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Climate Smart Agriculture

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Introduction

Climate-smart agriculture (CSA) is an integrated approach to managing landscapes to help adapt agricultural methods, livestock and crops to the ongoing human-induced climate change and, where possible, counteract it by reducing greenhouse gas emissions, at the same time taking into account the growing world population to ensure food security. Thus, the emphasis is not simply on sustainable agriculture, but also on increasing agricultural productivity. In other words, Climate smart agriculture (CSA) is an approach that helps to guide actions needed to transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate (FAO,2010).

Objectives of CSA

CSA aims to tackle three main objectives. CSA invites to consider these three objectives together at different scales - from farm to landscape – at different levels - from local to global - and over short and long time horizons, taking into account national and local specificities and priorities.

1. Sustainably increasing agricultural productivity and incomes
2. Adapting and building resilience to climate change and
3. Reducing and/or removing greenhouse gas emissions, where possible.

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. 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.

2. Adapting and 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. 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. 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.

3**. Reducing and/or removing greenhouse gas emissions, where possible**

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. 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.

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 ploughed, 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.

Main elements of climate smart agriculture

CSA is not a set of practices that can be universally applied, but rather an approach that involves different elements embedded in local contexts. CSA relates to actions both on-farm and beyond the farm, and incorporates technologies, policies, institutions and investment. Different elements which can be integrated in climate-smart agricultural approaches 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, agro biodiversity 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

Actions that are needed to implement climate-smart agriculture

Governments and partners seeking to facilitate the implementation of CSA can undertake a range of actions to provide the foundation for effective CSA across agricultural systems, landscapes and food systems. CSA approaches include four major types of actions:

1. Expanding the evidence base and assessment tools to identify agricultural growth strategies for food security that integrate necessary adaptation and potential mitigation
2. Building policy frameworks and consensus to support implementation at scale
3. Strengthening national and local institutions to enable farmer management of climate risks and adoption of context-suitable agricultural practices, technologies and systems
4. Enhancing financing options to support implementation, linking climate and agricultural finance

Methods and Assessment of Climate-smart agriculture:

The Food and Agriculture Organization has identified several tools for countries and individuals to assess, monitor and evaluate integral parts of CSA planning and implementation by the FAO. Some of these tools include

1. Modelling System for Agricultural Impacts of Climate Change (MOSAICC): This modelling system helps countries conduct inter-disciplinary climate change impact assessment on agriculture through simulations.
2. Global Livestock Environmental Assessment Model (GLEAM): This simulates the interaction of activities and processes involved in livestock production (milk and meat production) and the environment. The model is designed to evaluate several environmental impact categories, such as greenhouse gas emissions, nutrient and water use, land use and land degradation and biodiversity interactions.
3. Sustainability Assessment of Food and Agriculture (SAFA) system: The guidelines of SAFA is a holistic and inclusive framework for sustainability performance assessment in the food and agriculture sector, including crop and

livestock production, forestry and fisheries. The monitoring and evaluation of activities set baselines, define indicators, measure progress and evaluate successes and setbacks in CSA interventions.

4. Economics and Policy Innovations for Climate-Smart Agriculture (EPIC): The programme works with governments, universities, research centres and other institutional partners in support of their transition to CSA through the use of economic and policy analysis. It does this by identifying and harmonizing climate-smart agricultural policies, impacts analysis, effects, costs and benefits as well as incentives and barriers to the adoption of climate-smart agricultural practices.
5. Ex-Ante Carbon-balance Tool (EX-ACT): This appraisal system was developed by FAO. In the project development phase, it provides ex-ante estimates of the impact of agriculture and forestry development projects, programmes and policies on the carbon-balance.
6. Climate Risk Management (CRM): This integrated approach addresses vulnerabilities to short-term climate variability and longer-term climate change within the framework of sustainable development. The key component of the FAO's CRM involves the provision of weather and climate information products for farmers, fishers and livestock herders for the assessment of risks so as to improve opportunities at local level.
7. Gender mainstreaming: In order to achieve CSA in a socially sustainable way; there is a need to understand the roles, capabilities and responsibilities of men and women to ensure equal access to CSA policies and practices benefits.
8. Monitoring and Assessment of Greenhouse Gas Emissions and Mitigation Potential in Agriculture (MAGHG) project: This project falls under the MICCA programme. Under this project, member countries are supported in gathering and reporting data on GHG emissions in the agriculture, forestry and other land use (AFOLU) sector for UNFCCC related reporting requirements.

Conclusion:

CSA is in line with FAO’s vision for Sustainable Food and Agriculture and supports FAO’s goal to make agriculture, forestry and fisheries more productive and more sustainable. It is an approach for developing agricultural strategies to secure sustainable food security under climate change. CSA provides the means to help stake holders from local to national and international levels identify agricultural strategies suitable to their local conditions.

References:

http://www.fao.org/climate-smart-agriculture/en/

https://ccafs.cgiar.org/climate-smart-agriculture-0

https://www.downtoearth.org.in/coverage/natural-disasters/climate-smart-agriculture-54437