasslands and forage-based production systems – Role of biological nitrification inhibition (BNI). In Proceedings of the 22nd International Grasslands Congress. Sydney, Australia, pp. 1468-1472 (Keynote paper).

Publication #32

Type: Other

CCAFS Themes: Theme 1

Citation: Jiménez, J. C., J. A. Cardoso, G. Fischer and I. M. Rao. 2013. Increased aerenchyma formation and exodermal suberin deposition in nodal roots of *Brachiaria humidicola* contribute to high level of waterlogging tolerance. Paper (poster) presented at the 11th Conference of the International Society for Plant Anaerobiosis. Oct 6 – 11. IRRI, Los baños, Laguna, Philippines.

Publication #33

Type: Other

CCAFS Themes: Theme 1

Citation: Jiménez, J. C., J. A. Cardoso, G. Fischer and I. M. Rao. 2013. Leaf antioxidant activity and changes in leaf pigments in two contrasting *Brachiaria* grasses in response to waterlogging. Paper (poster) presented at the 11th Conference of the International Society for Plant Anaerobiosis. Oct 6 – 11. IRRI, Los baños, Laguna, Philippines. (Received Best poster paper award).

Publication #34

Type: Other

CCAFS Themes: Theme 1

Citation: Cardoso, J. A., J. C. Jiménez, J. Rincon, J. Miles and I. M. Rao. 2013. Advances in identification of morpho-physiological traits associated with waterlogging tolerance in *Brachiaria* genotypes. Paper (oral) presented at the 11th Conference of the International Society for Plant Anaerobiosis. Oct 6 – 11. IRRI, Los baños, Laguna, Philippines.

Publication #35

Type: Other

CCAFS Themes: Theme 1

Citation: Acosta Francés, Mariola. 2013. Consideraciones de género en la Agricultura y en la Implementación y Mantenimiento de Prácticas Climáticamente Inteligentes: un Caso de Estudio en el Departamento del Cauca, Colombia. Tesis de Máster de Ciencias AgrisMundus. Universidad de Copenhague, Dinamarca.; Universidad de Montpellier SupAgro, Francia., Cali, CO. 83 p

Publication #36

Type: Other

CCAFS Themes: Theme 1

Citation: Cardoso, Juan Andres. 2013. Morpho-physiological mechanisms of adaptation to waterlogged soils in Brachiaria spp. PhD Thesis. University of Granada, Spain.

Publication #37

Type: Other

CCAFS Themes: Theme 1

Citation: Mardas, N., Bellfield, H., Jarvis, A., Navarrete, C., Comberty, C. 2013. Amazonia Security Agenda: Summary of Findings and Initial Recommendations. Global Canopy Programme y International Center for Tropical Agriculture

Publication #38

Type: Working papers

CCAFS Themes: Theme 1, Theme 4.3

Citation: Sova, Chase; Helfgott, Ariella; Chaudhury, Abrar. 2013. Multilevel stakeholder influence mapping in climate change adaptation regimes . CGIAR Research program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, DK. 52 p. (Working document No. 46)

Publication #39

Type: Working papers

CCAFS Themes: Theme 1, Theme 4.3

Citation: Sova, Chase; Chaudhury, Abrar. 2013. State of agricultural climate change adaptation policy in Nepal. CGIAR Research program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, DK. 64 p. (Working document No. 44)

Publication #40

Type: Journal papers

CCAFS Themes: Theme 3

Citation: Subbarao GV; Rao IM; Nakahara K; Sahrawat KL; Hash CT; Ando Y; Kawashima T. 2013. Potential for biological nitrification inhibition (BNI) to reduce nitrification and N₂O emissions from pasture-crop-livestock systems. Animal 7 Suppl 2:322–32

Publication #41

Type: Journal papers

CCAFS Themes: Theme 3

Citation: Subbarao GV; Sahrawat KL; Nakahara K; Rao IM; Ishitani M; Hash CT; Kishi M; Bonnett D; Berry W; Lata JC. 2013. A paradigm shift towards low-nitrifying agricultural systems – Role of biological nitrification inhibition (BNI). *Annals of Botany* 112:297–316.

Publication #42

Type: Book chapters

CCAFS Themes: Theme 1

Citation: Rao, I. M. 2013. Advances in improving adaptation of common bean and *Brachiaria* forage grasses to abiotic stress in the tropics. In: M. Pessarakli (ed). *Handbook of Plant and Crop Physiology*, pp. 847-889. CRC Press, Taylor and Francis Group, USA

Publication #43

Type: Conference proceedings

CCAFS Themes: Theme 1

Citation: Cardoso JA; Jiménez J; Rincón J; Rao I. 2013. Adaptive responses of *Brachiaria* grasses to hypoxia stress. *Proceedings of the 22nd International Grasslands Congress*, 15–19 sept 2013, Sydney, Australia. p. 137.

Publication #44

Type: Conference proceedings

CCAFS Themes: Theme 1, Theme 3

Citation: Peters M; Rao I; Castro A; Hyman G; Miles J; Arango J; Moreta D; Rincón A; Baquero JE; Guimaraes E. 2013. Potencial de los forrajes tropicales para la mitigación de emisiones de gases de efecto invernadero. Invited paper presented at Taller Internacional: Hacia una Política Nacional de Ganadería Agroclimáticamente Sostenible. 23 al 25 de Octubre de 2013, Bogotá, Colombia

Publication #45

Type: Conference proceedings

CCAFS Themes: Theme 1, Theme 3

Citation: Rao IM; Peters M; Castro A; Fisher M; Miles J; Schultze-Kraft R; Tapasco J; Hyman G; Bolliger A; Paul BK; van der Hoek R; Maass BL; Tiemann T; Cuchillo M; Arango J; Cook S; White D; Guimaraes E; Tohme J; Blummel M; Douchamps S; Rincón A; Bungenstab DJ; Villanueva C; Subbarao GV; Rudel T; Searchinger T. 2013. *LivestockPlus: Sustainable intensification of tropical forage-based systems for improving livelihood and*

environmental benefits. Invited paper presented at the International Workshop on Pastures, Climate Change and Sustainable Intensification. 28–29 May 2013, CIAT, Colombia

Publication #46

Type: Conference proceedings

CCAFS Themes: Theme 3

Citation: Moreta DE; Arango J; Sotelo M; Vergara D; Rincón A; Ishitani M; Castro A; Miles J; Peters M; Tohme J; Subbarao GV; Cadisch G; Rao IM. 2013. Using Biological Nitrification Inhibition as a Strategy to Improve Nitrogen Recovery and Nitrogen Use Efficiency of Agricultural Systems and to Mitigate Climate Change. Oral presentation at the 6th International Nitrogen Conference, November 18–22, 2013, Kampala, Uganda

Publication #47

Type: Conference proceedings

CCAFS Themes: Theme 1

Citation: Cardoso JA; Jiménez JC; Rincón J; Guevara E; Mena M; van der Hoek R; Jarvis A; Peters M; Miles J; Rao IM; Ayarza M; Cajas YS; Rincón A; Mateus H; Quiceno J; Barragán W; Lascano C; Argel P; Varela M; Hertentains L; de Gracia M. 2013. Genotipos de *Brachiaria* tolerantes a suelos inundados para adaptar sistemas de pastoreo a cambio climático. Oral presentation at VIII Taller de seguimiento proyectos Fontagro, Montevideo-Uruguay, July 23–25, 2013. p. 57–58.

Publication #48

Type: Conference proceedings

CCAFS Themes: Theme 3

Citation: Peters M; Wachholtz R; Castro A; Hyman G; Rao I; Arango J; Moreta D; Rincón A; Guimaraes E; Vaquero JE. 2013. Sustainable intensification (Forage) LivestockPlus. Paper (oral) presented at the Global Soils Week, Berlin, Germany.

4. Communications

Media campaigns:

Major news story promotion focusing on biological nitrogen inhibition, a property of certain *Brachiaria* grasses that enables them to suppress nitrous oxide emissions. Wire stories (e.g., from Kyodo and EFE) resulted in widespread coverage in Asian and Latin American media. Other major international coverage included stories in the Guardian (UK), Nature (UK), Reuters Alertnet (UK), and Climate Wire.

<http://www.theguardian.com/environment/2013/sep/17/grass-agriculture-emissions-scientists>
[http://www.nature.com/news/grass-gets-greener-1/13763](http://www.nature.com/news/grass-gets-greener-1.13763)

Suszkwi, J. 2014. National Inventory Takes Stock of Crops' Wild Relatives. USDA Agricultural Research. In press.

Braw, E. 2013. World food day: the search for sustainable crops. The Guardian. 16 October 2013. Available online at: <http://www.theguardian.com/sustainable-business/world-food-day-sustainable-crops>

Fisher, M. and Fisk, S. 2013. Protecting the weedy and wild kin of globally important crops. Press release for presentations given at the American Society of Agronomy (ASA), Crop Science Society of America (CSSA), and Soil Science Society of America (SSSA) International Annual Meetings, Nov. 3-6 in Tampa, Florida. Available online at: <https://www.crops.org/news-media/releases/2013/1001/604/>

Gewin, V. 2013. Weeds warrant urgent conservation. Nature News. 22 July 2013. doi:10.1038/nature.2013.13422. Available online at: <http://www.nature.com/news/weeds-warrant-urgent-conservation-1.13422>

Kew. 2013. Major global analysis offers hope for saving the wild side of staple food crops. Press release for global release of gap analysis results. 22 July 2013. Available online at: <http://www.kew.org/news/global-analysis-saving-the-wild-side-of-food-crops-.htm>

Gewin, V. 2013. US takes stock of valuable "weeds". Frontiers in Ecology and the Environment. Dispatches. The Ecological Society of America. Available online at: <http://www.esajournals.org/doi/pdf/10.1890/1540-9295-11.5.228>

Fisher, M. and Fisk, S. 2013. U.S. a surprisingly large reservoir of crop plant diversity. Press release for publication of Khoury. et al., 2013 An Inventory of Crop Wild Relatives of the United States. 29 April 2013. Available online at: <https://www.crops.org/news-media/releases/2013/0429/585/>

Fisher, M. 2012. Crop wild relatives and their potential for crop improvement. CSA News. May 2012, p. 4-10. Available online at: <https://www.agronomy.org/files/publications/csa-news/crop-wild-relatives.pdf>

Additional press releases available at: <http://tinyurl.com/my7cw4u>

Blogs:

Communications support for the new CCAFS regional program for Southeast Asia included six blog posts:

<http://www.ciatnews.cgiar.org/2013/12/14/why-markets-need-to-be-part-of-a-climate-smart-solution/>
<http://ccafs.cgiar.org/blog/climate-smart-road-map-global-rice-powerhouse#.UuqqaD1dX09>
<http://www.ciatnews.cgiar.org/2013/11/12/the-world-in-2050-on-the-front-line/>
<http://www.ciatnews.cgiar.org/2013/11/07/thinking-out-of-the-climate-box/>
<http://www.ciatnews.cgiar.org/2013/11/06/framing-the-bigger-picture-climate-change-in-se-asia/>
<http://www.ciatnews.cgiar.org/2013/10/31/decision-makers-debate-climate-threats-in-southeast-asia/>

Other CCAFS-related posts on CIAT's News Blog – mainly concerning the program's work in Latin America – included the following:

<http://www.ciatnews.cgiar.org/2013/09/25/idb-ciat-tackle-climate-change-vulnerability-grand-scale/>
<http://www.ciatnews.cgiar.org/2013/09/04/generating-climate-conscience-south-south-learning/>
<http://www.ciatnews.cgiar.org/2013/08/30/steadying-the-aim-crop-breeders-target-population-environments/>

<http://dapa.ciat.cgiar.org/?s=crop+wild+relatives>
<http://cwroftheus.wordpress.com/>
<http://www.cwrdiversity.org/category/news/>

Websites:

Link to CCAFS website and other details about the program featured in CIAT's new website.

<http://ciat.cgiar.org/climate-change>

www.cwrdiversity.org

Social media campaigns:

CCAFS-related blog posts promoted through Twitter and Facebook.

Newsletters:

Blogging, media outreach, and other communications support for two CCAFS meetings in Southeast Asia:

Scenarios for Future Food Security, Environments and Livelihoods in Southeast Asia, Hanoi, Vietnam
 Collaboration for Climate Change in Southeast Asia, Bangkok, Thailand

Navarrete-Frías C; Umaharan P; Debouck D; García S; Fuller C; Gibson N; Jarvis A; Castañeda-Álvarez N; Nowak A. 2012. Plant genetic resources: Foundations for a food-secure and climate-resilient future in the

Caribbean. CIAT Policy Brief No. 10. Centro Internacional de Agricultura Tropical (CIAT), Cali, Colombia. 6 p. Available online at: http://ciat.cgiar.org/wp-content/uploads/2013/04/policy_brief10_plant_genetic_resources.pdf

Events:

Bloggging, media outreach, and other communications support for two CCAFS meetings in Southeast Asia:

Scenarios for Future Food Security, Environments and Livelihoods in Southeast Asia, Hanoi, Vietnam
Collaboration for Climate Change in Southeast Asia, Bangkok, Thailand

Rieseberg L, Baute G, Renaut S, Khoury CK, and Dempewolf H (2014) “Ecological genomics and the development of environmentally resilient crops” Climate Change and ICRCGC 1 Workshop, Plant and Animal Genome XXII Conference, 11-15 January 2014, San Diego, USA.

Khoury CK, Castañeda Alvarez NP, Sosa CC, Achicanoy H, Bernau V, Castañeda A and Jarvis A (2014) “Global and National Perspectives on the Conservation of Crop Wild Relatives” Seminar, The Land Institute, 6 January 2014, Salina, USA.

Castañeda Alvarez NP, Khoury CK, Sosa CC, Achicanoy H, Bernau V, Castañeda A, and Jarvis A (2013) “Distributions and ex situ conservation concerns for crop wild relatives” Presentation to Universidade Federal de Lavras (UFLA) Brazil, 27 November 2013, Palmira, Colombia.

Castañeda Alvarez NP, Khoury CK, Sosa CC, Achicanoy H, Bernau V, Castañeda A, and Jarvis A (2013) “Distributions and ex situ conservation concerns for crop wild relatives” Presentation to Universidad Nacional de Colombia (UNAL), 25 November 2013, Palmira, Colombia.

Khoury CK, Castañeda Alvarez NP, Sosa CC, Achicanoy H, Bernau V, and Castañeda A, (2013) “Crop Wild Relatives: Global Gap Analysis” International Center for Tropical Agriculture (CIAT) Board Meeting, 18 November 2013, Palmira, Colombia.

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Castañeda Alvarez NP, Khoury CK, Sosa CC, Achicanoy H, Bernau V, Vincent H, Jarvis A, Struik PC, and Maxted N (2013). “A Global Perspective on Crop Wild Relatives: Distributions and Conservation Ex Situ” American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America Annual

International Meetings, 3-6 November 2013, Tampa, USA. Available online at: <https://dl.sciencesocieties.org/publications/meetings/2013am/11558> and <http://www.slideshare.net/CWRdiversity/a-global-perspective-on-cwr-asacssassa-tampa-2013?ref=http://cwroftheus.wordpress.com/category/news/>

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Khoury CK, Greene S, Castañeda Alvarez NP and Wiersema J (2012) "Toward a Strategy for Conservation of Crop Wild Relatives of the USA: Initial Results" United States Department of Agriculture, Agricultural Research Service, Plant Germplasm Operations Committee and Curators Annual Meeting, 4 June 2012, Spokane, USA. Available online at: <http://www.slideshare.net/CWRofUS/uscwrpresentationusda2012?ref=http://cwroftheus.wordpress.com/media-3/>

Castañeda N, Khoury C, Ramírez-Villegas J, Jarvis A, Vincent H, Maxted N, Eastwood R, Dempewolf H, and Guarino L (2011) "Una iniciativa para la conservacion de los parientes silvestres de los cultivos de mayor importancia global". Presentation, the Eighth International Symposium on Genetic Resources for Latin America and the Caribbean (SIRGEALC), 21-23 November, 2011, Quito, Ecuador.

Khoury CK (2011) "The Ecogeographic Distribution of Crop Wild Relatives: Implications for Conservation and Use: Initial Steps" Wageningen University Spatial Methods Group , 2 November 2011, Wageningen, The Netherlands. Available online at: <http://www.slideshare.net/CWRofUS/cwr-global-and-us-presentation-wag-2011?ref=http://cwroftheus.wordpress.com/media-3/>

Khoury C, Castañeda Alvarez NP, Vincent H, Jarvis A, Maxted N, Eastwood R, Ramírez-Villegas J, and Guarino L (2011) "Planning for Collecting the Crop Wild Relatives of the World's Major Crops" Botany 2011, 9-13 July 2011, Saint Louis, USA. Available online at: <http://www.slideshare.net/CWRdiversity/cwr-project-poster-botany-2011-11516015>

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Khoury CK (2011) "Toward a National Strategy for the Conservation of Crop Wild Relatives: Priority Genepools and Taxa" United States Department of Agriculture, Agricultural Research Service, Plant Germplasm Operations Committee Annual Meeting, 22 June 2011, Beltsville, USA. Available online at: <http://www.slideshare.net/CWRofUS/cwr-us-presentation-pgoc-2011?ref=http://cwroftheus.wordpress.com/media-3/>

Khoury CK (2011) "The Global Crop Diversity Trust: Adapting Agriculture to Climate Change- Collecting, Protecting and Preparing Crop Wild Relatives" United States Department of Agriculture, Agricultural Research Service, Plant Germplasm Operations Committee Annual Meeting, 21 June 2011, Beltsville, USA.

Castañeda N, Jarvis A, Ramírez-Villegas J (2011) "Nuestros tomates silvestres: ¿cuáles son y dónde buscarlos?" Presentation, Taller Internacional: El tomate silvestre en el mejoramiento genético de especies cultivadas frente al cambio climático, 12 May 2011, Chile.

Ramírez-Villegas J, Jarvis A, Debouck DG, Khoury C, Guarino L and Castañeda N (2010) "How Well Do We Preserve Agricultural biodiversity?: Gap Analysis and the Phaseolus Case Study" Centro Internacional de Agricultura Tropical (CIAT) 5th Scientific Poster Exhibit, 6-8 May 2010, Palmira, Colombia.

Videos and other multimedia:

Crop wild relatives' global atlas tutorial: <https://www.youtube.com/watch?v=O6JHveohPrk>

A CCAFS-branded video about CIAT's work on climate change with Colombia's Ministry of Agriculture and Rural Development

http://www.youtube.com/watch?v=5_BgooveTdY

Other communications and outreach:

CCAFS and its research prominently featured in CIAT corporate publications, particularly the Annual Report 2013-2013:

http://ciat.cgiar.org/wp-content/uploads/2013/04/annual_report_2012.pdf

Assisted in the recruitment of a communicator for the new CCAFS Latin America Program and laid the groundwork for active collaboration in 2014.

Infographic: <http://www.slideshare.net/CWRdiversity/cwr-infographic-final>

5. Case studies

Case Study #1

Title: Fostering data recording and the use of ICTs in Colombia by fruit growers enrolled in a Site-Specific Agriculture (SSA) information system to enhance adaptation to climate change

Author: Delerce Sylvain - Daniel Jiménez

Type: Capacity enhancement

Project description:

Reliable technical information on crop management is a key input for farmers to make the most appropriate decisions on their agricultural systems. In some cases this information can be scarce due to the lack of research, as it is the case for the Colombian fruit sector. In other cases, the problem is due to the fact that smallholders can't afford the services of private advisers. The Site-Specific Agriculture Sharing Experiences project seeks to generate climate-specific technical information on crop management based on the analysis of farmers' experiences, and to make it freely available. The idea behind the project is that by sharing their personal experiences, farmers can significantly speed up the adaptation of their agricultural systems, bridge the yield gap and adapt to climate variability and progressive climate change. In this process, it is vital to get final users actively involved in all steps. Indeed, the whole methodology aims at empowering farmers, helping them to generate and use the best information to make better decisions.

Introduction / objectives:

Site-specific agriculture (SSA) in this context is based on the principle of making better decisions by sharing data across many farms crops and climate zones to understand what practices work best where under what management and climate. The SSA approach supports in optimizing farm resources to attain higher yields but also to adapt to climate change through smarter advisory services.

Project results:

A user-friendly web application designed in collaboration with final users enables farmers to easily capture data on climate, soil and management on their farms. Comparative analyses generate site-specific technical information based on the data uploaded by the users. Farmers can consult personalized reports that help them making better decisions. Through a campaign of more than 40 fields workshops across Colombia, Fruit growers were trained in methodologies for capturing soil data such as using RASTA (Rapid Soil and Terrain Assessment) and on how to interpret the reports generated by the project. 4000 fields were registered in the system and from the 2800 users, about 500 directly use the web platform. In addition to farmers, several planning agencies used the maps and reports generated by the system to target studies and/or investments (for example in the Valle del Cauca to plan new plantations, or in the design of a NAMA in a CIAT-Colombian ministry of agriculture partnership). The success in the fruit sector is now being transferred to the rice and maize sector.

Partners:

The Colombian association for fruits and vegetables (ASOHOFRUCOL) (donor), Fondo nacional Hortifruticola (donor), Haute Ecole d'Ingénierie et de Gestion du canton de Vaud (HEIG-VD) (support in the analysis), Farmer Field School project

Links/sources for further information:

<http://www.frutisitio.org/>

Case Study #2

Title: In search of wild plants that can make agriculture climate smart

Author: Colin Khoury

Type: Successful communications, Policy engagement

Project description:

Global efforts to adapt staple foods like rice, wheat, and potato to climate change have been given a major boost by new research that reveals the details and whereabouts of their “wild relatives” – their undomesticated distant cousins that could contain genetic secrets to making food crops more productive and resilient. Some of these wild and weedy species have evolved to tolerate drought, higher temperatures, or pest and disease outbreaks, all of which are expected to become more frequent as a result of climate change. But according to the research carried out by CIAT together with the UK’s University of Birmingham, as part of a project led by Kew’s Millennium Seed Bank and the Global Crop Diversity Trust, close to three quarters of these plants are in serious need of collecting for conservation in the world’s seedbanks, meaning scientists are currently missing out on significant opportunities to breed more productive, climate-smart crops.

Introduction / objectives:

Climate change in combination with water, arable land and other resource limitations and soil degradation, combine to form a perfect storm threatening agricultural productivity globally. In many regions it is now evident that crops themselves will need to be adapted to new conditions, and many of the most important crops to food security lack a broad genetic base to make this adaptation possible.

Project results:

Using a technique called gap analysis, scientists studied 81 of the world’s most important food crops – including rice, wheat, maize, potato, bean, cassava, sorghum, and banana,. They found that of the 1089 wild relatives identified, over 70% are seriously underrepresented in gene banks. But fortunately, the new findings also show where these species might be found in the wild. With the new information, collecting teams will seek out the species that have highest priority and are most at risk in the largest coordinated conservation exercise for crop wild relatives ever undertaken. The study and collecting work are part of a major 10-year project funded by the government of Norway to help boost the resilience of staple foods crops to climate change.

Partners:

Kew Millennium Seed Bank (project coordinator), Global Crop Diversity Trust (project coordinator), University of Birmingham

Links/sources for further information:

<http://cwrdiversity.org/>



Case Study #3

Title: Understanding Landscape-scale Variability of Soil Health Indicators: Assessing the Effect of Cultivation

Author: Leigh Winowiecki

Type: Food security

Project description:

Soil organic carbon (SOC) is an important indicator of soil health because it integrates both inherent properties of soil as well as anthropogenic activities, including land-use change and land management, while contributing to the overall fertility of the soil. Biophysical field surveys were conducted using the Land Degradation Surveillance Framework (LDSF) in Hoima and Lushoto as part of the “Playing out transformative adaptation in CCAFS benchmark sites in East Africa: When, where, how and with whom?” project. LDSF sampling plots were co-located with the 140 CCAFS Household surveys in order to conduct interdisciplinary analysis on land health, gender and social-economic datasets.

Introduction / objectives:

The objectives were to assess the effects of land use on soil and land health metrics across the landscape, as well as provide a biophysical baseline for the sites. Each LDSF site had 160 sampling plots where field observations and samples were collected, including soil samples (0-20 cm and 20-50 cm), erosion assessments,

tree and shrub measurements, as well as current and historic land use.

Project results:

The results show strong decreases in topsoil OC following cultivation in Lushoto. The effects of cultivation are weaker in Hoima. In addition, cultivation leads to less variability in SOC, while pH values are higher in cultivated areas. These data indicate the potential to restore SOC content in cultivated areas through improved management practices.

Partners:

SARI, Lushto District council, NARO, HODDIFA, ZARDI Bulindi, NAADS

Links/sources for further information:

<http://ccafs.cgiar.org/blog/healthy-soil-tanzania-new-project> <http://dapa.ciat.cgiar.org/ccafs-ea-fieldwork/>



Lushoto & Hoima: Soil Health Baseline Assessment

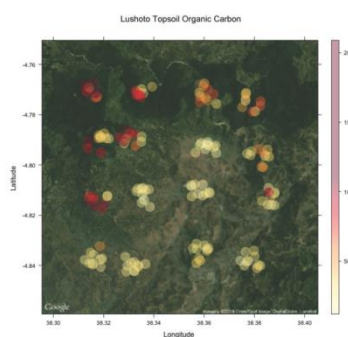


Leigh Winowiecki, International Center for Tropical Agriculture (CIAT)

22 January 2014

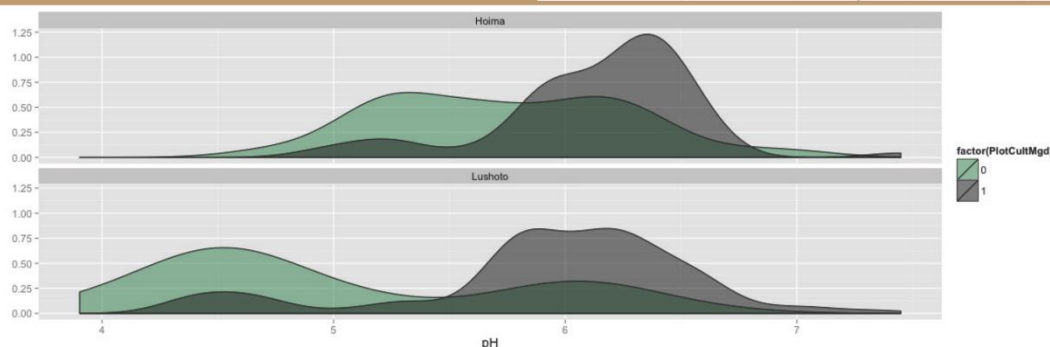
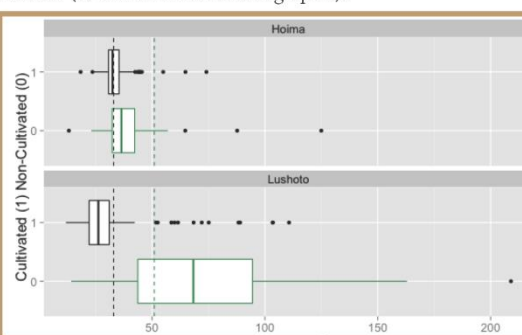
Understanding Landscape-scale Variability of Soil Health Indicators: Assessing the Effect of Cultivation

Soil organic carbon (SOC) is an important indicator of soil health because it integrates both inherent properties of soil as well as anthropogenic activities, including land-use change and land management, while contributing to the overall fertility of the soil. Biophysical field surveys were conducted using the Land Degradation Surveillance Framework (LDSF) in Hoima and Lushoto as part of the “Playing out transformative adaptation in CCAFS benchmark sites in East Africa: When, where, how and with whom?” project. The objective was to provide a biophysical baseline of key soil and land health metrics across the landscape. Each LDSF site had 160 sampling plots where field observations and samples were collected, including soil samples (0–20 cm and 20–50 cm), erosion assessments, tree and shrub measurements, as well as current and historic land use. LDSF sampling plots were co-located with the 140 CCAFS Household surveys in order to conduct interdisciplinary analysis on land health, gender and social-economic datasets. The map on the right shows the variability of topsoil organic carbon in the 160 LDSF plots in Lushoto. Another key objective was to determine the effects of land use on SOC in order to identify opportunities for strategic land management interventions. The below graphic shows the strong decrease in topsoil OC following cultivation in Lushoto. The effects of cultivation are weaker in Hoima. Overall, cultivation leads to less variability in SOC. pH values are higher in cultivated vs non-cultivated areas (as shown in the bottom graphic).



Topsoil organic carbon values (g kg^{-1}) for each of the 160 LDSF sampling plots in Lushoto.

Boxplots of topsoil organic carbon (g kg^{-1}) for cultivated (1) and non-cultivated (0) plots in Lushoto ($n=104$ and $n=53$, respectively) and Hoima ($n=65$ and $n=95$, respectively). The vertical lines show means for cultivated (33 g kg^{-1}) and non-cultivated plots (51 g kg^{-1}) for the two sites.



The distribution of pH in cultivated and non-cultivated areas of the two sites.

Case Study #4

Title: Determining carbon sequestration potential of forage-based production systems

Author: Aracely Castro & Idupulapati Rao

Type: Breakthrough science

Project description:

It is estimated that soils in the world contain 1500 Pg of organic carbon (C) to a depth of 1 m, and that by adopting improved management practices agricultural soils have the potential to sequester 0.4-0.8 Pg C per year. Two decades ago applied research work allowed concluding that there is a high potential for C sequestration in improved - well managed pastures established at the Colombian Eastern Plains, a region known as the Llanos. Given current dynamics of land use change in the region, from native savannas to improved pastures and other production systems including tree plantations that are becoming equally relevant, new research activities were conducted to confirm previous results and generate new information that can contribute towards national policies on climate change mitigation.

Introduction / objectives:

Carbon stocks up to a 1 m depth were estimated in 7 land use systems under experimental conditions. They included improved pastures, agrosilvopastoral systems, rubber associated with *Desmodium ovalifolium* as soil cover, sugar cane, rice and maize based crop rotations, and native savanna as reference. Treatments also included 3 tillage options: harrow, chisel and moldboard plow.

Project results:

Higher C stocks were observed in some (not all) of the improved – well managed pastures (average was 81 Mg ha⁻¹, compared to 63.3 Mg ha⁻¹ in the native savanna) and rubber associated with *D. ovalifolium* (72.5 Mg ha⁻¹). However this response was site specific, since C accumulation in the forage materials evaluated varied in the two locations probably due to differences in soil and climatic conditions. Agrosilvopastoral systems also showed some potential to accumulate C, but mostly associated to its tree component. Annual crops confirmed not only to reduce C stocks (41.3 and 47.6 Mg ha⁻¹ in rice and maize based system, respectively), but also showed high potential for CO₂ emissions. Tillage had an effect on C stocks in the soil; as expected use of moldboard plow significantly reduced C stocks in all land uses (52.8 Mg ha⁻¹) whilst harrow and chisel showed a minor reductions (60.6 and 61.2 Mg ha⁻¹, respectively) compared to the native savanna. Trade-off analyses of the most relevant changes in land uses in the region are under development.

Partners:

CIAT (Forages, Soils and DAPA teams) and the University of Purdue are involved in the generation and analysis of primary and secondary information for the biophysical (C sequestration potential) and socioeconomic (trade-offs) components of the work

Links/sources for further information:

Case Study #5

Title: Evidence-based prioritization of CSA at the national level: Development of a tool and indicator set

Author: Caitlin Corner-Doloff

Type: Innovative non-research partnerships, Policy engagement

Project description:

Accelerating the adoption of CSA techniques in the face of increasing climate change impacts requires tools for stakeholders to specifically integrate CSA into policy and planning. CIAT supported T1 and LAM in the development of a prioritization approach which characterizes CSA practices, prioritizes locally appropriate actions, and assesses costs and benefits in order to identify investment opportunities, and link national and locally planning mechanisms. The approach was developed in close consultation with members of the CSA Alliance, and piloted with national policy makers in Colombia.

Introduction / objectives:

The objectives of the work in 2013 was to co-design with key investors an approach that could plug into national planning processes, to develop a tool including indicator sets and economic methods for prioritizing, and trial in a pilot for Colombia.

Project results:

Through close consultation with multi-lateral agencies, especially the World Bank, the broad approach was defined. With the University of the Andes, CIAT helped develop a tool, and used data from previous projects in Colombia to trial it in Colombia. 3-5 pilots are planned in 2014 for implementation in 4 CCAFS regions, and in support of guiding CSA investment with multi-lateral donors.

Partners:

Universidad de los Andes, World Bank, FAO, other CSA Alliance partners.

Links/sources for further information:

Case Study #6

Title: Broad partnership for climate adaptation in Colombia: from national policy down to the ground

Author: Jeimar Tapasco

Type: Innovative non-research partnerships, Policy engagement

Project description:

During 2013 CIAT fully established the “CIAT-Minsitry of Agriculture agreement” and climate and the agricultural

sector in Colombia. This US\$8m initiative brings together partners from research, national government, producer and trade organisations and NGOs from across Colombia, working in a multi-sectoral, multi-level effort to adapt and mitigate Colombia's agricultural sector.

Introduction / objectives:

The agreement aims to put the climate variable into agricultural development in the country. This is being achieved through 4 primary objectives: 1) Enhances Colombia's capacity to model climate and crops for seasonal through to long term impacts, 2) Establish climate specific management systems and extension services, 3) evaluate and release adapted technologies, and 4) reduce the water and carb

Project results:

In the first year, CIAT established the partnership with 11 institutions, ranging from national government departments, national research organisations, producer/trade organisations and local NGOs. Field research is ongoing in 52 municipalities, covering 16 departments, with >800 evaluation plots, >200 farm-based action sites. Over 92 training and planning workshops were held consisting of 1279 participants from 52 institutions. A total of 97 researchers, policy makers and development practitioners are working under the agreement.

Partners:

FENALCE, FEDEARROZ, CENIPALMA, CIPAV, CORPORACIÓN BIOTECCORPORACION CLAYUCA, FUNDACIÓN BIOFUTURO RECURSOS NATURALES, GASA S.A.S, FUNDESOT

Links/sources for further information:

<http://www.aclimatecolombia.org/>

6. Outcomes

Title:

CIAT science influences national adaptation policy in Nicaragua, which leverages a large scale IFAD investment to support adaptation policy: “Adaption to changes in markets and effects of climate in Nicaragua- NICADAPT”

What is the outcome of the research (i.e. use of research results by non-research partners)?

In 2013 Nicaragua established the National Adaptation Plan for agriculture. Among the issues prioritized is the adaptation of smallholder coffee farmer livelihoods, and market-based diversification of coffee-based income at the national level, an issue which was prioritized partly based on CIAT’s impact analyses and engagement in private and public sector policy fora. The National Policy led to the government of Nicaragua to request IFAD to support Nicaragua on the adaptation of the coffee and cocoa supply chain to market and climate change. IFAD will invest 24.12 Mio USD to facilitate productive investments and provide technical assistance to improve productivity and increase adaptation capacities to climate change of poor smallholder producers of cacao and coffee in Nicaragua. This will be complemented by the strengthening of relevant public institutions and policies oriented at providing improved climate-proofed inputs to the production, improved information systems on weather events, as well as a general strengthening of the public sector to formulate incentive-based public policies for smallholder farmers.

The project will be financed in the following manner: (i) IFAD will finance a total amount of US\$ 24.12 million (65% of total) which consists of a highly concessional loan of US\$ 8.06 million (22%), a DSF grant of US\$ 8.06 million (22%) and an ASAP grant of US\$ 8.00 million (22%); (ii) BCIE will finance a loan of US\$ 7.00 million (19%); (iii) the Government of Nicaragua will provide US\$ 3.35 million in counterpart financing (9%); and (iv) the beneficiaries of the project will provide an estimated amount of US\$ 2.58 million (7.0%). The Project is expected to produce the following results, among others:

- 10% decrease in the prevalence of child malnutrition of beneficiary families
- 32 000 families improve their asset base by at least 20%
- 40 000 families have received direct services and 200 000 have received indirect services
- 20% increase in income from the production of coffee and cocoa in families belonging to cooperatives / associations with investment plans in place for at least two years
- 20 000 families adopt good management practices and investment decisions that improve crop adaptation to climate change
- The average productivity of coffee and cocoa increased by 20% in families belonging to cooperatives / associations with investment plans in place for at least two years

- 100 Investment Plans will be developed and implemented.

23. It is expected that the Project will provide a 28% Economic Rate of Return and the intervention represents an economic Net Present Value of US\$ 127.3 million

What outputs produced in the three preceding years resulted in this outcome?

CIAT's research shows that coffee is highly sensitive to climate change and that by 2050 coffee growing areas will move approximately 300 meters up the altitudinal gradient and push farmers at lower altitudes out of coffee production, increase pressure on forests and natural resources in higher altitudes and jeopardize the actors along the coffee supply chain. For cocoa the picture is not as dramatic as for coffee but shifts in production areas are also likely to happen by 2050. Cocoa is a promising alternative for coffee due to its high temperature requirements. That is why it makes sense to address both supply chains jointly.

The formal outputs are the scientific publications listed below. However more important were all the dozens of meetings held and presentation given to Ministries, NGO, donors and private sector and a targeted communications and media campaign to disseminate the findings of the studies.

Scientific Outputs

Schroth, Gotz; Läderach, Peter; Dempewolf, Jan; Philpott, Stacy; Hagggar, Jeremy P.; Eakin, Hallie; Castillejos, Teresa; García Moreno, Jaime; Soto Pinto, Lorena; Hernández, Ricardo; Eitzinger, Anton; Ramírez Villegas, Julián. 2009. Towards a climate change adaptation strategy for coffee communities and ecosystems in the Sierra Madre de Chiapas, Mexico [Approved article] . Mitigation and Adaptation Strategies for Global Change (Netherlands) 14(7):605-625.

Läderach, P.; Lundy, M.; Jarvis, A.; Ramírez, J.; Pérez, P.E.; 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, Springer Verlag, Berlin. Chapter 42.

Läderach, P.; Hagggar, 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 no. 2. Centro Internacional de Agricultura Tropical (CIAT), Cali, Colombia. 4 p http://ciat.cgiar.org/wp-content/uploads/2012/12/policy_brief2_mesoamerican_coffee.pdf

Vermeulen, S.J., Challinor, A.J., Thornton, P.K., Campbell, B.M., Eriyagama, N., Vervoort, J., Kinyangi, J., Jarvis, A., Läderach, P., Ramirez-Villegas, J., Nicklin, K., Hawkins, E., and Smith, D.R. 2013. Addressing uncertainty in adaptation planning for agriculture. Proceedings of the National Academy of Sciences 110: 8357–8362.

Selected Media coverage

Al Gore Climate reality project: <http://www.ciatnews.cgiar.org/category/ciat-media/>

BBC: http://www.bbc.co.uk/mundo/noticias/2011/06/110630_cafe_cambio_climatico_ciat_am.shtml

Reuters: <http://www.reuters.com/article/2012/12/19/mexico-climate-idUSL1E8LCFBJ20121219>

2 degrees up movie in all the media and youtube: <http://www.ciatnews.cgiar.org/2012/06/19/two-degrees-up-climate-change-films-published-by-reuters-alertnet/>

Worldenvironment.tv:

http://www.worldenvironment.tv/index.php?option=com_content&view=article&id=1322:starbucks-prepares-for-disrupted-coffee-production-due-to-climate-change&catid=46:global-warming&Itemid=122

Nicaragua media coverage:

<http://www.elnuevodiario.com.ni/economia/309521-preocupan-efectos-de-cambio-climatico>

<http://www.elnuevodiario.com.ni/economia/308453-cambio-climatico-amenaza-a-agricultura>

http://spanish.china.org.cn/international/txt/2012-11/10/content_27065586.htm

<http://funica.org.ni/index/noticias/9-noticias/39-funica-apoya-la-conformacion-de-la-red-de-especialistas-de-cafe-de-nicaragua.html>

What partners helped in producing the outcome?

Catholic Relief Services (CRS)

Gesellschaft für Internationale Zusammenarbeit (GIZ)

Asociación de Cooperativas de Pequeños Productores de Cafe de Nicaragua (Cafenica)

Lutheran World Relief (LWR)

Fundación para el Desarrollo Tecnológico Agropecuario y Forestal de Nicaragua (FUNICA)

Who used the output?

Ministry of Agriculture (MAGFOR)

Ministerio del Ambiente y Recursos Naturales (MARENA)

International Fund for Agricultural Development (IFAD)

Fundación para el Desarrollo Tecnológico Agropecuario y Forestal de Nicaragua (FUNICA)

Catholic Relief Services (CRS)

Gesellschaft für Internationale Zusammenarbeit (GIZ)

Asociación de Cooperativas de Pequeños Productores de Cafe de Nicaragua (Cafenica)

Lutheran World Relief (LWR)

How was the output used?

The research outputs were first used to raise awareness of the government, private sector and civil society of the threat of climate change to coffee and cocoa production in Nicaragua. CIAT has been actively taking part for more than three years on the coffee roundtable, the cocoa roundtable, the donor roundtable and the sectorial climate change roundtable of the Ministry of Agriculture and Forestry (MAGFOR). The Government of Nicaragua included the research findings in their national adaptation plans and ministers and advisors of the president are

using the results in their presentations also:

<http://www.magfor.gob.ni/prorural/IIIMesa2012/PlanAdaptacion2013.pdf>

http://www.magfor.gob.ni/prorural/IIIMesa2012/Lineamientos_CC.ppsx

The government of Nicaragua then requested support from IFAD. Here what IFAD states in their project design document: “The Government of Nicaragua has requested IFAD to contribute to the strengthening of the cocoa and coffee chains, taking into account the climate vulnerability that the country is facing. The NICADAPTA Project will complement national policies and will therefore be highly aligned with national policies and priorities. The rationale for the Project is the comparative low productivity of smallholder producers of coffee and cocoa in Nicaragua compared with other countries in the region and the decent medium term market outlook for the selected crops. Moreover, studies from CATIE and CIAT show that the expected increase in temperature could reduce the current area of coffee in Nicaragua. Hence, there will be a need to adapt existing crop varieties to new climatic conditions. To accommodate the production, farmers must change their production activities to produce at higher altitudes, higher temperatures and with use of less water during critical periods. This change would affect smallholder farmers in Nicaragua, regarding the quantity produced, the quality achieved and the final price”.

What is the evidence for this outcome? Specifically, what kind of study was conducted to show the connection between the research and the outcome? Who conducted it? Please provide a reference or source.

The evidence of the outcome is the National Adaptation plan of the Government of Nicaragua, and the final report on project design from IFAD that outlines the scope, budget and targets of the new investment:

República de Nicaragua, Adaptación a Cambios en los Mercados y a los Efectos del Cambio Climático - NICADAPTA, Informe final sobre el diseño del proyecto, Informe principal y apéndices

Fecha del documento: 31/08/2013

N.º del proyecto: 1683-NI

N.º de informe: 2

División de América Latina y el Caribe

Departamento de Administración de Programas

National Adaptation Plan: <http://www.magfor.gob.ni/prorural/IIIMesa2012/PlanAdaptacion2013.pdf>

Project design document: http://www.ifad.org/operations/projects/design/110/nicaragua_lot.pdf

7. Outcome indicators

Outcome indicator:

One to five flagship technical and/or institutional approaches identified and developed with farmers, key development and funding agencies (national and international), civil society organizations and private sector in three regions, which would directly enhance the adaptive capacity of the farming systems to the climate change conditions.

Achievements:

Forage work on BNI and adapted *Brachearia* technologies has transitioned from upstream technology evaluation to a more participatory approach to evaluation with farmers across Latin America. Some significant uptake of these technologies is currently underway, especially in Nicaragua and Colombia. The Ministry of Agriculture of Colombia is currently finalizing a large scale plan for climate smart livestock promotion nationally, together with the Federation for Livestock Producers, a large producer and trade organisation representing over half a million livestock keepers.

Evidence:

Peters, M., Herrero, M., Fisher, M., Erb, K.-H., Rao, I., Subbarao, G. V., Castro, A., Arango, J., Chara, J., Murgueitio, E., van der Hoek, R., Laderach, P., Hyman, G., Tapasco, J., Strassburg, B., Paul, B.K., Rincon, A., Schultze-Kraft, R., Fonte, S., Searchinger, T. 2014. Challenges and opportunities for improving eco-efficiency of tropical forage-based systems to mitigate greenhouse gas emissions. *Tropical Grasslands – Forrajes Tropicales* 1: 156-167. Subbarao, G. V., I.M. Rao, K. Nakahara, Y. Ando, K.L. Sahrawat, T. Tsehay, J.C. Lata, S. Boudsocq, J.W. Miles, M. Ishitani and M. Peters. 2014. Nitrogen management in grasslands and forage-based production systems – Role of biological nitrification inhibition (BNI). *Tropical Grasslands – Pasturas Tropicales* 1: 168-174. Peters, M., I. Rao, M. Fisher, G. Subbarao, S. Martens, M. Herrero, R. van der Hoek, R. Schultze-Kraft, J. Miles, A. Castro, S. Graefe, T. Tiemann, M. Ayarza and G. Hyman. 2013. Tropical forage-based systems to mitigate greenhouse gas emissions. In: C. H. Hershey and P. Neate (Eds.) *Eco-Efficiency: From Vision to Reality*. CIAT, Cali, Colombia, pp. 171-190. Peters, M., Herrero, M., Fisher, M., Erb, K.-H., Rao, I., Subbarao, G. V., Castro, A., Arango, J., Chara, J., Murgueitio, E., van der Hoek, R., Laderach, P., Hyman, G., Tapasco, J., Strassburg, B., Paul, B.K., Rincon, A., Schultze-Kraft, R., Fonte, S., Searchinger, T. 2013. Challenges and opportunities for improving eco-efficiency of tropical forage-based systems to mitigate greenhouse gas emissions. In *Proceedings of the 22nd International Grasslands Congress*. Sydney, Australia, pp. 1251-1260 (Keynote paper). Subbarao, G. V., I.M. Rao, K. Nakahara, Y. Ando, K.L. Sahrawat, T. Tsehay, J.C. Lata, S. Boudsocq, J.W. Miles, M. Ishitani and M. Peters. 2013. Nitrogen management in grasslands and forage-based production systems – Role of biological nitrification inhibition (BNI). In *Proceedings of the 22nd International Grasslands Congress*. Sydney, Australia, pp. 1468-1472 (Keynote paper). Arango, J., D. Moreta, J. Nuñez, K. Hartmann, M. Dominguez, M. Ishitani, J. Miles, G. Subbarao, M. Peters and I. Rao. 2013. Developing methods to evaluate phenotypic variability in Biological Nitrification Inhibition (BNI) capacity of *Brachiaria* grasses. In *Proceedings of the 22nd International Grasslands Congress*. Sydney, Australia, pp. 1517-1519. Rao, I., M. Ishitani, J. Miles, M. Peters, J. Tohme, J. Arango, D. E. Moreta, H. Lopez, A. Castro, R. van der Hoek, S. Martens, G. Hyman, J. Tapasco, J. Duitama, H. Suarez, G. Borrero, J. Núñez, K. Hartmann, M.

Dominguez, M. Sotelo, D. Vergara, P. Lavelle, G. V. Subbarao, A. Rincon, C. Plazas, R. Mendoza, L. Rathjen and G. Cadisch. 2013. Climate-smart crop-livestock systems for smallholders in the tropics: Integration of new forage hybrids to intensify agriculture and to mitigate climate change through regulation of nitrification in soil. In Proceedings of the 22nd International Grasslands Congress. Sydney, Australia, pp. 1331-1332.

Moreta, D. E., J. Arango, M. Sotelo, D. Vergara, A. Rincón, M. Ishitani, A. Castro, J. Miles, M. Peters, J. Tohme, G. V. Subbarao and I. M. Rao. 2013. Biological nitrification inhibition (BNI) in Brachiaria pastures: A novel strategy to improve eco-efficiency of crop-livestock systems and to mitigate climate change. In Proceedings of the 22nd International Grasslands Congress. Sydney, Australia, pp. 980-981.

Outcome indicator:

Breeding strategies of regional and national crop breeding institutions in three target regions are coordinated, informed by CCAFS-led crop modeling approaches that are developed and evaluated for biotic and abiotic constraints for the period 2020 to 2050

Achievements:

CIAT's mandate crop breeding strategies have been informed by CCAFS science. A number of publications and analyses over the past few years have contributed to new, refreshed strategies for CIAT's mandate crops. This includes the validation of a biotic constraint focus in cassava, a focus on heat tolerance in common bean. Outputs from CIAT work on beans has been extensively disseminated and used to help inform strategies under the PABRA program in Africa, which involves 22 national programs. The Global Cassava Partnership, an alliance of multiple cassava R+D institutions have extensively adopted CIAT's concept of the rambo root, promoting cassava as a substitution crop and identifying biotic constraints as the priority for future breeding efforts. Within this alliance there are at least a dozen breeding organisations participating.

Evidence:

Publications: Genetic improvement of common beans and the challenges of climate changeS Beebe, J Ramirez, A Jarvis, IM Rao, G Mosquera, JM Bueno, M BlairCrop adaptation to climate change, 356-369Global Cassava Partnership strategy: <http://ciat.cgiar.org/gcp21>Adaptation of cassava to changing climatesH Ceballos, J Ramirez, AC Bellotti, A Jarvis, E AlvarezCrop Adaptation to Climate ChangeDrought Tolerance in Wild Plant Populations: The Case of Common Beans (*Phaseolus vulgaris* L.)AJ Cortés, FA Monserrate, J Ramírez-Villegas, S Madriñán, MW BlairPloS one 8 (5), e62898PABRA: <http://www.pabra-africa.org>Forages:Peters, M., Herrero, M., Fisher, M., Erb, K.-H., Rao, I., Subbarao, G. V., Castro, A., Arango, J., Chara, J., Murgueitio, E., van der Hoek, R., Laderach, P., Hyman, G., Tapasco, J., Strassburg, B., Paul, B.K., Rincon, A., Schultze-Kraft, R., Fonte, S., Searchinger, T. 2014. Challenges and opportunities for improving eco-efficiency of tropical forage-based systems to mitigate greenhouse gas emissions. Tropical Grasslands – Forrajes Tropicales 1: 156-167

Outcome indicator:

Integrated adaptation strategies for agricultural and food systems inserted into policy and institutional frameworks at regional, national or sub-national level in 2 target regions. Policy makers and key stakeholders use CCAFS research outputs - guidelines, tools and methods--- to support the development of NAPAS, sector specific adaptation plans, or germplasm benefit sharing policies.

Achievements:

In 2013 Nicaragua established the National Adaptation Plan for agriculture. Among the issues prioritized is the adaptation of smallholder coffee farmer livelihoods, and market-based diversification of coffee-based income at the national level, an issue which was prioritized partly based on CIAT's impact analyses and engagement in private and public sector policy fora. The National Policy led to the government of Nicaragua to request IFAD to support Nicaragua on the adaptation of the coffee and cocoa supply chain to market and climate change. IFAD will invest 24.12 Mio USD to facilitate productive investments and provide technical assistance to improve productivity and increase adaptation capacities to climate change of poor smallholder producers of cacao and coffee in Nicaragua. This will be complemented by the strengthening of relevant public institutions and policies oriented at providing improved climate-proofed inputs to the production, improved information systems on weather events, as well as a general strengthening of the public sector to formulate incentive-based public policies for smallholder farmers.

Evidence:

The evidence of the outcome is the National Adaptation plan of the Government of Nicaragua, and the final report on project design from IFAD that outlines the scope, budget and targets of the new investment: República de Nicaragua, Adaptación a Cambios en los Mercados y a los Efectos del Cambio Climático - NICADAPTA, Informe final sobre el diseño del proyecto, Informe principal y apéndices Fecha del documento: 31/08/2013 N.º del proyecto: 1683-NIN.º de informe: 2 División de América Latina y el Caribe Departamento de Administración de Programas National Adaptation Plan: <http://www.magfor.gob.ni/prorural/IIIMesa2012/PlanAdaptacion2013.pdf>
Project design document: http://www.ifad.org/operations/projects/design/110/nicaragua_lot.pdf

Outcome indicator:

One to five flagship risk management interventions evaluated and demonstrated by farmers and agencies at benchmark locations in three regions

Achievements:

Initial results from the Colombian agreement with the ministry of agriculture is providing farmers with tools and novel extension systems in rice, maize and fruits to better manage climate. These results are through the climate-specific management approaches being adopted by FEDEARROZ (the Federation of Rice growers of Colombia) and FENALCE (Federation of cereal and grain producers of Colombia).

Evidence:

<http://www.frutisitio.org>

Outcome indicator:

National meteorological services and regional climate centers trained and equipped to produce downscaled seasonal forecast products for rural communities in two countries in each of three regions

Achievements:

Initial results from the Colombian agreement involve significant capacity building and establishment of agreements for the use of seasonal forecasting tools in a number of important agricultural sectors of Colombia. An alliance between FEDEARROZ, FENALCE, IDEAM (national met office), Ministry of Agriculture and CIAT has been formed to develop seasonal forecasts and deploy them to producers in the rice and maize value chains. So far, achievements have consisted of testing of forecasting tools and institutional arrangements, and in 2014 initial pilots in target regions will do participatory testing.

Evidence:

<http://www.aclimatecolombia.org>

Outcome indicator:

Findings and evaluation tools on mitigation and livelihoods benefits of alternative agricultural development pathways used by global agencies and decision-makers in two countries in each of the three regions

Achievements:

CIAT's work on low emissions development pathways for Colombia with the World Bank, National Planning Department and local universities is now coming to fruition. Political issues have held back the launch, but CIAT's work on cost benefit analysis of mitigation measures has been central to the agricultural strategy, identifying priorities and suggesting focus on the policy. The full strategy is expected to be released in 2014, and current work continues along these lines in the development of a suite of NAMAs to support its implementation in the agricultural and livestock sectors.

Evidence:

<http://dapa.ciat.cgiar.org/taller-de-presentacion-del-proyecto-leds-colombia-y-validacion-de-cifras-del-sector-ganadero/>

Outcome indicator:

Decision-makers in three regions better informed re options and policy choices for incentivizing and rewarding smallholders for GHG emission reductions

Achievements:

We have demonstrated the potential contribution of carbon insetting schemes in coffee smallholder context to low emissions development and more resilient farming systems under progressive climate change. CIAT has engaged strongly with the private and public sector on this work. Green Mountain Coffee Roasters are now funding a pilot project which is being implemented by Catholic Relief Services (CRS) in Central America, with xxxx planned smallholder beneficiaries and xxxx T Carbon equivalent emissions planned to be sequestered.

Evidence:

Paper: <http://ccafs.cgiar.org/blog/are-there-synergies-between-climate-change-adaptation-and-mitigation-coffee-production#.Uu5ayrScM4NP> Policy brief: http://ciat.cgiar.org/wp-content/uploads/2013/04/policy_brief12_shared_value.pdf Plan Vivo Project Idea Note: Carbon Insetting to confront climate change, improve farmer livelihoods and enhance supply chain security

Outcome indicator:

Agriculture mainstreamed into the global climate change policies, and major international food security initiatives fully incorporate climate change concerns

Achievements:

The coffee and cocoa work has had fairly substantial influence in global strategies for climate adaptation. It is regularly cited by public and private sector actors alike as a clear example for the need to prioritise adaptation in agriculture. CIAT's work on crop wild relatives has also influenced the establishment of a US\$50m initiative focussed on collecting CWR and pre-breeding for climate adaptation. This initiative is funded by NORAD, and implemented through the Global Crop Diversity Trust.

Evidence:

Selected Media coverage Al Gore Climate reality project: <http://www.ciatnews.cgiar.org/category/ciat-media/>
 BBC: http://www.bbc.co.uk/mundo/noticias/2011/06/110630_cafe_cambio_climatico_ciat_am.shtml Reuters: <http://www.reuters.com/article/2012/12/19/mexico-climate-idUSL1E8LCFBJ20121219> 2 degrees up movie in all the media and youtube: <http://www.ciatnews.cgiar.org/2012/06/19/two-degrees-up-climate-change-films-published-by-reuters-alertnet/> Worldenvironment.tv: http://www.worldenvironment.tv/index.php?option=com_content&view=article&id=1322:starbucks-prepares-for-disrupted-coffee-production-due-to-climate-change&catid=46:global-warming&Itemid=122 Nicaragua media coverage: <http://www.elnuevodiario.com.ni/economia/309521-preocupan-efectos-de-cambio-climatico>
<http://www.elnuevodiario.com.ni/economia/308453-cambio-climatico-amenaza-a-agricultura>
http://spanish.china.org.cn/international/txt/2012-11/10/content_27065586.htm
<http://funica.org.ni/index/noticias/9-noticias/39-funica-apoya-la-conformacion-de-la-red-de-especialistas-de->

cafe-de-nicaragua.html

Outcome indicator:

Global database and set of tools for climate-smart agriculture established and used by key international and regional agencies

Achievements:

CIAT, together with T4 has developed and maintained the CCAFS-climate portal, which now boasts over 5,000 users, 5% of which are governmental organisations. CIAT has also co-funded and supported the development of the Analogues tool under leadership of T1, and through commissioned activities contributed to the development and release of Agtrials. More recently CIAT has lead development of cost-benefit prioritisation tools for CSA, which have been tested in Colombia and are currently being piloted in 4 more countries. This work is in close partnership with the World Bank and other members of the CSA Alliance.

Evidence:

<http://www.ccafs-climate.org/http://www.agtrials.org/>

Outcome indicator:

New knowledge on how alternative policy and program options impact agriculture and food security under climate change incorporated into strategy development by at least 3 national agencies, and 3 key international and regional agencies

Achievements:

CIAT's work has contributed to influencing national agricultural policy in Nicaragua (released 2013), and is soon to be released in Colombia (2014).

Evidence:

See outcome statement.

8. Leveraged funds

Leveraged funds #1

Title:

Adapting agriculture to climate change: collecting, protecting and preparing crop wild relatives Partner name:
Global Crop Diversity Trust Start - end year: 2011 – 2021.

Partner name: Global Crop Diversity Trust

Budget: \$49.200.000

Theme: T1