RESEARCH PROGRAM ON
Climate Change, Agriculture and Food Security

CGIAR CCAFS



Climate-Smart Villages

An AR4D approach to scale up climate-smart agriculture

Rationale

Agriculture and climate function hand in hand; they also dysfunction hand in hand. Today, 32-39% of global crop yield variability is explained by climate, translating into annual production fluctuations of approximately 2 to 22 million tonnes for major crops such as maize, rice, wheat and soybean [1]. At the same time, agricultural food systems contribute 19-29% of global greenhouse gas (GHG) emissions [2]. By 2050, the Food and Agriculture Organization of the United Nations (FAO) states that we need to deliver 60% more food for a growing global population with shifting consumption patterns, and all this in a harsher climate [3]. Decreases of around 5% in crop productivity are expected for every 1°C warming above historical levels [4], [5]. These global drivers and trends represent a truly grand challenge that requires concerted action.

Climate-smart agriculture (CSA) is proposed as a solution to transform and reorient agricultural systems to support food security under the new realities of climate change. CSA consists of co-achieving three objectives, or pillars, defined as:

1. Sustainably increasing agricultural productivity to support equitable increases in incomes, food security and development;
2. Adapting and building resilience to climate change from the farm to national levels; and
3. Reducing or removing GHG emissions where possible [6].

Despite the significant global action and investment now being oriented towards CSA, the science is immature. There is scant evidence on how different practices, technologies, services, processes and institutional arrangements contribute to the distinct pillars of CSA, and the synergies and trade-offs between these pillars across a range of agro-ecologies and social contexts. Evidence is needed on which options generate CSA-related outcomes, where the options should be targeted, the costs involved, and their expected co-benefits or disbenefits (including gender and labour aspects).

Photos: N. Palmer (CIAT)

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The CSV AR4D approach

Addressing the need for proven and effective CSA options, CCAFS has developed the Climate-Smart Village (CSV) approach as a means to agricultural research for development (AR4D) in the context of climate change. It seeks to fill knowledge gaps and stimulate scaling of CSA.

The CSV approach is founded on the principles of participatory action research for grounding research on appropriate and location/context-specific enabling conditions, generating greater evidence of CSA effectiveness in a real-life setting and facilitating co-development of scaling mechanisms towards landscapes, subnational and national levels.

Vision of the CSV AR4D approach

In this AR4D approach, CSVs are:

1. multi-stakeholder learning platforms;
2. participatory test-beds for generating greater evidence of CSA effectiveness; and
3. cornerstones to draw out scaling lessons for policy makers from local to global levels.

CSA is seen in a broad sense, including practices, technologies, services and institutional options (Figure 1).

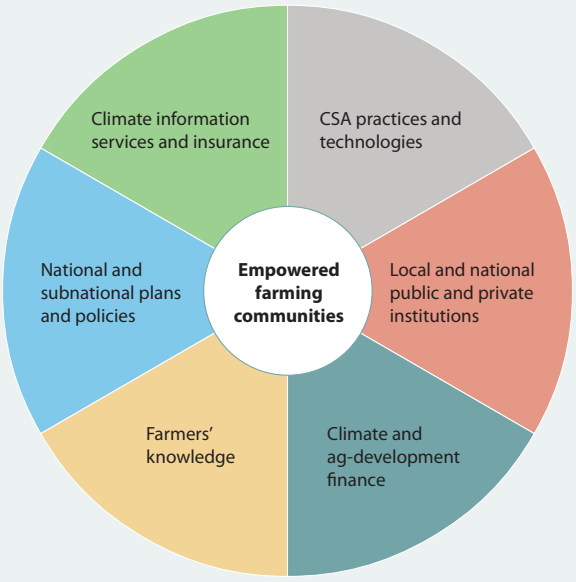

Figure 1.
Components considered in the CSV AR4D sites.

Key features of the CSV AR4D approach

- ✔ Sites for testing, through participatory methods, technological and institutional options.
- ✔ Sites where climate change in its broadest context is considered, but in relation to local realities: long-term adaptation, avoiding maladaptation, climate risk management, low emissions development.
- ✔ Embodies a holistic vision for climate change action – not a silver bullet approach.
- ✔ A platform for socially inclusive, multi-stakeholder collaborative work.
- ✔ Founded on the principle of bringing CSA to scale.
- ✔ Links global and local knowledge.

The CSV approach promotes local, incremental adaptation and transformative options and builds local capacities to continue to innovate, experiment, and adapt. The CSV approach aims to have a positive impact on agriculture-dependent communities and this includes ensuring the participation of women farmers and all social groups. Where possible, gender-differentiated aspects are assessed to ensure that prioritization and development of portfolios of climate-smart technologies, best practices, technologies, services, processes and institutional options address gender and social inclusion.

While many of the CCAFS partners in CSVs are concerned with local development, for CCAFS the CSVs are primarily "cornerstones" for generating key lessons for policy makers from subnational to global levels and for much wider scaling. CCAFS and partners use and adapt a range of qualitative and quantitative research methods across a broad set of CSVs for understanding the social, gender and biophysical constraints and enablers for adoption to fill gaps in evidence of CSA best bets. Institutional research is crucial, e.g. understanding the value of catalysing the convergence of initiatives and actions across different scales and sectors (e.g. national/subnational adaptation and mitigation programs; employment initiatives; youth strategies).

An ideal CSV AR4D site typically provides five types of decision support to farmers and other stakeholders, and allows for the research that assesses the effectiveness of such support:

1. Village/community agricultural land use plans and contingency plans considering current and future climate risks, soil and socio-economic conditions, and markets.
2. CSA portfolios that do not become maladaptive in future climate and market scenarios – assessed using models.
3. Strategic guidance before the planting season, where feasible based on seasonal forecasts, on most suitable CSA practices, technologies, services, processes and institutional options. This is done in a participatory mode with local farmer groups and due consideration is given to institutions in the region such as farmers' self-help groups, water-users associations, markets, and the availability of climate and agriculture development finance.
4. Tactical guidance to farmers on using real-time weather forecasts and value-added ICT based agro-advisories; on accessing good quality inputs and technologies for improving water/nutrient/energy use efficiencies, and on risk transfer through insurance mechanisms in case of crop and livestock losses.
5. Policy level guidance on policy barriers and policy options to unlock CSA and local and national development. This includes consideration of the financial needs to drive scaling.

Location and scale of CSVs

CSV AR4D sites are clusters of villages, local government jurisdictions or landscapes (with one or many villages). They were selected to focus on climate change hotspots across a wide range of agro-ecological zones with different farmers' typologies, climate risks and vulnerabilities allowing comparison, learning, extrapolation and climate analogue analysis. Many were located in statistically designed 10x10 km or 30x30 km sampling grids. They vary on their scale of operation depending upon the cultural context, specific options to be tested, research questions to be addressed and/or stakeholder preferences.

CCAFS started piloting the CSV approach in 2012 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 (Figure 2). These are not to be confused with the 2000 or more CSVs where development partners are scaling CSA (see "**Emerging success stories**").

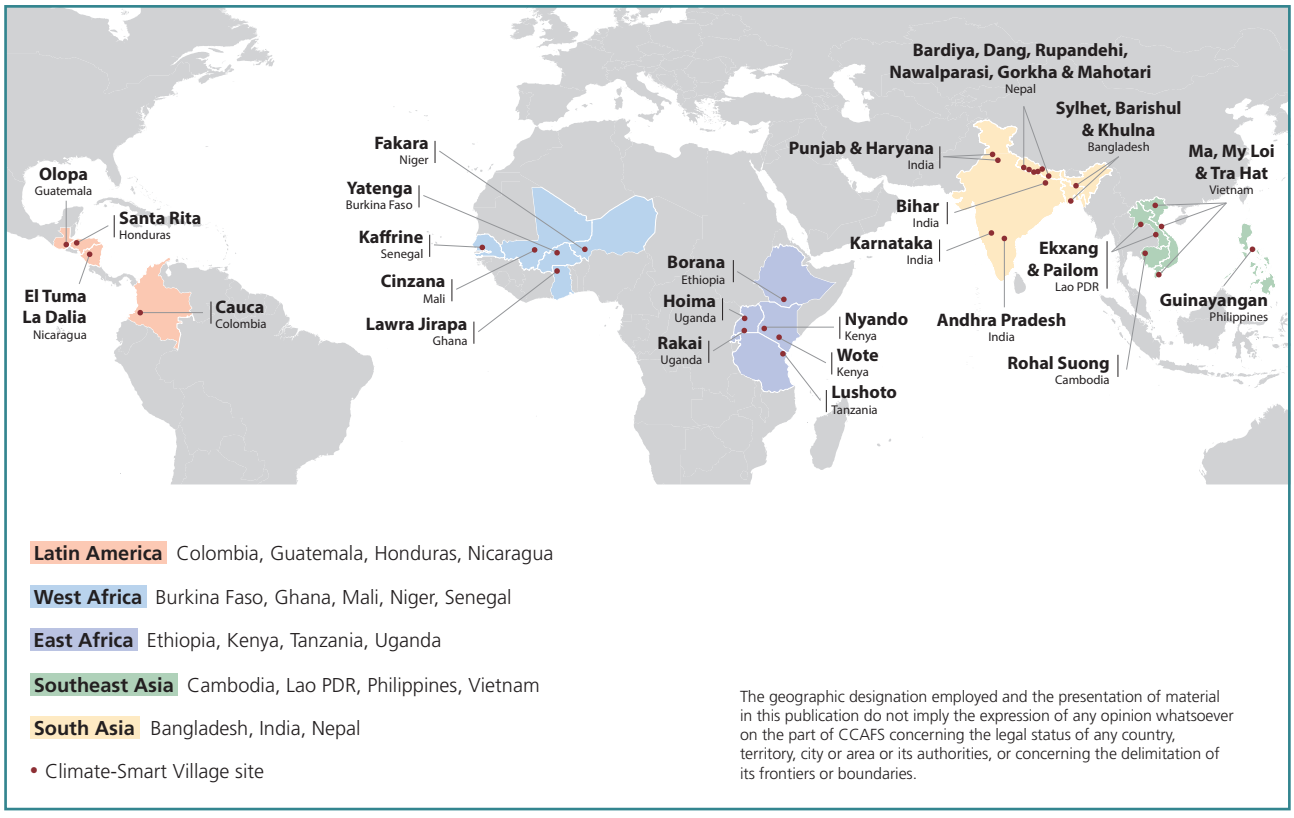

FIGURE 2. Location of the Climate-Smart Villages AR4D sites. This shows the CCAFS-facilitated CSV sites. There are also partner-facilitated CSV sites, numbering in their hundreds, where partners bring together various climate-smart solutions.

Climate-smart interventions

The options tested as part of the CSV research agenda for dealing with climate change and variability include: **weather-smart activities** (weather forecasts, climate-informed agro-advisories, weather insurance, climate analogues as a tool for forward planning, strategies to avoid maladaptation), **water-smart practices** (aquifer recharge, rainwater harvesting, community management of water, laser-land leveling, micro-irrigation, raised-bed planting, solar pumps), **seed/breed smart** (adapted varieties and breeds, seed banks including community-based activities), **carbon/nutrient-smart practices** (agroforestry, minimum tillage, land use systems, livestock management, integrated nutrient management, biofuels) and **institutional/market smart activities** (cross-sectoral linkages; local institutions including learning platforms or farmer-to-farmer learning and capacity development), contingency planning, financial services, market information, gender equitable approaches, and off-farm risk management strategies (Figure 3).

There is **no fixed package** of CSA interventions to be tested however **or a one-size-fits-all approach**. Interventions selected differ based on the region, its agro-ecological characteristics, level of development, capacity, and interest of farmers and the local government.

Theory of Change (ToC) and strategic partnerships

Significant investment is becoming available for scaling CSA, and a pipeline of tested CSA options that can be adapted to different site-specific conditions needs to be developed to maximize value for money of CSA-related finance.

The CSV approach is focussed around two main hypotheses. CSVs will generate evidence of CSA effectiveness at local scales (H1) and inform appropriate incentives and scaling strategies to generate greater CSA investment and outcomes (H2).

- *H1:* Context-specific knowledge on the impacts of practices, technologies, business models and information systems on CSA-related outcomes as well as on their cost-effectiveness compared to current practice, leads to adoption of CSA at the local level.
- *H2:* Improving and applying knowledge on socio-economic, technical, financial and political barriers to incentives for investment in and adoption of CSA options will lead to adoption of CSA at scale.

Each CSV site is established with its own ToC, or linked into a national CCAFS ToC to ensure that case study work builds into plans for scaling. The CCAFS ToC for how large-scale CSA adoption might occur focuses on

Types of climate-smart options

FIGURE 3. Types of climate-smart options that may be tested as part of context specific portfolios in the CSV sites.

Photo from left: N. Palmer (CIAT), C. Schubert (CCAFS), N. Palmer (CIAT), C. Schubert (CCAFS), T. Mwaura (CCAFS).

South-South farmer to farmer exchanges: A powerful mechanism to stimulate knowledge sharing, learning and the ability to innovate in the face of climate variability and change.

empowering national and subnational organizations and key actors with tools and knowledge to identify best-bet CSA options, and to establish incentive systems that scale up CSA. It builds on the theory presented by Lipper et al. (2014) for CSA around four areas for action [7]:

1. Working with partners, especially implementing partners and local organizations, to **build field-based evidence**;
2. Working with partners, especially climate risk management service providers and National Agricultural Research and Extension Systems (NARES), to understand how to **strengthen institutions and services** through better use of climate information (**developing capacity of institutions and services**);
3. Working with partners, particularly policy partners, to understand what works for **coordinated** climate and agricultural **policy and governance**; and
4. Working with partners, particularly the large agencies and companies driving implementation, to understand what works for stable, strategic **investment to reach scale**.

The science of CSVs

Key questions addressed in the CSV approach include:

- What are the relative synergies and trade-offs of different CSA portfolios in terms of productivity, adaptation and mitigation outcomes and their context-dependencies?
- What are the gender-, social-, health- and nutrition dimensions of promising CSA options?
- How does a development agency target and adapt CSA practices (specific or combinations) for increased synergies and improved adoption?
- What are the appropriate local-level enabling conditions required to increase CSA investment and enhance adoption of technologies and practices, and how might policy, finance and institutional innovations be designed to out-scale effectively?
- How do we know if CSA is effective and for whom?

Research questions in any particular CSV may be differently phrased to accommodate stakeholder input into the research process, and particular CSVs may have additional context-specific questions important to local stakeholders. Nonetheless, there is sufficient commonality in the key questions across CSVs in order to build cross-CGIAR Research Program (CRP) lessons.

Research outputs in CSVs include:

- Site-specific CSA options (e.g. climate-adapted germplasm, conservation agriculture, agroforestry, aquaculture, water harvesting, soil and water management options, livestock nutrition), including transformative options, and models of integrated crop-livestock-tree systems for increasing resilience. These would be tested and evaluated on farm, and would have been examined for gender implications and potential for scaling;
- Improved understanding of farmer and stakeholder perceptions along the value chain of CSA options, and assessments of the conditions for success and failure of interventions;
- Simulation of CSA options under different climate and socio-economic scenarios for informed decision-making.
- Empirical and big data analysis of climate-specific management options, generating climate-sensitive extension schemes and climate-site-specific advisory systems (including precision agriculture) for farmers.
- A farmer citizen science approach for adapting CSA options to the local context and scaling;
- Enhanced understanding of the institutional options that would enable scaling of CSA.

Steps in the CSV approach

In establishing a CSV AR4D site, the very first step is to build trust and partnerships amongst diverse stakeholders; and to get agreement and buy-in to a common approach. Once partners have agreed on the establishment of a CSV site, the major steps include:

1. Baseline assessment, including climate risk analysis and gender and social inclusion analysis;
2. CSV design: Identification and prioritization of climate-smart technologies, practices and services based on biophysical, socio-economic, gender, policy and institutional context; also considering possible synergies and trade-offs amongst individual activities;
3. Creating evidence: Evaluation and development of portfolios of climate-smart interventions (e.g. providing value-added weather services to farmers, promoting weather-based insurance, building capacity in climate change adaptation and facilitating community partnerships for knowledge sharing);
4. Scaling: This involves scaling up through policies and institutions, and scaling out to large areas through farm-to-farm and ICT-based approaches (Figure 4).

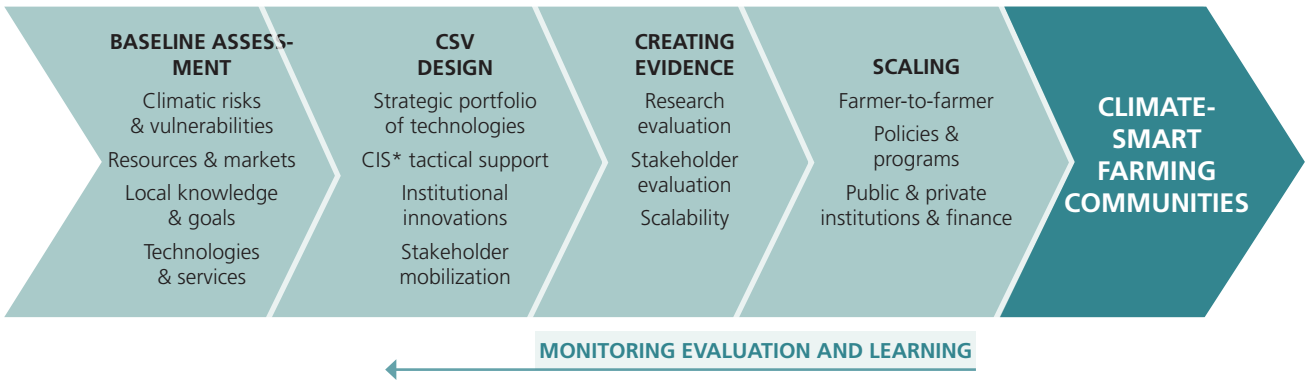

FIGURE 4. Steps for the implementation of the CSV AR4D approach. Implementation steps are based on stakeholder engagement and seldom follow a simple linear model. *Climate Information Services (CIS)

Scaling mechanisms

Scaling mechanisms tested across the regions include:

- "Horizontal" scaling (Scaling out) of climate-smart options: CSVs provide demonstration sites for farmer-to-farmer learning (often via self-help groups or producer organizations) and/or enable local promotion of CSA options through local government plans, programs and policies or through private sector business models.
- "Vertical" scaling (Scaling up): CSV research and lessons learned provides evidence for the efficacy of practices, technologies, services, processes and institutional options and is thus able to: influence large-scale CSA investment plans; promote mainstreaming of institutional changes; and/or informing policy instruments.

Engagement of the State Government of Haryana, INDIA

In Haryana, the state government has been actively involved in the CSV AR4D sites being implemented – right from the inception phase, leading to a sense of ownership. They have been key in government endorsements of approaches and plans; and have led to policy changes to promote CSA portfolios.

The Haryana government is now promoting hundreds of CSVs. These CSVs – not to be confused with the CCAFS AR4D sites – are villages where they promote integrated actions for climate change with a strong participatory approach. This example illustrates the need for bringing government stakeholders on board from the outset.

Emerging success stories

To illustrate what can be achieved in the CSV approach, we give two examples: "**Scaling climate information services in Kaffrine, Senegal**" and "**Engagement of the State Government of Haryana, India**" (see boxes below).

Scaling climate information services in Kaffrine, SENEGAL

Grounded on a highly participatory approach and the establishment of a national and local level multi-stakeholder platforms that provide an open space for dialogue, CCAFS and its partner the National Meteorological Agency (ANACIM) have developed and facilitated access to climate forecasts and agricultural advice for farmers.

The platform consists of farmers, climatologists, agricultural scientists, extension agents, non-governmental organizations, and the media. The forecasts and advisories have resulted in changes in: purchases of inputs, labour allocation, sowing dates and crop varieties.

The pilot project was implemented in the Kaffrine CSV in 2011 and has now been expanded to Diourbel, Fatick, Louga and Thies regions and is currently been scaled out to the rest of the country through a partnership with the Union des Radios Associatives et Communautaires du Sénégal (URACS), an association of 82 community-based radio stations, reaching about 7 million rural people across Senegal.

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