



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



Biodiversity
2013 technical report

1. Activity Reporting

Activity 607-2013 (Milestone 1.1.3 2014 (1).)

Title: User-friendly interface for environmental predictive germplasm characterization.

Status: Incomplete. Discussion have been held with collaborators to understand needs and decide whether the product should be online or local. Draft R scripts have been produced that still need to be integrated in a user-friendly interface. Some passport data were extracted from online genebank databases and linked to the Agtrials records as proof of concept. The collecting mission database and the crop ontology are being converted into an open standard (RDF) to enable access on the linked open data cloud by third party websites and use through queries. Annotation using a common set of trait concepts is being performed on Agtrials, the collecting mission data are being collected for Seeds4Needs, using mobile devices. The activity leader resigned in October 2013 which has slowed down progress.

Gender component:

The gender aspect was not considered in the design of the tool for now but if the data collected have such a component then the system will reflect it in the information stored beside the data. The information service is tailored on a gender neutral design in order to provide equal access to the whole wealth of information.

Deliverables:

- Generic predictive algorithms to predict trait values for genebank accessions and varieties.

Draft of R scripts.

- Prototype interface to use the algorithms to select accessions/varieties in an interactive way.

Some of the varieties' names in Agtrials (www.agtrials.org) are now linked to the passport data in the genebank when matching was possible. This provides the groundwork needed to display accession details on the Agtrials geospatial site and perform germplasm searches using location and traits. The addition of R scripts and development of a non-expert user interface is still pending.

Partners:

CIAT

Locations:

Global

Activity 608-2013 (Milestone 1.2.1 2013 (2).)

Title: Integrating the crop trait ontology into AgTrials.

Status: Partially complete. Traits for pearl millet were added in 2013 as well as additional methods and traits for the crops already published. Polapgene, a Polish consortium for genomics, submitted a first trait dictionary for barley, which will be merged with ICARDA's list as appropriate. The delay for barley was due to the fact that



ICARDA had to relocate its teams outside Syria so it took more time to identify contacts, but the list will be finalized by end of January 2014. Traits for musa, sweet potato, and lentil are being added. The work on adding environmental concepts with Jeffrey White from USDA and trial management variables with Medha Devare, CIMMYT-Nepal, started in January 2014. The Agtrials team has developed a synchronization routine between CO and Agtrials. Extraction of the trait information from collectors' fieldbooks from collection expeditions supported by Bioversity continued in 2013 and is published in the open access geospatial database. Traits are now available for sorghum, pennisetum, cassava, ipomoea, dioscorea and musa. Each trait was matched against a Crop Ontology concept and allocated a unique identifier. It provides useful trait observation made on the original samples collected that were introduced in genebanks as accessions.

Gender component:

Up to now this activity has no specific consideration for gender as the purpose is to develop a set a reference metadata for breeders to collect multi-site evaluation data in the field and annotation data files. We have very few post-harvest trait in CO that maybe would require a gender-based approach in the storage of related information. CO needs to compile all breeders' knowledge with reference concepts so it is universally applicable when measuring the crop performances in the field and for delivering information service to anyone interested. When evaluation with farmers participation, that has a gender aspect in it, will return traits related to a gender-based use of the varieties, then CO may have to integrate such an indicator of use.

Deliverables:

- Use cases for at least 6 crops developed for accessing to data and integrating Agtrials with the selected online sources based on the crop trait ontology.

The trait dictionaries are online for 14 crops on the Crop Ontology website (www.cropontology.org) and all of them are synchronized with Agtrials to enable the allocation of standard metadata to describe the uploaded data files for storage and query. Passport data for selected crops were extracted from the CGIAR online published genebank websites and linked to the trial records in Agtrials as a first proof of concept. A conversion of the passport data and the crop ontology into Resource Description Framework (RDF) format is being performed to open the corresponding data to the Linked Open Data Cloud. The integration of the CO concepts into Agrovoc and Agris 2.0 (FAO) is being tested to enable the search in bibliographic references of published papers on a trait based search.

- Testing the product with breeders.

The workshop is postponed for 2014.

Partners:

CIAT; ICARDA; CIP; ICRISAT; IITA; OSU; INRA; CIRAD; CIMMYT; USDA; WUR; Cornell University

Locations:

Global

Activity 609-2013 (Milestone 1.1.1 2014)

Title: Seeds for Needs East Africa.

Status: Complete. This activity has several sub-activities at a different stage of implementation which will be reported separately below: Ethiopia project 1:8. We tested a sub-set of durum wheat varieties that have been distributed to 48 farmers for baby trials (24/site in two sites) and 400 farmers in crowdsourcing (200/site). The 200 farmers received three landraces and one check, common to all farmers. The sub-set of accessions was selected by farmers in 2012 through a participatory variety selection on a 400 accessions mother trial with two replicates. Farmers harvested until December 2013 and we are waiting for a report on results. The farmers selected for crowdsourcing were located in 12 villages/site covering an area of ca. 350 km² and an altitudinal range from 2400m asl to 3200m asl. At each village we recruited one enumerator to assist in data collection and a mobile phone is provided to all farmers to facilitate communication. Recruitment of the enumerator took place after kebele administration provided three names and the team interviewed them to select the best candidate. In one site most of the selected enumerators were women. Prior to conducting the experiment, training was given to farmers and enumerators about field experiment and data collection. After the training, farmers set their own by-laws that work throughout the time of experiment. Among their by-laws:

- All villages decided to hold one meeting every month to discuss the growth status and characteristics of the accession.
- If someone fails to attend the monthly meeting, fails to evaluate or there is failure in the experiment, they set a punishment that starts from warning to total dismissal from the experimentation.
- They elect a chairman, rapporteur and cashier. Then the rapporteur usually reports to the enumerator each month.
- Disseminating the total current trials for at least five farmers targeting our next 1000 crowdsourcing experiment. This system creates a strong network among farmers, more precise flow of information between farmers and enumerators, as well as researchers, and an organized way to trace back which accession goes where. In other words we established a farmer group with very solid ties. In addition, two iButtons were installed at each village (although some were lost in the process). Two rain gauges were also installed in two villages. Farmers were then asked to evaluate as the season progresses various agronomic traits, including germination rate, time to flowering, time to maturity, resistance to pests and diseases (birds were a very big problem that will affect collection of yield data from some of the accessions) and will then complete data collection with yield data whenever this is possible. Overall 200 mini experiments were developed associated with detailed climatic data collected eight times each day and precise information on pests and diseases. The crowdsourcing, in this case, become more than having feedback from farmers and it developed a real participatory experiment with farmers communicating with each other and exchanging ideas. It also laid the foundations for sustainability as farmers are now well organized and could work in future projects. As an example of preliminary results, the farmers told us that one thing they liked about the accessions was that they were resistant to frost. We investigated further about the frost and with the iButtons we were able to see that the temperature went down to less than 4 degrees C for several days with a minimum peak of 0.2. We could assign numbers to what farmers said and we can also verify if the same frost occurred in all villages. The baby trials were bigger than crowdsourcing and with more detailed information on pests and diseases (collected

weekly since the first observation of disease to monitor the epidemic) will provide additional information on performance on different environments. In addition, we had set up with partners for two years a mother trial with 400 accessions with repetition in the two sites, a specific project on drought tolerance on a sub-set of accessions, and we have obtained detailed characterization data, a molecular Illumina 90K SNP chip which is showing huge diversity in at least 45,000 loci and which show how improved varieties are all mapping in one margin of the preliminary tree generated (these data are still very preliminary, but some trends can already be observed). This data set can be critical to develop nested association maps and consequently a strong PPB program. As for morphological characterization, in addition to the data collected in the mother trial, we repeated an experiment to assess drought resistance on a subset of the accessions (the original one was funded through Vavilov-Frankel fellowship and are building on that). Overall, three PhD students are involved in the project, one of whom Chiara Mancini is co-supervised by the grant manager and is an intern at Bioversity.

Ethiopia project 2 (IT-Benefit sharing grant with IBC): This project faced several problems during its first year of implementation, which delayed data collection. At the moment, due to a re-arrangement of staff within our partners, we are working closely with them to reassess project activities and priorities. As of now the project is taking place in five sites as follows: site 1. Central Highland, Shoa, (Ankober suitable for barley and Syadebir suitable for wheat); site 2. Eastern part of Ethiopia, Harar, Alemaya; site 3. North Ethiopia, Tigray, Gerealta; site 4. South Ethiopia, Awasa, Hagereselam; site 5. Rift valley, Debrezeit, Cheffiedonssa. On-farm activities took place, although with the limitations due to the delays mentioned above and the report on results is still to be drafted. This project is a continuation of a World Bank development marketplace project which is now completed (see deliverables page).

Varietal Diversification to manage climate risk in Kenya and Tanzania (collaboration with ABCIC) The project aims to understand the potential varietal diversification strategies have to decrease vulnerability of smallholder farmers to climate related risks. The project will assess levels of diversity of sorghum, pigeon pea and cowpea varieties in benchmark sites in East Africa, assess the current vulnerability of varieties and varietal portfolios, and identify varietal diversification needs and opportunities. Activities- On-farm inter- and intra-specific diversity was assessed through individual interviews (324) and focus group discussions (4) in 2 sites in Kenya and 1 site in Tanzania. The survey provides data on the socio-economic and environmental factors that lead to farmers' vulnerability, assess farmers' perceptions on climate change and provide information on which crops farmers are using for climate change adaptation and why.- Accessions of sorghum, pigeon pea and cowpea were selected and planted on 4 on-station trials to compare their performance under different climatic conditions and to allow for seed multiplication for on-farm trials. There were some external factors (livestock damage, pests) affecting the performance or low or zero germination of some accessions which reduced the amount of seeds available for on-farm trials. Documentation of the morphological characterization data was hindered by computer crashes in two sites in Tanzania. Trials in one site in Tanzania will be repeated in 2014. The trials were planted late and none of the seeds germinated. - On-farm trials are being carried out in 2 sites in Kenya and 1 site in Tanzania using a mother-baby trial system: mother trials testing 20 accessions and baby trials testing 4 varieties (in total 16 baby trials per site). Trials will be planted in 2014 in Kenya and are already planted in Tanzania (Dec-June 2014).- Crowdsourcing of the 20 best performing varieties (seed yield, days to 50% flowering, pest and diseases resistance and plant height). Combinations of four varieties are distributed to 500 farmers in small quantities in the three research sites. Participating farmers are asked to rank the four varieties based on their preferred traits for each crop. - Assessing the impact of climate change on

specific crops using crop suitability mapping. GIS software is used to predict the environment under which an accession or a group of accessions can grow based on the climatic characteristics of the locality in which they were collected. Predictions are made for future conditions (e.g. 50 years from now).- Using the characterization data from the on-station trials models for the selected crops will be made (1-2 varieties) to determine yield outcomes and stability under variable weather conditions, to model household income from crops, given varietal and crop diversification approaches and to model the potential of disease and pests under different climate models. This activity is ongoing, characterization data is collected and soil samples have been analyzed. APSIM (Agricultural Production Systems Simulator) and DSSAT (Decision Support System for Agrotechnology Transfer) farming systems models have been used to simulate the effects of environmental variables and management decisions.

- A vulnerability toolkit (using several PRA techniques to assess climate change vulnerability) was designed and tested in one site in Tanzania. This toolkit was co-developed by the Institute of Development Studies.

- Two students are involved in the project and carrying out the MSc research whilst contributing to project activities. Their projects are "Assessing Vulnerability to Climate Variability and Change of Small Scale Farmers in Nyando and Wote, Kenya" and "Genetic diversity of locally adapted landraces of sorghum, cowpea and pigeon pea in Tanzania" respectively.

- A training workshop was conducted from 22nd to 24th January 2013. Participants included project partners from National Plant Genetic Resource Center (NPGRC)

- Tanzania, Sokoine University of Agriculture

- Tanzania, Hombolo Agricultural Research Center – Tanzania, KARI - National Gene Bank of Kenya. The training provided information on the principles and application of climate change modelling, biological and environmental data and the GIS-based selection of accession from the genebanks. In Uganda and Rwanda selected sites for bean germplasm varietal testing was Rubaya, Kabwohe and Hoima. A team from Bioversity visited Hoima site and established contacts with NARO research team in Hoima. An MOU between NARO PGRC and NARO zonal offices in Hoima is being worked out to allow on farm testing and on station trials. In Uganda 20 varieties of beans are being multiplied and these will be tested in these sites during March-July planting season. In Rwanda – selected sites include – Bugesera, Rubaya (which is a common site with Uganda) and germplasm testing is already going on in Rwanda and a total of 20 varieties from their genebank and from farmers is already being tested in the three sites. Sites were visited in February 2013.

Gender component:

Ethiopia Women farmers are the primary beneficiaries and the project aims to develop a mechanism that will allow them access to locally adapted varieties of durum wheat and barley being held in the IBC Genebank, also providing benefits to the seed industry in Ethiopia. The project will aim at ensuring food security for Ethiopian women farmers in the face of unpredictable climatic changes, strengthening their economic self-sustainability, and boost the seed industry through the development of the market-based seed distribution system, particularly looking at opportunities for women. In addition, data on how farmers access planting materials, which were gathered as part of household survey based on interviews from male and female farmers of different age groups, will be analysed. Kenya and Tanzania Collected sex-disaggregated data through focus group discussions and in-depth individual interviews on varietal trait preferences, perceptions and land management practices.

Deliverables:

- Final report and peer reviewed article on multilocation trials in 3 pilot analogue sites Ethiopia for durum wheat and barley, including women farmers' evaluation.

Final report produced, four policy briefs produced, still working on the peer-reviewed paper. Pull out publication, "Seeds for Needs: Atlas of Crops" <http://www.biodiversityinternational.org/e-library/publications/detail/seeds-for-needs-atlas-of-crop-suitability/>

- Preliminary report of trials in five more regions in Ethiopia.

The project was facing some difficulties in its implementation and we are now in the process of redefining the whole project management structure. We are waiting for a report by partners about results from trials in 2013. Harvest took place in December 2013.

- Preliminary reports on multilocation trials in Kenya, Uganda, Rwanda and Tanzania.

Reports are produced for on-station trials in two sites in Kenya and two sites in Tanzania containing morphological characterisation data. In total 32 varieties of pigeon pea, 62 sorghum and 20 cowpea were selected and planted in the trial sites using a randomized complete block design. Some of the data was lost due to livestock damage (in Tanzania), aphid or bird attacks. Measures were taken but some of the accessions harvested very little seed. On-farm trials are still ongoing/yet to be planted and data is being collected. The on-farm trials consist of four mother trials and 16 baby trials in two sites in Kenya (Nyando and Wote) and one site in Tanzania (Hombolo, Dodoma). The 20 best performing varieties from on-station trials are selected and planted in the mother and baby trials. Trials in Hombolo will be conducted between Dec - June 2014 and in Nyando and Wote from April - August 2014. In Uganda and Rwanda sites were selected and agreements were made with the local community.

- Report on GIS training (number of trainings and participants).

Trainings were provided to National Genebank staff in Ethiopia, Kenya, Tanzania and Uganda respectively. Topics included: database management, GIS-based selection of germplasm, introductions to crop modelling, R statistical software, Maxent software and use of bioclim data. A training workshop on Climate Resilience and seeds was held in Mbarara in September 2013 as a follow up to a previous climate analogue training held in November 2012. It was organized by Biodiversity International and research Partners – National Agricultural Research Organization (NARO) – Uganda, and Rwanda Agriculture Board (RAB) and the National University of Rwanda (NUR). Participants were selected by research partners and consisted of a wide range of technical persons involved in climate change analysis, GIS specialists, breeders, crop scientists and agronomists. The training also involved a field exchange visit between a local genebank and another genebank from Rwanda. This was also used as a learning experience and knowledge exchange session exchange between farmers and with scientists.

- Promising accessions from genebanks evaluated and characterized (inc. using participatory approaches and in consultation with vulnerable women's groups).

This was done mainly in Ethiopia as the project started before the others. After farmers chose 40 accessions

from 2013 cropping season, they tested them under their conditions. We developed a baby and mother trial scheme complemented by crowdsourcing to enlarge the number of farmers involved. Selection of material was done dis-aggregating by gender and results will also be evaluated by gender. 48 farmers received the seeds for baby trials (24/site in two sites) and 400 farmers in crowdsourcing (200/site). The 200 farmers received three landraces and one check, common for all farmers. The sub-set of accessions was selected by farmers in 2012 through a participatory variety selection on a 400 accessions trial with two replicates. The farmers selected for crowdsourcing were located in 12 villages/site covering an area of ca. 350 km² and an altitudinal range from 2400m asl to 3200m asl. At each village we recruited one enumerator to assist in data collection and a mobile phone is provided to all farmers to facilitate communication. Recruitment of the enumerator took place after kebele administration provided three names and the team interviewed them to select the best candidate. In one site most of the selected enumerators were women. Prior to conducting the experiment, training was given to farmers and enumerators about field experiment and data collection. After the training, farmers set their own by-laws that work throughout the time of experiment. Among their by-laws:

- All villages decided to hold one meeting every month to discuss the growth status and characteristics of the accession.
- If someone fails to attend the monthly meeting, fails to evaluate or there is failure in the experiment, they set a punishment that starts from warning to total dismissal from the experimentation.
- They elect a chairman, rapporteur and cashier. Then the rapporteur usually reports to the enumerator each month.
- Disseminating the total current trials for at least five farmers targeting our next 1000 crowdsourcing experiment.

This system creates a strong network among farmers, more precise flow of information between farmers and enumerators, as well as researchers, and an organized way to trace back which accession goes where. In other words we established a farmer group with very solid ties. In addition, two i-buttons were installed at each village (although some were lost in the process). Two rain gauges were also installed in two villages. Farmers were then asked to evaluate as the season progresses various agronomic traits, including germination rate, time to flowering, time to maturity, resistance to pests and diseases (birds were a very big problem that will affect collection of yield data from some of the accessions) and will then complete data collection with yield data whenever this is possible. Overall 200 mini experiments were developed associated with detailed climatic data collected eight times each day and precise information on pests and diseases. The crowdsourcing, in this case, became more than having feedback from farmers and it developed a real participatory experiment with farmers communicating with each other and exchanging ideas. It also laid the foundations for sustainability as farmers are now well organized and could work in future projects. As an example of preliminary results, the farmers told us that one thing they liked about the accessions was that they were resistant to frost. We investigated further about the frost and with the i-buttons we were able to see that the temperature went down to less than 4 degrees C for several days with a minimum peak of 0.2. We could assign numbers to what farmers said and we can also verify if the same frost occurred in all villages. The bay trials were bigger than crowdsourcing and with more detailed information on pests and diseases (collected weekly since the first observation of disease to monitor the epidemic) will provide additional information on performance on different environments.

- Awareness raised among farmers and decision-makers about climate change risks. Information shared regarding how use of better-adapted varieties and gender-sensitive interventions can support vulnerable women farmers.

The preliminary results of the on-farm trials and the survey will be shared with the participants to raise awareness on how varietal diversification can decrease vulnerability to climate change risks. In Uganda and Rwanda farmers were asked and were able to identify their risk as late and unpredictable rain patterns, drought, pests and diseases as the major climate risks they face. Farmers were also able through participatory methods, classify, select and rank varieties of beans that are adapted to various climatic conditions such as drought, floods, heavy rains and pests and diseases. Farmers from Rubaya also selected varieties of beans which they wished to have in their genebank.

Partners:

IBC; ABCIC; KARI; ARI-Hombolo; RAB; NARO; Mekelle University; SARC; Scuola Superiore S. Anna

Locations:

East Africa (EA), Other

Activity 610-2013 (Milestone 1.1.1 2014)

Title: Seeds for Needs China.

Status: Complete. In 2013, completed the field tests of 100 accessions of buckwheat and oat in 10 locations for agronomic performance, involved farmers particularly women in evaluating accessions of buckwheat and oat for developing participatory evaluation methodologies, identified accessions of buckwheat and oat with strong adaptability to local environments, and initiated new activities on revitalizing traditional crop diversity for adaptation to climate change and resilient smallholder farming in southwest of China.

Gender component:

Local women were invited to participate the evaluation of the accessions of buckwheat and oat in the field trials. Group discussion including women will be organized to listen their opinions and comments. The roles of women in identifying the use values of germplasm will be integrated into the reports.

Deliverables:

- Participatory methodologies focusing on woman's role for evaluating and identifying accessions of buckwheat and oat to adapt to climate change developed through multilocation trials.

For developing participatory evaluation methodologies, local farmers were invited to participate in the field visits. Farmers' indicators and standards were discussed and selections on the materials were made on the accessions in the field. A guidelines on participatory evaluation of NUS will be drafted in 2014.

- Accessions of buckwheat and oat with adaptation to climate change demonstrated in changing environments by households, particularly women.

Multilocal trials on 100 accessions of buckwheat and oat were carried out in 10 locations in China. The major agronomic traits related to plant, flower, grain, etc. were characterized. Data are being

compiled will be analyzed on the performance of accessions on the adaptability of accessions to different climate conditions. Accessions with strong adaptability to different environments identified will be demonstrated and made available to local farmers in 2014.

- Farmers trained with knowledge of using adaptable materials to climate change.

During August, our Chinese colleague from CAAS, Dr. Wu Bin visited Xinjiang and provided technical training in the site of Qitai, Xinjiang with the knowledge in climate change, the importance of adaptability of NUS to changing environments and necessary activities to improve the adaptability of NUS for sustainable farming. About 40 farmers, including women from local communities participated the training activities.

- Reports and peer-reviewed papers.

4 articles were published in 2013.

Partners:

ICS, CAAS; Zhangjiakou Academy of Agricultural sciences; Chifeng Academy of Agricultural and Animal Husbandry Sciences; YAAS

Locations:

Other

Activity 611-2013 (Milestone 1.1.1 2014)

Title: Seeds for Needs PNG.

Status: Partially complete. All the field trials for taro and sweet potato at farmers' field conducted and the data analysis is in progress. Success story is being documented and the project closing workshop will be organized during May 2014. The project will end on 31 May 2014. The National Agricultural Research Institute (NARI), the main partner of this project, is multiplying the planting materials of the selected varieties of taro and sweet potato selected by farmers through participatory approach for their wider distribution as part of project upscaling activity and for wider impact of this project. A second GIS training course is also planned for the national partners during April 2014.

Gender component:

The PNG Women in Agricultural Development Foundation will play a key role in ensuring the participation of women farmers in germplasm selection and dissemination, assisted by private industries in PNG, such as the Fresh Produce Development Agency (FPDA) and Allele Fresh Produce.

Deliverables:

- Evaluation trial report on sweet potatoes and taro in PNG.

Filed on CCAFS intranet.

- Passport and characterization database of taro and sweetpotato germplasm collections in PNG and their mapping.

Filed on CCAFS intranet.

- Project evaluation workshop in PNG.

To be held in 2014

- Public awareness materials for all project sites, newspaper articles, presentations in conferences and workshops.

Newspaper articles filed.

Partners:

NARI

Locations:

Other

Activity 612-2013 (Milestone 1.1.1 2014)

Title: Seeds for Needs Laos Cambodia.

Status: Partially complete. Based on rapid survey, project sites in Cambodia and Laos are finalized. The project will be implemented across three sites in Cambodia and five sites in Laos. Crops for each project site have also been identified. Inception workshops in both countries were organized and project implementation plan for year one were finalized. Baseline survey format has been finalized and the training in undertaking baseline survey has been planned during from 15 to 28 February. A customized GIS training course was organized in New Delhi India, where one participant each from Cambodia and Laos was trained.

Gender component:

Through working with partners in Laos and Cambodia, local communities and women's groups, women farmers will directly participate in germplasm selection and dissemination.

Deliverables:

- Farmers Survey.

Baseline survey format has been finalized and the training in undertaking baseline survey has been planned from 15 to 28 February. The survey itself will be done in 2014.

- Climate change projection maps.

A customised GIS training course was organised in New Delhi India, where one participant each from Cambodia and Laos was trained; projection maps to follow in 2014.

- Report on current existing crop diversity.

Crops for each project site have also been identified; report to follow.

Partners:

RCCRC; CARDI

Locations:

South East Asia (SEA)

Activity 613-2013 (Milestone 1.1.1 2014)

Title: Seeds for Needs India.

Status: Partially complete. Genetic base-broadening farmers' field trials were continued for both rice and wheat. For rice crowdsourcing trials were conducted with 1200 farmers and for wheat, trials with 5000 farmers are underway. A project grant of US\$ 3.5 million from GEF was obtained and the Project Preparation Grant was received for the development of full size project proposal.

Gender component:

This activity is gender sensitive, engaging both male and female farmers in the on-farm trials and in project implementation. Disaggregate analyses of results will also be produced based on gender and diversity.

Deliverables:

- Training of farmers (need specifics of trainings for 2013).

Training in the application of Geographical Information System (GIS) and Climate Analogue Tools (CAT) for Agricultural Plant Genetic Resources (APGR) Management for the benefit of partners in South Asia and Southeast Asia has been provided with one training each being held in Chitwan, Nepal (2-4 April, 2013) and Thimpu, Bhutan (26-28 November, 2013) and two training courses in India (3-4 June, 2013 and 2-6 December, 2013). In Nepal and Bhutan, participants included scientists, stakeholders and field staff from the national programmes and NGOs of the respective countries while the first training in New Delhi, India included field staff of the NGOs partnering Bioversity in the crowdsourcing trials. The latter workshop held in New Delhi, India included 11 participants from India, 2 from Vietnam and 1 each from Cambodia and Laos. The purpose of these trainings was to introduce the participants to the applications of GIS tools to APGR analysis, including methods of assigning geo-references to germplasm, software and tools (both commercial and open source) available, the use of the Global Positioning System (GPS), the availability of climate databases and its use in the application for identification of climate analogue sites. Participants were introduced to DIVA-GIS, Maxent and the Climate Analogues tool that is freely available online. Participants were also introduced to the weather data loggers called iButtons that collect temperature and humidity at a pre-set time interval and are mounted on specially designed stands made of PVC pipes. The participants were shown how to calibrate the iButtons, 'mission' them to set the data resolution and time step for collecting data, mount them within the fields and explained the necessary conditions which must be met while installing the stands in the field. A preliminary training session was also conducted on seed selection for farmers involved in crowdsourcing across project sites in Unnao and Badaun in Uttar Pradesh and Vaishali, Muzaffarpur and Samastipur in Bihar. Training was conducted with 50 farmers each during the growing season of both rice and wheat and around 12 percent of the farmers trained were women farmers. The seeds harvested by these farmers were purchased by Bioversity at competitive rates for distribution in the next season's crowdsourcing trials. More scientific training of farmers will be conducted in this year's Rabi (post rainy) season with close collaboration of scientists from the national programme. Exchange visit of farmers was also organized across two project sites from 18-20 March 2013. Around six farmers (including one woman farmer) from three villages in Vaishali, Bihar travelled to the project site in Unnao, Uttar Pradesh to visit similar crowdsourcing trials, exchange ideas and methods with the Unnao farmers and observe the crowdsourcing trials in Unnao.



- Models/reports on the impacts of climate change on production of rice and wheat in IGP.

Genetic base-broadening farmers' field trials were continued for both rice and wheat. For rice crowdsourcing trials were conducted with 1200 farmers and for wheat, trials with 5000 farmers are underway.

Partners:

Gene Campaign; Humana People to People India; IARI

Locations:

South Asia (SAs)

Activity 614-2013 (Milestone 1.1.3 2014 (2).)

Title: Survey methodologies to assess the relative tolerances of local crops to cope with climate change conditions.

Status: Partially complete. There were delays in receiving final datasets from India and Nepal, which did not permit completion of the analysis in 2013. The results were consequently not available to share back with the communities in 2013. The analysis will be completed in early 2014 and follow-up meetings will be held in all three countries to share project results and build on findings concerning crops that are considered resistant to climate change. Meetings with farmers and stakeholders (scientists, policymakers) were held in Nepal and Bolivia in 2013 to discuss issues in conservation of agricultural biodiversity and its role in adaptation to climate change. Gender-sensitive approaches for building resilience were explored in these meetings.

Gender component:

Gender-specific focus group discussions were held in Nepal discussing custodian farmers roles and challenges in the maintenance and adaptation of traditional crops. A gender specialist participated in the meeting who provided feedback on gender-sensitive approaches for working with custodian farmers.

Deliverables:

- Organization of local validation workshops in Bolivia, Nepal and India with national experts and community representatives to share findings, discuss strategies for enhancing practices based on gender-sensitive approaches and build capacity.

Meetings were organized in Nepal and Bolivia to discuss the role of custodian farmers in on-farm conservation with particular attention to climate change resilience and gender. Results of the surveys were not discussed, as they were not yet available. A meeting entitled: "Enhancing the contribution of custodian farmers to the national plant genetic resource system in Nepal" was held in Pokhara from 31 July to 2 August 2013. Over 20 farmers (including both men and women) participated in the meeting, alongside representatives from the Nepali government, invited scientists from NGOs working in seed conservation, and Bioversity scientists. Discussions revolved around the role of custodian farmers in on-farm conservation, with an emphasis on the importance of dynamism and adaptation in sustainable conservation. Farmers involved in maintaining high levels of crop diversity and farmers engaged in participatory breeding were invited to foster dialogue on the balance between adaptation and conservation. Farmers' roles and challenges in maintaining and adapting traditional crops in situ were explored in gender-specific focus groups. Gender specialist Marlene Elias (Bioversity) provided

feedback on improving gender sensitivity of methodologies for working with custodian farmers. A meeting with custodian farmers was also held in Battallas on 11 November 2013 to discuss their roles, challenges, and needs to strengthen on-farm conservation.

- Published proceedings from each workshop including approaches, methods and tools deployed and assessment on their effectiveness in each country. Translation of the proceedings into both English and Spanish, and disseminated for capacity enhancement purposes.

Proceedings are under preparation for the meeting held in Nepal. The proceedings feature 12 short articles by the experts in attendance, as well as results from the group discussions and participatory seed exchange. Details on the publication: Sthapit, S. Meldrum, G. Padulosi, S. & Bergamini, N. (Eds). In Prep. Proceedings of the workshop: "Enhancing the contribution of custodian farmers to the plant genetic resources system in Nepal", Pokhara (Nepal), 31 July - 2 August, 2013. The presentation slides of the invited scientists have been shared on the NUS Community webpage including: Presentation by Jacob Van Etten (Bioversity) entitled "A citizen science approach to crop adaptation under climate change": Link to file: http://www.nuscommunity.org/fileadmin/NUS_Docs/documents/publications/slides/Jacob-Citizen_Science_approach.pdf Presentation by Chris Schmidt (Native Seeds/SEARCH) entitled "History, Mission, and Strategies of Native Seeds/SEARCH and a custom platform for sourcing and sharing crop-specific information for climate change adaptation". Link to file: http://www.nuscommunity.org/fileadmin/NUS_Docs/documents/publications/Others/Chris-Experience_of_Native_Seeds_SEARCH-USA.pdf Participant biographies were published for dissemination at the meeting. Link to

file: http://www.nuscommunity.org/fileadmin/NUS_Docs/documents/publications/proceedings/Participants_of_the_Custodian_Workshop.pdf Also, a short video entitled "Custodians of Agricultural Biodiversity", produced by Li-BIRD, was screened at the meeting. Link to the video: <http://vimeo.com/71795315> Formal proceedings will not be produced from the meeting held in Bolivia in 2013. A short video documenting the diversity fair held during the event was prepared and is available at the following link: <http://www.nuscommunity.org/resources/videos.html> A booklet reporting results from a case study by Helga Gruberg (Wageningen University) in Cachilaya, Bolivia was published by Bioversity International in English and Spanish. The study investigated the roles of custodian farmers and methodologies for supporting their work in on-farm conservation. The results of this case study informed discussions during the meeting on how to take the work with custodian farmers forward in Bolivia. Several copies of the Spanish booklet have been shared back with the farmers in Cachilaya. Details on the publication: Gruberg, H., Meldrum, G., Padulosi, S., Rojas, W., Pinto, M. Crane, T.A. 2013. Towards a better understanding of custodian farmers and their roles: insights from a case study in Cachilaya, Bolivia. Bioversity International, Rome and PROINPA, La Paz. Link to file: <http://www.biodiversityinternational.org/e-library/publications/detail/towards-a-better-understanding-of-custodian-farmers-and-their-roles-insights-from-a-case-study-in-c/> Gruberg, H., Meldrum, G., Padulosi, S., Rojas, W., Pinto, M. Crane, T.A. 2013. Hacia un mejor entendimiento sobre los agricultores custodios y sus roles: percepciones de un estudio de caso en Cachilaya, Bolivia. Bioversity International, Rome and PROINPA, La Paz. Link to file: <http://www.biodiversityinternational.org/e-library/publications/detail/hacia-un-mejor-entendimiento-sobre-los-agricultores-custodios-y-sus-roles-percepciones-de-un-estudi/?L=0&cHash=8180f73d941c812f4c3c1d9eebbce3d2>

Partners:

PROINPA; MSSRF; LIBIRD

Locations:

Activity 615-2013 (Milestone 1.3.1 2013.)

Title: The role of community seed banks in climate change adaptation and climate risk management.

Status: Partially complete. The review of literature has been completed. Some pilot experiences were identified that deal specifically with climate change adaptation. Some insights can be gained from these pilot cases, but more practical examples would be required to generate lessons.

Gender component:

Analysis will include social and gender variables affecting CSB management and governance, and particular attention to the role(s) of women farmers.

Deliverables:

- Global mapping of community seed banks and related farmer PGR management activities.

First results have been included in a book chapter: Vernooy, R. 2013. In the hands of many: a review of community gene and seed banks around the world. In Shrestha, P., Vernooy, Chaudhary, P. eds. Community seed banks in Nepal: past, present, future. Proceedings of a national workshop, 14-15 June 2012, Pokhara, Nepal. Pokhara: LI-BIRD, Rome: Bioversity International, 3-15.

- Survey of selected organizations implementing CSBs and analysis of their roles in climate change adaptation.

A number of case studies have been drafted. These case studies will be included in a forthcoming book: Vernooy, R., Sthapit, B, Shrestha, P., eds. 2014 (planned). Community seed banks: history, evolution and prospects. Abingdon: Routledge/Earthscan.

- Action research on the roles of community seed reserves and utilization mechanisms for dealing with climate risk, focusing on CCAFS sites.

This research has only started recently in selected countries.

- Exploration of novel arrangements to diversify local seed collections as a response to better cope with climate related stresses.

This research has only started recently in selected countries.

Partners:

LIBIRD; National Biodiversity Centre, Ministry of Agriculture; NARO; RAB

Locations:

Global

Activity 616-2013 (Milestone 1.3.3 2013.)

Title: Analysis of changing patterns of PGRFA use to adapt to climate change, and related policy frameworks.

Status: Partially complete. Survey was sent out in July, but data were lost due to collapse of the Sawtooth website, including their backup system. The survey was mailed out again in October. Over 300 responses by the end of 2013. Analysis of data and paper writing will take place in the first half of 2014. (Some of the survey data will also be used to complement data being collected for a paper that will be reported under CRP PIM). Meanwhile, in 2013, we published one peer-reviewed journal article that was based on the first phase of our research under this activity 2011–2013.

Gender component:

The survey allows for sex differentiation of results. We won't know until we get to data analysis in 2014 if gender variables will be revealed to play an important role in the formation of linkages contributing to availability or programs to use genetic resources.

Deliverables:

- Paper presenting analysis of survey in up to 20 countries of changing uses of PGRFA for climate change adaptation.

Due to problem with software mentioned in status description.

- Paper presenting meta analysis based on 2011 survey of centres and 2012 survey of other PGRFA users in up to 20 countries.

López Noriega, I.; Halewood, M.; Galluzzi, G.; Vernooy, R.; Bertacchini, E.; Gauchan, D.; Welch, E. (2013). How Policies Affect the Use of Plant Genetic Resources: The Experience of the CGIAR. *Resources* 2(3), 231-269. On Line

http://www.bioversityinternational.org/uploads/tx_news/How_policies_affect_the_use_of_plant_genetic_resources_the_experience_of_the_CGIAR_1668_01.pdf Special Issue Equitable and Sustainable Use of Genetic Resources. doi:10.3390/resources2030231. <http://www.mdpi.com/2079-9276/2/3/231> (published 19 August 2013) This paper is based on the first half of the work, that is the 2011 surveys.

- Recommendations for best practices to centres based on prior 2 papers and regional consultations. Presented in form of policy brief, technical paper for consortium office, and possibly separate journal article.

Due to problem with software mentioned in status description.

- Paper on the effects of climate change on countries' interdependence on PGRFA, based on an analysis of CGIAR Centres' data on PGRFA flows.

First draft of paper written. Now being revised based on comments received by Bioversity colleagues.

Partners:

University of Chicago

Locations:

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



Activity 617-2013 (Milestone 1.1.3 2013 (3).)

Title: Socio economic surveys on the use of indigenous knowledge in deploying crop diversity (especially NUS) for strengthening adaptation and resilience of production systems to climate change.

Status: Partially complete. Surveys have been carried out in Nepal, India and Bolivia with 2394 farmers interviewed. Data analysis is in progress. Datasets from India and Nepal were delayed in the process of data entry and verification, which did not permit completion of the analysis in 2013. Results on (1) the most resilient/resistant crops (including NUS) and (2) farmer climate change coping strategies have been summarized. The gender dis-aggregated analysis (3) has effectively been completed for Bolivia. A deeper analysis on (4) gender differences and (5) linking results to finer scale geography will be completed in early 2014.

Gender component:

The activity directly addresses gender in objective 4. The understanding of how men and women's knowledge and perceptions differ and complement one another will support the design of more resilient systems

Deliverables:

- Completion of socio-economic surveys in Nepal, India and Bolivia.

The data collected are posted on the Harvard Dataverse Network. Researchers interested in accessing the data may request access by sending a message.

- At least two socio-economic papers; elaborated for submission to peer-reviewed journals.

Two papers have been developed but not for submission to peer-reviewed journals. One paper was published in the New Agriculturist: Meldrum, G., Sthapit, S., Rojas, W., and King, E.D.I.O. 2013. Agricultural biodiversity enhances capacity to adapt to climate change. The New Agriculturist. Focus on Neglected and Underutilized Species. November 2013. Link to publication: <http://www.new-ag.info/en/focus/focusItem.php?a=3154>

A more detailed scientific article was submitted for publication in the NUS3 conference proceedings. The proceedings will be ready spring 2014: Meldrum G., Sthapit, S., Rojas, W., King, E.D.I.O., Padulosi, S. In Press. Methodology mapping for resilient production systems: approaches followed and results from surveys in Bolivia, India, and Nepal. Proceedings of the 3rd International Conference on Neglected and Underutilized Species: For a Food Secure Africa, Accra Ghana, 25-27 September 2013. Details on the submission and publication process for the NUS3 conference proceedings are available at this link: <http://nus2013.org/submit-an-abstract/>

An earlier version of the abstract of this paper was published in the book of abstracts that was circulated at the NUS3 conference. Link to file: http://nus2013.files.wordpress.com/2013/10/book-of-abstracts_final_errata_web.pdf

The slides on this work presented at the NUS3 conference in Ghana were shared on the webpage for the conference and on the NUS community webpage. Link to file: http://www.nuscommunity.org/fileadmin/NUS_Docs/documents/publications/slides/Meldrum_Presentation_Ghana.pdf

The survey designed and carried out in Nepal, India, and Bolivia was also carried out in Zimbabwe, Peru, and Vietnam through a partnership with OXFAM Novib. The preliminary findings of these surveys have been shared in a publication: Oxfam Novib, ANDES, CTD, SEARICE, CGN-WUR. 2013. Building on farmers' perceptions and traditional knowledge. Biodiversity management for climate change adaptation strategies. Oxfam Novib. The Hague, The Netherlands. Link to file:

http://www.nuscommunity.org/fileadmin/NUS_Docs/documents/publications/factsheets/434647DIVnieuwsbrief_OxfamNovib_LR_2_.pdf

The same survey was also carried out in Sarawak, Malaysia and Cochabamba, Bolivia through a partnership with the Platform for Agrobiodiversity Research (PAR). The results from Cochabamba have been integrated with the results from La Paz in the publications listed above. The results of these surveys have been compiled and will be shared in as a synthesis of research and a brief, which are currently being finalized by PAR. A short video was also produced in 2013 sharing outcomes of this project: <http://agrobiodiversityplatform.org/par/2013/07/31/farmers-and-genebanks-an-alliance-to-save-traditional-crops/>

The results from all locations (Bolivia, Nepal, India, Sarawak, Zimbabwe, Peru, and Vietnam) will be integrated into a report for submission to a peer-reviewed journal in 2014.

- Database on indigenous knowledge and resilient crops and varieties.

Our initial idea build a database to document the climate-hardy crops recognized by farmers in Latin America and South Asia has been expanded to become the development of a webpage. The "Neglected and Underutilized Species (NUS) Community" webpage has been launched as a platform to share information on climate-hardy underutilized traditional crops in connection with the IFAD NUS project. Numerous publications and presentations are shared on this webpage concerning the contribution of hardy neglected and underutilized species to climate change resilience of smallholder farmers. A link to the list of entries containing the words "climate change" on the webpage follows: <http://www.nuscommunity.org/search.html?cx=016697108779861396524%3Ayuj9yk4fkmc&cof=FORID%3A9&ie=UTF-8&q=climate+change&submit=Search> In particular, the site shares extensive information on the role of minor millets and quinoa in climate change adaptation. These crops were the focus of the IFAD NUS project, as well as the crops most recognized as resistant to climate change in the farmer surveys carried out in Bolivia, Nepal, and India in late 2012/early 2013. This platform will continue to be developed to share information on the role of traditional and underutilized crops in climate change adaptation. A global survey of agricultural researchers and farmers is being disseminated currently to build an inventory of climate-hardy traditional crops. The results will be shared in a publication and through the NUS community webpage. <http://www.bioversityinternational.org/news/detail/which-crops-hold-the-key-for-climate-change-adaptation-a-global-survey/> Additional information on indigenous knowledge and the use of climate-hardy crops was shared on the Adaptation and Mitigation Knowledge Network (AMKN) webpage (see deliverable 5).

- Draft of peer reviewed article to synthesize findings on use of indigenous knowledge in coping strategies with special attention on gender.

The gender dis-aggregated data analysis of the survey results from Bolivia, India and Nepal is partially complete. Work is underway to develop a paper for submission to a peer reviewed journal. Datasets from India and Nepal were delayed in the process of entry and verification, which did not permit completion of the analysis in 2013. The analysis for Bolivia is effectively complete. The results from Bolivia were submitted as a case study on social differentiation and gender in this CCAFS annual report.

- More than 20 cases on the use of agrobiodiversity as an adaptation strategy featured on AMKN in 2013. Information from Re-FARM (REsilience Framework for Agriculture and Risk Management database) database repurposed in AMKN.

In 2013, a total of 36 case studies documenting the use of agricultural biodiversity in climate change adaptation were shared on the Adaptation and Mitigation Knowledge Network (AMKN), re-purposing the information from Re-FARM (Resilience framework for agriculture and risk management database). The Re-FARM webpage : <http://agrobiodiversityplatform.org/refarm/>

Partners:

PROINPA; MSSRF; LIBIRD

Locations:

Latin America (LAM), South Asia (SAs)

Activity 618-2013 (Milestone 1.2.1 2013 (1).)

Title: Capacity building on crop adaptation to climate change, using CCAFS monitoring and modeling tools.

Status: Partially complete. Training Resource Kit on ‘Resilient Seed Systems: tools and techniques for climate change adaptation’ is under preparation. It integrates a series of research processes that countries would need to carry out in order to identify, acquire, test with farmers, conserve and evaluate seeds adapted to climate change. The concept was developed against a backdrop of two main projects at Bioversity International: i) The project Strengthening national capacities to implement the International Treaty on Plant Genetic Resources for Food and Agriculture (also known as Genetic Resources Policy Initiative 2); and ii) the ‘Seeds for Needs’ project which works in a participatory approach in several countries (Ethiopia, Papua New Guinea, and India) to test climate-adapted seeds with farmers. The Resource Kit concept was discussed with, and endorsed by the 8 National Focal Points of the GRPI2 project at a meeting in Rome. In 2013, the 8 modules of the Resource Kit were described, tested with partners in Eastern Africa and South Asia and modified according to feedback. A desk study was completed to inventory and characterize a large number existing training materials relevant to climate change adaptation and resilience of seed systems. Materials in CGIAR centres, universities, NGOs and private organizations were included. A consultant was hired in late 2013 to assist Bioversity in further developing the Resource Kit, including advising on design of new training materials if needed; further evaluation and field testing and evaluation of the pilot tool box with potential users; design and lay-out of a pilot version of the comprehensive tool box. The production of the final version of the tool box is to be completed in 2014.

Gender component:

The training materials, once completed, will include modules that takes into account gender aspects of farmers preferences for seeds. The process of developing the Training Resource Kit will testing with both men and women.

Deliverables:

- Partners in at least 7 countries trained in new monitoring and modelling tools for climate change adaptation for different crops, including subutilized ones.

Thirteen scientists (7 men, 6 women) participated in CCAFS-facilitated long-term training in 2013. As many as 4,495 trainees (an equal number male and female) attended 33 short training programmes. Of these, CCAFS facilitated training of farmers and communities reached 4064 trainees in Bolivia, Ethiopia, India, Nepal and Tanzania, while professional-level training included 431 scientists, extension specialists, etc. from at least 10 countries.

Partners:

Locations:

West Africa (WA), Latin America (LAM), South Asia (SAs), East Africa (EA)

Activity 619-2013 (Milestone 1.1.3 2015 (3).) Commissioned

Title: Study on the role of informal seed systems in climate change adaptation.

Status: Partially complete. We have implemented crowdsourcing variety selection and the use of small weather sensors in Honduras and Colombia. A first round of results is available for Honduras, with good data quality. Partner organizations and farmers gave positive feedback on the methodology. Working with mobile telephones was perceived positively. Seed system vulnerability assessment has been done in Colombia and will be reported in 2014. We are creating a database with seed system stakeholders for Central America to target our training efforts in 2014 and beyond.

Gender component:

In the crowdsourcing work, men's and women's preferences are analyzed separately. Both men and women have been involved. In the crowdsourcing work, no significant preference differences were found between male and female respondents, which was important to confirm. A (small) number of women participated in the workshops.

Deliverables:

- Report on informal system in Bolivia produced.

This deliverable has not been produced with a sufficient quality.

- Critical review of the functioning of local seed systems, their constraints and potential to deliver seed under climate change conditions in Ethiopia and PNG.

This review is part of the PhD dissertation of Stella Nordhagen (provided).

- Report on informal seed systems and links to the formal seed system for various Central and South American countries.

Thesis work will be ready in 2014.

- Paper on farmers and genebanks/access to genetic resources.

Data has been collected. Paper due in 2014.

- Crowdsourcing trial with beans in Honduras.

Report of first round of trials is ready. Second round data is now being collected in the field. Preliminary report provided.

- At least 10 seed enterprises trained in crowdsourcing.

This has been changed in orientation as the FAO project (Semillas para el Desarrollo) this depended on has been ended before the official ending date due to lack of funding. A number of organizations in Honduras have been invited to a workshop instead. This has been reported in the report under deliverable 5.

Partners:

Escuela Agrícola Panamericana Zamorano

Locations:

Latin America (LAM)

Activity 620-2013 (Milestone 1.2.1 2015 (3).)

Title: Climate change impact study of bananas and plantains, coconut and cacao.

Status: Partially complete. The framework for stakeholder planning of climate change adaptation based on climate change and variability and ecological hierarchies developed initially for the activity has yielded a suite of useful approaches. In 2013 substantial progress was made on a suitability mapping tool which is adapted to the particularities of semi-perennial and perennial crops and this was plugged into an interactive homologue zone mapping tool. This will permit users to modify key parameters which can take into account cultivar differences. The profiling of moderate and extreme weather events which perturb banana production was tested with data sets from Ecuador and initiated with data sets from Pakistan. Complete data sets are not abundant and the nature of variability to be audited is still emerging. Preliminary contacts with cocoa and coconut networks suggest that these tools will be readily applicable for these crops.

Gender component:

the framework to capture current farmer and research experience with climate variability and extreme events will address agronomic practices based on gender differentiation. In smallholder households whose resources are used in banana production, who provides labor, who makes decisions and how does the fluctuation in crop performance affect the different members of the household. We will also monitor the makeup of our collaborating team in terms of gender.

Deliverables:

- Testing of alternative approaches to mapping current crop suitability for bananas in tropics and subtropics and incorporation of climate change scenarios into crop suitability mapping to project impact of CC on banana production suitability using Participatory banana mapping site.

A method based on leaf emission rate as generated by growing degree and water adequacy is ready for further validation. The potential for leaf growth is considered a viable indicator of banana performance, closely linked to return time for ratoon harvest. Mapping is done by suitability classes, the parameters of which can be changed. This will allow easy construction of the layers in a the banana mapping site.

- Inventory of banana production practices organized by ecological hierarchy of application and response to climate change, variability and extreme events.

Several tools for analysis of frequency and type of weather events were tested to determine if they could indicate events of certain magnitude. Finding complete daily weather data bases has proven

challenging. We have also conducted focus groups with banana export growers in Ecuador to understand their perceptions on weather variability and the potential options. Additional data sets are being assembled in sites with subtropical climatic regime and alternating seasonal as well as within season variability.

- Alternative modeling approaches for impact of climate change on banana pests and diseases compiled and tested for nematodes, weevils, BLS.

A preliminary review was completed of different approaches to modeling pests and diseases in banana. ILCYM was used to generate response by banana weevil to abiotic parameters. A preliminary study using existing parameters was completed to project the response of weevils, BLS and nematodes to climate change applied to the specific case of Ecuador and globally. Collaboration was also established with an RTB grant on the risk assessment from climate change for pest and disease virulence and spread.

- Inventory of national partner human resources and programs on commodity crops and climate change.

Banana country representatives in three regional banana networks were queried about their collaborative links with national climate change adaptation planning. Few has knowledge of such initiatives and even fewer had effective working links. The focus of our approach has shifted from "who can collaborate with us" to "what tools and information do we need to plug into national planning initiatives" more effectively. Contacts are in progress on this point through the regional banana networks.

- Regional banana workshops on climate change adaptation in banana with proceedings incorporated into regional website.

Working sessions were carried out with three regional banana networks in East and Southern Africa, West and Central Africa and Latin America on a homologue approach to planning regional collaboration, to the analysis of weather variability in addition to changes in climatic averages and to the spectrum of strategies from genetic to ecosystem and landscape. Presentations from these sessions are available through www.banana-networks.org which has been recently inaugurated

- Data on previous yield trials, including IMTP and CIALCA, compiled through partners, entered into Agtrials and analyzed and with existing banana and ideotype models used for formulation of crop modeling strategy.

Data from IMTP and CIALCA are being processed and uploaded. One pending data set from nine trials in Uganda is still being tracked down. Use of the data to validate suitability mapping from the first delivery is planned.

- Mapping of current cocoa and coconut commodity production areas and special diversity with identification of approaches to modeling crop suitability for cocoa and coconut.

Contacts were initiated with Cacaonet and Cogent to get access to the spatial distribution of current genetic resources. Initial contacts with network advisers indicate that the tools under development for banana will be applicable with adaptation to the particularities of these crops.

Partners:

IITA; CIAT; University of Western Australia; COGENT; Queensland Department of Primary Industries; CacaoNet; Innovative Plantain; MUSALAC; BARNESA; BAPNET

Locations:

Global



Activity 621-2013 (Milestone 1.3.2 2014.)

Title: Development of a regional strategic action plan for PGRFA management for climate change adaptation in Mesoamerica.

Status: Complete. A Strategic Action Plan for Mesoamerica (SAPM) has been completed and a printed document has been generated. SAPM launch took place in Panama City in early December with attendance of stakeholders, including Ministry of Agriculture and Environment staff, academics, donors, and relevant regional and international organizations. Extensive diagnostic analysis of ex situ and in situ conservation status and policies completed. All the information compiled and the resulting analysis accessible through the SAPM website, called ITZAMNA . Presentation of SAPM at the Fifth Session of the Governing Body of the International Treaty in Oman during a side event of the Benefit-sharing Fund, a climate change adaptation side event and the LAC regional meeting. SAP plenary presentation at SIRGEALC, Commission on Genetic Resources Regional Meeting and other fora.

Gender component:

We have had a good representation of women at several levels: as members of the Project Steering Committee, as participants during the consultation process with farmers (one third of the 140 farmers interviewed to find out about their concerns), and during the two face to face consultations that included representatives from many sectors (a focused effort was made to identify women participants from various sectors: scientists, farmers, NARs, etc.). The research team also had a very good representation of women at all levels, from leadership to support positions.

Deliverables:

- Strategic Action Plan for Mesoamerica.

66 page document published in Spanish available at <http://www.biodiversityinternational.org/e-library/publications/detail/plan-de-accion-estrategico-para-fortalecer-la-conservacion-y-el-uso-de-los-recursos-fitogeneticos/>

- Second Stakeholder Consultation report.

Specific comments provided to the draft SAPM were captured during the Second Stakeholder Consultation and have already been included in the final document (under deliverable 1). The Second Stakeholder Consultation report is a document focused on the logistics of the meeting, including the group dynamics undertaken.

- Outline of SAP-based pilot projects.

CATIE-led project in collaboration with the PPB Programme CATIE will distribute accessions from its genebank for participatory evaluation. Accessions of chili pepper, squash, tomato, cassava and sweet potato will be distributed to the participants of the Participatory Plant Breeding Programme—active in most Central American countries—for joint evaluation.

- Outline of SAP-based pilot projects.

IICA led project in collaboration with INTA, IDIAP, INBIO and others: Assessment of the Conservation status of Central American PGRFA: rescuing the information base for planning and monitoring. Funding: 70,000 USD USDA-FAS. Activities in three countries: Panama, Costa Rica and Nicaragua. Activities: • Rapid appraisal of ABD conserved on farm • Community registries of ABD developed • Develop an atlas of the existence and distribution of local crop varieties at national and local level. • Determine gaps in ex situ collections.

- Donors and Decision Maker's meeting report.
Under development, will be ready in a few months.

Partners:

FPMA; Asocuch; CONARFIP; MAGA; DICTA; SNICS; ONS; CATIE; IICA; Escuela Agrícola Panamericana Zamorano; ICTA; INIFAP

Locations:

Latin America (LAM)

Activity 622-2013 (Milestone 1.3.3 2015.)

Title: Policy research on climate change, availability of adapted germplasm and benefit sharing as related to the work of the CGRFA, ITPGRFA Governing Body, CBD COP, IPBES.

Status: Complete. During 2013, Bioversity International staff participated in a number of international meetings of the ITPGRFA Governing Body, the CBD COP and IPBES making technical presentations and interventions, organizing and facilitating side events and preparing and disseminating policy briefs.

Gender component:

Where possible, interventions and contributions pay attention to the differentiated impact of climate change on the availability and use of agrobiodiversity by farmers and other stakeholders.

Deliverables:

- Technical inputs to international agencies, policy briefs, presentations at side-events.

Halewood, M.; Fadda, C.; Mathur, P.N.; Otieno, G. (2013). Policy brief on using crop diversity for climate change adaptation and policy support. Presented at CCAFS side event at the Firth Governing Body meeting of the ITPGRFA. <http://www.bioversityinternational.org/e-library/publications/detail/using-crop-diversity-to-adapt-to-climate-change-highlighting-the-importance-of-br-the-plant-trea/>

Partners:

CGIAR Consortium Office; CGRFA; ITPGRFA; CBD; IPBES

Locations:

Global

Activity 623-2013 (Milestone 1.3.3 2015.)

Title: National level case studies - Costa Rica and Guatemala -- on impact of climate change on crops/production systems, testing the ability to identify potentially useful germplasm using climate change and crop adaption modelling and international germplasm information systems, testing ability to obtain this germplasm through the multilateral system of access and benefit-sharing. Working with national stakeholders in Costa Rica to

identify options for implementing the multilateral system of access and benefit sharing in light of climate change adaptation needs.

Status: Partially complete. In both countries, the scoping phase is still ongoing. A first training workshop on GIS and climate modeling tools was organized for the Guatemala team (the Costa Rica team were trained in 2012). A second training workshop for both teams, originally scheduled for December 2013, will now be held in March 2014 (postponement was due to unavailability of a proper workshop facility). In addition, partners from both countries were trained with respect to climate and crop modeling tools at a mid-term review workshop, July 2013.

Gender component:

The influence of gender will be one of the variables included in the research on policy networks, and on access to genetic resources and related information.

Deliverables:

- Reports of research results in both countries concerning germplasm flows into, out of, and within the countries concerned related to climate change adaptation.

For Costa Rica, a case study of beans was completed, but not yet reported on. Germplasm interdependency in the context of climate change in Guatemala was discussed at a national inception workshop in Guatemala, 21–22 March 2013; see blog post: <http://grpi2.wordpress.com/2013/04/11/kick-off-workshop-in-guatemala/>

- Reports of research results in both countries concerning impact of climate change to date on crops and production systems in target sites in the two countries.

Preliminary results from both countries were discussed at the GRPI 2 mid-term review workshop 16–19 July 2013. See the report: Vernoooy, R.; Halewood, M.; Otieno, G.; López-Noriega, I.; Wedajoo, A. 2013. Strengthening national capacities to implement the International Treaty on Plant Genetic Resources for Food and Agriculture. Report of the mid-term review workshop, 16–19 July 2013.

- Reports of research results in both countries concerning predictive modelling of future climate changes in those same areas, and locating sites where current climate is analogous.

Analysis in progress.

- Reports of research results in both countries concerning identification/location of germplasm from analogue sites that may be useful for adaptation in target sites.

Not yet done.

- Report based on research in Costa Rica regarding options for implementing the multilateral system of access and benefit sharing in light of lessons learned above and analysis of existing legal frameworks.

In progress.

Partners:

ONS; CATIE; MAGA; Universidad del Valle

Locations:

Latin America (LAM)

Activity 624-2013 (Milestone 1.3.3 2015.)

Title: Climate change adaptation case studies - Uganda and Rwanda -- on impact of climate change on crops/production systems, testing the ability to identify potentially useful germplasm using climate change and crop adaption modelling and international germplasm information systems, testing ability to obtain this germplasm through the multilateral system of access and benefit-sharing.

Status: Partially complete. In both countries, target crops and reference sites have been selected and data on climate and other crop stresses have been compiled. Partial analogue analyses have been carried out as well and some germplasm with potential adaptation capacity has been identified. Procedures have been set in motion to obtain this germplasm and introduce it for field evaluation in 2014. Partners from both countries were trained with respect to climate and crop modeling tools at a mid-term review workshop, July 2013. Pilot training for 'resilient seed systems: tools and techniques for climate change adaptation' was also carried out for partners from both countries, in Uganda, November 2013.

Gender component:

The influence of gender will be one of the variables included in the research on policy networks, and on access to genetic resources and related information.

Deliverables:

- Reports of research results in both countries concerning germplasm flows into, out of, and within the countries concerned related to climate change adaptation.

For both countries, preliminary results of germplasm flows are available. More in-depth analysis will take place based on additional research, including a survey of plant breeders and genebank managers.

- Reports of research results in both countries concerning impact of climate change to date on crops and production systems in target sites in the two countries.

Partners in both countries received two training sessions in the GIS tool and climate change modelling. See the blog: <http://grpi2.wordpress.com/2013/10/31/participatory-research-and-capacity-strengthening-in-east-africa-linking-farmers-scientists-and-policy-makers-to-use-crop-diversity-for-climate-change-adaptation/> Research was done, but results have yet to be discussed in depth in both countries. This will take place early 2014. A preliminary report is being finalized by country teams and will be shared soon.

- Reports of research results in both countries concerning predictive modelling of future climate changes in those same areas, and locating sites where current climate is analogous.

A preliminary report has been drafted for both countries. Modelling was done for beans as the main crop in both countries.

- Reports of research results in both countries concerning identification/location of germplasm from analogue sites that may be useful for adaptation in target sites.

Germplasm has been identified from Ugandan genebank (to be tested in Rwanda) and also from the Rwandan genebank (to be tested in Uganda). This germplasm has been exchanged using the SMTA. Other accessions from the global gene pool have also been identified and are in the process of being requested formally. This has been done for beans. A similar procedure will be followed for bananas in Uganda and maize in Rwanda.

- By end of year, germplasm introduced into trials.

This will be done in 2014.

- Analysis of policy frameworks within the countries related to accessing, introducing germplasm, and institutional capacities to take advantage of climate change, crop modelling and accession level information systems.

This has been done. Reports will be available January 2014.

- Pilot capacity strengthening for representatives from farmers organizations and national agricultural research programs in the use of these tools (to inform more efforts in 2014).

A workshop was held for NARO staff and farmers from both countries.

- In Uganda, national strategies to implement the multilateral system.

National partners from Uganda and Rwanda contributed to study of options for national implementation of the multilateral system of the Treaty in harmony with their commitments to regulating access and benefit sharing under other international laws. They are co-authors, with Bioversity staff, of the peer reviewed journal article based on that study. Halewood M. et. al. 2013. 'Implementing 'Mutually Supportive' Access and Benefit Sharing Mechanisms Under the Plant Treaty, Convention on Biological Diversity, and Nagoya Protocol', 9/2 Law, Environment and Development Journal p. 68, available at <http://www.lead-journal.org/content/13068.pdf> (N.B. this study was also supported by, and reported under, CRP PIM)

Partners:

NARL; NARO; ACODE; RAB

Locations:

Other, East Africa (EA)

Activity 625-2013 (Milestone 1.3.3 2015.)

Title: National level case studies - Cote d'Ivoire and Burkina Faso- on impact of climate change on crops/production systems, testing the ability to identify potentially useful germplasm using climate change and crop adaption modelling and international germplasm information systems, testing ability to obtain this germplasm through the multilateral system of access and benefit-sharing.

Status: Incomplete. Training in GIS and climate modelling tools for both teams was scheduled for December 2013, but had to be postponed due to bureaucratic problems. However, partners from both countries were trained with respect to climate and crop modelling tools at a mid-term review workshop, July 2013. In Cote d'Ivoire, research has yet to begin. In Burkina Faso, some scoping work has been carried out.

Gender component:

The influence of gender will be one of the variables included in the research on policy-making networks, and on access to genetic resources and related information.

Deliverables:

- Reports of research results in both countries concerning germplasm flows into, out of, and within the countries concerned related to climate change adaptation.

A comprehensive report about Burkina Faso's dependence on germplasm coming from abroad has been produced. Once partners receive training in GIS tools and climate change models, scheduled for

March 2014, this report will be completed with a study about how dependence is expected to increase for some crops as a result of climate change. For Cote d'Ivoire only some preliminary data have been compiled.

- Reports of research results in both countries concerning impact of climate change to date on crops and production systems in target sites in the two countries.

Partners have done a literature review on climatic changes in Burkina Faso and on their impacts on agricultural production, paying special attention to certain species. Impacts in particular target sites will be studied once partners receive training on GIS tools and climate change models, scheduled for March 2014. For Cote d'Ivoire only some preliminary data have been collected.

- Reports of research results in both countries concerning predictive modelling of future climate changes in those same areas, and locating sites where current climate is analogous.

This activity will be carried out once partners in both countries receive training on GIS tools and climate change models, scheduled for March 2014.

- Reports of research results in both countries concerning identification/location of germplasm from analogue sites that may be useful for adaptation in target sites.

This activity will be carried out in both countries once partners receive training on GIS tools and climate change models, scheduled for March 2014.

- Options for implementing the multilateral system of access and benefit sharing in light of lessons learned above and analysis of existing legal frameworks.

A general analysis of how the multilateral system can contribute to meeting Burkina Faso's needs for foreign germplasm has been conducted and documented. Partners are currently studying how existing legal frameworks need to be amended in order for the multilateral system to be fully operational in Burkina Faso, including in the context of climate change adaptation. For Cote d'Ivoire, such analysis has not yet been carried out. National partners from Cote D'Ivoire and Burkina Faso contributed to study of options for national implementation of the multilateral system of the Treaty in harmony with their commitments to regulating access and benefit sharing under other international laws. They are co-authors, with Bioversity staff, of the peer reviewed journal article based on that study. Halewood M. et. al. 2013. 'Implementing 'Mutually Supportive' Access and Benefit Sharing Mechanisms Under the Plant Treaty, Convention on Biological Diversity, and Nagoya Protocol', 9/2 Law, Environment and Development Journal p. 68, available at <http://www.lead-journal.org/content/13068.pdf> (N.B. this study was also supported by, and reported under, CRP PIM)

Partners:

University of Abobo-Adjamé; CNRA; SP/CONAGREP; Université de Ouagadougou

Locations:

West Africa (WA)



Activity 626-2013 (Milestone 1.3.3 2015.)

Title: National level case studies - Nepal and Bhutan - on impact of climate change on crops/production systems, testing the ability to identify potentially useful germplasm using climate change and crop adaptation modelling and international germplasm information systems, testing ability to obtain this germplasm through the multilateral system of access and benefit-sharing.

Status: Partially complete. Researchers from both countries took part in two training workshops on GIS and climate modelling tools held in 2013 (in April in Nepal and November in Bhutan). In addition, partners from both countries were trained with respect to climate and crop modelling tools at a mid-term review workshop, July 2013. In both countries, target crops and reference sites have been selected and data on climate and other crop stresses have been compiled. Partial analogue analyses have been carried out and some germplasm with potential adaptation capacity has been identified. In Nepal, procedures have been set in motion to obtain this germplasm and introduce it for field evaluation in 2014. In Bhutan, before procedures can be set in place, government approval will need to be obtained. This may take some time, perhaps delaying actual field evaluation until 2015.

Gender component:

The influence of gender will be one of the variables included in the research on policy-making networks, and on access to genetic resources and related information.

Deliverables:

- Reports of research results in both countries concerning germplasm flows into, out of, and within the countries concerned related to climate change adaptation.

Draft reports for both countries were produced.

- Reports of research results in both countries concerning impact of climate change to date on crops and production systems in target sites in the two countries.

Partial research results were generated at the training workshop on 'Application of GIS and Climate Analogue Tools for PGR Management and Increased Varietal Adaptation', 2–4 April 2013, Sauraha, Chitwan, Nepal. See blog post: Adapting to climate change: training workshop for teams of Bhutan and Nepal. (GIS tools and climate analogues). <http://grpi2.wordpress.com/2013/05/05/adapting-to-climate-change-training-workshop-for-teams-of-bhutan-and-nepal/>

- Reports of research results in both countries concerning predictive modelling of future climate changes in those same areas, and locating sites where current climate is analogous.

Partial research results were generated at the training workshop on resilient seed systems: tools and techniques for climate change adaptation (for GRPI2 partners from Bhutan and Nepal), 26–28 November 2013, Thimpu, Bhutan. See blog post: GRPI2 CCAFS training workshop in Bhutan for Bhutanese and Nepalese <http://grpi2.wordpress.com/2013/11/29/resilient-seed-systems-tools-and-techniques-for-climate-change-adaptation/>

- Reports of research results in both countries concerning identification/location of germplasm from analogue sites that may be useful for adaptation in target sites.

Partial research results were generated at the training workshop on resilient seed systems: tools and techniques for climate change adaptation (for GRPI2 partners from Bhutan and Nepal), 26–28 November 2013,

Thimpu, Bhutan. See blog post: GRPI2 CCAFS training workshop in Bhutan for Bhutanese and Nepalese
<http://grpi2.wordpress.com/2013/11/29/resilient-seed-systems-tools-and-techniques-for-climate-change-adaptation/>

- Reports based on research in regarding options for implementing the multilateral system of access and benefit sharing in light of lessons learned above and analysis of existing legal frameworks.

National partners from Nepal and Bhutan contributed to study of options for national implementation of the multilateral system of the Treaty in harmony with their commitments to regulating access and benefit sharing under other international laws. They are co-authors, with Bioversity staff, of the peer reviewed journal article based on that study. Halewood M. et. al. 2013. 'Implementing 'Mutually Supportive' Access and Benefit Sharing Mechanisms Under the Plant Treaty, Convention on Biological Diversity, and Nagoya Protocol', 9/2 Law, Environment and Development Journal p. 68, available at <http://www.lead-journal.org/content/13068.pdf> (N.B. this study was also supported by, and reported under, CRP PIM)

Partners:

Ministry of Agriculture and Cooperatives; NARC; LIBIRD; National Biodiversity Centre, Ministry of Agriculture; CoRRb

Locations:

South Asia (SAs)

Activity 627-2013 (Milestone 2.1.1 2013.)

Title: Systematic review of literature on the use of agricultural biodiversity for risk management and adaptation to climate change.

Status: Complete. The website has been completed and a delivery report submitted. The website will serve as both a relational database hosting the case studies reviewed and a web environment capable of supporting discussion and collaboration among different parties interested in research on diversification, adaptation, climate change and agriculture. The main functionalities are to:

- Publish and expose case studies
- Provide a flexible and expandable relational database
- Allow users to join
- Offer simple and query build search functions
- Allow users to input additional case studies
- Offer a hierarchical categorization of users and scalable permission access.

Details on the use of the website can be found in the website manual (Annex 2) The second output of this grant was the development of a paper based on the systematic review of cases of diversification as a risk management approach to climate change associated risks. The paper is in a final stage of review.

Gender component:

In the systematic review, a section within the results and discussions specifically addresses the gender dimensions of diversification as an adaptation to climate change, including gender-specific constraints and barriers to diversification as an adaptation to climate change; activities from which women are traditionally excluded and those amenable to women's participation; and differences in opportunities and outcomes from diversification for male versus female-headed households. The database allows for the further expansion of the

state of knowledge on gender issues relevant to diversification strategies through the inclusion of gender as an outcome and keyword. This will permit future applications of the database to target adaptation strategies under diverse scenarios that benefit women.

Deliverables:

- To submit a paper on peer review journal on major findings of the work done.
The paper is in its final stage.
- The database: searchable and downloadable as csv file from a web site that will publish the data.
The database was completed and is online (link below).

Partners:

Columbia University; ICRAF

Locations:

Global

Activity 628-2013 (Milestone 3.3.1 2014.)

Title: Impact of progressive climate change on Mesoamerican agriculture and ecosystem services. Projections and scenario development.

Status: Incomplete. This activity has been cancelled due to budget constraints.

Gender component:

Deliverables:

- Assessment of available databases and knowledge gaps.
This activity has been cancelled due to budget constraints.
- Consultation and engagement of Central American governments on impact pathways and key criteria for regional scenario building.
This activity has been cancelled due to budget constraints.
- Baseline evaluation of climate change impact in Central America for CCAFS.
This activity has been cancelled due to budget constraints.
- Development and submission of a cross center and cross CRP proposal.
This activity has been cancelled due to budget constraints.

Partners:

Locations:

Latin America (LAM)

Activity 629-2013 (Milestone 4.2.2 2014.)

Title: Local climate change vulnerability assessment and adaptation planning.

Status: Complete. Vulnerability assessment activities have been executed in Tanzania and Colombia. A draft manual has been developed. In 2014 we will further publish and promote outcomes from this activity.

Gender component:

Vulnerability will be analyzed separately for women and men by splitting them into different groups during workshops. This is fully integrated in the vulnerability analysis methodology.

Deliverables:

- Review of toolkits.

Report available.

- Vulnerability assessment and methodological evaluation of toolkit -- East Africa and/or South Asia.

Reports available.

- Vulnerability assessment and methodological evaluation of toolkit -- Latin America.

Report attached.

Partners:

IDS

Locations:

Latin America (LAM), East Africa (EA)

Activity 630-2013 (Milestone 4.1.2 2013.)

Title: International Scoping Study of the Role of Agrobiodiversity as an Instrument for Climate Change Adaptation.

Status: Complete. Successfully completed. Postdoctoral Research Fellow (Dr Mary Thompson) contracted and joint Bioversity/FAO/BC3/Diversitas scoping study meeting held 8–11 October 2013. Draft meeting report available and awaiting comment from participants. Objective of the workshop was to identify key research issues and questions for both crop and livestock diversity, undertake a gap analysis, map out areas for strategic future research (including for joint research) and identify strategies to facilitate donor dialogue and project development. The workshop involved approximately 35 experts from multiple specialty areas including animal and plant genetic resources and conservation, forest genetic resources, social scientists, and others. Over the course of the workshop a common understanding was reached by the experts that conserving functional agrobiodiversity provides critical adaptation options for animals, plants, farmers and food systems in the face of the irreversibility associated with impacts from multiple drivers of change including climate change. Concerning the best ways to support this functional agrobiodiversity and the understanding of its role in adaptation to climate change, some key points and ideas emerged from the overall group relating to research needs. These points were also supported by the expert survey and include the following: 1. More genomic, biological, and

socio-economic data is needed to strengthen future projects, support monitoring of trends, and provide a clear evidence base upon which policymakers can base decisions. 2. There is a need to geo-reference current and future data to support more efficient integration with other ABD and climate change adaptation data to promote a more holistic understanding of changes and trends in ABD associated with climate, climate variability, extreme events, and the associated impacts. 3. A landscape scale approach to research projects is agreed to be a useful means of better encompassing the dynamism and complexity within particular linked agricultural, social, and ecological systems. Follow-up activities (journal paper and concept note development) are ongoing.

Gender component:

Relevant evidence regarding gender differentiated roles in the use of diversity for climate change adaptation included in the review, gender issues considered as part of the gap analysis and, where relevant, will be integrated into any project proposals developed. The expert meeting also aimed for a gender balance and the inclusion of participants with expertise in gender issues within the specific field being researched.

Deliverables:

- State of the art review/synthesis of evidence regarding agrobiodiversity as an instrument for climate change adaptation.

Workshop report (draft, awaiting input from participants). Title: Report of the Expert Workshop on Crop and Livestock Diversity for Climate Change Adaptation, Rome, 8–11 October 2013 Format: Word

- Expert scoping study meeting to identify key research issues/questions.

Expert scoping study workshop jointly realized by Bioversity/BC3/FAO/Diversitas 8–11 October 2013 at Bioversity HQ (Rome), involving approximately 35 participants. Objective was to identify key research issues and questions for both crop and livestock diversity, undertake a gap analysis, map out areas for strategic future research (including for joint research) and identify strategies to facilitate donor dialogue and project development

- A gap analysis, including mapping out areas for strategic future research and the identification of strategies to facilitate donor dialogue/policy maker uptake pathways.

Based on workshop findings, gap analysis at an advanced stage of write-up

- Development a hub of community of practice made up of experts in fields associated with agrobiodiversity and climate change adaptation.

Ongoing process building upon the network formed as part of the workshop realization

- Develop project proposals.

To be realized in 2014 so nothing to report in 2013

- Peer-reviewed international scientific journals.

To be realized in 2014 so nothing to report in 2013

Partners:

BC3; UC Berkeley; FAO

Locations:

Global

2. Succinct summary of activities and deliverables by Output level

Output: 1.1.1

Summary:

Work on Seeds for Needs has been better integrated and is moving towards outcomes. The work in India is the most advanced in terms of outscaling, now reaching several thousands of farmers and achieving leverage. We report this as one of the outcomes. Work in East Africa and Central America is also advancing well. Work on all three continents now incorporates crowdsourcing and weather sensors as new methodological elements. In terms of methodology, we have now gained a better understanding of how variety ranking can be combined with data from local weather sensors and mobile telephony, preparing for further technology development and outscaling in 2014.

Output: 1.1.3

Summary:

In the course of the year, training of community members on cultivation practices for resilient crops were carried out in India (13 villages in Tamil Nadu, 5 villages in Madya Pradesh and villages across Bageshwar, Almora and Nainital in Uttarakhand), Bolivia (8 communities around Lake Titicaca) and Nepal (villages of Talium, Lekhnath NP, Namdu and Kachorwa). The target of training courses has been women farmers and other vulnerable groups particularly. An estimated 2950 people benefited directly from these activities. Community Biodiversity Registers were introduced in target communities of the IFAD-NUS project to document cultivation of resilient crops and their traits allowing farmers to share knowledge and seeds for adaptation purposes. Knowledge about food preparation and income generation opportunities from resilient crops were also disseminated during community-based workshops, seed fairs and farmer visits.

Output: 1.2.1

Summary:

Several stakeholder tools for generating approaches to adaptation planning were refined through work with three different regional banana networks in Africa and Latin America representing over 35 countries. An interactive mapping tool allows the user to choose limits for categories based on temperature and rainfall variables. An approach using monthly climatic data was launched based on growing degree days and total development units to predict banana growth cycles. These tools were also used to look at effect of climate change on pest and disease severity. An inventory approach with banana and plantain export bananas and plantains in Ecuador was piloted to understand the role of moderate and extreme weather events in banana productivity and grower management practices.



Output: 1.3.1

Summary:

Researchers are assisting community seed banks, technically and operationally, to integrate climate change adaptation more effectively into their activities. This is done through training activities as well as through building relationships with national and international genebanks through which "new" germplasm can be accessed that has better adaptation potential. These efforts are based on an assessment of socio-economic and agro-ecological farming conditions.

Output: 1.3.2

Summary:

The Strategic Action Plan for Mesoamerica has been formulated using a methodology that combines analysis of scientific evidence on the current state of plant genetic resources for food and agriculture (PGRFA) in the region in the context of climate change adaptation, and a broad participatory process involving stakeholders from all countries in the region: Panamá, Costa Rica, El Salvador, Nicaragua, Honduras, Guatemala and Mexico. The plan proposes 64 actions in 6 thematic components, which constitute a road map to strengthen conservation, access and use of plant genetic resources in Mesoamerica for the next ten years. The 6 thematic components are: on-farm and in situ conservation, sustainable use, institutions and policies, education and capacity building, operations, and financial components. The SAPM has been taken up by several national and regional bodies already, and has been reported as an outcome.

Output: 1.3.3

Summary:

Multistakeholder research teams in 9 countries analyzed their existing access and benefit sharing laws vis-a-vis their commitments, under the international plant treaty, to participate in an international system of crop genetic diversity pooling and sharing for agricultural research. ICAR, NBPGR and Bioversity (for CCAFS) published a road map for policy and institutional reforms in India that need to be undertaken at the levels of the Ministries of Agriculture and Environment to implement the multilateral system of access and benefit sharing. ICAR is in the process of developing a south-south technology transfer program whereby India will make adapted crop germplasm available for use in arid and semi-arid farming systems in sub-Saharan Africa. The national agriculture research council led a process to draft a revision of the National Agrobiodiversity Policy to prioritize implementation and participation in the multilateral system of access and benefit sharing. The draft is currently being considered by the Minister of Agriculture; if accepted, it will be further submitted to Cabinet in 2014 (see case study on policy engagement). Eight countries initiated exercises to confirm what crop genetic resources they will include in the multilateral system of access and benefit sharing. One completed the exercise, and the other seven will finish in 2014, sending notification to the secretary of the plant treaty.

Output: 2.1.1**Summary:**

We delivered a literature review on the role of crop diversification to address climate risk and a website with an inventory of case studies based on this literature review. Through our global program Seeds for Needs, we are testing innovative approaches to varietal diversification to deal with climate risk in the field. In East Africa, the approach was customized and tailored to local needs by using FGD or other participatory tools to assess specific needs and climate related risks, as well as household surveys.

Output: 3.3.1**Summary:**

Note: our activity under this output had been cancelled due to budget constraints.

Output: 4.1.2**Summary:**

Realization of an Expert Workshop on Crop and Livestock Diversity for Climate Change Adaptation (Bioversity/BC3/FAO/Diversitas, October 2013) to identify key research issues and questions, undertake a gap analysis and map out areas for strategic future research. Follow-up activities involve journal article elaboration and proposal development (possibly in collaboration with Future Earth/Diversitas), including aimed at testing approaches and strategies for addressing (workshop findings): 1) the need for more genomic, biological, and socio-economic data to strengthen future projects, support monitoring of trends, and provide a clear evidence base upon which policymakers can base decisions; and 2) the application of landscape scale approaches as a useful means of better encompassing the dynamism and complexity within particular linked agricultural, social and ecological systems.

Output: 4.2.2**Summary:**

Studies in two countries (Tanzania and Colombia), together with the Institute of Development Studies (Sussex) have helped to generate a local participatory vulnerability assessment methodology that explicitly takes into account gender and social differentiation in different livelihoods. The new manual, together with the experience developed in 2013, will serve as the basis for systematic implementation of this approach in order to guide community adaptation planning.



3. Publications

Publication #1

Type: Journal papers

CCAFS Themes: Theme 1

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* 4(1):155-178.

Publication #2

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Liu W, Zhang Z, Wu B. 2013. Karyotype analysis of diploid oat germplasm introduced from Canada. *Journal of Plant Genetic Resources* 14(1):143-147.

Publication #3

Type: Journal papers

CCAFS Themes: Theme 1, Theme 4.2

Citation: Lopez Noriega I, Halewood M, Galluzzi G, Vernooy R, Bertacchini E, Gauchan D, Welch E. 2013. How policies affect the use of plant genetic resources: the experience of the CGIAR. *Resources* 2(3):231-269.

Publication #4

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Neufeldt H, Jahn M, Campbell BM, Beddington JR, DeClerck F, De Pinto A, Gullede 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 and Food Security* 2(12).

Publication #5

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Zhang Z, Zhao L. 2013. Molecular characterization of genetic diversity of underutilized crops: buckwheat as an example. *Acta Horticulturae* 979:407-419.

Publication #6

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Xu W, Zhang Z, Zhang E, Wu B. 2013. A Genetic Linkage Map for Naked Oat (*Avena nuda* L.). *Journal of Plant Genetic Resources* 14(1): 139-143.

Publication #7

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Du X, Zhang Z, Wu B, Li Y, Wang A. 2013. Construction and Analysis of Genetic Linkage Map in Tartary Buckwheat (*Fagopyrum tataricum*) Using SSR. *Chinese Agricultural Science Bulletin* 29(21): 61-65.

Publication #8

Type: Journal papers

CCAFS Themes: Theme 1

Citation: van Zonneveld M, Castañeda N, Scheldeman X, van Etten J, Van Damme, P. 2013. Application of consensus theory to formalize expert evaluations of plant species distribution models. *Applied Vegetation Science* doi: 10.1111/avsc.12081.

Publication #9

Type: Journal papers

CCAFS Themes: Theme 2

Citation: Mijatović D, Van Oudenhoven F, Eyzaguirre P, Hodgkins T. 2013. The role of agricultural biodiversity in strengthening resilience to climate change: towards an analytical framework. *International Journal of Agricultural Sustainability* 11(2): 95-107.

Publication #10

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Meldrum G, Sthapit S, Rojas W, King O. 2013. Agricultural biodiversity enhances capacity to adapt to climate change. *New Agriculturist* 13(6).

Publication #11

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Halewood M, Andrieux E, Crisson L, Gapusi JR, Wasswa Mulumba, J, Koffi EK, Yangzome Dorji T, Bhatta MR, Balma D. 2013. Implementing 'Mutually Supportive' Access and Benefit Sharing Mechanisms Under the Plant Treaty, Convention on Biological Diversity, and Nagoya Protocol. *Law, Environment and Development Journal* 9(2): 68-96. (Kindly note, this journal article has also been reported to CRP PIM as the content reflects our work in both CRPs)

Publication #12

Type: Books

CCAFS Themes: Theme 1

Citation: Bioversity International. 2013. Plan de accion estrategico para fortalecer la conservacion y el uso de los recursos fittogeneticos mesoamericanos para la adaptacion de la agricultura al cambio climatico - PAEM 2014-2024. Cali: Bioversity International

Publication #13

Type: Book chapters

CCAFS Themes: Theme 1

Citation: Hijaba Y, Vernooy R, Tsogt J. 2013. Generating localized weather forecasts for nomadic herders in Mongolia. In: Gunfeld H et al, eds. *Development research to empower all Mongolians through information technology*. Ulaanbaatar: Datacom.

Publication #14

Type: Book chapters

CCAFS Themes: Theme 1

Citation: Luchetti D, Dulloo E, Asfaw A, Collette L. 2013. Conservation and sustainable use of genetic resources for food and agriculture. In: *Climate-smart Agriculture Sourcebook*. Rome: The Food and Agriculture Organization.

Publication #15

Type: Book chapters

CCAFS Themes: Theme 1

Citation: Bellon MR, van Etten J. 2013. Climate change and on-farm conservation of crop landraces in centres of diversity. In: Jackson M, Ford-Lloyd B, Parry M, eds. Plant genetic resources and climate change. Oxford: CABI.

Publication #16

Type: Policy briefs

CCAFS Themes: Theme 1

Citation: Halewood M, Mathur PN, Fadda C and Otieno G. 2013. Using crop diversity to adapt to climate change: highlighting the importance of the Plant Treaty's policy support. Rome: Bioversity International.

Publication #17

Type: Policy briefs

CCAFS Themes: Theme 1

Citation: van de Gevel J, Gellaw A, Fadda C. 2013. Seeds for Needs: adaptation to climate change - Innovative tools to match seeds to the needs of women farmers in Ethiopia. Nairobi: Bioversity International.

Publication #18

Type: Policy briefs

CCAFS Themes: Theme 1

Citation: van de Gevel J, Gellaw A, Fadda C, van Zonneveld M. 2013. Seeds for Needs: atlas of crop suitability. Nairobi: Bioversity International.

Publication #19

Type: Policy briefs

CCAFS Themes: Theme 1

Citation: van de Gevel J, Gellaw A, Fadda C. 2013. Seeds for Needs: participatory variety selection. Nairobi: Bioversity International.

Publication #20

Type: Policy briefs

CCAFS Themes: Theme 1

Citation: van de Gevel J, Gellaw A, Fadda C. 2013. Seeds for Needs: perceptions on climate change. Nairobi: Bioversity International.

Publication #21

Type: Conference proceedings

CCAFS Themes: Theme 1

Citation: Matteis L, Chibon P, Espinosa H, Skofic M, Finkers R, Bruskiwich R, Hyman G, Arnaud, E.2013. Crop ontology: vocabulary for crop-related concepts. Presented at the First International Workshop on 'Semantics for Biodiversity' (S4BioDiv). held in Montpellier, France, 27 May 2013.

Publication #22

Type: Conference proceedings

CCAFS Themes: Theme 2

Citation: Thornton P, Lipper L, Baas S, Cattaneo A, Chesterman S, Cochrane K, de Young C, Ericksen P, van Etten J, DeClerck F, Douthwaite B, DuVal A, Fadda C, Garnett T, Gerber P, Howden M, Mann W, McCarthy N. 2013. How does climate change alter agricultural strategies to support food security? Background paper for the conference "Food Security Futures: Research Priorities for the 21st Century" held in Dublin, Ireland, 11-12 April 2013.

Publication #23

Type: Conference proceedings

CCAFS Themes: Theme 1

Citation: Mink P, Lopez Noriega I. 2013. Addressing global challenges through agricultural technology transfer - a list of selected literature. Background document for the Second Meeting of the Platform for the Co-Development and Transfer of Technologies, ITPGRFA, held in Bandung, Indonesia, 30 June -1 July 2013. Rome: ITPGRFA.

Publication #24

Type: Other

CCAFS Themes: Theme 1

Citation: Vernooy R, Ykhanbai H, Tsogt J. 2013. Mongolia's nomadic weather readers. Resilience March 2013. [web article]

Publication #25

Type: Other

CCAFS Themes: Theme 1

Citation: Ramirez M, Galluzzi G, van Zonneveld M, Thomas E, van Etten J, Pinzon S, Alcazar C, Beltran M, Libreros D, Solano W. 2013. Plan de accion estrategico para fortaleces la conservacion y el uso RFG mesoamericanos para la adaptacion de la agricultura al cambio climatico - PAEM - 2014-2024. [abstract]

Publication #26

Type: Other

CCAFS Themes: Theme 1

Citation: Baena M. 2013. Analysis of stakeholders in Mesoamerica for adaptation of agriculture to climate change. [Report]

Publication #27

Type: Working papers

CCAFS Themes: Theme 1

Citation: Mittra S, van Etten J, Franco T. 2013. Collecting weather data in the field with high spatial and temporal resolution using iButtons. Bioversity International.

Publication #28

Type: Working papers

CCAFS Themes: Theme 1

Citation: Mittra S, van Etten J, Franco T. 2013. Guía técnica para el registro de datos meteorológicos en el campo con una alta resolución espacial y temporal utilizando iButtons. Bioversity International

Publication #29

Type: Books

CCAFS Themes: Theme 1

Citation: Brahmi P, Mathur PN, Bansal KC(Eds).A road map for implementing the multilateral system of access and benefit-sharing in India. 2013. Bioversity International, Rome; ICAR and NBPGR, New Delhi.

Publication #30

Type: Journal papers

CCAFS Themes:

Citation: Harvey CA, Chacón M, Donatti CI, Garen E, Hannah L, Andrade A, Bede L, Brown D, Calle A, Chará J, Clement C, Gray E, Ha Hoang M, Minang P, Rodríguez AM, Seeberg-Elverfeldt C, Semroc B, Shames S, Smukler S, Somarriba E, Torquebiau E, van Etten J, Wollenberg E. 2013. Climate-smart Landscapes: Opportunities and Challenges for Integrating Adaptation and Mitigation in Tropical Agriculture. Conservation Letters.

Publication #31

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Mijatovic D,van Oudenhoven F, Eyzaguirre P, Hodgkin T. 2013. The role of agricultural biodiversity in strengthening resilience to climate change: towards an analytical framework. International Journal of Agricultural Sustainability.11 (2) 95-107. Apologies, we reported this as an online first in 2012, but this was published in 2013.

4. Communications

Media campaigns:

- 22 May, 2013 - Campaign page for International Day of Biodiversity included promotion of Seeds for Needs: http://old.bioversityinternational.org/international_day_of_biodiversity
- 28 March, 2013 - Crowdsourcing Crop Improvement: A Q & A with Jacob van Etten <http://www.crowdsourcing.org/editorial/crowdsourcing-crop-improvement-a-qa-with-jacob-van-etten/24893>

Blogs:

Web stories on Bioversity website:

- 25 April, 2013 – Article in both Spanish and Englisho Communities saving maize diversity in Guatemala <http://www.bioversityinternational.org/news/detail/communities-saving-maize-diversity-in-guatemala/o> Comunidades en Guatemala guardan la diversidad del maíz <http://www.bioversityinternational.org/news/detail/comunidades-en-guatemala-guardan-la-diversidad-del-maiz/>
- 6 May, 2013 - Strategic Action Plan to strengthen the Plant Genetic Resources in Mesoamerica http://old.bioversityinternational.org/announcements/strategic_action_plan_to_strengthen_the_plant_genetic_resources_in_mesoamerica.html
- 5 June, 2013 - Blog post in both Spanish & English (also posted on CCAFS blog):o Farmer strategies to adapt to climate change in Colombia <http://www.bioversityinternational.org/news/detail/farmer-strategies-to-adapt-to-climate-change-in-colombia/o> Estrategias de los agricultores para adaptarse al cambio climático en Colombia <http://www.bioversityinternational.org/news/detail/estrategias-de-los-agricultores-para-adaptarse-al-cambio-climatico-en-colombia/>
- 11 September, 2013 - From the fields of Bihar, India (DG Dialogues) <http://www.bioversityinternational.org/news/detail/from-the-fields-of-bihar-india/>
- 11 Oct, 2013 - Climate-smart territories — An interview with Jacob van Etten <http://www.bioversityinternational.org/news/detail/climate-smart-territories-an-interview-with-jacob-van-etten/>
- 16 Dec, 2013 - Plant genetic resources and climate change (Publication promotion) <http://www.bioversityinternational.org/news/detail/plant-genetic-resources-and-climate-change/On> CCAFS website/blog:
- March 11, 2013 - Farmers become citizen scientists: Testing wheat crops for climate change adaptation <http://ccafs.cgiar.org/blog/testing-wheat-crops-climate-change-adaptation#.Us60z2RDvXg>
- Mar 14, 2013 - Climate smart villages in India show early signs of great reform achievements <http://ccafs.cgiar.org/blog/climate-smart-villages-india-show-early-signs-success#.Us60zWRDvXg>
- June 4, 2013 - Farmer strategies to adapt to climate change in Colombia <http://ccafs.cgiar.org/blog/farmers-map-strategies-adapt-climate-change-colombia#.Us60zGRDvXg>

- November 26, 2013 - Assessing climate change vulnerability and its effects on food security: Testing new tools in Tanzania <http://ccafs.cgiar.org/blog/assessing-climate-change-vulnerability-and-its-effects-food-security-testing-new-tools-tanzania#.Ut-QFLE1jmh>
- (Publication) Using crop diversity to adapt to climate change: highlighting the importance of the Plant Treaty's policy support <http://ccafs.cgiar.org/publications/using-crop-diversity-adapt-climate-change-highlighting-importance-plant-treatys-policy#.Us60sWRDvXg> On the Genetic Resources Policy blog January 30, 2013 - Climate analogues for Rwanda and Uganda – building capacity to exploit the multilateral system. <http://grpi2.wordpress.com/2013/01/30/climate-analogues-rwanda-uganda/> April 11, 2013 - National kick-off workshop for GRPI2 project in Guatemala. 21-22 March 2013 <http://grpi2.wordpress.com/2013/04/11/kick-off-workshop-in-guatemala/> May 5, 2013 - Adapting to climate change: training workshop for teams of Bhutan and Nepal (GIS tools and climate analogues), 2-4 April 2013, Sauraha, Chitwan, Nepal <http://grpi2.wordpress.com/2013/05/05/adapting-to-climate-change-training-workshop-for-teams-of-bhutan-and-nepal/> October 31, 2013 - Crop diversity for climate change in Africa <http://grpi2.wordpress.com/2013/10/31/participatory-research-and-capacity-strengthening-in-east-africa-linking-farmers-scientists-and-policy-makers-to-use-crop-diversity-for-climate-change-adaptation/> November 19, 2013 - Reporting on the GRPI2 mid term review workshop 16-19 July 2013 <http://grpi2.wordpress.com/2013/11/19/mid-term-review-workshop-report/> November 20, 2013 - Resilient seed systems: tools and techniques for climate change adaptation for Bhutan and Nepal <http://grpi2.wordpress.com/2013/11/29/resilient-seed-systems-tools-and-techniques-for-climate-change-adaptation/>

Websites:

Landing pages on new Bioversity website with acknowledgement/links to CCAFS:

- August 2013 - Adaptation to climate change <http://www.bioversityinternational.org/research-portfolio/adaptation-to-climate-change/>
- August 2013 - Seeds for Needs <http://www.bioversityinternational.org/research-portfolio/adaptation-to-climate-change/seeds-for-needs/>

Social media campaigns:

- All web stories and blog posts are promoted on our social media channels, mainly on Facebook (<https://www.facebook.com/bioversityinternational>) and Twitter @BioversityInt, as well as cgiar.org and to a lesser extent Yammer
- CCAFS content and projects are regularly promoted through the same channels
- November 2013 - Tweeting and social media support during the Global Landscapes Forum, UNCCC COP19 in Warsaw, including a blog post: To change the outlook of climate change, landscapes and biodiversity are part of the equation (DG Dialogues) <http://www.bioversityinternational.org/news/detail/to-change-the-outlook-of-climate-change-landscapes-and-biodiversity-are-part-of-the-equation/>

Newsletters:

Internal newsletter to Board members/Ambassadors <http://www.bioversityinternational.org/ambassador-toolkit/April> 2013 includes CCAFS projects:<http://us4.campaign-archive2.com/?u=b155cf56487b60ffa7a477a&id=653078e75c> December 2013 - Bioversity International Policy Unit Update <http://us4.campaign-archive1.com/?u=e3ef78ee83b27e141a2055fdb&id=3fbb176ac5>

Events:

- July 2013 - Africa Agriculture Science Week Contributed videos and materials for CCAFS booth
- September 2013 - Using crop diversity to adapt to climate change: the importance of the International Treaty's policy support. Side event during the 5th session of the Governing Body of the International Treaty, Oman, 24–28 September 2013. Organized side event and distributed publications. Side event flyer and presentations available from: <http://www.planttreaty.org/content/using-crop-diversity-adapt-climate-change-importance-international-treaty%E2%80%99s-policy-support>
- September 2013 - CGIAR Centres' experiences implementing their Article 15 Agreements with the Governing Body. Side event during the 5th session of the Governing Body of the International Treaty, Oman, 24–28 September 2013. Organized side event on behalf of the CGIAR Consortium. Flyer and presentation available at: <http://www.planttreaty.org/content/cgiar-centres%E2%80%99-experiences-implementing-their-article-15-agreements-governing-body>
- September 2013 - Mutually Supportive national implementation of the Treaty's multilateral system, and access and benefit-sharing under the CBD and the Nagoya Protocol. Side event during the 5th session of the Governing Body of the International Treaty, Oman, 24–28 September 2013. Organized side event. Flyer and presentation available at <http://www.planttreaty.org/content/mutually-supportive-national-implementation-itpgrfa%E2%80%99s-multilateral-system-and-access-and-ben>
- November 2013 - Global Landscapes Forum, UNCCC COP 19 Social media and blog (see above)

Videos and other multimedia:

- 6 March, 2013 - Seeds for Needs: Climate-proofing agriculture by optimizing crop variety use (presentation by Jacob van Etten): <http://www.youtube.com/watch?v=Bdt5vpyJXeA>
- 22 May, 2013 - 'Seeds for Needs' project in India: <http://www.youtube.com/watch?v=FjydyN354OU>

Other communications and outreach:

Slideshare presentations:

- 2 August, 2013 - Seeds for needs <http://www.slideshare.net/BioversityInternational/seeds-for-needs>
- 9 October, 2013 - Crop and tree species diversification for climate risk management <http://www.slideshare.net/BioversityInternational/sesion-2-maaerten-van-zonneveld>
- 9 October, 2013 - Climate-smart seed systems <http://www.slideshare.net/BioversityInternational/sesion-1-jacob-van-etten-wallace> Flickr sets:
- February 2013 - Seeds for Needs -

India <http://www.flickr.com/photos/bioversity/sets/72157632982993783/>

- March, 2013 - Conserving maize diversity in

Guatemala <http://www.flickr.com/photos/bioversity/sets/72157633260144856/>

- April, 2013 - Climate change adaptation in the

Americas <http://www.flickr.com/photos/bioversity/sets/72157633760643174/> Multiple stories in Annual Report

2012 (published in Jun 2013): <http://annualreport2012.bioversityinternational.org/> Training guides:

- June 2013 - iButton training guides in both English & Spanish: o Guía técnica para el registro de sotos

meteorológicos en el campo con una alta resolución espacial y temporal utilizando iButtons

[http://www.bioversityinternational.org/e-library/publications/detail/guia-tecnica-para-el-registro-de-satos-](http://www.bioversityinternational.org/e-library/publications/detail/guia-tecnica-para-el-registro-de-satos-meteorologicos-en-el-campo-con-una-alta-resolucion-espaci)

meteorologicos-en-el-campo-con-una-alta-resolucion-espaci/o Collecting weather data in the field with high

spatial and temporal resolution using iButton [http://www.bioversityinternational.org/e-](http://www.bioversityinternational.org/e-library/publications/detail/collecting-weather-data-in-the-field-with-high-spatial-and-temporal-resolution-using-ibutton/)

library/publications/detail/collecting-weather-data-in-the-field-with-high-spatial-and-temporal-resolution-using-

ibutton/

5. Case studies

Case Study #1

Title: Gendered climate change perceptions and coping strategies of smallholder farmers in Bolivia

Author: Gennifer Meldrum, Wilfredo Rojas, Stefano Padulosi, Paul Bordoni, and Ximena Cadima

Type: Social differentiation and gender

Project description:

A survey was carried out of 234 households in 13 communities in the districts of La Paz and Cochabamba, Bolivia to assess their climate change perceptions and coping strategies. The communities were selected considering aspects such as high diversity of crops, varieties, and agro-ecosystems, willingness and support of farmers and local authorities, and ease of interaction and communication between field technicians and the community. Initially, local authorities were contacted in each community and meetings with the local farmers were conducted to inform them of the objective and scope of the survey. Local authorities then asked for volunteers to be interviewed. One farmer was interviewed in each participating household regarding the crops they grow, their perceptions of changes in the weather in the last 20 years, the impacts of climate change in general and for men and women specifically, as well as the actions they have taken to cope. Interviewers requested to speak with the head of the household but in some cases another household member who had time was interviewed. On average

Introduction / objectives:

Farmers' climate change perceptions and coping strategies underpin their adaptive capacity. Access to information and resources, such as agricultural biodiversity, strongly influence these factors and can differ between men and women leading to divergent vulnerabilities. In this study we investigated gendered climate change perceptions and coping strategies among smallholder farmers in Bolivia to

Project results:

Most farmers noticed weather changes in the last 20 years (92%), particularly higher temperatures and late rains, which have led to more pests and disease and reduced yields. Most farmers consider the whole family is impacted, rather than one gender specifically (88%) and that both men and women's roles are affected (64%). Men tend to see more effect of climate change on men's roles, as do women for their roles. Common coping actions are to plant different crops and disease resistant varieties, plant trees, harvest more water and increase reliance on livestock. Water and livestock are often the responsibility of women so an increased work load in these areas could contribute to some women feeling their roles have changed more than men's. Potato and quinoa were the crops most recognized as resistant to the changes. More men recognized improved variety runa toralapa as resistant, while men and women similarly considered native potato varieties (e.g. luki) resistant.

Women more often noted susceptibility of Andean roots oca and papalisa. More farmers took action to cope with changes in

Partners:

Foundation for the Promotion and Research of Andean Products (PROINPA) International Fund for Agricultural Development (IFAD) The Platform for Agricultural Biodiversity (PAR) The Christensen Fund

Links/sources for further information:

NUS Community Website IFAD NUS III project description New Agriculturist Article features non-gender disaggregated analysis from the same survey Proceedings from the NUS3 Conference will present non-gender disaggregated analysis from the same survey (more scientific than the New Agriculturist Article) – should be available soon. Video on the PAR project in Cochabamba that was supported by the Christensen Fund.



Case Study #2

Title: Resilient seed systems: tools and techniques for climate change adaptation

Author: Ronnie Vernooy

Type: Capacity enhancement

Project description:

With a changing climate, farmers and breeders alike will be forced to look further afield for germplasm that has better adaptive traits. Germplasm with useful features may come from various sources, including farmers’ fields, community seed banks and national and international genebanks. One expected consequence is that interdependence will increase and hence the relevance of international mechanisms to access and use germplasm, such as the multilateral system of the ITPGRFA. Involving farmers more directly and actively in the



research process toward adaptation can make crop experimentation more effective. In order to assist farmers and breeders with assessing the changing needs for national and foreign sourced germplasm, climate and crop modeling tools can be used to project the adaptive capacity of a given crop to expected changes in climate both spatially and temporally. Adding a climate modeling component to the conventional experimental crop improvement cycle opens up new windows for research and training.

Introduction / objectives:

In order to facilitate this kind of adaptation, Bioversity International is developing a resource box that allows users to select a variety of tools for the different steps in the research cycle, mix and match these tools in a flexible manner and design a comprehensive capacity building strategy for managing germplasm flows and interdependence in the context of climate change adaptation.

Project results:

About 100 researchers, genebank managers and extension agents from Bhutan, Burkina Faso, Cambodia, Costa Rica, Côte d'Ivoire, Ethiopia, Guatemala, India, Lao PDR, Nepal, Rwanda and Uganda have been trained in the use of GIS and climate modeling tools and techniques applied to crop experimentation. The partners are accessing materials from CG genebanks, but also accessing them through bilateral exchanges between the national genebanks of the participating countries. The researchers are also investigating obtaining materials for international exchange from participating farmer communities, in conformity with national laws. A number of field tests are in the planning stage, which will bring together these actors together with farmers to assess the potential of newly introduced germplasm to adapt to changing climate conditions. In Bhutan, the tools and techniques will be used to revise national crop conservation and breeding strategies. With the support of a consultant, Bioversity International is finalizing the resource box which will be made available online and in hardcopy form.

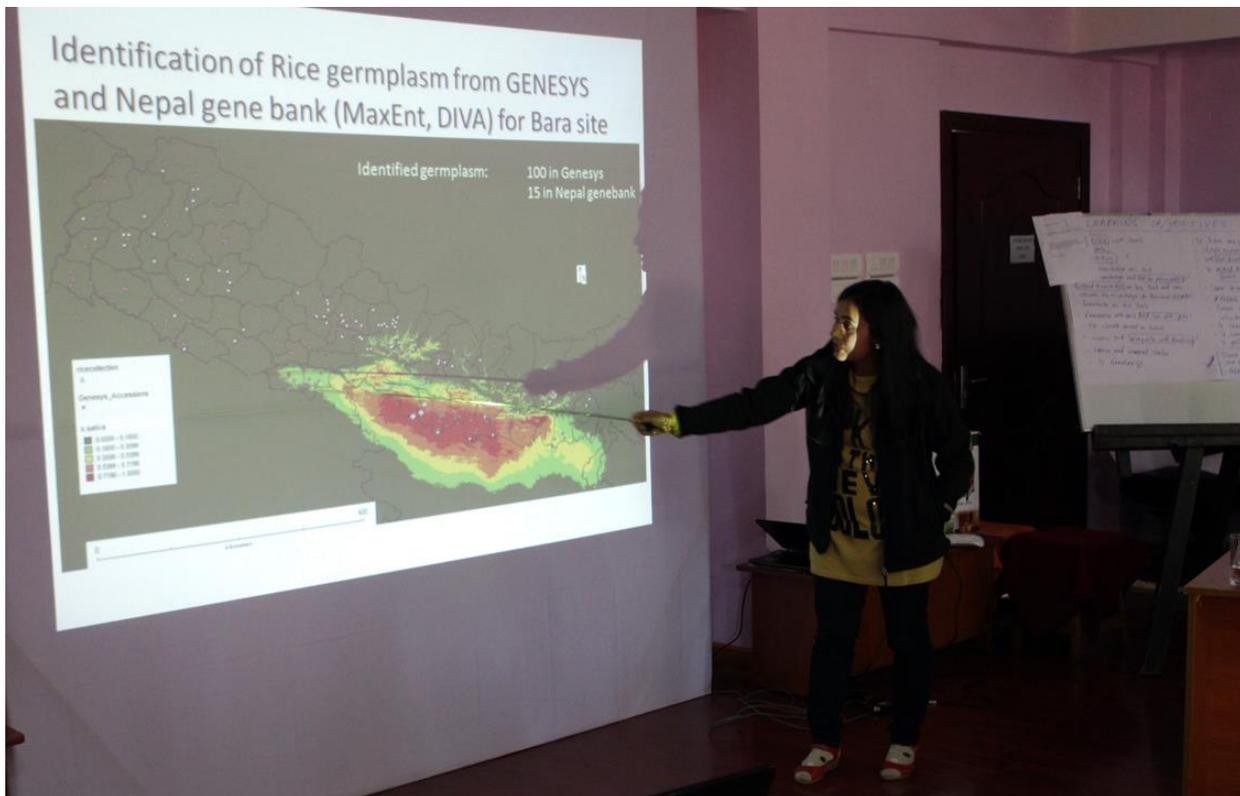
Partners:

Researchers, genebank managers, extension agents from national and international organizations in Bhutan, Burkina Faso, Cambodia, Costa Rica, Côte d'Ivoire, Ethiopia, Guatemala, India, Lao PDR, Nepal, Rwanda and Uganda. Guy Bessette, consultant.

Links/sources for further information:

<http://grpi2.wordpress.com/2013/11/29/resilient-seed-systems-tools-and-techniques-for-climate-change-adaptation/> <http://grpi2.wordpress.com/2013/10/31/participatory-research-and-capacity-strengthening-in-east-africa-linking-farmers-scientists-and-policy-makers-to-use-crop-diversity-for-climate-change-adaptation/> <http://grpi2.wordpress.com/2013/05/05/adapting-to-climate-change-training-workshop-for-teams-of-bhutan-and-nepal/> <http://ccafs.cgiar.org/blog/climate-change-models-may-help-spur-lawmakers-implement-seed-treaty>





Case Study #3

Title: Can farmers become citizen scientists for climate adaptation?

Author: Jacob van Etten and Juan Carlos Rosas

Type: Participatory action research

Project description:

Climate adaptation requires a massive discovery process to identify locally suitable technologies that work under new climatic conditions. Scientists need to work actively with farmers to achieve this. But current participatory action research (PAR) methods are mostly designed to work with relatively small groups of farmers. In a citizen science approach, large groups of people each make a small scientific contribution. These small contributions add up to large discoveries. Can a citizen science approach help to discover new climate adaptation solutions? Bioversity runs a series of projects to find the answer to this question. In a project in Honduras, Bioversity scientists test a citizen science approach by focusing on the selection of suitable bean varieties. Farmers grow a small set of varieties and evaluate them for different traits. These observations are then combined and compared, guiding farmers' choices for the varieties they will grow next season. Bioversity and partners use the trials to improve the methodology, comparing results with those obtained in other count

Introduction / objectives:

One goal of this project was to test a new software program ClimMob, developed by Bioversity, which makes it possible for others to set up and analyze crowdsourcing experiments. Researchers also used weather sensors to track the weather conditions. Finally, they evaluated farmers' ability to use mobile telephones to report observations in next rounds, to cut the costs of field visits.

Project results:

Farmers evaluated 20 different bean varieties. ClimMob proved to work well to design the experiment. It automatically created reports for researchers and customized infosheets for the participating farmers, with feedback on their own observations. The software makes it possible to reduce the time between crop harvest and the analysis of results in farmer workshops. Farmers produced data of good quality and identified some new varieties they had not tried under local climatic conditions before. The weather sensors worked well, but there were some difficulties with obtaining their GPS coordinates. To make the use of sensors in the field more user-friendly and reliable, Bioversity is planning to develop an app for smartphones. The researchers also asked farmers if they wished to participate again and if so, if they would be able to report back using their mobile telephone. Most farmers wanted to participate again (89%) and were ready to use a mobile phone for this (82%). In 2014, more farmers will participate, and will try to use of mobile phones for reporting!

Partners:

Bioversity works on this project with scientists from Zamorano, an agricultural university in Honduras. The research also involves two NGOs based in Honduras, PRR and FIPAH. These partners have much experience on technology development with farmers.

Links/sources for further information:

Seeds for Needs [http://www.bioversityinternational.org/research-portfolio/adaptation-to-climate-change/seeds-for-needs/Comparable experience in India:](http://www.bioversityinternational.org/research-portfolio/adaptation-to-climate-change/seeds-for-needs/Comparable%20experience%20in%20India)<http://ccafs.cgiar.org/blog/testing-wheat-crops-climate-change-adaptation>
Sensors: <http://www.bioversityinternational.org/e-library/publications/detail/collecting-weather-data-in-the-field-with-high-spatial-and-temporal-resolution-using-ibutton/>



Case Study #4

Title: Revising national policies in Nepal to facilitate the implementation of ITPGRFA and MLS

Author: Michael Halewood, Madan Bhatta, Bal K. Joshi, Chiranjibi Bhattarai and Devendra Gauchan

Type: Policy engagement

Project description:

The project supports national partner organizations to use crop diversity to adapt to climate changes, including by developing appropriate institutional, community and national policies. One window for this was created when Nepal acceded to the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) in 2009. The ITPGRFA creates the ‘multilateral system of access and benefit sharing’ through which countries can pool and share crop genetic diversity for the purposes of agricultural research, crop breeding, food security and conservation. Increased climate variability and migrating climates are increasing the value of access to crop diversity as a source of genetically-based adaptation. The project is supporting a multi-stakeholder research team to acquire potentially adapted germplasm, working through the applicable laws that govern access to those resources both domestically and abroad. Lessons learned help policymakers identify mechanisms to ensure future access to and supply of such materials. Another opportunity was presented in process to revise NBSAP2002

Introduction / objectives:

One of the objectives of the project is to identify nationally appropriate mechanisms to implement the multilateral system, to make it possible for Nepalese individuals and organizations to provide and access internationally pooled germplasm to be used for adaptation to climate change and other agricultural purposes.

Project results:

The GCP multi-year capacity-building program trained 146 trainees (breeders, students, professors) in use of the fieldbook to record field evaluation data in Algeria, Bangladesh, Benin, Burkina Faso, China, Ethiopia, Ghana, India, Ivory Coast, Kenya, Malawi, Mali, Morocco, Mozambique, Nepal, Niger, Nigeria, Pakistan, Philippines, Senegal, South Africa, Tanzania, Thailand, Tunisia, Uganda, USA and Zimbabwe. GCP breeding projects apply the fieldbook for rice (Benin), wheat (China), sorghum (Mali), cassava (Nigeria), chickpea (Kenya, Ethiopia), cowpea (Burkina Faso, Senegal) to harmonize data capture across evaluation sites. Data files in the CCAFS Global Agricultural Evaluation Trials Repository (Agtrials) are identified using CO trait terms, facilitating retrieval of datasets in the repository—1410 agronomic variables measured and 29633 of 34329 trials described using CO trait names. Trait observations recorded in collectors’ fieldbooks during 500 collecting expeditions from 1974, which is information treasured by genebanks, were described using the CO terms in the geospatial database

Partners:

Ministry of Agriculture Development, Ministry of Forest and Soil Conservation, Nepal Agricultural Research Council, and Local Initiatives for Biodiversity, Research and Development

Links/sources for further information:

<http://grpi2.wordpress.com/2014/01/27/securing-crop-diversity-for-climate-change-adaptation-creating-policy-space-for-nepal-to-participate-in-the-multilateral-system-of-access-and-benefit-sharing/>



Case Study #5

Title: Crop Ontology: a resource for enabling access to breeders' data

Author: Elizabeth Arnaud, Luca Mattei, Hannes Gaisberger, Rosemary Shrestha, Herlin R. Espinosa Gutierrez Espinosa, Glenn Hyman, Peter Kulakow, Lukas Mueller, Arlett Portugal, Graham McLaren, Trushar Shah

Type: Inter-center collaboration

Project description:

The Generation Challenge Programme (GCP) focuses on crop improvement for drought-prone and harsh environments, assisting developing-world researchers to access a broader pool of plant genetic diversity and technologies. To succeed, breeders must understand genotype–environment interactions, and identify the genetic basis and heritability of adaptive traits, which requires harnessing the increasing volume of agriculture-related information and harmonizing the terminology used across the disciplines to describe the crop phenotypes. Therefore, eight CGIAR Centers and their national partners developed the Crop Ontology (CO), which currently includes breeders' trait descriptions for 15 crops: cassava, banana, barley, chickpea, common bean, cowpea, groundnut, maize, pearl millet, pigeon pea, potato, rice, sorghum, wheat and yam. CO is an open source of standard lists of traits, methods and scales for breeders' fieldbooks and crop information systems like the CCAFS Global Agricultural Trials Repository and the International Cassava Database of the Cassava Next Generation Sequencing project.

Introduction / objectives:

Comparison and interpretation of crop trait data is impeded by semantic heterogeneity—i.e. similar traits named differently, or different traits named identically. It is vital that crop modellers, climate-change scientists, pre-breeders, breeders and agronomists share a common language to describe phenotypes and interpret descriptions provided by farmers for their preferred varieties' performance.

Project results:

Through the GCP multi-year capacity-building programme, 146 trainees (breeders, students and professors) were trained in the use of the fieldbook to record field evaluation data in Algeria, Bangladesh, Benin, Burkina Faso, China, Ethiopia, Ghana, India, Ivory Coast, Kenya, Malawi, Mali, Morocco, Mozambique, Nepal, Niger, Nigeria, Pakistan, Philippines, Senegal, South Africa, Tanzania, Thailand, Tunisia, Uganda, USA and Zimbabwe. The GCP breeding projects apply the fieldbook for rice in Senegal, wheat in China, sorghum in Mali, cassava in Nigeria to harmonize the data capture across evaluation sites. Data files in the CCAFS Global Agricultural Evaluation Trials Repository (Agtrials) are identified using the CO trait terms which facilitates the retrieval of data sets in the repository: 1,410 agronomic variables measured and 29,633 of 34,329 trials described using the CO trait names. Trait observations recorded in collectors' fieldbooks during 500 collecting expeditions from 1974, which is treasured information by genebanks, were described using the CO terms in the geospatial database.

Partners:

Bioversity International, CIMMYT, IITA, ICARDA, ICRISAT, CIAT, CIP, IRRI, CIRAD, INRA, USDA-ARS, Cornell University, Polapgen, Oregon State University. Breeders' networks of the CGIAR centers.

Links/sources for further information:

www.croponontology.org<https://www.integratedbreedingplatform.net> www.agtrials.org
<http://www.cassavabase.org> <http://bioversity.github.io/geosite/> Papers: Multifunctional crop trait ontology for breeders' data: field book, annotation, data discovery and semantic enrichment of the literature
<http://aobpla.oxfordjournals.org/content/2010/plq008.abstract> Bridging the phenotypic and genetic data useful for integrated breeding through a data annotation using the Crop Ontology developed by the crop communities of practice.

<http://www.frontiersin.org/Journal/10.3389/fphys.2012.00326/abstract>



6. Outcomes

Outcome #1

Title:

Strategic Action Plan to strengthen conservation and use of Mesoamerican Plant genetic resources in adapting agriculture to climate change (SAPM). The SAPM is a 10-year road map to strengthen conservation, access and use of plant genetic resources in Mesoamerica, as a strategic element for food security and agricultural adaptation to climate change and other threats. The SAPM comprises 64 actions under 6 thematic components and activities, covering ten Mesoamerican crops and their wild relatives, prioritized for their local, regional and global importance. The SAPM was developed in consultation with over 100 stakeholders from the region.

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

The SAPM was adopted by the quorum of Ministers of Agriculture who make up the Central American Agricultural Council (CAC) and received a pledge of support for its implementation from the Director General of the Inter-American Institute for Cooperation on Agriculture (IICA) (see 2.1). CAC is the body of the Central American Integration System (SICA) responsible for proposing and executing regional actions, programmes and projects in agriculture and livestock, forestry and fisheries, regarding plant and animal health policies and also science and technology research geared towards the modernization of production. IICA is a specialized body of the Organization of the American States (OAS), and has the mission to encourage, promote and support the efforts of its 34 member countries for the sustainable development of agriculture and the well-being of rural populations. IICA has already started implementing actions included in the SAPM (see 2.2.). Minutes of the meeting of Ministers are available on CCAFS intranet, Bioversity, Outcome 1 - supporting docs. In addition, several single and multi-country initiatives inside and outside Latin America are modeling their own Strategies or Actions Plans on the SAPM (See 2.3, 2.4, 2.5, 2.6). The FAO Commission on Genetic Resources for Food and Agriculture will take the SAPM into account in their development of 'Guidelines for Preparation of National Strategies for PGRFA' (See 2.7).

2.1 The most important political body at the regional level, the Central American Agricultural Council (CAC), made up of Ministers of Agriculture of eight countries, agreed to support the SAPM at its Ordinary Meeting of Ministers in 2013. CAC further instructed its Executive Secretariat to facilitate the link between the SAPM and its technical group on Climate Change and Integrated Risk Management (CCIRM), and similar initiatives under the CAC umbrella.

2.2 The Inter-American Institute for Cooperation on Agriculture (IICA) has offered its support to the implementation of the SAPM. In fact, IICA's Programme on Agriculture, Natural Resources Management and Climate Change has emphasized that the SAPM will guide their actions regarding PGRFA for the next 10 years. Evidence in that direction is a new project that IICA has started with USDA funding, designed within the framework of the Action Plan and in collaboration with the NARs of Panamá, Nicaragua and Costa Rica, and the National Institute of Biodiversity of Costa Rica (INBIO), among others. IICA has plans to involve more countries.

2.3 The SAPM is influencing the development of the national seed legislation of Guatemala, specifically the seed system actions contemplated within the Genetic Resources Strategic Plan of Guatemala. Stakeholders in the SAPM process are also key participants in this process in Guatemala and are contributing their knowledge about the genesis of the project and the actions already identified at the

regional level, which are very much in line with the national strategy being developed. 2.4 A project, funded by Norway, which recognizes the implementation of farmers' rights in Guatemala, includes four of the six thematic components of the SAPM as part of their project design. 2.5 The National Committee on PGRFA of Honduras (CONAREFIH) is utilizing the SAPM as a roadmap for their discussions on the conservation and utilization of PGRFA, from which recommendations will emerge for inclusion in the National Biodiversity Plans and for compliance with the Global Plan of Action. 2.6 The following projects, supported by the International Treaty on Plant Genetic Resources for Food and Agriculture, have requested a copy of the SAPM, with the intention to use it as a guide. Feedback has been very complimentary about the product.

- 'Community-based biodiversity management for climate change resilience', which covers 11 countries from South Asia, Latin America and Africa: Bangladesh, Benin, Brazil, Ecuador, India, Guatemala, Malawi, Nepal, Nicaragua, Zambia and Zimbabwe. Requested by Abishkar Subedi, PhD, Genetic Resources and Seed System Specialist, Centre for Development Innovation, Wageningen UR.
- 'Strategic partnership with farmer innovators for adaptation and management of plant genetic resources to climate change'. Countries: Bhutan, Cambodia, Lao PDR, Philippines, Vietnam. 2.7 The Commission on Genetic Resources for Food and Agriculture will take the SAPM into account in their development of 'Guidelines for Preparation of National Strategies for PGRFA', to be presented to the Commission at its Fifteenth Session in 2015 for adoption by all countries. The development, resulting structure and content of the SAPM were discussed with representatives from 14 LAC countries who participated in recent consultation meetings organized by the Commission to provide their input to the draft guidelines. The LAC participants found the SAPM very much in line with the areas that should be included in the National Strategies and as a consequence in the guidelines

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

The Strategic Action Plan for Mesoamerica (SAPM) was developed over a period of one year and it had one main output, the PAEM proper. Less than a year passed between the first stakeholder consultation and the submission of the first projects using the SAPM recommendations (See section 2). There are two aspects to the methodology of the SAPM that we believe fast-tracked its uptake by policymakers, regional organizations, NGOs and others: (a) the analysis of scientific evidence (diagnosis) on the current state of plant genetic resources for food and agriculture in the region, in the context of climate change adaptation and, (b) a broad consultation process from all countries in the region: Panama, Costa Rica, El Salvador, Nicaragua, Honduras, Guatemala and Mexico. The scientific diagnosis built on: (i) the Hemispheric Conservation Strategy from 2008 regarding the prioritization of some of the crops done by PGRFA experts; (ii) publicly available information accessible through the CGIAR germplasm databases on those crops (SINGER, GENESYS, but also GBIF, scientific publications), (iii) accession-level data for the geospatial analysis (over 3000 maps of the crops and their wild relatives), (iv) all the country reports prepared for the State of the World of PGRFA. The consultation process for the SAPM was unprecedented. Over 100 representatives were convened from different sectors of national governments (agriculture, environment and health), regional government organizations, universities, regional and international agriculture organizations, farmers, civil society and donors. These included many non-traditional PGRFA stakeholders—many of whom did not even know that they were stakeholders until the process made them aware of the importance of PGRFA.

What partners helped in producing the outcome?

There were two partners for the research itself: The association of producers of the Cuchumatanes (ASOCUCH), particularly the Participatory Breeding Programme (FP) and the Tropical Agricultural Research and Higher Education Centre (CATIE). Due to the nature of the project, which relied on big data analysis, most research was done in-house, and the most important non-research partners were policymakers. A core group of stakeholders who supported the development of the SAPM through their presence and active engagement in the consultation events comprises one representative each of: ASOCUCH, IICA, CATIE, CAC-SE (CAC-Executive Secretariat), UNDP, a Vice Minister of Agriculture from Costa Rica, and focal points of the International Treaty.

Who used the output?

See Question 2.

How was the output used?

Basically in three ways:

- In the design of projects, as a source of specific actions to implement, which are backed by scientifically sound analysis and approved by a regional process .
- As a model and guide for the development of PGRFA-related frameworks and norms leading to legislation in Mesoamerica.
- As a model to follow in developing multi-country plans for specific topics in other parts of the world, such as the projects listed in 2.6..

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.

In addition to the specific actions described in 2 and 6, we sought feedback on levels of satisfaction regarding the SAPM document, the process leading to it and ideas about next steps. Interviews with 12 participants (conducted by a project researcher) attending the launch of the SAPM were recorded, plus the opinions expressed during the formal presentations and open mike comments were also noted and a sample of them are transcribed below. They were all positive. Additionally, we sent a survey to all stakeholders (over 100) who had participated in the consultations, which included space to make comments. Over one third of those surveyed (34) answered (anonymously). Their answers assess several aspects of the SAPM. All aspects were graded from very good to excellent by the majority of participants (from 68% to 91%). Full survey report available on request. Highlights from the various sources of evidence follow:

- Over 90% surveyed gave a rating from very good to excellent for the relevance of the SAPM to the region, and to their own work.
- The consultative process garnered 74% of high to very high marks and the proposed actions in the plan were deemed from very good to excellent by 76% of respondents.
- Around 70% of those surveyed felt the information (diagnostic studies) provided during the process of

creation of the SAPM was from very good to excellent, as well as the selection of participants for the consultations.

Select quotes:

- “While the SAPM will be used by the CCIRM technical group of CAC, it is also relevant for other technical groups within CAC such as food security, agro business, rural development, etc. A SAPM linked to the regional agenda transcends the national level and becomes a viable tool to deal with climate change.” (CAC Executive Secretariat officer Manuel Jimenez)
- “The PAEM is a unique participatory process replicable in other regions of the world” (Anonymous) “The SAPM focuses on ten crops, but the framework is applicable to other PGRFA, constituting a set of guidelines for the development in the region for many institutions and many projects.” (Oliver Komar, Director, Regional Institute of Biodiversity for Central America and the Dominican Republic and Central American Commission for the Environment and Development IRBIO-CCAD-SICA)
 - “My opinion is that the process was very well designed and executed. The final product represents a very useful source of information and reference for the region”. (Anonymous) • “It is worthwhile to point out the effort displayed to have a high level of participation in the process.” (Anonymous)
- “We [meaning Guatemalans and members of the PPB Programme] are using the SAPM because we know it [i.e. as stakeholders, they have been involved in, and are knowledgeable about, the regional process]... The SAPM legitimizes our work on participatory plant breeding and in this way we can upscale and outscale our activities” (Sergio Alonzo, Participatory Plant Breeding Programme and ASOCUCH NGO)
- “The PAEM is a roadmap for the conservation of PGRFA that will be of great use for political and technical decision making and it will be a basic document in the preparation of the National Plans”. (Anonymous)

Outcome #2

Title:

Seeds for Needs India: Broadening the genetic base of crops to empower farmers for climate change adaptation through crowdsourcing

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

This project is targeted at increasing farmers’ adaptability to climate change through agricultural diversification, using a crowdsourcing approach, whereby farmers are given small quantity of seeds of three varieties, from a broader set of several varieties, to test in the field and report back their preferential rankings on these varieties using scoring cards and their mobile phones. Farmers are given codes instead of the variety names so that they maintain objectivity while recording their observations and reporting their preferences. There are three main outcomes to this research.

- 1) The project has created greater awareness among farmers about the role and importance of planting good quality seeds, the importance of scientific agronomic methods for planting and the use of a broader range of crop varieties for climate change adaptation. Farmers’ knowledge about new sources of seed material has



increased and farmers are now willing to grow a larger number of varieties on farm. This will lead to genetic base-broadening of the farmers' system, to more sustainable production, as well as resilience to climate change.

2) The methodology used in this project on participatory experimentation and crowdsourcing has resulted in the rapid spread of the methodology's implementation; in just two years the Indian farmers' network has grown from 30 to 5000 farmers directly benefiting for their sustainable yields and resilient farming system.

3) The capacity building component of this study has strengthened the local seed system by bringing more local farmers into the seed production chain.

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

Careful identification of varieties recommended for different agro-ecological zones of India, and based on their past performances, through extensive farmers' field trials, resulted in achieving substantially better yields on farmers' fields (see Figure 1, filed under CCAFS intranet, Bioversity, Outcome 2 - Figure 1) and in turn led to the establishment of a large farmers' network (from 30 participating farmers in 2011, to 5000 in 2013). The approach of participatory experimentation and empowering farmers as "citizen scientists" has led to these outcomes.

What partners helped in producing the outcome?

A diversity of stakeholders' involvement has resulted in these outcomes and include: (i) Farmers – undertaking field experiments on their own farm without any incentives and involved in the identification of suitable varieties for their local adaptability; (ii) Local extension workers – for regular field trial monitoring, advising farmers on how to maintain the trials in good condition and educating them on field practices as necessary; (iii) Researchers from national partners' institutes – for planning and identification of suitable varieties for the on-farm trials and monitoring on regular basis, as well as for recording scientific data and data analysis. Among others, Bioversity's partners in achieving this outcome include: Indian Council of Agricultural Research (ICAR) institutes such as the Indian Agriculture Research Institute (IARI), Pusa and the Directorate of Wheat Research (DWR), Karnal; and local NGOs like Humana People to People, India (HPPI); Gene Campaign; Ashok Sansthan, Ghazipur and the Nand Educational Foundation for Rural Development (NEFORD).

Who used the output?

Beneficiaries of the outcome are not only the 5000 farmers directly involved in the experimental work or those of neighboring villages who hear of the successful agricultural model by word of mouth, but also other stakeholders at all levels. On observing the success of the trials in Bihar, the Indian government has become full partners in the programme through the Indian Council of Agricultural Research (ICAR), which has signed a three-year agreement to partner with Bioversity on this approach to climate change adaptation for food security in India, and is in the process of expanding the model to other states of India including Madhya Pradesh, Chhatisgarh and West Bengal. Based on the growth of the Indian farmer network and success of the trials, CIMMYT has also become a partner in the project and has provided seed materials of eight varieties to be tested in the on-going trials. New NGOs such as Ashok Sansthan and NEFORD during the current season have expressed their willingness to experiment this model in their own locations. Other partners like the State Agriculture Universities (SAUs) have also shown interest in joining the Seeds for Needs programme, e.g. in Rajasthan, two

new agricultural universities located at Jodhpur and Kota are keen to use this methodology and approach in their respective areas of operation.

How was the output used?

The effectiveness of this participatory approach in evaluating new varieties and its popularity in uptake among participating farmers has raised the interest of new partners to join this programme and has resulted in replication of the model in several new sites in India where new farmers' field trials have been established. The outcome has also resulted in the use and uptake of innovative technologies like the establishment of mini weather stations using iButtons that record temperature and humidity has shown cost-effective methods to record micro-climate variables that can be used both by the researchers to study the impact of temperature and humidity during the crop growing season, in addition to allowing farmers easy access to that information. The model's potential has resulted in engaging new partners and donors to support the intervention's and research's further development and outscaling, in addition to the model being adopted in other ongoing projects in the region, e.g. Vodafone India is showing a strong interest in partnering with project through their programmes for agriculture research. The Government of India's Ministry of Agriculture and GIZ (Germany), under the umbrella of the Indo-German Development Cooperation, are interested in applying our crowdsourcing approach to in the project titled "Establishing Climate Change Knowledge Network in Indian Agriculture (CCKN-IA)". The objective of this project is to establish climate change knowledge network for Indian agriculture sector and facilitate the use of the newly developed network by various stakeholders at national, state and district level to operationalize the National Mission on Sustainable Agriculture (NMSA) in selected districts of three states of India (Maharashtra, Jharkhand and Odisha) in the initial phase and provision to upscale across country. This project will create a knowledge network for providing information to farmers through various modes of communication and receive feedback from farmers for better implementation..

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.

Evidence to support the link of our research with outcomes, and potential impact, was collected as part of the project. One indicator is the growth in the number of participating farmers. In 2013, 5000 farmers' field trials on-going across 142 villages covering 8 districts of 2 states of India. Another indicator is the number of stakeholders wishing to replicate the methodology and the increase in trials being undertaken. There is one farmers' network in India spread over several districts in 2 states. In 2011-12, there were 3 villages in Bihar. Under the project, this figure increased to 109 villages in 7 districts of UP and Bihar in post-rainy season (for wheat) 2012-13. In 2013, there are currently 142 villages 8 districts of UP and Bihar. Our results strongly suggest that the introduction of wheat varieties may lead to significant increase in yields. In Bihar, farmers traditionally grow three wheat varieties (PBW343, UP262, PBW373). As mentioned earlier, the yield in Bihar for 2012-13 was 24.27 q/ha, while for the same period, the crowdsourcing trials achieved yield up to 49.14 q/ha for 10 varieties (see Figure 1). In the post-rainy season of 2013-14, 20 varieties have been provided. The trials are on-going and harvesting will take place between the end of March and mid-April 2014 across all sites. This increase was for the trials as a whole. The project included 800 participating farmers in post-rainy season 2012-13, and 5000 farmers in 2013-

14. As a result of this intervention, an agreement was signed in November 2013 with the Indian national partners [Indian Council of Agricultural Research (ICAR)/Indian Agricultural Research Institute (IARI)] to use this crowdsourcing approach in other states of India such as Jharkhand, Orissa and West Bengal; videos showing interest by farmers; and interest of other NGOs such as Ashok Sansthan and NEFORD to promote this approach and develop new networks of farmers in two districts of Uttar Pradesh all attest the nexus between method and results being taken up. Links: September, 2013 - From the fields of Bihar, India (DG Dialogues) <http://www.biodiversityinternational.org/news/detail/from-the-fields-of-bihar-india/>

14 March, 2013 - Climate smart villages in India show early signs of great reform achievements <http://ccafs.cgiar.org/blog/climate-smart-villages-india-show-early-signs-success#.Us60zWRDvXg>

22 May, 2013 - 'Seeds for Needs' project in India:
<http://www.youtube.com/watch?v=FjydyN354OU>

February 2013 - Seeds for Needs – India
<http://www.flickr.com/photos/biodiversity/sets/72157632982993783/>

7. Outcome Indicator

Outcome indicator #1

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:

In India, about 5000 farmers have been reached with variety selection crowdsourcing experiments, building capacity to implement this new methodology in a number of local organizations. The ICAR system has signed an agreement with Bioversity to implement this approach more broadly. We have started to use this approach in East Africa and Central America as well, moving towards outcomes.

Evidence:

ICAR-Bioversity agreement. Other evidence mentioned under Bioversity's second "excellent outcome".

Outcome indicator #2

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:

Crop modelling approaches for banana have been developed in 2013, making progress towards outcomes.

Evidence:

Outcome indicator #3

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:

A regional plan for PGR use for climate change adaptation, whose development was led by Bioversity, has been signed by the ministers of Central America. This achievement has been reported as an "excellent outcome". In the activities related to the GRPI2 project, multistakeholder research teams in 9 countries analyzed their existing access and benefit sharing laws vis-a-vis their commitments, under the international plant treaty, to participate in an international system of crop genetic diversity pooling and sharing for agricultural research. ICAR, NBPGR and Bioversity (for CCAFS) published a road map for policy and institutional reforms that need to be undertaken at the levels of the Ministries of Agriculture and Environment to implement the multilateral system of access and benefit sharing in India. ICAR is in the process of developing a south-south technology transfer program whereby India will make adapted crop germplasm available for use in arid and semi arid farming systems in sub Saharan Africa. The national agriculture research council lead a process to draft a revision of the National Agrobiodiversity Policy to prioritize implementation and participation in the multilateral system of access and benefit sharing. The draft is currently being considered by the Minister of Agriculture; if accepted, it will be further submitted to Cabinet in 2014 (see case study on policy engagement). Eight countries initiated exercises to confirm what crop genetic resources they will include in the multilateral system of access and benefit sharing. One completed the exercise, and the other seven will finish in 2014, sending notification to the secretary of the plant treaty.

Evidence:

See outcome statement for further evidence on Central America. See activities under 1.3.3 for evidence on GRPI2 outcomes.

Outcome indicator #4

Outcome indicator:

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

Achievements:

Progress towards outcomes is described under "Summary by outputs". In the second phase of CCAFS, we plan to invest more in this line of research.

Evidence:

Outcome indicator #5

Outcome indicator:

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

Achievements:

The methodology and internal capacity for local vulnerability analysis and adaptation planning are now in place to engage more partners and expand this activity. There are good opportunities to implement local adaptation planning in 2014.

Evidence:

8. Leveraged funds

Leveraged funds #1

Title:

Mainstreaming agrobiodiversity conservation and utilization in agricultural sector to ensure ecosystem services and reduce vulnerability (PPG). Note the PIF has been approved, and project design is now underway.

Partner name: UNEP/GEF

Budget: \$150000

Theme: T1

Leveraged funds #2

Title:

Full project to be initiated following the approval of above.

Partner name: UNEP GEF

Budget: \$3500000

Theme: T1

Leveraged funds #3

Title:

Use and conservation of agrobiodiversity for increased agricultural sustainability, smallholder wellbeing and resilience to climate change in India. Window 3 funding which will contribute to our CCAFS activities in South Asia.

Partner name: ICAR

Budget: \$4625000

Theme: T1