1. Activity Reporting.

Activity 499-2014

Evidences of climate-smart agriculture/climate-smart villages in adaptation and mitigation of climate change and variability

Status	Complete	Milestone	1.1.1 2014
Start date	2012 Jan	End date	2014 Dec

Description: The project also aims to explore the wider enabling environment for scaling out climate-smart agriculture through climate-smart village model at the national and sub-national levels. Institutional models of climate-smart village will be developed and evaluated working in collaboration with various stakeholders (government, farmers' organizations, NGO/INGOs, private industries and others). The project will also involve to identify socio-economic and institutional barriers of adopting climate-smart villages and strategies to overcome such barriers in different agro-ecological zones and political units.

Status: Complete. Promotion of a portfolio of CSA practices and technologies is one of the major components in the CSVs. During the period under report, the activities undertaken in CSVs in Bangladesh, India and Nepal were meant to disseminate information on CSA practices and technologies among farmers which were relevant to their local situation and help them increase productivity and profits and improve their adaptive capacity to climate change and climate variability. The project also conducted workshops, training, seminars and field visits to strengthen stakeholders' capacity in planning and implementing CSA activities in the CSVs.

Gender Component: Strengthening gender capacity for climate change adaptation in the CSVs

Objectives:

1. To conduct participatory action research related to climate risk management, adaptation and mitigation.
2. To engage and communicate strategies for scaling out climate smart agricultural practices.

Deliverables:

Description	Type	Year	Status	Justification
Report on evidence and portfolio of CSA/CSVs tested and evaluated in collaboration with farmers.	Research report (i.e. workshop report, consultant's report, discussion paper, project report, student thesis, etc.)	2014	Complete	

Partners:

1- International Maize and Wheat Improvement Center (CIMMYT):
ML Jat <m.jat@cgiar.org>

2- WorldFish:
Kevin Kamp <k.kamp@cgiar.org>

3- Nepal Agricultural Research Council (NARC):
Ananda Gautam <akgrrp@rediffmail.com>

4- International Water Management Institute (IWMI):
Giriraj Amarnath <g.amarnath@cgiar.org>

Location(s):

Countries: Bangladesh, India, Nepal,
Benchmark Site: Bagerhat (Morrelganj), Rupandehi, Vaishali, Karnal,

Activity 1036-2014

Do we need Seed Banks for climatic risk management?

Status	Complete	Milestone	1.1.3 2014 (2)
Start date	2014 Apr	End date	2014 Aug

Description: This study assesses: how much agricultural areas would have the requirement of seed banks, what would be the investment return period from such seed banks, seeds of which crops seeds and varieties should be stored in a given region, and what could be a suitable business model to make seed banks economically and socially viable in South Asia. The study considers four different rainfall scenarios based on the distribution of rainfall during the sowing period and in subsequent crop growth session: : i) normal rainfall during two sowing weeks followed by three weeks of drought and then revival of rainfall in the subsequent two weeks; ii) normal rainfall during two sowing weeks followed by five weeks of drought and then revival of rainfall in the subsequent two weeks; iii) normal rainfall during two sowing weeks followed by seven weeks of drought; and iv) drought during four weeks of sowing period followed by normal rainfall.

Status: Complete. All activities planned for this study were completed successfully. The study aimed to assess the requirement of seedbanks for climate risk management in agriculture across South Asia. Based on the rainfall analysis (rainfall patterns and probability of drought during the and after the crop sowing period), this study identify areas which may have requirement of seed banks based on analysis of rainfall distribution during monsoon season, identify region specific viable crop combinations for seed banks based on agronomic and environmental requirements and economic analysis of seed banks for the identified grids having requirement of seed banks. Results indicate that among the seven countries studied, there was no requirement for seed banks in Afghanistan, Bhutan, SriLanka and Nepal because climatic risks needing replanting did not exist. Only a limited area in central India showed the need of replanting and hence need for new seeds. Even here costs: benefits analyses indicate that establishing Seed Banks for crop replanting may not be economically viable.

Gender Component: Not defined

Objectives:

1. To identify areas which may have requirement of seed banks based on analysis of rainfall distribution during monsoon season
2. To identify region specific viable crop combinations for seed banks based on agronomic and environmental requirements
3. To identify business model of seed banks for the identified grids having requirement of seed banks

Deliverables:

Description	Type	Year	Status	Justification
Guidelines for community seed bank for climate risk management	Research report (i.e. workshop report, consultant's report, discussion paper, project report, student thesis, etc.)	2014	Complete	

Partners:

Partners not defined

Location(s):

Regions: South Asia (SAs),

Activity 446-2014

Hotspots of germplasm conservation and evaluation of key crops based on climate risk analogues

Status	Complete	Milestone	1.1.3 2014 (1)
Start date	2011 Oct	End date	2014 Dec

Description: Most of the studies being undertaken relating to climate change adaptation focus on agronomic impacts of climate change. However, no systematic efforts have been made to evaluate genebank collections by plant breeders and researchers to facilitate adaptation and reduce the impacts of changing climates on food and nutrition security and farmers' livelihoods. This project employs climate analogue tool to identify hotspots for germplasm collection and evaluates a range of germplasm and varieities for their performance in current and future climates.

Status: Complete. All activities planned in the project were completed successfully. They includes: i) Map ex situ collections of target crops and diversity analysis for climate adaptation, ii) Understand the degree to which promising genebank collections can help farmers cope with climate change, iii) Evaluate and validate suitability of homologous-analogues approach for current climate conditions, iv) Develop a national database for information retrieval for selecting germplasm accession of target crops for climate adaptation, and, v) Explore means of strengthening links between national genebank collections with researchers, extension workers and local farmers in the context of adaptation to climate risks. The study identified the climate change vulnerable sites for all five target crops (
Chickpea, Pearl Millet, Pigeon pea, Sorghum and Wheat) and recommendations were made for re-collection of landraces at vulnerable sites and potential pre-adapted genotypes from climate analogous sites. NBPGR carried out several exploration missions and collected 31 accessions that were further tested for diversity using simple sequence repeat markers. An open access interactive online information system has been developed to view the results of the climate change analysis performed in this project. Capacity building of researchers and scientists involved in various fields of agricultural PGR management was done in India and Nepal.

Gender Component: Not defined

Objectives:

1. To map ex situ collections of target crops and diverstiy analysis for climate adaptation.
2. To identify analogue future environmetn sites for each target crops
3. To develop a national database for information retrieval for selecting germplasm accession of target crops for climate adaptation.

Deliverables:

Description	Type	Year	Status	Justification
Case study report on climate analogue linked germplasm conservation and evaluation	Research report (i.e. workshop report, consultant's report, discussion paper, project report, student thesis, etc.)	2014	Complete	

Partners:

1- National Bureau of Plant Genetic Resources (NBPGR):
KC Bansal <director@nbpgr.ernet.in>

2- Nepal Agricultural Research Council (NARC):
Ananda Gautam <akgrrp@rediffmail.com>

Location(s):

Countries: India, Nepal,

Benchmark Site: Rupandehi, Vaishali, Karnal,

Activity 531-2014

Farmer's prioritization of climate smart agricultural practices and technologies

Status	Complete	Milestone	1.2.1 2014
Start date	2012 Jan	End date	2014 Dec

Description: This study assesses farmers' preferences and willingness to pay for climate smart agricultural technologies in seven diverse rainfall zones in Rajasthan and Madhya Pradesh in India. The study also attempts to understand if there is any correlation between farmers' preferences for technologies as against those of government representatives or researchers. This assessment is needed to inform the government and private sector to make informed decisions about investments in the preferred climate smart agricultural technologies in order to promote climate resilient agriculture in vulnerable areas.

Status: Complete. This study assessed farmers' preferences and willingness to pay for climate smart agricultural technologies in seven diverse rainfall zones in Rajasthan and Madhya Pradesh in India. The study indicates that farmers' preferences for climate-smart agricultural technologies in the selected districts of Rajasthan and Madhya Pradesh are marked by some commonalties as well as differences. The district-wise selected matrix of technologies shows that farmers have indicated high preference to combination of diverse complementary technology interventions to minimize the climatic risks in agriculture. Farmers have clearly indicated high preferences for certain technologies such as crop insurance, weather-based agro-advisory services, water conservation and management, and site-specific nutrient management.

Gender Component: This study also indicates that a gender differentiated approach is very important while selecting technologies. In all districts, men and women have different preferences for certain climate-smart agricultural technologies. For instance, site specific nutrient management and weather based agro-advisories were more preferred by women farmers than men farmers.

Objectives:

1. Report on prioritization process and results for adaptation planning

Deliverables:

Description	Type	Year	Status	Justification
The deliverable includes farmers' preferences and willingness to pay for climate smart agricultural technologies in seven diverse rainfall zones in Rajasthan and Madhya Pradesh in India.	Research report (i.e. workshop report, consultant's report, discussion paper, project report, student thesis, etc.)	2014	Complete	

Partners:

1- Bharatiya Agro Industries Foundation (BAIF):
Managing Director <baif@baif.org.in>

Location(s):

Countries: India,

Activity 468-2014

Developing improved insurance products for crops in India

Status	Complete	Milestone	2.1.2 2014
Start date	2013 Jan	End date	2014 Dec

Description: Evaluation of current index-based insurance programs can provide guidelines for scaling out such program in the region. Similarly, provision of agricultural advisories can play an important role for farmers in their effective acquisition, allocation and management of resources (inputs such as irrigation, fertilizers, and pesticides). This information, if provided in advance, can help them adapt their agricultural system to climate variability and achieve stability in agricultural production in terms of quality and quantity. For this, an efficient mechanism of agro- advisory service based on reliable and trusted sources and expertises is required. Information and Communication Technology (ICT) can play a pivotal role to assist farmers to deal with their farming problems and to transfer new agricultural technologies and ideas resilient to climate change.

Status: Complete. This project is intended to showcase the use of community strength and technology for addressing weather risks at village as an insurance unit, improved basis risk with the availability of local weather data, and risks that encountered by individual farmers on their fields due to natural calamities and defined weather perils. This project was implemented in Punjab and Haryana. Rainfall indices for wheat and potato crops were developed for the index insurance program of the Agricultural insurance Company of India.Two contracts were offered to farmers viz., named peril insurance contract as stand-alone product, which is indemnity based and named peril insurance contract as Top-Up with WBCIS, where local weather station is used as reference weather station. Farmers were offered to pay premium with flexible sum insured. Total 20 farmers were enrolled from each village under this scheme. Each farmer bought one unit of insurance cover by paying Rs. 240/- for the sum insurance of Rs. 2,000/-. Total sum insured under this scheme from six villages was Rs. 2,40,000/- for which 120 farmers paid Rs. 28,800/- as premium.Farmers have shown enthusiasm and satisfaction with the scheme. Before large scale application of the scheme, several technological, operational and legal issues need to be addressed. Bundling insurance with other community based risk reduction strategies such as in CCAFS's Climate-Smart Villages may be a preferable approach.

Gender Component: Not defined

Objectives:

1. To evaluate current weather-index based insurance programs in India.
2. To develop agro-advisories and disseminate to rural farmers community in Nepal.
3. To evaluate the performance of ICT based dissemination of climate services.

Deliverables:

Description	Type	Year	Status	Justification
Community insurance products evaluated and assessed with the insurance company; better and enhanced targeting of ICT based dissemination of climate services	Research report (i.e. workshop report, consultant's report, discussion paper, project report, student thesis, etc.)	2014	Complete	

Partners:

1- eeMausam Weather Risk Management Services Private LTD:
Srinivasa Rao Gattineni <rao.gs@eemausam.com>

Location(s):

Regions: South Asia (SAs),

Activity 474-2014

Testing and evaluating CRAFT toolkit for crop yield forecasting

Status	Complete	Milestone	2.3.1 2014
Start date	2012 Jan	End date	2014 Dec

Description: Crop yield forecasts provide a crucial relevance to many agricultural and food security decisions, including the food safety net and relief programs, agricultural insurance, and management of the agricultural inputs and credit supplies. A systematic yield forecasting model is not yet developed for many South Asian countries. This project aims to test CCAFS crop forecasting toolkit in South Asia.

Status: Complete. This crop yield forecasting using CRAFT toolkit will be continued for 2015. All partners in each location have developed database for CRAFT toolbox and run the models. The simulations under the study were conducted with location specific climate data, soil data, crop and management data and genetic coefficients. CRAFT toolkit was able to forecast yields of selected crops (rice, wheat and maize) in minimum errors in Nepal and Bangladesh.Department of Sri Lanka has also developed database for the CRAFT toolkit and tested for rice yield forecasting. The results obtained for calibration and validation, and yield forecasting were reasonably satisfactory in all case studies.

Gender Component: Not defined

Objectives:

1. To generate data base for crop yield and production forecasting.
2. To apply the CCAFS toolkit for crop yield monitoring
3. To enhance the capacity of national programs for crop yield forecasting.

Deliverables:

Description	Type	Year	Status	Justification
Report of crop yield forecasting.	Research report (i.e. workshop report, consultant's report, discussion paper, project report, student thesis, etc.)	2014	Complete	

Partners:

1- World Food Programme (WFP):
Kurt Burja <kburja@wfp.np>

2- Center for Environmental and Geographic Information Services (CEGIS):
Sk. Ghulam Hussain <ghussain@agni.com>

3- Natural Resources Management Center:
Dharmakeerthi Wickramasinghe <wickey56@ymail.com>

Location(s):

Countries: Bangladesh, Nepal, Sri Lanka,
Benchmark Site: Bagerhat (Morrelganj), Rupandehi,

Activity 490-2014

Estimation of emissions at farmer scale and development of MRV guidelines

Status	Complete	Milestone	3.3.2 2014
Start date	2012 May	End date	2014 Jun

Description: Rapid, precise, and globally comparable methods for monitoring greenhouse gas (GHG) fluxes are required for accurate GHG inventories from different cropping systems and management practices. In order to achieve this, a quick but reliable and inexpensive methodology is needed for estimating GHG fluxes. Little information is available on baseline emissions from different cropping regime in South Asia. This study attempts to test, validate and simulate GHG emissions using DNDC at the core CCAFS sites in South Asia and then simulate for the region.

Status: Complete. This study evaluated the PAS relative to the GC in terms of their measured daily and cumulative N2O, and CO2 fluxes in wheat fields during the winter season, CH4 and N2O fluxes in flooded rice fields during the monsoon season, and N2O flux in maize fields during the summer months in northwestern India. Based on the study at the farmers field, a manual on measuring GHG fluxes in Indian cropped fields using gas chromatograph (GC) and photo-acoustic analyzer (PAS) was prepared. The manual includes: i) recommendations on type of chamber to use, sampling time and frequencies considering diurnal trends, plant effect, and unbiased sampling, ii) detailed procedures and description of materials for gas sampling and analysis by GC and PAS, iii) flux calculations, iv) quality assurance checks, v) estimation of minimum detection limits, and vi) ancillary measurements

Gender Component: Not defined

Objectives:

1. To prepare a manual on measuring GHG fluxes using gas chromatograph (GC) and photo-acoustic analyzer (PAS).
2. To assessing the performance of the photo-acoustic infrared gas monitor for measuring CO2, N2O and CH4 fluxes.
3. To measured CH4 and N2O fluxes from experimental fields I and farmer's fields under varying management practices.

Deliverables:

Description	Type	Year	Status	Justification
Report on MRV guideline and a journal paper	Research report (i.e. workshop report, consultant's report, discussion paper, project report, student thesis, etc.)	2014	Complete	

Partners:

1- International Rice Research Institute (IRRI):
JK Ladha <j.k.ladha@irri.org>

2- Applied Geosolutions, LLC (AGS):
William Salas <wsalas@appliedgeosolutions.com>

Location(s):

Countries: India,

Activity 495-2014

Strengthening gender capacity for adaptation to climate change and variability

Status	Complete	Milestone	4.1.3 2014
Start date	2011 Jan	End date	2015 Dec

Description: Field-evidence shows that even a "vulnerable" and poor women can play a pro-active role in adapting to climate change. Women are often in a better position to note certain environmental hazards and seek solutions to their problems where these affect their families directly. They use various strategies to know which traditional seed varieties will withstand increased salinity or grow in water stress areas and which native trees should be protected for food and fodder. This type of knowledge is critical for developing efficient adaptation measures. Women leaders have the advantage of accessing government programmes, schemes and resources to help poor farmers adapt. Thus, training elected women leaders is of special advantage in helping communities adapt to climate change in South Asia.

Status: Complete. This project aimed to strengthen women's capacity for climate change adaptation in agriculture in the climate smart villages. CCAFS projects led by CG centers and national partners in Bangladesh and India conducted several workshops and training activities including with women farmers to strengthen their capacities to tackle climate change and variability in the climate smart villages. Partners in Nepal have trained about 30000 farmers (50% of them women) in CSA practices and technologies.

Gender Component: Strengthening gender capacity for climate change adaptation

Objectives:

1. To build capacity of rural women for scale out climate smart interventions in agriculture.

Deliverables:

Description	Type	Year	Status	Justification
Report on gender trans-formative capacity building	Research report (i.e. workshop report, consultant's report, discussion paper, project report, student thesis, etc.)	2014	Complete	

Partners:

1- Alternative Futures:
Aditi Kapoor <aditikapoor2@gmail.com>

2- Nepal Agricultural Research Council (NARC):
Ananda Gautam <nkgautam@radiffmail.com>

Location(s):

Countries: India, Nepal,

Benchmark Site: Rupandehi, Vaishali, Karnal,

Activity 501-2014

Regional engagement for building strategic partnership with multiple stakeholders

Status	Complete	Milestone	4.1.3 2014
Start date	2012 Jan	End date	2014 Dec

Description: CCAFS South Asia team will strategically plan, implement, monitor and evaluate regional and flagship projects to achieve CCAFS goals. The team will involve generating science-based information for climate change adaptation and mitigation, developing communication products and disseminate them, and engaging with various stakeholders by organizing workshops, trainings and other national and regional meetings

Status: Complete. CCAFS South Asia undertook a number of initiatives to strengthen regional engagement and communications and to showcase CCAFS' research to a variety of stakeholders including scientists, researchers, policy makers, private industries, development institutions, farmers, and political leaders. CCAFS shared science-based knowledge to key stakeholders and engaged in climate-smart agricultural related policy discussions.

Gender Component: Not defined

Objectives:

1. To strengthen regional network for capacity building to conduct research, policy formulation and implementaiton.
2. To share knowledge and experiences among the regional countries.

Deliverables:

Description	Type	Year	Status	Justification
Knowledge products	Workshop	2014	Complete	

Partners:

Partners not defined

Location(s):

Regions: South Asia (SAs),

Activity 531-2014

Develop and evaluate prioritization planning tools to support climate change adaptation

Status	Complete	Milestone	4.2.2 2014 (1)
Start date	2012 Jan	End date	2014 Dec

Description: This project will supplement SA regional program in terms of models, data and tools relating to all four flagships and will also support continuation of few selected past initiatives relating to crop yield monitoring, development of agricultural NAPs/SAPs, improvement of triggers for weather based crop insurance schemes and planning of food security under climate risk management. Prioritization toolkit will be refined, a user-interface developed and used for sub-national level planning together with flagships 1 and 4. Trade-offs analysis using the same toolkit and associated databases would help in understanding mitigation potential better.

Status: Complete. Climate Smart Agricultural Prioritization (CSAP) toolkit developed by CCAFS provides guidelines for making investment decision in location specific climate smart agricultural practices and technologies. This toolkit helps a dynamic and spatially-explicit optimization modeling to explore a range of sectorial growth pathways coupled with climate-adaptation strategies. Integrating detailed bottom-up biophysical, climate impact and agricultural-emissions models this tool is capable of supporting multi-objective analysis of agricultural production in relation to food self-sufficiency, incomes and mitigation targets. A case study using CSAP was demonstrated for investment prioritization in Bihar. The national partners in Bangladesh and Nepal developed the database for prioritization exercise by CSAP.

Gender Component: Not defined

Objectives:

1. Build and test toolkit for adaptation prioritization in agriculture

Deliverables:

Description	Type	Year	Status	Justification
Development of climate-smart adaptation prioritization (CSAP) toolkit for national and local level adaptation planning	Research report (i.e. workshop report, consultant's report, discussion paper, project report, student thesis, etc.)	2014	Cancelled	

Partners:

1- Nepal Development Research Institute (NDRI):
Punya Regmi <punyaregmi@gmail.com>

2- Center for Environmental and Geographic Information Services (CEGIS):
Malik Khan <mkhan@cegis.org>

Location(s):

Countries: Bangladesh, India, Nepal,

Benchmark Site: Bagerhat (Morrelganj), Rupandehi, Vaishali, Karnal,

2. Succinct summary of activities and deliverables by Output level.

Output: 1.1.1

Summary: The climate analogue based evaluation of germplasm was conducted in Bihar and Andhra Pradesh for pigeon pea; in Madhya Pradesh, Uttar Pradesh, Maharashtra and Karnataka for wheat; and Andhra Pradesh, Karnataka, Maharashtra and West Bengal for chickpea. Development of climate risk analogue maps for the selected crops was completed.

Output: 1.1.3

Summary: A report on the assessment of seed banks requirement for climate risk management in South Asia prepared. Results indicate that among the seven countries under study, there was not a single grid which showed requirement for seed banks in Afghanistan, Bhutan and Nepal while maximum number of grids which may require seed banks for climate risk preparedness were in India. Few locations in Bangladesh, Pakistan and Sri Lanka require seed banks.

Output: 1.2.1

Summary: Farmers preferences and willingness-to-pay for climate-smart agricultural practices and technologies assessed in the seven diverse rainfall zones in Rajasthan and Madhya Pradesh in India. This study indicates that farmers' preferences for climate-smart agricultural technologies in the selected districts are marked by some commonalties as well as differences. The district-wise selected matrix of technologies shows that farmers have indicated high preference to combination of diverse complementary technology interventions to minimize the climatic risks in agriculture

Output: 2.1.2

Summary: Indices for monsoon season crops developed for the index insurance program were implemented in collaboration with the Agricultural Insurance Company of India and farmers group in the Anantapur district in Andhra Pradesh and Nawada district in Bihar, India.

Output: 2.3.1

Summary: All partners in Bangladesh, Nepal and Sri Lanka have developed database for CRAFT toolbox and successfully run the new version of CRAFT and developed report on crop yield forecasting for selected crops. Report on crop yield forecasting available.

Output: 3.3.2

Summary: A manual for GHG flux measurements by the closed-chamber gas chromatography method in rice-wheat system in India was developed. This manual provides guidelines for site-specific measurement of GHG emissions as well as clear protocols on Measurement, Reporting and Verification (MRV).

Output: 4.1.3

Summary: CGIAR centers and CCAFS's national partners have tested and evaluated several CSA practices and technologies through a participatory approach in collaboration with local farmers, researchers and government officials. Various CSA technologies such as methods of tillage, crop establishment time and methods, nutrient and water management, and genotypes performance were evaluated in Bangladesh, India and Nepal.

Output: 4.2.2

Summary: 1500 women farmers were trained on climate smart agriculture in Nepal. WorldFish, CIMMYT and Alternative Future conducted several capacity development events for strengthening gender capacity for implementation of climate smart agricultural practices and technologies in Bangladesh, India and Nepal.

3. Communications.

Media Campaigns:

In 2014, CCAFS South Asia generated several media reports and was cited in several news and feature stories particularly on Climate Smart Villages.

BBC: India's farmers beating climate change with technology
Inter-Press Services:U.N. Pushes Climate-Smart Agriculture – But Are the Farmers Willing to Change?
Reuters UK: FEATURE-Climate-smart farmers get tech savvy to save India's bread basket
Christian Science Monitor: Climate-smart farmers get tech savvy
Voice of America: India's 'Climate Smart' Villages Target Sustainable Agriculture
The Hindu: Messages draw out village women to farming
The Hindu: Everyone has weather updates on their fingertips in this village
The Hindu: Karnal farmers get climate-smart
Press Club of India:Press Club of India
India Climate Dialogue:Climate smart villages show how to adapt, and make money
Global Village: How Climate-Smart Villages In Bangladesh India and Nepal are preparing farmers for the future
The Guardian: Science-development-ebola-climate-change-food-security
Business Line: Can our agriculture tackle climate change
Times of India:Government to come up with contingency plan to tackle El Nino
Business fights Poverty: In the Land of the Monsoon, Searching for Innovations to Protect Farmers from Climate Risks
Financial Express: Agriculture must get Climate Smart
Financial Express: Bihar Haryana farmers turn climate smart
NHK World: India's High-Tech farming
NHK Japan: India's High Tech farming (in Japanese)
Sci Dev Net: Climate smart villages help female farmers in Nepal
Haryana media: Press clipping available (no link)
The Tribune: http://www.tribuneindia.com/news/comment/smart-agriculture-for-food-security/14017.html
Financial Express: Private insurers may help farmers weather the storm

Blogs:

Growing rice with less water
Empowering women to take the lead on climate change adaptation
Climate-smart villages: local adaption to promote climate-smart agriculture
New study shows how climate will impact water availability in Kosi
Fertilizer tool used in CSV wins innovation award
A new approach to crop insurance in India

Diverse and inclusive communication leads to better uptake of agromet services
Making genebanks climate ready for the Future
Building evidence on benefits of CVS
Stakeholders learn new features of yield forecasting toolkit
Getting more out of local knowledge
New manual on guidelines for greenhouse gas measurements
How village shopkeepers spread the word on CSA
Improved crop indices benefits more than 50000 farmers

Websites:

The South Asia page of the CCAFS website was regularly updated with blogs, events and publications.

Social Media Campaigns:

Social media tools were used widely to disseminate research and publications. The twitter handle for South Asia is (cgiarclimate_SA) . The number of followers has increased to 700. Social media tools were used for specific campaigns- International Women's Day, World Water Day ,launch of the IPCC report, Climate Smart Village media visit, COP and during workshops and conferences. Followers of the South Asia handle include media, civil society groups, international organisations, donors, and CG centres and researchers.

Newsletters:

In all, four electronic newsletters were sent to the 992 subscribers on CCAFS South Asia list.

Issue 7	Jan 2014	28.6 percent opens
issue 8	May 2014	32.1 percent opens
issue 9	Sept 2014	33.8 percent opens
Issue 10	Nov 2014	33.1 percent opens

Events:

Workshop on Modified National crop insurance Scheme (New Delhi)
Discussion on Flagship 1 call (New Delhi)
Training workshop on maintenance of CRAFT: CCAFS's Regional Agricultural Forecasting Toolkit (New Delhi)
CCAFS South Asia participated in a farmers fair organised by the Indian Agriculture Research Institute (New Delhi).
Regional Impact Pathways and Theory of Change Workshops (Bangkok)
Climate Change, Agriculture and Food Security: Opportunities for Regional Collaboration (Ho Chi Minh City)
CCAFS participated in a workshop organised by Ministry of Panchayti Raj (Gandhinagar)
IPCC Report launch event in (London)

Videos and other Multimedia:

In early 2014, CCAFS South Asia released a video on Climate-Smart Villages. The video on YouTube has reached about 2300 views. The video was used as promotional and communication material to highlight the concept of Climate Smart Villages to a variety of stakeholders. It was also screened at workshops and conferences.

Nearly 500 DVD copies of the videos were distributed to farmers during farmers field days.

Videos were also distributed through village kiosks who uploaded the CSA videos onto farmers' phones.

A video was also released on Training-of Trainers workshop with women's cooperatives in Bihar on Climate Change, Gender and Food Security. Launched on International Women's Day, the video was shared widely on social media and the website and has 550 views

Another video on village kiosks disseminating climate-smart agriculture videos on farmers phones, in Bihar was also released in early 2014. It has 269 views.

Other Communications and Outreach:

In September 2014, CCAFS South Asia organised a media field visit to Climate Smart Villages in Karnal, Haryana. To time with the UN Summit of Climate Change in New York, the visit aimed to show journalists how farmers are adapting to climate change and climate variability through technologies and practices that are increasing yields, building adaptive capacity and lowering emissions as co-benefits from the adaption strategies.

A booklet/report on Climate-Smart Villages in Karnal, Haryana was also brought out in collaboration with CIMMYT- India.

In September 2014, a compilation of flyers covering the full spectrum of CCAFS research in South Asia from 2010- 2014 was brought out. The flyers highlighted the current status of research outputs, initial evidence and the partners involved in each research activity.

Blog books were also brought out with a compilation of blogs. The distribution list for this print material includes, government agencies, national partners, agriculture universities, policymakers and international organisations and donors.

4. Case studies.

Case Study #1

Title: Strengthening the evidence base for scaling-out Climate-Smart Villages in South Asia

Author: Pramod K Aggarwal and Arun Khatri-Chhetri

Type: Inter-center collaboration; Capacity enhancement; Participatory action research ;

Project Description:

Climate-Smart Villages are sites for local action towards climate-risk management in farming communities. Through a community-based approach, they promote climate adaptation, resilience, and increase productivity and food security. Researchers, local partners, farmers' groups and policy makers collaborate to select the most appropriate technologies and institutional interventions based on global knowledge and local conditions. This project is involved in generating evidence on climate-smart agricultural (CSA) practices and technologies by testing and evaluating them in Climate-Smart Villages (CSVs) to assess their potential in increasing crop production, input use efficiency (water, nutrient and energy) and in reducing greenhouse gas emissions. The project also aims to develop a portfolio of climate-smart interventions in CSVs and in strengthening capacity development and uptake of CSA among local farmers, research and development organisations and government officials. During the period under report, the activities undertaken in CSVs in Bangladesh, India and Nepal were meant to disseminate information on CSA practices and technologies among farmers which were relevant to their local situation and to help them increase productivity and profits and improve their adaptive capacity to climate change and climate variability. In Bangladesh, vegetable towers and rice-field fish rings were piloted and evaluated in the flood and salinity-prone areas in Khulna district.

CCAFS's project in India and Nepal focused on participatory evaluation and demonstration of CSA practices and technologies in Climate-Smart Villages. Different tillage methods, crop establishment time and methods, nutrient and water management, and genotypes performance in rice, wheat and maize crops were evaluated based on their productivity and economic returns.

Introduction / objectives:

CSA interventions was evaluated in the CSVs in Bangladesh, India and Nepal. The objectives of this project are: i) to generate evidence of CSA practices and technologies through participatory evaluation on farmers' fields,ii) integration of CSA into the Climate-Smart Village model, and iii) strengthening stakeholders adaptive capacity to climate change and variability.

Project Results:

Results show that a portfolio of CSA practices and technologies help to increase crop productivity, farm income and input use efficiency (water, nutrient and energy), and reduce greenhouse gas emissions (Aryal et al. 2015, Jat et al. 2014, Sapkota et al. 2014). The project also developed location-specific portfolios of CSA interventions in Climate Smart Villages (e.g. CSV in Haryana). The CSVs were expanded to 67 villages (27 in Haryana, 29 in Bihar and 11 in Punjab) and 12 villages in Nepal (Rupandehi, Morang, Sunsari) in collaboration with local farmers and their cooperatives, governments and national research organizations (e.g. agriculture universities, NARC and ICAR). The project also conducted workshops, trainings, seminars and field visits to strengthen stakeholders' capacity in planning and implementing CSA activities in the CSVs. In Nepal, scientists in collaboration with farmers have evaluated 18 rice and 20 wheat varieties on farmers' fields to select the most suitable drought and flood-tolerant varieties. A majority of farmers in CSVs prefer to grow early maturity and fine quality rice and drought-tolerate wheat varieties.The project team has developed a portfolios of CSA for rice, maize and sugarcane crops to implement in demonstration plots and disseminate knowledge on CSA practices, technologies and services to local farmers. In this reporting period, CSA demonstration plots of rice (20 plots), maize (15 plots) and sugarcane (20 plots) have been established and about 3000 farmers (50% of them women) were trained in CSA practices and technologies. CCAFS's project in Bangladesh has tested vegetable towers, rice-field fish rings and sorjan agriculture to help families boost food production in coping with serious problems of floods and salinity in the coastal regions of Bangladesh. These practices significantly increase yield and net returns to farmers.

Partners:

Practical Action Consulting-Nepal, Institute of Agriculture-Nepal, Nepal Agricultural Research Council (NARC), WorldFish, IFPRI, and CIMMYT

Links / sources for further information:

Bangladesh:
http://ccafs.cgiar.org/blog/coping-climate-change-bangladeshi-farmers-boost-food-production-simple-interventions#.VNhTUvmUcpU

India:
http://ccafs.cgiar.org/publications/climate-smart-villages-haryana-india#.VNhTG_mUcpU

http://ccafs.cgiar.org/blog/climate-smart-villages-local-adaption-promote-climate-smart-agriculture#.VNhUSPmUcpU

http://ccafs.cgiar.org/blog/fertilizer-tool-used-climate-smart-villages-wins-%E2%80%98best-innovation-technology%E2%80%99-title#.VNhUmPmUcpU

Nepal:
http://ccafs.cgiar.org/blog/building-evidence-benefits-climate-smart-agriculture#.VNhUDPmUcpU

Case Study #2

Title: Do we need seed banks for managing climate risks in agriculture?

Author: Pramod K Aggarwal and Arun Khatri-Chhetri

Type: Policy engagement; Food security;

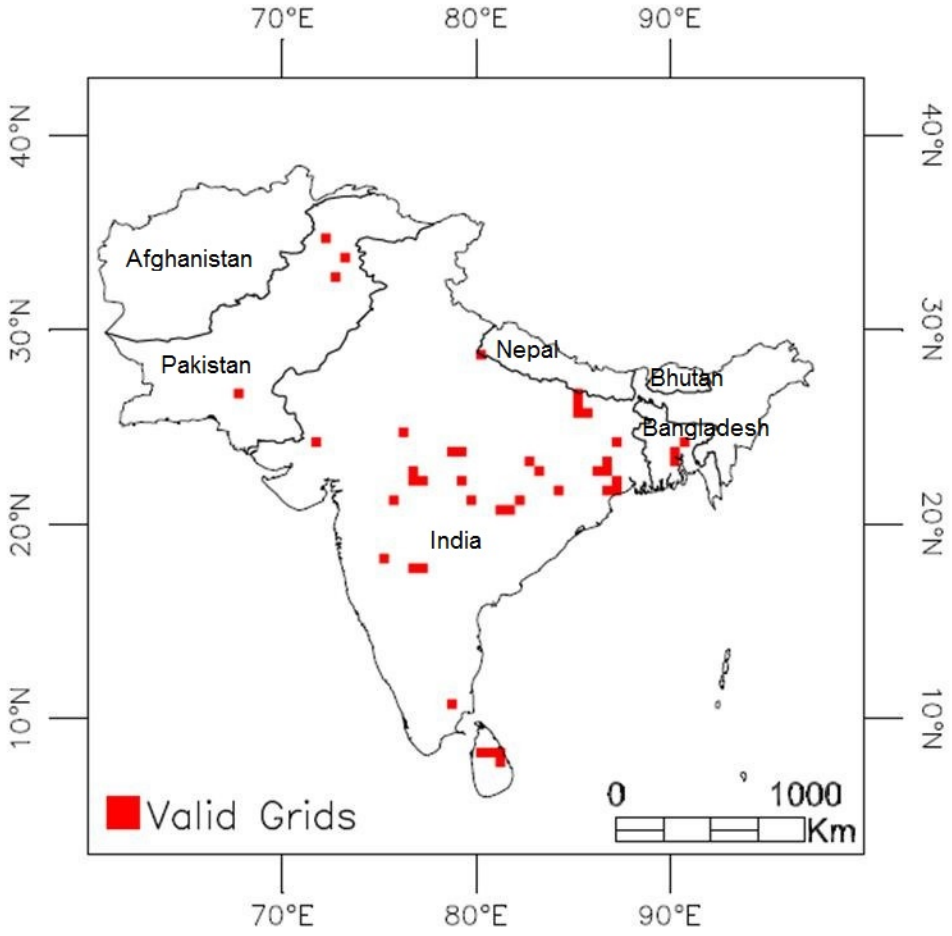


Fig: The map of 43 valid grids identified that require seed bank with 5-7 years return period

Project Description:

In many parts of South Asia, rains often fail around the planting period. To ensure food and livelihood security of millions, seeds of alternate crops/varieties are required by farmers on short notice. This has led to increasing demand for some policy initiatives of setting up Seed Banks which can quickly provide seeds to farmers in different regions. Such Banks are different from gene banks which aim to preserve genetic materials for breeding purposes or other uses. Establishing Seed Banks for large regions such as South Asia is expensive. This project evaluates gridded rainfall patterns of the last 50 years to assess the need for seeds for replanting in South Asia as a result of monsoon aberrations. The data relates to India, Nepal, Bangladesh, Pakistan, Bhutan, Sri Lanka and Afghanistan. Analyses is done for various scenarios such as complete rainfall failure; delayed onset on rainfall, normal onset followed by drought periods of different durations.

Introduction / objectives:

The projects aimed to answer the following questions: (i) what is the extent of area where failure of monsoon during sowing period is followed by revival of monsoon for re-sowing of follow-on crops? These should be the areas where seed banks could be a viable option for climate risk preparedness, (ii) if such areas are identified, then what are the area specific alternate crop/variety combinations for which seed banks are required?, and (iii) what should be the business model of such seed banks for certain regions?

Project Results:

Results indicate that among the seven countries, there was not a single grid which showed requirement of seeds in Afghanistan, Bhutan and Nepal and hence no Seed Banks are needed here. Only very few locations in Bangladesh, Pakistan and Sri Lanka showed the need for seeds for replanting and hence Seed Banks are not desirable here as well. Only some parts of central India, including 6 percent of the rainfed agricultural area showed a requirement of seeds for replanting. But the requirement of seeds here was only once in every 6 years. The remaining area had seed requirements only once in 10-15 years only.

The economic analysis of maintaining seed banks in the identified grids indicates that the total cost of maintaining the seed of alternative crops in seed banks for an average period of six years was far too high, in comparison to the benefits. It is therefore concluded that Seed banks for replanting due to early drought need not be established anywhere in South Asian region. However, we still need to analyze if the increased climatic variability in future would make this an attractive adaptation option.

Partners:

Consultant

Case Study #3

Title: Farmers' preferences and willingness-to-pay for climate-smart agriculture technologies
Author: Pramod K Aggarwal and Arun Khatri-Chhetri
Type: Participatory action research ;

Project Description:

This study assesses farmers' preferences and willingness to pay for climate-smart agricultural technologies in seven diverse rainfall zones in Rajasthan and Madhya Pradesh in India. The study also attempts to understand if there is any correlation between farmers' preferences for technologies as against those of government representatives or researchers. This assessment is needed to inform the government and private sector to make informed decisions about investments in the preferred climate smart agricultural technologies in order to promote climate resilient agriculture in vulnerable areas.

The study employs the scoring and bidding protocols to elicit the technology choices of farmers' focus groups and their willingness to pay for these technologies. The approach for assessing farmers' preferences and willingness to pay is based on the contingent valuation technique. This study is an attempt to generate farmer-level information to support adaption related policy decision making. This information is expected to be useful to better understand the perceptions towards climate smart agricultural technologies among farmers and their preferred interventions for adaptation to climate change and climate variability.

Introduction / objectives:

It was hypothesized that choice and willingness-to-pay for climate-smart agricultural technologies is differentiated by attributes of technologies, agro-climatic conditions and the socio-economic background of farmers. Under this hypothesis, this project has the following objectives: i) to assess

farmers' preferences of climate-smart agricultural technologies across a rainfall gradient in central India, ii) scout the most preferred mix of technologies/interventions for climate-smart agriculture, and iii) understand the correlation between choices of climate-smart agricultural technologies among farmers vis-à-vis that of local level government officials and scientists.

Project Results:

This study indicates that farmers' preferences for climate-smart agricultural technologies in the selected districts of Rajasthan and Madhya Pradesh are marked by some commonalities as well as differences. The district-wise selected matrix of technologies shows that farmers have indicated high preference to combination of diverse but complementary technology interventions to minimize climatic risks in agriculture. Farmers have clearly indicated high preferences for certain technologies such as crop insurance, weather-based agro-advisory services, water conservation and management, and site-specific nutrient management. This study also indicates that a gender differentiated approach is very important while selecting technologies. In all districts, men and women have different preferences for certain climate-smart agricultural technologies. For instance, site specific nutrient management and weather based agro-advisories were more preferred by women farmers than men farmers. There was not much difference in choice of technologies for diverse categories of land holdings. It was observed that small-holders tend to prefer technologies that lead to creation of long term water reserves. Further, small-holders tend to choose multiple technologies covering diverse livelihood resources.

This study also observed that farmers in the study areas were not very aware about climate-smart technologies such as weather-based crop advisories, laser land levelers and leaf color charts. In many areas, farmers were not informed about possible adaptation measures for reducing climate risks. Furthermore, existing agriculture development programs implemented by the government were not aligned with farmers' preferences and willingness to adopt climate-smart agricultural technologies. The study recommends proper sensitization and capacity building among government departments and field staff.

Partners:

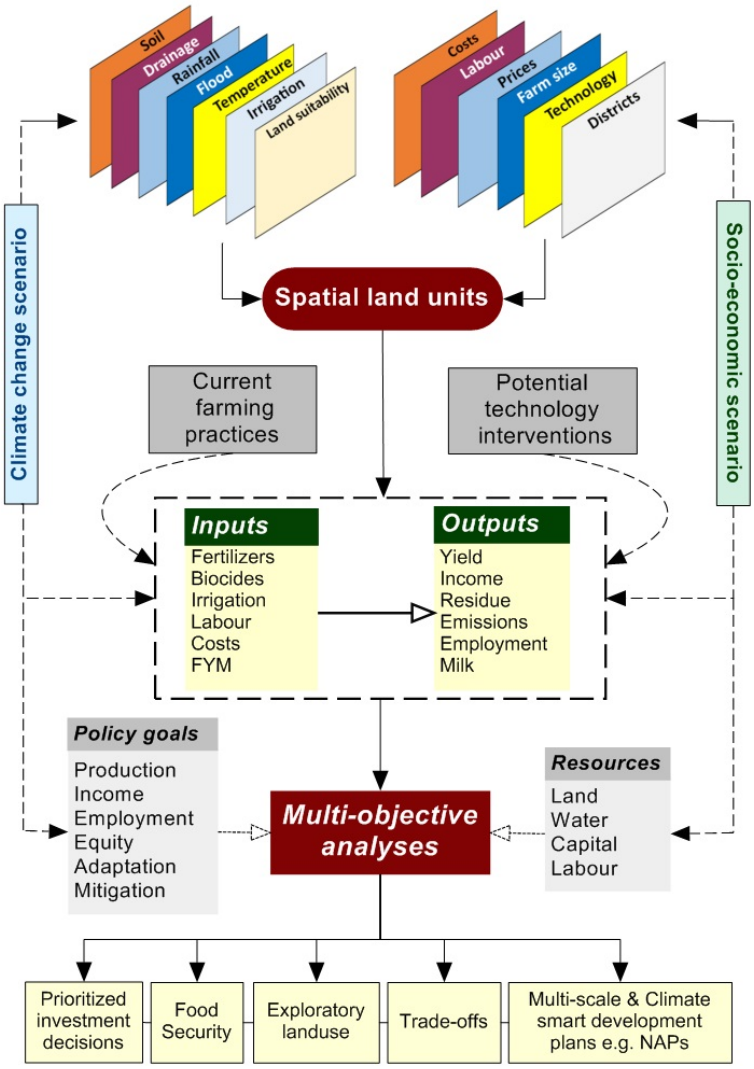
BAIF

Case Study #4

Title: Prioritizing Climate-Smart Agricultural Interventions at Multiple Spatial and Temporal Scales

Author: Paresh B. Shirsath, A. Dunnett, P.K. Aggarwal, J. Ghosh, P.K. Joshi, and P. Thornton

Type: Capacity enhancement; Policy engagement; Breakthrough science;



Project Description:

Climate-smart agriculture interventions have varying costs and environmental and economic impacts. Their implementation requires appropriate investment decisions in both on-farm capital of individual farmers and the wider community level agricultural outreach programmes that are relevant in current as well as future scenarios of climate and economic development. Decision support tools are therefore needed that can assist different stakeholders to prioritize and hence take appropriate strategic interventions to transform agriculture to become climate-resilient, adaptive and efficient. This case study focus on development, refinement and application of the Climate Smart Agricultural Prioritization (CSAP) toolkit at multiple spatial and temporal scales. The toolkit development was started in 2013; in 2014 it under went series of modifications and database development for the prioritization exercise by national partners. The need of proprietary software, licensing requirements and user-friendly graphic

user interface (GUI) was seen as major hurdle in its rapid outreach. Hence, the GUI and algorithms were developed using open source software (python). The capabilities of the toolkit is demonstrated on a case-study application for the state of Bihar, situated in the Indo-Gangetic plain of northern India. The project developed a range of baseline growth scenarios and assess their vulnerability to climate-change impacts for near-term (2020s), mid-term (2050s) and long-term (2080s) under CMIP5 based new emission scenarios. The project also explored the potential strategies for climate change adaptation and the resulting priorities for investment in climate-smart agricultural practices and technologies in the near and long-term (2020 to 2080).

Introduction / objectives:

This study highlights the development and validation of the Climate Smart Agricultural Prioritization (CSAP) toolkit. This toolkit develops a dynamic, spatially-explicit optimisation model to explore a range of sectorial growth pathways coupled with climate-adaptation strategies. Integrating a detailed bottom-up biophysical, climate impact and agricultural-emissions models this tool is capable of supporting multi-objective analysis of agricultural production in relation to food self-sufficiency, incomes and mitigation targets. The CSAP toolkit supports wide range of analyses ranging from food security assessment to preparation of climate smart development plans.

Project Results:

The CSAP toolkit was refined and a GUI developed using open source solvers. A case study using the CSAP toolkit was demonstrated for investment prioritization in Bihar. The national partners in Bangladesh and Nepal developed the database for the prioritization exercise by CSAP. Case study demonstration resulted in explicit identification of the investments required to climate-proof agricultural development – providing valuable bottom-up evidence to support top-down estimates of the costs of climate change adaptation. Through application of the model to a range of constrained growth pathways, the project was able to demonstrate the potential of the model to identify priorities for investment in: (i) crops best suited to delivering target growth under impacts of climate change on yields; (ii) technologies to deliver targeted increases in growth based on potential yield increases and efficient use of resources; and (iii) locations for priority investment given existing surplus productive capacity.

Partners:

IFPRI, CEGIS, Bangladesh, ICAR, India and NDRI, Nepal

Links / sources for further information:

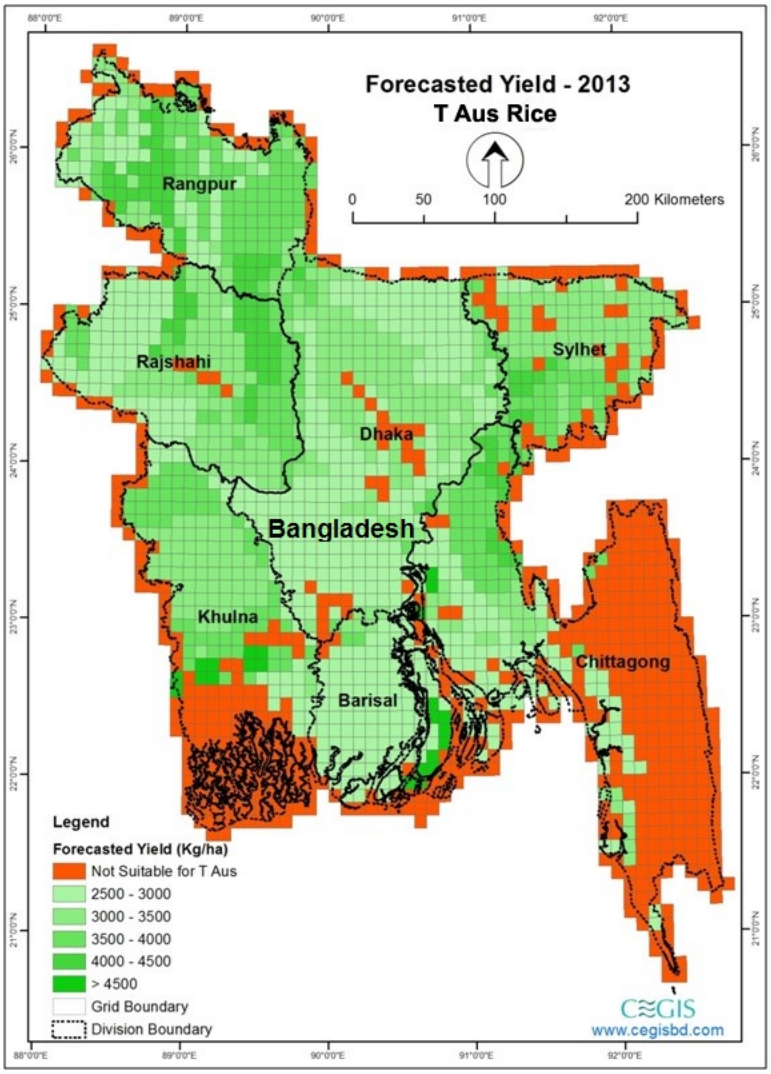
http://ccafs.cgiar.org/blog/new-toolkit-climate-smart-agriculture-can-help-policymakers-make-better-decisions

Case Study #5

Title: In-season crop yield forecast using the CCFAS Regional Agricultural Forecasting Tool

Author: P. B. Shirsath, Jim Hansen and Pramod K. Aggarwal

Type: Capacity enhancement; Breakthrough science; Food security;



Project Description:

Real-time monitoring of crop conditions for assessing the climatic stresses at regional scales can help in recommending contingency measures to stakeholders. It can also caution policy makers about likely food shortfall situations. Agricultural risks associated with increasing climate variability and extreme events are likely to impact food security. Therefore, it is essential to devise a system to monitor crop growing conditions, crop growth for reliable crop yield forecast under current and future climate variability. This case study deals in the application of CCAFS Regional Agricultural Forecasting Toolbox (CRAFT) for making in-season crop yield forecasts. The CCAFS Regional Agricultural Forecasting Toolbox (CRAFT) uses seasonal weather forecasts, historical databases, and current weather to estimate yields of various crops in advance. It can provide policymakers and stakeholders precise information on the likely volume of crop production in specific areas at different times of the

year. The tool also supports risk analysis and climate change impact studies for policymakers and help anticipate the impacts of climate variations on crop production and in agricultural and food security management decisions. Three case study applications of CRAFT were done in Bangladesh, Nepal and Sri Lanka.

Introduction / objectives:

Knowledge of crop yield forecasts has different connotations for different stakeholders. At the farm level, the yield forecast before the harvest time gives producers information to plan their farming activities and their marketing strategies. Crop yields forecasts for the coming year gives the government time to initiate appropriate policies and farmers to make crop selection decisions to undertake marketing schemes. An accurate prediction model generally benefits the policy making body for more robust and realistic plans. The main purpose of conducting this case study was to test and evaluate the CRAFT toolkit in different countries in South Asia.

Project Results:

The simulations under the study were conducted with location specific climate data, soil data, crop and management data and genetic coefficients. The CRAFT toolkit was able to forecast yields of selected crops (rice, wheat and maize) with minimum errors in Nepal and Bangladesh. The World Food Program in Nepal is using the CRAFT toolkit for crop yield forecasting to prepare seasonal crop outlook and food security monitoring in collaboration with ministry of agriculture, Nepal. For Bangladesh, the results for in-season forecast for Aus paddy and wheat at division level are good with coefficient of determination of 0.86 and 0.93, respectively. With these demonstrated capabilities we can engage stakeholder on the benefits of using CRAFT in preparing crop outlook based at the national level. The Natural Resource Management Department of Sri Lanka has also developed a database for the CRAFT toolkit and tested for rice yield forecasting. The results obtained for calibration and validation, and yield forecasting were reasonably satisfactory in all case studies.

Partners:

CEGIS, Bangladesh, WFP, Nepal and NRMC, Sri Lanka

Links / sources for further information:

http://ccafs.cgiar.org/blog/stakeholders-learn-new-features-yield-forecasting-toolkit

5. Outcomes.

Outcome #1:

Climate-Smart Villages scaled out in India

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

In India, the State Government of Maharashtra is funding a project to implement the CCAFS's model of Climate-Smart Villages among socially-differentiated communities in1000 villages in tribal regions in Maharashtra. The project will be implemented in 2015 by ICRISAT and partners. Similarly, considering the significant impact of climate change on livelihoods, the Central Ministry of Panchayati Raj (local-level development) has considered integrating Climate-Smart Villages in local development plans.

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

Evidence from Climate-Smart Villages in CCAFS's pilot sites, assessment and development of portfolio of CSA interventions in a Climate-Smart Village; videos of climate smart agriculture interventions and farmers testimonials.

* Climate-Smart Villages in Haryana, India. CCAFS and CIMMYT
* Aryal, J. P., Sapkota, T. B., Jat, M. L. and Bishnoi, D. K., On-farm economic and environmental impact of zero-tillage wheat: a case of North-West India. Exp. Agr. 2015, 51 (1), 1-16.
* Sapkota, T. B., Majumdar, K., Jat, M. L., Kumar, A., Bishnoi, D. K., McDonald, A. J., and Pampolio, M., Precision nutrient management in conservation agriculture based wheat production of Northwest India: profitability, nutrient use efficiency and environmental footprint. Field Crop Res., 2014, 155, 233-244.

CSV Video: https://www.youtube.com/watch?v=zH8wFwy_o0o

What partners helped in producing the outcome?

Key research partners were national agricultural research organizations (ICAR, NARC, BARI), local governments, farmer community groups, private sector partners (IKSL and Agriculture Insurance Company of India) and CGIAR centers (CIMMYT, IFPRI, IWMI, IRRI and Bioversity).

Who used the output?

State Government of Maharashtra and Central Ministry of Panchayati Raj, India

How was the output used?

The State Government of Maharashtra is planning to use the CSV approach of climate-smart agriculture prioritization, ICT, insurance and technologies in 1000 tribal communities in the state. The Central Ministry of Panchayati Raj has proposed to consider integrating Climate-Smart Villages in local development plans.

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?

Letter of funding (Rs. 28.875 Crores: US$ approx. 4.6 M) from the State Government of Maharashtra and proceedings from the National Workshop on Integrated District Planning, Ministry of Panchayati Raj, in Gandhinagar Gujarat: http://www.panchayat.gov.in/documents/10198/333815/Proceedings%20of%20National%20Workshop%20on%20Integrated%20District%20Planning_Sep%202014.pdf

7. Outcome indicators.

Outcome Indicator:

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

Achievements:

• In India, the Government of Maharashtra funded IRs. 28.875 Crores (US$ approx. 4.6 M) for developing Climate Smart Villages in the Tribal Communities of Maharashtra.

• The Central Ministry of Panchayati Raj considered working towards climate-smart villages for resilient local level development.

Evidence:

• Letter of funding (Rs. 28.875 Crores: US$ approx. 4.6 M) from the Government of Maharashtra

• Proceedings of the National Workshop on Integrated District Planning, Ministry of Panchayati Raj: http://www.panchayat.gov.in/documents/10198/333815/Proceedings%20of%20National%20Workshop%20on%20Integrated%20District%20Planning_Sep%202014.pdf

8. Leveraged funds.

Leveraged funds #1

Title:

Scaling-up of the Climate-Smart Village program (CSVP) for Tribal Regions of Maharashtra

Partner Name: Ministry of Tribal Welfare, Tribal Development Department

Budget: $4,600,000.00

Theme :4

9. Publications.

Publication #1:

Is South Asian Agriculture Adapting to Climate Change? Evidence from the Indo-Gangetic Plains

Citation:

Ojha HR; Sulaiman V R; Sultana P; Dahal K; Thapa D; Mittal N; Thompson P; Bhatta GD; Ghimire L; Aggarwal P.K, 2014. Is South Asian Agriculture Adapting to Climate Change? Evidence from the Indo-Gangetic Plains, Agroecology and Sustainable Food Systems, vol. 38, no. 5, pp. 505 - 531

Identifier	CCAFS Themes	Type	Access
http://www.tandfonline.com/doi/abs/10.1080/21683565.2013.841607	Theme 3,	Peer-reviewed journal articles	Limited

Publication #2:

Multimodel ensembles of wheat growth: many models are better than one

Citation:

3. Martre, Pierre, Daniel Wallach, Senthold Asseng, Frank Ewert, James W. Jones, Reimund P. Rötter, Kenneth J. Boote, Alex C. Ruane, Peter J. Thorburn, Davide Cammarano, Jerry L. Hatfield, Cynthia Rosenzweig, Pramod k. Aggarwal, Carlos Angulo, Bruno Basso, Patrick Bertuzzi, Christian Biernath, Nadine Brisson, Andrew J. Challinor, Jordi Doltra, Sebastian Gayler, Richie Goldberg, Robert F. Grant, Lee Heng, Josh Hooker, Leslie A Hunt, Joachim Ingwersen, Roberto C Izaurralde, Kurt Christian Kersebaum, Christoph Müller, Soora Naresh Kumar, Claas Nendel, Garry o'Leary, Jørgen E. Olesen, Tom M. Osborne, Taru Palosuo, Eckart Priesack, Dominique Ripoche, Mikhail A. Semenov, Iurii Shcherbak, Pasquale Steduto, Claudio O. Stöckle, Pierre Stratonovitch, Thilo Streck, Iwan Supit, Fulu Tao, Maria Travasso, Katharina Waha, Jeffrey W. White and Joost Wolf . 2014 Multimodel ensembles of wheat growth: Many models are better than one. Global Change Biology. DOI: 10.1111/gcb.12768

Identifier	CCAFS Themes	Type	Access
10.1111/gcb.12768	Not defined	Peer-reviewed journal articles	Limited

Publication #3:

Modeling Water Management and Food Security in India under Climate Change. In Practical

Applications of Agricultural System Models to Optimize the Use of Limited Water.

Citation:

4. Islam, A, Shirsath, PB, Kumar, S N, Subash, N, Sikka, AK., Aggarwal, PK. 2014. Modeling Water Management and Food Security in India under Climate Change. In Practical Applications of Agricultural System Models to Optimize the Use of Limited Water. Advances in Agricultural Systems Modeling p. 267–316. American Society of Agronomy, Inc., Crop Science Society of America, Inc., and Soil Science Society of America, Inc.

Identifier	CCAFS Themes	Type	Access
	Theme 1,	Book chapters	Limited

Publication #4:

Projected Effect of Droughts on Supply, Demand, and Prices of Crops in India

Citation:

Praduman Kumar, P K Joshi, Pramod Aggarwal. 2014. Projected Effect of Droughts on Supply, Demand, and Prices of Crops in India. Economic & Political Weekly. vol xlIX no 52; 54-63.

Identifier	CCAFS Themes	Type	Access
http://www.epw.in/review-rural-affairs/projected-effect-droughts-supply-demand-and-prices-crops-india.html	Theme 1,	Peer-reviewed journal articles	Limited

Publication #5:

Vulnerability of Indian mustard (Brassica juncea (L.) Czernj. Cosson) to climate variability and future adaptation strategies

Citation:

7. Naresh Kumar, Soora, Pramod Kumar Aggarwal, Kumar Uttam, Jain Surabhi, D. N. Swaroopa Rani, Nitin Chauhan and Rani Saxena (2014). Vulnerability of Indian mustard (Brassica juncea (L.) Czernj. Cosson) to climate variability and future adaptation strategies. Mitigation and Adaptation Strategies to Global Change. 10.1007/s11027-014-9606-Z

Identifier	CCAFS Themes	Type	Access
http://springer.libdl.ir/article/10.1007%2Fs11027-014-9606-z	Theme 1,	Peer-reviewed journal articles	Limited

Publication #6:

Assessment of impacts of climate change on rice and wheat in the Indo-Gangetic Plains

Citation:

The citation is not defined yet.

Identifier	CCAFS Themes	Type	Access
	Not defined	Peer-reviewed journal articles	

Publication #7:

Vulnerability of wheat production to climate change in India

Citation:

9. Naresh Kumar S, P. K. Aggarwal, D. N. Swarooparani, Rani Saxena, Nitin Chauhan, Surabhi Jain (2014). Vulnerability of wheat production to climate change in India. Climate Research. doi: 10.3354/cr01212

Identifier	CCAFS Themes	Type	Access
10.3354/cr01212	Not defined	Peer-reviewed journal articles	Limited

Publication #8:

Rising temperatures reduce global wheat production

Citation:

S. Asseng, F. Ewert, P. Martre, R.P. Rötter, D.B. Lobell, D. Cammarano, B.A. Kimball, M.J. Ottman, G.W. Wall, J.W. White, M.P. Reynolds, P.D. Alderman, P.V.V. Prasad, P.K. Aggarwal, J. Anothai, B. Basso, C. Biernath, A.J. Challinor, G. De Sanctis, J.Doltra, E. Fereres, M. Garcia-Vila, S. Gayler, G. Hoogenboom, L.A. Hunt, R.C. Izaurralde, M. Jabloun, C.D. Jones, K.C. Kersebaum, A.-K. Koehler, C. Müller, S. Naresh Kumar, C. Nendel, G. O?Leary, J.E. Olesen, T. Palosuo, E. Priesack, E.

EyshiRezaei, A.C. Ruane, M.A. Semenov, I. Shcherbak, C. Stöckle, P. Stratonovitch, T.Streck, I. Supit, F. Tao, P. Thorburn, K. Waha, E. Wang, D. Wallach, J. Wolf, Z.Zhao, and Y. Zhu. 2014. Rising temperatures reduce global wheat production Nature Climate change. DOI: 10.1038/NCLIMATE2470

Identifier	CCAFS Themes	Type	Access
http://www.nature.com/nclimate/journal/v5/n2/full/nclimate2470.html	Not defined	Peer-reviewed journal articles	Limited

Publication #9:

Coping weather adversity and adaptation to climatic variability: A cross-country study of smallholder farmers in South Asia

Citation:

"Bhatta, G., Aggarwal, P.K. et al. 2014. Coping weather adversity and adaptation to climatic variability: A cross-country study of smallholder farmers in South Asia. Climate and development (in press)"

Identifier	CCAFS Themes	Type	Access
	Theme 1,	Peer-reviewed journal articles	

Publication #10:

Plant genetic engineering, climate change and food security

Citation:

10. Ortiz R, Jarvis A, Fox P, Aggarwal PK & Campbell BM. 2014. Plant genetic engineering, climate change and food security. CCAFS Working Paper no. 72. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark. Available online at: www.ccafs.cgiar.org

Identifier	CCAFS Themes	Type	Access
http://ccafs.cgiar.org/publications/plant-genetic-engineering-climate-change-and-food-security#.VN184SzMDdM	Theme 2,	Non-peer reviewed articles	Green

Publication #11:

Assessment of India's integrated agrometeorological advisory service from a farmer perspective

Citation:

Venkatasubramanian, K.; Tall, A.; Hansen, J.; Aggarwal, Pramod. 2014. Assessment of India's integrated agrometeorological advisory service from a farmer perspective. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). 65p. (CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) Working Paper 54)

Identifier	CCAFS Themes	Type	Access
	Theme 2,	Other	