Progressing towards climate resilient agriculture

Top ten success stories from CCAFS in South Asia

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a strategic global partnership of CGIAR and Future Earth. It brings together the world's leading researchers in agricultural sciences, development research, climate science and Earth System science, to identify and address the most important interactions, synergies and trade-offs between climate change, agriculture and food security.

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Introduction

Photo Credit: Neil Palmer (CIAT)

In the last few decades, South Asia has made great strides in agriculture and food security. Despite this, the region has one-fourth of the world's hungry people and forty percent of the world's malnourished children and women. A large proportion of this population lives in regions that have widespread poverty and are very prone to climatic risks. With shrinking land and water resources, producing food sustainably to meet the needs of a growing population is a herculean task.

Climate change is likely to compound these problems further. Millions of people in South Asia are vulnerable to depleting glaciers, increasing coastal erosion, frequent floods, droughts, and periods of higher temperatures associated with global climate change. There is now conclusive evidence that the climate is changing and its impacts are already being felt in South Asia. Numerous studies show that the productivity of crops, fish and livestock will decline in the absence of adaptation measures. If the Sustainable Development Goals of ending poverty, achieving food security and promoting sustainable agriculture are to be realised, climate change adaptation and mitigation interventions need to be implemented in earnest. There is, therefore, an urgent need to identify cost-effective, inclusive (with a focus on gender and socially marginalized groups), evidence-based, integrated and scalable solutions to enhance the adaptive capacity of vulnerable farming communities.

Many stakeholders from the region which includes governments, researchers, civil society members as well as industry, have stepped up their efforts to develop strategies to reduce the vulnerability of agriculture to climatic risks. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), a strategic global partnership of CGIAR and Future Earth, has been active in South Asia since 2010.This booklet highlights 10 success stories, catalysed by CCAFS research and partnerships in South Asia, that are having an impact on building climate-smart agricultural (CSA) systems in the region. These systems are characterized by the achievement of enhanced food security and development goals through sustainably increased productivity, enhanced resilience and reduction of Green House Gas (GHG) emissions wherever possible.

The success stories presented here, exhibit evidence on how agriculture can be transformed to become resilient and productive, thereby, protecting the farming systems from the hazards of climate change. One of the key highlights of the following success stories is the use of the Climate-Smart Village AR4D approach to identify models of CSA portfolios which have been brought to scale by several state governments in India (Story 1), by the Nepal government (Story 3), through the system of farmers' cooperative in Gujarat, India, by utilizing solar power to minimize climatic risks in agriculture (Story 4), and by the deployment of precision nitrogen sensors (Story 10). In the area of agriculture insurance, CCAFS research has made significant contributions towards improving the risk transfer mechanism which has traditionally been marred by faulty designs. Consequently, research, leading to the designing and use of innovative models for determining triggers in weather index insurance has led to a win-win insurance product for farmers, industry and the government (Story 5). Further, the Nepal government is also being aided, in its efforts towards regular monitoring and assessment of its food security through CCAFS knowledge products (Story 8).

In the domain of policy research and uptake, CCAFS research on interactive scenarios and policy analysis for agricultural development and food security has been used in the formulation of national development plans in Bangladesh (Story 7). Similar initiatives in India, have resulted in the latter becoming the first nation in the world to adopt a comprehensive agroforestry policy recognising the potential of agroforestry to reduce poverty, enhance productivity, while also making agricultural landscapes more resilient to the risks of climate change (Story 2). CCAFS has engaged in research and evidence building to help address the massive challenges of floods and droughts in the region. Using this research and field evidence on floodwater management, district level plans are being developed by the government of Uttar Pradesh, India (Story 6).

Encouraged by the evidence built around adaptation and mitigation benefits of the Alternate Wetting and Drying (AWD) technology in rice cultivation, Bangladesh government is promoting this for wide-scale adoption in the country (Story 9).

In addition to these ten success stories, this document also includes ten other successes and emerging stories that highlight some of the significant work being undertaken, some of which have established outcomes and some other, expected to lead to positive accomplishments in the near future.

All of this work would not have been possible without the active participation and support of farmers and farmer groups; CGIAR centres active in the region; national agricultural research systems; local, regional and national governments; civil society members; industry partners and our numerous donors.

Top ten stories

1 Building resilient agriculture in India using the Climate-Smart Village approach

Several state governments in India have started using the Climate-Smart Village AR4D approach to identify models of Climate-Smart Agriculture portfolios that can be brought to scale

Photo credit: Neil Palmer (CIAT)

What was the problem?

India is one of the most vulnerable countries to climate change. Rise in average temperatures, changes in rainfall patterns, and increasing frequency of extreme weather events such as severe droughts and floods have been observed in different agro-ecological zones of India, which poses a significant threat to India's food security. Compounding these issues is the significant amount of Green House Gas (GHG) emissions, making it pertinent for future agricultural systems to explore strategies to reduce such emissions wherever possible. Several technological, institutional and policy interventions have been proposed by the experts to manage these climatic risks and to mitigate GHG emissions. Action is needed to integrate top-down government schemes and scientific innovations, with the stakeholder needs to build lasting resilience in Indian agriculture.

Partners:

Indian Council of Agricultural Research, State Agricultural Universities, State Governments in India, Borlaug Institute for South Asia, International Maize and Wheat Improvement Center, International Food Policy Research Institute, International Water Management Institute, International Rice Research Institute, International Crops Research Institute for Semi-Arid Tropics, Community based Farmers Organizations, Machinery, ICT and Agriculture Insurance Companies

How was this addressed?

CCAFS has developed the Climate-Smart Village (CSV) as an AR4D approach to test, through participatory methods, technological and institutional options for dealing with climate change in agriculture. Started in 2012 in India, it aims to scale-up and scale-out appropriate options and draw out lessons for policy makers from local to global levels. The testing of options is done in a multi-stakeholder collaborative platform at the CSV sites that are generally a cluster of villages. The key focus of these CSV-AR4D sites is to generate evidences on synergies as well as trade-offs between different options in terms of productivity, adaptation and mitigation. The figure below illustrates the major components of a typical CSV approach. There is no fixed package of interventions or a one-size-fits-all approach. Options differ based on the CSV site, its agro-ecological characteristics, level of development, capacity and interest of the farmers and of the local government. The results of the CSV approach are usually a portfolio of CSA options and institutional and financial mechanisms. These can be scaled up/out by the national/sub-national governments, NGOs and private sector actors in the region.

A number of tools such as the Climate-Smart Agriculture Prioritization (CSAP) toolkit, choice-experiments for CSA prioritization, CCAFS Mitigation Options Tool (CCAFS- MOT) for emission measurement, Gender and Social Inclusion Toolbox, crop simulation models, and climate analogues, are used in the process. This research done in the states of Punjab, Haryana, Bihar, Maharashtra, and Telangana has yielded models of CSA portfolios that can be scaled up for building resilience.

How was the CSV approach scaled up?

To scale-up and out the results of the CSV approach, CCAFS has undertaken the following:

1. Establishing CSV-AR4D sites as learning platforms for building evidences for CSA. Individuals and collectives of farmers, local governments, industry, and other stakeholders are involved with various CGIAR centres and National Agricultural Research Systems in participatory evaluation of all options.
2. Organizing farmers' fairs, video testimonials and village bulletins to scale out good CSA practices and for promoting farmer-to-farmer learnings.
3. Developing strategies to integrate the resultant portfolio of options from CSV-AR4D sites with the agricultural development strategy/ programs of the government and other donors.

Currently, the government of Haryana, in collaboration with International Maize and Wheat Improvement Center (CIMMYT), is implementing the results of the CSV-AR4D sites in 500 villages with a focus on resource conserving machinery, and sensors for optimizing fertilizer use and reducing GHG emissions. Governments of Bihar, Maharashtra, Madhya Pradesh and Telangana have also proposed to finance the use of this approach for building resilience in agricultural systems in thousands of villages.

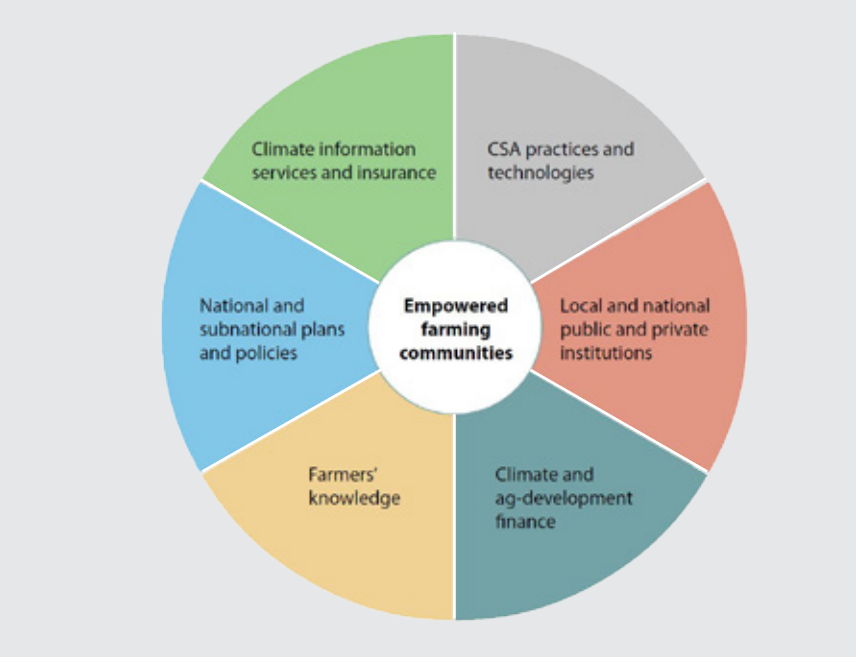

Figure: Key components of a CSV-AR4D approach

2 India's agroforestry policy to promote Climate-Smart Agriculture

India became the first nation in the world to adopt a comprehensive agroforestry policy which recognises its potential to reduce poverty, enhance productivity, while also making agricultural landscapes more resilient to the risks of climate change

What was the problem?

Over 60% of India's farmers are rainfed smallholders with two hectares or less of land and are highly vulnerable to the impacts of climate change. Agroforestry can increase the resilience of smallholder farmers, while contributing towards poverty reduction and increasing the productivity of their farms. In addition to direct benefits, agroforestry sinks atmospheric carbon, improves agricultural soils and provides a range of ecosystem services to the farm communities. Though agroforestry has been practiced for generations in India, its full potential has not been realized for many reasons. Among these are lack of appropriate policies, legal constraints, inadequate investments, weak markets and a dearth of institutional finance. The government of India harbours an aim of increasing tree covers from 25% to 33% and agroforestry is recognised as one of the alternatives to meet this target. However, a policy was required to achieve the target through a greater coordination across the wide range of agroforestry programs currently operating in different ministries, such as those of agriculture, rural development and environment.

Partners:

Government of India, Indian Council of Agricultural Research and World Agroforestry Centre

How was this addressed?

Since 2003, the World Agroforestry Centre (ICRAF) has been working with different governmental and non-governmental organizations in India, to conduct research in agriculture and forestry to improve livelihood of millions of smallholders. ICRAF contributed to the policy development process through the Agroforestry Policy Initiative with key national partners, especially the National Advisory Council of India. A series of workshops in 2012 and 2013 brought out a framework and significant recommendations. These efforts specifically sought to mainstream climate change and its related aspects, and the policy document highlights the climate change mitigation and adaptation benefits of agroforestry. This policy focuses on improving productivity of farm communities and their livelihoods by promoting integrated farming systems. The policy can also help to meet the increasing demand for agroforestry products (such as food, fodder and fuelwood) and in minimizing the extreme climatic risks (such as heat stresses, droughts and floods).

How were the recommendations scaled up?

Technical inputs, and intensive dialogue and consultations with all stakeholders led to the development of a framework and significant recommendations, which contributed to the preparation of the draft agroforestry policy. The President of India launched the National Agroforestry Policy at the World Agroforestry Congress in February 2014, an event organized by ICRAF and partners. The National Agroforestry Policy will help increase the area under agroforestry from 25 million hectares to 53 million hectares. A National Agroforestry Mission/Board is proposed to be set up with an initial investment of around USD 33 million. ICRAF is expected to continue to play a key role in this policy implementation, including through support to the National Agroforestry Mission/Board.


Photo credit: CCAFS South Asia

3 Nepal government scales out the Climate-Smart Village approach

Encouraged by the evidence generated in the CSV-AR4D approach tested in several districts, Nepal government has integrated the lessons learnt in its national agricultural adaptation and development plans

What was the problem?

Nepal's agriculture has always been prone to various climatic risks. Such risks including heightened frequency and severity of droughts, heavy rainfalls leading to floods and landslides, and heat/cold waves have increased in recent times. In response to this global climate change problem, the government of Nepal has initiated many adaptation and mitigation related policies and programs. For example, the National Climate Change Policy (NCCP), National Adaptation Programme of Action (NAPA), Local Adaptation Plans of Action (LAPA), Agriculture Development Strategies (ADS) and Nepal's Intended Nationally Determined Contribution (INDC) are highlighting the need for climate-smart interventions in agriculture and allied sectors. However, there is a lack of an integrated approach towards climate change adaptation and mitigation which can converge government's schemes and programs, and leverage financial resources for risk management at the local level.

Partners:

Ministry of Agricultural Development of the Government of Nepal, Nepal Agricultural Research Council, Local Initiatives for Biodiversity, Research and Development, Climate and Development Knowledge Network, Practical Action Consulting, International Maize and Wheat Improvement Centre, International Food Policy Research Institute, International Water Management Institute, Community based Farmers Organizations and ICT and Solar Energy Companies

How was this addressed?

CCAFS has initiated piloting the CSV-AR4D approach as a strategy for mobilization of local stakeholders, institutions and financial resources and to create evidence for the realization of Climate-Smart Agricultural (CSA) technologies and practices. In 2013, this approach started from Rupandehi District of Nepal in collaboration with Nepal Agricultural Research Council (NARC) and local organizations. This pilot has considered several cross-sectoral issues such as water management, energy use, bio-diversity and rural development.

At the same time, work was initiated to replicate the CSV approach of building resilient communities in eastern Nepal (Parsa, Morang and Sunsari) under the Pilot Program for Climate Resilience funded by the International Finance Corporation. CCAFS and its partners worked closely with leading agri-business companies (Sugar Mill, Rice Mill and Livestock Feed Company). In recent years, CCAFS and its partners have expanded its AR4D sites in Nepal in five districts (Bardiya, Dang, Nawalparasi, Gorkha, Mahottari). The main focus at these sites has been to identify and prioritize locally suitable CSA options, participatory evaluation of selected technologies, and explore scalability of single or portfolios of CSA options.

How was the CSV approach scaled up in Nepal?

CCAFS has collaborated with scientists from NARC and CGIAR centres, local NGOs and farmers in participatory testing and evaluating of a range of climate-smart interventions in the CSV-AR4D sites. The results of these evaluations have been integrated into the village and district agriculture development plans and linked with national/local adaptation plans (NAPA and LAPA). Regular communication and engagement with national and sub-national level policy makers and implementers, policy dialogues and workshops, and periodic exposure visits to CSV-AR4D sites have created awareness about the CSV approach in Nepal.

Since 2016, the government of Nepal started implementing the CSV approach as part of the climate adaptation program in 14 climatically most vulnerable districts in 7 States (2 districts in each state). CCAFS in partnership with Local Initiatives for Biodiversity, Research and Development (LI-BIRD), has been providing technical support to the National Planning Commission and the Ministry of Agricultural Development of Nepal, to implement the CSV approach in the country.

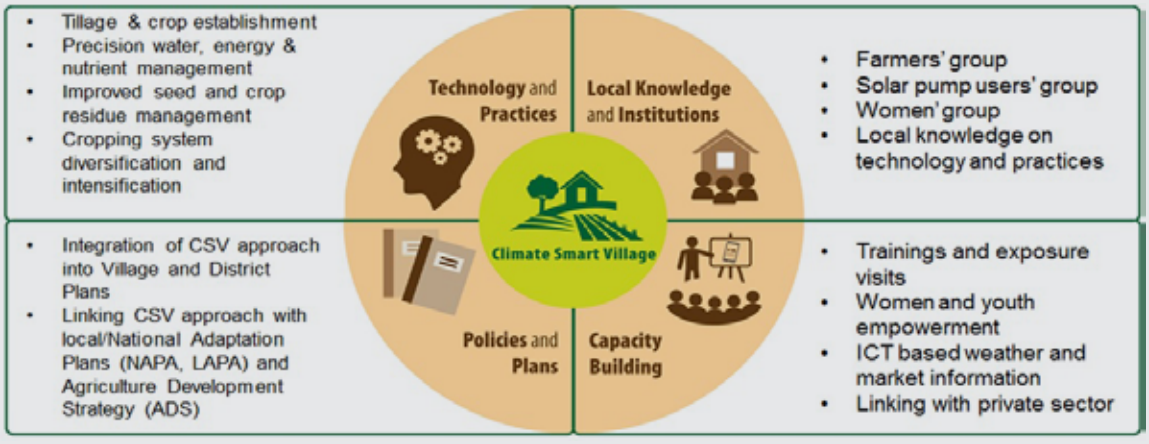

Figure: Portfolios of CSA interventions in pilot CSVs

4 Growing solar power as a remunerative crop to minimize climatic risks in agriculture

Lessons from the solar irrigation cooperative in the state of Gujarat has stimulated its government to invest in such endeavours on a large scale

What was the problem?

In many parts of India, irrigation in agriculture is mainly done with underground water by using fossil fuels or electric water pumps. Poor irrigation systems, high cost of pumping groundwater and limited availability of electricity are key problems for many rural farmers. Considering the declining costs, solar irrigation pumps could be a possible replacement for diesel pumps. But there is no sustainable business model of solar energy use in agriculture that could be followed by farmers to use energy for water pumping during periods of rainfall deficit as well as to earn additional cash when crops do not require irrigation.

Partners:

Dhundi Solar Pump Irrigators' Cooperative, Madhya Gujarat Company Vij Limited, Tata Trusts, International Water Management Institute and Water, Land and Ecosystems Program of the CGIAR

How was this addressed?

International Water Management Institute, CCAFS, Water, Land and Ecosystems Program of the CGIAR, and India-Tata Program collaborated to pilot the 'Solar Pump Irrigators' Cooperative Enterprise (SPICE) model for sustainably promoting solar pumps in the water scarce area of Gujarat State. A group of farmers in a village (Dhundi in Kheda District) were encouraged to form a cooperative around solar irrigation systems. The cost of solar pumps was subsidized by the government and the project for the cooperative. The cooperative also developed a Power Purchase Agreement with the local power distribution company for selling surplus power when farmers were not using the irrigation pumps.

This pilot project has generated evidences of income generation from an improvement in agricultural production as well as the sale of surplus energy to the local power distribution company. It has also promoted a range of climate-smart interventions such as water use efficient technologies for vegetable farming, improved seed and nutrient management, minimum tillage and introduction of low water requirement crops. The member farmers use solar energy for irrigating their crops, and for selling irrigation service to neighbouring farmers while the residual surplus energy gets sold to the local power distribution company. The figure below shows the changing dynamics of electricity generated and irrigation use. Between January and May (dry season), cooperative's member farmers could use solar energy generated either to meet their own irrigation needs or to sell irrigation service to fellow farmers. The option for selling surplus energy to the local power grid became available to the cooperative from May 2016 onwards, which was reflected in reduced irrigation use. This model, thereby, effectively helped in reducing the use of power and water in agriculture, without impinging on farmers' incomes.

How was the model scaled up?

This pilot project focused on research uptake as soon as the experiment started showing results and this paid off as it received significant space in policy discussions in the state. Since the start of its operation, many stakeholder visits including that of farmer's learning visits have taken place to the project location in order to better comprehend the model. These visitors include government officials, academia and representatives from the solar industry. Within six months of its functioning, such stakeholder interest and high profile visits provided further impetus to this pilot, thereby, gaining traction in the state and national level policy discussions. A draft policy has been made by the government of Gujarat based on this model of solar cooperatives. This pilot experiment has been able to influence the government of Gujarat to think differently when it comes to expanding solar installation in the state and the government now plans to invest and scale out this solar cooperative model across the state.

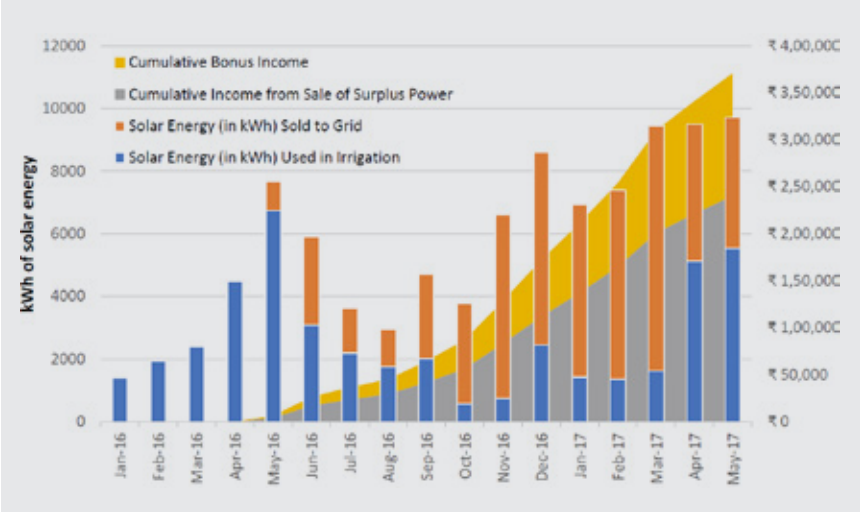

Figure: Initial results of energy generated and income from the solar cooperative in Gujarat

5 Improved weather-based crop insurance for reducing agrarian distress

Innovative use of models for determining triggers for site-specific rainfall thresholds led to a win-win insurance product for farmers, industry and the government, that was used by more than one million farmers in the state of Maharashtra, India

Photo credit: CCAFS South Asia

What was the problem?

In weather-based crop insurance, the claim payment to farmers is an explicit function of specific triggers related to thresholds of rainfall, temperature or humidity as recorded at a specified reference weather station. India in 2015 had 14 million farmers covered by such a scheme. Despite such schemes being heavily subsidized by the government, most farmers remain largely dissatisfied with them due to faulty design of triggers, leading to high basis risk and insufficient pay-outs.

Partners:

Government of Maharashtra, Indian Council of Agricultural Research and Agricultural Insurance Company of India

How was this addressed?

CCAFS developed a new methodology for defining scientific triggers for location specific weather-based insurance contracts. It involved the use of a heuristic model linked to crop-weather data, statistical modelling of crop-weather relations, multiple crop growth simulation models, and optimization techniques to identify threshold triggers of rainfall/temperature at different crop growth stages that will maximize farmer's satisfaction by ensuring pay-outs when due. A Farmer Satisfaction Index was constructed to measure the effectiveness of the insurance products. Interests of the industry and the government were also protected by simultaneously ensuring that these triggers do not lead to payments when climatic risks are less, premiums do not increase from their current levels, and a minimum level of profit is ensured for industry viability. Such optimized rainfall triggers were established for major crops for each sub-district/ district to further reduce the basis risk. In summary, it was demonstrated that the new product, based on scientific knowledge, is a win-win situation for all stakeholders- farmers, industry as well as the government.

How was the method scaled up?

Maharashtra is a chronic climatic risk prone state of India. The state government of Maharashtra together with the Agriculture Insurance Company of India implements various insurance schemes for different commodities. We ensured that these stakeholders were involved in this process of defining triggers right since the beginning of the program. A comparison of the performance of the proposed product versus the current product helped stakeholders in understanding the value of the product. District-wise contracts with specified triggers were prepared for soybean, cotton, rice and pearl millet. State government and the insurance company adopted these contracts in their scheme in 2015. More than one million farmers were insured by the revised product in the rainy season in 2015 alone.

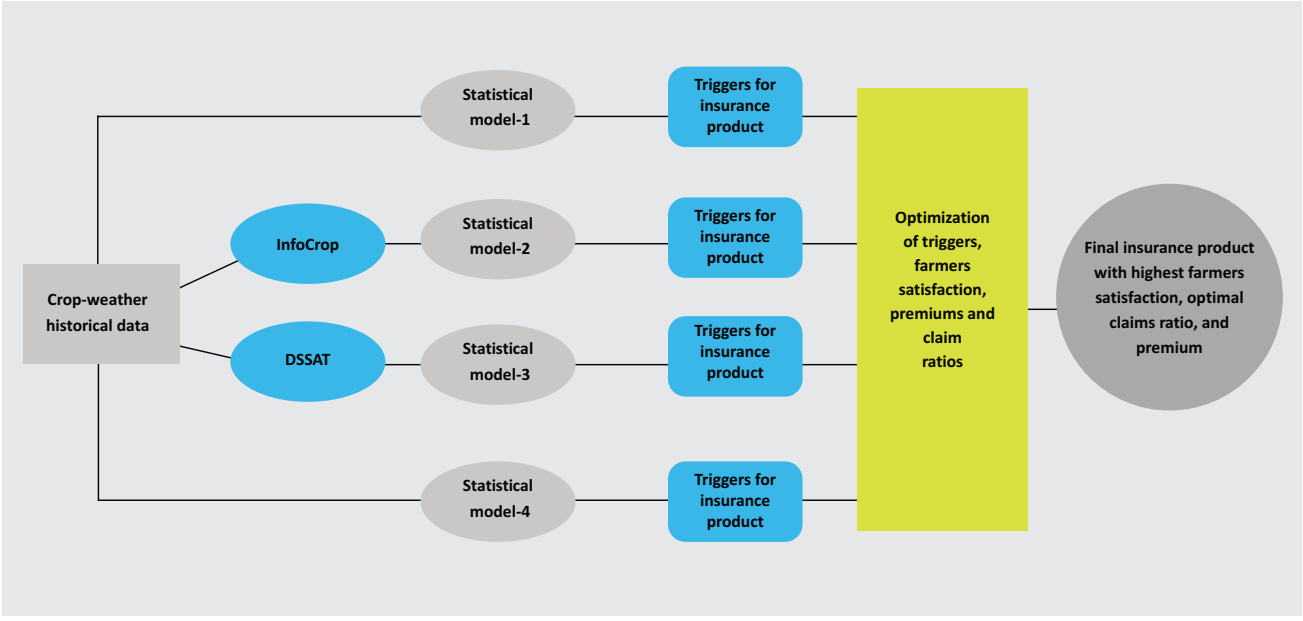

Figure: Schematic diagram showing various steps of the methodology employed for rainfall trigger estimation

6 Transforming hazards into opportunities: underground taming of floods for drought management

Government of Uttar Pradesh integrates evidence from large scale field pilot on flood water management in its district development plans

What was the problem?

Seasonal floods are a common occurrence in river basins. During the rainy season, excess runoff in large volumes from the upstream parts of the basin often causes great damages downstream. On the other hand, some of these regions face shortage of water due to year-round agriculture production which is largely dependent on groundwater. Large quantities of water pumped for agriculture, especially in the dry season when surface water is limited, can exceed the amount that is recharged by rainfall. This causes groundwater levels to fall, with major consequences for all users of the resource. The solution to tackle these two interlinked problems has not yet been implemented at a scale.

Partners:

Government of Uttar Pradesh, Indian Council of Agricultural Research, Central Soil Salinity Research Institute, Acacia Water, Livelihoods and Natural Resource Management Institute, The Energy and Resources Institute, Krishi Vigyan Kendra and International Water Management Institute

How was this addressed?

International Water Management Institute supported by CCAFS and others developed and demonstrated the concept 'Underground Taming of Floods for Irrigation' (UTFI) which involves diverting high water flows from rivers or canals at times when these flows pose flood risk and recharging the groundwater via village ponds or small dams that are modified for this purpose. The pilot project has been implemented by the inhabitants of Rampur village of Uttar Pradesh with support from authorities at higher levels. A holistic methodology, as illustrated in the figure below, brings together various strands of activities to help understand the complex issues associated with flood and groundwater management. Areas where the UTFI model appears to have potential are first mapped prior to carrying out more detailed assessments. Process-based hydrological as well as hydraulic models are employed to inform about the impact of UTFI interventions on downstream canal water flows during both the dry and wet seasons. The models also evaluate the potential of UTFI to enhance the level of delivery of ecosystem services such as flood control, groundwater recharge and dry season water availability. The project designs recharge interventions that are low cost, low-tech, robust and easily managed by farmers and local communities. With the frequency and intensity of floods and droughts predicted to intensify in the near future, UTFI represents a new management approach that has the capacity to reduce climate related vulnerability and risks and by exploiting floodwaters to reduce drought risks.

How was the approach scaled up?

Detailed technical and non-technical investigations, stakeholder engagement and communication activities have led to the first operational UTFI interventions at pilot scale in the state of Uttar Pradesh, India. A detailed proof of concept is underway from the technical, economic, gender/social and institutional perspectives. The stakeholder engagement in the process has resulted in garnering large support from the highest officials within the District Rural Development Agency of Rampur district that has led to the inclusion of this technology in their district development plans with an aim for scaling by 50-100 times. Community participation in the UTFI pilot in terms of site renovation and maintenance has been formalized through its inclusion in the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGA) – India's national flagship program focused on natural resource management and livelihood improvement.

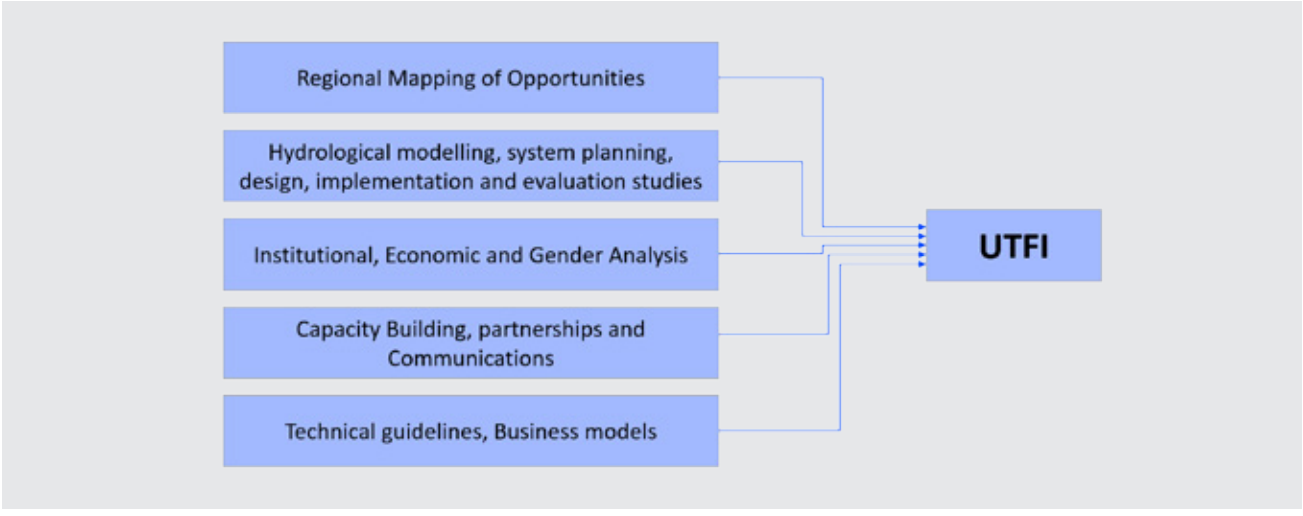

Figure: Key components of a typical Underground Taming of Floods for Irrigation technology

7 Strategic policy guidance on Climate-Smart Agriculture in Bangladesh

CCAFS research on interactive future scenarios and alternative policy analysis has been used in the formulation of the agricultural development plans of Bangladesh

Photo credit: WorldFish

What was the problem?

Climatic scenarios in Bangladesh pose a grim picture, with increasing frequency of severe floods and droughts, intrusion of coastal water into the agricultural lands, cyclones and other weather related extreme events. The government of Bangladesh has started several initiatives to address the immediate impact of climate change through disaster risk management and climate change adaptation activities. However, understanding these challenges calls for an analysis of the transformational changes that will be needed in terms of policies, institutions and governance in agricultural production and food security in the future. Well-developed future scenarios can offer rich information and data in response to regional and sub-regional situations.

Partners:

Planning Commission of Bangladesh, International Centre for Climate Change and Development, University of Oxford, Environmental Change Institute and International Food Policy Research Institute

How was this addressed?

CCAFS developed socio-economic and climate scenarios as a tool for strategic policy planning and investment decisions as shown in the figure below. This tool was evaluated in Bangladesh together with policymakers, researchers, private sector partners, NGOs, and other stakeholders to build future scenarios for Bangladesh that look at social, political and economic uncertainties in agricultural development and food security under climate change. Food security trends were projected with a model called IMPACT [From International Food Policy Research Institute (IFPRI)], while the GLOBIOM model added land use patterns in Bangladesh. This quantification work helped to produce counter-intuitive consequences of the scenarios that required reconsideration of the narratives and led to improved scenarios and feasible strategies to ameliorate food security, environments and livelihoods under climate change. The policy dialogue provided clear impact pathways to achieve adaptation goals in the agriculture sector, to the Bangladesh Planning Commission.

Similarly, IFPRI worked closely with the Bangladesh Planning Commission for convergence of policies and programs for sustainable and climate resilient agriculture in Bangladesh. Alternative policies and institutions were evaluated to evolve policies, programs and institutions that help implement the climate-smart interventions.

How were the recommendations scaled up?

Relevant partnerships were developed in Bangladesh whose capacities were raised on the scenarios making process and in understanding the opportunities for convergence of policies. Workshops were organized with the Planning Commission of the government to continuously engage them with the methodologies and add to their perspective. The comprehensive analysis of existing agricultural programs and policies and recommendations to forge greater convergence of Climate-Smart Agriculture among government programs provided valuable inputs to the preparation of the 7th Five Year Plan (2015-16 to 2019-20) of Bangladesh (Chapter 4: Agriculture). Recommendations from future scenarios assessment on adaptation to climate change, land use and environment were also incorporated in the preparation of the 7th Five Year Plan.

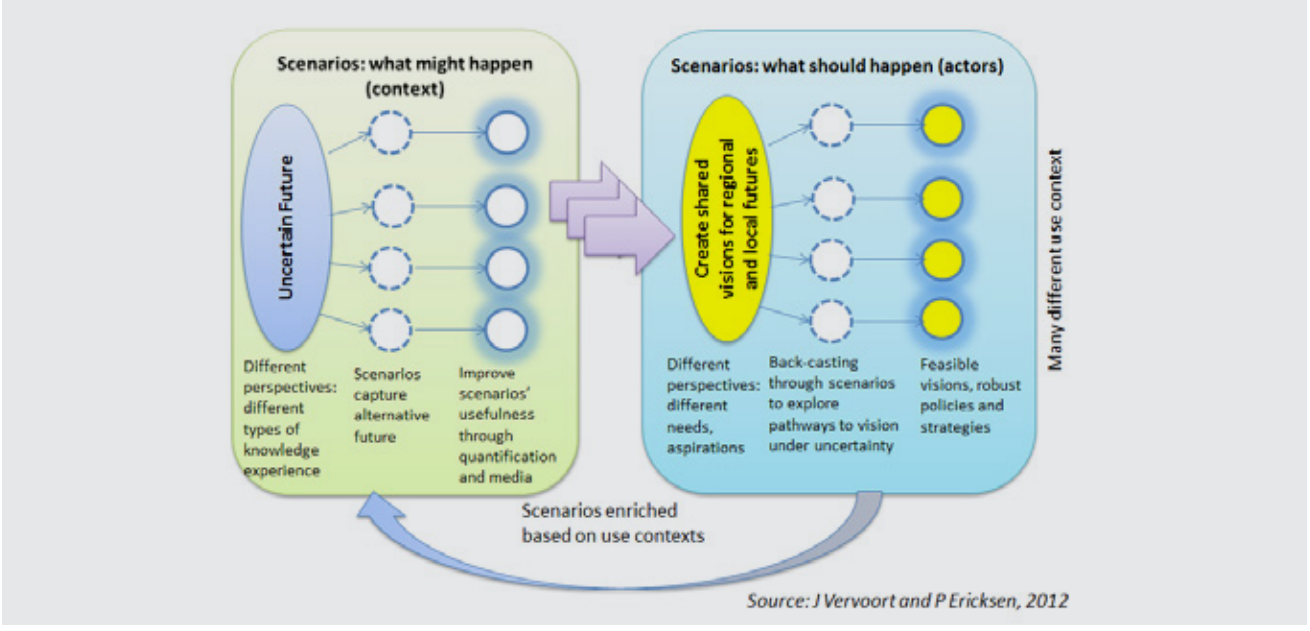

Figure: Future scenario development process

8 Enhanced technology support strengthens Nepal government's food security monitoring program

Nepal government and World Food Programme deploy CCAFS knowledge products for real-time monitoring and assessment of the impacts of climatic risks on its food security

Photo credit: Neil Palmer (CIAT)

What was the problem?

Unpredictability in crop yields in climate vulnerable regions is often damaging on more counts than one, negatively influencing not just food security but the larger economy as it affects factors such as import-exports, food prices as well as people's livelihoods. Nepal's food security is fragile because of large climatic risks. The government undertakes efforts to estimate crop yields by relying on traditional crop cuts, surveys and field verification reports. This process is slow and expensive and does not offer real-time information on the crop situation.

Partners:

Nepal Food Security Monitoring System, Ministry of Agricultural Development of the Government of Nepal, Nepal Agricultural Research Council, World Food Programme and Food and Agriculture Organization

How was this addressed?

CCAFS South Asia and the CCAFS Flagship on Climate Services and Safety Nets have developed an open source, flexible crop-forecasting platform-CCAFS Regional Agricultural Forecasting Toolbox (CRAFT) that includes a crop simulation module, a weather and seasonal forecast simulation module, and a geographic information system module. The toolbox can help determine advance information on in-season crop yields, thus enabling researchers, planners and food security experts to make informed decisions. The toolbox uses historical databases of weather and crop yields and current weather to estimate yields of various crops in advance. Once the spatial-temporal inputs were prepared, CRAFT was used first to compute the crop yields by hindcasting to establish the validity of the model across the historical time series. The CRAFT was then used for in-season estimates of rice and wheat production. The following figure shows a comparison of our real-time assessments for rice and wheat production estimates with that of the government of Nepal.

How was the tool scaled up?

The World Food Programme (WFP) supports Nepal Government's Food Security Monitoring System (NeKSAP) to produce in-season crop yield outlooks. CCAFS researchers engaged with both organisations and strengthened their capacities to use CRAFT as an alternate mechanism for quick estimates of the effects of climatic risks in crop yields. Stakeholders' confidence in CRAFT increased, when CCAFS shared the results of hindcasting for many years, showing strong agreement with the Ministry's own estimates made at a huge cost. WFP and NeKSAP have been using CRAFT since 2014 for assessing the impact of climatic risks on crop production in Nepal and are continuously supported by CCAFS in this endeavour. The advance estimates are shared with Ministry of Agricultural Development and other related stakeholders in different forums. The results are also disseminated through NeKSAP publications (like the Food Security Bulletin, Crop Situation Updates and CRAFT Reports) available at the NeKSAP website and NeKSAP google group, and also through national media.

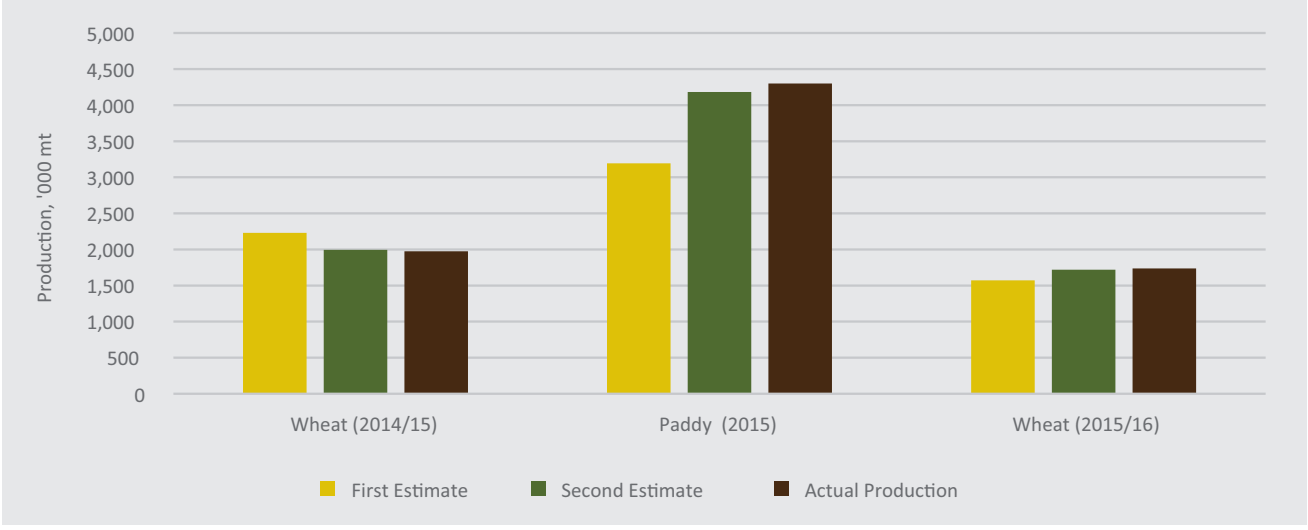

Figure: Comparison of CRAFT estimates against actual production of rice and wheat in Nepal

9 Propelling a low emission pathway for rice cultivation in Bangladesh

Bangladesh government, encouraged by the evidence on adaptation and mitigation benefits of the Alternate Wetting and Drying (AWD) technology in rice cultivation, is promoting this for wide-scale adoption in the country

What was the problem?

Rice is the major staple food of Bangladesh. Traditional rice production techniques are water intensive and in many places farmers use electricity or/and diesel pumps during its production, which significantly increases its cost of cultivation as well as Green House Gas (GHG) emissions. Rice production is responsible for about 25% of total estimated methane emissions from Bangladesh, making rice cultivation the third-largest source of methane after domestic wastewater and livestock. Technologies which can minimize the cost of cultivation, promote water use efficiency, and reduce emissions while maintaining yield are, therefore, a critical requirement for the country.

Partners:

Bangladesh Rice Research Institute, Government of Bangladesh, Global Research Alliance on Agricultural Greenhouse Gases, Food and Agriculture Organization, International Rice Research Institute, Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants and other research and development partners

How was this addressed?

Creation of low emission development pathways is one of the focus areas of CCAFS's research. The research on Alternate Wetting and Drying (AWD) was facilitated through a partnership between the International Rice Research Institute (IRRI), CCAFS and the Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants (CCAC). IRRI has continuously tested and evaluated AWD in collaboration with Bangladesh Rice Research Institute (BRRI) in the research farm and farmers' fields. The research showed that AWD technology can address the twin problems of adaptation and mitigation in Bangladesh's agricultural sector through efficient water management. It enables farmers to save up on irrigation water by up to 30% and reduces methane emissions by 30-70% without yield penalty. Reduction of water requirement can be a blessing in times of long dry spells during rice growing season. The research team has also assessed opportunities and barriers to the large-scale implementation of the AWD method including biophysical and socio-economic suitability and current policy actions in the country. The AWD method is more suitable for rice during Aus (pre-monsoon paddy) and Boro seasons when water supply is low.

How was the technology scaled up?

The research team facilitated the formation of policy-focused working group by its national focal partners and identify areas with high mitigation potential and design country-specific agricultural development interventions for the up-scaling of mitigation practices including AWD. A national work plan for AWD was developed with the participation of the Ministry of Agriculture, Department of Environment, BRRI including other relevant ministries/departments and development partners. Currently, AWD is being scaled out in Bangladesh by the national government with technical support from IRRI and partner organizations.


Photo credit: CCAFS South Asia

10 Precision nutrient management for tackling GHG emissions and food insecurity in South Asia

Multiple stakeholders in Bangladesh, India and Nepal have integrated precision nutrient management tools and techniques into their strategies to increase nutrient-use-efficiency, lower Green House Gas (GHG) emissions and improve farm profits

Photo credit: CIMMYT

What was the problem?

Rice based cropping system in South Asia is one of the major sources of Green House Gas (GHG) emissions. In the intensively cropped areas in the region, farmers are using imbalanced and inappropriate nutrient doses, which not only lead to high production costs and low nutrient use efficiency but also increase total GHG emissions from the agricultural lands. The bottleneck in improving nutrient use efficiencies are often attributed to a lack of access to soil testing and hence the nutrient recommendations. Fertilizer best management practice would require that farmers consider the spatial and temporal variability and inherent nutrient supply capacity of their soils. Blanket fertilizer applications result in under-fertilization in some areas and over-fertilization in others. To address these issues, site-specific precision nutrient management strategies need to be adopted at scale to achieve the triple goals of food security, protection of natural resources and reduction of agriculture's environmental footprint.

Partners:

Women's groups, Youth clubs, Farmers' Organizations, NGOs, State Governments in India, Indian Council of Agricultural Research, State Agricultural Universities, Bangladesh Agricultural Research Council, Nepal Agricultural Research Council, International Plant Nutrition Institute, Borlaug Institute for South Asia and International Maize and Wheat Improvement Center

How was this addressed?

Various decision support systems (e.g. Nutrient Expert); sensors (e.g. GreenSeeker) and management techniques (e.g. direct drilling of fertilizer, fertigation, micro-dosing) have been developed and used for soil as well as plant-based precision nutrient management recommendations. The tools, techniques and decision support systems are based on the scientific principles of 4R nutrient stewardship i.e. application of the right source of nutrient, at the right rate, at the right time, and at the right place to make efficient use of nutrients by the plants. CIMMYT's research, both on-station and with farmers in their own fields has provided farmers with simple and practical approaches to assess whether a given crop is fertilized optimally and if not, identify the opportunities to improve fertilizer management practices. Research in various states of Bangladesh, India and Nepal has generated a robust evidence base, supporting the tangible benefits of a range of improved (i.e. the Nutrient Expert and GreenSeeker, drilling application of urea, fertigation and micro-dosing) fertilizer management practices, over the conventional ones. Results as shown in the figure below, indicate that these decision support tools can help improve crop productivity, net income, nutrient use efficiency, and more importantly, reduction of GHG emission intensity from the crop lands.

How was the approach scaled up?

These decision support tools for crop nutrient management were tested and evaluated in collaboration with government's agriculture research organizations, state agriculture department and universities. Strategic research and learning platforms have been developed in various locations to demonstrate the technical aspects as well as benefits of the technologies to farmers, private sector players, extension agents and researchers. Periodically, travelling seminars and farmers' fairs have been organized in these learning platforms to bring farmers, researchers and change agents for learning and sharing experiences. Linkages with the private sector have been initiated to develop local service providers and provide business case for some of these technologies. Some of these tools have been integrated into the precision nutrient management programs of states, such as Punjab, Haryana, Bihar, Maharashtra, Karnataka, Orissa in India and also, by the government of Nepal.

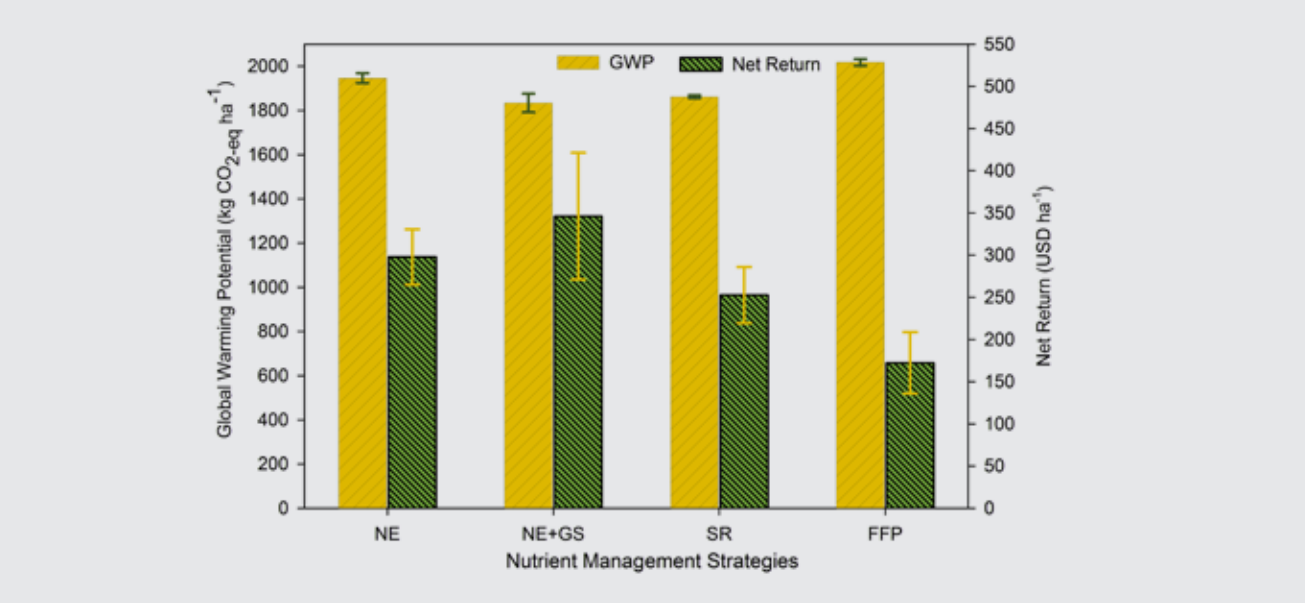

Figure: NE=Nutrient Expert, NE+GS = Nutrient Expert followed by GreenSeeker, SR= State Recommendation and FFP= Farmers' fertilization practice

Other successes and emerging stories

1 India's Food Security Bill promotes climate resilient coarse grain cultivation

Photo Credit: ICRISAT

Crop diversification is an important strategy for climate resilience. Bioversity International and its partners co-designed a sustained effort to investigate the potential of small millets, that are highly nutritious and resilient to climatic stresses. The evidence generated from these efforts in combination with appropriate policy engagement has found reflection in India's Food Security Bill. This bill targets more than 800 million people with publicly financed food distribution, and will distribute coarse grains such as millets, sorghum, and maize, in addition to rice and wheat. In 2010-2011, 31.8 million households cultivated coarse grains in India, which are resilient to climate induced stresses.

Partners:

Government of India, Indian Council of Agricultural Research, M S Swaminathan Research Foundation and Bioversity International

2 Precision Land Levelling (PLL) improves water and nutrient use efficiency in the Indo-Gangetic Plains

Photo Credit: CIMMYT

Low efficiency in irrigation is one of the major problems associated with agricultural water management in India. CCAFS scientists in CIMMYT and IRRI have tested and evaluated Precision Land Levelling (PLL) technologies in collaboration with ICAR, agricultural universities and farmers across many states of India. Scientists have shown that PLL can improve water and nutrient use efficiency, increase crop yields and income, and reduce Green House Gas (GHG) emissions in the rice-wheat production system. A vibrant market in Laser Land Levelling machines is now established in the Haryana state where approximately 2000 machines are hired out most of the time. There is evidence that smallholders have begun to collaborate among each other to hire the machines while removing borders between their plots to make it easier to operate them. Laser Land Levelling has also emerged as a key technology in the region's 'Climate-Smart Villages', and has been integrated well with other tools and approaches. It has also been described as a 'precursor technology', as the performance of other techniques improved significantly on laser-levelled fields.

Partners:

State Governments in India, Indian Council of Agricultural Research, State Agricultural Universities, Krishi Vigyan Kendra, International Maize and Wheat Improvement Centre, International Rice Research Institute and Farmers managed custom hiring centres

3 Public-Private Partnerships help enhance farmers' capacities for adaptation to climate change

Climate risk management in the heavily populated and vulnerable South Asian region requires tremendous investments. Efforts of the government alone may not be sufficient to address this challenge. Public-Private Partnerships could be an additional option for this. CCAFS has been working with national partners to develop, test and evaluate the Public-Private Partnership (PPP) model in Nepal. Three private agribusiness companies: *Probiotech Industries Pvt. Ltd* for maize, *Golchha Organisation* for sugarcane and *Sharda Group* for rice have joined their hands to promote Climate-Smart Agriculture (CSA) in their outreach areas. A range of climate-smart technologies and practices suitable for these crops were demonstrated in the company's outreach areas. Capacities of *15,000 farmers, part of the supply chain of the aforesaid industries, were raised by targeted training programs* in climate-smart agricultural practices. Many of them also attended exposure visits and participated in farmer to farmer learning exchanges. Similar partnerships between resource conservation technology related machinery manufacturers, government and farmers have been facilitated by CIMMYT in north-western India.

Partners:

Government of Punjab, Government of Haryana, Probiotech Industries Pvt. Ltd, Golchha Organisation and Sharda Group, Jain Irrigation, District Agriculture Office, Nepal Agricultural Research Council, International Maize and Wheat Improvement Center, International Finance Corporation and Practical Action Consulting

4 Building climate resilience through the Citizen Science approach

Photo Credit: Bioversity International

Crop diversification is one of the principle means to help farming communities, especially those highly vulnerable to climate change, in building resilience. Thus, a combination of different crop varieties/species/landraces not only proves to be the best insurance against such stresses, but also lends additional benefits such as improving soil fertility, supporting pollination, pest control, ensuring yield stability while also contributing to food and nutritional security. Through the Citizen Science approach, approximately 46,000 participatory trials in different locations in India have been successfully conducted by Bioversity International. The initiative has brought under its coverage over 25,000 farmers from 600 villages of 49 districts in 7 states of India. Two technology based outputs as part of the initiative has been the micro-weather recording device called i-button and the ClimMob 2.0 tool, an online platform that allows scientists to analyse the collected data and generate individual/collective preferences for the region. These results are being further scaled out through training courses in Citizen Science for CSA in universities and also through extension services.

Partners:

Indian Council of Agricultural Research, Protection of Plant Varieties and Farmers' Rights Authority, National Bureau of Plant Genetic Resources, Indian Agricultural Research Institute, Bioversity International and other local partners

5 Mainstreaming gender in the National Adaptation Plan of Nepal

Agriculture is a primary source of income in Nepal and women are an indispensable part of the Nepalese agriculture, with 61% of those engaged in the sector, being women. High levels of male out-migration from the country-side due to various reasons including climate induced changes in production levels, is further aggravating their workload, and limiting their productivity. CCAFS along with Local Initiatives for Biodiversity, Research and Development (LI-BIRD) has initiated steps to raise awareness of women members of parliament, high echelons of the bureaucracy (with a focus on women officials) and women members of the President's office on climate change, agriculture, right to food, and gender equality issues. The project aims to provide science based evidences and approaches of integrating gender and Climate-Smart Agriculture (CSA) in the National Adaptation Plan (NAP) and the Right to Food Bill in Nepal. The latter promotes the human rights based approach in the efforts to achieve food security at all levels (legislation, policy and program design, formulation and implementation). It is expected that these efforts would lead to the development of greater integration of gender and climate change issues in national policies and program implementation.

Partners:

Government of Nepal, Right to Food Network, Village Land Right Forum, Local Initiatives for Biodiversity, Research and Development

6 Mapping hotspots of germplasm collection in a scenario of climate change

Bioversity International and National Agriculture Research Centres in South Asia developed a regional database of crop germplasm matching their suitability with current and future climatic zones. In India, a passport database was developed, including geo-referenced information for almost 40,000 accessions of Indian collections of chickpea, pearl millet, pigeon pea, sorghum, and wheat. They were collected from the global databases of GENESYS, Bioversity International, collection missions, SINGER, EURISCO and GRIN-Global, and updated with the NBPGR database containing geo-referenced information. Similarly, in Nepal, more than 4,000 accessions of cereal, pulses, oilseeds and vegetables were collected and geo-referenced. The Climate Analogue Tool was used to map the performance of these germplasm in different agro-climatic conditions, providing crop adaptation information under current and future climatic scenarios and help identify hotspots where germplasm will be threatened by future climate change. Special collection missions were launched at such hotspots to conserve germplasm. Researchers from India, Sri Lanka, Bangladesh, Nepal and Bhutan have been trained on identifying such hotspots of germplasm using the climate analogue and similar tools.

Partners:

National Bureau of Plant Genetic Resources (India), National Agriculture Genetic Resources Centre (Nepal) and Bioversity International

7 Flood-mapping and insurance in India and Bangladesh

About 800 million people live in flood-prone areas in South Asia with 70 million experiencing yearly floods. Agricultural communities are subjected to severe economic pressure from flood-induced losses. Traditionally, flood-risk management has focused on engineered responses, or rebuilding activities and compensation after the event, particularly in the case of agriculture. The risk transfer option has not been widely practiced owing to complexities in the development and design of flood insurance contract for agriculture. IWMI supported by CCAFS is developing an innovative approach for real-time flood monitoring and designing effective insurance scheme for flood induced losses in low-income communities. This project integrates hi-tech modelling and satellite imagery with other ground data to predetermine flood thresholds, which could trigger speedy compensation pay-outs. Effective end-to-end solutions are being developed in collaboration with a range of organizations and experts and demonstrating the proof-of-concept. Engagement with the insurance industry and governments in the Indian states is likely to lead to scaling up of flood mapping for disaster relief and launching of flood insurance products.

Partners:

Government of Bihar, Ministry of Agriculture Forestry and Fisheries of the Government of Japan, Institute of Water Modelling, Water, Land and Ecosystems Program of the CGIAR, International Food Policy Research Institute, Civil Society, Insurance and Re-insurance Companies

8 Undertaking loss assessment for crop insurance

Crop insurance in India has now reached more than 50 million farmers with the implementation of the new flagship scheme of the government. Village is proposed as the spatial unit for crop insurance to reduce basis risk while increasing farmer's satisfaction. However, loss assessment at village scale using traditional methods of crop sampling is posing huge operational and financial challenges in such a large country. CCAFS-SA is assessing the suitability of satellite based vegetation indices, rainfall, temperature, unmanned aerial vehicles, digital pictures, hand-held sensors, and statistical and crop growth simulation models for yield monitoring to increase the efficiency and efficacy of the loss assessment process. Big data applications in crop insurance are also being explored to design a scheme with reduced basis risks. The stakeholders are now being sensitized about the results. We hope this research would lead to new crop insurance guidelines and methodologies which would increase satisfaction of farmers, industry and the government.

Partners:

CGIAR Research Program on Climate Change, Agriculture and Food Security-South Asia, Borlaug Institute for South Asia, RMSI Private Limited

9 Empowering women leaders through capacity development to address climate change in the region

Photo Credit: Neil Palmer (CIAT)

Notwithstanding the fact that approximately 60% of the total labour force in South Asian agriculture comprise of women, they continue having significantly less access to important productive, financial and information resources for agriculture, including land. Adding to their woes are climate related stresses, including the outmigration of males to urban areas in search of alternative livelihoods due to loss of agricultural productivity. These added pressures in combination with a lack of knowledge on adaptation strategies are only further marginalizing this group. Together with the national and sub-national partners, CCAFS is actively involved in gender transformative research as well as in designing capacity strengthening programs for women farmers, women's group leaders as well as women policy makers in the region. To reach scale, the Training of Trainers (ToT) program on gender and climate change has been undertaken for the elected women leaders in the state of Bihar, India and members of women cooperative groups in Nepal. These initiatives have covered approximately 7,586 women leaders from 75 districts in Nepal and 1,500 women in India. More than 10,000 copies of the South Asia Gender and Climate Change training manual have been printed in local languages and distributed across the region.

Partners:

The Youth and Small Entrepreneur Self-Employment Fund in the Ministry of Finance (Nepal), Alternative Futures (India), Bihar Mahila Samakhya (India)

10 Expanding the scale of Climate-Smart Agriculture with the private sector

The Climate-Smart Village (CSV) approach is all set to be scaled-up by partner organizations in South Asia. CCAFS is collaborating with ITC Limited, a multi-business conglomerate of India, to build resilient agriculture production systems through the promotion of climate-smart technologies and farmers' capacity building in ITC's 2000 outreach villages in 6 states of India. The collaboration aims to provide greater evidence of CSVs related to economic (yield, income, employment), social (gender role and group cohesion) and environmental (water efficiency, carbon sequestration and nutrient efficiency) benefits. It further promotes the development of a new business and institutional model for public-private partnership including financing and resource leveraging mechanisms for the implementation of the CSV approach. Such partnerships could become a role model for many other similar organizations.

Partners:

ITC Limited and its local partners

Contacts for more details

Top ten success stories	Contact persons
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2. India's agroforestry policy to promote Climate-Smart Agriculture	Henry Neufeldt (ICRAF) *h.neufeldt@cgiar.org* Vijendra Pal Singh(ICRAF) *v.p.singh@cgiar.org*
3. Nepal government scales out the Climate-Smart Village approach	Bal Ram Thapa (LI-BIRD, Nepal) *bthapa@libird.org* Arun Khatri-Chhetri (CCAFS-SA) *A.khatri-chhetri@cgiar.org*
4. Growing solar power as a remunerative crop to minimize climatic risks in agriculture	Tushar Shah (IWMI) *T.Shah@cgiar.org*
5. Improved weather-based crop insurance for reducing agrarian distress	Pramod Aggarwal (CCAFS-SA) *p.k.aggarwal@cgiar.org* Paresh Shirsath (CCAFS-SA) *p.bhaskar@cgiar.org*
6. Transforming hazards into opportunities: underground taming of floods for drought management	Paul Pavelic (IWMI) P.Pavelic@cgiar.org
7. Strategic policy guidance on Climate-Smart Agriculture in Bangladesh	Maliha Muzammil (University of Oxford) *maliha.muzammil@gmail.com* Joost Vervoort(Utrecht University) *j.m.vervoort@uu.nl* Pramod Joshi (IFPRI) *p.joshi@cgiar.org*
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2. Precision Land Levelling (PLL) improves water and nutrient use efficiency in the Indo-Gangetic Plains	Mangi Lal Jat (CIMMYT) *m.jat@cgiar.org*
3. Public-Private Partnerships help enhance farmers' capacities for adaptation to climate change	Milan Kumar Joshi (PAC) *Milan.Joshi@practicalaction.org.np* Arun Khatri-Chhetri (CCAFS-SA) *A.khatri-chhetri@cgiar.org*
4. Building climate resilience through the Citizen Science approach	Jacob van Etten (Bioversity International) *j.vanetten@cgiar.org*
5. Mainstreaming gender in the National Adaptation Plan of Nepal	Bikash Paudel (LI-BIRD, Nepal) *bpaudel@libird.org* Lakpa Sherpa (LI-BIRD, Nepal) *Lakpa.sherpa@libird.org*
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