# KNOWLEDGE ON climate SMART AGRICULTURE


## Climate-Smart Agriculture: What is it? Why is it needed?

In the next 20 years, increasing the productivity and incomes from smallholder crop, livestock, fishery and forestry production systems will be key to achieving global food security. Most of the world's poor are directly or indirectly dependent on agriculture, and experience has shown that growth in agriculture is often the most effective and equitable strategy for reducing poverty and increasing food security. Climate change multiplies the challenges of achieving the needed growth and improvements in agricultural systems, and its effects are already being felt. Climate-Smart Agriculture (CSA) is an approach to dealing with these interlinked challenges in a holistic and effective manner. This brief is intended to give an overview of the approach and its main features, as well as answers to frequently asked questions about it.

### *1. What is climate-smart agriculture?*

Climate-smart agriculture is an approach to help guide actions to transform and reorient agricultural systems to effectively and sustainably support development and food security under a changing climate. "Agriculture" is taken to cover crop and livestock production, and fisheries and forest management. CSA is not a new production system – it is a means of identifying which production systems and enabling institutions are best suited to respond to the challenges of climate change for specific locations, to maintain and enhance the capacity of agriculture to support food security in a sustainable way.

The concept was first launched by FAO in 2010 in a background paper prepared for the Hague Conference on Agriculture, Food Security and Climate Change (FAO, *"Climate-Smart" Agriculture Policies*, Practices and Financing for Food Security, Adaptation and Mitigation. 2010), in the context of national food security and development goals, to tackle three main objectives (FAO, *Climate-Smart Agriculture Sourcebook*. 2013):

- Sustainably increasing food security by increasing agricultural productivity and incomes;
- Building resilience and adapting to climate change
- Developing opportunities for reducing greenhouse gas emissions compared to expected trends

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### 1.1 Sustainably increasing agricultural productivity and incomes

Around 75% of the world's poor live in rural areas and agriculture is their most important income source. Experience has shown that growth in the agricultural sector is highly effective in reducing poverty and increasing food security in countries with a high percentage of the population dependent on agriculture (World Bank, *World Development Report*. 2008). Increasing productivity as well as reducing costs through increased resource-use efficiency are important means of attaining agricultural growth. "Yield gaps" indicating the difference between the yields farmers obtain on farms and the technically feasible maximum yield, are quite substantial for smallholder farmers in developing countries (FAO, *The State of Food and Agriculture*. 2014). Similarly, livestock productivity is often much lower than it could be. Reducing these gaps by enhancing the productivity of agro-ecosystems and increasing the efficiency of soil, water, fertilizer, livestock feed and other agricultural inputs offers higher returns to agricultural producers, reducing poverty and increasing food availability and access. These same measures can often result in lower greenhouse gas emissions compared with past trends.

### 1.2 Building resilience to climate change

According to the recently released fifth assessment report of the Intergovernmental Panel on Climate Change (IPCC), the effects of climate change on crop and food production are already evident in several regions of the world, with negative effects more common than positive ones, and developing countries highly vulnerable to further negative impacts from climate change on agriculture (IPCC Summary for Policymakers. IPCC *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects,* eds Field, C. B. *et al.* Cambridge Univ. Press, 2014). In the medium and long term, average and seasonal maximum temperatures are projected to continue rising, leading to higher average rainfall, but these effects are not evenly distributed. With globally wet regions and seasons getting wetter and dry regions and seasons getting drier (Porter, J. R. *et al*. in *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects,* eds Field, C. B. *et al*. 485–533. IPCC, Cambridge Univ. Press, 2014).

There is already an increase in the frequency and intensity of extreme events, such as drought, heavy rainfall and subsequent flooding and high maximum temperatures. The increased exposure to these climate risks, already being experienced in many parts of the world, poses a significant threat to the potential for increasing food security and reducing poverty amongst low-income agricultural-dependent populations.

It is possible to reduce and even avoid these negative impacts of climate change – but it requires formulating and implementing effective adaptation strategies. Given the site-specific effects of climate change, together with the wide variation in agro-ecologies and farming, livestock and fishery systems, the most effective adaption strategies will vary even within countries. A range of potential adaptation measures have already been identified which can provide a good starting point for developing effective adaptation strategies for any particular site. These include enhancing the resilience of agro-ecosystems by increasing ecosystem services through the use of agro-ecology principles and landscape approaches. Reducing risk exposure through diversification of production or incomes, and building input supply systems and extension services that support efficient and timely use of inputs, including stress tolerant crop varieties, livestock breeds and fish and forestry species are also examples of adaptation measures that can increase resilience.

### 1.3 Developing opportunities to reduce greenhouse gases emissions compared to expected trends

Agriculture, including land-use change, is a major source of greenhouse gas emissions, responsible for around a quarter of total anthropogenic GHG emissions. Agriculture contributes to emissions mainly through crop and livestock management, as well as through its role as a major driver of deforestation and peatland degradation. Non-$CO_2$ emissions from agriculture are projected to increase due to expected agricultural growth under business-as-usual growth strategies.

There is more than one way agriculture's greenhouse gas emissions can be reduced. Reducing emission intensity (e.g. the $CO_2$eq/unit product) through sustainable intensification is one key strategy for agricultural mitigation (Smith, P. *et al*. in *Climate Change 2014: Mitigation of Climate Change* Ch. 11. IPCC, Cambridge Univ. Press, 2014). The process involves implementation of new practices that enhance the efficiency of input use so that the increase in agricultural output is greater than the increase in emissions (Smith, P. *et al.* in *Climate Change 2014: Mitigation of Climate Change* Ch. 11. IPCC, Cambridge Univ. Press, 2014).

Another important emissions reduction pathway is through increasing the carbon-sequestration capacity of agriculture. Plants and soils have the capacity to remove $CO_2$ from the atmosphere and store it in their biomass – this is the process of carbon sequestration. Increasing tree cover in crop and livestock systems (e.g. through agro-forestry) and reducing soil disturbance (e.g. through reduced tillage) are two means of sequestering carbon in agricultural systems. However, this form of emissions reduction may not be permanent – if the trees are cut or the soil plowed, the stored $CO_2$ is released. Despite these challenges, increasing carbon sequestration represents a huge potential source of mitigation, especially since the agricultural practices that generate sequestration are also important for adaptation and food security.

## 2. Synergies and Tradeoffs between CSA objectives

A fundamental issue for the CSA approach is identifying and addressing tradeoffs that arise between the three objectives and developing context-specific and pragmatic approaches to dealing with them. When taken together, the three objectives imply a need for more resource-efficient and resilient systems (FAO, *Climate-Smart Agriculture Sourcebook*. 2013). The CSA approach is designed to identify and enable implementation of strategies that explicitly account for each of the objectives, reducing tradeoffs and enhancing synergies between them, across varying conditions.

The scale at which CSA actions are considered is also important in defining CSA. The question posed is usually whether CSA implies that the activities undertaken by every farmer in every field should generate food security, adaptation and mitigation benefits ("triple wins"). The short answer to this question is no. A CSA policy for agricultural development includes various interventions (on practices, delivery systems/institutions and policies) at various scales (community, landscape, agro-ecological zone, regional and national). The need for adaptation and potential for mitigation in relation to achieving food security/development vary amongst these activities and scales, and thus the potential to capture synergies. The CSA approach recognizes the priority of food security in agricultural strategies of developing countries, integrates adaptation required to maintain and enhance food security, as well as the degree to which mitigation co-benefits can be generated at national, regional and global levels.

Finally, CSA recognizes that a key issue to resolve in thinking about synergies, and ultimately in accessing climate finance, is how the baseline or reference level will be defined in order to measure progress on any of the objectives.

For those developing countries seeking international support for agricultural adaptation/mitigation, the way in which achievement of objectives is measured, would have to be in line with international procedures agreed by the UNFCCC or the funding mechanism in question, such as the Adaptation Fund, the Global Environment Facility and the Green Climate Fund. For those not seeking international support, national policy will tend to guide action and measurement as formulated in instruments such as national climate change and agricultural policies, strategies and investment plans.

## 3. What does the CSA approach involve?

The CSA approach is still relatively new and under continuous development. The approach involves tools to identify climate-smart sustainable agricultural growth pathways for given locations and situations. CSA aims to identify technical and economic principles that can be applied in the development of climate-smart action options that are embedded in national and local institutional frameworks.

**A. The CSA readiness approaches include four major types of actions:**

1. ***Expanding the evidence base*:** One of the key pieces of information that agricultural policy makers need, and often lack, are the current and near-future projected effects of climate change in their country, and the implications for the agricultural priorities and programs of the country. Factors such as increasing rainfall variability, delayed onset of the rainy season, and increasing seasonal maximum temperatures, are all examples of climate change impacts that are already being realized and different responses are needed for effective adaptation for each of these. Identifying effective adaptation options to maintain and enhance the capacity of agriculture to generate productivity and income increases needed for food security is thus one fundamental objective of the CSA evidence base. Estimates of the potential reduction in greenhouse gas emissions (or increased carbon sequestration) that adaptation strategies can generate is a second key objective of the evidence base, as this is essential for accessing climate finance for mitigation. These two elements of the evidence base can be used to develop recommendations on the type of practice or change in agricultural systems needed for CSA. The final major objective of the evidence base is to generate information on the barriers to adoption of practice changes identified as CSA priorities, as well as the policy and institutional responses that can be made to overcome them.
2. ***Supporting enabling policy frameworks:*** Implementing CSA requires the development of supportive policies and plans, as well as coordination across processes and institutions responsible for agriculture, climate change, food security and land use, to avoid contradictions or inconsistencies. This is accomplished through dialogue amongst key stakeholders in a participatory process to build consent in identifying and managing trade offs and capturing any synergies across major policy efforts for agriculture and climate change. Inclusion of farmers (women and men), resource managers and value-chain participants, including the private sector is crucial.
3. ***Strengthening national and local institutions:*** Building the capacity of national policy makers to participate in global-level policy fora on climate change and agriculture, and to reinforce their linkages with local-level governance structures contributes to an enabling environment for coherent action across levels and the two policy

areas. Strengthening local institutions to empower, enable and motivate farmers is essential. Emerging evidence indicates that there are five important enabling actions needed from local institutions to support CSA. These are: 1) facilitating the capacity of farmers (and herders, fishers and foresters) to work together in a coordinated fashion to manage land and water resources across landscapes, through land tenure systems, water-use groups, farmer's organizations etc. 2) increasing the flow of information between national and local levels – through institutions such as extension and weather information services, 3) increasing access to credit for investing in sustainable land and water management through micro-finance institutions, 4) improving timely access to the type and amount of inputs (such as seeds and inorganic fertilizer) needed for enhancing efficient use in agricultural production systems, and 5) supporting effective risk management at the farm level through coordinated actions that may include insurance, safety nets, income diversification and storage capacity.

4. ***Enhancing financing options***: Transition to climate-smart agricultural development pathways requires new investments. A key opportunity for CSA, particularly among the international community, is to unlock both agriculture and climate finance for institutional change at the national and local level, including improving access to capital, insurance products and other safety nets among smallholder farmers. Climate finance represents a significant additional source of finance to the agricultural sector which faces a considerable funding gap. New climate financing instruments are currently under development, primarily the Green Climate Fund which could reach financing levels of $100 billion/year from 2020, if commitments are realized. Moreover, there is an increasing tendency of Official Development Assistance to take into account climate change in financing decisions. Working with financing sources to develop mechanisms and procedures that support the capacity of developing countries to measure, report and credit mitigation co-benefits they can realize through their agricultural development and adaptation activities is an important enabling measure that has a prominent role in the CSA approach. Instruments such as the nationally appropriate mitigation actions (NAMAs) and National Adaptation Plans (NAPs) are the key national policy instruments for defining national priorities for adaptation and mitigation that can be expected to play an important role in linking to national and international sources of finance. Ideally, these should be aligned with national agricultural investment plans to facilitate the linkages between agricultural and climate finance to support CSA.

**B. What are we likely to see on the ground with CSA?**

Different elements of climate-smart agricultural systems may include:

1. ***Management of farms, crops, livestock, aquaculture and capture fisheries***: What is most "climate-smart" depends strongly on biophysical and socio-economic contexts. Options for crops include switching varieties or species, changing cropping calendars, and nutrient management such as micro-dosing, mulching or organic fertilizers application. Options for livestock include improving the quality of pastures and feed, changing herd management, and specific responses to heat stress. In fisheries, changes in locations, quotas and species are all relevant, while in aquaculture, combining species and managing temperature are climate-smart options. Overall farm-management options include diversification of production, integrated crop-livestock systems, agroforestry, restoring organic soils, limiting soil erosion, energy efficiency, use of biomass fuels, integrated pest management, and enhancing management of water resources and irrigation.

2. ***Landscape or ecosystem management:*** CSA also encourages looking at agricultural systems in the context of larger landscapes and ecosystems, so as to better understand the inter-linkages between agricultural production and ecosystem services within and external to agro-ecosystems. The role of water-resource management and land-use change in food security, adaptation and mitigation across landscapes is an important element. Regulating ecosystem services such as hydrology or biodiversity, including in the soil, can generate production, adaptation and mitigation co-benefits. Multiple objective forest management can generate benefits for food security, development, adaptation to climate change (microclimate), water management, soil protection, agrobiodiversity protection (pollinators) and assist with carbon storage and greenhouse gas emission reduction.

3. ***Services for farmers and land managers***: Increasing adaptive capacity of farmers, herders, fishers and foresters requires increasing a range of services. These include climate information services, such as seasonal forecasts or early-warning systems, advisory services that link climate information to agricultural decisions, and financial services such as credit and insurance. Social protection as well as new index-based weather insurance products can increase the ability of smallholders to invest in agriculture despite increasing climate variability.

4. ***Changes in the wider food system:*** Agricultural production is not the only focus of adaptation and mitigation actions that support food security and livelihoods. Across the value chain, innovations in harvesting, storage, transport, primary and secondary processing, retail and consumer activities are essential elements of the enabling and incentivizing environment needed for CSA.

**4.1. How is CSA related to sustainable agriculture? Are they the same thing?**

The CSA approach builds upon the concepts, technologies and experience of sustainable agriculture, but explicitly focuses on integrating the impacts of unprecedented climate change. The CSA approach involves assessing sustainable agricultural practices to determine if and how climate change may affect their intended outcomes of improving livelihoods, environmental management and adoption/disadoption of agricultural practices. CSA involves building recommendations and possible options for reorienting existing sustainable agricultural strategies to respond to changing conditions, as well as to provide innovative policy and financing tools to implement them.

**4.2 Does CSA promote agroecological practices?**

As mentioned above, a more efficient use of resources is key to improving productivity and farm incomes, while reducing emissions. Agroecological principles and practices by enhancing ecosystem services to increase sustainably productivity can play a key role. Moreover, by strengthening agro-ecosystems, they also contribute to their resilience.

**4.2. Does CSA promote GMOs?**

No, CSA does not promote GMOs. The CSA approach involves the development of a set of feasible options for addressing the challenges of climate change for specific locations and conditions in conjunction with key stakeholders including national governments, agricultural research and development institutions at international and national levels, and households/communities, civil society and the private sector at the local level. The use of GMOs is determined by national policies in each country.

**4.3. Is financing from carbon markets a key element of CSA?**

No, carbon markets are only a very small part of the potential climate finance that can be channeled to agriculture with very limited potential for the smallholder sector. However, linking climate finance to agricultural investments for food security/development is a key element of CSA. Climate finance includes financing for both adaptation and mitigation, and it can be channeled through public sector financing such as bilateral donors, multilateral financial institutions, the Global Environment Facility, the Green Climate Fund, and through nationally-developed instruments such as National Climate Change Funds, national climate change and agricultural investment plans and more specific instruments such as National Adaptation Action/National Adaptation Plans and Nationally Appropriate Mitigation Actions.

**4.4. Does CSA impose mitigation requirements on developing country agriculture?**

No. CSA does not advocate use of a narrow carbon lens to address agricultural and climate change challenges. The CSA approach calls for a strong focus on identifying potential synergies between food security, adaptation and mitigation, as well as estimating costs and tradeoffs between mitigation and other objectives to better inform countries on the potential for capturing mitigation co-benefits and associated financing. CSA clearly recognizes food security as a priority, integrating needed adaptation and possible mitigation. The CSA approach can support national policy on agricultural mitigation in the broader context of sustainable development, which is still under preparation in most countries.