RESEARCH PROGRAM ON
Climate Change,
Agriculture and
Food Security

[Center name]

2013 technical report

1. Activity Reporting

Activity 337-2013 (Milestone 1.1.1 2013)

Title: Household and community studies of gender aspects of adaptation and impacts of climate change.

Status: **Complete.** Household surveys, key informant interviews and focus group discussions were conducted at selected climate analogue sites in Kenya and Zimbabwe to assess climate- induced risks and identify possible adaptation options with a gender perspective. This work was carried out under the project CALESA project with funding support from GIZ. The household surveys were conducted at four locations in Kenya and Zimbabwe and a total of 1300 households (a minimum of 150 at each site) were covered by the survey. The survey assessed the socio-economic and demographic characteristics, crop and livestock production characteristics and production constraints at the study sites. At each site 4 focus group discussions (FGDs) - 2 composed of male farmers and 2 of female farmers were also held. a. Preliminary results show that climate analogue analysis and involvement of stakeholders such as smallholder farmers through interviews, participatory evaluations can contribute in identifying adaptation options for smallholder farmers in different climates. b. Characteristics of household heads differ, as well as coping and adaptation strategies for crop production within and across analogues. c. Higher proportions of de-facto female heads at the dry, warmer sites imply higher levels of male labor migration. d. De-juri female heads are mostly older than the de-facto heads. e. Higher proportions of female heads who are full time farmers imply higher contribution by some rural women in domestic and agricultural production. Results indicate greater contribution by rural women in domestic and agricultural production f. Gender differences exist in preferred crops and management strategies across sites.g. Lower yields at both drier and wetter analogues compared to their reference sites indicate potential reduction in maize yields in warmer 2050s climates.h. Lower maize yields in female headed households in Kadoma and in Chiredzi show that the importance of gender in climate change and agricultural planning.I. At drier site Chiredzi small grains and crops diversification are important strategies for coping and adapting to environmental stresses. j. Implications are increased uptake of small grains such as sorghum and millets in Matobo and areas with similar rainfall and temperature characteristics in 2050s. k. Gender issues for small grain production include labor for production, pest management, harvesting and processing, against a background of male labor migration. l. Different preferences for crop management strategies imply gender issues for differently managed households will vary across sites, particularly between the dry analogue pair. m. There may be need for increased investment in water management research and development for drier areas.n. At the wetter climates soil and water management strategies are important strategies for smallholders. This is illustrated by high proportions of smallholder farmers who use strategies to conserve soil moisture and increase soils fertility such as use of inorganic and organic forms of fertilizer. o. Gender issues may include, in addition to labor for production, socio-economic factors such as asset ownership, sharing from proceeds after selling crops particularly in male headed. p. Access to draft power, labor, agricultural assets, social and financial capital in differently managed households are important for increasing adoption of effective crop management strategies.

Gender component:

Gender issues are the primary objective of these studies (see Activity title). Surveys and FGDs specifically oriented towards elucidating the views of women on climate change and its impacts.

Deliverables:

- Enhanced understanding of gender specific implications of climate change

See report

- Strategies to support women farmers to adapt to climate change

See report

- Two PhD Theses

The students are expected to submit their theses in 2014

Partners:

KARI; KMD; MSU; MSD; HAW Hamburg

Locations:

East Africa (EA),Other

Activity 338-2013 (Milestone 1.2.1 2013 (2).)

Title: Conduct an integrated assessment of climate sensitivity of agricultural systems and its effect on food security using AgMIP protocols in EA, Saf

Status: **Partially complete.** Comprehensive assessment of climate change impacts on smallholder farming systems was conducted in Eastern and Southern Africa with funding support from UKAID under the global Agricultural model intercomparision and improvement project (AgMIP) coordinated by Columbia University, New York, USA. The target areas in eastern Africa include Embu county in Kenya, Wami basin in Tanzania, Adama and Adugodem woredas in Ethiopia and Hoima and Masindi districts in Uganda. Observed climate data for 23 locations from the target areas for the period 1980-2010 was collected and analysed for variability and trends. Location specific downscaled climate scenarios were generated for 20 CMIP5 GCMs for mid century (2040-69) and end century (2070-99) periods under RCP 4.5 and 8.5. In all the target areas, surveys were conducted to identify and define the farming systems in a way that can be integrated with crop simulation models. Impacts on maize crop was assessed using crop simulation models APSIM and DSSAT by setting up more than 1500 farmer systems with varying climate, soil and management conditions to capture the full diversity of the systems. Using the experimental data, the models were calibrated to simulate 10 different varieties that are widely grown in the target areas. The results from the crop simulation analysis were then integrated with ToA-MD for economic analysis. Some highlights:1.No clear trend is discernable from the historical records of annual and seasonal rainfall2.An increase in the CV of seasonal rainfall is observed when computed for 10 year moving periods3.The changes in temperature and rainfall in the downscaled scenarios are in agreement with the trends observed in the large scale predictions for eastern Africa reported by IPCC4.In several areas in Eastern Africa, a significant increase in rainfall was predicted by most GCMs5.An increase in the potential and farmer yields was observed in many agro-ecologies mainly due to an increase in rainfall and the temperatures remaining in the optimal range even with the projected increase in temperature6.The direction and magnitude of impacts of projected changes in climate on crop growth and performance was influenced by both the current climate and the management practices employed. For example in Kenya, significant decline in yields was observed in systems using Katumani variety, higher fertilizer nitrogen and low plant populations7.To a large extent the

negative impacts can be minimized and opportunities can be capitalized by deploying the available varieties and adjusting the management practices employed by smallholder farmers8.Adaptation strategies identified from this analysis indicate that a 2-3 fold increase in productivity is possible in many agro-ecologies even under climate change. However, in environments such as LM5 (lower midland livestock and millet growing areas) significant negative impact is expected.In Southern Africa, the DSSAT and APSIM crop models were calibrated for maize, cowpeas and mucuna for 3 sites in 3 countries, Malawi, Mozambique and Zimbabwe. The models were later on used to assess the sensitivity of current farming systems (mainly maize) to climate change. This was done using 20 GCMs, RCP 8.5 for mid-century time period. Results showed that reductions in maize production in southern Africa can range from 10-20 % depending on projected rainfall and temperature changes. An integrated assessment of mixed crop-livestock systems was also done to evaluate the benefits of adaptation strategies on crop and livestock production. Three adaptation strategies (micro-dose, recommended rate of fertilizer application, and maize mucuna rotations) were evaluated for 1 site in Zimbabwe using 5 GCMs, RCP 8.5, mid-century time period. Results show that adaptation strategies that use organic soil amendments are likely to reduce climatic and economic risks and can improve on-farm benefits. Integrated diversified farming systems will be more beneficial and farmers are likely to adopt these. Economic development in these systems would also play an important role in alleviating poverty and risk.

Gender component:

Gender issues are addressed in two ways. Firstly by assessing the impacts of climate change and how these impacts differ depending on gender and household composition. Secondly by ensuring gender balance in capacity building activities

Deliverables:

- Database on key soil, crop and socio-economic parameters

A database with data from calibration and validation of crop models, future climate scenarios, crop performance under current and future climatic conditions is prepared and the same will be made ac accessible through AgMIP web site in April 2014. Climate data will not be a part of it due to current policies of met agencies in the region which restrict the distribution of data.

- Calibrated crop and socio-economic models

Crop models APSIM and DSSAT were calibrated for about 10 varieties and the same are included in the database of the model. These files are also included in the AgMIP database.

- Teams in participating countries with required skills

Teams of climate, crop and economic modelers with necessary skills to calibrate, validate and conduct scenario analysis were established in Kenya, Ethiopia, Tanzania and Uganda. They are actively contributing to the ongoing work and related activities in their respective countries. Further enhancement of their skills through hands on work is in progress.

- Climate change imapct assessment reprots to mid and end century periods for target regions

This deliverable is due next year but draft reports for Kenya and Ethiopia are ready and for other countries the same is under preparation.+

- Workshops to bring together all partners to assess imapcts and interpret the results

This deliverable is planned for next year.

Partners:

Mekelle University; EIAR; KARI; KMD; SUA; TMA; Makerere University; UMD

Locations:
East Africa (EA)

Activity 339-2013 (Milestone 1.2.1 2013 (2).)

Title: Conduct detailed ex-ante assessment of climate change impacts on target crops and assess adequacy of various soil, water, and crop management practices in alleviating the impacts of climate change

Status: **Partially complete.** An ex ante analysis was carried out to assess the climate sensitivity of various agricultural systems and proposed adaptation measures in Kambi Ya Mawe, Wote, Kenya. System simulation model APSIM v 7.4 was used to generate yields of maize for 30 years using current (observed) and downscaled future climate data. Future climate scenarios were generated using MarkSIM-GCM for 6 GCMs (bccr, cnrm, echam, inmnm, miroc and csiro) and the average (ensemble) for A2 carbon emission scenarios for the end century (2070-2099) period. The ex-ante analysis was conducted to evaluate the climate sensitivity of maize as a function of various management options that included plant population (2.2,3.0, and 4.0 plants/m2), planting dates (early, normal and late), variety (Katumani, Dekalb, H511 and H513), soil and water conservation practice (normal ploughing and tied ridges) and fertilizer application (0,20,40,60 and 80 Kg N/ha). From the results, it is evident that early planting and higher plant population >30,000 plants per hectare performed better both under current and future climates. Longer duration varieties such as H511 performed better under future climates compared to short duration varieties like Katumani (the most widely used variety). Results also indicate no significant benefit from water conservation mainly due to an increase in rainfall but application of fertilizer nitrogen up to 60kg N per hectare will be required to get good yields. The variety H511 which performed well under future climates fared poorly when grown under climatic conditions with no nitrogen inputs. Highest yields were obtained under the scenario developed from the GCM “INMNM”. In India, Pigeonpea and groundnut are important complements to cereals in dryland farming systems and in human and livestock diets. Women often cultivate groundnut and pigeonpea for income (including high-value exports) and to improve the nutritional value of their family’s diet. Watersheds in the Indian SAT with different seasonal rainfall and soil types (Alfisols and Vertisols) are prioritized for conducting farmer-participatory experiments on groundnut and pigeonpea. Four promising varieties of pigeonpea and groundnut will be experimented for ex-ante assessment of climate change impacts on these crops.

Gender component:

Deliverables:

- Journal articles on effectiveness of management practices in alleviating impacts of climate change

The student who completed her master thesis has prepared the paper and the same is currently under review by International Jornal of Agricultural Resources, Governance and Ecology

- Journal article on impact of climate change on target crops

This is delayed due to a delay in getting the results from field experiments conducted in Kenya and Zimbabwe which are required to calibrate the crop model. For this reason, the project received a no cost extension up to September 2014.

- Recommendations on breeding and management strategies

This is linked to the above and is rescheduled as deliverable in 2014.

- Quantified information on growth and performance of seelcted crops and varieties under different manageemnt conditions in different temperature regimes

This is linked to the above and is rescheduled as deliverable in 2014.

- Calibrated APSIM to assess crop growth and peformance under a range soil, climatic and managemnt conditions

This is linked to the above and is rescheduled as deliverable in 2014.

- Publications on imapcts of cliamte change and options to manage them

This is linked to the above and is rescheduled as deliverable in 2014.

Partners:

KSDA; BAIF; KARI; KMD

Locations:

Activity 340-2013 (Milestone 1.2.1 2013 (2).)

Title: Developing most appropriate protocols, geospatial analysis, and crop simulation models in yield gap assessment at local, regional, and global scales for assessment of current and future food security and potential for sustainable intensification.

Status: **Complete.** Protocols for yield gap assessment were developed and are documented on the website and in the form of journal articles (special issue of Field Crops Research). 12 NARS partners were trained in the methodologies and have been helping out with data collection. The website (www.yieldgap.org) is fully functional (full yield gap assessments for few countries pending). The project has been presented at multiple international conferences. In Nigeria and Ghana, the project was presented to the ministry of agriculture and this created great interest in using the atlas for national food security studies.

Gender component:

Deliverables:

- Calibrated and validated crop growth models to simulate potential and water-limited yields of major cereals.

Different crop models for different crops were used. Maize simulations were done at the University of Nebraska with Hybrid-Maize. Wheat, millet and sorghum were simulated at Wageningen University with WOFOST. Rice was simulated at AfricaRice with ORYZA2000. Crop modelers are taking part in AgMIP for model intercomparisons. The protocol for model selection and calibration is uploaded as deliverable but also available on the website.

- A network of country agronomists in the 12 countries trained in yield gap assessment

Several workshops and working visits took place in 2013. The 12 country agronomists have worked with the core project team to get acquainted with the methdologies and protocols. Some of them have embarked on doing national food security studies based on the atlas.

- Weather data and data used for crop growth simulation available on the website (IP issues pending)

As expected we are facing problems in making daily weather data publicly available for some countries. And in some cases long term high quality data are simply not available. However, the project has come up with a

promising method to generate weather data based on a limited number of years of observations combined with satellite data. We are still planning to make at least the generated daily weather data publicly available on the website. The protocol for weather data is uploaded as deliverable and also available on the website.
- Paper published on yield gap assessment protocols
Multiple papers published in a special issue of Field Crops Research. The special issue is made Open Access http://www.sciencedirect.com/science/journal/03784290/143. Two relevant papers are uploaded as deliverable.
- User friendly and transparent global yield gap atlas available on the website
www.yieldgap.org is now fully functional. Methodologies and data are documented and available.

Partners:

University of Nebraska; WUR; CIMMYT; AfricaRice; IRRI; jkuat; AGRHYMET; IER

Locations:

East Africa (EA)

Activity 341-2013 (Milestone 1.2.1 2013 (2).)

Title: Simulation of yield components for representative West African maize, millet, peanut, sorghum genotypes for wet, dry, current climates (using historical analogues; links to CRP1.1)

Status: **Partially complete.** The DSSAT, APSIM and (cereals only) SarraH models were calibrated for phenology and yield of the following West African cultivars using historical physiological and breeding trial data from ICRISAT, CIRAD, Agrhymet Regional Centre, SARI, IER, INERA and CERAAS: CIVT, M9D3, Hainikirey, Maewa, ZATIB (millet), CSM63E, CSM388, CSM335, IS15401, IRAT204, Sariaso10, Lata, Fadda (sorghum), Obatanpa, Teezey (maize), F-Mix and Chinese (peanut). Supplementary trials were conducted on station in Samanko, Mali to produce crop phenology and growth data for sorghum varieties Fadda, Nieleni, IS15401, Pablo, CSM63E, SK5912, Grinkan, Soumba, and 621B. Yield components were simulated by these 3 models over more than 1,000 smallholder farms in the districts of Nioro, Senegal (), Koutiala (Mali), and Navrongo (Ghana) using agronomic management data extracted from WorldBank RuralStruc farm-level surveys (2007). Simulated yields successfully matched observed survey yields. Probability of exceedance distributions were generated for baseline climates at each location (1980-2009) as well as future mid-century scenarios under RCP8.5 at each site (5 GCMs each). Significant differences were noted in yield distributions and statistics across sites and crops. A single adaptation measure (10% increase in grain-filling duration, and deeper root distribution profile) was used to simulated virtual cultivar. It did successfully offset the negative effects of climate change at all sites. Resulting yield projections were fed into the trade-offs analysis model (TOA-MD) to estimate impacts on net revenue, per capita income, and % adoption rates with and without adaptation to climate change.

Gender component:

The cohort of students and young scientists trained under this activity involved equal number of females and males. Females trained include: Aichata F.M. Sako, Madina Diancoumba, Manda Sissoko, Suwadu Sakho-Jimbira, Adja Rokiatou Sangare, Evelyn Asante-Yeboah. Crop modeling team is led by Dr. (Mrs) Dilys Sefakor Maccarthy (Univ. of Ghana) and also involves Dr. (Mrs) Myriam Adam.Analyses included peanut as a typical 'female crop' in the simulated districts. RuralStruc survey data can be gender disaggregated to some extent, and household

stratification can include gender components.

Deliverables:

- APSIM, DSSAT, SarraH models calibrated for at least 20 ecotypes (5 per species); response of millet and sorghum yields to baseline and altered photoperiod, temperature, CO2 assessed;

The DSSAT, APSIM and (cereals only) SarraH models were calibrated for phenology and yield of the following West African cultivars using historical physiological and breeding trial data from ICRISAT, CIRAD, Agrhymet Regional Centre, SARI, IER, INERA and CERAAS: CIVT, M9D3, Hainikirey, Maewa, ZATIB (millet), CSM63E, CSM388, CSM335, IS15401, IRAT204, Sariaso10, Lata, Fadda (sorghum), Obatanpa, Teezey (maize), F-Mix and Chinese (peanut). Supplementary trials were conducted on station in Samanko, Mali to produce crop phenology and growth data for sorghum varieties Fadda, Nieleni, IS15401, Pablo, CSM63E, SK5912, Grinkan, Soumba, and 621B. Yield components were simulated by these 3 models over more than 1,000 smallholder farms in the districts of Nioro, Senegal (), Koutiala (Mali), and Navrongo (Ghana) using agronomic management data extracted from WorldBank RuralStruc farm-level surveys (2007). Simulated yields successfully matched observed survey yields. Probability of exceedance distributions were generated for baseline climates at each location (1980-2009) as well as future mid-century scenarios under RCP8.5 at each site (5 GCMs each). Significant differences were noted in yield distributions and statistics across sites and crops. A single adaptation measure (10% increase in grain-filling duration, and deeper root distribution profile) was used to simulated virtual cultivar. It did successfully offset the negative effects of climate change at all sites.

Partners:

University of Ghana; Agrhymet Regional Centre; UDS; IPAR; SARI; INERA; Agence Nationale de la Météorologie du Mali; ANACIM

Locations:

West Africa (WA)

Activity 342-2013 (Milestone 1.2.1 2015 (1).)

Title: Evaluation / phenotyping of genetic diversity for adaptation to climate change (links to CRP3.5 & 3.6, CIMMYT, IRRI)

Status: **Partially complete.** Sub-Activity 1 - Test seed setting under a gradient of temperature and humidity conditions in selection of pearl millet (APSIM, JK&students) and chickpea (i-Legume, VV&students) genotypes, to generate coefficients to develop crop simulation model that are "CC-aware"Two trials have been carried out in pearl millet to: (i) determine the temperature threshold where seed setting starts being affected. In short, tolerant material show no sign of decrease in seed set below 42°C, whereas sensitive genotypes have a decrease in seed set above 36°C; (ii) Test the respective effect of high temperature and relative humidity on seed set in a range of tolerance and sensitive pearl millet genotypes. In short, seed set decreases upon high afternoon temperature but also upon low early morning relative humidity %.For chickpea, trials are being conducted with 4 contrasting genotypes, and consist of a staggered planting (early to late) to force flowering to occur during a range of temperature conditions at the beginning of the Indian summer. Two sowing have been done in the 2012-13 season, 4 during the 2013-14 season, and 2-4 more will be done during the 2014-15 season. The main purpose is to establish a relationship between the harvest index (HI) and the mean temperature during the R1-

R5 stage (flowering to beginning of seed growth). We expect to find an exponential decay function, whose coefficient would be used to develop a loop where HI is made temperature-dependent in the i-Legumes family of legume crop models (Soltani and Sinclair, 2011, FCR 124, 252-260).Deliverable: Model input for the VPD response traitSub-Activity 2 - Assess reference collections of germplasm in different species to identify variants for the capacity of restricting transpiration under high VPD conditions (mainly chickpea &pigenopea planned for 2014) and develop model input coefficients related to this trait (VV)This activity is a generic activity that will be continued for several years. It has been completed for the reference collection of sorghum (close to 400 entries), in the scope of a training of a PhD student from CERAAS (Senegal – Bassirou Sine). A portion of the reference collection of has been assessed: peanut (60 entries), pearl millet (20 entries). It has been done in several types of breeding populations (one recombinant inbred line of chickpea, cowpea, peanut), or in lines introgressed with drought adaptive trait QTL (e.g. staygreen introgression lines of sorghum). We plan to run the reference collection of pearl millet and chickpea in 2014. Because the measurement of leaf area is a major bottleneck to the throughput of this activity, a large phenotyping platform has been developed to speed up the leaf area development.Deliverable: Evaluation / phenotyping of genetic diversity for adaptation to climate change (links to CRP3.5 & 3.6, CIMMYT, IRRI)Genetic variant (germplasm) from different species capable of controlling water losses under CC-like conditions, and usable by breedersSub-Activity 3 - Assessment of the link between the VPD response trait and high TE within the germplasm in lysimetric trials (VV&SKG&PG))This link is now established. In the case of sorghum, both germplasm from the reference collection and staygreen QTL introgression lines were assayed for transpiration efficiency (TE) in a lysimetric system (see Vadez et al 2011a Crop and Pasture Science 62 (8) 1-11, and Vadez et al 2011b Functional Plant Biology 38, 553-566). The extreme lines for TE were tested for their transpiration response to increasing vapor pressure deficit (VPD) and showed a clear contrast (high TE lines were VPD-sensitive, whereas low TE lines are VPD-insensitive). This link still needs to be published and has been reported during the Interdrought IV conference (Perth, Australia, 2-6 Sept 2013). Similar work has been carried out in three sets of pearl millet genotypes: (i) the pearl millet inbred germplasm association panel (a sort of reference collection); (ii) a recombinant inbred line population; (iii) a fine mapping population. In the case of the germplasm the link is incomplete and out of 10 low-TE materials, about 2/3 are VPD-insensitive, whereas in the 10 high-TE materials, also 2/3 are VPD-sensitive. We hypothesized that other mechanisms could be involved there like stomata patchiness (See explanation in Vadez et al 2014, J Exp. Bot., forthcoming). In the case of the RIL and fine mapping population, we have exactly the same link we found in sorghum.Deliverable: Linkage established between transpiration response to VPD and high transpiration efficiencySub-Activity 4 - Run simulations and developing maps representing traits effects (VPD response/heat response) on yield across crops/regions and giving a probability of success (VV&JK&MD)Simulations using APSIM have been carried out in sorghum and these cover the postrainy sorghum area of south India (covering about 5 M ha across Andhra Pradesh, Maharashtra, and Karnataka). In short, the VPD response trait would have a positive effect both on grain yield and stover yield across the entire region, although the benefit would be the highest in the areas affected by the most severe forms of water stress (onset of terminal drought at pre-flowering and flowering stages). This trait would also have an impact on the net monetary benefit. The details of this study are under review at Functional Plant Biology. The main outputs have been reported at the Interdrought IV conference (Perth, Australia, 2-6 Sept 2013) and in other fora.Similar simulation studies have been undertaken in peanut using the i-Legume crop model version of peanut, for a large block of latitude and longitudes in West and Central Africa. Maps showing the effect have been generated and show a positive effect

of that traits in latitudes roughly ranging above 11 degree North, whereas there would be no effect (but no detrimental effect either) at lower latitudes.Similar simulations have been carried out in soybean and show a clear benefit of the trait in latitudes above 8 degrees North in West and Central Africa, and in several part of East and Southern Africa (see Fig. 7 in Sinclair et al 2014, Soybean production potential in Africa, Global Food Security, forthcoming).Deliverable: Impact high temperature on sorghum & millet simulatedCrop simulations on the effects of the VPD response trait on yield

Gender component:

Some of the traits we target in that activity focus on crop resilience to harsh climate (especially under drought) and indirectly beneficiate food security, which has a gender and diversity (on the young) angle

Deliverables:

- Breeding strategies for climate change in chickpea & groundnut formulated

2014 - The peanut work still needs to be published. It has been reported in different meetings (GCP Annual Research meeting, 27-30 sept 2013, Lisbon - This presentation is available in the GCP website) For peanut, breeding should integrate this trait for the development of any material at latitude of and above 11 degree North in West and Central Africa.

- Impact high temperature on sorghum & millet simulated

2014 or 2015 is a more realistic date - Also the deliverable should read as "Threshold temperatures above which temperature impacts seed setting identified in sorghum and pearl millet". The experimental work on pearl millet has been completed and thorough analysis and writing is still pending. The experimental work of sorghum has started.

- Genetic variant (germplasm) from different species capable of controlling water losses under CC-like conditions, and usable by breeders

The activity is indicated as "complete" also in the report we have mentioned that a lot more germplasm needs to be tested, which will take several years. Here we have to appreciate that the VPD response trait is new and has not been screened for earlier. therefore, a lot more work is needed to make a systematic search for variants.There are also various reports indicating which line is a possible variant.

- Linkage established between transpiration response to VPD and high transpiration efficiency

The best way to describe this deliverable is publication reporting the evidence. The key information has already been presented in different for a (eg the Interdrought conference). Publications are in process.

- Model input for the VPD response trait

We think there was a mistake in uploading this deliverable, which was initially inputed as "Model input coefficients for the temperature responses (chickpea 2014/ millet 2015). Delivery is likely coming in 2015 only and here we mean the response of the harvest index (HI) to temperature (not the VPD response).Before being able to achieve this deliverable, one more season of cropping is needed before being able to run the relationships between temperature and HI.

- Crop simulations on the effects of the VPD response trait on yield

The work has been done for sorghum in the postrainy season of India. This work is on-going for West and Central Africa although this is not planned as a CCAF activity. The work on sorghum is under review in Functional Plant Biology and will be soon available.The peanut work still needs to be published. It has been reported in different meetings (GCP Annual Research meeting, 27-30 sept 2013, Lisbon - This presentation is available in the GCP website) For peanut, breeding should integrate this trait for the development of any material at latitude of

and above 11 degree North in West and Central Africa.

Partners:

UQ

Locations:

Global

Activity 343-2013 (Milestone 2.1.1 2013.)

Title: Identifying role of social institutions, social capital and social networks in adaptation processes & practices; mobilising & supporting building social capital; developing community based climate change preparedness plans (links to CRP2); establish links to EA & WA adaptation projects

Status: **Complete.** Trainings of the partners on the tools of the study was successfully completed. All studies and activities in the field have been completed. The draft report is completed and being reviewed and finalised.

Gender component:

This research activity is conceptualised with a focus on gender and is titled " Gendered response to climate change". All activities will have a gender focus.Draft working report 'Gender and Equity considerations in the design of climate services for farmers- Lessons from kaffrine' (being finalized). More here: http://ccafs.cgiar.org/blog/unleashing-potential-rural-women-active-agents-changehttp://humanitariannews.org/20120417/unleashing-potential-rural-women-active-agents-changehttp://ccafs.cgiar.org/fr/live-video-seminar-who-has-right-climate-change-adaptation-18-february

Deliverables:

- An inception and training workshop for all the partners to understand the study objectives and come to a common understanding.

Two training for partners on the study tools were conducted. The training modules are sent to Lieven as we could not upload it.

- A research report on "adaptation strategies in the drylands- lessons and implications for policy.

Draft report is complete and is being reviewed and finalised

- A research report based on qualitative (gender and social analysis) and quantitative surveys on the social network architecture of the rural communities experiencing cliamte variability.

Draft report is complete and is being reviewed and finalised

- A video documentary on "The role of formal and informal social networks in adapting to climate variability - a focus on gender".

NA

- A database linked to the VDSA/VLS on formal and informal networks in Aurepalle and Dokur.

NA

Partners:

GRAVIS; AKSHARA Livelihoods Pvt.

Locations:

South Asia (SAs)

Activity 344-2013 (Milestone 2.1.3 2013 (3).)

Title: Participatory testing of technologies for reduced risk (e.g. micro-dosing, seed priming), increased profitability and stability (e.g., soil and water conservation, forecast based decisions) and enhanced soil quality (e.g., CA, agroforestry)

Status: **Partially complete.** Considering the high risk associated with the investments on crop production technologies, we have tested the value of some of the low risk technologies such as improved decision making based on forecast based advisory, precision application of small doses of fertilizer, treating the seed with Growplus, water conservation with tied ridges and improved agronomy. The evaluation was carried out both on station and on farm. On station trials were conducted in Kenya and Zimbabwe wile on farm trials were done in Kenya. In the on farm studies, interesting differences were observed between men and women farmers on the number of technologies adopted and outcome of those adoptions. Women farmers reported adopting higher number of technologies than men farmers, but the benefit achieved by the adoption of these technologies is higher in case of men farmers. Higher percent of women farmers expressed willingness to continue with the use these technologies compared to men farmers. This probably has implications in the sustainability of the adopted technologies. Some of the constraints reported in clude probabilistic nature of the information in case of agro-advisories which can go wrong, labor intensive operations in case of microdosing and tied ridging, incomplete land preparation in case of seed priming, non-availability of improved seed and capital are some of the constraints mentioned by the non-adopters and by those who tested but not willing to continue with adoption of the same. On station trials were conducted at four different locations in Kenya and Zimbabwe (climate analogues) to assess the effectiveness of seed priming with or without Grow plus, tied ridges, microdosing and plant population effects. Results indicate a strong interaction between the sites and also between the seasons.

Gender component:

Our surveys in the target areas have indicated that women farmers have low access to cash and other resources to invest on improved technologies. The low risk technologies from this project are expected to help women farmers more. Nearly 30% of the participants in the study are women which help in conducting gender disaggregated analysis of results.

Deliverables:

- Report with results from participatory assessemnt on acceptance and contribution of potential technologies in reducing risk and increasing yield

A project report is prepared and submitted to the donor. More detailed report is under preparation.

- Journal article on role and effectiveness of microdosing, seed priming etc in reducing risk and improving productivity

One of the MSc students associated with this work presented the results at East Africa Soil Science Conference held during October 2014 at Nakuru, Kenya and the same is currently being reviewed for publication in a journal. Another journal article on the risks and opportunities is under preparation.

Partners:

KARI; EIAR

Locations:

East Africa (EA)

Activity 345-2013 (Milestone 2.1.3 2013 (1).)

Title: Participatory design of gender-responsive M&E protocol to assess progress and evaluate concrete results/transformation from farmers' use of Climate services

Status: **Complete.** See report under deliverables

Gender component:

See report under deliverables

Deliverables:

- Gender-responsive M&E tool to assess progress and evaluate concrete results/transformation from farmers' use of Climate services

Field tested, Gender-responsive and locally-relevant M&E protocol developed to evaluate the usefulness of climate services for farmers; field testing of proposed M&E tool in East Africa site (Nyando site), South Asia (Faisalwadi) and West Africa (Kaffrine site); CCAFS report on developed tool to be published at the end of consultant hire in April 2014

- Community of practice across CGIAR centers around impact assessment of Climate Services on ressource-poor farmers under a changing climate

http://cscop.iri.columbia.edu/index.html

Partners:

IFAD; CSP; WMO

Locations:

East Africa (EA)

Activity 346-2013 (Milestone 2.3.1 2015.)

Title: Testing and promotion of effective communication methods and formats for presenting climate information including seasonal climate forecasts tailored to the end user needs.

Status: **Partially complete.** This is the second year of farmers' participatory evaluation (FPE) of seasonal rainfall forecast based crop management options by farmers in Kurnool and Anantapur districts in South India. The study was conducted in four villages in each of the two districts with forty to fifty volunteered farmers in each village. The NCEP GCM regional (CF2) downscaled forecasts are generated by IITM for the main rainy season months of June-July-August-September (JJAS) with an initial boundary condition of April 2013. The monthly forecasted rainfall means were disaggregated into daily weather variables using disaggregation tools and techniques. Crop yields were estimated using crop models under different management scenarios with hindcast rainfall and forecasted rainfall for the ensuing season. The probabilistic forecast of seasonal rainfall distribution and scenarios of different crop management options and their productivity estimates wer communicated. Daily rauinfall records were kept at all the places and weekly weather forecasts were made available on request. The management decisions made during the season were recorded and are currently being evaluated.The forecast of average conditions is line with the long range forecast issued for the country and based on the forecast

farmers were advised to go for sowing from second fortnight of July as June rainfall has less than 30% probability. Twenty two out of fifty farmers in one villages of Kurnool took up double cropping of hybrid maize followed by chickpea or hybrid maize/pigeonpea inter crop. Rainfed hybrid maize yield with almost all farmers were around 5 t ha-1 and are expecting 800-1000 kg ha-1 intercrop pigeonpea yields. In another village, farmers who followed forecast and planted cotton had better yield (up to a record of 3 to 4 t ha-1) of kapas than cotton sown early in June (2-2.5 t ha-1) as the bolls were affected by more rain during mid-season.The activity was completed in Zimbabwe and it has been on-going since 2009/10 as part of a PhD study by Martin Moyo. This study sought to investigate the scope for seasonal climate forecasts with and without crop simulation modelling, introduced in a participatory way to improve crop productivity in smallholder farming in the face of climate variability in Zimbabwe. In 2013, a total of 32 AGRITEX personnel and more than 200 farmers from 2 districts, Hwange and Lupane were trained to impart increased understanding and skills on (i) practical implications of climate variability (and change) and (ii) appropriate coping and adaptation strategies for smallholder farmers. The extension staff and farmers were also capacitated to access/understand both SCF and "weather-within-climate" information for improved decision making in farm management. Six (6) Field Schools (FS) that integrated the use of climate information (notably the inclusion of "weather-within-climate" information and short term weather forecasts) and various agricultural technologies were established and these reached out to about 300 farmers. The "weather-within-climate" information that was disseminated included weather events that were deemed to be of use to farmers in their daily activities; and this was presented as estimated risk expressed in terms of probabilities for selected weather events such as rainfall onset and cessation, number of rain days, and risks of dry spells during growing season.

Gender component:

Female headed hosueholds will specifically be targeted to be part fo the contact farmers that will receive training on the use and interpretation of the SCF and weather forecasts and they will also host demonstration plots that will be used as a learning tool for decision making given the weather forecast information.

Deliverables:

- ICT based methods (e.g., radio, SMS, TVs, voice KVK in India) for rapid and timely dissemination of climate information

Three radio programs were developed and broadcasted by Mbaitu FM in Kenya

- Training workshops for staff from NARES as well as contact farmers in use of climate data and SCF interpretation with facilitation from the National Met. Services (NMS)

A series of training programs involving about 550 farmers from two divsions Kaitit and Wote were conducted during September 2013Two training programs for the extension officers in Machakos and Makueni conties were conducted in September 2013

- Scaling up the use of seasonal climate forecasts, using farmer participatory research approaches linked with ICTs (mainly mobile phones)

A program to test the scaling up of climate services was initiated with a combination of radio programs, training of extension officers and development of location specific posters and agro-advisories

- Assess the impact of using both ICTs and a participatory agro-meteorology based extension strategy on adaptation to climate variability and change

Surveys to assess the impact of provision of climate information in planning and managing smallholder farms before and after the provision of climate information were conducted and a final survey will be carried out at

the end of the ongoing crop season in March 2014.

- Efficient formats and communication channels for presenting seasonal climate forecast information to farmers

Forecast based agro-advisories for Kaiti and Wote divisions near Wote were developed and availed to farmers and extension officers

- Training modules aimed at improving knowledge and understanding of probabilistic forecasts and potential role of forecasts in reducing risk

A training module was developed with locally relevant material and the same is currently being revised and finalised

- ICT mediate approaches (mobile;tablet etc.) (for India)

Different approaches were developed and currently being evaluated

Partners:

University of Reading; MSD; KARI; KMD; Ministry of Agriculture, Kenya; IRI; AGRITEX; IMD

Locations:

South Asia (SAs),East Africa (EA),Other

Activity 347-2013 (Milestone 2.1.2 2013.) Commissioned

Title: Household modeling tools tested and adapted for evaluating impacts of climate risk and risk management interventions on rural livelihood resilience in 2 countries; Models for crop and water management applied to climate risk and its management in 4 countries.

Status: **Complete.** The study explored farmers' perceptions towards investments into soil and water conservation technologies under variable climatic conditions, quantified the risks and the benefits of investments in soil and water conservation technologies with due consideration to short term trends in climate. It finally identified the potential opportunities to reduce risks and increase benefits of investments in soil and water conservation technologies. The study was carried out in Mwania and Makindu watersheds in Eastern Kenya. A sample size of 120 households was used. Descriptive statistics were conducted using Statistical Package for Social Sciences (SPSS ver. 11.5). The crop simulation model APSIM was also calibrated and validated using data from trials conducted at Katumani and Kiboko research stations to evaluate the potential of reducing risk and to assess the benefits of using irrigation, water harvesting and terraces. Results indicate that farmers who were non-users of SWC technologies perceived high cost and input unavailability locally as the key constraints. On the other hand, benefit realized after investing in SWC technologies was perceived as the reason behind investment for the users. Investing in irrigation is 12.7% and 42.7% more costly than terraces and water harvesting respectively in maize production while under beans production, it is 55.5% pricey compared to the latter technologies. Returns obtained under irrigation are 40% and 43.5% higher in maize and beans respectively in the study sites. Modelling results indicate that investing during above normal seasons is risky in all technologies but beneficial during normal seasons. During below normal seasons irrigation gives the highest returns. Model simulations further indicate 73% and 61% yield gains in maize and beans production when up to 30kg N/ha fertilizer is applied. The study recommends development of strategies that will ensure reduction of prices of farm inputs and their availability to resource poor farmers to enhance investment in irrigation to

ensure food security in semi-arid Eastern Kenya.

Gender component:

The proposed analysis will take into consideration the differences in the management of farms by men and women farmers especially in the selection and use of crops, varieties and management practices. By setting up model scenarios in a way that reflects these differences, it is possible to evaluate how and men farmers will be impacted by changes in climate and what adaptation options are required to improve their resilience to these impacts.

Deliverables:

- At least 3 researchers in each of the four participating countries trained and using the models.

The researchers were trained and are actively participating in the assessing the climate change impacts under AgMIP project.

- A report on adaptation options for different households.

A student submitted the Masters thesis to Kenyatta University and defended it.

Partners:

KARI; Makerere University; EIAR; SUA

Locations:

East Africa (EA)

Activity 348-2013 (Milestone 2.3.2 2013.) Commissioned

Title: Assess the reliability of seasonal climate forecasts and usefulness in farm level decision making. Identification and evaluation of existing communication channels for disseminating climate information. Develop, test and evaluate effective communication methods and formats for timely disseminating of Seasonal Climate Forecasts.

Status: **Complete.** The meteorological agencies in Tanzania, Uganda and Ethiopia and University of Nairobi in Kenya have initiated this study. The analysis of reliability of seasonal climate forecasts is completed in Tanzania and Ethiopia. The seasonal weather forecasts issued by Tanzania Meteorological Agency (TMA) were verified for the period of March-April-May (MAM) and October-November-December (OND), 1983-2013. These forecasts are developed through downscaling of regional seasonal climate forecast to National level taking into consideration of the results from preliminary seasonal climate forecast and micro-climatic features in various climatological zones over the country. Based on the verification approaches used, it was observed that the seasonal forecasts issued by TMA were accurate and skilful. The usefulness of the seasonal weather forecasts in planning and managing farming activities in Bagamoyo district was assessed. Participatory rural appraisal methods, key informant interviews and focus group discussions were used in data collection and the collected data was analysed using Statistical package for social sciences (SPSS). It has been found that about eighty six percent (86%) of the respondents are aware of the seasonal climate forecasts issued by TMA, but only fifty five percent (55%) of the respondents acknowledged using the forecasts information in planning and managing farming activities. Training of small holder farmers, agriculture extension officers on how to use seasonal weather forecasts products from TMA is recommended as one of the strategy that could help to improve the

knowledge and use of the seasonal weather forecast in planning and managing farming activities. The dissemination of agro meteorological information to farmers through radio broadcasts which are interpreted into village level action by expert farmers, and through extension workers is thought to be effective communication methods for timely dissemination of seasonal climate forecasts to farmers. Analysis of forecast in other countries is also completed and the reports are under preparation.

Gender component:

The assessment of reliability of forecasts is gender neutral. However, the section on communication methods considered the differential requirements of men and women by involving men and women equally.

Deliverables:

- Report on agroclimatology of selected districts in the four target countries.

Reducing Risk and Capitalizing on Opportunities Created by Variable climate through use of Downscaled Seasonal Climate Forecast: Pilot study over Central Ethiopia

- Report on reliability of seasonal climate forecasts and its use in farm level decision making.

REDUCING RISK AND CAPITALIZING ON OPPORTUNITIES CREATED BY VARIABLE CLIMATE THROUGH USE OF IMPROVED DOWNSCALED SEASONAL CLIMATE FORECAST IN BAGAMOYO DISTRICT, COASTAL REGION, TANZANIA

Partners:

UoN; NMA; TMA; UMD

Locations:

East Africa (EA)

Activity 349-2013 (Milestone 2.1.1 2013.)

Title: Continuation and expansion of seasonal forecasts and advisories at the Makuene benchmark site.

Status: **Complete.** See activity 348-2013.

Gender component:

This activity is planned to involve both men and women farmers and evaluate the differences if any in their understanding of the probabilistic climate information and how the same is interpreted and used in planning farm operations. This information will help in tailoring the products (training module and information products) to meet the specific needs of both the groups.

Deliverables:

Partners:

KARI; KMD

Locations:

East Africa (EA)

Activity 350-2013 (Milestone 3.3.1 2013.)

Title: Assess land use change dynamics, deploy GHG measurement equipment at long-term dryland sites, including Jatropha plantations; assess biomass production potential from annual crops, perennial trees crops, and natural vegetation across an agro-ecological gradient (with ICRAF; links to CRP1.1).

Status: **Partially complete.** Activity did not materialize in West Africa. Some work on GHG was done in India: Assessment of greenhouse gas (GHG) emissions from a long-term conventional tillage and conservation agriculture experiment with maize-chickpea cropping system in the semi-arid tropics. The report is included in the deliverables.

Gender component:

Deliverables:

- Baseline rates for C emissions from deforestation and land use conversion assessed

See report.

Partners:

ICRAF; IER; SARI; NASA JPL; AMEDD; JECAM; UDS

Locations:

West Africa (WA)

Activity 434-2013 (Milestone 4.2.1 2013 (3).)

Title: Analysis of long-term legume pest dynamics data from ICRISAT Patancheru in relation to agro-climatology. Mapping of climate variability and change in India, based on historic gridded climate data. Assessing changes in climates and water balances for selected contiguous SAT areas of India, under PRECIS projected high resolution temperature and rainfall situations.

Status: **Partially complete.** See report in deliverables

Gender component:

Deliverables:

- Empirical relations between climate and pest dynamics established.

Historic pest surveillance data of twenty two years (1990-91 to 2011-12) on key pests of groundnut, chickpea and pigeonpea crops collected at ICRISAT Centre. Pests considered are Spodoptera, Helicoverpa, Leaf miner, Jassids, Thrips and Aphids. Pheromone trap data for Spodoptera, Helicoverpa and Leaf miner were collected for the same 22-year period. These pest data along with weather data are summarized according to standard weeks, for further analyses.

- Areas with high climate variability mapped, changes in area under different climates identified and quantified.

Based on the gridded climate data of India Meteorological Department, climates were classified and changes in areas identified. Presented a research paper on “Changes in the Semi-Arid areas in India”, in the National Symposium on “Climate Change and Indian Agriculture: Slicing Down the Uncertainties”, at CRIDA during 22-23 Jan 2013, which was judged as the first best presentation and received the award. Journal paper entitled

"Increased arid and semi-arid areas in India with associated shifts during 1971-2004" was published in the Journal of Agrometeorology 15 (1): 11- 18 (June 2013). This publication received "Outstanding Scientific Article Award" by ICRISAT for the year 2013.

- Changes in water balance and LGP under projected climates available for selection of suitable varieties and management practices resilient to change.

Climate trend analysis of ICRISAT Patancheru and selected locations in Karnataka and Gujarat was done. Changes in water balance based on UKMO_HadCM3 projections under SRES A1B scenario for 2030s were assessed. A few water balance elements have shown considerable changes in projected climates compared to present period.Report on climate trends and changes in water balance and LGP under projected climates is prepared and available.

Partners:

KSDA; BAIF

Locations:

South Asia (SAs)

Activity 435-2013 (Milestone 4.2.1 2013 (5).)

Title: Develop an interactive and user-friendly Global Yield Gap Atlas (5 cereal crops, 12 countries). Training an agronomist network in SSA and SAs on data requirements and selection and use of models to estimate crop yield potential, yield gap, and water productivity. (with AfricaRice, IRRI, CIMMYT)

Status: **Complete.** Protocols for yield gap assessment were developed and are documented on the website and in the form of journal articles (special issue of Field Crops Research). 12 NARS partners were trained in the methodologies and have been helping out with data collection. The website (www.yieldgap.org) is fully functional (full yield gap assessments for few countries pending). The project has been presented at multiple international conferences. In Nigeria and Ghana, the project was presented to the ministry of agriculture and this created great interest in using the atlas for national food security studies.

Gender component:

Deliverables:

- A network of agronomists in selected countries of SSA and SAs is established who are conversant in agronomically-driven data requirements and simulation models for yield gap assessment and interpretation at local to national scales.

Several training workshops and work visits were organized in 2013. At least 12 NARS partners from SSA and SA are trained in the methodologies and protocols used for the yield gap atlas.

- Interactive web-based yield gap atlas available.

The atlas is now fully operational at www.yieldgap.org. Methodologies, data and protocols are documented and available on the website (except weather data, see comments on IP issues and new method for weather propagation under activity under theme 1).

- Web-based platform with information about methods and data used for developing the global yield gap atlas to inform policymakers.

www.yieldgap.org. The web-based platform is fully operational (full yield gap analysis still pending for a few countries). In Nigeria and Ghana the platform has been shown to policymakers at the ministry of agriculture, and there was a lot of interest in using the atlas for national food security assessments.
- Paper published on yield gap assessment protocol.
Multiple papers published in a special issue of Field Crops Research. The special issue is made Open Access http://www.sciencedirect.com/science/journal/03784290/143. Two relevant papers are uploaded as deliverable.

Partners:

University of Nebraska; WUR; IRRI; AfricaRice; CIMMYT; INERA; University of Ghana

Locations:

Global

Activity 436-2013 (Milestone 4.2.1 2013 (5).)

Title: Collect and analyze bio-physical and household survey data from CCAFS sites, ICRISAT sites, ICRISAT village level studies in India and WA, and AgMIP project sites for integrated assessment of climate change impact and adaptation with the Tradeoff Analysis model TOA-MD (regional) and IMPACT (global) (linked to activities 1.1 & 2.1, with ILRI).

Status: **Complete.** AgMIP is still ongoing but major progress has been made in 2013. Especially relevant are the 'regional projects' within AgMIP in West-. East-. Southern Africa and South Asia (http://www.agmip.org/regional-integrated-assessments-handbook/#). ICRISAT has been leading three of these regional projects (East Africa, West Africa, Southern Africa livestock). In all regional projects bio-physical and household survey data were collected and integrated assessments with TOA-MD were performed. An important new component of the (regional and global) integrated assessments is the development of Representative Agricultural Pathways (socio-economic scenarios developed with stakeholders). AgMIP has been collaborating with the CCAFS scenario officer on this.

Gender component:

Deliverables:

- Participatory stakeholder and training workshops conducted.
Several training workshops were organized during 2013 (overview on http://www.agmip.org/events-2013/). Stakeholder workshops were held in the different regions mainly to to elaborate RAPs.
- TOA-MD set up for CCAFS, ICRISAT and AgMIP sites.
TOA-MD is set up for multiple sites in the different regional projects in SSA and SA. So far ImpactLite data for CCAFS sites was not made available, so no TOA-MD had been set up yet. An overview of integrated assessment applications can be found at the website of the AgMIP global meeting http://www.agmip.org/feature-view/hats-off-to-the-4th-annual-agmip-global-workshop/. Some posters were uploaded as deliverable. Full writeup of all applications is planned for 2014.
- links made with IMPACT model (global).
Links between regional and global integrated assessments are made through the development of

Representative Agricultural Pathways, socio-economic scenarios that should be consistent across scales. The latest presentation on RAPs is uploaded as deliverable.

- Papers published on climate change impacts and adaptation (regional and global).

Several papers are in preparation or have been submitted for publication in 2014. The regional integrated assessment applications will go to a special issues of 'Handbook of Climate Change'. A paper on RAPs is also submitted.

Partners:

OSU; UCT; ARC; UEM; UFS

Locations:

East Africa (EA)

Activity 437-2013 (Milestone 4.3.3 2014.)

Title: Evaluation of promising crop technologies/traits/management practices for productivity enhancement of pearl millet and chickpea under current and future climates using virtual crop model in target regions and countries.

Status: **Partially complete.** Under this activity, we have collated chickpea experimental yield trial data, soil and weather information for 6 locations in India and 3 locations in East Africa and documented for crop model calibration. The data were documented and uploaded in the data sharing platform - ICRISAT DATAVERSE system. The pearl millet experimental yield trial data collection for Indian location was completed and for WCA is underway. This is a part of 2014 activity.Three chickpea popular cultivars were calibrated in DSSAT and virtual cultivars co-efficient for promising technologies like drought tolerant, heat tolerant and high yield potential were calibrated using multi-location trail data. The potential of the promising technologies were assessed under current and future climate. The results were published in European Journal of Agronomy.

Gender component:

Deliverables:

- Documented yield trail data of pearl millet and chickpea for minumum 2-3 popular cultivars in the target regions (cultivar, phenology data, management data), soil information, daily weather data of respresentative yield trail sites in 3 target regions like WCA, ESA and SA.

The chickpea yield trail data was documented and archived in ICRISAT DATAVERSE system

- DSSAT pearl millet and chickpea model improvement and calibration and validation of baseline culivars.

The chickpea model calibration and validation of baseline cultivars was documented and presented a report.

- Virtual crop model for identified promising technologies and simulation analysis current and future climates.

A journal paper was published in European Journal of Agronomy.Singh, P., Nedumaran, S., Boote, K.J., Gaur, P.M., Srinivas, K., and Bantilan, M.C.S. 2014. Climate change impacts and potential benefits of drought and heat tolerance in chickpea in South Asia and East Africa. European Journal of Agronomy, 52 (2014) 123–137. http://dx.doi.org/10.1016/j.eja.2013.09.018

- Research report on regional scale impact of climate change on chickpea and pearl millet on crop yields and production under changing climate.

The regional assessment is part 2014 work plan. The spatial data for soil, weather and management is collated and spatial crop model for chickpea is underway.

Partners:

UF; IFPRI; CRP Grain Legumes

Locations:

East Africa (EA)

Activity 438-2013 (Milestone 4.3.3 2014.)

Title: Assess the impact of changing socio-economic conditions and climates on production of dryland crops, prices, food availbility and nutritional security in the semi-arid regions of Africa and Asia using integrated modeling approach (linked with CRP2, AgMIP, ILRI).

Status: **Partially complete.** Under this activity, we have linked the crop model results (change in crop yield under baseline climate and 2050 climate) for the dryland crop into IMPACT model for different climate scenarios. The IMPACT model was calibrated for dryland crops and assessed the future of dryland cereals (sorghum and millet) futures in Asia under changing socio-economic drivers and climate change scenarios.

Gender component:

Deliverables:

- The different scenarios results will be documented and published in the web portal for easy access and reteieval.

The IMPACT model scenarios results for sorghum and millets are documented in a data visualization software called STATPLANET and soon will be published in web for easy visualization.

- Research report on Climate change impact on dryland agriculture and food security in SAT regions.

A draft working paper on Future of sorghum and millets in Asia under changing socio-economic and climate scenarios is under review and will be published in 2014.

- A policy brief on climate change impacts and its implication on dryland agriculture in Asia and Africa.

Based on the working paper a policy brief on Future of Sorghum and millets Asia will be prepared.

Partners:

IFPRI; ILRI

Locations:

Global

Activity 15-2013 (Milestone 4.3.3 2014.) Commissioned

Title: Evaluating the potential of new technologies of sorghum and groundnut by using virtual crop modelling approach.

Status: **Complete.** The potential of the promising technologies for sorghum and groundnuts were evaluated using virtual crop model in DDSAT. The potential of the drought and heat tolerant sorghum and groundnuts promising technologies were assessed under current and future climates. The results were published in peer reviewed journals.

Gender component:

Deliverables:

- Compilation of required crop model data (like weather, soil and yield trail data) for groundnut and sorghum
The experimental data were documented and archived
- Working paper on simulation analyses of virtual crop models of groundnut and sorghum for the selected ICRISAT targeted sites in WCA, ESA and Asia.
2 Journal paper were publishedSingh, P., Nedumaran, S., Ntare, B.R., Boote, K.J., Singh, N.P., Srinivas, K., and BANTILAN, M.C.S. (2013) Potential benefits of drought and heat tolerance in groundnut for adaptation to climate change in India and West Africa. Mitigation and Adaptation Strategies for Global Change. http://dx.doi.org/10.1007/s11027-012-9446-7Singh, P., Nedumaran, S., Traore, P.C.S., Boote, K.J., Rattunde, H.F.W., Prasad, P.V.V., Singh, N.P., Srinivas, K., and Bantilan, M.C.S. 2014. Quantifying potential benefits of drought and heat tolerance in rainy season sorghum for adapting to climate change. Agricultural and Forest Meteorology, 185. pp. 37-48. http://dx.doi.org/10.1016/j.agrformet.2013.10.012
- Research report on global scale impact of climate change on groundnut and sorghum.
The spatial crop model validation is underway and the results will be analysed and published in 2014.
- Advanced simulation analyses of virtual cultivars of rice.
This is not ICRISAT deliverable
- Participation in one or more final/transition workshops.
The virtual crop model results of groundnut and sorghum were presented in Annual Global Futures project review meetings and AgMIP regional workshops.
- Contribution to dissemination report to partners, donors, researchers, and policymakers providing details on modeling, impacts of different scenarios and preliminary conclusions and recommendations on effective policy interventions.
The potential impacts of drought and heat tolerant technologies of groundnuts and sorghum were demonstrated to management of CRP Grain legumes and CRP Dryland Cereals

Partners:

UF; IFPRI

Locations:

Global

Activity 475-2013 (Milestone 2.1.2 2013.)

Title: DSS for yield forecasting for meeting local needs developed for a few key crop commodities. Customized Software as well as other innovative tools developed considering availability of data; downscaled seasonal forecast information products utilized, training organized on use of DSS; data required collected from each region; first preliminary runs of the DSS done; validation trials established with historical data.

Status: **Incomplete.** Unclear how this activity ended up in the P&R system.

Gender component:

Deliverables:

Partners:

Locations:

2. Succinct summary of activities and deliverables by Output level

Output: **1.1.1**

Summary:

337-2013: Household surveys, key informant interviews and focus group discussions were conducted at selected climate analogue sites in Kenya and Zimbabwe to assess climate- induced risks and possible adaptation options with a gender perspective under the project CALESA supported by GIZ. The household surveys were conducted at four locations in Kenya and Zimbabwe and a total of 1300 households (at least 150 from each site) were covered by the survey. The survey assessed the socio-economic and demographic characteristics, crop and livestock production characteristics and production constraints at the study sites. At each site 4 FGDs, 2 composed of male farmers and 2 of female farmers were held at each of the study sites. Some insights from these studies include:a. Preliminary results show that climate analogue analysis and involvement of stakeholders such as smallholder farmers through interviews, participatory evaluations can contribute in identifying adaptation options for smallholder farmers in different climates. b. Characteristics of household heads differ, as well as coping and adaptation strategies for crop production within and across analogues. c.Higher proportions of de-facto female heads at the dry, warmer sites imply higher levels of male labour migration. d. De-juri female heads are mostly older than the de-facto heads. e. Higher proportions of female heads who are full time farmers imply higher contribution by some rural women in domestic and agricultural production. Results indicate greater contribution by rural women in domestic and agricultural production f. Gender differences exist in preferred crops and management strategies across sites.g. Lower yields at both drier and wetter analogues compared to their reference sites indicate potential reduction in maize yields in warmer 2050s climates.h. Lower maize yields in female headed households in Kadoma and in Chiredzi show that the importance of gender in climate change and agricultural planning.I. At drier site Chiredzi small grains and crops diversification are important strategies for coping and adapting to environmental stresses. j. Implications are increased uptake of small grains such as sorghum and millets in Matobo and areas with similar rainfall and temperature characteristics in 2050s. k. Gender issues for small grain production include labour for production, pest management, harvesting and processing, against a background of male labour migration. l. Different preferences for crop management strategies imply gender issues for differently managed households will vary across sites, particulalry between the dry analogue pair. m. There may be need for increased investment in water management research and development for drier areas.n. At the wetter climates soil and water management stragegies are important strategies for smallholders. This is illustrated by high proportions of smallholder farmers who use strategies to conserve soil moisture and increase soils fertility such as use of inorganic and organic forms of fertilizer. o. Gender issues may include, in addition to labour for production, socio-economic factors such as asset ownership, sharing from proceeds after selling crops particularly in male headed. p. Acces to draft power, labour, agricultural assets, social and financial capital in differently managed households are important for increasing adoption of effective crop management strategies.

Output: 1.2.1

Summary:

338-2013: Comprehensive assessment of climate change impacts on smallholder farming systems was conducted in Eastern and Southern Africa with the funding support from UKAID under the global Agricultural model intercomparision and improvement project (AgMIP) coordinated by Columbia University, New York, USA. The target areas in eastern Africa include Embu county in Kenya, Wami basin in Tanzania, Adama and Adugodem woredas in Ethiopia and Hoima and Masindi districts in Uganda. Observed climate data for 23 locations from the target areas for the period 1980-2010 was collected and analysed for variability and trends. Location specific downscaled climate scenarios were generated for 20 CMIP5 GCMs for mid century (2040-69) and end century (2070-99) periods under RCP 4.5 and 8.5. In all the target areas, surveys were conducted to identify and define the farming systems in a way that can be integrated with crop simulation models. Impacts on maize crop was assessed using crop simulation models APSIM and DSSAT by setting up more than 1500 farmer systems with varying climate, soil and management conditions to capture the full diversity of the systems. Using the experimental data, the models were calibrated to simulate 10 different varieties that are widely grown in the target areas. The results from the crop simulation analysis were then integrated with ToA-MD for economic analysis. Some highlights:1. No clear trend is discernable from the historical records of annual and seasonal rainfall2. An increase in the CV of seasonal rainfall is observed when computed for 10 year moving periods3. The changes in temperature and rainfall in the downscaled scenarios are in agreement with the trends observed in the large scale predictions for eastern Africa reported by IPCC4. In several areas in Eastern Africa, a significant increase in rainfall was predicted by most GCMs5. An increase in the potential and farmer yields was observed in many agro-ecologies mainly due to an increase in rainfall and the temperatures remaining in the optimal range even with the projected increase in temperature6. The direction and magnitude of impacts of projected changes in climate on crop growth and performance was influenced by both the current climate and the management practices employed. For example in Kenya, significant decline in yields was observed in systems using Katumani variety, higher fertilizer nitrogen and low plant populations7. To a large extent the negative impacts can be minimized and opportunities can be capitalized by deploying the available varieties and adjusting the management practices employed by smallholder faremrs8. Adaptation strategies identified from this analysis indicate that a 2-3 fold increase in productivity is possible in many agro-ecologies even under climate change. However, in environments such as LM5 (lower midland livestock and millet growing areas) a significant negative impact is expected.339-2013:Based on the proposed measures, an ex ante analysis was done to assess the climate sensitivity in Kambi Ya Mawe, Wote, Kenya. APSIM model v 7.4 was used to generate yields of maize for 30 years using observed weather data and downscaled weather data for 6 GCMs (bccr, cnrm, echam, inmnm, miroc and csiro) and the average (ensemble) for A2 carbon emission scenarios during the end century (2070-2099). The downscaled weather scenarios were generated using Marksim-GCM. The ex-ante analysis was conducted with maize to evaluate its climate sensitivity as a function of management options that included plant population (2.2,3.0, and 4.0 plants/m2), planting dates (early, normal and late), variety (Katumani, Dekalb, H511 and H513), soil and water conservation practice (normal ploughing and tied ridges) and fertilizer application (0,20,40,60 and 80 Kg N/ha). From the results, it is evident that early planting and adjusting plant population to 30000 plants per hectare to get high yields was found to be the best option. Also, use of improved varieties particularly H511 in the area of study rather than Katumani (the most used variety). Further, water conservation will not be an issue of concern, however, application of fertilizers up to 60kg N per hectare will give good yields.

Highest yields are obtained under “INMNM” GCM. Comparing use of fertilizers, adoption and non-adoption of SWC technology, the results shows 26% increase, 2% and 4% decrease in the yields respectively. In India, Pigeonpea and groundnut are important complements to cereals in dryland farming systems and in human and livestock diets. Women often cultivate groundnut and pigeonpea for income (including high-value exports) and to improve the nutritional value of their family’s diet. Watersheds in the Indian SAT with different seasonal rainfall and soil types (Alfisols and Vertisols) are prioritized for conducting farmer-participatory experiments on groundnut and pigeonpea. Four promising varieties of pigeonpea and groundnut will be experimented for ex-ante assessment of climate change impacts on these crops.340-2013:Protocols for yield gap assessment were developed and are documented on the website and in the form of journal articles (special issue of Field Crops Research). 12 NARS partners were trained in the methodologies and have been helping out with data collection. The website (www.yieldgap.org) is fully functional (full yield gap assessments for few countries pending). The project has been presented at multiple international conferences. In Nigeria and Ghana, the project was presented to the ministry of agriculture and this created great interest in using the atlas for national food security studies.341-2013:The DSSAT, APSIM and (cereals only) SarraH models were calibrated for phenology and yield of the following West African cultivars using historical physiological and breeding trial data from ICRISAT, CIRAD, Agrhymet Regional Centre, SARI, IER, INERA and CERAAS: CIVT, M9D3, Hainikirey, Maewa, ZATIB (millet), CSM63E, CSM388, CSM335, IS15401, IRAT204, Sariaso10, Lata, Fadda (sorghum), Obatanpa, Teezey (maize), F-Mix and Chinese (peanut). Supplementary trials were conducted on station in Samanko, Mali to produce crop phenology and growth data for sorghum varieties Fadda, Nieleni, IS15401, Pablo, CSM63E, SK5912, Grinkan, Soumba, and 621B. Yield components were simulated by these 3 models over more than 1,000 smallholder farms in the districts of Nioro, Senegal (), Koutiala (Mali), and Navrongo (Ghana) using agronomic management data extracted from WorldBank RuralStruc farm-level surveys (2007). Simulated yields successfully matched observed survey yields. Probability of exceedance distributions were generated for baseline climates at each location (1980-2009) as well as future mid-century scenarios under RCP8.5 at each site (5 GCMs each). Significant differences were noted in yield distributions and statistics across sites and crops. A single adaptation measure (10% increase in grain-filling duration, and deeper root distribution profile) was used to simulated virtual cultivar. It did successfully offset the negative effects of climate change at all sites. Resulting yield projections were fed into the trade-offs analysis model (TOA-MD) to estimate impacts on net revenue, per capita income, and % adoption rates with and without adaptation to climate change.

Output: 2.1.1

Summary:

343-2013: This study generated evidence based knowledge on the risk management stategies of women and men in rural communities in regards to livelihood patterns/options and use of formal and informal social networks.Trainings of the partners on the tools of the study was successfully completed. All studies and activities in the field have been completed. The draft report is completed and being reviewed and finalised.

Output: 2.1.2

Summary:

347-2013: The study explored farmers' perceptions towards investments into soil and water conservation technologies under variable climatic conditions, quantified the risks and the benefits of investments in soil and water conservation technologies with due consideration to short term trends in climate. It finally identified the potential opportunities to reduce risks and increase benefits of investments in soil and water conservation technologies. The study was carried out in Mwania and Makindu watersheds in Eastern Kenya. A sample size of 120 households was used. Descriptive statistics were conducted using Statistical Package for Social Sciences (SPSS ver. 11.5). The crop simulation model APSIM was also calibrated and validated using data from trials conducted at Katumani and Kiboko research stations to evaluate the potential of reducing risk and to assess the benefits of using irrigation, water harvesting and terraces. Results indicate that farmers who were non-users of SWC technologies perceived high cost and input unavailability locally as the key constraints. On the other hand, benefit realized after investing in SWC technologies was perceived as the reason behind investment for the users. Investing in irrigation is 12.7% and 42.7% more costly than terraces and water harvesting respectively in maize production while under beans production, it is 55.5% pricey compared to the latter technologies. Returns obtained under irrigation are 40% and 43.5% higher in maize and beans respectively in the study sites. Modelling results indicate that investing during above normal seasons is risky in all technologies but beneficial during normal seasons. During below normal seasons irrigation gives the highest returns. Model simulations further indicate 73% and 61% yield gains in maize and beans production when up to 30kg N/ha fertilizer is applied. The study recommends development of strategies that will ensure reduction of prices of farm inputs and their availability to resource poor farmers to enhance investment in irrigation to ensure food security in semi-arid Eastern Kenya.

Output: 2.1.3

Summary:

344-2013: Considering the high risk associated with the investments on crop production technologies, we have tested the value of some of the low risk technologies such as improved decision making based on forecast based advisory, precision application of small doses of fertilizer, treating the seed with Growplus, tied ridges and imporved agronomy both on station and on farm. On station trials were conducted in Kenya and Zimbabwe wile on farm trials were done in Kenya. In the on farm studies, interesting differences were observed between men and women farmers on the number of technologies adopted and outcome of those adoptions. Women farmers reported adopting higher number of technologies than men farmers, but the benefit achieved by the adoption of these technologies is higher in case of men farmers. Higher percent of women farmers expressed willingness to continue with the use these technologies compared to men farmers. This probably has implications in the sustainability of the adopted technologies. Some of the constraints reported in clude probabilistic nature of the information in case of agro-advisories which can go wrong, labor intensive operations in case of microdosing and tied ridging, incomplete land preparation in case of seed priming, non-availability of improved seed and capital are some of the constraints mentioned by the non-adopters and by those who tested but not willing to continue with adoption of the same. On station trials were conducted at four different locations in Kenya and Zimbabwe

(climate analogues) to assess the effectiveness of seed priming with or without Grow plus, tied ridges, microdosing and plant population effects. Results indicate a strong interaction between the sites and also between the seasons.

Output: 2.3.1

Summary:

346-2013: The study initiated in 2012 to assess the value of training and provision of agro-advisories in improving the planning and management of smallholder farms was extended to cover about 550 farmers in two divisions in Wote district. Training workshops were conducted during September, one month before the start of the short rain season followed by provision of forecast information. Also agro advisories were prepared with relevant agricultural technologies for the target locations and distributed to the participating farmers. Surevys to capture the change in the decision made by farmers ue to increased access to climate information was evaluated through surveys before and during the season. The end season surveys to assess the impact of the changed decisions will be carried out in March 2014 after the harvest of the crops.We have also developed and tested a methodology to scale up the climate services to reach as many farmers as possible in the Makueni and Machakos counties around the Wote bench mark site. . This is a demand driven process involving two steps. In the first step we broadcasted three radio programs highlighting the role of climate in agriculture, options to manage the climate variability better and usefulness of seasonal climate forecasts. These radio programs have created awareness and interest in farmers about climate information. Two training programs involving extension officers from Machakos and Makueni counties were also conducted to support the farmers with additional clarifications when approached. To help the extension officers in providing climate services, two different posters were developed and distributed to all the extension officers. One is a general poster explaining the key climate terms and the other one is presenting the location specific climate information. The second poster was compiled using historical climate data for about 37 locations in the two counties. The posters were prominently displayed in the offices of extension officers and other strategic locations in the target areas. We are now assessing the impact of this through the records kept by extension officers.

Output: 2.3.2

Summary:

347-2013: The meteorological agencies in Tanzania, Uganda and Ethiopia and University of Nairobi in Kenya have initiated this study. The analysis of reliability of seasonal climate forecasts is completed in Tanzania and Ethiopia. The seasonal weather forecasts issued by Tanzania Meteorological Agency (TMA) were verified for the period of March-April-May (MAM) and October-November-December (OND), 1983-2013. These forecasts are developed through downscaling of regional seasonal climate forecast to National level taking into consideration of the results from preliminary seasonal climate forecast and micro-climatic features in various climatological zones over the country. Based on the verification approaches used, it was observed that the seasonal forecasts issued by TMA were accurate and skilful. The usefulness of the seasonal weather forecasts in planning and managing farming activities in Bagamoyo district was assessed. Participatory rural appraisal methods, key informant interviews and focus group discussions were used in data collection and the collected data was

analysed using Statistical package for social sciences (SPSS). It has been found that about eighty six percent (86%) of the respondents are aware of the seasonal climate forecasts issued by TMA, but only fifty five percent (55%) of the respondents acknowledged using the forecasts information in planning and managing farming activities. Training of small holder farmers, agriculture extension officers on how to use seasonal weather forecasts products from TMA is recommended as one of the strategy that could help to improve the knowledge and use of the seasonal weather forecast in planning and managing farming activities. The dissemination of agro meteorological information to farmers through radio broadcasts which are interpreted into village level action by expert farmers, and through extension workers is thought to be effective communication methods for timely dissemination of seasonal climate forecasts to farmers. Analysis of forecast in other countries is also completed and the reports are under preparation.

Output: 3.3.1

Summary:

350-2013: An experiment in India has provided solid evidence that increased turnover of C (through elevated CO2 emissions) in the minimum tillage plots has fuelled an increase in N2O emissions under minimum tillage. There is conflicting evidence in the literature on the impact of conservation agriculture on GHG emissions (Palm et al., 2014) and NUE generally however the data from the ICRISAT trials is consistent with the fact that whilst reduced tillage may provide a better soil physical environment, the increased availability of C enhances the rate of denitrification when those conditions exist. This interaction requires careful dissection as whilst conservation agriculture is (quite correctly) being promoted as the cornerstone of food production in the developing world it may have a significant downside with respect to mitigation opportunities re climate change.

Output: 4.2.1

Summary:

436-2013: The Tradeoff Analysis model for Multi-Dimensional impact assessment (TOA-MD) has been developed and adapted as an integrated assessment framework for regional analysis of climate change and adaptation impacts. The methodology is now well established and several regional integrated assessments are ongoing in SSA and SA. Several stakeholder and scientific workshops have been held in which participants were introduced to and trained in TOA-MD. Current developments are linking TOA-MD with CCAFS scenario work in the form of Representative Agricultural Pathways (RAPs). TOA-MD will be further used for regional impact assessment in CCAFS sites and study areas from related initiatives like AgMIP. Within AgMIP, a link with the global modeling studies will be made. (also relevant for output 4.3.3.).

Output: 4.3.3

Summary:

436-2013: The Tradeoff Analysis model for Multi-Dimensional impact assessment (TOA-MD) has been developed and adapted as an integrated assessment framework for regional analysis of climate change and adaptation impacts. The methodology is now well established and several regional integrated assessments are ongoing in SSA and SA. Several stakeholder and scientific workshops have been held in which participants were introduced to and trained in TOA-MD. Current developments are linking TOA-MD with CCAFS scenario work in the form of Representative Agricultural Pathways (RAPs). TOA-MD will be further used for regional impact assessment in CCAFS sites and study areas from related initiatives like AgMIP. Within AgMIP, a link with the global modeling studies will be made. (also relevant for output 4.2.1.).15-2013: The potential of the promising technologies for sorghum and groundnuts were evaluated using virtual crop model in DDSAT. The potential of the drought and heat tolerant sorghum and groundnuts promising technologies were assessed under current and future climates. The results were published in peer reviewed journals.

3. Publications

Publication #1

Type: Journal papers

CCAFS Themes: Theme 1, Theme 4.2, Theme 4.3

Citation: Van Wart J, van Bussel LGJ, Wolf J, Licker R, Grassini P, Nelson A, Boogaard H, Gerber J, Mueller ND, Claessens L, van Ittersum MK, Cassman KG. 2013. Use of agro-climatic zones to upscale simulated crop yield potential. Field Crops Research 143: 44-55.

Publication #2

Type: Conference proceedings

CCAFS Themes: Theme 1, Theme 4.2

Citation: Claessens L, Antle JM, Stoorvogel JJ, Valdivia RO, Thornton PK, Herrero M. 2013. A Method for Evaluating Climate Change Adaptation Strategies for Small-Scale Farmers Using Survey, Experimental and Modeled Data. Climate-Smart Agriculture Global Science Conference, University of California, Davis, USA, 20-22 March 2013.

Publication #3

Type: Conference proceedings

CCAFS Themes: Theme 4.2, Theme 4.3

Citation: Claessens L, Vanlauwe B, Cassman KG, van Wart JP, Grassini P, van Ittersum MK, van Bussel LGJ, Wolf J, Boogaard H, de Groot H, Stoorvogel JJ. 2013. Soil suitability for sustainable intensification in smallholder systems in Sub-Saharan Africa. First International Conference on Global Food Security, Noordwijkerhout, The Netherlands, 29 September - 2 October 2013.

Publication #4

Type: Conference proceedings

CCAFS Themes: Theme 1, Theme 4.2

Citation: van Bussel LGJ, Adjei-Nsiah S, Wolf J, van Oort P, van Wart JP, Grassini P, de Groot H, Boogaard H, Claessens L, Yang H, Cassman KG, van Ittersum MK. 2013. Yield gap assessment and exploration for self-sufficient cereal production in Ghana in 2050. First International Conference on Global Food Security, Noordwijkerhout, The Netherlands, 29 September - 2 October 2013.

Publication #5

Type: Conference proceedings

CCAFS Themes: Theme 1

Citation: Homann-Kee Tui S, Masikate P, Descheemaker K, Claessens L, Crespo O, van Rooyen A. 2013. Climate change adaptation strategies in semi-arid Zimbabwe for sustainable intensification of crop-livestock systems. First International Conference on Global Food Security, Noordwijkerhout, The Netherlands, 29 September - 2 October 2013.

Publication #6

Type: Conference proceedings

CCAFS Themes: Theme 1, Theme 4.2

Citation: Claessens L, Cassman KG, Van Wart JP, Grassini P, Vanlauwe B, van Ittersum MK, van Bussel LGJ, Boogaard H, Stoorvogel JJ, Wolf J, Yang H. 2013. Soil Data for Yield Gap Assessment and Soil Suitability Index for Sustainable Intensification. Water, Food, Energy & Innovation for a Sustainable World, ASA-CSSA-SSSA International Annual Meetings, Tampa, Florida, USA, 3-6 November 2013.

Publication #7

Type: Conference proceedings

CCAFS Themes: Theme 1, Theme 2

Citation: Masikati P, Crespo O, Descheemaeker K, Walker S, Homann Kee Tui S, Claessens L, Famba S, van Rooyen A, Gama A, Lennard C. 2013. Crop-Livestock Intensification in the Face of Climate Change: Exploring Opportunities to Reduce Risk and Increase Resilience In Southern Africa Using an Integrated Multi-Modeling Approach. Water, Food, Energy & Innovation for a Sustainable World, ASA-CSSA-SSSA International Annual Meetings, Tampa, Florida, USA, 3-6 November 2013.

Publication #8

Type: Conference proceedings

CCAFS Themes: Theme 1, Theme 4.2, Theme 4.3

Citation: Valdivia RO, Antle JM, Claessens L, Nelson GC, Rosenzweig C, Ruane AC, Vervoort J. 2013. Representative Agricultural Pathways and Scenarios: A Trans-Disciplinary Approach to Agricultural Model Inter-Comparison, Improvement and Climate Impact Assessment. Water, Food, Energy & Innovation for a Sustainable World, ASA-CSSA-SSSA International Annual Meetings, Tampa, Florida, USA, 3-6 November 2013.

Publication #9

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Vadez V, Kholova J, Zaman-Allah M, Belko N 2013. Water: the most important 'molecular' component of water stress tolerance research. Functional Plant Biology 40, 1310-1322.

Publication #10

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Vadez V, Kholova J, Medina S, Aparna K, Handerberg H 2014. Transpiration efficiency: New insight onto an old story. Journal of Experimental Botany.

Publication #11

Type: Journal papers

CCAFS Themes: Theme 1, Theme 4.3

Citation: Singh P, Nedumaran S, Ntare BR, Boote KJ, Singh NP, Srinivas K, Bantilan MCS 2013. Potential benefits of drought and heat tolerance in groundnut for adaptation to climate change in India and West Africa. Mitigation and Adaptation Strategies for Global Change. http://dx.doi.org/10.1007/s11027-012-9446-7

Publication #12

Type: Journal papers

CCAFS Themes: Theme 1, Theme 4.3

Citation: Singh P, Nedumaran S, Traore PCS, Boote KJ, Rattunde HFW, Prasad PVV, Singh NP, Srinivas K, Bantilan MCS. 2014. Quantifying potential benefits of drought and heat tolerance in rainy season sorghum for adapting to climate change. Agricultural and Forest Meteorology 185, 37-48.

Publication #13

Type: Journal papers

CCAFS Themes: Theme 1, Theme 4.3

Citation: Singh P, Nedumaran S, Boote KJ, Gaur PM, Srinivas K, Bantilan MCS. 2014. Climate change impacts and potential benefits of drought and heat tolerance in chickpea in South Asia and East Africa. European Journal of Agronomy, 52 (2014) 123–137. http://dx.doi.org/10.1016/j.eja.2013.09.018

Publication #14

Type: Journal papers

CCAFS Themes: Theme 2

Citation: Nyamangara J, Masvaya E N, Tirivavi R, Nyengerai K. 2013. Effect of hand-hoe based conservation agriculture on soil fertility and maize yield in selected smallholder areas in Zimbabwe. Soil & Tillage Research 126, 19–25.

Publication #15

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Nyamadzawo G, Wuta M, Nyamangara J, Gumbo D. 2013. Opportunities for optimization of in-field water harvesting to cope with changing climate in semi-arid smallholder farming areas of Zimbabwe. SpringerPlus 2013, 2:100.

Publication #16

Type: Journal papers

CCAFS Themes: Theme 4.2

Citation: Kesava Rao AVR, Wani SP, Singh KK, Ahmed MI, Srinivas K, Bairagi SD, Amadevi O. 2013. Increased arid and semi-arid areas in India with associated shifts during 1971-2004. Journal of Agrometeorology 15 (1), 11- 18.

Publication #17

Type: Journal papers

CCAFS Themes: Theme 4.2

Citation: Vadez V, Soltani A, Sinclair TR. 2013. Crop simulation analysis of phenological adaptation of chickpea to different latitudes of India. Field Crops Research 146, 1-9.

Publication #18

Type: Journal papers

CCAFS Themes: Theme 4.2

Citation: Craufurd PQ, Vadez V, Jagadish SVK, Vara Prasad PV, Zaman-Allah M. 2013. Crop science experiments designed to inform crop modeling. Agricultural and Forest Meteorology 170, 8-18.

Publication #19

Type: Journal papers

CCAFS Themes: Theme 4.2

Citation: Kholová J, McLean G, Vadez V, Craufurd PQ, Hammer GL. 2013. Drought stress characterization of post-rainy season (rabi) sorghum in India. Field Crops Research 141, 38-46.

Publication #20

Type: Journal papers

CCAFS Themes: Theme 2

Citation: Tall A, Patt AG, Fritz S. 2013. Reducing Vulnerability to Hydro-Meteorological Extremes in Africa A Qualitative Assessment of National Climate Disaster Management Policies: Accounting for Heterogeneity. Weather and Climate Extremes 1, 4-16.

Publication #21

Type: Journal papers

CCAFS Themes: Theme 1

Citation: Hamidou F, Halilou, O, Vadez V. 2013. Assessment of Groundnut under Combined Heat and Drought Stress. Journal of Agronomy and Crop Science 199, 1-11.

Publication #22

Type: Book chapters

CCAFS Themes: Theme 2

Citation: Kalungu J, et al. (2013) Assessing the Impact of Rainwater Harvesting Technology as Adaptation Strategy for Rural Communities in Makueni County, Kenya, Handbook of Climate Change Adaptation, Article ID:367546 , Chapter ID:23

Publication #23

Type: Journal papers

CCAFS Themes: Theme 2

Citation: Kalungu JW, Filho WL, Harris D. 2013. Smallholder Farmers' Perception of the Impacts of Climate Change and Variability on Rain-fed Agricultural Practices in Semi-arid and Sub-humid Regions of Kenya. Journal of environmental and earth science 3, 129-140. ISSN 2224-3216 (Paper), ISSN 2225-09048 (ONLINE) Volume 3. No. 7

Publication #24

Type: Conference proceedings

CCAFS Themes: Theme 1, Theme 2

Citation: Musiyiwa, K, Filho WL, Nyamangara J, Harris D. 2013. An assessment of gender sensitive adaptations options to climate change in smallholder areas of Zimbabwe, using climate analogue analysis and considering farmer perceptions. The 27th Soil Science Society of East Africa and the 6th Africa Soil Science Society- Transforming Rural Livelihoods in Africa: How can land and water management contribute to enhanced food security and address climate change adaptation and mitigation? 20-25 October, 2013. Nakuru, Kenya.

Publication #25

Type: Conference proceedings

CCAFS Themes: Theme 2

Citation: Musiyiwa, K., W. Leal Filho, J. Nyamangara and D. Harris 2013. Assessment of Innovations for Sustainable Livelihoods for Smallholder Farmers in Response to Changing Climates in Semi - Arid Zimbabwe through Farmer Perceptions. The "International Conference on Innovation Systems for Resilient Livelihoods: Connecting Theory to Practice". Regional Agricultural and Environmental Innovations Network- Africa (RAEIN-Africa). 26-28 August, 2013. Johannesburg, South Africa

Publication #26

Type: Journal papers

CCAFS Themes: Theme 1, Theme 2

Citation: Lodoun T, Sanon M, Giannini A, Traore PS, Some L, Rasolodimby JM, 2013. Seasonal forecasts in the Sahel region: the use of rainfall-based predictive variables. Theoretical and Applied Climatology. DOI: 10.1007/s00704-013-1002-1

Publication #27

Type: Journal papers

CCAFS Themes: Theme 1, Theme 2

Citation: Lodoun T, Giannini A, Traoré PS, Some L, Sanon M, Vaksman M, Millogo Rasolodimby J, 2013. Changes in seasonal descriptors of precipitation in Burkina Faso associated with late 20th century drought and recovery in West Africa. Environmental Development 5, 96-108.

Publication #28

Type: Journal papers

CCAFS Themes: Theme 1, Theme 2

Citation: Tuner NC, Rao KPC 2013. Simulation analysis of factors affecting sorghum yield at selected sites in Eastern and Southern africa, with emphasis on increasing temperatures. Agricultural Systems 121, 53–62.

Publication #29

Type: Journal papers

CCAFS Themes: Theme 2

Citation: Nageswara Rao V, Sastry RK,Craufurd PQ,Meinke H, Parsons D, Rego TJ, Rathore A. 2014. Cropping systems strategy for effective management of Fusarium wilt in safflower. Field Crops Research 156, 191-198.

Publication #30

Type: Book chapters

CCAFS Themes: Theme 1, Theme 4.2

Citation: Rosenzweig, C., J.W. Jones, J.L. Hatfield, C.Z. Mutter, S.G.K. Adiku, A. Ahmad, Y. Beletse, B. Gangwar, D. Guntuku, J. Kihara, P. Masikati, P. Paramasivan, K.P.C. Rao, and L. Zubair 2013: The Agricultural Model Intercomparison and Improvement Project (AgMIP): Integrated regional assessment projects. Handbook of Climate Change and Agroecosystems: Global and Regional Aspects and Implications Volume 2 Issue Pages 263-280

4. Communications

Media campaigns:

1. Small farmers need 'all the support they can get' for climate adaptation (Thomson Reuters Foundation (14 Nov 2013) http://www.trust.org/item/20131114135203-6rxk9/
2. Does small-scale climate adaptation pay? http://www.trust.org/spotlight/does-small-scale-climate-adaptation-pay/?tab=introduction

Blogs:

http://ccafs.cgiar.org/blog/Intercrop-innovations-build-resilience-dryland-areas%2520
http://ccafs.cgiar.org/blog/showing-how-climate-services-can-work-smallholder-farmers#.UtPHgLTcCH9
http://ccafs.cgiar.org/blog/getting-grips-how-farmers-perceive-climate-variability-and-its-impacts
http://ccafs.cgiar.org/blog/strengthening-availablity-and-use-climate-services-africa#.UtPIMbTcCH8
http://ccafs.cgiar.org/blog/defining-climate-research-agenda-development-africa#.UtPIo7TcCH8
http://ccafs.cgiar.org/blog/how-can-we-reach-million-farmers-climate-services#.UtPJ4bTcCH8
http://ccafs.cgiar.org/blog/developing-methodology-evaluate-climate-services-farmers
http://ccafs.cgiar.org/blog/how-do-you-assess-climate-change-adaptation-options-farmers-lessons-agmip#.UtPLI7TcCH8
http://ccafs.cgiar.org/blog/Shining-light-trade-offs-agricultural-systems#.UtPLVrTcCH8

Websites:

http://aasw6.wordpress.com/2013/07/19/micro-doses-bring-mega-results/
http://foodtank.org/news/2013/07/what-do-we-mean-when-we-talk-of-gender-strategies-for-agricultural-research
http://news.sciencemag.org/sciencenow/2013/02/predicting-the-bumper-crops-of-t.html
http://www.nature.com/news/global-survey-reveals-routes-to-boosting-crop-yields-1.11306
http://www.bbc.co.uk/news/science-environment-24385547
http://www.scidev.net/global/food-security/news/call-for-an-ipcc-like-science-panel-on-food-security.html
http://www.agmip.org/blog/2013/10/31/day-2-of-the-4th-annual-agmip-global-workshop/
http://feedstuffs.com/story-crop-yields-peaked-45-106622

Social media campaigns:

All media campaigns, important blogs and newsletters are shared on Facebook and Twitter.

Newsletters:

1. Enhancing the resilience of water supply and farming systems in Southeast Asia http://www.icrisat.org/newsroom/latest-news/happenings/happenings1603.htm#5
2. Baseline survey supervisors on resilient dryland systems trained http://www.icrisat.org/newsroom/latest-news/happenings/happenings1561.htm#5
3. Farmers' field day on sorghum-legumes technology held in Makueni District, Kenya

http://www.icrisat.org/newsroom/latest-news/happenings/happenings1557.htm#5

4. Communicating climate services for farmer communities http://www.icrisat.org/newsroom/latest-news/happenings/happenings1575.htm#2
5. ICRISAT at the 6th AASW: Showcasing agricultural science and innovation for food security http://www.icrisat.org/newsroom/latest-news/happenings/happenings1581.htm#2
6. Malawi seed project showcased at Dublin Conference on Hunger, Nutrition and Climate Justice http://www.icrisat.org/newsroom/latest-news/happenings/happenings1568.htm#3
7. Extension workers trained in climate services to benefit farmers in Kenya http://www.icrisat.org/newsroom/latest-news/happenings/happenings1578.htm#6
8. Progress being made on Global Yield Gap Atlas http://www.icrisat.org/newsroom/latest-news/happenings/happenings1570.htm#6
9. Combating climate change: Eastern Africa holds 4th Agricultural Model Intercomparison and Improvement regional meeting in Nairobi http://www.icrisat.org/newsroom/latest-news/happenings/happenings1579.htm#1
10. Microdosing: Changing lives of smallholder farmers in Zimbabwe http://www.icrisat.org/newsroom/latest-news/happenings/happenings1580.htm
11. Surmounting climate change: Up-scaling climate information services in Kenya http://www.icrisat.org/newsroom/latest-news/happenings/happenings1585.htm#1
12. 4th Annual Global Workshop for assessing future climate change impacts on agriculture http://www.icrisat.org/newsroom/latest-news/happenings/happenings1597.htm#8
13. CALESA 4th News letter (August 2013) http://www.calesa-project.net/news/fourth-newsletter-out-building-capacities-for-future-adaptation
14. CALESA 3rd Newletter (24 April 2013): http://www.calesa-project.net/news/third-newsletter-out-activities-of-the-calesa-project-in-zimbabwe
15. CALESA 2nd News Letter (11 February 2013) http://www.calesa-project.net/news/second-newsletter-out-insights-of-some-of-the-main-research-activities-carried-out-so-far-during-2012-by-calesa%E2%80%99s-partnership)
16. CCAFS-ESA: Getting to grips with how farmers perceive climate variability and its impacts (http://ccafs.cgiar.org/blog/getting-grips-how-farmers-perceive-climate-variability-and-its-impacts#.UtT33-L1VEI)
17. Predicting suitable crop varieties and management to adapt to climate change, New Agriculturist http://www.new-ag.info/en/news/newsitem.php?a=2430
18. Looking into the future: How models can help us assess agricultural trade offs, Agricultures, http://www.agriculturesnetwork.org/resources/extra/news/looking-into-the-future-how-models-can-help-us-assess-agricultural-trade-offs

Events:

Events are reported in the Newsletters.

Videos and other multimedia:

1. Empowering farmers through Climate Serviceshttp://www.youtube.com/watch?v=R-HozaLA1S4
2. Dr. Lieven Claessens (ICRISAT) on how to assess climate change adaptation options for farmers http://www.youtube.com/watch?v=064spD__970

Other communications and outreach:

ICRISAT Annual Report 2012 (published in 2013)

1. Kaffrine farmers forearmed with forecasts (pp 10-12)http://www.youblisher.com/p/727108-Annual-Report-2012
2. http://www.icrisat.org/who-we-are/investors-partners/donor-flyers/Flyer%20Senegal_A3%202_4_2013_scr.pdfCORAF/WECARD and ICRISAT
3. http://www.icrisat.org/who-we-are/investors-partners/donor-flyers/Flyer%20CORAF_A3%20Scr.pdf

5. Case studies

Case Study #1

Title: Regional and global integrated assessments of climate change and adaptation

Author: Lieven Claessens, Sibiry Traore

Type: Inter-center collaboration,Innovative non-research partnerships,Capacity enhancement

Project description:

In a multi-disciplinary collaboration between several cgiar centers, universities and NARS, a new approach to ex ante impact assessment, the Tradeoff Analysis model for Multi-Dimensional impact assessment (TOA-MD) has been developed. The objective was to develop a flexible analysis framework, integrating bio-physical and socio-economic modeling approaches, to be used by researchers and stakeholders worldwide.

Introduction / objectives:

Within the climate change research community and beyond, there is an urgent call for the development of relatively simple methods for ex ante evaluation of adaptation to climate change at the household and agricultural system levels, especially in resource-poor countries.

Project results:

The TOA-MD methodology is now ready and available for download from the website http://tradeoffs.oregonstate.edu (after registration and completing a learning module). Within CCAFS and affiliated projects like AgMIP, more and more people from CGIAR centers, NARS and universities have been introduced to the methodology and are actively using it for their regional applications (see the map on http://tradeoffs.oregonstate.edu). We are also currently integrating TOA-MD with the CCAFS scenario work in the form of Representative Agricultural Pathways (RAPs). The approach offers a flexible framework for evaluating adaptation strategies using scarce data of resource-poor countries and allows a rapid integrative analysis for timely advice to farmers and policymakers and for exploration of adaptation strategies with their impacts on vulnerability. In some recent workshops, stakeholders (mostly policy makers) of the different countries in SSA and SA have been introduced to the research results and policy briefs are currently being jointly prepared.

Partners:

Oregon State and Wageningen Universities: original developers of the TOA-MD model. ICRISAT, ILRI, IFPRI, CIP, CIMMYT: actively using the methodology for analysis of regional datasets (household surveys from completed and ongoing projects).

Links/sources for further information:

www.agmip.org

Case Study #2

Title: Building climate resilient agriculture in India

Author: Cynthia Bantilan, Naveen P Singh , Byjesh K

Type: Social differentiation and gender,Innovative non-research partnerships,Participatory action research

Project description:

It is essential that the future needs of the farmers to successfully implement adaptation measures to address climate change/variability and improve agricultural productivity and incomes of the farmers be addressed. The idea is to suggest policies/strategies to create an enabling environment for the farmers to address climate variability and also to address socioeconomic problems resulting from changing weather patterns.

Introduction / objectives:

As part of the Asian Development Bank (ADB)-funded project on “Vulnerability to climate change: Adaptation strategies and layers of resilience”, ICRISAT and the Indian Council of Agricultural Research (ICAR) jointly organized a Policy Dialogue on “Building climate resilient agriculture in India” on22 May at the NASC complex, New Delhi. The policy dialogue was aimed at informing policy makers, deve

Project results:

This research initiative and collaboration fructified at the global level with an assigned special role of ICRISAT in formulating drought policies for developing nations at High level Meeting on National Drought Policy (HMNDP) testimonies the accomplishment. The outcomes of this research initiative the competencies acquired through this partnership, partners are currently pursuing research with extended study domain and greater inclusiveness. Leveraging upon the importance of initiatives such as ‘village level studies’ for better understanding of livelihood vulnerability under the context of climatic change were successfully disseminated through “policy dialogues” and International conference invitations such as UNU-WIDER conference at Helsinki, Finland etc. It had contributed immensely to the drafting process of drought policies through “High-level Meeting on National Drought Policy (HMNDP) “, under the aegis of WMO, UNCCD, FAO and other national and international organization.For ex. In India, National Academy of Agricultural Science (NAAS, India) has published a policy document on

Partners:
Partners from national policy circles, government,non-governmental organization, research institution, international and other developmental agencies.

Links/sources for further information:
http://www.icrisat.org/mip-climatechange-welcome.htm

Case Study #3

Title: Easily-obtained household characteristics determine opportunities to benefit from agricultural intensification
Author: Dave Harris
Type: Social differentiation and gender,Participatory action research ,Food security

Project description:
This research, at four pairs (two in Kenya and two pairs in Zimbabwe) of temperature analogue sites matched for rainfall but differing in temperature, seeks to explore the similarities and differences between the performance of a range of cereal and legume crops and improved resource management technologies in response to differences in temperature. We use a combination of two approaches: (1) on-station field trials to generate biophysical data for input to a crop modeling exercise that will facilitate prediction of the effects of temperature increases on crop performance; (2) baseline surveys and participatory exercises (some during visits to the on-station trials) of communities of rural households adjacent to the research stations. These are to characterize households and to investigate historical and current agricultural and livelihood patterns and to explore perceptions of climate change and its effects. This study is explicitly focused on gender and seeks the views of men and women separately in their attitudes to climate change issues.

Introduction / objectives:
As part of a project that seeks to combine predictions of the bio-physical potential of crops, varieties and natural resource management technologies with household characteristics and the gender-differentiated perceptions of smallholder farmers in relation to climate change, a small subset of HH data (farm size, household size and number of seasons per year) was used to predict the degree to whic

Project results:
Apart from rainfall and temperature differences between sites, the most obvious difference between Kenya and Zimbabwe is the number of cropping seasons per year – which was previously known – but which has important implications for the potential annual productivity and profitability of crop production.

Partners:

Much of the survey work is being done by two PhD students jointly supervised by ICRISAT and the University of Life Sciences, Hamburg, Germany, and facilitated in the field by KARI, Kenya and Midlands State University, Zimbabwe.

Links/sources for further information:

Case Study #4

Title: Seasonal Climate forecast based advisory service

Author: KPC Rao

Type: Successful communications,Innovative non-research partnerships,Capacity enhancement

Project description:

Use of seasonal climate forecast information by smallholder farmers depends on the reliability, availability and ability to contribute to changed decisions. The project tested these elements by (i) evaluating the reliability of the available seasonal climate forecasts by developing hindcasts and comparing them with observed data (ii) assessing the potential role of forecast information in influencing decisions and contribution of those decisions to risk reduction using crop simulation model APSIM with historical climate data for that location (iii) generating location specific downscaled seasonal climate forecast and presenting the same in user friendly format in the form of advisory and (iv) measuring the benefits from the information provided in terms of changed decisions and outcome of those decisions. The work also proposes to develop an automated system to generate location specific agro-advisories with due consideration to locally available resources and relevant technologies.

Introduction / objectives:

In a situation where important farm decisions, whose outcome is highly sensitive to the amount and distribution of rainfall during the season, are to be made well before knowing the seasonal conditions, advance information about the rainfall during the forthcoming season has the potential to help farmers make more tactical decisions about investments and adopt management practices that make best u

Project results:

Reliable and skillful seasonal climate information when available with sufficient lead time can provide a sound basis for smallholder farmers to plan and manage their resources productively, profitably and sustainably. Discouraged by the high level of uncertainty and risk associated with investments on key farm inputs such as fertilizers, farmers have adopted low risk conservative management practices which cannot make use of the opportunities created during good crop seasons. Forecast information assists farmers in making informed decisions while investing on these inputs so that they avoid or limit investments in seasons predicted to be below normal and increase in seasons predicted to be above normal. This will contribute to the better

management resources including labour, increase income, improve resilience to extreme events and make them better prepared to adapt to the progressive changes in climate.

Partners:

International Research Institute for climate and society-Provision of downscaled forecast informationKenya Meteorological Department - historical and seasonal climate informationKenya Agricultural Research Institute-Technologies

Links/sources for further information:

6. Outcomes

Outcomes #1

Title:

Climate Services for Farmers in Kaffrine, Senegal

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

i. At least 2000 farmers receive and use climate services in Kaffrine (assessment by independent M&E firm still underway to ascertain exact figures) ii. Policy Influence- National: National stakeholders from National met Agency, Department of Agriculture and Extension brought together to produced integrated climate services for farmers in Kaffrine; iii. Policy influence- Global: Wide diffusion of Kaffrine pilot experience across the globe: training of farmers in Kenya in March 2013 that features Kaffrine experience; current training planned in Colombia by CCAFS LAM in July 2013 will feature Kaffrine film (translated to Spanish) and experience.

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

Window to evidence feasibility of farmer-focused climate services; Plethora of news coverage on Kaffrine pilot across the globe, a few references here:i. World Farmers' Organization: http://wfo-oma.org/climate-change/case-studies/communicating-seasonal-climate-information-in-kaffrine-senegal-for-better-agricultural-management.htmlii. Hearing from Farmers in Kaffrine: http://www.senegalaisement.com/senegal/photos_galerie_senegal.php?action=affiche&galerie=55227776@N04&server=8105&photo=8467537717&tof=8467537717_5feca879d9&mcle=kaffrine&PHPSESSID=7ef1a9b94f27f511273800345f320320

What partners helped in producing the outcome?

Partnerships brokered: CCAFS West Africa with Senegal Meteorological Agency (ANACIM), Senegal NARES (ISRA), Department of Agirculture, local farmer associations and CBOs (World Vision, Red Cross), rural radio networks and professional communicators.

Who used the output?

Farmers in KaffrineNational level stakeholders and policy makers in SenegalGlobal stakeholders (e.g. diffusion to Kenya, CCAFS LAM,...)

How was the output used?

http://ccafs.cgiar.org/blog/senegal-farmers-use-forecasts-combat-climate-risks#.UvCxzbT-WFE.

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.

Documentation of the outcome: http://ccafs.cgiar.org/blog/senegal-farmers-use-forecasts-combat-climate-risks#.UvCxzbT-WFE

Outcomes #2

Title:

Norway 10M Project on Climate Services for East Africa

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

i. Policy influence- Integration of CCAFS-ICRISAT research findings on good practice to scale up climate services for farmers as cornerstone of Norway/GFCS 10M investment for improved climate services in Tanzania and Malawiii. Planned outcomes for 2014-15: millions of farmers in East Africa to be serviced with improved climate services for farmers.

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

Research findings on good practice to scale up climate services for farmers.Firm positioning of CCAFS as a partner in the global agenda on climate services.http://ccafs.cgiar.org/blog/reaching-farmers-climate-information-mission-possible#.UvC0frT-WFE

What partners helped in producing the outcome?

World Meteorological Organization's Global Framework for Climate Services (GFCS) office (leader of Project consortium), World Health organization (WHO), Norway research institutions (CICERO and CMI), Red Cross and World Food Program.

Who used the output?

World Meteorological Organization's Global Framework for Climate Services (GFCS) office (leader of Project consortium)

How was the output used?

Research findings and positioning of CCAFS as partner in the global agenda on climate services led to the investment in the project in East Africa..

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.

Project funded.

Outcomes #3

Title:

Promoting use of climate information by smallholder farmers through training and advisories

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

The two outcomes of this work are:1. Extension workers in Makueni and Machakos counties have a better understanding of probabilistic climate information and are actively promoting its use by smallholders2. Smallholder farmers in the counties are accessing and making use of location specific climate information in planning and managing their farms

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

1. Assessing and understanding the farmer perceptions about the climate variability, its impacts on agriculture and the way they adapted to it2. Development of forecast based agro-advisories3. Training manual and material produced to train the farmers and extension agents in understanding and utilizing probabilistic climate information

What partners helped in producing the outcome?

1. International Research Institute for Climate and Society (IRI)2. Kenya Meteorological Department (KMD)3. Kenya Agricultural Research Institute (KARI)4. Agricultural Extension department of Govt of Kenya in Makueni and Machakos counties

Who used the output?

1. about 50 agricultural extension officers in the two counties2. About 34,000 farmers accessed the information. We do not have a figure on how many of them actually used the information but it is estimated that at least 50% of them used the information. Most of the people received the information are those who voluntarily sought it based on the awareness created through radio programs

How was the output used?

The climate information provided was mainly used in 1.Selecting crops and varieties for that season 2. Allocation of land for various crops and enterprises including total area cultivated3. Investment on inputs such as improved varieties and fertilizers.

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.

1. The evidence on number of extension officers promoting this work comes from the number of workers trained and participated in the review meeting to report back, the number of extension officers availed extension materials especially the posters and number of places at which this material is displayed2. The

evidence on number of farmers using this information comes from the records kept the extension officersThe extension material prepared and the detailed division wise number of farmers who have accessed climate information and the means by which the information was accessed can be found at the blog (www.ccafs-esa.weebly.com). These numbers are based on the records kept by the extension officers.