C3 Enabling policy environment for CSA

Overview

Making the transition to climate-smart agriculture demands not only strong political commitments, but also greater coherence, co-ordination and integration among the various sectors dealing with climate change, agricultural development and food security. Scaling up climate-smart agriculture systems to increase the resilience of agricultural communities to the impacts of climate change and decrease greenhouse gas emissions depends heavily on the coherence of national policies and cross-sectoral planning.

To increase policy coherence, there is a need for a systematic and inclusive assessment of current policies and their intended and unintended effects on the set of development objectives prioritized by a country, including the three objectives of climate-smart agriculture: sustainable increases in agricultural productivity and incomes, climate change adaptation in the agriculture sectors, and reduction and removal of greenhouse gas emissions. Depending on the country, the priority among the different climate-smart agriculture objectives may vary. Nevertheless, it is important to identify and enhance synergies between the different policy objectives, address trade-offs and, where necessary, take compensatory actions. Understanding the local and gender-differentiated barriers to the adoption of climate-smart practices as well as the incentive mechanisms that can encourage their adoption can help policy makers design new climate-sensitive policies, where they may be necessary.

Chapter C3-3 presents the latest development in international agreements that influence and guide national climate-smart agriculture planning and implementation. Chapter C3-4 considers the issues related to coherence, coordination and integration that are specific to national climate-smart agriculture policy making. Chapter C3-5 presents examples of various policy measures that can provide incentives for the adoption of climate-smart agriculture practices and technologies, and reduce the barriers that impede their uptake. Examples from several countries highlight the various approaches that have applied in national efforts to promote climate-smart agriculture.

Key messages

- Before designing new climate-sensitive policies, policy makers should systematically assess the intended and unintended effects of a wide range of current international and national agricultural and non-agricultural agreements and policies on the objectives of climate-smart agriculture and take into account other national development priorities.
- New policies to stimulate the adoption of climate-smart agriculture systems should focus on filling policy gaps and contribute to the country-driven capacity development in the short and long term.
- Policy makers should exploit synergies between the three objectives of climate-smart agriculture. However, some trade-offs may have to be accepted and possibly compensated for when achieving synergies is not an effective or efficient option.
- Understanding the socio-economic and gender-differentiated barriers and incentive mechanisms that affect the adoption of climate-smart agriculture practices is critical for designing and implementing supportive policies.
- A key role for the public sector is the creation of an enabling environment that can allow private sector and civil society stakeholders to make timely and well-informed decisions on matters pertaining to sustainable food production, climate change adaptation, and reductions and removals of greenhouse gases.

Introduction

Scope

This module looks at issues related to the coherence between agriculture and climate policies at the global, national and local levels. The main message is the necessity for the public sector to create an enabling policy and legal environment for climate-smart agriculture. Various stakeholders – agricultural producers, producer organizations, non-governmental organizations (NGOs) and the private sector – will take necessary actions only if there is a coherent policy framework in place that supports the achievement of the climate-smart objectives. This module is intended mainly for national, subnational and local policy makers who need guidance for adjusting and harmonizing policies, programmes or action plans (e.g. agriculture, environment and climate policies) to create an enabling environment that promotes a transition to climate-smart agriculture. It is anticipated, however, that other stakeholders in the food system, including research institutions, extension services, NGOs, will benefit from the module as it can help them adjust their operations and advocate for policies that support climate-smart agriculture. Overcoming sectoral constraints and other barriers is a fundamental challenge for achieving objectives related to climate change and food security. At the national, subnational and local levels, new institutional structures and alliances may be needed among private and public stakeholders, for example in policy making, research, extension and financing. This will require participatory system-wide capacity development to strengthen the capacities of individual policy makers and their institutions (see module C1).

Objective

The objective of this module is to provide guidance for identifying and analysing existing international and national policy frameworks and the contribution they make to achieving the objectives of climate-smart agriculture. This can be done using ex ante and ex post policy analysis, and where necessary, adjusting policies and their implementation mechanisms, or designing new policies that provide better support to the scaling up of climate-smart agriculture. An overview of key global agreements can help countries gain a deeper understanding of the connections between international mechanisms and their own policy measures.

Global frameworks shaping national climate policies

In 2015, two major international agreements were reached that will influence policies, strategies and actions from the global to local level in the coming years: the 2030 Agenda for Sustainable Development (see chapter C3-3.2) and the accompanying the Sustainable Development Goals (SDGs), which were adopted in September 2015; and the Paris Agreement on climate change (see chapter C3-3.1), which was reached in December 2015 and ratified in November 2016.

A third global framework that will guide national sustainable development activities is the Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030, which was adopted at the Third World Conference on Disaster Risk Reduction in Sendai, Japan in March 2015 (see chapter C3-3.3). There are other international agreements, which may not have an explicit climate focus, that may nevertheless influence national climate policy objectives.

C3 - 3.1 The 2030 Agenda and Sustainable Development Goals

The 2030 Agenda for Sustainable Development, including the 17 SDGs articulate global objectives that were agreed by United Nation Member States and represent the follow-up to the Millennium Development Goals. The SDGs will shape national development plans over the next 14 years. The agriculture sectors are at the heart of the 2030 Agenda. To make progress toward the reaching the targets laid out in the SDGs, it will be crucial to make agriculture and food systems more sustainable, which will include reducing food losses and waste. This can be done by improving management practices in crop and livestock production, forestry and fisheries and aquaculture, and by encouraging behaviours in consumers that support sustainable climate-smart development. A key aspect in the implementation of Agenda 2030 will be establishing a country-driven and country-owned development process, which can be achieved by adopting a system-wide and integrated approach to capacity development. Climate-smart agriculture can help achieve many of the SDGs, including:

- SDG 1 - 'End poverty in all its forms everywhere';
- SDG 2 - 'End hunger, achieve food security and improved nutrition and promote sustainable agriculture';
- SDG 12 - 'Achieve sustainable production and consumption';
- SDG 13 - 'Take urgent action to combat climate change and its impacts'; and
- SDG 15 - 'Sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss'.

Progress in several other SDGs is required to support the transition to climate-smart agriculture. Because of these interdependencies, the 2030 Agenda recognizes that it is not possible to address the challenges associated with food security, rural livelihoods and the sustainable management of natural resources in isolation. An integrated cross-sectoral approach is required, which would involve a range of activities, including greater cooperation in collecting and harmonizing data.

C3 - 3.2 The Paris Agreement supports national efforts to achieve climate-smart agriculture

The Paris Agreement on climate change recognizes “the fundamental priority of safeguarding food security and ending hunger, and the particular vulnerabilities of food production systems to the adverse effects of climate change”. It also reaffirms the important role of land use, land-use change and forestry in mitigating climate change (FAO, 2016a).

The Intended Nationally Determined Contributions (INDCs), which were submitted by the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), are the foundation of the Paris Agreement. The

INDCs outline the national roadmaps for addressing climate change. They become Nationally Determined Contributions (NDCs) when the UNFCCC Party officially ratifies the Paris Agreement. The NDCs have to be reviewed every five years and as time goes by will ideally become more ambitious in their political commitment and specific actions.

A FAO analysis of the INDCs shows that countries have accorded the agriculture sectors a prominent role in their climate change actions. As of July 2016, 189 countries (190 UNFCCC Parties) had submitted a total of 161 INDCs and 22 NDCs. All 189 countries outline mitigation contributions in general, and 168 countries specify targets or actions related to crop and livestock production, land use, land-use change and forestry. In addition, 93 percent of developing countries included adaptation in the agricultural sectors in their INDCs. Vulnerability to long-term climate change and climate variability, including extreme events, such as droughts and floods are mentioned by 126 countries (FAO, 2016c). Overall, the majority of least developed countries cite extreme events as being among their most immediate concerns. Developed countries identify long-term hazards, such as increased temperatures, as a major challenge in their INDCs (FAO, 2016b).

In INDCs, countries often refer to both mitigation and adaptation in the agriculture sectors, which indicates the potential to leverage mitigation-adaptation synergies. In many cases, opportunities for realizing these synergies were explicitly mentioned, with 57 countries endorsing or even prioritizing actions based on the potential synergies between mitigation and adaptation. Several countries refer to concepts, such as climate-smart agriculture, that capitalize on mitigation-adaptation synergies. Specifically, 32 countries, most of them in sub-Saharan Africa, explicitly mention climate-smart agriculture (FAO, 2016b). Uruguay has noted that as a result of its 2010 climate-smart agriculture policy, the country will continue to make efforts to build a more efficient, resilient and low-carbon cattle farming sector, by introducing new technologies and incorporating successful experiences gained by other countries with similar characteristics (FAO, 2010; 2016b).

The targets and objectives outlined in NDCs need to be translated into actions on the ground. To build upon potential synergies and avoid maladaptations in this process, policy coherence within and across all the agriculture sectors is of high importance. Improving policy coherence also needs to be linked with an integrated and system-wide capacity development process (see module C1). It is also crucial to integrate climate change considerations associated with the agriculture sectors and food security and nutrition, such as land and water management, into policies related to disaster risk reduction and social protection.

UNFCCC instruments link climate change contributions to concrete national actions.

Countries can deliver their determined adaptation and mitigation contributions through various means. A series of instruments – National Adaptation Programmes of Action (NAPAs), National Adaptation Plans (NAPs) and Nationally Appropriate Mitigation Actions (NAMAs) ¬– has been established under the UNFCCC for linking international climate change negotiations and outcomes to concrete national mitigation and adaptation actions. A principle common to all these instruments is that adaptation and mitigation measures should not be treated in isolation from other climate and development goals. This calls for a careful analysis of the potential synergies, co-benefits and trade-offs among the proposed actions. The NAPAs, NAPs and NAMAs can support countries in leveraging international climate finance for making the transition to climate-smart agriculture.

- NAPAs were established by the UNFCCC in 2001 as a dedicated, harmonized, country-led instrument for least developed countries. NAPAs identify priority activities for climate change adaptation that respond to urgent and immediate needs for which further delay could increase vulnerability or lead to increased costs at a later stage. By January 2017, 50 countries had submitted NAPAs to the UNFCCC Secretariat (UNFCCC, 2016a). The majority of priority projects indicated in NAPAs are related to the agriculture sectors and food security (Meybeck *et al*., 2012). Most of these NAPAs belong to the following categories: cross-sectoral activities, including early warning systems, disaster risk management, education and capacity building; the management of ecosystems; water management; crop and livestock production; and economic diversification and income generation.

- All NAPAs are eligible for funding under the UNFCCC Least Developed Countries Fund (LDCF), which is managed by the Global Environment Facility (GEF) for their implementation. By mid-2016, the LDCF had approved funding for 173 NAPA projects and programmes in 49 least developed countries (UNFCCC, 2016b).
- NAPs are considered to be a core vehicle for making progress on adaptation priorities and towards achieving the goals and targets laid out in NDCs. The NAP process, which was established under the Cancun Adaptation Framework in 2010, supports Parties to the UNFCCC to develop and implement strategies and programmes that address medium- and long-term adaptation needs. NAPs can build upon the NAPAs. At the national level, the formulation and implementation of NAPs, which is part of ongoing adaptation and resilience building, are often done within a wider climate change response that may also include disaster risk reduction and climate change mitigation. NAPs provide an opportunity to address the concerns and needs of the agriculture sectors and agricultural stakeholders in broad national climate adaptation strategies, policies and plans. Adaptation planning requires institutional coordination among the crop and livestock, forestry and fisheries and aquaculture sectors, and also with other sectors that use natural resources, particularly land and water (FAO, 2017). For implementing the adaptation actions, emphasis is placed on integrating climate change considerations and actions into the sectoral policies, plans and programmes in all the agriculture sectors (FAO, 2017). A global programme, the Integrating Agriculture in National Adaptation Plans (NAP-Ag) Programme, led by FAO and United Nations Development Programme (UNDP), supports partner countries by using a country-driven process to identify and address climate change adaptation measures for the agriculture sectors in national planning and budgeting processes through the formulation and implementation of a NAP.
- By August 2017, seven NAPs have been submitted to the UNFCCC by Brazil, Burkina Faso, Cameroon, Kenya, Sri Lanka and Sudan, and the West Bank and Gaza Strip. They all give importance to adaptation in agriculture. In June 2016, the Green Climate Fund (GCF) decided to open new funding window under its Readiness Programme to support the process to formulate and implement NAPs and other adaptation planning processes in developing countries. Through this funding window, the GCF Secretariat provides up to USD 3 million per country.
- NAMAs, as defined by UNFCCC, are prepared by national governments in developing countries to provide for nationally appropriate actions that reduce emissions in the context of sustainable development (UNFCCC, 2016c). NAMAs can be project-based, programmatic, sector-wide, or focused at the policy level (Wilkes *et al*., 2013). As of July 2016, interventions in the agriculture, forestry and other land use sectors were included in approximately 18 percent of all NAMA proposals submitted to the UNFCCC NAMA Registry (UNFCCC, 2016d). Efforts to reduce greenhouse gas emissions in crop and livestock production, forestry, and fisheries and aquaculture, and land use create opportunities to build on the synergies between sustainable development and climate goals, particularly through activities related to sustainable agriculture intensification and improved efficiency in the use of resources. For example, greenhouse gas emissions can be reduced by improving livestock health and diets (see Box C4.1). Other measures that can be used to intensify production and increase the efficiency of resources include improving methods for applying nitrogen fertilizers, alternate wetting and drying of rice paddies, expanding agroforestry and sustainably managing organic and mineral soils (Avagyan *et al*., 2016). All of these measures contribute to increasing agricultural productivity and building resilience to the impacts of climate change.

Box C3.1 Kenya – Aligning agriculture priorities in NAPs, NDCs and national development plans through broad stakeholder engagement

Kenya has been on the forefront of addressing climate change, launching a National Climate Change Response Strategy (NCCRS) in 2010 and a National Climate Change Action Plan (NCCAP) in 2013. The Action Plan outlines adaptation as a priority for the country because of the serious adverse socio–economic impacts climate change is expected to cause and the increasing vulnerabilities of different sectors.

The NAP (2015–2030), whose development started in 2014, is Kenya's first plan on adaptation and covers crop and livestock production, forestry and fisheries. It builds on the comprehensive technical analysis that was carried out to prepare the Adaptation Technical Analysis Reports (ATAR), which were developed as part of the NCCAP.

The aim of Kenya's NAP is to consolidate the country's vision on adaptation, which is supported by macro-level adaptation actions targeting economic sectors and country-level vulnerabilities to enhance long-term resilience and adaptive capacity. The national adaptation planning was informed by a highly participatory process coordinated through the Adaptation Thematic Working Group (TWG) and the NCCAP task force. The process included consultations at national and county levels that involved many different stakeholders, including national government ministries, departments and agencies, county governments, civil society organizations and the private sector. The finalization of the NAP was the first priority action in the ATAR, and the Adaptation TWG was tasked with completing it, and fulfilling the consultation and analytical guidelines as stipulated in the UNFCCC NAP Technical Guidelines. Issues related to gender, vulnerable groups and youth have been outlined and budget estimates allocated. Financial support came from multiple sources, including the United Kingdom's Department for International Development (DFID) through the Strengthening Adaptation and Resilience to Climate Change in Kenya (StARCK+) Project and the Climate and Development Knowledge Network (CDKN). Part of the team that developed the NAP underwent UNFCCC–led NAP capacity building in Ethiopia and Zambia, and received support through the UNDP-FAO NAP-Ag Programme. Representatives from the agriculture sectors participated in the TWG, which ensured that agricultural concerns were incorporated into the NAP. The NAP recognizes the climate-smart approach as the approach through which the agriculture sectors can achieve their adaptation goals. All these developments are addressed in Kenya's INDC, which was submitted in 2015.

Source: Ministry of Agriculture, Livestock and Fisheries of Kenya, 2016

C3 - 3.3 The Sendai Framework for Disaster Risk Reduction

The SFDRR, which builds on the experiences of the Hyogo Framework for Action (2005-2015), recognizes that disaster risk reduction is an important part of efforts to achieve sustainable development and address climate change (see module C5). The actions at the national and global levels that are promoted by the SFDRR fall into four priority areas; gaining a better understanding of risk; strengthening risk governance; investing in resilience; and improving preparedness, response, and recovery. The Framework addresses climate change as one of the drivers of disaster risk and notes that the linkages with the 2030 development agenda and the Paris Agreement offer a unique opportunity "to reduce disaster risk in a meaningful and coherent manner across policies, institutions, goals, indicators and measurement systems for implementation".

By adopting the SFDRR, countries pledged to enhance efforts to strengthen disaster risk reduction and reduce the losses of lives, assets and livelihoods caused by disasters. The endorsement of this new framework was a milestone in shaping the global resilience agenda. From a food security, nutrition and agriculture perspective, the specific innovative elements of the SFDRR include a call for a stronger multisectoral engagement; a tighter focus on preparedness; and a greater role of social safety net mechanisms in the areas of food security and nutrition. The SFDRR also makes direct references to the need for protecting livelihoods and productive assets including livestock, working animals, tools and seeds.

C3 - 3.4 Need for a stronger alignment between the global agendas at the national level

The agriculture sectors offer enormous potential and opportunities to create synergies between activities to addressing climate change, promote sustainable development and reduce the risk of disasters (see also Chapter C3-3.3 and module C5). Recent analyses have demonstrated that there is a high degree of alignment between the SDG targets and the climate actions communicated in the INDCs (Northrop *et al*., 2016). The benefits of aligning disaster risk reduction and climate change policies and strategies to increase resilience, for example, under the climate-smart agriculture agenda, have been acknowledged by an increasing number of countries (see also module C5-5).

The five principles of sustainable food and agriculture endorsed by FAO membership include climate change and disaster risk reduction as key dimensions. These principles, which provide the basis for the policy dialogue and governance arrangements needed at the national level to identify sustainable development pathways connecting the SDGs, various sectors and different stages of value chains, are:

1. improve efficiency in the use of resources;
2. engage in direct action to conserve, protect and enhance natural resources;
3. protect rural livelihoods and improve equity and social well-being;
4. enhance the resilience of people, communities and ecosystems, especially to climate change and market volatility;
5. recognize that responsible and effective governance is essential for the sustainability of both the natural and human systems (FAO, 2014).

Implementing and monitoring the measures that have been undertaken to address climate change, foster sustainable development and reduce disaster risk in an integrated and coherent manner can maximize the impact of investments. Conducting an analysis that maps out potential co-benefits and trade-offs among these various objectives can establish a solid foundation for building a set of national targets that serve all three of these agendas. This analysis can then be used to develop an integrated national implementation plan for reaching these targets, which reflects national priorities and maximizes international and domestic financial resources, including development and climate financing. Participation of all stakeholders is critical, as is strengthening organizational and institutional capacities (see module C1).

National policy coherence for climate-smart agriculture

Making a transition to climate-smart agriculture requires coherency in the range of policies formulated to support the sustainable increase of agricultural productivity and incomes, climate change adaptation and mitigation. Streamlining various policy processes to simultaneously tackle a wide set of objectives, however, is not an easy task. Creating *ad hoc* policies without a systematic policy assessment can be an inefficient way of targeting and achieving climate-smart agriculture objectives. This chapter describes a systematic policy assessment framework to help countries capitalize on synergies, understand the trade-offs between the different climate-smart agriculture objectives, and design appropriate policies that support climate-smart agriculture.

C3 - 4.1 Mainstreaming climate-smart agriculture objectives into national policies

A variety of objectives drive national policy-making processes. Considered and formulated in isolation, policies may result in disconnected actions on the ground. Achieving sustainable development, reducing poverty, developing a 'middle-class' or reducing the dependency on fossil fuels are all worthy examples of development

objectives, but they are not always aligned with other national objectives. Policies are often formulated in sectorial 'silos', but even within a given sector there is a need to harmonize policy objectives. Objectives related to agricultural sustainability are increasingly recognized as a priority in many developed and developing countries. However, the majority of current policies in this area remain focused on achieving gains in productivity and profitability.

This segmented policy approach is partly a result of the parallel policy debates at the national and international levels (see chapter C3-3). Socio-economic plans are often discussed under the umbrella of ministries of economic or social affairs, and environmental plans are discussed at the sectoral level or under the auspices of environmental or natural resources ministries. Finance ministers on the other hand influence fiscal policy and public investment allocations, and central bankers manage exchange rates and money supplies. Also, policy discussions related to climate change have traditionally dealt with climate change mitigation and adaptation as separate issues (Harvey *et al.*, 2014). For instance, at the international and national levels, climate change adaptation and mitigation are often addressed through different processes (see chapter C3-3.2). National actions in these areas are often led by different ministries or institutions, and involve distinct constituencies and funding sources (Locatelli *et al*., 2011).

The disconnect in policy actions also stems from the competition for scarce resources, both natural and financial. The different spatial and temporal scales of the problems that policy makers must address, including climate change, create different implementation incentives. It is Understandable that, given the often limited human resources and current socio-political systems, policy makers prioritize urgent, rather than long-term issues. For instance, to increase food security in places like Saudi Arabia or North India, governments stimulate the use of groundwater for agricultural use, using different incentives schemes. This increases agricultural production, but triggers serious trade-offs between current and future production possibilities. These underground reservoirs are practically non-renewable, and the rapid extraction of groundwater reduces the adaptive capacity of communities that are dependent on this resource.

Policy-making processes are often complex and inflexible. Priority actions may change relatively quickly, but it is not always easy to adjust policies and institutions. The prioritization process is also not always reflected in national development and investment plans, and current legislation may not support the necessary changes the policy makers want to implement.

However, governments are becoming increasingly aware of the need to achieve greater coherence among diverse objectives and national regulatory frameworks. Policy makers’ interests in pursuing a range of development pathways, including the 'Green Economy' (see module A1 and module C7), 'Blue Growth', sustainable development and climate-smart agriculture, reflect the importance of achieving synergies between different objectives. More and more, the three previously distinct development objectives –sustainable development, disaster risk reduction and climate change adaptation and mitigation– are being discussed in unison (see chapter 3.4 and module C5 on disaster risk reduction).

C3 - 4.2 Assessment of policy coherence to increase policy effectiveness

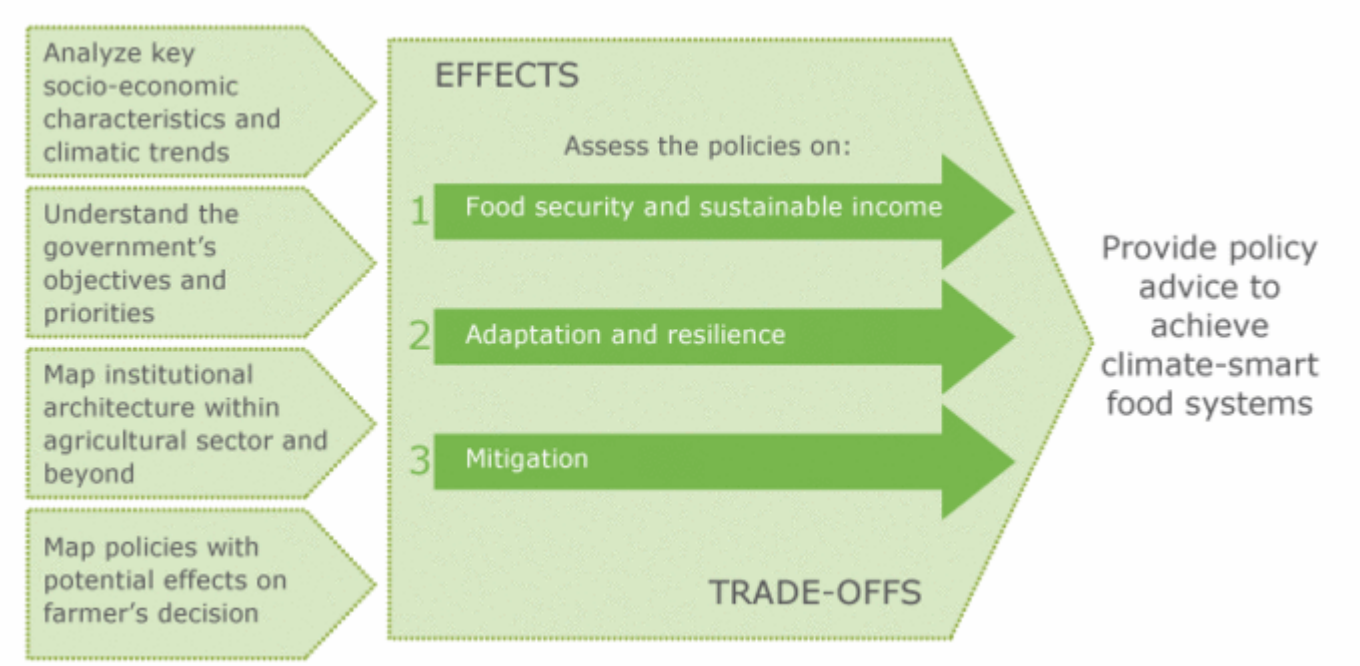
The need to increase policy coherence calls for a systematic assessment of current policies and their effects on the set of objectives prioritized by a country. New policies need to target an increasing number of objectives, and the regulatory frameworks must become more holistic and more complex.

Existing agricultural and non-agricultural policies can have intended and unintended effects on objectives related to sustainable increases in productivity, climate change adaptation and mitigation. It is important to assess whether existing policies provide consistent signals to farmers and whether feedback loops exist that can connect farmers' experiences on the ground with policy makers to improve policy formulation. Only by assessing the impacts of policies on multiple objectives, can decisions be made that harness synergies and lead to acceptable trade-offs. A key principle is to create a policy-making process that is participatory and inclusive of all key stakeholders, where

possible. This approach contributes to more country-owned and sustainable interventions and delivers results that are in line with system-wide capacity development (see module C1).

To achieve these ends, a step-by-step approach can be followed. This approach is based on the work undertaken by the FAO Economic and Policy Innovations for Climate-Smart Agriculture (EPIC) programme (see module C10) and the Organisation for Economic Co-operation and Development (OECD, 2016). Figure C3-1 describes the building blocks of the proposed policy assessment framework.

Figure C3.1. Policy assessment framework



1. A necessary prerequisite for assessing synergies and trade-offs is to understand the key trends related to the impacts of climate change and greenhouse gas emissions in the agriculture sectors, as well as the vulnerability of agricultural systems and farmers in a given country (see module A2 on climate change adaptation and mitigation). It is also advisable to review the key national socio-economic and demographic trends to understand the dynamics that are shaping development. Identifying these key trends can help determine the goals that should be prioritized, and areas where policy action is most needed. Key issues to consider include: climate-related hazards; the levels of exposure, vulnerability, and adaptive capacity of agricultural systems and farmers; the potential risks and impacts on agricultural systems and farmers; and the potential impacts of agricultural and food production systems on climate.
2. An important part of the assessment is to outline the set of objectives and indicators against which the policies are to be evaluated. A sound knowledge of the government's priorities helps create a better understanding of how objectives related to increases in agricultural productivity and income, climate change adaptation and mitigation are prioritized. Countries increasingly stress the importance of adaptive actions against locally-specific climate change related risks and vulnerabilities. However, the respective weight policy makers attribute to the different objectives of climate-smart agriculture vary by country. Policy makers should assess not only if, and to what extent, they have integrated the three objectives of climate-smart agriculture, but also if the prioritization of these objectives corresponds to their international commitments, national development priorities and climate-related risks and impacts. The process of putting the three climate-smart agriculture objectives on the agenda of national policy-making processes is challenging. In general, economic growth and food security objectives have driven policy actions. Recently, many countries have gradually introduced climate change adaptation in policy design and implementation. The extent and levels of this integration differ among countries. This Integration can be reflected in the policy, legal and institutional frameworks; the design and implementation of programmes or projects; or

both. For instance, through NAPs or sectoral plans, climate change adaptation has become institutionalized in many countries. On the other hand, some countries have not yet designed national adaptation plans, but are testing adaptive practices on the ground. Integrating these objectives should take place at different levels (national, subnational and local) and within sectoral plans and programmes.

3. Without coordinated institutions, it is difficult to mainstream the prioritized objectives and ensure that they are translated into actions. The lack of institutional coordination and co-operation, and a segmented institutional approach can lead to trade-offs being made in the outcomes of activities intended to achieve multiple objectives or even a single objective. At the international, regional, national and local levels, countries should assess the challenges involved in strengthening the coherence and coordination among different institutions and within each institutional setting. Based on this assessment, policy makers should determine whether the institutions are working together in an effective and coordinated manner, and through which intra- and inter-institutional mechanisms the coherence and coordination issues could be identified, monitored and addressed. Identifying the key institutions and stakeholders responsible for addressing the three objectives of climate-smart agriculture is the first step in an analysis of institutional effectiveness and coordination. It is essential to analyse how the objectives and the associated strategies and funding mechanisms are integrated and distributed between and within various institutions. Identifying the challenges to institutional coherence, can ultimately contribute to creating synergies between different objectives. Two examples of how a country can ensure that the objectives of climate-smart agriculture are mainstreamed within the institutional setting are provided in Box C3.2.

Box C3.2 Mainstreaming climate-smart agriculture objectives within institutional settings

Example 1 - An institutional shift toward inter- and intra-ministerial collaboration in France

France has prioritized efforts to promote synergies between the three objectives of climate-smart agriculture. It does so by ensuring intra-ministerial collaboration and creating high-level coordination mechanisms between various ministries. It has also restructured intra-ministerial departments to better reflect the prioritization of both economic and climate objectives within various departments.

The French Ministry of Agriculture, Agri-food, and Forests (MAAF) and the Ministry of Environment, Energy, and the Sea (MEEM) are the main ministries responsible for ensuring progress is made toward reaching objectives related to agricultural productivity and climate change mitigation and adaptation. Shared objectives, agreement on indicators, and participation of each Ministry's leadership in the other Ministry's policy-making process are the main tools for collaboration. This takes place under the arbitration of the Prime Minister's Office (Ignaciuk, Coger and Dameron, 2017).

Intra-ministry restructuring and direct collaboration with research, for example with the Institut national de la recherche agronomique (INRA), also reflect the growing attention that has been paid to reducing the climate footprint of the agriculture sectors and increasing their adaptive capacity. In 2008, MAAF merged its previously separate directorates that had been focusing on economic and environmental issues. The newly unified directorate was restructured again in 2015 in an effort to better integrate objectives related to competitiveness, and climate and environmental concerns (Ignaciuk, Coger and Dameron, 2017). The government of France promotes collaboration among ministries and active cooperation with other institutions, including the Economic and Environmental Interest Groups (GIEE) that bring together stakeholders from the fields of research, industry and education to enhance cooperation.

Example 2 - Sustainable institutional support to climate-smart agriculture through inter-ministerial core teams in Malawi and Zambia

Recognizing the importance of institutions to support climate-smart agriculture and address the common

coordination problems across different ministries and research organizations, the EPIC programme has placed special emphasis on supporting partner countries to establish sustainable inter-ministerial coordination platforms, and creating an evidence base for climate-smart agriculture and using it to underpin national policies.

Based on a thorough institutional mapping exercise, a climate-smart agriculture core team was established in each country. The core team included representatives from the Ministry of Agriculture, the Ministry of Environment, national agricultural research organizations, national farmers' unions and most importantly, universities. These core teams have followed the international and regional policy discourse on climate change, agriculture and food security and have continued their work after the project ended. FAO has also supported the attendance of Ministry of Agriculture staff at UNFCCC negotiations along with the Ministry of Environment staff (who regularly attend) to build institutional capacities and create a greater impetus for continued cooperation between ministries. The climate-smart agriculture core team in Zambia is now in charge of maintaining an overview of all national activities related to climate-smart agriculture, including activities connected with the Global and African Alliances for climate-smart agriculture, GCF, GEF and UNFCCC (Arslan *et al*., 2014).

Building on these institutional innovations, the EPIC programme also organized inter-ministerial dialogues in both countries. The dialogue in Zambia brought together staff from the Zambian Ministry of Agriculture and Livestock (MAL) and the Ministry of Land, Natural Resources and Environmental Protection (MLNREP). This dialogue, which was purposely held during the preparation phases of the draft NAP and the draft National Policy on Climate Change (NPCC), contributed to the refinement and improvement of both the NAP and the NPCC. It served to minimize the contradictions and capitalize on the complementarities between the objectives articulated in these two important policy documents.

Monitoring and assessment framework

1. A wide range of international and national regulations, economy-wide policies and sector-specific policies create a diverse set of incentives and disincentives to achieve progress in all three objectives of climate-smart agriculture. Policy makers should map the policies that can have positive and negative incentives for the adoption of climate-smart agriculture practices. Sometimes these incentives and disincentives, which can play a large role in changing the behavior of farmers and other stakeholders in the value chain and determine the adoption rate of climate-smart agriculture activities, may not initially appear to be related to policies. Examples of policy mapping can be found in Ignaciuk, Coger and Dameron (2017), Ignaciuk and Boonstra (2017) and OECD (2017).
2. A systematic assessment of the effects of policies on the three objectives of climate-smart agriculture is often lacking. It is, however, crucial to assess the effects of various policies on all three objectives. Both quantitative and qualitative tools are necessary to shed more light on where the synergies and trade-offs occur. Ideally, governments should rely on evidence that quantifies the extent of these effects. Given the site-specific, evidence-based nature of climate-smart agriculture interventions, the capacity to create this type of evidence needs to be built into national institutions (e.g. universities, national research institutions) to ensure the continuity of an evidence-based policy culture (see also module C10 on step-by step implementation of climate-smart agriculture). Poorly designed policies may not only be ineffective in achieving their explicit objectives, they may also generate unintended negative effects on efforts to reach other objectives (see Box C3.3).

Box C3.3 Perceived versus actual effects of trade policy on food security and climate change adaptation in the Philippines

Trade restriction measures can exacerbate the impacts of climate change by reducing the ability of producers and consumers to adapt. For example, restrictions on rice imports, such as those that have been put in place in the Philippines, are likely to limit farmers' capacity to respond to changes in market signals. These restrictions stimulate the production of rice, even in areas where it is not well suited, rather than motivate farmers to switch to more resilient and competitive crops. The current setting of trade policy in the Philippines induces higher domestic rice prices, which contributes to higher rates of undernourishment and increases the impact of extreme weather events on the prevalence of food insecurity. The inability to reduce production deficits caused by climate events further increases the price of rice. This is especially detrimental for net rice consumers, of which subsistence farmers form a large group.

The trade measures currently in place are working against food security objectives. Based on the quantitative assessment done by the OECD and International Food Policy Research Institute (IFPRI) trade liberalization of rice would decrease the rate of undernourishment by 3.2 percentage points by improving access to rice of poor households (OECD, 2017). While this policy supports the incomes of net rice producers, it taxes the majority of households, who are net rice consumers. In 2012, about 72 percent of all Philippine households and 34 percent of rice producing households were net rice consumers. Thus, despite the policy objective to improve food security by increasing rice self-sufficiency, the current rice trade regime is in fact contributing to a more prevailing state of food insecurity in the Philippines.With more persistent, negative effects of climate change, it is very likely that food insecurity will increase in the future.

Without trade restrictions, trade responses could reduce the trends in undernourishment. The restrictive trade regime driven by the objective of self-sufficiency in rice production also increases the risk of food insecurity in case of domestic crop failures.

Source: OECD, 2017

In some cases, the unintended effects of policies may actually contribute significantly to achieving climate change objectives, and regulations targeting other objectives can also have positive effects on emission reductions. For instance, in the Netherlands, the liberalization of the energy market contributed significantly to meeting the country's greenhouse gases reduction target. Similarly, animal welfare policies, particularly a regulation that obliged pig producers to use anesthesia while castrating piglets, resulted in lower nitrogen emissions in the country (Box C3.4). These examples highlight the importance of taking a more holistic approach to policy analysis when considering climate-smart agriculture. Given the difficulty in assessing every policy in a large number of sectors, it is necessary to prioritize policies based on a consideration of the sectors that are most likely to have an impact on emissions and incentives. This may involve, for example, focusing on policies related to energy, water, livestock, forestry and agricultural inputs.

Box C3.4 Unintended effects of energy and animal welfare policies on emissions reduction in the Netherlands

In the Netherlands, the liberalization of the energy market and the high prices of fossil fuels are behind the notable success the greenhouse horticulture industry has had in reducing its emissions. In 2011, the Dutch hothouse sector consumed 52 percent less energy per unit of production compared with 1990.

Improvements in efficiency were made mainly by changes in cultivation practices, energy conservation, and the use of gas engines in combined heat and power plants. In 2017, approximately 70 percent of the 9 200 hectares of greenhouses in the country produce 10 percent of the electric energy consumed nationally. The impetus to rethink greenhouse horticulture production, specifically its energy use, evolved from the liberalization of the energy market and changes in fuel prices, which at the time the liberalization policy came into affect were high. The higher fuel prices allowed 'green' electricity producers to charge a substantive amount for electricity. Other market considerations, such as a government stimulus that was provided for the 'first movers' into the green energy market also contributed to the changes in greenhouse horticulture production. In addition, agricultural producers in the Netherlands are highly entrepreneurial. With high fuel prices, investments in combined heat and power plants for energy production, and investments in geothermal energy as a source of energy became viable (Ignaciuk and Boonstra, 2017).

Animal welfare policies affect the regulatory environment in the agricultural sector and can have an impact on greenhouse gas emissions. For example, the recent obligations to use anesthesia while castrating pigs resulted in a significant reduction of greenhouse gas emissions. In this case, the industry was faced with a dilemma. The meat from non-castrated pigs can have a particular smell, which is not always appreciated by consumers, but the costs of anesthesia are significant in a very competitive market. Consumers also strongly opposed castration without anesthesia, and this topic was even discussed at the Dutch parliament. Weighing all the pros and cons, the pig industry decided not to castrate pigs for the domestic market. They did however introduce a 'smell' control to the production chain. Non-castrated pigs can more easily absorb minerals, and the industry could reduce mineral-rich feed in the piglets' diets. This, in turn, resulted in much lower levels of phosphorus and nitrogen in their manure. This explains to a large extent why the emissions from pig manure did not increase, despite a significant increase in the pig population (Ignaciuk and Boonstra, 2017).

Policymakers are increasingly facing decisions regarding which trade-offs are acceptable, which ones need to be revised, and what additional policies can be used to correct some of the trade-offs that are caused by the current policy framework. A difficult, but necessary, action is to determine if and when some trade-offs between the three objectives are acceptable. It is ideal, but not always possible to obtain double or triple wins between sustainable increases in productivity and incomes, climate change adaptation and mitigation objectives. Trade-offs between policy objectives can be present, for example, in situations where productivity is prioritized over adaptation or mitigation. A good example of such trade-offs occur when support measures are provided for electricity to pump irrigation water in dry areas. Typically, these measures increase short-term productivity, but over the long term, farmers' resilience may decrease if they are no longer able to withdraw sufficient amounts of water from overdrained reservoirs (FAO, 2011).

Understanding and addressing the many barriers that can prevent the uptake of climate-smart agriculture can help policy makers design effective supportive policies. Some of these barriers are of particular interest to policy makers since overcoming them is vital to achieving policy objectives. Table C3-1 provides a classification of these barriers, with particular attention given to those barriers that can be overcome by different policy initiatives. Chapter C3-4 and module C10 consider these barriers in more detail. Table C3-1. Barriers to the adoption of climate-smart agriculture and differentiated policy responses – based on the experiences of OECD countries.

Table C3.1. Barriers to the adoption of climate-smart agriculture and differentiated policy responses – based on the experiences of OECD countries

Type of barrier	Description	Focus	Suggested role for policy
Farm level			

Type of barrier	Description	Focus	Suggested role for policy
Structural	Inexistent or unclear land tenure	CCA and CCM	Limited policy priority
	Insufficient infrastructure and complementary markets	CCA and CCM	Possible investment in infrastructure
	Farm succession, age and structure	CCA and CCM	Not a policy priority
Economic	Perceived or real negative effects on production	CCM	Communication and education; Improved access to funding; Payments for environmental services
	High cost of adoption	CCA and CCM	Possible investment support for certain measures but evidence is mixed
	Hidden and transaction costs	CCA and CCM	Simplification of regulation
	Limited access to credit	CCA and CCM	Depending on underlying reason, strengthen capacity for public or private finance
Social and cultural	Appropriateness of practices from a cultural and social standpoint	CCM	Communication and participation
Behavioural and cognitive	'Beliefs' about climate change	CCM	Communication and engagement
	Perceived long time horizons, uncertainty and risk management	CCA and CCM	Communication and engagement; Provide certainty where possible (e.g. regulatory certainty)
	Competing pressures on farmer due to increased regulatory requirements	CCA and CCM	Not a policy priority
National and Policy level			
National level	Perceived negative effect on country's competitive position on international markets	CCM	Research and communication
	General level of information and education awareness	CCA and CCM	Targeted engagement policies and demonstration
	Limited extent of climate policy	CCM	Policy should provide regulatory certainty
	Possibility of leakage	CCM	Global governance
	Pre-decided farm management due to industry cooperation	CCA and CCM	Inclusion of environmental and climate issues in national regulation
	Sectoral reporting on greenhouse gas and administrative costs	CCM	International level reform of inventories
Policy related	Non-climate related agricultural policies (e.g. input subsidies, production support, subsidized insurance)	CCA and CCM	Remove policy distortions

Note: CCA (climate change adaptation); CCM (climate change mitigation)

Source: adapted from Wreford, Ignaciuk and Gruere, 2017.

Policy processes and instruments to support climate-smart agriculture

This chapter focuses on the roles of various stakeholders in the national planning and budgeting processes, and the available policy tools and instruments that governments have at their disposal to promote climate-smart agriculture. A variety of examples are presented from Africa, Asia and Latin America, which draw from findings and lessons from work done at the national and regional level.

C3 - 5.1 The role of climate-smart agriculture stakeholders

The decisions that men and women farmers, fisherfolk, pastoralists and foresters make regarding the adoption locally adapted climate-smart agriculture practices and production systems are informed and influenced by a range of factors, including the need to provide for the family, available risk management tools, their level of knowledge, and their access to inputs, financing and markets.

By providing incentives and removing barriers to adoption, governments can create a conducive environment for producers to adopt climate-smart agriculture practices. To establish this enabling environment for farmers and other private sector stakeholders, financing institutions and civil society – all of which have an important role to play in climate-smart food systems ¬– it is also essential for governments to adapt existing policies and regulations; design new coherent policies, strategies, plans and programmes for climate-smart agriculture development where necessary; and allocate adequate resources for their implementation.

Whether climate smart agriculture objectives will be achieved depends in large part on the engagement of civil society (see module C1 on system-wide capacity development). NGOs from the North and the South can contribute to providing extension services and advocating for climate-smart agriculture policies. An example of civil society engagement is the Kenyan agricultural carbon project (2010-2017), which was funded by the World Bank and operated by Swedish NGOs. The project involved over 60 000 smallholder farmers, roughly half of them women, in local formal and informal organizations that promoted group-based learning and implemented improved land management practices. NGOs can also support the testing and scaling up climate-smart agricultural systems. For instance, a local non-profit organization Tefy Saina promoted the development of the System of Rice Intensification (see module B1) in Madagascar (SRI-Rice, 2015). The System of Rice Intensification is a farming practice that has the potential to help farmers adapt to increased rainfall variability resulting from climate change, as the system is better able to withstand drought and can help keep fields from becoming waterlogged (Styger and Uphoff, 2016). NGOs have also initiated or contributed to region-wide scaling up of climate-smart agriculture. In Africa, the five international NGOs (World Vision, Catholic Relief Services, CARE International, Concern Worldwide and OXFAM) played a fundamental role in establishing the Africa Climate-Smart Agriculture Alliance.

The private sector – farmers and co-operatives businesses, other agribusinesses, and financial institutions ¬– can also promote, support and finance climate-smart agriculture. Agribusinesses, with supply chains in developing countries, can buy sustainably produced products and promote the adoption of climate-smart agriculture practices by investing in research, input supply and advisory services. Many private sector companies are also committed to reducing the environmental footprint of their operations and are the principal players in building value chains that connect farmers with markets. For instance, the World Business Council of Sustainable Development (WBCSD) works with its member companies to create a set of solutions that are supportive of sustainable businesses. Currently, climate-smart agriculture is one of WBCSD's focus areas (WBCSD, 2017). Private financing institutions are needed to provide credit, saving opportunities and insurance services to farmers and other value chain stakeholders who want to transform their practices and operating systems. Both large private entities and individuals can contribute indirectly to financing climate-smart agriculture projects. For instance, they can seek to offset their carbon footprints by purchasing emission reductions on the carbon markets, which can help finance

mitigation projects (see more on climate financing in module C4).

C3 - 5.2 Climate-smart agriculture planning and public expenditure

Coordination in climate-smart agriculture planning and budgeting among different agencies at the national and local levels is critical for ensuring coherence in the implementation of national objectives (see module C1). Cross-sectoral climate-smart agriculture policy interventions also need to consider current legislation and regulations and, if needed, incorporated them into existing legal and regulatory frameworks. There are many areas where synergies can be created and where a particular policy instrument or a particular regulation intended to support climate-smart agriculture can serve to meet several other objectives (e.g. an expansion of social safety transfers, sustainable energy development, improved land-use regulations and disaster risk reduction), See modules C7 on social protection and safety nets, module B9 on energy and module C5 on disaster risk reduction.

Each country has its own planning and budgeting cycle. Annual budgets, in which national planning and expenditure frameworks are transposed into the budget allocation for the responsible sectoral agencies, drive the implementation of climate-smart agriculture programmes or action plans. To reach the objectives of climate-smart agriculture, it is critical to align appropriate financing with the agencies responsible for implementing actions. This planning phase should also encompass broader national objectives, including those outlined in NAPAs or NAPs. In addition to the investment budgets, budgets for operations and maintenance also need to be considered. Annual planning in a specific sector is often based on a sectoral medium-term plan, such as a time-bound agriculture sector development plan that sets medium-term goals and priorities.

The annual implementation of sectoral plans is usually supported by a monitoring mechanism, which may include a mid-term review. Monitoring is expected to generate information on the performance of a project or a sectoral or national plan, and provide advice on adjustments to correct the course if necessary. Towards the end of the cycle, an evaluation of the value obtained for the money that was invested will inform the next planning cycle.

The integration of climate change into policy-making processes follows the steps of this cycle. It starts from conducting climate-risk assessments, cost-benefit analyses and prioritization during planning; moves to securing adequate funding for climate-related measures during budgeting; carrying out activities and monitoring the results during implementation; assessing the value added from the climate-smart agriculture interventions during mid-term review; and adjusting the plans if necessary, and evaluating economic, social and environmental benefits towards the end of the planning cycle. This process should be linked with the overall adaptation and mitigation planning.

Many developing countries do not have the information needed to analyse systematically the performance of the expenditures that have been directed to the food and agricultural sectors. Governments often acknowledge the need to gather and process this information on a regular basis in order to make rational, evidence-based policy choices, and that the development of appropriate indicators is an important prerequisite for policy analysis and efficient budgetary processes. Incorporating information about climate-smart agriculture policies is particularly important given the increasing recognition of the role that the agricultural sectors has to play in raising incomes, reducing poverty, improving food security and mitigating climate change.

In many countries, policy making for climate change and the coordination of related actions have been partly decentralized to local governments. In these cases, local development plans, which document the specific development objectives, may also refer to the challenges posed by climate change. This is often typical in areas suffering from acute climate risks that threaten lives and physical security, and where the economy is strongly affected by weather variability. For instance, in Isiolo and Kitui Counties in the dryland regions of Kenya where severe droughts occur every 3-5 years, county adaptation planning committees have been established to coordinate funding for ward-level projects (NDMA, 2014). Broader inter-ministerial action has also been undertaken to address the impacts of climate change in this area. The coordination between national and subnational planning and implementation is essential for fostering coherence among higher-level objectives and local implementation.

Where decentralized government institutions (provinces, regions, districts and counties) have the responsibility for certain elements of climate-smart agriculture planning or implementation, it is important that financial flows from the central government are sufficient to allow these authorities to carry out their responsibilities in ways that are consistent with the law. In a majority of countries, local institutions have the authority over certain areas (e.g. extension services) and have access to their own budget sources (e.g. local taxes) on top of their nationally allocated budgets. In these situations, they are the primary agents determining their own strategy.

In addition to channelling investments to climate-smart agriculture, it is advisable to climate-proof other budgetary decisions and investments in the agriculture sectors. This involves screening the investment plans through a 'climate change lens' to assess the potential impacts of climate change on the achievement of the investment goals (GTZ, 2010). Climate-proofing may also have a mitigation perspective, in that it can be used to assess the potential impact of the investment on greenhouse gas emissions. Specific carbon calculators can support these assessments. For example, the FAO Ex Ante Carbon-balance Tool (Ex Act) is a widely used appraisal system that provides estimates of the impact of agriculture and forestry development projects, programmes and policies on the carbon balance. For additional information, see module C4 on investments and financing. Designing and implementing climate-smart agriculture budgeting processes across various levels of government requires system-wide capacity development. In many countries, decentralization processes have not been accompanied with adequate strengthening of local human resources and institutional capacities (see also module C1 on capacity development).

C3 - 5.3 Levels of interventions for climate-smart agriculture

Financing can be considered at several levels: at the national and international level where the public sector allocates resources to promote the scaling up of climate-smart agriculture (e.g. investment in research, extension and infrastructure); at the household level where farmers' decisions to adopt climate-smart agriculture practices often depend on availability of funds; and at wider private sector level, where companies may want to decrease their environmental footprint of their investments or look for different, more sustainable, markets.

At the national level, policies and actions are needed to reduce the financial risks associated with the shift to climate-smart agriculture practices, lower transaction costs, facilitate monetary transactions, enable access to financial services and facilitate long-term investments. This can be done by promoting mechanisms, such as safe-savings deposits that provide incentives to save, low-priced credit (e.g. joint-liability group lending), and insurance schemes (e.g. index-based weather insurance). The financial needs of smallholder farmers for working capital expenditures (e.g for sustainable mechanization equipment) and quality seeds and planting materials also have to be addressed and supported (FAO, 2016c). By creating a conducive enabling environment, governments can support the development of markets for inputs that can support of climate-smart agriculture.

At the household level, financial incentives need to focus on supporting the adoption of climate-smart agriculture systems and mitigating the potential risks of testing and adopting new practices. There are two main problems related to financing: the difficulties in obtaining upfront investments for implementing climate-smart agriculture practices that often that take time to generate gains in productivity; and the fact that current markets cannot accurately account for the value of the environmental benefits that climate-smart agriculture delivers. To reap the long-term benefits that climate-smart agriculture brings in terms of to increased productivity, greater resilience and enhanced climate change mitigation, farmers and governments need to take advantage of a range of available financing sources (see module C4 on climate-smart agriculture financing and investment). The most successful programmes often blend different sources of funding and include a mix of other policy support measures.

Many private sector companies are committed to reducing the environmental impact of their operations and communicating their results through different instruments, such as the independent and certified Global Reporting Initiative. By taking into account the importance of improving the nation-wide business environment through simple, transparent regulations and tax structures, finance regulations can incorporate climate-smart agriculture requirements into lending conditions. The example of the Brazilian National Development Bank (BDNES) is

illustrative. Using screening guidelines to determine whether loans are consistent with the Equator Principles (a credit risk management framework for determining, assessing and managing environmental and social risk in project finance transactions), the BDNES has improved its environmental and social screening process; developed specific guidelines for sustainable agriculture, livestock and forest management; heightened the attractiveness of green lines of business; increased the focus on social inclusion; and decreased its carbon footprint (World Bank, 2011).

The most effective way of supporting climate-resilient, low-carbon agricultural systems is to incorporate climate change into other policies and use public climate financing as a catalyst. One example of such an approach is the Pilot Programme for Climate Resilience (PPCR), which operates in 30 countries and is supported through the Climate Investment Funds (CIF). Over 40 percent of the PPCR funds have been allocated to making agriculture and water management more resilient (CIF, 2016). The Programme has found innovative ways to enhance resilience, including proposing new financing mechanisms, investing in information and communication technologies and encouraging the engagement of the private sector. The lessons learned from effort to integrate climate change into national and sectoral policies and plans can help countries gain access to climate finance for adaptation through a number of international financing sources (e.g. the Adaptation Fund and GCF) (see module C4 on climate financing).

At the national level, raising new sources of revenue for implementing climate-smart agriculture strategies may also be possible by establishing an integrated investment framework to attract national and international climate funds from different public and private sources. An example is Zambia's National Agriculture Investment Plan, which integrates climate change concerns into its situational analysis and in the actions proposed for financing (GRZ, 2014).

C3 - 5.4 Climate-smart agriculture policy instruments

Instead of designing new policies, it is often sufficient to analyse and adjust existing policies and ensure their enforcement to increase support for scaling up climate-smart agriculture. New policy measures can potentially be designed to fill the gaps that are not adequately covered by existing policies, or compensate for trade-offs that are made in efforts to achieve the different objectives of climate-smart agriculture. If necessary, governments can use fiscal or regulatory instruments where policy gaps exist, or when public benefits may need to be strengthened. When designing and adjusting policies to reinforce the adoption of regulatory instruments for strengthening climate-smart agriculture, local entities and governments should engage in a proactive dialogue that includes farmers and other stakeholders.

Market-based instruments

Taxes and subsidies on inputs and outputs

Governments support farmers and agri-businesses by providing various forms of stimulus for agricultural production (e.g. input or output subsidies). Governments may also opt for taxing particular inputs or outputs to discourage harmful activities, such as those that pollute the environment, or to implicitly stimulate green alternatives. For instance, in many developed countries, governments have increased the tax level on diesel used for agricultural production. Recently Austria and the Netherlands phased out the fuel tax concessions for farmers (OECD, 2015).

Much of the existing production support in both developed and developing countries involves subsidies on inputs, such as fertilizer and energy, or direct payments to farmers (FAO, 2016a). It is not always straightforward task to determine whether a particular policy instrument is supportive of efforts to achieve climate-smart agriculture

objectives. Subsidies for mineral fertilizer may be an adaptive measure when they fill nutritional deficits, if they are done using site-specific nutrient management in a production system that practices crop rotation to ensure nutrient cycling. Their application, however, will contribute to greenhouse gas emissions.

In Viet Nam policy makers recognized the potential flaws of fertilizer subsidies and introduced compensatory measures. Under this policy, which is known as the 'five reductions, one must' policy, farmers are encouraged to use rice varieties with clear origin, pure breed and guaranteed quality ('one must'). The 'five reductions' are: the reduction of the number of seeds planted per unit; the reduction of the amount of water used (at certain times); the reduction of the amount of fertilizer applied; the reduction of the amount of pesticides applied; and the reduction of post-harvest losses. Under this policy, the use of chemical fertilizers, pesticides, labour and water declined from earlier levels, while farmers earned higher incomes from rice production (Chi *et al*., 2013).

Agriculture-specific input subsidy programmes (e.g. for fertilizers, seeds or pesticides) are usually implemented by ministries of agriculture. However, they are often considered as part of both social protection policies and agricultural policies because they target low-income farmers and because they aim to improve household food security and reduce hunger (FAO, 2015). Input subsidies in crop production are addressed in module B1 (chapter B1-5). Social protection is addressed in module C7.

In general, energy or water use subsidies contribute to higher production, but they may also lead to unsustainable practices. For example, energy subsidies have contributed to aquifer depletion in water-scarce countries, such as India (Ignaciuk, 2015). Inadequate water regulation and pricing regimes, which create a lack of incentive to conserve water, have contributed to widespread drainage and salinity problems in a number of irrigation-dependent economies (e.g. Pakistan and Uzbekistan). In Egypt, for example, farmers receive irrigation water free of charge, but an indirect payment is transferred to the government for this service. To finance the irrigation system the government in Egypt imposes a fixed price on cotton at the market gate. Since this price is lower than the world market price, the government obtains revenues by selling cotton at the international markets. These revenues finance the irrigation system. A similar situation has prevailed in Uzbekistan (IWMI, 2010). Water management for climate-smart agriculture is addressed in module B6.

Subsidized credits

Inadequate access to financial instruments, including credit services, especially among women, is one of the greatest obstacles to scaling up climate-smart agriculture. Studies in southern Africa have pointed out that only 16 per cent of the agriculture households in Malawi and 10 per cent in Zambia have access to some form of credit from both formal and informal sources (FAO, 2012a). Gender and climate-smart agriculture are addressed in module C6.

In many developing countries, long-term financing for smallholder agriculture is not available, but short-term credit and micro-credit facilities may be an option. However, improved access to long-term finance remains important for tree cultivation where replacing older trees with newer, higher yielding varieties may lead to short-term revenue losses. In general, medium- and long-term finance is needed to cover the up-front investment in technologies that over the long-term will increase productivity, improve the efficiency in the use of resources, build resilience to climatic shocks and reduce emissions.

Given the often limited amount of public resources available, it is important that governments engage with the private sector and empower it to provide long-term, inexpensive credit to producers so that they can invest in climate-smart agriculture systems.

Payments for environmental services

Payment for ecosystem or environmental services (PES) is a policy instrument that can be used to provide incentives to adopt climate-smart agriculture practices. In forestry, for example, it is based on the legal and monetary recognition of the environmental services that forests offer, such as carbon sequestration, watershed

protection or biodiversity conservation. PES schemes typically involve ‘service users’, such as governments, NGOs or the private sector, who pay forest owners, or ‘service providers’, to manage forests sustainably (IIED, 2012). A PES programme in Costa Rica has been used to pay land managers to conserve and sustainably manage forested areas, or to reforest degraded land. By 2012, the programme had signed nearly 13 000 contracts, worked in nearly 800 000 hectares of forests, and distributed almost USD 280 million to land managers (IIED, 2012).

Another example is the The Transboundary Agro-ecosystem Management Project for the Kagera River Basin (Kagera TAMP), which was implemented by FAO with financing from the GEF. The project, which operated in the border area of the Burundi, Rwanda, Uganda and the United Republic of Tanzania, has promoted PES schemes for a range of environmental services, such as carbon sequestration, watershed management, and biodiversity and landscape preservation. These schemes have delivered financial and non-financial benefits to farmers (Bertram, 2011).

Forest conservation interventions and programmes in developing countries to reduce emissions from deforestation and forest degradation, and strengthen the role of conservation and sustainable management of forests to enhance of forest carbon stocks are grouped under the acronym 'REDD+'. The REDD+ mechanism under UNFCCC requires REDD+ countries to promote and support a set of environmental and social safeguards, which stipulate that REDD+ actions should be in line with conservation of natural forests and biodiversity, and respect the rights of indigenous peoples and local communities. The REDD+ mechanism offers incentives for developing countries to reduce emissions from forested lands and invest in low-carbon pathways to sustainable development in the forest sector. Through REDD+, developing countries can receive results-based payments for additional efforts made towards climate change mitigation in the forest sector. REDD+ goes beyond reducing emissions from deforestation and forest degradation. It also offers incentives for conserving and enhancing forest carbon stocks through sustainable forest management.

Conditional social protection measures

One of the challenges in making the transition to climate-smart agriculture is ensuring that it delivers benefits to the most vulnerable households and communities. In some regions, climate change, which is expected make impoverished and food insecure communities even more vulnerable to risks, will likely increase the importance and need for social protection measures to reduce hunger and poverty. A challenge and opportunity at the national level is to identify options to bring together and better coordinate social protection and climate-smart agriculture interventions. Social protection encompasses initiatives that provide cash or in-kind transfers to the poor and school meals to children; protect the vulnerable against risks; and enhance the social status and rights of the marginalized. These initiatives all have the goal of reducing poverty and economic and social vulnerability. Social protection includes three broad components: social assistance, social insurance and labour market protection (FAO, 2015).

Conditional social protection programmes may provide cash to help overcome credit constraints that agricultural communities, and particularly women, face, and that are a common barrier to investments in climate-smart agriculture practices.

Social protection programmes also play an important role in managing risk and building the overall resilience for households and individuals. They have been shown to have positive and significant impacts on coping strategies. For example, in periods of crisis, participants in these programmes are less likely to undertake harmful coping strategies, such as reducing food consumption or selling off productive assets, which can lead to a long-term decline in income and food security (FAO, 2016c). Social protection programmes can also contribute to resilient livelihoods by improving nutrition, health and educational opportunities in vulnerable households. This, in turn, increases their capacity to engage in productive activities, including climate-smart agriculture. See more on social protection and safety nets in module C7.

Market creation support

In many countries, agricultural and food markets are imperfect, or even non-existent for many specialized products. Linking smallholder farmers to local, national and regional markets improves farmers' access to the inputs and knowledge required to make the shift to climate-smart agriculture and opens channels for selling more products. For example, developing a market for crops used in crop rotations would be a major driver for the adoption of climate-smart crop systems that are resilient to the impacts of climate change and that may mitigate greenhouse gas emissions. This is important for both input and output markets. Seed production, for instance, provides economically viable opportunities for producers to tap into new markets and for customers who are typically dependent on a limited supply of seed. Market integration for climate-smart crops is dealt with in module B1-5.

As noted in module C1 on system-wide capacity development, addressing inadequate markets in rural areas requires innovative institutional arrangements and partnerships that improve market linkages and offer more stable and better prices to producers. Tapping into the potential of climate-smart agriculture to deliver benefits to agricultural producers will depend on establishing an enabling institutional environment. Institutions at various levels will need to be able to convey market information to agricultural producers, coordinate production and marketing, provide market infrastructure, define and enforce property rights and contracts, mobilize producers to engage with markets, and enhance the competitiveness of agro-enterprises (FAO, 2012a).

Trade-based instruments

Extreme price volatility in both input and outputs markets may be a disincentive to the adoption of climate-smart systems, particularly when adoption requires major investments. Some degree of price volatility can be attributed to extreme weather events as they can provoke changes in production patterns and increase the risks of disruptions in local and regional supply chains (FAO, 2012b). In addition to the direct impacts of climate change on primary production, changing socio-economic conditions can affect comparative advantages and trade flows, and potentially alter food trade and the future international competitiveness of some producers, especially those in developing countries (FAO, 2016d). To reduce price volatility from the international market, governments have tested various trade-based instruments, such as tariffs, export and import restrictions, price controls, intervention buying, rationing, user subsidies and deficiency payments. All of these instruments come at an economic cost, and many can create unintended consequences (FAO, 2016c) (see also Chapter C3-4). The policy responses of individual countries to food price volatility can make prices on international markets even more volatile (FAO, 2012a, OECD, 2017). Trade restrictions, such as tariff and non-tariff barriers, which limit the ability of global agricultural and supply chains to response to change, should be minimized.

Regulatory instruments

Securing tenure rights

Secure land and water rights are part of the enabling environment that can help channel investments into sustainable land and water management, which are crucial elements of climate-smart agriculture. Issues related to tenure are central to many climate-smart agriculture strategies (e.g. agroforestry, integrated food-energy systems) because tenure security creates incentives for long-term investment. Unclear land tenure can create difficulties in establishing benefit distribution mechanisms for PES schemes (Runsten and Tapio-Bistrom, 2011). In the United Republic of Tanzania, insecure land tenure was also identified as a major barrier to adoption for some key climate-smart agriculture practices, including soil and water conservation and agroforestry (Rioux *et al*., 2016).

There are several reasons why good governance of tenure is becoming an essential element for the successful implementation of activities related to climate-smart agriculture.

- Tenure is a decisive factor in the identification of stakeholders whose food security and livelihoods are affected by climate change.
- Strengthening smallholders' tenure rights can contribute to empowering them to become drivers for climate change actions and custodians of over natural resources.
- Agricultural producers with insecure tenure face the risk that their rights to resources will be threatened by competing claims, or completely denied in cases of eviction.
- Insecure tenure discourages long-term planning in favour of maximizing short-term profits, and complicates the implementation of effective climate change action plans.

Land tenure is a complex issue. It covers a mix of rights, rules and institutions. Some systems emphasize individual ownership, while others are based on communal approaches. Policy makers and other stakeholders working to design and implement climate-smart agriculture systems need to consult with land tenure specialists to understand different tenure systems and operate within them. A good example of this is the provision of land users' rights to trees, which helped promote re-greening in Niger (Stickler, 2012). Land rights are a key part of the enabling environment for investing in sustainable intensification, landscape restoration, and sustainable woodland and forest management. Effective land tenure regimes can create the link between sound agricultural and forest land-use planning.

Land tenure has also a strong gender dimension. Women may have little incentive to adopt sustainable land and soil management practices, plant trees or extend irrigation facilities on their plots because they face the risk of losing access to their land and investments (see module C6 on gender issues in climate-smart agriculture). A multistakeholder dialogue, engaging women and other marginalized and vulnerable groups, is important for ensuring that the benefits of any climate-smart agriculture intervention are equitable and reach those most in need. Experience over the past decades has shown for example, when local communities are involved in decision-making and have the support from legitimate decentralized institutional arrangements that have been developed through participatory consultative processes, forests can be sustainably managed and degradation can be reversed (FAO, 2016a).

Land use and land planning

Land management regulations and practices also play a key role in climate-smart agriculture (see module A3). For example, requirements that call for the controlled grazing of animals can protect streambeds or erosion control mechanisms. However, these measures only work where they can be properly implemented and enforced. The public must accept them and understand why they are needed. Voluntary mechanisms and incentives are equally important.

For larger landscape restoration initiatives, cross-sectoral coordination is essential. Agencies often work in relative isolation and even at cross-purposes, even when they may be dealing with shared resources. This is partially due to the way institutions are structured and their lack of capacity to cooperate closely in land-use planning and management (see module C1 on system-wide capacity development). Institutions dealing with ecosystem and land-use issues need to follow an integrated approach to the management of natural resources, especially forests, trees, soil and water, by engaging in multisectoral land-use planning (Braatz, 2012).

Governments can enhance integrated landscape planning and implementation processes through improved governance and facilitation of:

- planning, decision-making and negotiation processes;
- landscape-level conflict resolution;
- landscape management mechanisms (e.g. watershed and territorial management committees, territorial planning, water-user associations) that are defined based on the local conditions and issues; and
- incentives for supporting ecosystem services.

Regulatory mechanisms for input use and management practices

Many countries put in place specific regulatory measures for the use of a particular input or management method. For instance, in 2013 the European Commission imposed a temporary ban on the use of the three key neonicotinod insecticides, which are harmful to bees. Currently, the European Union is contemplating the complete ban on these insecticides. Measures that target management practices include regulations related the sustainable use of residues. In India and France, for example, there is a ban on the burning of residues.

Conclusions

Achieving the objectives of climate-smart agriculture will require close collaboration among various stakeholders and coherent cross-sectoral policies. Policy work to support climate-smart agriculture needs to be aligned with the goals and objectives of international agreements, including the 2030 Agenda for Sustainable Development, the Paris Agreement and the SFDRR.

The principles that guide policies that are intended to support climate-smart agriculture, sustainable development and food security are very similar. However, different countries have different development priorities. To formulate appropriate climate-smart agriculture strategies and interventions, reliable information, good quality data, sound climate change projections and impact assessments, and robust evidence is required. Capacities to implement climate-smart agriculture interventions also need to be strengthened and current barriers to adoption need to be systematically addressed at all levels (see module C1).

Current national development, agriculture, food security and climate change policies need to be carefully analysed and adjusted to increase their coherence. Policy makers need to gain a better understanding of how different policies effect efforts to reach the objectives of climate-smart agriculture. To better support the scaling up of climate-smart agriculture it is often sufficient to analyse and adjust existing policies and ensure their enforcement rather than design new policies. New policy measures may need to be formulated to fill the gaps that are not adequately covered by existing policies, or compensate for trade-offs between different objectives. If necessary, governments can use fiscal or regulatory instruments to cover policy gaps or strengthen public benefits.

To create an enabling environment for expanding climate-smart agriculture and it into broader national development plans, institutions with effective and transparent governance structures need to be established. If climate-smart agriculture interventions are to be successful, policy makers need to adapt regulations so that they meet the country's specific environmental needs, and accompany these regulations with incentives that encourage agricultural producers and other stakeholders in the food system to adopt climate-smart agriculture practices.

Regulatory and fiscal instruments can help promote climate-smart agriculture and overcome barriers to its adoption and expansion. Incentives (e.g. price and non-price measures) need to focus on surmounting the constraints that limit the adoption of climate-smart agriculture practices. A mix of different forms of support (e.g. regulations, capacity development, investments in research and innovation, the dissemination of knowledge, improvements in infrastructure, social protection and safety nets) are often more effective and sustainable in creating a pathway for scaling up climate-smart agriculture.

Civil society, the private sector and financial institutions all play vital roles in implementing climate-smart agriculture. These groups need to work together with key national line ministries and development agencies and donors to develop climate-smart agriculture policies through an inclusive participatory process that can capitalize on the range of experience of different stakeholders.

Acknowledgements

Coordinating lead authors: Ada Ignaciuk (FAO), Kaisa Karttunen (Think Tank e2)

Contributing authors: Nina Koeksalan (FAO), Elizabeth Laval (FAO), Janie Rioux (FAO), Julia Wolf (FAO).

Reviewers: Astrid Agostini (FAO), Patrick Kalas (FAO), Alexandre Meybeck (FAO), Lisen Runsten (FAO).

Notes: The module is an update of Module 13 *Mainstreaming Climate-Smart Agriculture into national policies and programmes* in the Climate-Smart Agriculture Sourcebook (2013) written by Majory-Anne Bromhead (World Bank) and Reuben Sessa (FAO) with contributions from Savis Joze Sadeghian (FAO). The module was reviewed by Leslie Lipper (FAO).

Acronyms

BDNES	Brazilian National Development Bank
EPIC	Economic and Policy Innovations for Climate-Smart Agriculture programme
GCF	Green Climate Fund
GEF	Global Environmental Facility
INC	Intended National Contribution
LDCF	Least Developed Countries Fund
NAMA	National Appropriate Mitigation Action
NAP	National Adaptation Plan
NAPA	National Adaptation Programme of Action
NGO	Non-governmental organization
OECD	Organisation for Economic Cooperation and Development
PES	Payment for ecosystem (or environmental) services
PPCR	Pilot Program for Climate Resilience
REDD+	Reduce emissions from deforestation and forest degradation, and strengthen the role of conservation and sustainable management of forests to enhance of forest carbon stocks
SDG	Sustainable Development Goal
SFDRR	Sendai Framework for Disaster Risk Reduction
UNFCCC	United Nations Framework Convention on Climate Change
WBCSD	World Business Council of Sustainable Development

References

Arslan, A., Asfaw, S., Branca, G., Cattaneo, A., Cavatassi, R., Grewer, U., Kokwe, M., Van Linh, N., Lipper, L., Mann, W., McCarthy, N., Paolantonio, A., Phiri, G. & Spairani, A. 2014. *How do we actually change the business as usual management of agricultural systems? A methodology for building Climate-Smart Agriculture*. FAO, Rome.

Avagyan, A., Rioux, J., Bernoux, M. & Nuutinen, M. 2016. *Food security and climate benefits through nationally appropriate mitigation actions in agriculture*. FAO, Rome.

Bertram, D. 2011. *Positioning the Kagera TAMP project in the PES landscape of Eastern Africa*. FAO, Rome.

Braatz. 2012. Building resilience for adaptation to climate change through sustainable forest management. In Meybeck, A., Lankoski, J., Redfern, S., Azzu, N., & Gitz, V. eds. *Building resilience for adaptation to climate change in the agriculture sector*. Proceedings of a joint FAO/OECD Workshop. FAO, Rome.

Chi, T.T.N, Anh, T.T.T, Tuyen, T.Q, Palis, F., Singleton, G., Van Toan, N. 2013. Implementation of "one must and five reductions" in rice production in An Giong Province. *Omonrice*, 19: 237-249.

Climate Investment Fund (CIF). 2016. *Pilot Programme for Climate Resilience*. Fact Sheet.

FAO. 2010. *Climate-smart agriculture: policies, practices and financing for food security, adaptation and mitigation*. Technical Input for the First Conference on Agriculture, Food Security and Climate Change in the Netherlands.

FAO. 2011. *The state of the world's land and water resources for food and agriculture (SOLAW) – Managing systems at risk*. FAO, Rome and Earthscan, London.

FAO. 2012a. *Developing a climate-smart agriculture strategy at the country level: lessons from recent experience*. Rome.

FAO. 2012b. *Price volatility from a global perspective. Technical background document for the high-level event on "Food price volatility and the role of speculation"*. FAO Headquarter, Rome, 6 July 2012.

FAO. 2014. *Building a common vision for sustainable food and agriculture: principles and approaches*. Rome.

FAO. 2015. *The State of Food and Agriculture. Social protection and agriculture. Breaking the cycle of rural poverty*. Rome.

FAO. 2016a. *The State of Food and Agriculture*. Climate change, agriculture and food security. Rome.

FAO. 2016b. *The agriculture sectors in the Intended Nationally Determined Contributions: Analysis*. By Strohmaier, R., Rioux, J., Seggel, A., Meybeck, A., Bernoux, M., Salvatore, M., Miranda, J. & Agostini, A. Environment and Natural Resources Management Working Paper No. 62. Rome.

FAO. 2016c. *Climate change and food security: risks and responses*. Rome.

FAO. 2016d. *Submission by the Food and Agriculture Organization of the United Nations (FAO) to the United Nations Framework Convention on Climate Change (UNFCCC) on Issues relating to agriculture: adaptation measures*. Rome.

FAO. 2017. *Addressing agriculture, forestry and fisheries in National Adaptation Plans.* Supplementary Guidelines.

Government of the Republic of Zambia (GRZ). 2013. *The National Agriculture Investment Plan 2014 – 2018 under the Comprehensive Africa Agriculture Development Programme*. Ministry of Agriculture and Livestock. Lusaka, Zambia.

German Organisation for Technical Cooperation (**GTZ).** 2010. *Climate-proofing for development. Adapting to climate change, Reducing Risk*. Federal Ministry for Economic Cooperation and Development. Germany.

Harvey, C.A., Chacón, M., Donatti, C.I., Garen, E., Hannah, L., Andrade, A., Bede, L., Brown, D., Calle, A., Chará, J., Clement, C., Gray, E., Hoang, M.H., Minang, P., Rodríguez, A.M., Seeberg-Elverfeldt, C., Semroc, B., Shames, S., Smukler, S., Somarriba, E., Torquebiau, E., van Etten, J. & Wollenberg, E. 2014. Climate-Smart Landscapes: Opportunities and Challenges for Integrating Adaptation and Mitigation in Tropical Agriculture. *Conservation Letters*, 7: 77–90.

Ignaciuk, A. 2015. *Adapting Agriculture to Climate Change: A Role for Public Policies*. OECD Food, Agriculture and Fisheries Papers, No. 85, OECD Publishing, Paris.

Ignaciuk, A. & Boonstra, C. 2017. *Synergies and trade-offs between agricultural productivity and climate change mitigation and adaptation: Netherlands case study*.

Ignaciuk, A., Coger, T. & Dameron, V. 2017. *Synergies et arbitrages entre productivité agricole et adaptation au changement climatique et atténuation: étude de cas sur la France*.

International Institute for Environment and Development (IIED). 2012. *Payments for Environmental Services in Costa Rica: from Rio to Rio and beyond*. IIED Briefing May 2012.

International Water Management Institute (IWMI). 2010. *Water pricing and allocation*. Water Issue Brief 6 (2010). International Water Management Institute.

Locatelli, B. 2011. *Synergies between Adaptation and Mitigation in a nutshell*. Centre for International Forestry Research (CIFOR), Bogor, Indonesia.

Meybeck, A., Lankoski, J., Redfern, S. Azzu, N. & Gitz, V. (Eds.). 2012. *Building resilience for adaptation to climate change in the agriculture sector*. Proceedings of a joint FAO/OECD Workshop. FAO, Rome.

Ministry of Agriculture, Livestock and Fisheries of Kenya. 2016. *Integrating agriculture in NAPs - Country work plan*.

National Drought Management Authority (NMDA). 2014. *Isiolo County Adaptation Fund: Activities, Costs and Impacts after the 1st Investment Round*. Project Report. Ada Consortium, Resource Advocacy Programme, Government of Kenya and IIED.

Northrop, E., Biru, H., Lima, S., Bouye, M., & Song, R. 2016. *Examining the Alignment between the Intended*

Nationally Determined Contributions and Sustainable Development Goals. Working Paper. Washington, DC: World Resources Institute.

Organisation for Economic Co-operation and Development (**OECD).** 2015. *OECD Companion to the Inventory of Support Measures for Fossil Fuels 2015*. Paris.

OECD. 2016. *Synergies and trade-offs between agricultural productivity and climate change mitigation and adaptation: a Policy assessment framework*. Paris.

OECD. 2017. *Agricultural Policies in the Philippines*. Paris.

Rioux, J., Gomez San Juan, M., Neely, C., Seeberg-Elverfeldt, C., Karttunen, K., Rosenstock, T., Kirui, J., Massoro, E., Mpanda, M., Kimaro A. *et al.* 2016. *Planning, Implementing and Evaluating Climate Smart Agriculture in Smallholder Farming Systems. The experience of the MICCA pilot in Kenya and the United Republic of Tanzania*. FAO, Rome.

Rosenstock, T.S., Mpanda, M., Kimaro, A., Luedeling, E., Kuyah, S., Anyekulu, E., Freeman, O.E., Thiong'o, M., Abwanda, S., Mutuo, P., Mativo, J., Shaba, S., Kirui, J., Franzel, S., Neufeldt, H., Shepherd, K. & Constance, N. 2014. *Science to support climate-smart agricultural development. Concepts and results from the MICCA pilot projects in East Africa*. FAO, Rome.

Runsten, L. & Tapio-Bistrom, M.L. 2011. *Land tenure, climate change mitigation and agriculture*. Mitigation of Climate Change in Agriculture (MICCA) project.

SRI-Rice. 2015. *Summary of SRI in Madagascar*.

Stickler, M. 2012. *Right to trees and livelihoods in Niger*. Focus on land in Africa. Brief.

Styger, E. & Uphoff, N. 2016. *The System of Rice Intensification (SRI): Revisiting Agronomy for a Changing Climate*. Climate-Smart Agriculture Practice Brief. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

United Nations Framework Convention on Climate Change (**UNFCCC).** 2016a. *NAPAs received by the secretariat*.

UNFCCC. 2016b. *Report of the Global Environment Facility to the Conference of the Parties*. FCCC/CP/2016/6.

UNFCCC. 2016c. *Focus: Mitigation – NAMAs, Nationally Appropriate Mitigation Actions*.

UNFCCC. 2016d. *NAMA registry* [online].

Wilkes, A., Tennigkeit, T. & Solymosi, K. 2013. *National integrated mitigation planning in agriculture: a review paper*. FAO, Rome.

World Business Council for Sustainable Development (WBCSD). 2017. *Climate-smart agriculture* [online].

World Bank. 2011. *Increased productivity and food security, enhanced resilience and reduced carbon emissions for sustainable development opportunities and challenges for a converging agenda: country examples*. Agricultural and Rural Development Department.

Wreford, A., Ignaciuk, A. & Gruere, G. 2017. *Overcoming barriers to the adoption of climate-friendly practices in agriculture*. OECD Food, Agriculture and Fisheries. Papers No. 101. OECD, Paris.