NATIONAL GEOGRAPHIC INDIA Partnerships

Climate-Smart Villages

THE FUTURE OF FARMING

As changing weather patterns pose serious threats to traditional agrarian systems, Climate-Smart Agriculture methods are coming to the rescue of farmers across the world

By Padmaparna Ghosh

Based on "The Climate-Smart Village Approach: Framework of an integrative strategy for scaling up adaptative options in agriculture" by P. K. Aggarwal et.al, Ecology and Society, 2018

With contributions from:
P.K.Aggarwal (Regional Program Leader, CCAFS/BISA-CIMMYT South Asia), **Andy Jarvis** (Flagship Leader, CCAFS/CIAT), **Bruce Campbell** (Program Director, CCAFS), **Arun Khatri-Chhetri** (Science Officer, CCAFS South Asia), **Shehnab Sahin** (Communications Specialist, CCAFS South Asia) and others from the CGIAR Research Program on Climate Change, Agriculture and Food Security.

Dressed in a typical farmer's white head wrap, Horil Singh of Rajapakar village in Bihar laments the unpredictability of weather today. "We have seen the weather change to a great extent. We are desperate for rains but are often let down."

Bihar is blessed with fertile, alluvial soil and abundant water resources, sealing its reputation as an agricultural haven. However, conditions are changing. Studies show that changes in rainfall and temperature are affecting rain-fed and irrigated cropping systems, posing major climate risks for crop production. Millions of farmers like Singh are facing uncertainty, which can wreak havoc in traditional farming systems, not just in terms of incomes and livelihoods but also food security.

However, there is hope in the shape of Climate-Smart Agriculture (CSA), whose objectives are to provide solutions to transform and reorient agricultural systems to support food security on a changing planet. CSA, in short, aims to bolster agricultural productivity in a sustainable manner (which in turn increases farm incomes, food security and development) while assisting farmers in adapting and building resilience to climate change (from the farm to national levels) and reducing or removing green house gases (GHG) whereever possible.

Today Rajapakar is a Climate-Smart Village (CSV), a part of a project led by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Built on the principles of CSA, this program provides technological, organizational and systemic support to farmers in association with institutions to help them cope with climate change, in 36 sites across 20 countries.

Uma Kant Singh, another farmer from Rajapakar, says, "Today we receive news through agro-advisory services. We farmed with the System of Rice Intensification (SRI) method for paddy and zero till for wheat, with much higher yields."

Be it index-based insurance which safeguards farmers from losses due to floods and drought or crop damage owing to weather unpredictability, to agro-advisory and weather services, along with technological interventions at various levels, these villages are using diverse ways to adapt to climate change from every angle, and building microcosms that represent farming for the future.

THE GLOBAL CONTEXT

Even though, at present, we are living in a time of maximum agricultural yield in human history, we, as a race are still grappling with severe food insecurity.

In South and Southeast Asia, the Caribbean, and Sub-Saharan Africa, almost 800 million people still have insufficient food. Global food production must double by 2050 to keep up with population growth and food demand. Things get worse when you throw climate change into this volatile mix.

"The magnitude and speed of climate change efforts in agriculture will be critical to the future of large segments of the world's population, particularly in the developing countries in South Asia and Sub-Saharan Africa," says Arun Khatri-Chhetri, Associate Scientist and Science Officer with the CCAFS program in South Asia.

Climate change is expected to impact food production through increased temperatures, erratic rainfall patterns, and more frequent and intense floods and droughts. This can lead to yield losses up to 60%. Recent studies have shown that almost one-third of yield variability is related to climatic variability.

"In Latin America, climate variability wreaks havoc on agriculture—from drought and fires, water issues, flooding, excess rain to increase in pests and diseases. It is like a perfect storm," says Andy Jarvis, Flagship Leader for Climate-Smart Agriculture, with the CCAFS program.

And that is not all.

Agricultural food systems are also contributing to this problem themselves by contributing around a quarter of GHG emissions, creating a vicious cycle of agriculture both driving climate change and suffering from its consequences.

There is a vision of a sustainable, resilient and robust agricultural food system that reduces GHG emissions, which in turn has the potential to reduce the severity of the problem—but does such a panacea exist?

"It has to. Otherwise we are in deep trouble. If we are serious about our Sustainable Development Goals (SDG), we have to reach 500 million small holder farmers by 2030. We have to reduce 1 giga ton of CO2 from agriculture compared to business as usual. At the moment, we are only likely to get to 20-40% of that unless we look towards very transformative actions," says Bruce Campbell, Program Director for CCAFS.

Several CSVs are showing that its possible. Early results from CSVs in Asia, Africa, and Latin America are illustrating various ways of coping with these issues in diverse agro-ecological settings. Results also show that this approach has high potential for scaling out promising climate-smart agricultural technologies, practices, and services.

"Through CSA and these villages, we are looking at how we can help farmers adapt to all this, so that they are thinking on their feet, capable of dealing with this right now and in so doing setting themselves up for the long term," says Jarvis.

CLIMATE-SMART VILLAGES AS CLASSROOMS

In a way, Rajapakar village is a classroom, it is a site of learning for agricultural research. The CCAFS program hopes that it will be a beacon of hope for a more resilient and sustainable future.

Around the world, there are several successful examples of CSA programs and studies, however, the problem is lack of adoption of innovative practices. For example, in Betul district in Madhya Pradesh, farmers were seen to continue using very old seeds that were handed down to them by their ancestors.

"Despite such seeds being low-yield, conviction in indigenous traditions, together with lack of access to credit and knowledge, compelled the farmers to continue its use," says Pramod Aggarwal, Regional Program Leader for CCAFS in South Asia. As part of CGIAR's interventions, the beneficiary farmers have now been provided with resilient and high yielding varieties of seeds.

"There is a big demand for such improved seeds now with other tribal farmers," says Aggarwal.

Lack of practical evidence of their effectiveness in real world situations contributes to low adoption of new technologies. Climate change often complicates this situation because its impact varies across sites. Therefore, to effectively implement such innovations, there needs to be integration between science, technology and decision-making, that takes into account local socioeconomic conditions. It has to be a platform for a socially inclusive and multi-stakeholder collaborative work.

The concept of CSVs was founded on the principle of scaling up CSA, and most importantly, to provide the evidence that this works. Keeping future scaling in mind, these villages were selected as climate change hotspots across a wide range of agro-ecological zones with different types of farming, climate risks and vulnerabilities which would allow comparison, learning, and analysis.

One common feature that runs through the concept of CSVs is that there is no "magic bullet" of a solution. Issues, variabilities, vulnerabilities, capacities are widely divergent, and therefore, solutions also need to be diverse.

Since 2012, CCAFS started piloting the CSV approach in Africa (Burkina Faso, Ethiopia, Ghana, Kenya, Mali, Niger, Senegal, Tanzania and Uganda), and South Asia (Bangladesh, India and Nepal) and then extended in 2014 to Latin America (Colombia, Guatemala, Honduras and Nicaragua), and Southeast Asia (Cambodia, Laos, Philippines and Vietnam). CCAFS and its partners currently facilitate AR4D in about 36 CSV sites.

HOW CAN A VILLAGE BECOME CLIMATE-SMART?

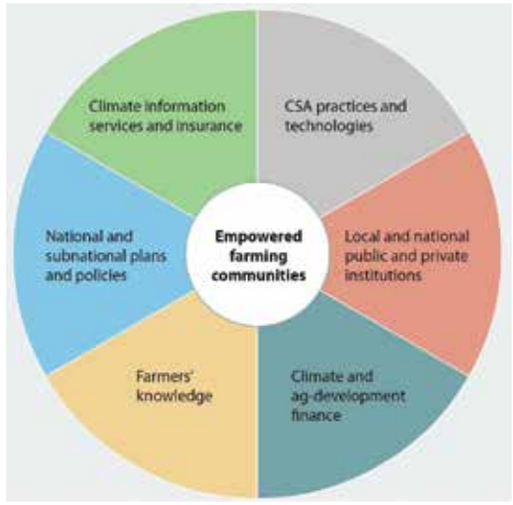
The process of implementing the CSV approach is simple.

First is a "baseline assessment", which is understanding the problem. This is done in a participatory manner, taking in the concerns and local knowledge of all the actors in the cycle. Historical climate data is analyzed to assess the risks and long-term suitability of the main cropping and livestock systems.

The next step is all about constructing the right basket of solutions—a portfolio of practices and technologies that will address food security, adaptation, and mitigation that need to be tested in the CSVs. "Typically this includes interventions which are water-smart, weather-smart, seed/breed-smart, carbon/nutrient-smart and/or market/institution-smart. All of these interventions are site-specific and are chosen after extensive discussion with women and men farmers, local governments and researchers," says Aggarwal.

Once the plan is in place, the ground is set for creating evidence for other areas with similar conditions, problems and constraints. This is the real test of theory and on-the-field realities, and bringing all farmers on board is critical.

Key components that are considered in a Climate-Smart Village approach, depending upon the region and relevance.



For instance, solar powered community irrigation systems in Gujarat, Bihar and Madhya Pradesh has led to multiple benefits: supplementary income through surplus power sale, clean and regular source of electricity for farm irrigation, changed land use management, and reduction of GHG emissions. Therefore the system is being scaled up by the government of India.

In the CSVs in Betul, Madhya Pradesh, hundreds of farmers have directly benefitted from a wide range of weather resilient agricultural technologies from crop insurance, weather and agro-advisory services, improved seeds, and solar pumps.

The problem of climate change is fine grained. Just like the Bihar example where climate variability is different from one location to another, globally too these can oscillate widely. This is why scientists working on CSA do not apply one solution to every site.

"Agriculture is highly context specific. For example, take alternate wetting and drying in rice paddies. This reduces water consumption by 50% and reduces GHG emissions by 30-50%. But it cannot be applied blindly everywhere. Priorities shift from one area to the next," says Campbell. And this is why field testing in varied regions is so important.

And finally, we come to scaling up and out. Once intervention portfolios are successfully tried and tested, the evidence is used to contribute to scaling promising innovations.

THE CLIMATE-SMART VILLAGE APPROACH IN INDIA

Empowering tribal women through CSVs: In the CSVs of the tribal district of Betul in Madhya Pradesh, set up with support from the United States Agency for International Development and BAIF, "Super-Champion" farmers have been identified based on land ownership and influence. Mostly women, these farmers are providing training on CSA technologies and practices, knowledge distribution on insurance and ICT based agro-advisories among fellow farmer beneficiaries.

KUNAL PANDEY (CCAFS)

Increasing efficacy and efficiency of crop insurance schemes: Millions of Indian farmers lose some part of their crop every year due to excess rainfall, drought or flood. CSVs are also providing evidence to develop improved insurance products and increasing farmers' access to and satisfaction with agriculture insurance. "Crop loss assessment is getting a fillip with the deployment of satellites, Unmanned Aerial Vehicle, computer models and artificial intelligence," states Pramod Aggarwal, of CCAFS, BISA-CIMMYT.

PHOTO 1: NIRMAL SIGTIA (IWMI); PHOTO 2: PRAMOD AGGARWAL (CCAFS)

Private sector involvement for climate change adaptation in agriculture:
Private sector partnerships are critical in ushering in socio-economic transformation in the future. CCAFS has partnered with ITC Limited, a multi-business conglomerate, in India for enhancing farmer livelihoods and resilience through the CSV approach in several states.
NEIL PALMER (CIAT)

Innovation in approach for climate-smart water use:
International Water Management Institute (IWMI) is evaluating technologies for “Underground Taming of Floods for Irrigation” in the state of Uttar Pradesh, which can accelerate recharge of the underground water table by floodwater. In Gujarat and Bihar, an innovative community model of solar pumps has led to higher crop yields and income, and reduced GHG emissions in the CSVs. “Farmers of such villages can earn additional income by selling surplus energy to the state electricity grids, says Tushar Shah of IWMI.
PRASHANT VISHWANATHAN (IWMI)

Digitization of knowledge transfer empowering agricultural communities:
In the CSVs, digital technology is being tested and evaluated to rapidly provide farmers access to weather information and scientific agro-advisories to utilize this knowledge in real time.
PRASHANTH VISHWANATHAN (IWMI)

CSVs show pathways to control air pollution and increase farmers' income:
Rice residue burning in north-western states of India is a major source of air pollution affecting millions in Delhi and its neighbourhood. Farmers resort to this practice to quickly clear their fields for timely wheat planting. In the CSVs of Punjab and Haryana, CIMMYT-BISA has demostrated that a Happy Seeder Machine provides an alternative residue management option which also helps sow wheat in the standing rice stubbles.
NEIL PALMER (CIAT)



The Climate-Smart Village approach in Bangladesh:
World Fish is promoting a range of climate-smart technologies in a coastal agriculture production system in Bangladesh. Farmers in the CSVs of coastal Bangladesh are getting benefits from scaling out of a fish ring micro habitat (left) to conserve species during drought, vegetable cultivation in ditches during floods (middle) and shrimp cultivation in paddy fields (right).
HARUN-OR RASHID (WORLD FISH)

This is done in two ways:
1. Farmer-to-farmer learning through self-help groups or associations. Messaging from a trusted source is the most effective way to spur farmers to adopt new technologies and practices.
2. Sharing CSV research and lessons to influence large-scale CSA investment plans, promote mainstreaming of institutional changes, and inform policy instruments.

Ultimately, CSA is about illustrating which solutions are best for certain sets of problems. Devender Singh from Rajapakar village explains, "These villages will serve as benchmarks and show farmers how to use new technologies in a changing climate, so that they can cope with the changes."

NO TIME BETTER THAN NOW

Farmers across the globe are bearing the brunt of climate change. The Paris Climate Agreement aims to restrict global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and it is critical to start acting now.

"Climatic risks associated with food and livelihood insecurities are also causing a lot of cross-country migration leading to global unrest and social tensions. Addressing these challenges in vulnerable regions of South Asia and Africa is very urgent," says Aggarwal.

For CGIAR, this is a long game, just like climate change. These are long-term investment sites, for long-term learning. Jarvis terms this as a kind of a "lighthouse approach". "Like beacons that are visible from far away and attracts interest and curiosity and become demonstration sites. And we hope that they will take it to other regions." ●

The Climate-Smart Village approach in Nepal:
With the support of the government and local partners, the CSVs of Nepal have become efficacious learning sites for a range of agricultural technologies and practices. Since men here migrate to urban areas, gender and social inclusion interventions are of prime focus in the CSV approach. Balaram Thapa of LI-BIRD states, "Increasing access to water resources and improved, climate-resilient seeds helps farmers to minimize impact of climatic risks in agriculture."
NEIL PALMER (CIAT)

THE CLIMATE-SMART VILLAGE APPROACH IN SOUTH EAST ASIA

Rice terrace farming as a conservation practice:
The CSVs in Vietnam serve as platforms to evaluate the CSA benefits of farmers' indigenous practices and new technologies. Rice terrace farming is one such practice that conserves water and increases productivity.
LEO SEBASTIAN (CCAFS)

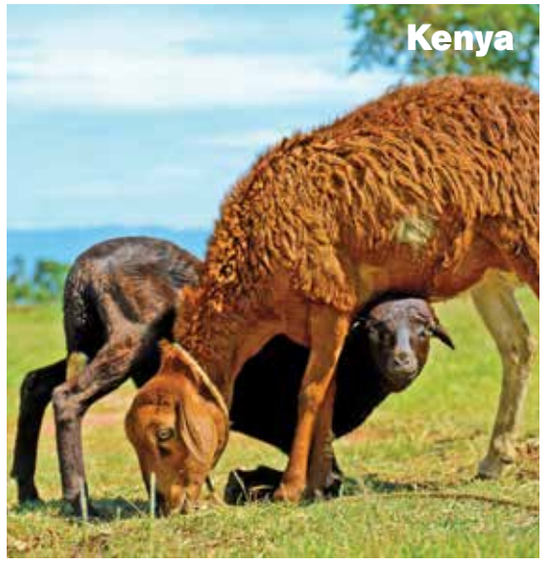
Capacity strengthening programs:
In the CSVs in the drought prone lowlands of Savannakhet, Laos, on-site trainings are helping in dissemination of knowledge on stress tolerant crops, water conservation and climate information services from trainers to farmers and scaled to neighbourhoods through field visits.
JEROME VILLANUEVA (CUSO INTERNATIONAL)

Stress tolerant rice varieties:
Seasonal flooding in many areas of South East Asia forces farmers to grow either crops that are flood-tolerant but low-yielding or those that can escape flood periods. Recently developed submergence tolerant varieties have come to the rescue.
ISAGANI SERRANO (IRRI)

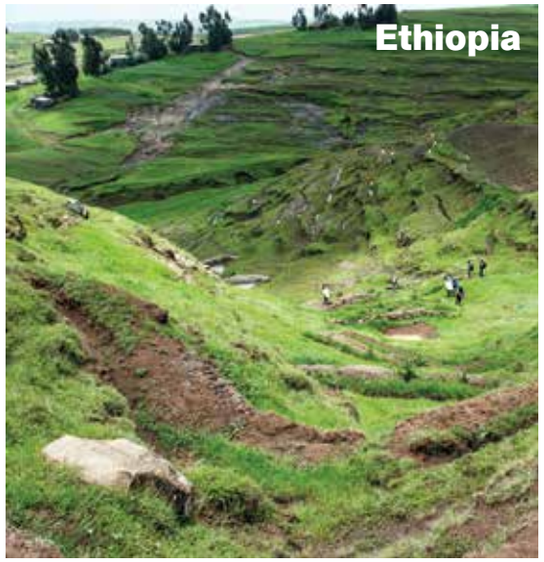
Alternate Wetting and Drying (AWD) technique:
Climate change induced uncertainties worsen the productivity of rainfed rice. CSVs are promoting AWD technique, developed by the International Rice Research Institute (IRRI). "AWD reduces water use by 30% and methane emissions by 48% without impacting yield," states Leocadio Sebastian of CCAFS/IRRI.
ISAGANI SERRANO (IRRI)

THE CLIMATE-SMART VILLAGE APPROACH IN EAST AFRICA

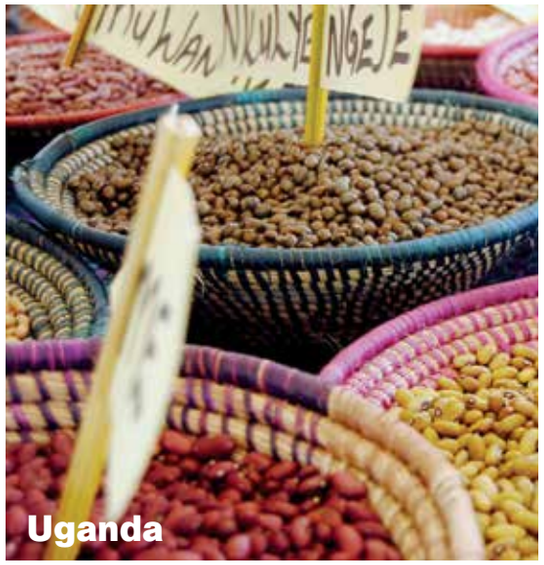
Improved ruminant breeds:
Breeds of Red Maasai sheep and Galla goats, crossed with the local breeds, have been introduced in the CSVs. Dawit Solomon of CCAFS/International Livestock Research Institute says, “Their small body size, flexible feeding habits and short generation intervals helps climate risk management.
SOLOMON KILUNGU (CCAFS)



Land restoration for climate-smart benefits:
CSVs provide evidence to develop social safety net programs that include the restoration of degraded land and agroecosystems. While increasing food and nutrition security, it also contributes to mitigation of greenhouse gas emissions.
GEORGINA SMITH (CIAT)



Participatory Varietal Evaluation:
To address climate-related risks in Lushoto district, Tanzania, CCAFS, in partnership with local government and research organizations, is promoting the process of Participatory Varietal Evaluation to guide the development and selection of farmer’s preferred varieites.
SARA QUINN (CIP)



Community Seed Banks for farm resilience:
Climate-risk resistant seeds grown in CSVs are stored in seed banks. These banks help enhance diversity and resilience building by ensuring rapid availability of seeds of stress-tolerant varieties to a large number of farmers.
I.LOPEZ-NORIEGA (BIOVERSITY INTERNATIONAL)

THE CLIMATE-SMART VILLAGE APPROACH IN WEST AFRICA

Weather advisory services:
“Developed in CSVs, real-time weather monitoring and agro-advisory services go a long way in improving farmer’s practices that minimize risks, reduce losses and improve production,” says Robert Zougmore of CCAFS/ International Crops Research Institute for the Semi Arid Tropics.
JAMES HANSEN (IRI)

CSA innovations in land use:
Implemented in the CSVs, half-moons and zaï techniques are efficient soil and water conservation practices that help farmers to harvest under severe drought spells and low soil fertility conditions in semi-arid cropping systems.
ROBERT ZOUGMORE (CCAFS)

Bio-fortifiedand drought-tolerant crop varieties:
In the CSVs, such varieties of millet and sorghum are helping in increasing staple food crop production, improving food and nutrition security of farmers and triggering income-generating activities around seed production.
ROBERT ZOUGMORE (CCAFS)

Farmer managed natural tree regeneration:
This practice is helping farmers in the CSVs to protect crops from strong winds and improve soil fertility, which doubles yields of sorghum and millet produced under trees. Additional timber and non-timber products from trees further enhances their income.
TONY RINAUDO (WORLDVISION)

THE CLIMATE-SMART VILLAGE APPROACH IN LATIN AMERICA

Climate-smart water conservation technique:
CSV farmers' innovation is outstanding. This practice is fuel-free and helps avoid wastage. It has been a great solution for low-income rural families for meeting water demand for homes and vegetable gardens.
ALEXANDRA POPESCU (CCAFS)

Climate-resilient crop varieties in CSVs:
Due to climate variability, rural families face a hard time achieving food and nutrition security. Climate-resilient varieties of crops alongside efficient water harvesting practices have been introduced to enhance food security, income and resilience.
CRIS SOTO (CATIE)

Agroforestry improves coffee quality:
Coffee quality and yield improves under tree shadows because berries develop balanced sugars. "Such a CSA practice can be easily implemented by small-scale farmers using tree species such as banana and cocoa," says Ana Maria L. Rodriguez of CCAFS/International Center for Tropical Research.
NEIL PALMER (CIAT)

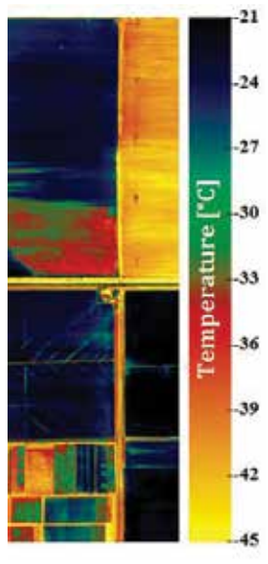
Agro-diversity for resilience:
Agro-diversity is key for rural families' food and nutrition security. Improved bean trials are being implemented in La Prensa community in the Olopa CSV.
NEIL PALMER (CIAT)

THE CLIMATE-SMART VILLAGE APPROACH AT THE GLOBAL LEVEL

CSVs provide evidence for science-led policy:
Bruce Campbell of CCAFS presenting his vision of transforming agriculture by adapting to climate change to policy makers during a side event at COP 23, 2017.
MICHAEL MAJOR (CROP TRUST)

South-South Learning:
CSVs are also learning platforms for south-south exchange of knowledge, technologies and practices among the developing countries.
J.L URREA (CCAFS)

Communication for development:
Various communication mediums and platforms are engaged to spread awareness about research in the CSVs globally. Through programs such as 'Shamba Shape Up' TV series in Kenya, 9 million viewers are made aware of such activities monthly.
SARA QUINN (CIP)



Advanced technology for research:
CSVs also provide guidance on developing new technologies to meet future challenges. Here, latest remote sensing technologies are deployed by CIMMYT to develop new crop varieties (left); and a CIAT researcher evaluates genetic resources for building drought and heat tolerance (right).
NEIL PALMER (CIAT),CIMMYT AND INSTITUTO DE AGRICULTURA SOSTENIBLE (IAS)

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