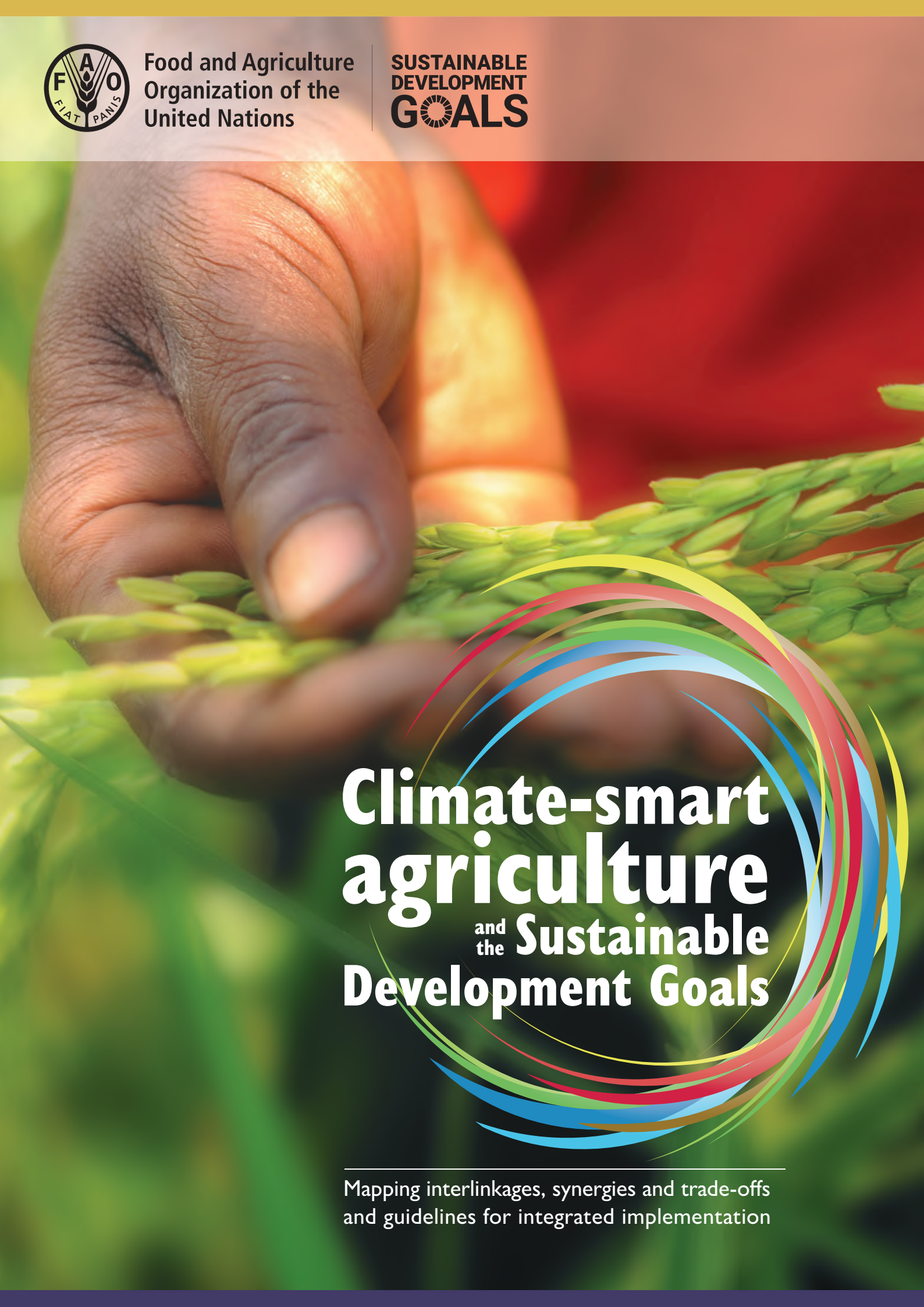

Food and Agriculture Organization of the United Nations

SUSTAINABLE DEVELOPMENT GOALS

Climate-smart agriculture and the Sustainable Development Goals

Mapping interlinkages, synergies and trade-offs and guidelines for integrated implementation

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Food and Agriculture Organization of the United Nations
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FOREWORD

Persistent food insecurity, a growing world population, accelerating global warming, and its impacts on agriculture make the climate-smart agriculture (CSA) approach ever more relevant. CSA works to reconcile the objectives of sustainably increasing agricultural productivity and incomes, building resilience and adapting agriculture to climate change, and reducing and removing greenhouse gas emissions from agriculture. While triple-wins between these three objectives are not always possible and trade-offs have to be made, CSA must also consider the overall sustainability of its results in order to achieve truly positive and lasting outcomes in the fight against hunger and climate change.

The United Nations 2030 Agenda for Sustainable Development, with its 17 Sustainable Development Goals (SDGs) and 169 targets, provides a universally accepted and comprehensive framework addressing all aspects and dimensions of sustainability. The integration of the CSA approach with implementation of the 2030 Agenda provides an opportunity to enhance the overall sustainability of CSA results and synergize CSA interventions with other sustainable development efforts. To achieve this integration, a clear understanding of how the CSA implementation process can engage with the 2030 Agenda throughout the five CSA implementation steps is required. Moreover, the interlinkages between CSA objectives and the SDGs and associated targets need to be well understood – including both potential synergies and trade-offs.

This publication presents an assessment and mapping of CSA-SDG interlinkages. These provide entry points for targeted CSA planning, to enhance synergies and reduce potential trade-offs between CSA objectives and SDGs. The publication also provides guidelines for integrating the CSA implementation steps with the 2030 Agenda. An important aspect of these guidelines is integration with the Paris Agreement – and the nationally determined contributions (NDCs) pledged by countries – as a complementary process to the 2030 Agenda, and the central reference point for countries' commitments to climate action.

I hope that this publication will serve as an inspiration for governments and other stakeholders to enhance the integration of their CSA work with efforts undertaken under the 2030 Agenda for Sustainable Development and the Paris Agreement. This should constitute a first step in unlocking the potential of CSA to contribute to the achievement of the Sustainable Development Goals.

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LIST OF ACRONYMS

7FYP	Bangladesh 7th Five Year Plan
AIDS	Acquired immunodeficiency syndrome
BAU	Business-as-usual
BCCSAP	Bangladesh Climate Change Strategy and Adaptation Plan
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CIAT	International Center for Tropical Agriculture
CRGE	Ethiopia Climate Resilient Green Economy Strategy
CSA	Climate-smart agriculture
CSL	Climate-smart livestock
DRF	Development Results Framework
ECLAC	Economic Commission for Latin America and the Caribbean
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field School
GDP	Gross domestic product
GEF	Global Environment Facility
GHG	Greenhouse gas
GoB	Government of Bangladesh
GoB MoA	Government of Bangladesh Ministry of Agriculture
GoB MoEFCC	Government of Bangladesh Ministry of Environment, Forests and Climate Change
GoEc	Government of Ecuador
GoEt	Government of Ethiopia
GTP II	Ethiopia Growth and Transformation Plan II
HIV	Human immunodeficiency virus
ICCC	Inter-institutional Committee on Climate Change
ICT	Information and communication technology
IICA	Inter-American Institute for Cooperation on Agriculture
INDC	Intended nationally determined contribution
IPCC	Intergovernmental Panel on Climate Change
ISC	Inter-Ministerial Steering Committee
IWRM	Integrated water resources management
JFFLS	Junior Farmer Field and Life School
LDC	Least developed country

LULUCF	Land use, land-use change and forestry
MAA	Multi-attribute analysis
MRV	Monitoring, reporting and verification
MS	Master of Science
NAP	National Adaptation Plan
NDC	Nationally determined contribution
NDP	Ecuador National Development Plan
NGO	Non-governmental organization
NPC	Ethiopia National Planning Commission
PhD	Doctor of Philosophy
REDD+	Reducing Emissions from Deforestation and forest Degradation, plus the sustainable management of forests, and the conservation and enhancement of forest carbon stocks
SDG	Sustainable Development Goal
STC	Sub-technical committee
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary National Review
WEF	Water–energy–food

Chemical formulae

CO_2	Carbon dioxide
CO_2eq	Carbon dioxide equivalent
CH_4	Methane

EXECUTIVE SUMMARY

Rising sea levels and more intense storms and droughts are becoming the new normal. In addition, the imperative of reducing food insecurity and population growth amid changing dietary preferences requires increased food production at a time when natural resources are more and more constrained. Given these intertwined challenges and threats to sustainable development, the world needs a comprehensive approach to addressing one of the primary connections between people and the planet: food and agriculture. Climate-smart agriculture (CSA) offers a wealth of opportunities in this respect, combining a focus on sustainably increasing agricultural productivity and incomes; building resilience and adapting to climate change; and reducing and/or removing greenhouse gas (GHG) emissions, where possible.

The global community has long recognized the interconnected challenges of sustainable development, and there is now a unified global response: the 2030 Agenda for Sustainable Development. As an approach, CSA can be an effective way to develop the agriculture sector – including crop and livestock production, fisheries, aquaculture and forestry – in a manner that helps to achieve the 17 goals and associated targets, collectively referred to as the Sustainable Development Goals (SDGs), which make up the 2030 Agenda. Action on climate change (further codified by the global community in the Paris Agreement, negotiated under the United Nations Framework Convention on Climate Change or UNFCCC) is one of the main Sustainable Development Goals that can be advanced by CSA. In this publication, we elaborate on the specific ways that CSA can contribute to various SDG targets, and explain how nationally determined contributions (NDCs) to the Paris Agreement are a critical component of advancing the Sustainable Development Goals through CSA. Finally, we provide guidelines for countries so that they can implement CSA in a manner that is aligned with their priorities, as related to the SDGs and the Paris Agreement. It is hoped that this publication will inform discussions following the in-depth review of SDG 13 (climate action) by the 2019 High Level Political Forum on Sustainable Development, and help provide a basis to justify investing in CSA as a way to achieve SDG 13, as well as other Sustainable Development Goals. In addition, this publication can help to inform the efforts of the Koronivia Joint Work on Agriculture, under the UNFCCC, which focuses on many of the key aspects of adaptation and mitigation in the agriculture sector.

Key messages:

- Climate-smart agriculture actions can support the achievement of all 17 Sustainable Development Goals. As such, CSA offers the possibility for helping countries to achieve the SDGs and their nationally determined contribution objectives. In addition to advancing climate, food security and income objectives, when a CSA approach is well-designed, it can also contribute to priority goals ranging from gender and social equality to urban development, education and employment, and forest and ocean health, to name a few. In the Assessment and mapping of CSA-SDG interlinkages section of this publication, we identify key categories of climate-smart agriculture actions under each of the three CSA pillars, and assess how each category relates to the various SDG targets. In addition, we consider the key steps needed to implement CSA, and explore how these relate to specific SDG targets.
- Instances may arise where a climate-smart agriculture action intended to advance one SDG objective creates a trade-off related to another (or related to one of the other CSA pillars). These potential trade-offs are presented in the Assessment and mapping of CSA-SDG interlinkages section, and where possible, we provide examples of solutions for avoiding or reducing the trade-off. These trade-offs are not unavoidable, and careful planning can ensure that they are minimized.
- In many instances, the Sustainable Development Goals form the basis of countries' national development planning. There is also increasing emphasis on the importance of integrating efforts to achieve the SDGs and NDC objectives at national level. This presents opportunities to maximize synergies and avoid duplication of

efforts related to planning, implementation and reporting. As such, there is value in considering these agendas jointly, and how best to support them, when it comes to developing a climate-smart agriculture approach.

- Good practice in developing a climate-smart agriculture approach should involve several key steps related to:
    - creating the evidence base for the approach;
    - supporting enabling policies and planning;
    - strengthening national and local institutions;
    - enhancing access to finance; and
    - implementing practices in the field.

  In addition, monitoring and evaluation is a key element for successful iterative implementation, and it should be integrated into the implementation steps throughout.

- All these steps can be implemented in a manner that supports the relevance of climate-smart agriculture in the context of a country's integrated efforts to achieve the SDGs and its NDC objectives. For example, when deciding on priorities from the various CSA options available, one possible criterion could be how effectively it advances a particular SDG or NDC priority.
- This paper represents a first step in defining specific ways in which climate-smart agriculture can support the achievement of the Sustainable Development Goals and nationally determined contribution objectives. Next steps may include: developing a methodology to assess context-specific synergies and trade-offs between CSA actions and SDG targets, as well as identifying the relationships between CSA and SDG indicators.

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PART 1

Introduction

1.1 Context and rationale

Some 821 million people are currently undernourished, and as of 2017, nearly one-quarter of children under five were affected by stunting. After several years of improvement, the past three years have seen a steady increase in hunger, returning to levels of a decade ago (FAO *et al.*, 2018). *The State of Food Security and Nutrition in the World 2018* finds that climate variability and extremes are among the three main causes of this disturbing trend. This is unsurprising given that all dimensions of food security and nutrition – including food access, availability, utilization and stability – can be affected by climate variability and extremes (FAO *et al.*, 2018).

Changes in the climate are already disrupting production of important crops such as rice, wheat and maize in both temperate and tropical regions, and without concerted climate adaptation (and mitigation) efforts, this trend will accelerate as temperatures continue to increase (FAO *et al.*, 2018). At the same time, the agriculture sectors – crop and livestock production, fisheries, aquaculture and forestry – are major contributors of greenhouse gas emissions at global level. Agriculture, including forestry and land-use change, is responsible for about 24 percent of global anthropogenic GHG emissions, including some 56 percent of total non-carbon dioxide (CO_2) emissions (IPCC, 2014).

The dual challenge (adaptation and mitigation) of climate change, coupled with the urgent requirement for agricultural production to increase by 60 percent by 2050 to meet food needs (FAO, 2017a), drives the imperative for a comprehensive approach. Climate-smart agriculture is an approach for transforming food and agriculture systems to support sustainable development and safeguard food security under climate change. CSA comprises three pillars or objectives: **(1)** sustainably increase agricultural productivity and incomes; **(2)** adapt and build resilience to climate change; and **(3)** reduce/remove GHG emissions, where possible. While it is not expected that every CSA activity in every context will produce 'triple wins', or positive results across all three pillars, agricultural producers, policy-makers and researchers should take into account the three objectives when designing a CSA approach, so to ensure that synergies are maximized and trade-offs minimized (FAO, 2017a). In order to be as effective as possible, a CSA approach should be developed in a context-specific manner, taking into account local climate and environmental, market, economic and cultural conditions (Celeridad, 2018).

The importance of agriculture in relation to the Sustainable Development Goals and nationally determined contributions

Agriculture is a key driver of development, especially in developing countries. In the case of least developed countries, the agriculture sector often generates more than 30 percent of gross domestic product (GDP) (World Bank, 2019a). As FAO (2016a) notes, food and agriculture are at the heart of the 2030 Agenda for Sustainable Development (see Box 1), in that these systems are key to ending poverty and hunger, sustaining natural resources and addressing both climate change mitigation and adaptation – all critical aspects of the Sustainable Development Goals.

BOX 1 - Transforming our world: the 2030 Agenda for Sustainable Development

In 2015, countries adopted the 2030 Agenda, and its 17 Sustainable Development Goals (SDGs), which provide a focus for global development efforts during the period 2016-2030. These 17 goals and their associated 169 targets and 232 indicators are aspirational. They focus on the most pressing sustainable development priorities, including ending poverty and hunger, reducing inequality, acting on climate change, and creating decent work and economic growth.

The various overlaps and relationships between the 17 SDGs and their associated targets (see Appendix 1),[1] considered integrated and indivisible in the 2030 Agenda, make clear that food, poverty and environmental sustainability cannot be considered in a siloed manner, and that investment in agriculture and rural development are powerful tools for ending hunger and poverty (FAO, 2015). Agriculture also figures prominently in countries' nationally determined contributions to the Paris Agreement (see Box 2). An analysis by FAO (2016b) of 22 NDCs and 140 intended nationally determined contributions (INDCs)[2] revealed that 131 countries included as priority areas adaptation and/or mitigation actions in the agriculture sectors. Nearly 95 percent of developing countries included reference to adaptation in the agriculture sector. The prioritization of mitigation in agriculture is also high;[3] according to FAO's analysis of NDCs and INDCs, 71 percent of developing countries and 98 percent of developed countries have included reference to mitigation in agriculture (FAO, 2016b). In addition, the Paris Agreement recognizes the importance of climate action for achieving the 'fundamental priority of safeguarding food security and ending hunger' (COP, 2015).

BOX 2 - The Paris Agreement

The Paris Agreement was adopted in 2015 within the United Nations Framework Convention on Climate Change (UNFCCC), acknowledged as the "primary international, intergovernmental forum for negotiating the global response to climate change" by the 2030 Agenda. The central objectives of the Paris Agreement are to limit global temperature rise to well below 2 degrees Celsius, and to increase the ability to adapt to adverse climate change impacts and foster climate resilience. The agreement's mechanism for meeting these priorities is the nationally determined contribution (NDC) – the iterative commitment that each country party to the agreement offers towards achieving the goals laid out in the Paris Agreement.

Climate-smart agriculture as key to achieving the Sustainable Development Goals and nationally determined contributions

Several of the Sustainable Development Goals relate to climate change, agricultural production, natural resources and ecosystems, and income and/or food security. Climate-smart agriculture sits at the nexus of these development imperatives, given its aims to simultaneously achieve productivity and income increases, build resilience, and

1 The list of goals and targets in Appendix 1 is limited to those where this publication finds linkages with CSA.

2 At the time of this analysis, only 22 countries had converted their INDCs to NDCs. INDCs are essentially first drafts of NDCs.

3 In NDCs, 'agriculture' includes land use, land-use change and forestry (LULUCF).

reduce/remove greenhouse gas emissions, where possible. As such, CSA can [4] play an important role in supporting efforts to address these challenges. Due to the multi-objective nature of CSA, it offers the possibility of achieving more SDG objectives than agriculture or climate interventions with a more singular focus. While many nationally determined contributions include mitigation and adaptation in the agriculture sector, 32 NDCs explicitly reference CSA (FAO, 2016b).

The focus of this publication and target audiences

After the introductory section, Part 2 of this publication focuses on the assessment and mapping of the synergies and trade-offs between climate-smart agriculture and the Sustainable Development Goals, in order to highlight opportunities to advance efforts related to the SDGs through implementation of CSA.[5] Part 3 describes how nationally determined contributions to the Paris Agreement are a critical element in efforts[6] to advance achievement of the SDGs through CSA at national level. Part 4 offers guidance for national policy-makers and development practitioners on good practices, to ensure that CSA is included in a country's integrated efforts to achieve the SDGs and its NDC objectives. It is anticipated that this publication will inform discussions following the in-depth review of SDG 13 (climate action) during the 2019 High Level Political Forum on Sustainable Development, and help provide a basis to justify investing in climate-smart agriculture as a way to achieve SDG 13 and SDG 2 (zero hunger), as well as other SDGs. The target audience for this publication includes: national-level decision-makers and policy-makers responsible for planning and implementation of the 2030 Agenda for Sustainable Development and the Paris Agreement, such as representatives of National Planning Commissions; decision-makers and policy-makers in the fields of climate change, agriculture and rural development, such as representatives of Ministries of Agriculture or Environment; and, development practitioners supporting developing countries in planning and implementation related to CSA, the 2030 Agenda for Sustainable Development Agenda and the Paris Agreement.

1.2 Methodology

Assessment and mapping of CSA-SDG interlinkages

The assessment and mapping of CSA-SDG interlinkages (Part 2) aim to identify ways in which climate-smart agriculture can contribute to countries' achievement of the Sustainable Development Goals. The definition of CSA used in this publication is based on the FAO definition of agriculture – and of CSA, by extension (see Box 3). The assessment – and the subsequent mapping – takes a comprehensive view of the Sustainable Development Goals, i.e. they consider CSA in relation to all 17 goals, as well as the targets under each SDG. In order to be relevant to as many countries as possible, the assessment and mapping focus on the globally agreed targets, though it is acknowledged that many countries refine these to be more applicable to their national circumstances. The assessment does not provide a methodology for determining the concrete contributions of a specific Climate-smart agriculture intervention to SDG targets. Rather, it presents entry points for targeted CSA planning and more detailed analysis, based on potential CSA-SDG synergies and trade-offs. The development of such a methodology could build on the assessment undertaken in this publication.

4 It should be noted that in developing and scaling-up CSA practices, careful attention must be paid to context-specific sustainability. A CSA action that is sustainable in one context might not be so in another. This is a limitation of the CSA approach.

5 Since climate action is a focus area within the SDGs (SDG 13), it is assumed that the mapping and assessment of linkages between CSA and the SDGs can also inform implementation of countries' NDCs. However, given the nationally determined nature of the NDCs (in contrast to the global nature of the SDGs), linkages between CSA and specific NDCs are not described in this publication.

6 The publication's focus on such an 'integrated effort' is discussed in the Methodology section.

BOX 3 - Definitions of agriculture

The **Food and Agriculture Organization of the United Nations (FAO)**'s definition of agriculture includes crop and livestock production, forestry, fisheries and aquaculture.

In the **UNFCCC**, there are three main workstreams where the subsectors included in FAO's definition of agriculture are discussed: Agriculture; Land use, land-use change and forestry; and Reducing Emissions from Deforestation and forest Degradation, plus the sustainable management of forests, and the conservation and enhancement of forest carbon stocks (REDD+). Agriculture is not defined within the **Paris Agreement**, i.e. various countries define agriculture differently in their NDCs. In FAO's assessment of the inclusion of agriculture in NDCs and intended nationally determined contributions (INDCs), agriculture includes forestry, land use and land-use change.

The **Sustainable Development Goals** do not explicitly define agriculture. All subsectors included in the FAO definition are represented in the SDGs; some targets and indicators consider agriculture in general, while others focus on specific subsectors, such as fisheries (SDG 14) and forestry (SDG 15).

The general approach to the assessment and mapping of climate-smart agriculture in relation to the Sustainable Development Goals is to consider existing mappings and literature, described in the Literature review section, and use expert judgement to assess and map linkages between CSA and the SDGs at the target level. This publication uses the three pillars of CSA, as well as the five steps of CSA implementation – described in the *Climate-Smart Agriculture Sourcebook* (FAO, 2017a) – as the framework for the mapping and assessment (see Table 1).

There are hundreds of actions that could be implemented under a CSA approach, including strategies, practices and production systems. It is not the scope of this publication to explore the contribution of every single potential CSA action to the Sustainable Development Goals. Instead, under each CSA pillar we have clustered potential CSA actions based on similarities in the way that they contribute to each pillar's objectives (see Box 4). The clustering was based on an extensive – but not exhaustive – list of potential CSA actions (Sources: FAO, 2017a; Peterson, 2014; GACSA, 2018), and resulted in three categories of CSA actions per pillar. The list of categories, including examples of CSA actions under each, is provided in Table 1.

These categories of CSA actions provide the framework for exploring the interlinkages between CSA pillars and SDG targets. It should be noted that some types of CSA actions can contribute to different CSA pillars in similar ways. For example, the diversification of a monocropping production system can create new economic opportunities to improve the farmer's livelihood (CSA Pillar 1). At the same time, it will increase the resilience of the production system to climatic shocks (CSA Pillar 2). Therefore, 'Diversify production systems' is a category of CSA actions under both CSA Pillars 1 and 2. Such overlaps of categories between CSA pillars reflect the potential for synergies between the pillars. It should also be noted that the categorization of CSA actions proposed in this publication intends to capture the key aspects common to different types of CSA actions, but does not claim to be complete.

BOX 4 - Clustering of CSA actions into categories: Example of CSA action category 'Increase resource use efficiency' (CSA Pillar 3)

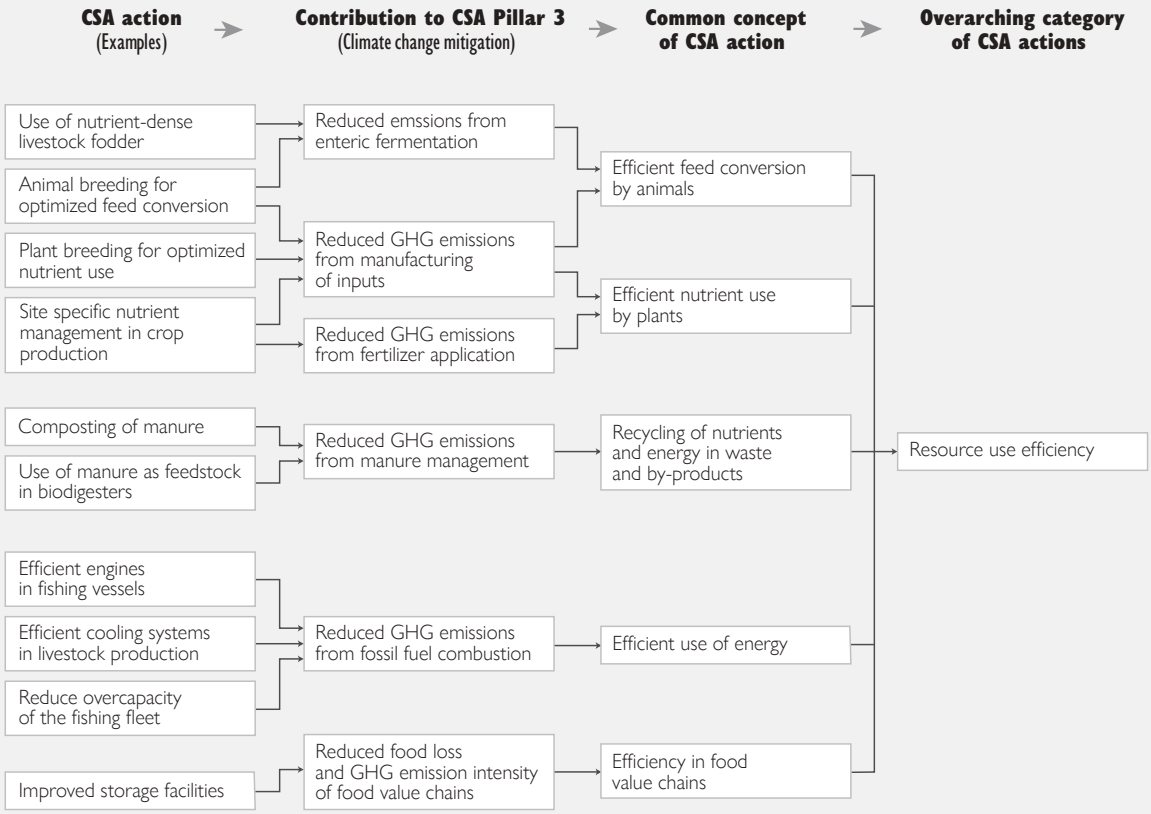


Table 1: Framework for the assessment and mapping of CSA-SDG interlinkages

CSA Pillar 1 – Sustainably increase agricultural productivity and incomes

CSA Action Category 1.A – Increase resource use efficiency
1.A Efficiency

CSA actions that increase the production per unit of inputs and reduce the material footprint of food production, e.g. breeding of high-yielding crop varieties; recycling of by-products and waste as farm inputs.

CSA Action Category 1.B – Diversify production systems
1.B Diversification

CSA actions, both on- and off-farm, that improve food producers' livelihoods through creation of additional income sources, e.g. adopting integrated crop-livestock systems; establishing local processing facilities.

CSA Action Category 1.C – Manage agro-ecosystems, ecosystem services and biodiversity
1.C Ecosystem

CSA actions that enhance ecosystem services which support the productivity of food production systems and allow for reduced use of external inputs, e.g. sustainable soil management to increase soil fertility; creation of habitats for wild animal species that provide biological pest control.

CSA Pillar 2 – Build resilience and adapt to climate change

CSA Action Category 2.A – Diversify production systems
2.A Diversification

CSA actions, both on- and off-farm, that distribute the climate risk over a greater number of elements of a production system/livelihood, e.g. introduction of crop rotation; adoption of agroforestry.

CSA Action Category 2.B – Adjust production activities to reduce risk exposure, sensitivity, and adapt to changing conditions
2.B Exposure

CSA actions that adapt specific elements of a production system to changing climate conditions and reduce their exposure or sensitivity to a given climate risk, e.g. constructing water harvesting ponds for supplemental irrigation of crops; switching to heat-tolerant livestock breeds or species.

CSA Action Category 2.C – Manage agro-ecosystems, ecosystem services and biodiversity
2.C Ecosystem

CSA actions that increase the capacity of agro-ecosystems to absorb climate shocks and other climate change-related stressors, e.g. mangrove restoration for coastal protection and fish stock regeneration; adoption of agroforestry to buffer impacts of extreme temperatures and rainfall events.

CSA Pillar 3 – Reduce and/or remove GHG emissions, where possible

CSA Action Category 3.A – Increase resource use efficiency
3.A Efficiency

CSA actions that reduce the use of energy-intensive farming inputs, such as fertilizers and fossil fuels, and the loss of nutrients in the form of GHG emissions, e.g. use of nutrient-dense livestock fodder that achieves high feed conversion rates and low enteric fermentation; site-specific nutrient management in crop production.

CSA Action Category 3.B – Retain and sequester carbon in agro-ecosystems
3.B Sequestration

CSA actions that enhance the capacity of agro-ecosystems to absorb, store and retain carbon from the atmosphere and result in increased carbon stocks, e.g. sustainable forest management to prevent the degradation of forests; adoption of agroforestry to increase the carbon stocks in crop and pasture land.

CSA Action Category 3.C – Replace fossil fuel-based energy with renewable energy
3.C Renewables

CSA actions that contribute to the reduction of GHG emissions from fossil fuel combustion through the substitution of fossil fuels used in agriculture with energy from renewable sources, and through the provisioning of biomass for bioenergy production, e.g. bioenergy production from livestock manure in anaerobic digesters; use of solar energy to power irrigation pumps.

CSA Implementation process

Step 1 – Expand the evidence base	**Step 1: Evidence**
Step 2 – Support enabling policy frameworks/planning	**Step 2: Planning**
Step 3 – Strengthen national and local institutions	**Step 3: Institutions**
Step 4 – Enhance financing options	**Step 4: Financing**
Step 5 – Implement practices in the field	**Step 5: Adoption**

The climate-smart agriculture action categories and CSA implementation steps were screened against the full list of SDG targets and the results of other existing mappings of interlinkages between sustainable agriculture and the SDGs at target level (FAO 2018a;[7] ECLAC, FAO & IICA, 2017). Based on this screening and expert judgement, the authors created a matrix with a preliminary selection of potential CSA-SDG interlinkages. This first selection was narrowed down based on targeted literature research. The only interlinkages retained were those for which a relevant example of a synergy or trade-off was found in literature. The main sources of this literature research were FAO reports, in particular the *Climate-Smart Agriculture Sourcebook* (FAO, 2017a), and the Intergovernmental Panel on Climate Change (IPCC)'s *Special Report: Global Warming of 1.5 ^{0}C* (Roy *et al.* 2018), alongside peer reviewed journal articles.

Related to each of the CSA action categories and implementation steps, several examples are provided of relatively universally applicable CSA actions.[8] These include the introduction of high-quality, nutritious animal feed and the

7 The authors consulted unpublished background information of the mapping 'Contributions to SDG targets' presented in FAO (2018a), which disaggregates the five principles of Sustainable Food and Agriculture into the 20 actions described in the publication.

8 The examples presented serve to illustrate the CSA action categories and implementation steps. However, they do not represent a comprehensive mapping of all possible CSA actions and measures.

adoption of sustainable soil management practices. In most instances, a CSA action will contribute synergistically to SDG targets, often contributing to multiple SDG targets (denoted with a ↑). In some instances, however, the linkage is presented as a potential trade-off (denoted with a ↓). Some CSA action categories or implementation steps present both potential synergies and trade-offs with a specific SDG target, in correspondence with different CSA activities under that action category or step. Where one specific CSA activity presents both a potential synergy and trade-off with an SDG target – depending on the modalities of implementation – the linkage is denoted with a ↓↑. In the case of potential trade-offs, it should be noted that these are not necessarily unavoidable. Where possible, suggestions on how to avoid, reduce or compensate for such trade-offs are provided. It should also be noted that the synergies and trade-offs identified are not universally valid, and may not apply for specific contexts, or for all possible CSA actions under a given category or implementation step.

While the assessment of CSA action categories focuses on interlinkages with SDG targets, at the end of each section a summary is provided of the main synergies and trade-offs that exist with the other CSA pillars. This summary is not an assessment in itself, and is solely based on relevant aspects mentioned throughout the respective section.

The results of the analysis of CSA-SDG interlinkages are summarized in mapping as **a)** tables throughout the assessment (Sections 2.1 and 2.2); **b)** an overview chart of all SDGs, presenting synergies and trade-offs at the SDG goal/CSA pillar level in Section 2.3; and **c)** a table for each SDG, presenting results at the SDG target/CSA action category level in Appendix 1.

Guidelines for implementation of CSA in the context of a country's integrated effort to achieve the SDGs and its NDC objectives

The final section of this publication presents guidelines for implementing climate-smart agriculture in the context of a country's integrated effort to achieve the SDGs and its NDC objectives. Rather than considering the SDGs and NDCs separately, the focus is on integrated efforts, given growing emphasis at national and international levels on streamlining these processes (see, for example, Bouyé *et al*, 2018). Since climate action is critical for achieving the SDGs, and sustainable development is critical for achieving NDC objectives, opportunities to reduce transaction costs and conserve limited capacity abound when advancing SDGs and NDCs in an integrated manner. Given the short timeframe available to achieve the SDGs and the Paris Agreement goals, efforts to advance both these agendas as efficiently as possible should be pursued.

The guidelines (Part 4) follow the five CSA implementation steps comprehensively described in FAO's *Climate-Smart Agriculture Sourcebook* (FAO, 2017a):

1) expand the evidence base;
2) support enabling policy frameworks/planning;
3) strengthen national and local institutions;
4) enhance financing;
5) implement practices in the field.

One additional focus area has been added: monitoring, evaluation and reporting. While not a formal step in the CSA implementation process, monitoring and evaluation is a critical aspect of each step in the context of iterative implementation. In order to give it due attention, this topic is accorded its own section. In this case, monitoring and evaluation has been combined with reporting. This is due to: **a)** the importance of reporting on SDG and NDC progress in the international system; and **b)** since reporting is often combined with monitoring in processes stemming from the UNFCCC, i.e. monitoring, reporting and verification, including the Paris Agreement. Building on

the *Climate-Smart Agriculture Sourcebook*'s description of these implementation steps, the guidelines focus, step-by-step, on the actions pertinent for implementation of CSA in a manner that ensures its relevance and integration into a country's integrated effort to achieve the SDGs and its NDC objectives. Focus topics in the guidelines include:

- how agriculture sector climate vulnerability assessment and greenhouse gas inventory can help to demonstrate the value of CSA in achieving NDC goals;
- the importance of involving CSA proponents in SDG- and NDC-related leadership bodies at national level;
- accessing multilateral sources of climate finance;
- aligning CSA reporting to support reporting on the SDGs and NDC.

Subnational authorities are often critical for successful implementation of activities that contribute to a country's CSA, SDG and NDC objectives. This is due to their proximity to stakeholders, and their relatively small administrations, which can allow for beneficial flexibility. However, such authorities often lack the technical and financial capacity to engage meaningfully in national agenda setting and implementation. For these reasons, national governments may find value in supporting subnational authorities to engage in CSA implementation. As such, each section of the guidelines includes brief descriptions of how national authorities can support subnational authorities in the given implementation step.

In order to develop these guidelines, good practices highlighted in the literature are complemented by practical experience drawn from case studies in three countries. These – Bangladesh, Ecuador and Ethiopia – were chosen for reasons of geographical diversity, their differing levels of economic development, and their ongoing engagement in and commitment to CSA. Interviews were conducted with officials from the ministries tasked with implementing climate-smart agriculture, and with efforts related to the SDGs and the Paris Agreement/NDC. These included Ministries of Environment, Agriculture and Planning, as well as a representative of the NGO community in the case of Bangladesh. Interviews focused on the CSA implementation steps that form the focus of the guidelines, with a particular emphasis on how this implementation relates, if at all, to a country's efforts to achieve the SDGs and its NDC objectives. Information from these interviews, along with publicly available sources on the three countries' agriculture, CSA, SDG and NDC approaches, is presented throughout the guidelines, and stand-alone case studies on these three countries are presented in APPENDIX 3: Country case studies.

1.3 Literature review

Studies on the relationship between CSA and the SDGs were reviewed, as were studies focusing on the link between sustainable agriculture and the SDGs. The latter was included in order to provide a broader base of literature to consider, and because CSA builds on and takes into account the general principles of sustainable agriculture. Indeed, FAO considers climate-smart agriculture to be one of its sustainable agriculture approaches (FAO, 2014a).

Assessment and mapping of CSA-SDG interlinkages

The literature suggests significant opportunities for advancing achievement of the SDGs through climate-smart agriculture. The two mappings reviewed investigating the relationships between CSA and the SDGs found linkages to all the Sustainable Development Goals except SDG 3 (good health and well-being). For example, the Central American Integration System (SICA) climate-smart agriculture strategy for the period 2018–2030 (SICA, 2017) maps three strategic axes – essentially aligned to the three CSA pillars – to the 17 goals (see Figure 1 below). The

relationship between the strategic axes and the goals, in the Central American context, is described as either directly or indirectly supporting the goal, or as creating an enabling environment for achieving the goal.

Climate-smart agriculture strategy for the SICA region (2018-2030)

Stategic axis 1

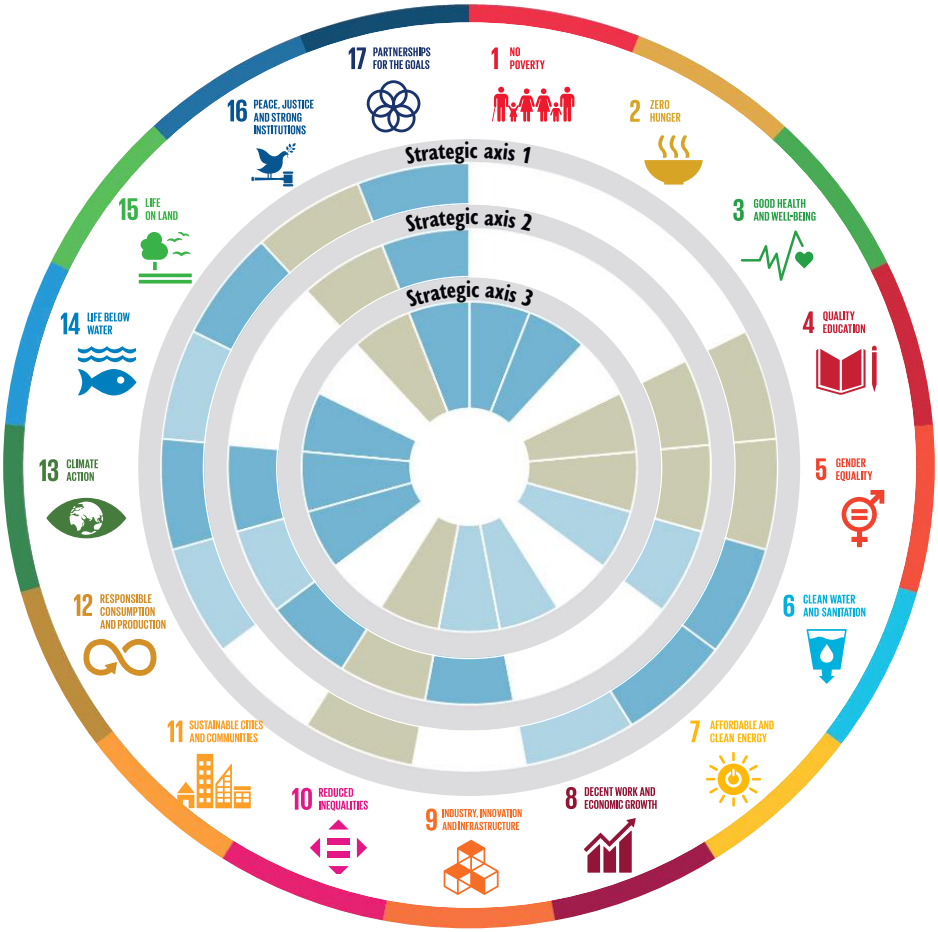
Efficient productive systems for sustainable livelihoods

Stategic axis 2

Integrated risk management and climate adaptation

Stategic axis 3

Sustainable and low emission agricultural landscapes



Conventions

- Habilitating framework
- Directly linked
- Indirectly linked

Figure 1: SICA visualization of the relationship between CSA and the SDGs (SICA, 2017)

In its report *Rabobank's contribution to the UN Sustainable Development Goals*, Rabobank (2018) provides an overview of many of the synergies between climate-smart agriculture and the Sustainable Development Goals, based on the work that the multinational bank supports. Rabobank sees CSA as directly supporting SDGs 2, 8, 9, 12, 13, 15 and 17, and indirectly supporting SDGs 1, 2, 5, 7, 8, 9, 10, 13, 15 and 16. Both these studies assess the linkages at goal level, and distinguish between direct and indirect links to the SDGs, but neither provides descriptions of the methodologies used to identify the linkages.

Assessment and mapping of sustainable agriculture-SDG interlinkages

As a body of literature, the studies reviewed on linkages between sustainable food and agriculture systems more generally and the Sustainable Development Goals find that all SDGs are advanced by sustainable food and agriculture systems. For example, *The outlook for agriculture and rural development in the Americas: A perspective on Latin America and the Caribbean 2017–2018* (ECLAC, FAO & IICA, 2017) focuses on how the production and consumption aspects of a sustainable food system, as a general concept, help to achieve various SDG targets, finding linkages to targets for all the SDGs. The production dimension includes food production, processing and distribution activities, environmental security outcomes, and the food security element. The consumption dimension includes activities related to consumption, social well-being outcomes, and food security elements linked to the proper functioning of the food market (access, availability and stability). As shown in Table 2, ECLAC, FAO & IICA (2017) find strong linkages between these dimensions and various SDG targets.

Table 2: Mapping linkages between food system elements and relevant SDG targets

Dimensions, activities and outcomes		
Description	Sustainability of food system production activities dimension	Consumption, food security and social well-being dimension
Activities	Production Processing and packaging Distribution and marketing	Consumption
Outcomes	Use Environmental security	Availability Access Stability Social well-being
SDGs with greatest affinity in each dimension	SDG 6 (Targets 6.1, 6.3, 6.4, 6.5, 6.6, 6.A) SDG 7 (Targets 7.2, 7.3, 7.A, 7.B)* SDG 9 (Targets 9.2, 9.3, 9.4, 9.A, 9.B)* SDG 12 (Targets 12.1, 12.2, 12.3, 12.4, 12.5, 12.A, 12.B, 12.C) SDG 13 (Targets 13.1, 13.2, 13.3, 13.A)	SDG 1 (Targets 1.1, 1.2, 1.3, 1.4, 1.5) SDG 3 (Targets 3.1, 3.2, 3.4, 3.D)** SDG 4 (Targets 4.1, 4.2) SDG 5 (Target 5.A) SDG 10 (Targets 10.1, 10.4, 10.A, 10.B, 10.C) SDG 16 (Target 16.1)
SDGs with targets in both dimensions	SDG 2 (Targets 2.A, 2.B) SDG 8 (Targets 8.2, 8.3, 8.4, 8.8) SDG 11 (Target 11.4) SDG 14 (Targets 14.1, 14.2, 14.3, 14.5, 14.C) SDG 15 (Targets 15.1, 15.2, 15.3, 15.4, 15.5, 15.6, 15.8, 15.B) SDG 17 (Targets 17.6, 17.7, 17.8)	SDG 2 (Targets 2.1, 2.2, 2.3, 2.4, 2.5, 2.C) SDG 8 (Targets 8.1, 8.5, 8.9, 8.10, 8.A) SDG 11 (Target 11.B) SDG 14 (Targets 14.4, 14.6, 14.7, 14.B) SDG 15 (Targets 15.7, 15.9, 15.C) SDG 17 (Targets 17.2, 17.4, 17.5, 17.9, 17.10, 17.11, 17.12, 17.18)

Source: ECLAC, FAO & IICA (2017)

* Targets 7.1 and 9.1 are related to consumption activities.
** Target 3.9 is related to production activities.

Food and agriculture: Key to achieving the 2030 Agenda for Sustainable Development (FAO, 2016a) describes, through country case studies, ways that agriculture supports the achievement of all SDGs. *Transforming food and agriculture to achieve the SDGs* (FAO, 2018a) identifies 20 key actions across the 5 elements of sustainable food and agriculture (increase productivity, employment and value addition in food systems; protect and enhance natural resources; improve livelihoods and foster inclusive economic growth; enhance the resilience of people, communities and ecosystems; adapt governance to new challenges), and maps the links between these actions and the SDGs. The actions range from protecting land tenure, to enhancing soil health, and mainstreaming biodiversity conservation. When viewed overall, these actions – many of which can be considered CSA activities – have linkages to all the SDGs. While the publication does not use the approach of distinguishing between direct and indirect linkages, it notes that the strongest linkage is to SDG 2, and that links to SDGs 1, 13, 14 and 15 are also significant.

FAO's *Food and agriculture: Driving action across the 2030 Agenda for Sustainable Development* (2017b) describes how focusing on SDG 2 can serve as a pathway to achieving the rest of the SDGs. The publication also highlights the importance of tackling SDGs 2 and 1 in tandem. It presents a number of country case studies on FAO-supported activities, together with the SDGs that they advance at goal level.

In *World livestock: Transforming the livestock sector through the Sustainable Development Goals* (FAO, 2018b), FAO describes how sustainable livestock production, which aligns in many ways to CSA, can help to achieve all the SDGs. The publication draws tangible links between sustainable livestock production and everything from quality education (SDG 4), to sustainable cities (SDG 11), to peace and social stability (SDG 16).

FAO's *2018 The State of the World's Forests* (FAO, 2018c) quantifies how forests and trees – important aspects of a CSA approach – can contribute to achieving the SDGs. It provides in-depth analysis related to the relevant targets of SDGs 1, 2, 5–8, 11–13 and 15, which were deemed to be the most relevant to forests, and brief descriptions of how forests and trees might contribute to the other SDGs at goal level.

The Economist Intelligence Unit and the Barilla Center for Food & Nutrition provide another mapping links between food and agriculture and the SDGs in *Fixing food 2018: Best practices toward the Sustainable Development Goals* (EIU, 2018). The publication lays out several indicators related to social, economic and environmental aspects of three pillars: food loss and waste; sustainable agriculture; and nutritional challenges. Indicators focus on a range of topics, including financial access and land rights, sustainable investment, overnourishment, and malnourishment. The linkage between each indicator and the SDGs is mapped at goal level, and the authors conclude that all SDGs are linked to one or more of these indicators. Some of these indicators relate closely to CSA and, as such, the mapping has been considered in this publication.

The concept of possible trade-offs between agriculture actions and the SDGs, as well as the possible magnitude of the potential benefits/trade-offs, is described in Chapter 5 of the IPCC's *Special Report: global warming of 1.5 °C* (Roy *et al*., 2018). Based on peer reviewed literature, the report considers a handful of actions related to agriculture and food systems, and maps the potential synergies and trade-offs of each action to each of the SDGs at target level. Actions considered include: sustainable healthy diets and reduced food waste; land-based GHG reduction and soil carbon sequestration; GHG reduction from improved livestock production and manure management systems; reduced deforestation (REDD+); afforestation and reforestation; responsible sourcing of forest products; and, blue carbon. While largely positive, the report identified some significant trade-offs. For example, it is noted that efforts to reduce deforestation by increasing biomass production for bioenergy can have negative effects on food security, if land becomes unavailable for food production (Roy *et al*., 2018).

Conclusion

While there is a relatively robust body of literature on linkages between practices that could be considered sustainable agriculture and the SDGs, publications assessing the relationship between CSA and SDGs are relatively limited: one focuses exclusively on the Central American context (SICA, 2017), and the other presents relatively low levels of detail on how it came to its conclusions about linkages (Rabobank, 2018). Both focus on linkages at goal level, rather than investigating linkages with the targets themselves. That said, the literature finds ample opportunity for CSA and/or sustainable agriculture to advance the Sustainable Development Goals, and in common with this publication, tends to rely on expert judgement to make assessments. With the exception of the IPCC report (Roy *et al*., 2018), the criteria used in developing these expert judgements are generally not specified. Furthermore, much of the literature focuses exclusively on linkages at goal level, without explicitly considering the specific targets with which there might be positive or negative linkages. In terms of trade-offs, aside from the IPCC report, discussion of trade-offs between CSA (or sustainable agriculture) and the SDGs is relatively limited. This publication builds on the approach of identifying possible trade-offs, in addition to synergies, and offers potential options to address them, where possible. Table 3, below, provides an overview of the linkages found in the literature between sustainable agriculture and/or CSA and the Sustainable Development Goals.

Table 3: Overview of linkages between climate-smart agriculture/sustainable agriculture and the Sustainable Development Goals found in the literature*

Mapping		SDG																
Source	Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Mappings of CSA to SDGs																		
The climate-smart agriculture strategy for the SICA Region (2018–2030) (SICA, 2017)	Goal	D			E	E	D/I	D	I	D/I	E	D	D/I	D	D/I	D	E	D
Rabobank's contribution to the UN Sustainable Development Goals (Rabobank, 2018)	Goal	I	D/I			I		I	D/I	D/I	I		D/I	D/I		D/I	I	D
Mappings of sustainable agriculture to SDGs																		
A perspective on Latin America and the Caribbean (ECLAC, FAO & IICA, 2017)	Target	X (C)	X (P/C)	X (C)	X (C)	X (C)	X (P)	X (P)	X (P/C)	X (P)	X (C)	X (P/C)	X (P)	X (P)	X (P/C)	X (P/C)	X (C)	X (P/C)
Food and agriculture: Key to achieving the 2030 Agenda for Sustainable Development (FAO, 2016a)	Goal	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Transforming food and agriculture to achieve the SDGs (FAO, 2018a)	Target	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Food and agriculture: Driving action across the 2030 Agenda for Sustainable Development (FAO, 2017b)	Goal	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
World livestock: Transforming the livestock sector through the Sustainable Development Goals (FAO, 2018b)	Goal	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fixing food 2018: Best practices toward the Sustainable Development Goals (EIU, 2018)	Goal	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2018 The State of the World's Forests (FAO, 2018c)	Target**	D	D	I	I	D	D	D	D	I	I	D	D	D	I	D	I	I

D = Direct linkage; **I** = Indirect linkage; **E** = Enabling environment; **X** = Unspecified
(P) = Related to production; **(C)** = Related to consumption

* **Note:** All linkages described in the table are synergies or contributions to SDGs. None of the mappings included in this table explored potential trade-offs.

** **Note:** Only for direct linkages

Guidelines for implementation of CSA in the context of a country's integrated efforts to achieve the SDGs and its NDC objectives

There are two main guidelines for implementing climate-smart agriculture in developing country contexts, both of which were consulted during preparation of this publication. These are the FAO *Climate-Smart Agriculture Sourcebook* (FAO, 2017a) and the CGIAR Research Programme on Climate Change, Agriculture and Food Security's 'CSA 101', an online guide (CCAFS, 2017). The *Climate-Smart Agriculture Sourcebook* is divided into three substantive sections: the CSA concept; production and resources; and enabling frameworks. For the guidelines section of this publication, the enabling frameworks section was heavily consulted. The *Climate-Smart Agriculture Sourcebook*, and FAO more generally, recommends a five-step process for implementing CSA. As described in the Methodology section, these five steps form the outline for the guidelines in this publication. As also noted, this publication has included an additional, cross-cutting focus area – monitoring, evaluation and reporting. In the *Sourcebook*, monitoring and evaluation (M&E) is described in the enabling frameworks section, which provides a comprehensive overview of M&E systems for climate-smart agriculture. Reporting systems are mentioned in the *Sourcebook*, but are not described in detail.[9] The *Sourcebook* mentions the importance of aligning CSA with national goals, but does not analyse the integration of CSA into other national agendas, or the implementation of CSA at subnational level – both areas on which the present guidelines focus.

While structured differently, the CSA 101 website recommends many of the same steps as the *Sourcebook* for developing and implementing a national CSA approach, e.g. policy engagement, institutional arrangements, financing and monitoring and evaluation. The level of detail provided on these various steps is somewhat limited, but useful references and case studies are provided, and these were considered when developing these guidelines.

The other source that was substantially consulted for these guidelines was *Connecting the dots: Elements for a joined-up implementation of the 2030 Agenda and Paris Agreement* (Bouyé *et al.*, 2018). This focuses not on CSA or even agriculture, but on how SDG and NDC agendas can be integrated at national level. The current publication uses these focus topics to extrapolate how CSA implementation might be structured to be relevant for a country's integrated efforts to achieve the SDGs and its NDC objectives. We find that focus topics in Bouyé *et al.* (2018), such as budget tagging, creating a whole-of-government approach, involving local authorities and optimizing data collection, are relevant for CSA implementation, both generally and in the context of integration with efforts to achieve the SDGs and NDC objectives.

While the three above-mentioned sources constitute the main literature reviewed in developing the guidelines, the authors have consulted several others in order to suggest specific tools, or provide examples from various developing country contexts. These sources cover a wide range of areas, including methodologies for carbon accounting in the agriculture sector, good practices on integrated rural development, and implementation through Farmer Field Schools.

Conclusion

The literature presents useful guidelines for implementing climate-smart agriculture and for integrating SDG and NDC agendas at national level. In addition, myriad sources describe specific tools, methodologies and approaches that can be drawn upon by countries interested in specific sub-steps of the CSA implementation process.

9 While reporting systems are not discussed in detail in the *Sourcebook*, the topic has been included in the present guidelines for the reasons mentioned in the Methodology section: the importance of national reporting for the international processes related to the SDGs and NDCs, and because reporting is often grouped with monitoring (and verification) in the UNFCCC.

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PART 2

Assessment and mapping of CSA-SDG interlinkages

Climate-smart agriculture pursues three objectives – the CSA pillars – simultaneously. It can achieve these objectives through different types of actions, specific to each CSA pillar. Actions taken to advance one CSA pillar may generate positive impacts (co-benefits), as well as negative impacts (trade-offs) related to another CSA pillar. For example, practices that improve the efficiency of fertilizer use result in savings on the purchase of fertilizers. This can increase the profit margin of crop production (a benefit for CSA Pillar 1), while also reducing GHG emissions linked with fertilizer manufacture (a co-benefit for CSA Pillar 3). These practices can therefore be considered to contribute to both CSA Pillars 1 and 3 by increasing the resource use efficiency (see categorization of CSA actions in Section 1.2).

A key value of the CSA approach lies in the systematic mapping and evaluation of these co-benefits and trade-offs. This allows for strategic planning, so to develop synergies and reduce trade-offs between the interlinked objectives of sustainable production, climate change adaptation and mitigation in agricultural sector strategies, programmes and projects – taking national development priorities and location-specific context into account.

The call to "take urgent action to combat climate change and its impacts", expressed in SDG 13, makes climate action an integral part of the 2030 Agenda for Sustainable Development. Another central goal of this agenda is to "end hunger, achieve food security and improved nutrition, and promote sustainable agriculture" (SDG 2). Climate-smart agriculture unites both SDG 2 and SDG 13 in its objectives, and can clearly support their achievement. Moreover, CSA offers many opportunities to support other aspects of sustainable development, within and outside the agriculture sector.

The assessment and mapping described in the following sections aim to show the value of the CSA approach in supporting implementation of the 2030 Agenda for Sustainable Development. They should also serve as support and guidance for policy-makers, planners and the private sector implementing CSA at national or subnational level, in identifying opportunities for synergies, as well as potential trade-offs with other development objectives in a given country- or location-specific context. This section is divided into three topics: assessment of interlinkages between CSA pillars and SDG targets (Section 2.1); assessment of interlinkages between CSA implementation steps and SDG targets (Section 2.2); and a summary of the results and overview mapping of the CSA-SDG interlinkages (Section 2.3). Detailed mappings of CSA-SDG interlinkages from an SDG-centred perspective are provided in Appendix 1, together with definitions of the SDG targets cited in this publication.

2.1 Assessment of interlinkages between CSA pillars and SDG targets

The three CSA pillars form the backbone of the CSA approach. These are:

- increase agricultural productivity and incomes;
- build resilience and adapt to climate change;
- reduce and/or remove GHG emissions, where possible.

This section assesses the interlinkages between SDGs at target level and the CSA pillars. For the purpose of the assessment, each pillar is divided into three categories of CSA actions, as described in the methodology (Section 1.2). An overview of the synergies and trade-offs identified is presented in a table at the end of each CSA Pillar section. In addition, for each CSA action category there is a brief summary of the main synergies and trade-offs between CSA Pillars that emerge in the discussion.

2.1.1 CSA Pillar 1 – Sustainably increase agricultural productivity and incomes

The main objective of CSA Pillar 1 is to sustainably increase the productivity of food production and the incomes of food producers. Sustainability is an integral part of the definition, and should be considered in all its three dimensions – economic, social and environmental – when developing CSA strategies and options. CSA Pillar 1 supports food security in two main ways: **1)** Increased productivity leads to stronger availability of food at household level and local markets; and **2)** Increased incomes result in greater accessibility to food.

The CSA action categories for achieving CSA Pillar 1 objectives assessed below are:

1) increase resource use efficiency;
2) diversify production system;
3) manage agro-ecosystems, ecosystem services and biodiversity.

At the end of this section, Table 4 summarizes the interlinkages identified between SDG targets and the CSA action categories of CSA Pillar 1.

2.1.1.1 CSA action category 1.A: Increase resource use efficiency – synergies and trade-offs with the SDGs

Efficient use of resources in food production systems can be achieved in several ways. For example, the precise, timely and well-dosed application of fertilizers and pesticides, introduction of high-quality nutritious livestock feed, and use of higher-yielding seed and animal varieties can all increase the productivity of a system, while reducing the need for external inputs. The use of such inputs can be further reduced by increasing the recycling of by-products and waste as inputs within food production systems or the wider value chain. Examples include using manure as fertilizer, or crop residues and agro-industrial by-products such as oilseed cake for livestock feed (FAO, 2017c).

Resource use efficiency therefore contributes to more sustainable production (↑ SDG 2.4) and increased incomes among food producers (↑ SDG 2.3). These include agriculture-dependent rural poor (↑ SDG 1.1, 1.2) (Roy *et al.*, 2018) and women, who generally have relatively lower levels of access to capital and credit for inputs (↑ SDG 5.A) (FAO, 2017a). The increased productivity and financial assets also improve the availability of, and access to food and, hence, food security (↑ SDG 2.1).

This CSA action category naturally supports targets related to sustainable economic growth, focusing on the efficient use of resources, decoupling economic growth from environmental degradation, and reducing the material footprint of production (↑ SDG 8.4, 12.2). The use of by-products and waste, in particular, supports the target of reducing waste (↑ SDG 12.5). There are also potential benefits for reducing the environmental impacts of cities by establishing circular economy relationships with peri-urban areas (↑ SDG 11.6), such as through the use of compost from municipal waste for agriculture (FAO, 2017a).

Food loss is an important aspect of resource use efficiency, as each loss on-farm or along the agricultural value chain represents an unproductive use of resources, with its associated cost and GHG emissions. Good post-harvest practices, such as appropriate storage or processing into more durable products, are therefore critical for reducing food loss and increasing resource use efficiency. Reducing food losses is the explicit objective of (↑) SDG 12.3, and contributes to improved incomes and food security (↑ SDG 2.1, 2.3) and decreased GHG emission intensity (↑ SDG 13; CSA Pillar 3). Improved storage practices can also prevent damage from increased heat and moisture, and therefore support the climate resilience and adaptive capacity of food producers (CSA Pillar 2).

In addition to a reduction of energy-intensive inputs, the use of more efficient engines, such as in fishing vessels, and practices that reduce the number of machinery operations, such as no-till and precision agriculture, can help to lower the energy intensity of an economy (↑ SDG 7.3). In manual labour-dominated production systems, the introduction of small machinery can lead to higher productivity and/or reduced working hours and a higher return on labour in the process (↑ SDG 2.3, 8.2) (FAO, 2017a). Using sustainable mechanization can also free up time for other economic or social activities and education, especially for children and women engaged in labour-intensive farming activities (↑ SDG 5.1, 4.1, 10.2). However, even mechanization that is sustainable can reduce work opportunities, with the strongest negative impact on poor rural labourers who depend on them for their livelihoods (↓ SDG 1.1, 1.2).

Pest and disease management can be an important strategy in improving resource use efficiency. Healthy organisms – both plants and animals – can utilize farming inputs such as fertilizers, livestock fodder and fish feed more productively, thereby increasing the overall productivity of the respective production system. Moreover, pest and disease management reduces the risk of crop or livestock losses that would result in reduced productivity. In livestock management, for example, regular disease surveillance and maintenance of animal health can result in improved reproduction rates, reduced mortality, and lower slaughter age, all of which increase productivity. This is also reflected in a higher output of products for a given level of emissions, i.e. reduced GHG emission intensity (↑ SDG 13; CSA Pillar 3) (FAO, 2017a). Effective pest and disease management can improve resilience to climate change, as the incidence of certain gastrointestinal parasites and other livestock diseases is expected to increase with climate change (↑ SDG 13.1; CSA Pillar 2). There are also potential benefits for human health. For example, improved disease surveillance and health prevention for livestock can help to curb the spread of animal vector-borne

diseases (↑ SDG 3.3) (FAO, 2018b), while integrated pest management in crop production reduces the emissions of hazardous chemicals to the environment (↑ SDG 3.9).

The efficient use of resources brings positive outcomes for people, the environment and natural resources. Efficient irrigation practices can help to reduce pressure on water resources, producing a particular benefit for women, who may otherwise be tasked with sourcing and applying water manually (↑ SDG 5.4, 6.1), as well as to the environment and the economy (↑ SDG 6.4). The efficient use of chemical products in food production reduces the amount of harmful substances released into the environment (↑ SDG 12.4), including freshwater bodies (↑ SDG 6.3), marine ecosystems (↑ SDG 14.1) and terrestrial ecosystems (↑ SDG 15.1).

Sustainable intensification is a concept closely linked to and compatible with CSA Pillar 1 and, in particular, with the CSA action category 'Increase resource use efficiency'. It promotes context-specific practices that enable increased productivity while maintaining or reducing the amount of land needed for production (FAO, 2017a). This enables other land to be spared, and set aside for conservation purposes, thereby supporting the conservation and restoration of terrestrial ecosystems and biodiversity (↑ SDG 15.1, 15.5). However, it should be noted that agrobiodiversity within the intensified arable land area may be reduced (Roy *et al.*, 2018). This risk could potentially be mitigated by planting beneficial insect-attracting plants and creating agroforestry buffers around parcels of intensified arable land.

Another risk is that sustainable intensification could have the opposite effect on the release of harmful substances into natural environments (↓ SDG 12.4, 6.3, 14.1, 15.1) if productivity objectives are not balanced with those of sustainability, leading to unregulated use of chemical fertilizers and pesticides (Roy *et al.*, 2018). This threat could potentially be avoided by simultaneously incentivizing site-specific nutrient management. In addition, more efficient and profitable irrigation practices may encourage an expansion of irrigated land, increasing agricultural water consumption and the pressure on water resources as a result (↓ SDG 6.1, 6.4). Care must be taken at the CSA planning stage to ensure that this risk is taken into account, and avoided or compensated for in the project design.

A focus on a few high-yielding improved crop varieties or animal breeds may endanger local diversity in crop and animal species (↓ SDG 15.5). It may also increase vulnerability to disease outbreaks and climatic shocks, thereby presenting a trade-off with CSA Pillar 2 and (↓) SDG 13.1. In instances where only those with sufficient resources can access high-yielding crop varieties or animal breeds, the introduction of such technologies could further increase income inequality (↓ SDG 10.1, 10.2, 10.3).

Main synergies and trade-offs with other CSA pillars

Pillar 2: *Synergies*: The improvement of financial assets increases food producers' resilience to climate shocks and adaptive capacity. More efficient use of resources that are constrained by climate change, e.g. water, eases the climate-related burden associated with that given resource.

Pillar 3: *Synergies*: Increased resource use efficiency can lead to reduced GHG emissions associated with the production and application of agricultural inputs, including energy. *Trade-off*: However, sustainable intensification could lead to an increase in absolute GHG emissions, even if emission intensities are reduced. This possible trade-off can be countered by ensuring that carbon sequestration in areas outside the intensified land area is prioritized.

2.1.1.2 CSA action category 1.B: Diversify production systems – synergies and trade-offs with SDGs

The diversification of economic activities is a sustainable development target in itself (↑ SDG 8.2). Diversified production systems, such as shifting from monocropping to crop rotation, agroforestry or integrated crop-livestock production, provide food producers with additional income sources and an opportunity to increase the overall household income (↑ SDG 2.3). They also present a risk mitigation strategy in the event of failure of one of the

production components, market fluctuations or market failure (↑ SDG 1.5, 2.4) (FAO, 2017a; Roy *et al*., 2018). However, Arslan *et al*. (2017) note that diversification does not necessarily result in increased incomes, depending on the present push and pull factors of diversification in a specific context.

The increased availability of a wider variety of foods in diversified production systems, and the increased accessibility of these – enabled by higher incomes – can contribute to more nutritious, healthier diets for food producers and their communities. This offers potential benefits for their nutritional status (↑ SDG 2.1, 2.2), general health (↑ SDG 3.4), labour productivity, ability to improve their livelihoods (↑ SDG 1.1, 1.2, 8.1), and learning ability and focus (↑ SDG 4.1) (FAO, 2018b). In addition, higher incomes can facilitate access to education (↑ SDG 4.1, 4.2), health care, and other basic services (SDG 1.4). The integration of livestock in crop-based production systems can also provide animal-source foods, which can particularly improve child and maternal health (↑ SDG 3.1, 3.2) (FAO, 2018b).

From a broader food systems perspective, small-scale local processing facilities offer an opportunity for production diversification beyond the farm-scale. Their establishment creates jobs in decentralized areas, and can provide an off-farm income source for food producers themselves (↑ SDG 8.5) (CCAFS, 2017). In addition, small-scale local facilities mean that food travels shorter distances, limiting GHG emissions associated with transport (↑ SDG 13; CSA Pillar 3) (FAO, 2017a). Decentralized aggregation, processing and distribution increase the resilience of the broader food system. If facilities in one region are negatively affected by a climate impact, such as flooding, other aggregation, processing and distribution facilities may be unaffected, and able to operate as usual, keeping the overall system relatively close to normal (↑ SDG 13.1; CSA Pillar 2).

Main synergies and trade-offs with other CSA pillars

Pillar 2: *Synergies*: Diversification is considered a key approach for limiting the sensitivity of a system to climate change. In addition, the increased income that can be associated with production diversification increases food producers' and their communities' resilience to shocks and adaptive capacity.

Pillar 3: *Synergies*: GHG emissions can be reduced as a result of production diversification, e.g. through shorter transport distances of food, and increased local aggregation and processing.

2.1.1.3 CSA action category 1.C: Manage agro-ecosystems, ecosystem services and biodiversity – synergies and trade-offs with the SDGs

Managing the agro-ecosystem in a sustainable way can provide mutual benefits for productivity and incomes and the environment. Such management practices can be applicable directly to a plot of crop or pasture land, such as through soil or grazing management. They may also be applied to other elements in the agricultural landscape, for example with the aim of improving structural or biological diversity.

An example of agro-ecosystem management related to crop production is the suite of sustainable soil management practices: minimum tillage, retention of permanent soil cover, and use of crop rotation, all of which help to improve soil structure, fertility and water-holding capacity, and avoid depletion of specific nutrients often experienced under monocropping. These practices improve the availability and provisioning of nutrients and water to crops and, hence, productivity (↑ SDG 2.4) (Richards *et al*., 2014). For resource poor farmers in particular, these practices can offer a strategy to increase the use of naturally available nutrients, raise productivity levels and improve livelihoods – including incomes and access to basic services – under constrained availability of, or access to purchased fertilizers (↑ SDG 1.1, 1.2, 1.4). At the same time, they preserve soil resources and enhance the soil's capacity to provide ecosystem services (↑ SDG 15.1), such as regeneration of groundwater resources, filtering of water and denaturing of pollutants, thereby contributing to improved access to water (↑ SDG 6.1) and water quality (↑ SDG 6.3) (Lal, 2016).

Similarly, the restoration of degraded pastures helps livestock producers to improve productivity, preserve the natural production resource base, and enhance the provision of ecosystem services. This is supported by sustainable grazing practices, such as reduction of grazing pressure, rotational grazing and controlling of the timing of grazing (FAO, 2017a). In rotational grazing, the frequency and timing of grazing is adjusted to match the livestock's needs with the availability of pasture resources. Particular attention is paid to maintenance of forages at an early growth stage. This enhances the quality and digestibility of the forage, thereby improving the system's productivity (↑ SDG 2.4), and reducing methane emissions from enteric fermentation per unit of live weight gain (↑ SDG 13; CSA Pillar 3). Restored pastures with healthy soils and vegetation are more resistant to erosion and drought (↑ SDG 13.1, 15.3; CSA Pillar 2), and enhance soil carbon sequestration (↑ SDG 13; CSA Pillar 3).

At farm and landscape levels, natural elements that are maintained or created within the agricultural landscape increase the structural heterogeneity and biodiversity of the agro-ecosystem. Elements such as buffer strips and hedgerows provide habitats for wild plant and animal species. At the same time, they support the productivity and sustainability of the agro-ecosystem by enhancing biological pest control, pollination, erosion protection, and the reduction of nutrient leaching (↑ SDG 15.5).

Some of these practices may be more labour-intensive than conventional practices, increasing the labour burden as a result. In such cases, there is a risk of increased use of child labour within food producers' households, limiting children's opportunities to access education (↓ SDG 4.1), or increasing women's labour burden (↓ SDG 5.4). Synergies with sustainable mechanization can be explored to reduce this risk.

Main synergies and trade-offs with other CSA pillars

CSA Pillar 2: *Synergies*: Improved ecosystem functionality, e.g. soil health, increases buffering capacity and resilience to climate change impacts.

CSA Pillar 3: *Synergies*: Healthy, well-managed soils sequester and store carbon in their soil organic matter.

Table 4: Interlinkages between SDG targets and CSA Pillar 1

For each CSA action category, SDG targets with synergies are shown in green, and trade-offs in yellow. The presence of synergies and/or trade-offs between an SDG and CSA Pillar 1 as a whole is indicated by green and yellow shading.

	CSA action category	SDG 1	SDG 2	SDG 3	SDG 4	SDG 5	SDG 6	SDG 7	SDG 8	SDG 9	SDG 10	SDG 11	SDG 12	SDG 13	SDG 14	SDG 15	SDG 16	SDG 17
CSA Pillar 1	Synergy	1.A Efficiency	1.1 1.2	2.1 2.3 2.4	3.3 3.9	4.1	5.1 5.4 5.A	6.1 6.3 6.4	7.3	8.2 8.4		10.2	11.6	12.2 12.3 12.4 12.5	SDG13 13.1	14.1	15.1 15.5		
		1.B Diversification	1.1 1.2 1.4 1.5	2.1 2.2 2.3 2.4	3.1 3.2 3.4	4.1 4.2				8.1 8.2 8.5					SDG13 13.1				
		1.C Ecosystem	1.1 1.2 1.4	2.4				6.1 6.3							SDG13 13.1		15.1 15.3 15.5		
	Trade-off	1.A Efficiency	1.1 1.2					6.1 6.3 6.4				10.1 10.2 10.3		12.4	13.1	14.1	15.1 15.5		
		1.B Diversification																	
		1.C Ecosystem				4.1	5.4												
	CSA - SDG interlinkages																		

Synergies

Trade-offs

2.1.2 CSA Pillar 2 – Build resilience and adapt to climate change[10]

The main objective of CSA Pillar 2 is to build the resilience of food production systems and food producers' livelihoods to the impacts of climate change, and enable their adaptation to projected long-term changes in the climate. Climate change increasingly impacts agricultural production, affecting the availability of food, as well as its accessibility, e.g. due to shortages of food supplies and related price spikes (FAO *et al.*, 2018). Building climate change resilience is therefore crucial to improved food security, since it contributes to ensuring intra- and inter-annual stability in the availability of and access to food.

The CSA action categories for achieving CSA Pillar 2 objectives assessed below are:

1) diversify production system;
2) plan production activities to reduce risk exposure, sensitivity, and adapt to changing conditions;
3) manage agro-ecosystems, ecosystem services and biodiversity.

At the end of this section, Table 5 summarizes the interlinkages identified between SDG targets and the CSA action categories of CSA Pillar 2.

10 It should be noted that all actions described in this section link to SDG 13 (climate action).

2.1.2.1 CSA action category 2.A: Diversify production systems[11] – synergies and trade-offs with the SDGs

In addition to the economic opportunities related to the diversification of production systems as a way of expanding income sources (as described in the previous section on CSA Pillar 1), this is an important strategy for building resilience in a context of increased climate variability and extremes (↑ SDG 13.1) (Roy *et al*., 2018; FAO *et al*., 2018). Diversification can also reduce emissions intensity compared with monocrop systems, through reduced erosion and loss of soil organic matter (↑ SDG 13.1). Diversification can take the form of expanding into multiple crop or livestock species, or integrated farming systems such as crop-livestock systems, agroforestry and silvopastoral systems or mixed crop-aquaculture-livestock systems. This enables risks to be distributed over several agricultural activities with different degrees of exposure and sensitivity to climatic stresses and extremes, reducing the income volatility of food producers (↑ SDG 1.1, 1.2, 1.5, 2.4). It can also increase the resilience of the production system as a whole, for example, by creating a favourable microclimate for crops growing under shade trees in agroforestry systems, thereby reducing heat stress (FAO, 2017a).

Engagement in additional agricultural activities offers opportunities for income growth, especially for households with low incomes (↑ SDG 10.1). A critical factor in realizing such opportunities is connecting smallholder producers to markets. However, there is a risk that diversification will increase the workload of women, since additional, possibly labour-intensive tasks in crop/livestock management and post-harvest handling – which are typically performed by women – may be required (↓↑ SDG 5.1) (Roy *et al*., 2018).

Beyond benefits at household level, diversification also supports stronger resilience of local, regional or national food systems as a whole, as it contributes to a more diversified food basket (↑ SDG 2.1, 2.2) (FAO, 2017a).

Main synergies and trade-offs with other CSA pillars

Pillar 1: *Synergies*: Diversification is a shared CSA action category of Pillars 1 and 2, contributing to both stable incomes in the long term, and resilience to climate variability and extremes. *Trade-offs*: Where CSA activities lead to increased workloads for women, the social sustainability aspect of Pillar 1 will be negatively affected.

Pillar 3: *Synergies*: Diversification of agricultural activities creates opportunities for recycling nutrients, waste and by-products between components of a production system, thereby reducing the need for external inputs and associated GHG emissions and costs. In addition, diversification reduces the likelihood of erosion and loss of organic matter, also contributing to reduced GHG emissions.

2.1.2.2 CSA action category 2.B: Adjust production activities to reduce risk exposure, sensitivity, and adapt to changing conditions – synergies and trade-offs with the SDGs

Understanding climate risks and their potential impact on specific agricultural activities is fundamental for identifying targeted measures to reduce the exposure and sensitivity to those risks, and developing better adapted production systems. There is scope for a wide range of pre-emptive responses. These include the careful design of production sites, protective construction works – such as flood-control infrastructure – and early warning systems, and the selection of stress-resistant or better adapted varieties and species. These measures enable food producers to increase the resilience of their production systems and livelihoods to climate variability and extremes (↑ SDG 1.5, 11.5, 13.1), and stabilize yields and income in the long term (↑ SDG 2.3, 2.4; CSA Pillar 1).

11 This approach is also described as a key CSA action category under Pillar 1. See description in that section (above) to understand the important actions under that Pillar, and how they relate to the SDGs.

BOX 5 - Water–energy–food nexus assessment

The water–energy–food (WEF) nexus approach seeks to balance different social, economic and environmental goals and interests related to the water, energy and food sectors. Due to the close interactions between these sectors and their associated interest groups, interventions in any of these sectors may result in synergies and trade-offs with another. The WEF nexus assessment provides a methodology to support decision-makers in assessing the status of water, energy and food systems, the impacts of possible response options, and the comparison between alternative options. The WEF nexus assessment consists of three components:

1) Context analysis (qualitative)
Identification of local/national priorities and competing interests.

2) Quantitative assessment
Application of problem-specific tools to determine impacts of intervention options on the nexus status, scenario development, and comparison of options based on nexus sustainability and resource use efficiency indicators.

3) Response options
Selection of best intervention options by decision-makers, considering sectoral priorities and results of the assessments.

Cross-sectoral and interdisciplinary stakeholder dialogue throughout the WEF nexus assessment process is a prerequisite for its successful implementation.

Source: FAO 2014c

One example of this type of measure is the siting of aquaculture farms; the particular siting of such farms in coastal areas is critical for reducing exposure to risks related to storms and sea level rise. The selection of species or varieties that are relatively tolerant of climate-related impacts reduces the sensitivity of a production system. A case in point is the use of short-cycle species for aquaculture systems in regions with elevated drought risk, and of species that are relatively tolerant of acidic waters (↑ SDG 14.3) (CCAFS, 2017). In East Africa, one adaptation measure observed in the livestock sector is the shift from cows to camels in pastoralist dairy production systems. This is because camels are more tolerant of drought, and provide a more constant milk supply throughout the year (Roy *et al*., 2018).

Breeding supports the development of new varieties and breeds that are better adapted to climatic stresses and use limited resources more efficiently, including water (↑ SDG 6.4; CSA Pillar 1). In particular, crossbreeding of traditional, locally-adapted varieties/breeds with improved varieties/breeds allows for combining properties that enhance resilience with properties that enhance productivity. In livestock breeding, for example, local breeds' tolerance of poor nutrition, heat and local diseases can result in greater resilience to changing climate conditions. Meanwhile, the genes of the improved varieties can offer higher productivity over local-only stock (FAO, 2017a). Support to national breeding programmes for climate change adaptation, and to the adoption of new varieties and breeds also helps to promote access to genetic resources and benefits from their utilization (↑ SDG 15.6).

One important measure to reduce both exposure and sensitivity to climate risks is the use of climate and weather information services. Daily and seasonal forecasts support appropriate timing of management operations in crop and livestock production, particularly under increasingly variable climate conditions, improving the efficient use of resources and avoiding yield reductions and losses (↑ SDG 1.5, 11.5, 2.3, 2.4; CSA Pillar 1; CSA Pillar 3) (Thornton

et al., 2018). In a context of increasing frequency of storms, early warning systems offer an important tool for fishing industries and fishers, enabling them to increase the lead time to prepare for storms, and bolster the protection of people and equipment against loss and damage (FAO, 2017a).

In the broader context of the food system, resilience and adaptation measures should also target post-harvest processes, and the infrastructure and logistics of supply chains. Improved storage facilities and packaging reduce farmers' vulnerability to climate-related impacts such as pest infestations, interrupted transport routes to markets, or price spikes (↑ SDG 1.5, 2.3, 2.4). They also reduce food loss and associated GHG emissions (↑ SDG 12.3, 13; CSA Pillar 3). Climate-proofing of key transport routes, processing and distribution facilities, and the increasing of stocks of critical production inputs, are important strategies to build resilient supply chains, and ensure timely access to production inputs and output markets (FAO, 2017a).

It should be noted that resilience and adaptation measures may pose trade-offs to other CSA and sustainable development objectives, especially when they involve new infrastructure, energy-intensive processes, or the modification of environmental flows. These trade-offs should be assessed and addressed from the planning stage and at different spatial scales, using different tools and approaches. These include cost-benefit analysis (Branca *et al*., 2017), the water–energy–food (WEF) nexus approach (FAO, 2014b and 2014c; Mohtar, 2016; see also Box 5), integrated water resources management (IWRM; Shah and van Koppen, 2006; Moriarty *et al*., 2010), and watershed management (FAO, 2006 and 2014d).

Protective construction works, such as dykes, can protect the livelihoods of food producers, especially the poor and most vulnerable, from flooding, storms and sea level rise. In the Mekong Delta in Viet Nam, the heightening of dykes provided flood protection and allowed rice farmers to intensify production – from double to triple cropping – and increase incomes (↑ SDG 1.5, 2.3, 2.4, 10.1).[12] However, the measure disadvantaged the most resource-poor farmers, who were deprived of the natural influx of nutrients to their fields via flooding, and lacked the financial resources to compensate with purchased fertilizers, or to intensify their systems. The dyke heightening therefore exacerbated existing inequalities, and negatively affected the production and livelihoods of the poorest rice farmers (↓ SDG 2.3, 2.4, 10.1, 10.3; CSA Pillar 1). The reduced sedimentation also accelerates the subsidence of the flood plain in the long term (↓ SDG 15.3) (Roy *et al*., 2018).

Cooling systems to counter increased heat stress, such as in livestock farming or storage, may result in high energy consumption – possibly resulting in increased GHG emissions, depending on the source of energy – and increased costs (↓ SDG 2.4, 7.3, 13; CSA Pillar 1; CSA Pillar 3) (Roy *et al*., 2018). Therefore, the additional cost should be assessed against benefits from avoided losses, so as to ensure overall profitability of the activity. Alternative, renewable energy sources should also be explored, in order to limit associated GHG emissions (see Section 2.1.3.3).

The construction of water storage structures, whether large dams or on-farm water harvesting ponds, can improve access to irrigation water, thereby reducing vulnerability to droughts. At the same time, they change the environmental flows of water, with potential negative impacts on the access to water resources of other users, who tend to be relatively poor or otherwise marginalized (↓ SDG 6.1, 10.2), and on water-related ecosystems (↓ SDG 6.6, 15.1).

Main synergies and trade-offs with other CSA pillars

Pillar 1: *Synergies*: Crossbreeding can improve the resilience of breeds and varieties in synergy with productivity and resource use efficiency. *Trade-offs*: Targeted resilience and adaptation measures are often associated with additional costs, which will be borne differently by women and men, depending on socio-economic status. Benefits of these measures may accrue to society as a whole, and/or particular individuals in the mid to long term, through

12 It should be noted that increased rice cropping, depending on the method used, e.g. flooded paddy production, can increase methane emissions (↓ SDG 13.1).

stabilization of production and incomes. Planning and interventions that help to avoid yield reductions and loss or damage to productive assets can improve resource use efficiency.

Pillar 3: *Synergies*: Avoided yield reduction/loss due to resilience and adaptation measures reduces GHG emission intensity. *Trade-offs*: Adaptation measures involving increased energy use may cause an increase in GHG emissions, if not sourced from renewable energy.

2.1.2.3 CSA action category 2.C: Manage agro-ecosystems, ecosystem services and biodiversity – synergies and trade-offs with the SDGs

Enhancing ecosystem services and biodiversity in agro-ecosystems and surrounding landscapes and seascapes strengthens the resilience and adaptive capacity of these systems to the impacts of climate variability and change (↑ SDG 1.5, 2.4, 13.1). It also contributes to the sustainable use and conservation of terrestrial, aquatic and marine ecosystems, conservation of biodiversity (↑ SDG 6.6, 14.2, 14.5, 15.1, 15.2, 15.4) and restoration of degraded land (↑ SDG 15.3). Management practices that improve soil structure and fertility result in increased erosion protection, water infiltration and water retention, thereby building resilience in crop and pasture land to climate change impacts such as droughts, floods and storms (Power, 2010). Higher water infiltration and retention improves the use of rainfall water by crops, benefiting crop productivity and reducing irrigation requirements (↑ SDG 2.3, 2.4, 6.4). It also enhances the recharge of groundwater and can therefore improve access to water, although greater vegetation cover and a higher share of trees in agro-ecosystems may also result in increased water consumption through transpiration and reduced recharge (↓↑ SDG 6.1).

Greater biodiversity of both agricultural and wild species within the agro-ecosystem and the surrounding landscape supports disease regulation, as it limits the spread of pests and diseases and supports a stronger presence of natural predators (↑ SDG 2.5) (FAO, 2017a; Power, 2010). Agricultural biodiversity is supported by the diversification of production systems (CSA Pillar 1; CSA Pillar 2) and the use of a wider range of crop varieties and animal breeds. Greater diversity in crop varieties and animal breeds can also enhance the *in situ* conservation of the genetic diversity of cultivated plants and domesticated animals (↑ SDG 2.5). Biodiversity of wild species is promoted through the provision of diverse habitats interspersed in the agricultural landscape, such as natural biotopes, set-aside land, and other structural elements such as hedges or buffer strips (↑ SDG 2.5). Disease regulation is further enhanced by structural heterogeneity within cultivated areas through the use of intercropping practices; these can apply a wide range of spatial and temporal patterns that integrate different annual and perennial crop species. Structural heterogeneity can also support the regulation of the microclimate, and buffer the impacts of temperature extremes.

Traditional ecosystem-based production systems, such as Globally Important Agricultural Heritage Systems (GIAHS), are often well adapted to local conditions and integrated in the natural ecosystem. Their use and adaptation as part of a CSA strategy helps to conserve and revive cultural and natural heritage (↑ SDG 11.4) (FAO, 2014e).

Agroforestry is an integrated production system that combines production of woody perennials and crops or grasses and/or animals on the same piece of land, and applies many of the above-mentioned principles. Other examples of practices that build resilience through the sustainable management of ecosystems are the restoration of degraded pastures (↑ SDG 15.3; see Section 2.1.1.3) and sustainable forest management (↑ SDG 15.2) (FAO, 2017a). The limitation of overfishing and the sustainable management and conservation of marine and coastal areas support the development of ecosystems rich in biodiversity that are more resilient to climate change (↑ SDG 14.2, 14.4, 14.5). Such ecosystems support the sustainable management of fish stocks and enhance the resilience of fishers. Mangroves are particularly important elements in coastal ecosystems. Their conservation and sustainable management play a crucial role in maintaining and regenerating fish stocks. In addition, they provide protection for production systems in coastal areas from the physical impacts of climate change (↑ SDG 11.5) and sequester carbon (↑ SDG 13; CSA Pillar 3) (FAO, 2017a; CCAFS, 2017).

The adoption of sustainable practices and production systems, such as agroforestry, to enhance ecosystem services and biodiversity may be associated with yield and income reductions at the initial stage, but are usually compensated in the long term (↓↑ SDG 2.3, 2.4) (Power, 2010). To offset yield and income reductions in the short term, social protection mechanisms, such as cash transfers, can be tied to the promotion of CSA practices (see, e.g., FAO, 2019a) (↑ SDG 1.3).

Main synergies and trade-offs with other CSA pillars

Pillar 1: *Synergies*: Enhanced ecosystems and biodiversity can provide benefits for both resilience and productivity/incomes (see Section 2.1.1.3). *Trade-offs*: The adoption of practices under this CSA action category, such as agroforestry, may reduce productivity and economic benefits in the short term – and may impact women and men differently. However, these trade-offs are usually compensated in the long term. Agricultural intensification to promote productivity should occur in a sustainable way, so to avoid trade-offs with ecosystem services and biodiversity.

Pillar 3: *Synergies*: Many of the practices under this CSA action category, such as agroforestry, enhance the sequestration of carbon in soils and plant biomass.

Table 5: Interlinkages between SDG targets and CSA Pillar 2

For each CSA action category, SDG targets with synergies are shown in green, and trade-offs in yellow. The presence of synergies and/or trade-offs between an SDG and CSA Pillar 2 as a whole is indicated by green and yellow shading.

CSA Pillar 2		CSA action category	SDG 1	SDG 2	SDG 3	SDG 4	SDG 5	SDG 6	SDG 7	SDG 8	SDG 9	SDG 10	SDG 11	SDG 12	SDG 13	SDG 14	SDG 15	SDG 16	SDG 17
	Synergy	2.A Diversification	1.1 1.2 1.5	2.1 2.2 2.4			5.1					10.1			13.1				
		2.B Exposure	1.5	2.3 2.4				6.4				10.1	11.5	12.3	SDG13 13.1	14.3	15.6		
		2.C Ecosystem	1.3 1.5	2.3 2.4 2.5				6.1 6.4 6.6					11.4 11.5		SDG13 13.1	14.2 14.4 14.5	15.1 15.2 15.3 15.4		
	Trade-off	2.A Diversification					5.1												
		2.B Exposure		2.3 2.4				6.1 6.6	7.3			10.1 10.2 10.3			SDG13		15.1		
		2.C Ecosystem		2.3 2.4				6.1											
		CSA - SDG interlinkages																	

Synergies

Trade-offs

2.1.3 CSA Pillar 3 – Reduce and/or remove GHG emissions, where possible

The main objective of CSA Pillar 3 is to reduce GHG emissions from food production – in terms of both absolute emissions and emission intensities – and sequester carbon in agro-ecosystems, agricultural landscapes and seascapes. The IPCC (Roy *et al.*, 2018) finds that limiting global warming to 1.5 °C above pre-industrial levels, compared with a warming of 2.0 °C, would make it markedly easier to achieve many aspects of sustainable development. It would result in a reduced number of people exposed to climate risks and vulnerable to poverty, and greater chances of eradicating poverty and reducing inequalities. In principle, therefore, efforts related to climate change mitigation in agriculture and food systems, combined with efforts in other sectors, contribute to achieving multiple Sustainable Goals, including those related to equality (SDG 10), poverty (SDG 1), and hunger (SDG2).

While climate change mitigation measures in agriculture are clearly 'actions to combat climate change' (SDG 13), it should be noted that there is no specific target under SDG 13 that focuses on reducing GHG emissions. The only SDG target with an indicator accounting for GHG emissions is SDG 9.4, which focuses on the manufacturing sector, including the processing of food products, but excluding the agricultural production stages up to harvest. Nevertheless, this publication considers all the actions described below as contributing to SDG 13.

The CSA action categories for achieving CSA Pillar 3 objectives assessed below are:

1) increase resource use efficiency;
2) retain and sequester carbon in agro-ecosystems;
3) replace fossil fuel-based energy with renewable energy.

At the end of this section, Table 6 summarizes the interlinkages identified between SDG targets and the CSA action categories of CSA Pillar 3.

2.1.3.1 CSA action category 3.A: Increase resource use efficiency – synergies and trade-offs with the SDGs

The efficient use of resources as a climate change mitigation strategy in agriculture targets the reduction of GHG emissions (↑ SDG 13) related to: the application of organic and inorganic fertilizers to crops, e.g. site specific nutrient management; livestock production, and in particular enteric fermentation in ruminants (e.g. use of nutrient-dense feeds); management of manure (e.g. composting or use of biodigesters); manufacturing of inputs (e.g. reducing the need for feed through higher feed conversion rates); and use of energy (e.g. use of machinery and cooling systems). There are strong synergies with CSA Pillar 1, as most related measures will also reduce expenditure on inputs, and/or increase the productivity of the production system (↑ SDG 1.1, 1.2, 2.3, 2.4) (see Section 2.1.1.1) (Roy *et al*., 2018). GHG emissions represent a loss of nutrients and energy from the production system, in particular nitrogen and carbon compounds. Avoided GHG emissions result in a greater availability of these resources for biomass production and energetic use, and a reduced need for additional inputs, thereby increasing overall resource use efficiency (↑ SDG 8.4). The reduction of food losses improves resource use efficiency along food value chains, and reduces their GHG emission intensity (↑ SDG 12.3).

In mechanized production systems and industries along food value chains, the use of efficient technologies can reduce GHG emissions from energy use, and increase energy use efficiency. Examples include efficient cooling systems in livestock production, or efficient engines in fishing vessels (↑ SDG 7.3, 9.4). An additional measure to reduce energy use in fisheries is reducing overcapacity of the fishing fleet. This also benefits the control of overfishing and the sustainable management of fish stocks (↑ SDG 14.4) (FAO, 2017a).

The promotion of efficient cooking stoves is often part of CSA initiatives in areas where open wood fires are mainly used for cooking. Besides saving fuelwood and reducing GHG emissions from food preparation, the stoves help to reduce air pollution with particulate matter, resulting in health benefits related to respiratory diseases (↑ SDG 3.9) (FAO, 2017a; Thomas *et al*., 2015). They can also empower girls and women, since they reduce their burden in fuelwood collection (↑ SDG 5.1) (Roy *et al*., 2018).

Breeding plays an important role in reducing the requirements for energy-intensive fertilizers and feed, by optimizing nutrient use and feed conversion efficiency in plants and animals, respectively. Modern breeding techniques also enable the development of varieties that produce nitrification-inhibiting substances in their roots. This is a process that occurs naturally in subspecies of the forage crop *Braccharia* and in sorghum and reduces the loss of the valuable plant nutrient nitrogen through volatilization of nitrous oxide (Subbarao *et al*., 2017).

Main synergies and trade-offs with other CSA pillars

Pillar 1: *Synergies*: Most measures and practices that improve resource use efficiency help to achieve productivity/income gains, and GHG emission reduction in synergy. Reduction in input use for the purpose of GHG emission reduction results in the same economic, social and environmental benefits identified under CSA Pillar 1.

Pillar 2: *Synergies*: Reduced expenditures for manufactured inputs can support accumulation of financial assets among food producers. It is widely recognized that individuals and communities with higher incomes and savings levels have higher levels of adaptive capacity to deal with climate impacts.

2.1.3.2 CSA action category 3.B: Retain and sequester carbon in agro-ecosystems – synergies and trade-offs with the SDGs

The sequestration of carbon in agro-ecosystems occurs through the assimilation of atmospheric carbon dioxide (CO_2) in plant biomass, and its long-term storage in stable compounds of the soil organic matter and in woody biomass and derived products. This can be achieved, for example, through a combination of conservation tillage and mulching of cover crops and crop residues, integration of trees in crop and livestock systems (agroforestry and silvopastoral systems), restoration of degraded ecosystems, seaweed aquaculture, sustainable forest management, reforestation and afforestation. Carbon sequestration in agro-ecosystems effectively contributes to climate change mitigation only when stocks of sequestered carbon are retained in the agro-ecosystems in the long term. This requires the sustained use of sustainable management practices over time, and the conservation of carbon-rich agro-ecosystems, including wetlands, peatlands, forests and mangroves (↑ SDG 13) (FAO, 2017a).

This CSA action category largely relies on the same practices that enhance ecosystem services related to increasing productivity (see Section 2.1.1.3), and on building the resilience of agro-ecosystems (see Section 2.1.2.3). It therefore presents strong synergies with CSA Pillar 1 and CSA Pillar 2, and contributes to productive and resilient production systems (↑ SDG 1.5, 2.3, 2.4), food security (↑ SDG 2.1, 2.2), and the sustainable use, restoration and conservation of ecosystems (↑ SDG 6.6, 14.2, 15.1, 15.2, 15.3). It should be noted that the increased stock of living biomass may also result in higher water consumption due to transpiration, and a reduction of hydrological flows to the detriment of downstream water users and water-related ecosystems (↑↓ SDG 6.1, 6.6) (Roy *et al*., 2018).

The transition from slash-and-burn and burning of crop residues to more sustainable practices focused on reducing GHG emissions can reduce air pollution associated with particulate matter and reduce risks of respiratory diseases (↑ SDG 3.9).

The conservation and sustainable management of forest land can provide a variety of livelihood and income-generation options for forest-dependent communities (World Bank, 2016). Linking sustainable forest management with the responsible sourcing of timber presents opportunities to create decent jobs (↑ SDG 8.3) (Roy *et al*., 2018). When pressure exists for alternative uses of land, for example, the expansion of crop or livestock production, especially in regions that are hard to monitor, forest protection policies should be accompanied by the promotion of sustainable intensification of crops and/or livestock. This is to reduce trade-offs associated with the protection of lands (Tiedeman and Ghosh, 2018).

Afforestation and reforestation initiatives may also create competition for land, and negatively affect the access of farmers to it, in particular, poor or marginalized subsistence farmers without land titles. This can have repercussions on their livelihoods, food security and economic opportunities (↓ SDG 1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 10.1, 10.3) (Roy *et al*., 2018).

Main synergies and trade-offs with other CSA pillars

Pillar 1: *Synergies*: Practices that increase soil organic carbon content also improve soil fertility and productivity. *Trade-offs*: There are potential trade-offs related to competition for land between food production and afforestation.

Pillar 2: *Synergies*: Practices that increase soil organic carbon content also improve soil structure, thereby reducing susceptibility to erosion, drought and floods. Agroforestry systems can improve resilience through the creation of favourable microclimates, and reduce susceptibility to erosion.

2.1.3.3 CSA action category 3.C: Replace fossil fuel-based energy with renewables

The use of fuels and energy derived from renewable energy sources – wind, solar, hydropower, geothermal and biomass – is associated with substantially lower GHG emissions, compared with fossil fuels. Agriculture can directly contribute to increasing the share of renewable energy in fuel and energy consumption – and thereby to climate change mitigation – through the provisioning of biomass, i.e. agricultural products, by-products and waste, for bioenergy generation, assuming that the energy intensity of biomass production is minimized (↑ SDG 7.2, 13).

In anaerobic digesters, biomass, such as manure from intensive livestock systems, is decomposed in containers in the absence of oxygen. The methane (CH_4) produced in the fermentation process is captured and can be used for heating, cooking or energy production. This technology allows farmers to produce bioenergy on-farm, creating opportunities for income generation and diversification (↑ SDG 2.3). The controlled fermentation process reduces the direct release of methane into the atmosphere, and lowers farm requirements for alternative energy sources. Digested slurry, the by-product of the fermentation process, can be used as fertilizer, replacing external inputs and increasing the production system's resource use efficiency and profitability (↑ SDG 2.4; CSA Pillar 1) (FAO, 2017a). The fermentation process also kills pathogenic organisms in manure and human excreta used for biogas production, thereby reducing health and food safety risks related to the use of treated manure and consumption of resulting crops (↑ SDG 3.3) (Roy *et al*., 2018).

Agriculture can also profit from other renewable energy technologies to reduce the use of fossil fuels in food production, and along the whole food value chain. Examples include solar-powered irrigation systems (SPIS) and solar cooling systems in dairy production (↑ SDG 9.4). SPIS can substantially reduce GHG emissions from water pumping (GACSA, 2017a). The installation of photovoltaic panels, as part of SPIS, as well as other renewable energy technologies can also provide electricity for additional uses. This has the effect of enhancing access to sustainable and reliable energy, particularly in remote areas without an electricity grid connection (↑ SDG 7.1). Moreover, the decentralized use of such technologies reduces dependence on unreliable electricity and fuel supply services, which may be further affected by the impacts of climate change on transport and electricity infrastructure (↑ SDG 13.1; CSA Pillar 2). Decentralized renewable energy systems can also reduce the burden on girls and women of procuring traditional biomass (↑ SDG 5.1) (Roy *et al*., 2018).

The use of arable land to produce biomass for bioenergy, and the direct use of food crops for bioenergy, may compete with food production and food security objectives. This can particularly affect resource-poor and vulnerable food producers by compromising their access to arable land (↓ SDG 1.1, 1.2, 1.4), as well as their food security, due to reduced availability of food and increasing food prices (↓ SDG 2.1, 2.2) (Roy *et al*., 2018). Approaches and tools are available to assess the sustainability of bioenergy options and identify and minimize potential trade-offs. These include the Assessment Framework for Integrated Food-Energy Systems (FAO, 2014b) and the Water–Energy–Food Nexus Tool (FAO, 2014c).

Main synergies and trade-offs with other CSA pillars

Pillar 1: *Synergies*: The use of renewable energy can reduce production costs. Bioenergy, in particular, offers opportunities for recycling by-products and waste, thereby increasing resource use efficiency in the production system. *Trade-offs*: Competition for land and biomass between bioenergy and food production could result in trade-offs and affect food security.

Pillar 2: *Synergies*: Decentralized renewable energy systems increase the resilience of food producers and communities in remote areas; if the grid is negatively impacted by a disaster, users of decentralized energy will be unaffected.

Table 6: Interlinkages between SDG targets and CSA Pillar 3

For each CSA action category, SDG targets with synergies are shown in green, and trade-offs in yellow. The presence of synergies and/or trade-offs between an SDG and CSA Pillar 3 as a whole is indicated by green and yellow shading.

		CSA action category	SDG 1	SDG 2	SDG 3	SDG 4	SDG 5	SDG 6	SDG 7	SDG 8	SDG 9	SDG 10	SDG 11	SDG 12	SDG 13	SDG 14	SDG 15	SDG 16	SDG 17
CSA Pillar 3	Synergy	3.A Efficiency	1.1 1.2	2.3 2.4	3.9		5.1		7.3	8.4	9.4			12.3	SDG13	14.4			
		3.B Sequestration	1.4 1.5	2.1 2.2 2.3 2.4	3.9			6.1 6.6		8.3					SDG13	14.2	15.1 15.2 15.3		
		3.C Renewables		2.3 2.4	3.3		5.1		7.1 7.2		9.4				SDG13 13.1				
	Trade-off	3.A Efficiency																	
		3.B Sequestration	1.1 1.2 1.3 1.4	2.1 2.2				6.1 6.6				10.1 10.3							
		3.C Renewables	1.1 1.2 1.4	2.1 2.2															
		CSA - SDG interlinkages																	

Synergies

Trade-offs

2.2 Assessment of interlinkages between CSA implementation steps and SDG targets

A crucial element of a successful transformation to climate-smart food production systems is the CSA implementation process itself. This generally consists of five steps: **1)** provide a solid evidence base for climate-smart decisions; **2)** create an enabling environment for the adoption of CSA options; **3)** build the capacities of institutions to support CSA at all levels; **4)** mobilize resources for CSA; and **5)** identify and implement the most suitable mechanisms to achieve wide and sustained adoption of CSA options by food producers (FAO, 2017a). This section assesses the interlinkages between SDGs and CSA implementation steps and respective actions, many of which directly correspond to the means of implementation identified in the 2030 Agenda for Sustainable Development. At the end of this section, Table 7 summarizes the interlinkages identified between SDG targets and the five CSA implementation steps.

2.2.1 Step 1: Expand the evidence base

A solid evidence base is a key enabling condition for identifying effective and sustainable CSA options and informed decision-making in the development of agricultural policies. Expanding the evidence base is therefore an important element in strengthening countries' adaptive capacity (↑ SDG 13.1). This involves, for example, assessing climate change impacts and GHG emissions from agriculture and food systems, identifying and evaluating climate-smart options in a wider context of sustainable development, and assessing institutional and financial needs for implementation, and of course, information provided through the feedback loop of monitoring and evaluation (FAO, 2017a). The information gathered should enable governments to answer questions such as:

- What are the likely climate impacts at sectoral and subsectoral levels, and how do the time frames associated with those impacts inform the time line of adaptation interventions?
- How do the costs of adaptation for a given sector or subsector compare with the likely profits and livelihood benefits of the same sector or subsector?
- Would these investments be better spent on increasing imports and diversifying national, regional or local economies?
- Are there trade or value-added opportunities that would make a high cost of adaptation worthwhile?

One important aspect of expanding the evidence base relates to a key focus of climate-smart agriculture: promoting a gender-responsive approach. As such, this step should include the collection of sex-disaggregated data and the performance of gender analysis. In this way, it provides the basis for gender-sensitive agricultural policies and project planning that support the equality of opportunities for women and men (↑ SDG 5.5) (FAO 2017a).

2.2.2 Step 2: Support enabling policy frameworks/planning

Following the creation of a solid evidence base, climate-smart agriculture options are prioritized, and a consistent, country-owned CSA strategy is developed. Guided by this strategy, agriculture-related climate change measures are integrated into the pertinent sectoral plans and strategies; existing policies are revised and, if needed, new policies developed to create enabling conditions for implementation of prioritized CSA options, set appropriate incentives, and address barriers to adoption and possible trade-offs (↑ SDG 13.2) (FAO, 2017a). This planning process can also be linked to, and benefit the planning and implementation processes under international climate change-related mechanisms (↑ SDG 13.B).

A comprehensive assessment of current polices and their intended and unintended consequences on national development priorities should be conducted. The aim is to inform the revision and development of policies, and ensure the greatest possible policy coherence, supported by multistakeholder dialogue and inclusive decision-making processes (↑ SDG 17.14). Coordinated planning and policy coherence across sectors enable relevant interlinkages to be identified, synergies enhanced, and potential trade-offs avoided – or at least minimized or compensated (Bouyé *et al*., 2018).

Existing policies adopted to improve the priority area of agricultural productivity may present trade-offs with adaptation and mitigation objectives, and with the sustainable use of natural resources. For example, fossil fuel or electricity subsidies for pumping irrigation water in dry areas may increase productivity in the short term. But in the longer term, they may result in wasteful use of energy, overexploitation of water resources, and ultimately affect farmers' resilience (FAO, 2017a). Integrated planning approaches such as the Water–Energy–Food (WEF) nexus approach (FAO, 2014c; see Section 2.1.2.2 and Box 5) can support the redesign of such policies, by facilitating coordination across a range of objectives and sectors (↑ SDG 12.C). The result can be improved outcomes for

resilience (↑ SDG 13.1), sustainable water withdrawals (↑ SDG 6.4), energy efficiency (↑ SDG 7.3), and climate change mitigation (↑ SDG 13). Revisions of subsidies should pay particular attention to poor food producers, so as to avoid unequal impacts on their livelihoods and food security. This can be ensured by targeted social protection measures (see below).

Similar subsidies exist in the fisheries sector. Their redesign or abolishment aims to reduce overcapacity in fishing fleets (↑ SDG 14.6) with positive outcomes for the sustainable management of fish stocks (↑ SDG 14.4), the resilience of fishing communities and industries (↑ SDG 13.1), and reduced GHG emissions (↑ SDG 13) (see Sections 2.1.2.3 and 2.1.3.1). A debate on the synergies between sustainable fisheries, adaptation and mitigation can also create additional momentum for the implementation of international law related to the conservation and sustainable use of oceans (↑ SDG 14.C).

The promotion of CSA options that build on and/or enhance ecosystem services and biodiversity (see Sections 2.1.1.3 and 2.1.2.3) can support the integration of these values into the planning and strategy development of agriculture and related sectors (↑ SDG 15.9).

One important aspect to consider in planning climate-smart agriculture activities is the tenure rights of food producers. Many practices promoted in CSA initiatives, such as agroforestry or conservation agriculture, require up-front investment, and take time to realize benefits. Only secure tenure rights to cultivated land can guarantee that food producers will benefit from such investment. Weak or lacking tenure rights, in particular for women and indigenous people, often pose a barrier to the adoption of promoted practices, since there is a risk of dispossession (FAO, 2017a; Alcorn, 2013). It is therefore critical for CSA planning to understand the tenure system in place, and develop synergies with initiatives focused on building equitable legislation for tenure (↑ SDG 16.B) and achieving equal tenure rights for all population groups, including the poor (↑ SDG 1.4), women and girls (↑ SDG 5.1, 5.A), and indigenous peoples (↑ SDG 10.3). The *Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security* (VGGT) provide guidance for such initiatives (FAO, 2012).

Depending on the socio-economic context and prioritized climate-smart agriculture options, social protection programmes and measures can be important features of the CSA implementation process, and contribute to national efforts on social protection and equality (↑ SDG 1.3, 1.B, 10.4). Social protection measures, such as food vouchers, cash transfers, insurance of risks and transfer of productive assets, directly alleviate the poverty of poor food producers (↑ SDG 1.1, 1.2), and improve their access to basic services (↑ SDG 1.4) and food security (↑ SDG 2.1, 2.2). This, in turn, supports the productive capacity of the beneficiaries, and enables them to engage in economically productive activities and invest in more sustainable, resilient and innovative agricultural practices (↑ SDG 2.3, 2.4, 8.3) (FAO, 2017a; FAO, 2018a).

The building of livelihood assets and insurance of risk through social protection increases the resilience of poor and vulnerable food producers, allowing them to mitigate the impact of climate shocks on food security and livelihoods (↑ SDG 1.5). It also helps them to avoid negative coping strategies, such as the sale of productive assets, or exploitation of natural resources in unsustainable ways (↑ SDG 6.6, 14.4, 15.1, 15.2, 15.3, 15.4, 15.5) (FAO, 2017a; GACSA, 2017b). Social protection measures, for example cash-for-work, can also contribute to implementing CSA options that reach beyond the capacities of single households, and strengthen the resilience of the community or landscape as a whole. Examples of such CSA options are reforestation, construction works for erosion control and watershed management, and transport infrastructure to improve access to markets. This can support both the creation of decent work (↑ SDG 8.5) and the building of resilient infrastructure (↑ SDG 9.1).

While the planning and development of resilient infrastructure holds potential for synergies with building resilient rural livelihoods (↑ SDG 1.5) and equal opportunities (↑ SDG 10.2), attention should be paid to possible trade-offs with ecosystem services. For example, in sensitive ecosystems, road construction could have negative effects on terrestrial carbon sinks (↓ SDG 13, 13.2; CSA Pillar 3), land and water resources, and biodiversity (↓ SDGs 6.6, 15.1, 15.2, 15.4, 15.5).

2.2.3 Step 3: Strengthen national and local institutions

Implementing CSA is a knowledge-intensive and innovative process, and requires a high level of technical skill and institutional coordination. Capacity development is, therefore, a fundamental part of this process (FAO, 2017a). Institutions are the organizing force for food producers and decision-makers, as well as the avenue through which CSA can be scaled up and sustained (CCAFS, 2017). Appropriate institutional capacity should be developed at three different scales:

- Local: Institutions at district and community levels support the translation of generic information about CSA to a local context, and can act as the last-mile liaison with food producers.
- Meso: Local governments and agencies are often useful channels for accessing support from, and communicating needs to national governments from the local level. As such, they may warrant appropriate funding or capacity-building support to perform this function.
- National: The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS, 2017) notes that national institutions normally play a critical role in information production related to technology and management options, climate variability and projections, and market conditions. They also tend to provide safety nets. National institutions would take the lead in mainstreaming CSA in plans and policies, strengthening horizontal and vertical collaboration, and identifying and supporting options for decentralized support for implementation.

An effective way of ensuring institutional capacity development across these levels involves building and supporting multistakeholder networks, partnerships and platforms. These can facilitate, for example, the co-development of innovations for climate-smart agriculture, the generation of evidence for the knowledge-intensive decision-making processes involved in CSA, or implementation of CSA options at field level (↑ SDG 17.17) (FAO, 2017a; FAO, 2019b).

Capacity development for CSA implementation covers a wide range of areas that have links to many different SDGs and related targets. These include human and institutional capacities on climate change mitigation and adaptation (↑ SDG 13.1, 13.3); development planning for improved links between rural areas, peri-urban and urban areas (↑ SDG 11.A); integrated water resources management and related coordination mechanisms at different scales (↑ SDG 6.4, 6.5, 6.A); research and transfer of CSA-related technologies (↑ SDG 12.A); and accessing and utilizing genetic resources (↑ SDG 15.6).

Working together with university students on the analyses and assessments involved in expanding the evidence base – for example through the sponsoring and mentoring of graduate student researchers and interns – can be an effective pathway to strengthen the professional skills and capacities of youths (↑ SDG 4.4) (FAO, 2017a).

Coordination between different sectors, including agriculture and the environment, is key for sustainable and equitable outcomes of CSA. This can be achieved by adjusting institutional mandates and processes, and by establishing institutional coordination mechanisms, such as interministerial and multistakeholder taskforces. Improved coordination and participation in CSA planning can enhance the efficiency, accountability and transparency of governance processes related to CSA (↑ SDG 16.6). It can also support the integration of climate change measures in policies, strategies and planning in the agriculture sector, and possibly serve as a model for better integration in other sectors (↑ SDG 13.2).

Institutions providing immediate support to food producers, such as extension, information and financial services organizations, form an important part of the enabling environment for CSA implementation. Capacity development for CSA should include the establishment of such services, and ensure that related institutions have the appropriate skills. One example of financial services is climate-related insurance. This enables food producers, especially small-scale farmers, to maintain a basic level of livelihood and food security when a climate shock unexpectedly occurs, and to take financial risks related to investments in climate-resilient and adaptive technologies (Microinsurance

Network, 2018; Barooah *et al*., 2017; GACSA, 2017b). Establishing financial services for climate-smart agriculture therefore contributes to the capacity of financial institutions to provide broad access to such services (↑ SDG 8.10), and encourages investment in innovative practices and technologies (↑ SDG 9.3). Attention should be paid to the design of services such as insurance, since there is a risk of excluding poor people from accessing these, thereby exacerbating inequalities (↓↑ SDG 10.4) (Roy *et al*., 2018).

Strengthening the capacities of food producers' organizations, cooperatives, networks and individuals – especially smallholders – to participate in these services will not only strengthen the economic opportunities of this latter group (↑ SDG 8.1), but will also empower them to engage in decision-making (↑ SDG 16.7).

2.2.4 Step 4: Enhance financing options

As with any agricultural development initiative, preparing and implementing a CSA strategy requires investments. Positive economic returns on investment have been demonstrated for many climate-smart agriculture options, and long-term benefits of CSA adaptation and mitigation measures can be expected for national economies and food security (FAO, 2017a). Climate-smart agriculture can also provide an avenue to mobilize additional financial resources from international climate finance mechanisms and bilateral partners for sustainable agricultural development in developing countries (↑ SDG 17.3). Climate finance and official development assistance for CSA can contribute to the USD 100 billion climate finance target of developed countries, and leverage public domestic and private sector investments in CSA, including financial services (↑ SDG 8.10, 13.A) (see Section 2.1.4.3).

Enhancing the financing options for CSA can also contribute to increasing investments in a number of specific areas, for example, agricultural research and extension services (↑ SDG 2.A), sustainable forest management (↑ SDG 15.B), and the sustainable use of biodiversity and ecosystems (↑ SDG 15.A). One example of a financing mechanism for sustainable forest management is REDD+ (*Reducing Emissions from Deforestation and forest Degradation, plus the sustainable management of forests, and the conservation and enhancement of forest carbon stocks*). This is a system that provides developing countries with payments for sequestering carbon in forested lands. Given the costs associated with sustainable forest management, together with the foregone economic opportunities associated with alternative land uses, such as crop or livestock production, REDD+ can be an effective way to enable developing countries to continue sequestering carbon on their forested land, and to pursue the associated adaptation and livelihood co-benefits (Negra and Wollenberg, 2011).

There is a risk that CSA investments focused on highly productive, intensive and high-tech CSA solutions may shift resources away from other policy sectors, particularly those targeting potential beneficiaries who are most in need. CSA strategies should therefore take the needs and possibilities of all population groups into account, so as to ensure that investments in CSA also support the reduction of poverty and inequalities insofar as possible (↓↑ SDG 1.A, 10.B).

2.2.5 Step 5: Implement practices in the field

The principal objective of CSA implementation at field level is to strengthen the capacities of individual food producers and other stakeholders in the food system to build productive, resilient and sustainable food production systems and value chains in the context of climate change (↑ SDG 13.3). The focus of training programmes for food producers is naturally on technical skills and technologies, thereby improving the professional skills and qualification of adults and youths (↑ SDG 4.4).

In addition, participatory adult learning formats, such as the Farmer Field School (FFS) approach, offer a platform for discussing and promoting skills on a wide range of topics, such as healthy nutrition and other health-related

issues, including HIV/AIDS (↑ SDG 2.2, 3.3), entrepreneurial skills to connect food producers to markets and value chains (↑ SDG 9.3, 14.B), and the use of information and communication technologies (ICTs) to improve access to climate and other information (↑ SDG 5.B, 9.C). The participation of women and marginalized people in FFS can support their empowerment and improve social and economic inclusion (↑ SDG 5.5, 10.2). In order to achieve this objective, attention must be paid to the following questions: How is the opportunity for participation communicated? Who learns about it? What potential barriers to participation may beneficiaries face, depending on their sex, economic or social status (FAO, 2016c)?

Specific models already exist to target young people. For example, Junior Farmer Field and Life Schools (JFFLS) train vulnerable rural youth in agricultural, entrepreneurial and life skills. They include a module on climate change, sustainable agricultural practices and green jobs. JFFLS can support efforts to increase employment of youth in agricultural activities and counteract migration to urban areas (↑ SDG 8.6) (FAO, 2017a).

Table 7: Interlinkages between SDG targets and the CSA implementation steps

For each CSA implementation step, SDG targets with synergies are shown in green, and trade-offs in yellow. The presence of synergies and/or trade-offs between an SDG and the CSA implementation process as a whole is indicated by green and yellow shading.

CSA Implementation Steps		CSA Implementation step	SDG 1	SDG 2	SDG 3	SDG 4	SDG 5	SDG 6	SDG 7	SDG 8	SDG 9	SDG 10	SDG 11	SDG 12	SDG 13	SDG 14	SDG 15	SDG 16	SDG 17
	Synergy	Step 1 Evidence					5.5								13.1				
		Step 2 Planning	1.1 1.2 1.3 1.4 1.5 1.B	2.1 2.2 2.3 2.4			5.1 5.A	6.4 6.6	7.3	8.3 8.5	9.1	10.2 10.3 10.4		12.C	SDG13 13.1 13.2 13.B	14.4 14.6 14.C	15.1 15.2 15.3 15.4 15.5 15.9	16.B	17.14
		Step 3 Institutions				4.4		6.4 6.5 6.A		8.1 8.10	9.3	10.4	11.A	12.A	13.1 13.2 13.3		15.6	16.6 16.7	17.17
		Step 4 Financing	1.A	2.A						8.10		10.B			13.A		15.A 15.B		17.3
		Step 5 Adoption			3.3	4.4	5.5 5.B			8.6	9.3 9.C	10.2			13.B	14.B			
	Trafe-off	Step 1 Evidence																	
		Step 2 Planning						6.6			9.1				SDG13 13.2		15.1 15.2 15.4 15.5		
		Step 3 Institutions										10.4							
		Step 4 Financing	1.A									10.B							
		Step 5 Adoption																	
		CSA - SDG interlinkages																	

Synergies

Trade-offs

2.3 Conclusions of assessment and mapping of CSA-SDG interlinkages

The assessment of CSA-SDG interlinkages found that achievement of all Sustainable Development Goals can be advanced through particular CSA actions, and that potential trade-offs should be managed (see Figure 2 below and Table A2.1 in Appendix 2). This analysis, which uses the CSA pillars (and associated action categories), as well as the five CSA implementation steps as a starting point, is complemented by mapping these linkages, using each individual SDG as the starting point (see Appendix 1). The assessment and mapping revealed that the greatest number of touch points between CSA and the SDGs exist for Goals 1 (no poverty), 2 (zero hunger), 6 (clean water and sanitation), 8 (decent work and economic growth), 12 (responsible consumption and production), 13 (climate action), 14 (life below water) and 15 (life on land) (see Table 8). Given CSA's focus on incomes and productivity, as well as the natural environment, the synergies between CSA and these particular Sustainable Development Goals is unsurprising. Of the five implementation steps, Step 2: Support enabling policy frameworks/planning offers more synergies with SDG targets than any other. This is perhaps logical, given the centrality of planning for CSA, as well as for all the SDGs. While both CSA action categories and implementation steps link to virtually all SDGs, touch points with SDG 16 (peace, justice and strong institutions) and SDG 17 (partnerships for the goals) are only present in the CSA implementation steps, in particular Step 2 (planning), Step 3 (institutions), and Step 4 (financing). In terms of trade-offs, these are far fewer than the synergies between CSA and the SDGs. The highest number of potential trade-offs was identified for SDG 1, SDG 2, SDG 6, SDG 10 (reduced inequalities), SDG 13 and SDG 15. CSA Pillar 3 presents slightly larger numbers of potential trade-offs with SDGs than the other pillars or implementation steps. The potential trade-offs with SDG 13 (climate action) derive from prioritization of productivity objectives over resilience; energy-intensive adaptation strategies over reduced energy consumption; or infrastructure/economic development measures over preservation of terrestrial carbon stocks. This suggests the need for careful attention to be paid to managing these trade-offs during the planning stages. It also underscores the importance of balancing food production, climate change adaptation and mitigation goals – a central function of the CSA approach. This publication's findings align with those described in the literature review (Section 1.3), supplementing them by offering additional depth, details and explanations about the interlinkages between climate-smart agriculture and the Sustainable Development Goals.

Table 8: Share of SDG targets presenting synergies and trade-offs with climate-smart agriculture

	Share of SDG targets	
	Synergies	Trade-offs
SDG 1 - End poverty	7/7	5/7
SDG 2 - Zero Hunger	6/8	4/8
SDG 3 - Good health and well-being	5/13	0/13
SDG 4 - Quality education	3/10	1/10
SDG 5 - Gender equality	5/9	2/9
SDG 6 - Clean water and sanitation	6/8	4/8
SDG 7 - Affordable and clean engergy	3/5	1/5
SDG 8 - Decent work and economic growth	7/12	0/12
SDG 9 - Industry, innovation and infrastructure	4/8	1/8
SDG 10 - Reduced inequalities	5/10	5/10
SDG 11 - Sustainable cities and communities	4/10	0/10
SDG 12 - Responsible consumption and production	6/11	1/11
SDG 13 - Climate action	5/5	3/5
SDG 14 - Life below water	8/10	1/10
SDG 15 - Life on land	9/12	4/12
SDG 16 - Peace, justice and strong institutions	3/12	0/12
SDG 17 - Partnerships for the goals	3/19	0/19
Overall	89/169	32/169

Figure 2: Overview of interlinkages between CSA pillars/implementation process and SDGs[13]

13 A summary mapping with more details is provided in tabular format in Table 8 in APPENDIX 2: Summary table of CSA-SDG interlinkages.


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Discussion of nationally determined contributions in the context of CSA-SDG integration

Nationally determined contributions (NDCs) present countries' ambitions to reduce national greenhouse gas emissions and adapt to climate change under the Paris Agreement. Although mitigation and adaptation targets are generally set forth in separate components of the NDC document, many countries acknowledge the potential co-benefits and synergies between mitigation and adaptation actions, particularly in the agriculture sector. An analysis of NDCs[14] found that 57 countries selected and prioritized agriculture sector mitigation and adaptation actions based on their potential synergies, and 32 countries explicitly referred to climate-smart agriculture in their NDCs (FAO, 2016b). Although not explicitly expressed in other NDCs, Chandra *et al*. (2016) find that most agriculture sector mitigation and adaptation priorities align with the objectives of CSA. This confirms that climate-smart agriculture is a valid approach for pursuing countries' NDC ambitions in the agriculture sector, balancing mitigation and adaptation strategies and enhancing synergies, while ensuring progress on national food security and agricultural development objectives.

Under SDG 13 (climate action), the 2030 Agenda for Sustainable Development acknowledges the leading role of the United Nations Framework Convention on Climate Change (UNFCCC) in negotiating the global response to climate change. It is therefore essential to bring the Paris Agreement – the central international agreement on climate change, negotiated under the UNFCCC – and the NDCs into the picture when discussing efforts to achieve SDG 13. While NDC actions will clearly contribute to achieving SDG 13, it is also important to consider climate change in the context of all other Sustainable Development Goals since it is a risk multiplier, particularly for poor populations, and may impair any efforts on sustainable development (Bouyé *et al*., 2018). An integrated approach to implementation of the 2030 Agenda and the NDCs is therefore crucial in order to achieve sustainable outcomes for both.

Crumpler *et al*. (2019) developed a methodology to assess linkages between agriculture-related mitigation and adaptation actions set forth in the NDCs and SDG targets. Applied at global level, the assessment identified 1 700 potential 'climate action-sustainable development pathways', divided into 17 broad categories of climate actions in the agriculture sector. It shows that aside from SDG 13, the greatest potential for synergies between these climate actions and SDGs exists within SDG 15 (life on land), SDG 2 (zero hunger), SDG 12 (responsible consumption and production), and SDG 1 (no poverty). In addition, the assessment found potential synergies with all other SDGs, except SDG 17 (partnerships for the goals) (see Figure 3).

14 The analysis was mainly performed on intended nationally determined contributions (INDCs), the precursors of NDCs. These were converted to NDCs after national ratification of the Paris Agreement.

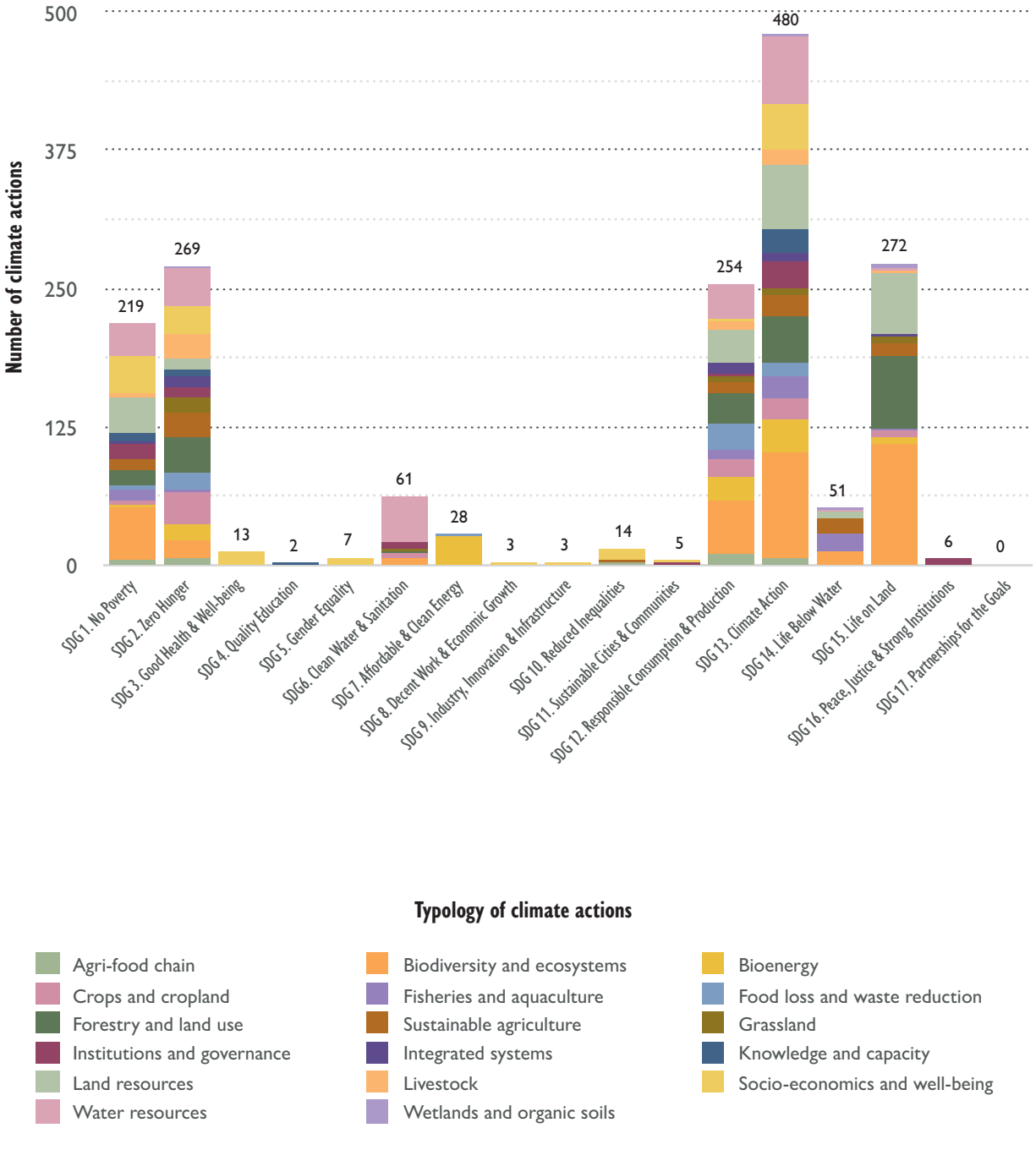

Figure 3: Distribution of climate action-sustainable development pathways in the agriculture sectors, per SDG (after Crumpler *et al.*, 2019)

The 'climate action-sustainable development pathways' in a country's NDC can inform the identification and prioritization of options in a CSA implementation process aimed at enhancing synergies across the SDGs. The distribution of these pathways across SDGs and targets can also support the identification of gaps in the contribution of NDC climate actions to SDGs, thereby providing an entry point for targeted enhancement of additional potential NDC-SDG synergies. Based on the assessment in Part 2 of this publication, the CSA approach can serve to strengthen these NDC-SDG synergies in the agriculture sector. The guidelines provided in the next section (Part 4) therefore refer to the implementation of CSA in the context of an integrated effort to achieve the SDGs and NDC objectives at national level.

PART 4

Guidelines for the implementation of CSA in the context of a country's integrated effort to achieve the SDGs and its NDC objectives

As described in the Introduction to this publication, climate-smart agriculture offers countries the possibility to achieve several SDG targets, as well as their NDC objectives. In order to leverage these opportunities, CSA should be implemented in a manner that maximizes the potential for integration of the approach into a country's joined-up effort to achieve the SDGs and its NDC objectives. Implementation of CSA in the context of a national integrated effort is the focus of Part 4 of this publication. FAO (2017a) provides a comprehensive overview of the main CSA implementation steps (expand the evidence base; support enabling policy frameworks/planning; strengthen national and local institutions; enhance financing; and implement practices in the field). Here, we build on FAO's description of these implementation steps, with an added focus area – monitoring, evaluation and reporting. The approach is to highlight sub-steps that are important for implementing a CSA approach in a manner that allows for its relevance and integration into a country's combined effort to achieve the SDGs and its NDC objectives. Each section includes a brief description of how support at subnational level can advance CSA implementation and the achievement of SDGs and NDC objectives at national level.[15] As described in the Methodology section, the guidelines were developed based on a combination of evidence from the literature, information from country case study, and expert judgement.

Throughout Part 4, reference is made to countries' integrated efforts to achieve the SDGs and their NDC objectives, despite the fact that these are linked to separate multilateral agreements (the 2030 Agenda for Sustainable Development and the Paris Agreement, respectively). This is due to an increasing insistence at national and international levels that the 2030 Agenda and the Paris Agreement should be advanced in an integrated manner at national level, so as to benefit from synergies between the two processes. This would allow for a reduction of transaction costs and avoid duplication of efforts associated with planning, implementing and reporting on these processes separately (see, for example, Bouyé *et al*., 2018).

4.1 Expand the evidence base

This step of the CSA implementation process comprises an assessment of climate change impacts and GHG emissions from agriculture/food systems, as well as non-climatic factors affecting agricultural production systems. Also included at this stage is the identification and evaluation – taking into account co-benefits and trade-offs – of climate-smart options in a wider context of sustainable development, and an assessment of institutional and financial needs for implementation. Certain aspects of building the evidence base for climate-smart agriculture are also crucial for integrating CSA into a country's efforts to achieve the SDGs and its NDC objectives. For example:

15 It should be noted that the level of decentralization in a country will influence the nature of the national-subnational collaboration on CSA, SDG and NDC efforts.

4.1.1 Determine current and projected impacts of climate change, non-climatic impacts on agricultural production systems and producers, and the role of agriculture in GHG emissions and mitigation opportunities (based on global, regional, national and local assessments)

One important step in developing a CSA evidence base in the context of the SDGs and NDCs is to determine the current and projected impacts of climate change on agriculture and other sectors related to climate-smart agriculture.[16] The assessment of these impacts can also help to demonstrate the importance of addressing climate change in an agriculture sector approach, and hence support the case of climate-smart agriculture as an integral part of a country's efforts to achieve the SDGs and its NDC objectives. In terms of climate impacts, global and regional assessments, such as those produced by the Intergovernmental Panel on Climate Change, are widely available for all regions. The World Bank's Climate Change Knowledge Portal provides country datasets focused on historical and projected changes in climatic conditions, with a focus on key sectors including agriculture, water resources and infrastructure (World Bank, 2019b). For countries with the capacity to develop higher resolution and more specific assessments of agriculture sector vulnerability, tools such as FAO's Modelling System for Agricultural Impacts of Climate Change (MOSAICC) enables users to assess crop production systems, water and forest resources, and the national economy under changing climatic conditions (FAO, 2015a).

Also critical in developing the CSA evidence base is a solid understanding of the sector's emissions, so as to pinpoint how best to target mitigation policies and interventions. For countries that have included agriculture in their NDC (or in their planning for implementation of SDG 13), this type of analysis may already have been performed. If not, the CSA planning phase can support development of agriculture-related climate change mitigation components of the SDG 13/NDC planning process, including the enhancement of synergies with other SDGs. National governments can use tools such as FAO's Agriculture, Forestry and Other Land Use (AFOLU) Emissions Analysis Tool. This provides an overview of emissions and trends in the AFOLU sector at country level, while also contextualizing emissions within the respective region(s), continent(s), and the world. The tool allows users to compare national GHG inventory data for the AFOLU sector reported to the UNFCCC with data from the FAOSTAT Emissions database. This can help countries to improve their capacity to report on the AFOLU emissions sector in national GHG inventories (FAO, 2019c), which are a key requirement for Parties to the Paris Agreement.

Given CSA's focus on improved productivity and incomes, non-climatic drivers of change to agricultural production systems and producers should also be considered in expanding the evidence base for climate-smart agriculture. These drivers include macroeconomic and microeconomic trends, shifting rural-urban population densities, and changes in agricultural technologies (see, for example, FAO, 2017d). Such drivers may already be considered in a country's agricultural or economic development planning, and it is likely that these types of trend will also be part of a country's planning efforts related to the SDGs and its NDC. Where these analyses do not yet exist, CSA planning can develop them as a contribution to the country's (integrated) efforts to achieve the SDGs and its NDC objectives.

4.1.2 Identify and evaluate potential climate-smart options

FAO recommends identifying and evaluating potential climate-smart options as an integral aspect of expanding the evidence base for CSA (FAO, 2017a). It should be noted that many of the sub-steps, described below, which would be undertaken to identify and evaluate potential climate-smart options, also relate to other key processes in a CSA

16 Depending on a country's SDG/NDC priorities, key sectors to assess may include infrastructure, water resources, land resources and oceans, related respectively to SDGs 11, 6, 15 and 14.

implementation approach. Examples include planning, institutional development and financing. Therefore, while the sub-steps listed below are described as part of the expanding the evidence base phase, a country may decide to undertake these in relation to another step of the CSA process.

Sub-steps of identifying and evaluating potential climate-smart options include:

- **Screening of existing national programmes, policies and strategies for options with potential contribution to CSA objectives**
  FAO (2017a) notes that, in order to identify and evaluate potential climate-smart agriculture interventions that would contribute to building a broader national CSA strategy, existing plans, strategies and policies should be screened to create a list of policy priorities that CSA could advance, assuming alignment between the plans, policies and strategies and the CSA pillars. This screening should include a review of, for example, the nationally determined contribution, National Development Plans, National Agriculture Investment Plans, Nationally Appropriate Mitigation Actions and National Adaptation Plans. Since these plans will probably also contain (and in some cases, are) the country's blueprint for achieving the SDGs and/or NDC objectives,[17] using them to identify potential CSA strategies and interventions will help to build explicit integration of CSA into a country's efforts related to the SDGs and NDC.
- **Identify synergies and trade-offs between pillars of a CSA action**
  As described in Part 2, some actions, such as practising agroforestry, create synergies across the three CSA pillars. In other instances, trade-offs are generated. For example, an action focused on implementing livestock cooling systems to adapt to increased heat could lead to additional GHG emissions. While it is important to identify these synergies and trade-offs between pillars in expanding the evidence base for CSA, this process can also be used to identify potential synergies and trade-offs between specific CSA actions and SDGs. This will enable synergies to be enhanced and avoid/reduce/compensate for trade-offs throughout the planning process in a strategic and targeted manner. The mapping presented in Part 2 can be used as a starting point for developing a country-tailored process, wherein particular SDGs or NDC objectives are mapped to CSA pillar and sub-pillar activity areas ('CSA action categories'). In this way, CSA planners will know that activities focused on, for example, CSA Pillar 1 action category 'Diversify production systems' (see Section 2.1.1.2) tend to create synergies and trade-offs with particular SDG targets or NDC priorities. Integrated approaches and tools such as the Water–Energy–Food Nexus Tool can be important in determining and prioritizing specific trade-offs in a given context (see Section 2.1.2.2, Box 5). Depending on how a country is prioritizing SDG implementation, or based on the contents of its NDC, pillar-specific actions can be prioritized to leverage synergies, or modified to avoid trade-offs. In order to undertake this analysis of synergies and trade-offs between a CSA action and a particular SDG, CSA planners can draw on data and assessments generated specifically for the particular SDG.
- **Identify the potential synergies and trade-offs relative to the baseline activities**
  This type of analysis serves two main purposes: **1)** It highlights how CSA actions produce climate and sustainability benefits relative to baseline activities, which can range from non-CSA agricultural interventions to no-action scenarios. For example, a baseline agricultural intervention might focus on increased market participation of food producers. While this is a useful approach in many instances, a CSA approach integrated with efforts to achieve the SDGs and NDC objectives would also consider the potential associated trade-offs. These could include further marginalization of the poorest producers, who are incapable of producing for markets (leading to poor outcomes in relation to SDG 10 on reduced inequality), or reduced food security (a trade-off related to SDG 2), since food is diverted to market, instead of being consumed locally. This analysis

17 In Ethiopia, for example, the county's current national development plan, the Growth and Transformation Plan II (GTPII), is the basis for its approach to achieve the SDGs. The country's Climate Resilient Green Economy Strategy, which is embedded in the GTPII, is the basis for its NDC. In Bangladesh, the Five Year Plan, the country's overarching economic growth and development planning process, is the basis for achieving the SDGs, and the Bangladesh Climate Change Strategy and Adaptation Plan is the basis for its NDC (GoB, 2017c). These examples are further described in the sections below: Support enabling policy frameworks /planning and Country case studies.

also serves to highlight any trade-offs associated with the CSA action, relative to the baseline activity, allowing these to be addressed, *ex ante*. Using the example above, perhaps the ideal CSA intervention would be two or more initiatives focused on market access for some producers, market readiness for other producers, and increased production for the poorest producers. Consideration of baselines is also critical for developing a monitoring and evaluation system that can show how a given intervention has performed (FAO, 2019b).
2) This type of analysis highlights how a CSA action produces benefits or trade-offs relative to actions that are unrelated to CSA, SDGs or NDCs. For example, non-climate-smart agriculture SDG action related to SDG 2.3 (double the agricultural productivity and incomes of small-scale food producers) might focus on the introduction of improved seed varieties, without consideration of projected climate change. A CSA action, on the other hand, would be likely to generate greater success in advancing this target by considering both productivity and climate risk.

Another aspect of assessing synergies and trade-offs between a CSA action and the baseline is consideration of the level at which an intervention would be applicable vs. the level at which the need is greatest. For example, field-level actions may link to SDG 2.4 (agricultural practices); the landscape level to SDG 15 (management of ecosystems and biodiversity); food system actions to SDG 12 (sustainable production and consumption); and the institutional level to means of implementation across the SDGs. It may be that a country has strong capacity to implement field-level actions, but the greatest need relates to structural change at food system level. In such a case, interventions focused on the field level can be made a lower priority, and others that focus on the food system level can be moved higher up the agenda.

- **Analysis of drivers and barriers to adoption**
  In this step of the process to evaluate climate-smart agriculture options, CSA planners identify the barriers to adoption of various CSA practices at field/household level. This process may be similar to those undertaken by SDG and NDC planners in order to ensure that related interventions are successfully adopted by both women and men. Some of the barriers to CSA adoption likely to be identified are ones that, if mitigated through effective planning, would also help to advance some SDG targets. For example, barriers to adoption of CSA (and other agricultural development interventions) include insecure land tenure rights; lack of access to financial services, including credit and insurance; lack of access to safety nets; and lack of access to appropriate markets. Addressing these barriers so as to ensure successful adoption of CSA interventions would also advance several SDGs, as described in the mapping exercise in Part 2. In addition, the process of considering drivers and barriers to adoption of CSA in the context of a country's integrated efforts to achieve the SDGs and its NDC objectives may reveal additional drivers or barriers that would not have been examined had the analysis focused only on CSA. In this way, the integrated approach may have a positive feedback effect on adoption of CSA.

4.1.3 Determine the institutional and financing needs for implementation of priority actions

Part of the expanding the evidence base phase involves identifying the institutional and financing needs of CSA priority actions. These two topics are then fleshed out in subsequent steps of the CSA implementation process, as detailed below. In relation to integration of CSA with efforts to achieve the SDGs and NDC objectives, institutional needs may include (additional) cross-ministerial coordination, as well as coordination and support of subnational implementation. One important issue to bear in mind is that integrating CSA with efforts to achieve the SDGs and NDC objectives may mean that entities other than the Ministry of Agriculture (or equivalent), such as Planning, Finance or Environment Ministries, have more authority over CSA planning and implementation than they normally would (see, for example, FAO, 2019b).

- **Costing of CSA interventions/options, e.g. cost-benefit analysis**
  In order to determine the financing needs of climate-smart agriculture, it is crucial to undertake a costing of options, through, for example, a cost-benefit analysis at both household and country levels. The particulars of CSA cost-benefit analyses are described in depth in FAO's *Climate-Smart Agriculture Sourcebook*. Given the focus on integrating CSA into a country's efforts to achieve the SDGs and its NDC objectives, we recommend that costs and benefits associated with advancing those agendas be explicitly considered in the cost-benefit assessment. For example, the ability of a CSA intervention to help achieve a priority SDG target should be qualified as a benefit. Given the global mandate and visibility associated with achieving the SDGs and NDCs, any benefits associated with CSA in this context could be considered benefits for the state in the global political arena. Furthermore, if there are additional costs associated with undertaking a CSA intervention in the context of integration with efforts to achieve the SDGs and NDC objectives – such as additional M&E or reporting burdens – this expenditure should also be considered.

4.1.4 Subnational level: Expanding the evidence base

In order to expand the evidence base for CSA at national level, it is essential to engage the subnational level actors, so as to create a spatially-explicit baseline as a starting point for CSA programming. There are a number of tools that can be designed at national level, in conjunction with subnational authorities, and then implemented at subnational level to gather relevant evidence that can inform national CSA policy. These tools include rapid rural appraisals, participatory rural appraisals (FAO, 1999), subnational surveys and household surveys (FAO, 2019d). In designing these data-gathering tools to enable integration with efforts to achieve the SDGs and NDC objectives, CSA proponents should align as closely as possible with subnational survey processes related to SDG and NDC efforts. In many countries, data on SDG progress are collected on an annual basis at subnational level, and CSA proponents can advocate for the inclusion in such surveys of CSA metrics that are SDG-relevant.

4.2 Support enabling policy frameworks/planning

This step of the climate-smart agriculture implementation process comprises the development of a consistent, country-owned CSA strategy. It includes prioritization of CSA options and the revision/development of policies and sectoral plans that create enabling conditions for implementing prioritized CSA options; the setting up of policy coordination mechanisms for relevant actors; and the consideration of gender and socio-economic differentiation in the planning process. FAO's *Climate-Smart Agriculture Sourcebook* provides a detailed overview of this step in the CSA implementation process. Here, we focus on how a few of the key elements of this step can be designed to enable maximum alignment between CSA implementation and a country's integrated effort to achieve the SDGs and its NDC objectives.

4.2.1 Develop a consistent, country-owned CSA strategic framework at national level

FAO notes that most countries have multiple strategies, policies and programmes in place that address some of the CSA objectives, and that integrating CSA into those documents may seem sufficient. However, given the need to advance multiple objectives at various time and geographical scales, "a unifying CSA strategic framework is needed to identify the synergies and trade-offs that exist between already existing policies, programmes and strategies" (FAO, 2017a). In addition, development of a country-owned strategic framework allows for explicit, *ex ante*

consideration of the country's SDG and NDC priorities, and integration of CSA into the integrated effort to achieve the SDGs and NDC objectives. Development of a CSA strategic framework aligned with such an integrated effort should entail:

- **Contribution of CSA to national development goals**
  It is critical that climate-smart agriculture be positioned within the broader framework of a country's development goals. In many countries, the national development goals will be aligned or take into account the country's SDG and NDC priorities. In Ethiopia, for example, the country's national development plan – the Growth and Transformation Plan II (2015-2020) (GTP II) – is aligned with the objectives of both the SDGs and the Paris Agreement (T. Bemnet, personal communication, 2019). In Ecuador, the National Secretariat for Planning and Development is drawing up a plan that sets out sectoral and local goals directly informed by the SDGs (including those related to climate) (S. Avalos, personal communication, 2019). Even if an explicit alignment between the country's development goals and its integrated SDG and NDC effort does not exist, CSA planners should articulate how climate-smart agriculture contributes to the achievement of national development goals.
- **Prioritization of intervention options**
  The CSA approach requires prioritization among the various possible actions, in order to provide a basis for targeted investment in climate-smart agriculture. The process of considering each CSA option as objectively as possible should involve developing a list of prioritization criteria, against which each option is weighed. Data for assessing each action against this list of criteria can be drawn from the assessments carried out under the Expand the evidence base step. Examples include identification of synergies and trade-offs, and analysis of drivers and barriers to adoption, described in Section 4.1.2, and the cost-benefit analysis for CSA options described in Section 4.1.3. Given the importance of integrating CSA into efforts related to jointly achieving the SDGs and NDC objectives, one set of prioritization criteria should revolve around the relative ability of the action to contribute to achieving those SDGs and NDC objectives. These criteria could be based on SDG indicators, such as the "ability of action to enable children to begin or remain in school due to improved nutrition status, or reduced agricultural labour needs" (based on SDG Indicators 4.1.1, 4.2.1, 4.2.2). They could also be based on a country's NDC, such as the "ability of action to reduce agricultural emissions through improvements in fertilizer management" (based on Bangladesh's NDC) (GoB, 2017a).
- **Development of policies, plans and investments supportive of CSA and its inclusion in a country's integrated efforts to achieve the SDGs and its NDC objectives**
  In its *Climate-Smart Agriculture Sourcebook* module on National Policy Coherence for CSA, FAO notes that, in addition to having a stand-alone CSA strategy, climate-smart agriculture should also be mainstreamed into plans and policies such as national agricultural or rural development plans. This process entails adjusting existing plans and policies to exploit synergies and minimize trade-offs related to the mainstreaming of CSA, and in some instances, new policies will have to be created.[18] In addition to adjusting existing or creating new policies related to agriculture, SDG- and NDC-related plans and policies may also have to be adjusted, so as to fully enable the integration of climate-smart agriculture into efforts to achieve the SDGs and NDC objectives. It is likely that SDG plans will already be in place at this point (see APPENDIX 3: Country case studies) and these may be difficult to adjust. As the national plans that form the basis for SDG implementation expire and are renewed, CSA planners should advocate for inclusion of climate-smart agriculture in these as a way to inform SDG implementation. As for NDC plans, given that countries are yet to start implementing their first NDCs, there may be clear opportunities for explicitly including climate-smart agriculture in the NDC implementation plan. In addition, many countries will soon begin developing their second NDCs. In these instances, climate-smart agriculture advocates should engage in national discussions to influence development of this second NDC.

18 This sub-step builds on the sub-step focused on screening existing national programmes, policies and strategies, described under the previous section: Identify and evaluate potential climate-smart options.

4.2.2 Coordinate policy-making processes and responsible institutions

In addition to developing a country-owned CSA framework, a critical step in both implementing climate-smart agriculture generally, and in integrating CSA into efforts to achieve the SDGs and NDC objectives, is to ensure coordination of the policy-making process. FAO warns that lack of institutional cooperation and coordination, as well as a siloed policy-making approach, can create trade-offs when activities are intended to meet multiple objectives, or even a single objective (FAO, 2017a; FAO, 2019b). In most countries, the CSA policy coordination process should involve at least the institutions focused on climate change/environment, agriculture, food security, rural development, water, energy and land use. When focusing on CSA integration into efforts related to achieving the SDGs and NDC objectives, coordination should also involve actors from planning and finance ministries, and any other institutions key to efforts related to SDGs and NDCs.

One way to support the integration of climate-smart agriculture in SDG- and NDC-related plans and policies is to create simple guidelines that agriculture (or SDG and NDC) planners can use to refine existing plans and policies, or create appropriate new ones. In Ethiopia, for example, guidelines were created for the Ministry of Agriculture and Natural Resources and the Ministry of Livestock and Fishery, to enable them to mainstream the principles of their Climate Resilient Green Economy (CRGE) Strategy – the blueprint of the country's climate and sustainable development work – into agriculture sector projects, programmes and policies (T. Bemnet, personal communication, 2019).

These guidelines could involve a simple checklist of steps, such as:

- Review existing policies and plans, and identify any barriers to CSA implementation within. For example, an agriculture sector plan might focus only on short-term results, which could impede advancement of CSA, given that many CSA options require time for benefits to accrue.
- Develop a menu of CSA actions that, in the context of the given country, advance efforts to achieve the SDGs and NDC objectives contained in the policy or plan. For example, if reducing emissions in the livestock sector is a major NDC/SDG priority, planners could design the menu to focus on the key actions that advance this priority. While not specific to any one country context, the CSA-SDG mapping presented in Part 2, or the SDG and NDC prioritization criteria described under 'Prioritization of intervention options' (see Section 4.2.1), could be useful in developing a country-specific menu.
- Identify a list of output indicators that planners or project developers could use to simultaneously measure progress on CSA and efforts related to achieving the SDGs and NDC objectives (FAO, 2019b). For example, if one of the country's SDG priority areas is improving water quality through reduced pollution, CSA indicators can be selected related to reduced leaching of chemicals into water bodies, through improved use of precision fertilization.

In addition, providing planners with a list of expert contacts at relevant ministries or with background documents on CSA will help planners to understand the process of mainstreaming. In Ethiopia, for example, the National Planning Commission (NPC), the entity responsible for overseeing the SDG and NDC implementation process, mandated the Ministry of Environment, Forest and Climate Change to create checklists of SDG- and NDC-related actions that sector ministries could use in developing their plans. These plans were then reviewed by the NPC, to ensure alignment with the SDG and NDC agendas (Bouyé *et al.*, 2018).

Integrated sectoral planning is an important aspect of integrating climate-smart agriculture into a country's efforts to achieve the SDGs and its NDC objectives, along with institutional coordination on a number of other levels. Some of these institutional coherence and coordination processes are described in Section 4.3.

4.2.3 Consider socio-economic and gender-differentiated barriers and incentive mechanisms

On average, 43 percent of the agricultural labour force in developing countries is made up of women (FAO, 2016d). In addition, more than 60 percent of the 3 billion people who live in the rural developing world work on land plots smaller than two hectares, and many of them are poor and food insecure, and lack access to markets and services (FAO, 2015b). FAO notes that for CSA implementation to be successful, gender and socio-economic differentiation must be taken into account in planning processes (FAO, 2017a). This focus is especially important when CSA implementation is integrated into a country's efforts to achieve the SDGs and its NDC objectives. A focus on women in climate-smart agriculture helps to advance SDG 5 (gender equality), especially Targets 5.1 and 5.A; a focus on the poorest and most vulnerable is imperative in addressing SDG 1.1, 1.2 and 1.4 on the elimination of poverty, and SDG 10.1, 10.2 and 10.3, which aim to reduce inequalities.[19] In addition, since a large percentage of countries have included gender equality in their INDCs (UNDP, 2016),[20] it can be assumed that a gender-responsive approach to CSA will also help countries to advance their NDC implementation.

FAO (2017a) highlights the following as some of the principles for ensuring that CSA planning and implementation is gender-responsive and supportive of the poorest and most vulnerable, both to enable an effective CSA approach, and to advance related SDGs:

- Enable equal access by women and poor and marginalized food producers to the productive resources and information required to implement CSA, including land, extension services, ICTs, seed stock, etc.
- Remove financing barriers to allow women and economically marginalized food producers to invest in CSA. These barriers often relate to access to loans, savings opportunities and insurance.
- Promote opportunities for women food producers to participate and advance in sustainable value chains, e.g. through access to marketing support and training in production of value-added products.
- Ensure small-scale food producers' and women's participation in planning, policy and budget processes, especially through subnational planning processes.
- Promote climate-smart agriculture through social protection systems, e.g. social assistance programmes that help the poorest and most vulnerable to meet basic needs, while also providing training on CSA.

In addition, it is important to understand the different barriers that women and men face to adopting adaptive practices, and design specific interventions that take these into account.

4.2.4 Subnational level: Support enabling policies and planning

There are various good practices that national governments can pursue to ensure that climate-smart agriculture is advanced through planning and policies at subnational level, and that this subnational implementation of CSA supports integrated national efforts to achieve the SDGs and NDC objectives. Good practices include:

- Supporting local governments to integrate CSA into local agriculture and climate planning. Ecuador, for example, through its *Climate-Smart Livestock* pilot project, has created Land Use and Development Plan guides

19 The aforementioned targets are described in the section APPENDIX 1: Mapping of CSA action categories and implementation steps against SDG targets.

20 The United Nations Development Programme (UNDP)'s analysis of gender in the INDCs was conducted in 2016, before many countries had formally transitioned their INDCs to NDCs. The analysis finds that 65 countries made at least one reference to gender equality or women (UNDP, 2016).

that include tools for climate change planning at subnational level. In addition, Ecuador has created a taskforce to support use of these guides by subnational governments.

- Ensuring that national-level planning frameworks explicitly include efforts to advance planning at subnational level, in a continuous manner.
- Including local authorities in national planning processes. In Ecuador, for example, the Inter-institutional Committee for Climate Change is the national government body that brings together all relevant ministries and actors on climate change. The body maintains two seats for subnational authorities; one is held by a coalition of provincial authorities, and the other is a municipal authority representative. The logic behind the inclusion of subnational representatives in this planning and decision-making body is that decisions taken at national level are implemented at subnational level, and should be feasible for subnational implementation.

4.3 Strengthen national and local institutions

The third critical step in implementing a national CSA approach is to develop appropriate institutional arrangements and capacities. In the *Climate-Smart Agriculture Sourcebook*, FAO notes that this step involves synchronizing mandates, and enhancing horizontal and vertical coordination within and among sectors, stakeholders, organizations and institutions. The following components of institutional capacity and set-up are fundamental for advancing a CSA approach and, in the context of integrating climate-smart agriculture with a country's efforts to achieve the SDGs and its NDC objectives, should be undertaken in a manner that reflects the needs of that integration. At the same time, building institutional capacity based on the following sub-steps has the co-benefit of supporting the achievement of SDG and NDC enabling environment goals, and more generally, of strengthening institutional capacity to achieve SDGs/NDCs.

4.3.1 Identify relevant institutions

Depending on the context, CSA institutions include agriculture ministries, environment ministries, rural advisory organizations, financial institutions, land tenure/customary law regimes, community-based organizations, insurance schemes and information and extension services, among others (FAO, 2017a). As with any comprehensive and multi-faceted agricultural development approach, the breadth of institutions that must be involved in order to ensure successful implementation is extensive. When it comes to implementing CSA in the context of integration with a country's efforts to achieve the SDGs and NDC objectives, the number of relevant institutions may expand considerably, and CSA advocates should work directly with SDG- and NDC-focused leadership to understand the suite of actors involved. These may include health and education ministries, urban development agencies, and the private sector.

4.3.2 Address gaps in institutional set-up

In developing a climate-smart agriculture approach, a ministry of agriculture may detect institutional gaps within its structure, related to one or more of the key aspects of CSA. For example, a key component may be the creation or strengthening of a working relationship with the country's hydrometeorological service. In terms of integration with efforts related to the SDGs and NDC, gaps may relate to a lack of familiarity or dialogue between the agriculture ministry and the authorities leading efforts to achieve the SDGs and NDC objectives, or a general lack of engagement with the related planning and implementation process. A whole-of-government approach, required for effective achievement of the SDGs and NDC objectives (see Section 4.3.5), can enhance the engagement of CSA actors in those efforts.

4.3.3 Build capacity of institutions working at nexus of efforts related to CSA/SDGs/NDCs

The integration of these various agendas requires a high level of knowledge about each one within institutions that may normally take a siloed approach to their sectoral focus. For example, ministries of agriculture may lack capacity in relation to climate change, such as greenhouse gas accounting and assessment of climate risks. Other relevant ministries may lack the ability to consider and balance multiple objectives at once, a deficiency that can be remedied by introducing simple checklists of all priorities to be considered. FAO's *Climate-Smart Agriculture Sourcebook* provides a comprehensive overview of methods for assessing and building institutional capacity in the context of

scaling up CSA. The main areas of focus, described below, also apply in the context of CSA integration into efforts related to achieving the SDGs and NDC objectives. These are:

- Implementation capacity – ability to deliver programmes and projects, from planning to monitoring and evaluation, e.g. the ability to monitor project outcomes related to the three CSA pillars, plus any SDG targets that may be advanced.
- Partnering capacity – ability to engage in networks, alliances and partnerships, e.g. is the Ministry of Agriculture well integrated into the SDG leadership bodies at national level?
- Knowledge capacity – ability to access, generate, manage and exchange information and knowledge, e.g. assuming that the Environment Ministry leads on NDC implementation, can it readily translate information from the UNFCCC process to line ministries that manage implementation?
- Policy and normative capacity – ability to formulate and implement policies and lead policy reform, e.g. do relevant authorities have the ability to think comprehensively about integration of the various agendas?

4.3.4 Ensure consistent leadership

In relation to integration of the 2030 Agenda and Paris Agreement agendas at national level, Bouyé *et al*. (2018) describe consistent leadership across institutions as key for their implementation. The authors highlight central aspects of consistent leadership as shared leadership between SDG and NDC oversight institutions, and joint participation of those lead institutions in coordination bodies for both implementation processes. This publication extends that thinking to include use of climate-smart agriculture in advancing those agendas. As such, ministries and individuals in a given country with responsibility for CSA should advocate for a permanent seat at the table in SDG and NDC leadership bodies, and CSA proponents should ensure that leaders from SDG and NDC coordination entities are directly involved in CSA decision-making bodies. In addition, attention should be paid to developing political will and CSA champions, so to ensure that climate-smart agriculture is on the table when NDC targets are renegotiated, or SDG priorities are reconsidered (FAO, 2016e).

4.3.5 Build a coherent, whole-of-government approach

In addition to having champions at a leadership level who will consistently push the CSA agenda within discussions related to the SDGs and NDC, there should be a whole-of-government approach to climate-smart agriculture, so that all ministries whose missions can benefit from CSA are aware of those benefits. Climate-smart agriculture should not be seen as exclusively falling within the remits of agriculture and environment ministries. Making actors across the government aware of the benefits of CSA will help to ensure that it is seen as a viable option for realizing a variety of national priorities related to achieving the SDGs and NDC objectives. It will also help to build alliances between CSA proponents and the more powerful ministries within a government, such as planning and finance ministries and the Prime Minister's office. One tool that can be used for building a whole-of-government approach is cross-sectoral dialogue. This could be in the form of *ad hoc* events, such as dedicated workshops, or permanent bodies, such as standing committees. Other options for dialogue include multistakeholder platforms, which provide oversight (see, for example, FAO, 2019b) and engage SDG and NDC implementation ministries on topics related to CSA, helping to highlight how climate-smart agriculture advances the missions of these other ministries. Such tools also build the capacity of line ministries to think and act outside their silos, and to be able to articulate how CSA supports other national priorities.

Ecuador is using sectoral councils as part of its whole-of-government approach. These are made up of groups of ministers charged with implementing efforts related to achieving the SDGs and NDC objectives, and who meet monthly to report on their ministries' progress toward SDG targets. The sectoral committees are coordinated by the National Secretariat of Planning and Development, but come under the auspices of the President's office. The Agriculture Ministry is represented in the sectoral committee focused on production.

4.3.6 Engage non-state actors in implementation

Non-state actors are critical for two key reasons. First, they are often key in disseminating information to local, potential adopters of CSA practices, including as part of rural advisory services systems, and in translating barriers and opportunities for implementation back to decision-makers. For example, private sector collaboration can be valuable for strengthening the entrepreneurial skills of farmers, and for providing certain services. The Government of Bangladesh has involved the private sector in insurance schemes for gender-responsive CSA, due to the private sector's experience with such schemes (World Bank, FAO and IFAD, 2015). Second, as Bouyé *et al.* (2018) describe in their guidelines for integrated implementation of the 2030 Agenda and Paris Agreement, many countries have mechanisms in place for engaging non-state actors in implementation – including action platforms, policy consultation groups, advisory panels, etc. When CSA approaches adequately involve non-state actors, these stakeholders can more seamlessly engage in the types of implementation mechanisms related to the SDGs and NDCs described above, thereby furthering the linkages between CSA and achievement of the SDGs and NDC objectives. In Bangladesh, the NGO Bureau, under the Prime Minister's office, is tasked with leading the process to achieve specific SDGs and NDC objectives. It then engages with, and in some cases provides funding for, the suite of NGOs working in Bangladesh on the given topic (M. Saifullah, personal communication, 2019).

4.3.7 Subnational level: Institutional arrangements and capacities for implementation of CSA in the context of a country's integrated efforts to achieve the SDGs and its NDC objectives

Given that many CSA, SDG and NDC interventions involve local-level implementation, effective involvement of subnational authorities is crucial. In order for subnational governments to be able to engage effectively in CSA interventions – from planning to monitoring and evaluation – national governments may have to support development of their institutional arrangements and capacity. The Global Taskforce of Local and Regional Governments highlights that an enabling environment for localization of the SDGs requires "capacity-building of local and regional governments in relation to the SDGs, empowering them to maximize their contributions, even in the face of limited competencies" (GTLRG, 2016). In many countries, mechanisms will already be in place for national-level support to subnational entities on institutional development, which can also be used in the context of CSA. These might range from providing training and embedding national staff in subnational entities, to providing guidance on the types of institutional arrangements that should exist, and funding to support the creation of institutional arrangements and capacities.

One particularly valuable approach highlighted by Bouyé *et al.* (2018) is to use subnational structures, such as councils of governors and networks of municipalities, to support local authorities in building relevant capacity. In relation to national implementation of the 2030 Agenda and Paris Agreement, the authors note that Indonesia, Kenya and Mexico have taken this approach to supporting implementation efforts of local authorities. In Kenya, for example, the Council of Governors has overseen the designation at county level – the key subnational jurisdiction in Kenya – of both climate and SDG implementation leads, as well as their capacity-building. This approach would also

be effective for building the capacity of subnational authorities to implement climate-smart agriculture. As described in Section 4.2 on planning, Ecuador has created a taskforce at subnational level to support local authorities in using the Land Use and Development Plan guidelines created through the *Climate-Smart Livestock* project.

4.4 Enhance financing options

In the *Climate-Smart Agriculture Sourcebook*, FAO highlights that "innovative financing mechanisms that improve the links between climate finance and agricultural investments from the public and private sectors are central to implementing climate-smart agriculture" (FAO, 2017a). Access to sufficient and ongoing financing is, of course, key for advancing CSA, and for achieving the SDGs and NDC objectives.

One approach adopted by some countries to achieve coherence in budgeting/financing involves creating a single financing strategy for all national development priorities. As such, finance for specific SDGs (and, as a cascade, NDC targets and CSA priorities) is an element supported within that strategy. Ecuador, for example, is in the process of creating its Sustainable Financing Strategy, which will be the single framework for accessing support for the SDGs. Climate change, and therefore NDC targets, will be a focus area within this coherent strategy, and CSA will be fundable through the climate focus area (S. Avalos, personal communication, 2019). In Ethiopia, the Climate Resilient Green Economy (CRGE) Facility serves as the single entity through which all finance for climate resilient green growth priorities, including CSA, is collected (from domestic, private, bilateral and multilateral sources), and then distributed.

Whether or not a country takes the approach of developing a unifying strategy or mechanism for financing SDG implementation, including through CSA, the following steps can contribute to supporting CSA as part of integrated efforts to achieve the SDGs and NDC objectives. Participatory budgeting can be useful for implementing any of the following steps, as the approach increases the likelihood of adoption of relevant practices on the ground. Participatory budgeting focuses on allocating public funds for local services through democratic decision-making by communities on how those funds are spent. Communities engage internally and with government officials to identify priorities and options, and the process typically concludes with a vote on how to spend the public funds (Campbell *et al*., 2018).

4.4.1 Integrate climate change into budgeting processes

Domestic public resources are often the biggest source of finance for national development priorities in developing countries. As such, in order to effectively finance climate interventions such as CSA, it is important that climate change be mainstreamed in sectoral budgeting processes. Focusing domestic resources on climate interventions also allows governments to leverage international climate finance for scaled-up impact at national level (FAO, 2017a). Palmer *et al.* (2014) highlight the fact that budgeting is a complex technical and political exercise, and allows for multiple entry points for integrating consideration of climate change. In Figure 4 below, the authors show opportunities to integrate climate change into the key budget process steps.

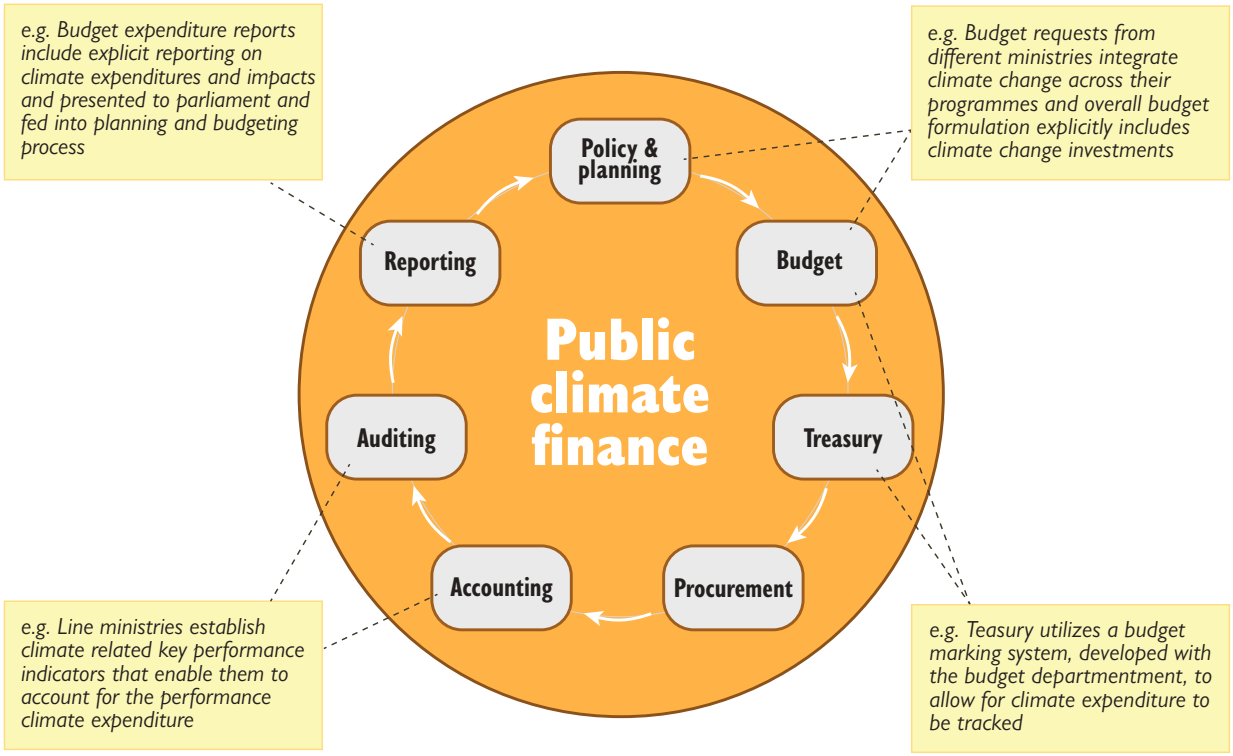

Figure 4: Opportunities for integration of climate considerations in key steps of the budget cycle (Source: Palmer *et al.*, 2014)

While this discussion has focused on integrating climate change into budgeting, the same process can be used to integrate other aspects of the SDG agenda into sectoral budgeting processes. This can ensure that, for example, agriculture sector budgets take into consideration specific sustainability priorities. In understanding these opportunities, policy integration is critical (see Section 4.3.5).

4.4.2 Track CSA expenditures as contributions to relevant SDGs and NDC objectives

Articulating the ways in which CSA supports a country's integrated efforts to achieve the SDGs and its NDC objectives helps to justify continued investment in the approach. Bouyé *et al.* (2018) note that insufficient climate- and SDG-finance tagging is a key challenge for tracking implementation of these agendas. This is because there are

normally several budget programmes that advance those priorities, but are not considered as specifically dedicated to climate and sustainable development. In addition, they note that often, sector budget programmes do not count these as relevant for the SDGs/NDCs. The onus for identifying the full range of actions that advance SDGs and NDC objectives is likely to be on those with primary responsibility for these agendas. In Ethiopia, for example, the CRGE Facility tracks expenditure on CSA in relation to the CRGE (NDC) goals. However, in many countries, responsibility for implementation of a given SDG target lies with a particular line ministry. In the context of CSA, it is important for agriculture ministries to have clear instructions on how to identify and tag activities that advance achievement of the SDGs and NDC objectives. These instructions could be as simple as a checklist of SDG target key words that project implementers could review for tagging purposes. Alternatively, the instructions could be more complex, such as requiring budgeters to identify a percentage of project funding that advances, for example, maternal health. Another valuable tracking approach to support CSA contributions to a country's integrated efforts to achieve the SDGs and its NDC objectives (assuming the CSA approach is synergistic with such an effort) is to set a target for the share of total agriculture budget that should be allocated to climate-smart agriculture. In this way, *ex ante*, the contribution of CSA to the SDG- and NDC-related effort is evident and supported.

4.4.3 Foster integrated approaches in national funds and banks

National funds and banks are increasingly integrating the SDG and NDC agendas in their funding approaches and priorities. Bouyé *et al.* (2018) note that banks have started taking steps such as orienting investment criteria towards rapid emission-reduction pathways, establishing lists of positive and negative investment areas, and conducting project- and portfolio-level risk and resilience assessments. For example, Mexico's development bank *Nacional Financiera* plays an important role in advancing the country's low-carbon development strategy by leveraging funds to attract private capital for clean energy projects (Bouyé *et al.*, 2018). Agricultural development funds and banks at national and subnational level can also support this integration, thereby helping to advance implementation of climate-smart agriculture, and the links between CSA and the country's integrated efforts to achieve the SDGs and its NDC objectives. As a first step in this process, national agricultural development funds and banks should include an explicit focus on climate-smart agriculture. This can be done by orienting investment criteria to include CSA benefits, such as "improves resilience to climate variability and change" or "reduces emissions intensity". In addition, national agricultural development funds and banks can support linkages between their investments and advancing the SDGs and NDC objectives by including criteria that align with a country's SDG and NDC priorities. In Ethiopia, for example, value chain efficiency in the livestock sector is an important SDG priority. Financing priority could therefore be given to investments that advance this CSA/SDG/NDC objective. In relation to its *Climate-Smart Livestock* pilot project, the Government of Ecuador is in early stage discussions with BanEcuador and the Ecuador Bank of Development to create credit lines at lower rates of interest, so as to support sustainable development activities such as the ones promoted by the project. The hope is that these types of incentives will encourage producers to further engage in climate-smart agriculture.

4.4.4 Access innovative financing mechanisms

The majority of finance for climate, agriculture and SDG interventions in developing countries comes from domestic public and private sources. However, "relatively small amounts of international climate finance can help to transform public agriculture budgets and private investments into sources of climate-smart agriculture financing" (FAO, 2017a). Development assistance allows for piloting approaches that will then become mainstreamed in national budgeting processes, and some larger-scale development assistance, such as Green Climate Fund financing, can enable countries to advance their goals at a greater scale.

There are several multilateral climate funds that developing countries can access to advance their CSA approach. These include the Green Climate Fund (GCF), which prioritizes projects that articulate linkages with the SDGs, funds managed by the Global Environment Facility (GEF) (including the GEF Trust Fund, the Least Developed Countries Fund and the Special Climate Change Fund), and the Adaptation Fund. Ecuador's *Climate-Smart Livestock* project, a CSA pilot for the country, is supported through the GEF.

Important for accessing all these funds, and especially for accessing the GCF, is evidence that countries' proposals are directly linked to their national development priorities, as evidenced by planning documents, national policy instruments and M&E systems. Both the GCF and the GEF require that proposals describe the SDG co-benefits that would be advanced through the project. As outlined in Section 4.2 on planning for CSA implementation, meaningful engagement of CSA planners in preparation of these national plans, some of them iterative in nature, will help to ensure that a CSA approach can be advanced through multilateral climate finance. It should be noted, however, that accessing these funds can be difficult for low-capacity countries (see Section 4.3.3 for additional discussion of capacity-building).

In addition to the multilateral climate funds, many multilateral development banks, such as the African Development Bank and Asian Development Bank, have large portfolios that finance climate-smart agriculture projects. The World Bank, for example, has financed several CSA projects, including a USD 420 million project focused on climate-resilient agriculture in Maharashtra, India (World Bank, 2018). The NDC Partnership is another avenue for accessing finance for CSA as part of NDC implementation. The partnership accepts requests from developing countries for support in NDC implementation, then tries to match those requests with offers of support from bilateral and multilateral donor institutions (NDCP, 2019).

4.4.5 Subnational level: Financing and budgeting for CSA implementation in the context of a country's integrated efforts to achieve the SDGs and its NDC objectives

Finance is one of the major obstacles to subnational governments' efforts to plan for and implement interventions (including those related to CSA), because of relatively limited ability to generate finance due to smaller tax bases and

fewer fee opportunities. National governments can support subnational implementation of CSA, including as part of national efforts to achieve the SDGs and NDC objectives through a number of mechanisms.

- **Provision of grants to subnational governments**
  The Global Taskforce of Local and Regional Governments, in its *Roadmap for localizing the SDGs: Implementation and monitoring at subnational level* (GTLRG, 2016), notes that an effective enabling environment for localizing the SDGs requires recognizing the need to make financial transfers from central government to local and regional governments. This is in order to correct the imbalance between the tasks assigned to these latter (related to implementation of the 2030 Agenda) and their limited resources (GTLRG, 2016). The same can of course be said in relation to CSA implementation. One approach adopted by the Government of Nepal to advance the SDG agenda involves providing grants to subnational authorities, with the express purpose of advancing specific SDG priorities. For example, the Ministry of Agriculture and Livestock and Development provides conditional grants to provinces and local governments to implement agricultural development projects. Given the reach that subnational governments have to potential implementers of agricultural interventions, more than one-quarter of the ministry's financial year 2018–2019 budget has been distributed through grants to these subnational authorities (GoN, 2018).
- **Clear communication to subnational governments about budget allocation**
  Related to the provision of grants to subnational governments is the need for clear and timely communication to subnational authorities on budget allocations. In the context of subnational implementation of nutrition programmes in Nepal, a key implementation constraint for local authorities was lack of timely communication from national government about how much they could expect, especially when the amount allocated differed from the amount requested through the budgeting process (Biradavolu *et al*., 2016).
- **Capacity-building to develop budgets that include CSA**
  While not universally the case, subnational governments will often have less capacity for all aspects of CSA/SDG/NDC-related implementation than national level government, and this includes the ability to develop budgets that incorporate climate-smart agriculture in an ongoing manner. National governments can invest in the capacity of subnational governments to budget for CSA through training in creating budget frameworks that take national development goals, e.g. CSA-, SDG- and NDC-related priorities, into account. Part of this capacity-building might also entail engaging with higher-capacity NGOs and academic institutions that have direct and trusted relationships with subnational governments, and can support these governments in budgeting processes.

4.5 Implement practices in the field

All the steps described above are critical for the actual implementation of CSA practices in the field. While CSA approaches should be bottom-up, i.e. a national strategy should be based on identifying the transitions needed on the ground, FAO notes that, in order for CSA implementation to be successful, efforts must be made to adapt a (national) CSA approach to a local setting, and in this process of adaptation, take into account the knowledge, priorities and requirements of local producers by directly engaging them in the project design process (FAO, 2017a). The same can be said for SDG- and NDC-related interventions focused on the adoption of practices at field level; context-specific social, cultural and environmental factors will influence the desire and ability of local populations to adopt a new practice. Project design related to CSA, the SDGs or NDC objectives at national level may not be sufficiently tailored to local contexts. As such, local project managers should engage with the target population to identify ways that a given intervention can be tailored and refined, so as to be as beneficial as possible to the target audience, thereby increasing the chances of adoption.

4.5.1 Design CSA interventions for co-implementation with interventions focused on achieving the SDGs and NDC objectives

A valuable approach to enhancing integration between climate-smart agriculture and a country's integrated efforts to achieve the SDGs and its NDC objectives involves designing interventions for co-implementation at field level. This would also maximize efficiency. Steps that can be taken to facilitate co-implementation include:

- ***Ex ante* integration of CSA and (an)other SDG priority in intervention design**
  The mapping and assessment of CSA-SDG linkages presented in Part 2 of this publication offers evidence that CSA intervention designers can use to ensure that synergies between certain CSA practices and specific SDG targets are leveraged, and that any potential trade-offs are minimized or compensated for. Beyond these direct linkages, which would exist in most contexts even without designing for the synergy, interventions can be designed to marry CSA and SDG priorities. For example, a CSA project focused on climate-resilient processing and distribution value chains could be co-designed to also focus on youth training and employment (SDG 8.6), if that were a priority for the country. This combination might not be the most direct or obvious pairing between CSA and the SDGs, but can be incorporated in design, if useful.
- **Screening and adjusting existing CSA interventions to identify opportunities for advancing other SDG- and NDC-related priorities**
  Implementation of some CSA interventions can continue for several years, and include opportunities, such as mid-term evaluations, to refine the approach used. While *ex ante* design for synergies would generally be ideal, in cases where longer-term, ongoing programmes present opportunities for expansion to include additional SDG- and NDC-related priorities, these programmes can be screened and adjusted. Mid-term evaluations often include recommendations for strengthening a given aspect, so the methodology of screening for opportunities related to achieving the SDGs and NDC objectives could be built into the normal mid-term review process. The assessment and mapping presented in Part 2 could be used as a starting point, to identify the 'low- hanging fruit', in terms of SDGs that could be advanced most easily through an ongoing CSA intervention. However, the process of adjusting the intervention to include an expanded focus could be more complex. In some instances, it might be as simple as adding additional curricula to the intervention, but as mentioned in the introductory paragraph to Section 4.5, any adjustment should be made in a participatory and inclusive manner, in order to ensure maximum applicability and adoptability.
- **Inclusion of CSA in integrated rural development approaches**
  Many projects targeting the rural poor combine interventions focused on a variety of needs, such as nutrition, gender equality, health care, education, workforce development and agriculture (see, for example, Ruel *et al.*, 2018). Conditional cash transfer programmes are an example of interventions that attempt to achieve multiple outcomes – such as poverty alleviation, education and maternal/ child health (see, for example, Sosa-Rubi *et al.*, 2011 and Del Pozo Loayza, 2012). Such an approach, if explicitly tied to CSA, SDG and NDC goals, is highly effective in ensuring integrated implementation. While predating the SDGs, another popular concept in discussions on implementing the 2030 Agenda is the nexus approach. This is a framework for the design of interventions that examine interactions among multiple sectors simultaneously (Liu *et al.*, 2018). Some researchers have found that nexus approaches can reveal synergies as well as trade-offs, and have the potential to reduce negative surprises and promote integrated governance, planning and management (Liu *et al.*, 2018). Especially popular within this type of approach are interventions focused on the water–energy–food nexus (see, for example, UNU, 2019, and Section 2.1.2.2 above). Climate-smart agriculture can address all elements of the water–energy–food nexus, and add value to most integrated rural development approaches to SDG implementation. While described here in the section on implementation, this type of integration begins at the planning stage.

- **Examples of co-implementation**
  Whether through *ex ante* integration, adjustment of an intervention during implementation, or as part of a nexus approach to SDG implementation, there are several ways in which CSA implementation can be easily integrated with other SDG- and NDC-related priorities. The mapping and assessment presented in Part 2 provides a more comprehensive overview, but the following are a few examples:

  - For countries where eliminating hunger is a major priority, CSA could be coupled with nutrition services,[21] e.g. (re)introduction of climate-resilient crops with high nutritional value such as cassava, which can be more calorically dense than other subsistence crops, such as maize, and more tolerant of drought conditions. Another example of a potential hunger elimination/CSA intervention is a school feeding programme in Ecuador launched by the President, which provides children with milk most days of the week. While the *Climate-Smart Livestock* pilot project that Ecuador is undertaking is not explicitly linked to the school feeding programme, is does have the objective of increasing production, reducing emissions intensity and increasing incomes (E. Pesantez, personal communication, 2019). The programme could therefore provide a market for farmers who, as a result of the intervention, begin producing additional volumes of milk.
  - For countries where gender equality is an important aspect of the SDG agenda, CSA interventions focused on training women in CSA practices, or on improving tenure security for women farmers, would help to advance a variety of SDGs.
  - Where poverty reduction and elimination of extreme poverty is a major focus, CSA interventions can be focused on income-generating activities, such as agroforestry systems involving high-value species, or non-timber forest products such as honey.

4.5.2 Subnational level: Implementing CSA practices in the field in the context of a country's integrated efforts to achieve the SDGs and its NDC objectives

When it comes to implementing practices in the field, it is important that subnational authorities are closely involved, as they have the most direct access to the target audiences of a given intervention. Tailoring interventions to the local context is one key way to engage subnational authorities. FAO's work on decentralized cooperation offers some guidance for supporting subnational authorities in implementing practices in the field (FAO, 2007). Major recommendations include:

- involving subnational authorities in project identification and formulation, within agreed priority frameworks;
- providing technical assistance to subnational authorities on project execution, for example by embedding staff or involving subnational government workers in national extension services;
- connecting subnational authorities with each other to share good practices and lessons learned in dealing with common challenges.

21 Health services primarily focused on nutritional status, e.g. nutrition education, food and micronutrient supplementation, breastfeeding, growth monitoring, oral rehydration and treatment and rehabilitation of the severely malnourished (NRC, 1986).

4.6 Monitoring, evaluation and reporting

Monitoring and evaluation is critical to ensure that climate-smart agriculture interventions are implemented properly, and that they achieve the desired outcomes. M&E promotes accountability to various stakeholders, and helps to ensure the sound use of human and financial resources. It also contributes to improving the design of future CSA interventions, and is part of a long-term learning process. During the implementation stage, it is essential to monitor progress and identify successes and problems in CSA interventions, be they pilot initiatives, projects or programmes. This monitoring will verify whether activities are meeting the objectives of CSA and project milestones in a way that satisfies efficiency standards. It will also facilitate the adjustment of activities to changing conditions, which is particularly important considering the uncertainties associated with climate change projections. Generally, project and programme monitoring involves tracking progress and intermediate results, and making adjustments during implementation. Monitoring tends to take place throughout project implementation. Evaluation primarily involves assessing results and impacts. It becomes more important during the mid-project cycle, and at the end of the project. Ideally, impact evaluation at the end of a project feeds into long-term evaluation of the national CSA approach, and the results of the evaluation process may lead to modification of policies and programmes (FAO, 2017a). FAO's guidelines for the design and implementation of monitoring and evaluation systems for climate-smart agriculture (FAO, 2019b) and the *Climate-Smart Agriculture Sourcebook* (FAO, 2017a) provide comprehensive overviews of monitoring, evaluation and learning on CSA.

Reporting on CSA activities, as with those related to the SDGs and NDCs, enables transparent assessment of progress against the priorities that a country has set for itself. In the case of the SDGs, paragraph 79 of the 2030 Agenda for Sustainable Development encourages countries to "conduct regular and inclusive reviews of progress at the national and sub-national levels, which are country-led and country-driven". These reviews then serve as the basis for voluntary national reviews in the context of the High Level Political Forum, as stipulated in paragraph 84 of the 2030 Agenda (UN, 2015). Under the Paris Agreement, all Parties are required to report on national GHG inventories, and progress on implementation of their NDC, and are encouraged to report on their adaptation actions (COP, 2015).[22] For most countries, reporting on CSA activities will occur as part of agriculture sector reporting.

4.6.1 Monitoring and evaluation of CSA in the context of the SDGs/NDCs

When it comes to integrating climate-smart agriculture in a country's efforts to achieve the SDGs and its NDC objectives, where possible, M&E systems should be integrated to avoid duplication and leverage synergies. When SDG and NDC monitoring and evaluation systems are nascent or in design stages, co-design of these systems is ideal. However, some countries will already have existing and robust SDG and NDC monitoring and evaluation systems in place,[23] in which case climate-smart agriculture M&E should be built on and integrated into these existing systems. Either way, outcomes, outputs and impacts of any CSA intervention should be captured in national climate-smart agriculture M&E frameworks, which are ideally aligned to national SDG and NDC monitoring and evaluation frameworks. Some of the steps in this alignment process include:

- **Align CSA indicators with those related to the SDGs and NDC objectives**
  The multilateral processes related to both the SDGs and the Paris Agreement come with sets of indicators, but in both cases, countries will refine these aspirational targets. As stated in the 2030 Agenda for Sustainable Development (UN, 2015), "*Targets are defined as aspirational and global, with each government setting its own*

22 Paris Agreement reporting builds on reporting requirements under the UNFCCC. As such, countries will already have experience with climate reporting, and may already include information on their CSA efforts in their climate reporting.

23 Monitoring and evaluation within UNFCCC parlance is generally referred to as Monitoring, Reporting and Verification (MRV).

national targets guided by the global level of ambition but taking into account national circumstances". Similarly, inherent in the NDC process is "country-drivenness", and each country will define for itself how to achieve the targets that it has set for itself.

The process of aligning CSA indicators with those related to the SDGs and NDC objectives might take the form of:

- **Adoption of SDG- and NDC-related indicators in a national climate-smart agriculture M&E framework**. As noted in the section on Planning, countries should have a stand-alone CSA plan or strategy, and an M&E framework is an important aspect of such a plan. At this point, some countries will have a national SDG monitoring and evaluation system in place; in developing a CSA monitoring and evaluation framework, it should be relatively straightforward to adopt the indicators from the SDG monitoring and evaluation system that the CSA plan can realistically advance. For example, one SDG indicator that Bangladesh has refined (from global SDG Indicator 2.2.1) and adopted is "Reduce the prevalence of stunting in children under 5 years of age to 12 percent" (GoB, 2017b). This SDG progress indicator could readily be adopted as part of a CSA monitoring and evaluation system, assuming that the CSA approach has a child nutrition focus.
- **Explicit inclusion of CSA indicators in SDG and NDC monitoring and evaluation frameworks**. For example, Ecuador is still in the process of developing a coherent monitoring, reporting and verification (MRV) framework for its NDC (J. Merino and P. Sangoluisa, personal communication, 2019). But since CSA was explicitly taken into account in developing the NDC (S. Avalos, personal communication, 2019), it is likely that CSA-related indicators will be included in the NDC monitoring, reporting and verification system.
- **Review/refinement of SDG- and NDC-related indicators to take CSA into account**. Although probably rare, there may be instances where CSA becomes part of the implementation plan related to achieving the SDGs and NDC objectives, after the SDG- and NDC-related M&E system is already in place. In these cases, the system would have to be expanded to include CSA indicators.
- **Using/updating a national development plan as the basis for developing CSA, SDG and NDC indicators**. In Ethiopia, the current national development plan *Growth and Transformation Plan II (2015-2020) (GTP II)* sets the stage for all SDG implementation, and includes a national M&E system. As such, all national SDG (and thus NDC and CSA) targets and indicators are integrated through this national M&E system (S. Tesfasilassie Tegegne, personal communication, 2019). For example, one of the indicators in the GTP II is "Reduced amount of carbon emissions from small scale mechanized farming (in million metric tons)". This is clearly an example of CSA, and shows that the plan explicitly links to SDGs 2.4, 13.1 and 13.2 (GoEt, 2016).

- **Optimize data collection and management**

  Data represent another key component of successful implementation, and also a key challenge; Bouyé *et al*. (2018) write of data challenges related to implementation of the SDGs and NDCs, "The implementation of the SDGs and the climate agenda raise similar data challenges. Those include strengthening national statistical systems, improving data availability, timeliness and interoperability, using new data sources, developing data literacy, and creating data infrastructures for data development and sharing." Similarly, access to and management of appropriate data is necessary for creating the evidence base to support CSA and, for many countries, a key challenge. Given the political cachet associated with the SDGs and NDCs globally and nationally, aligning CSA data collection needs and systems – which are critical for robust M&E and reporting – with those associated with reporting on the SDGs and NDC objectives, could help to justify data collection efforts related to it. One way of ensuring this integration is to align CSA data collection strategies with those used under the efforts related to the SDGs and NDC. For example, the household survey is an important

data collection tool for many developing countries' SDG monitoring and evaluation systems (see, for example, ISWGHS, 2019). Integration of CSA-related questions in household surveys, especially those targeting rural populations, can serve to maximize resource efficiency while drawing connections between CSA and other national development priorities for which data are collected through the survey, such as the SDGs.

Another valuable approach for integrating CSA data collection and management with that of a country's integrated efforts to achieve the SDGs and its NDC objectives is to include CSA data in national data platforms/portals. These systems are a means to collect and disseminate national statistics related to a variety of national development priorities. SDG implementation fora have highlighted the urgency of establishing and strengthening these national data systems (see, for example, UN Stats, 2018). Inclusion of CSA statistics in such data systems, even beyond those relevant for SDG monitoring and evaluation, is another useful approach for improved resource efficiency, and for making national development data public and interoperable.

4.6.2 Ensure synergies between reporting cycles at national and global levels

As described above, national reporting on SDG and NDC progress is a fundamental feature of both systems. The 2030 Agenda calls for reporting on SDG progress at national level, which informs regional and global reviews (through voluntary national reviews at the High Level Political Forum) of progress. The Agenda also stipulates that reporting and participation in reviews at all levels is voluntary (UNGA, 2015). Under the Paris Agreement, all Parties must report on national GHG inventories and progress made in implementing their NDC, and they are encouraged to report on impacts and adaptation through biennial transparency reports (APA, 2018).

Where possible, timing of reporting on CSA actions should be synchronized with national SDG and Paris Agreement reporting, and in particular, in time for NDC update processes. In addition to helping to ensure that outcomes from CSA activities can be taken into consideration in SDG/Paris Agreement reporting, synchronized timing of reporting could also allow for new agricultural development plans to take SDG- and NDC-related priorities into account in real time.

In addition, opportunities should be taken to align the structure of reporting on CSA (or agriculture sector reporting, more broadly) with the requirements and recommendations of reporting on SDGs and NDCs. For example, the SDG voluntary common reporting guidelines for voluntary national reviews at the High Level Political Forum recommend including discussion on how the three dimensions of sustainability are integrated in SDG implementation, and how the principle of 'leave no one behind' has been implemented. Of course, the guidelines also recommend discussion of progress on goals and targets (UN, 2017). If those tasked with preparing this type of reporting at national level are able to extract this type of information easily from CSA (and agriculture sector) reporting, it stands to reason that information on CSA's contribution to achieving the SDGs is more likely to be included.

4.6.3 Subnational level: Monitoring, evaluation and reporting on CSA in the context of a country's integrated efforts to achieve the SDGs and its NDC objectives

Much of CSA implementation, including monitoring and evaluation of CSA projects and programmes, involves subnational governments and authorities. National governments can ensure that subnational authorities are prepared and able to support national M&E and reporting on CSA through the following good practices:

- National governments can vertically integrate M&E processes by defining explicit indicators and outcomes for subnational governments to use in any project implementation and M&E work that they undertake. For national aggregation purposes, national governments would have to identify indicators that are nationally relevant, and which subnational authorities can use alongside more site- and context-specific indicators, as required.
- National governments should also ensure that capacity exists at subnational levels, and invest in its development, as necessary, for M&E and reporting. As discussed in the section on institutional capacities and arrangements, capacity-building could involve training that brings together subnational authorities; collaboration with NGOs, the private sector, universities and research institutions that may have M&E capacity and be able to support subnational governments; and, investment in data-sharing portals. In some instances, the ability to communicate data to a national portal may be a capacity that is lacking in subnational authorities.
- Also related to data collection are data sharing agreements. In instances where the project/programme being monitored does not involve national authorities, but the intervention helps to further national CSA/SDG/NDC priorities, there may be a need to set in place data sharing agreements between subnational and national levels, or between private sector project proponents and the national government.

4.7 Conclusions: Guidelines for the implementation of CSA in the context of a country's integrated effort to achieve the SDGs and its NDC objectives

This section presents guidelines for implementing climate-smart agriculture in a manner that promotes its contribution to a country's integrated effort to achieve the SDGs and its NDC objectives. The discussion focuses on the five CSA implementation steps described in the *Climate-Smart Agriculture Sourcebook*. An additional stand-alone topic has relevance to all of the five steps: monitoring, evaluation and reporting. Each of these six sections highlights the sub-steps most relevant for implementing CSA in the context of an integrated national effort related to the SDGs and NDCs. They also touch on how national governments can work with subnational governments to support achievement of the SDGs and NDC objectives.

The guidelines are based on evidence in the literature on related topics, the experience of three case study countries: Bangladesh, Ecuador and Ethiopia, and expert judgement. To date, there is limited practical experience in the literature or in case study countries of actual CSA implementation in the context of a country's integrated efforts to achieve the SDGs and its NDC. As such, the authors have focused on the subtopics which, based on FAO experience, they believe to be most relevant in the discussion about such implementation. To be sure, with the addition of practical experience over time, other topics will be considered essential, and some of those described in the preceding guidelines may be deprioritized. As such, these guidelines should be seen as a preliminary effort, which can be refined as supplementary experience becomes available.

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CONCLUSION

The global community has agreed that humanity's progress depends on achieving the 17 Sustainable Development Goals (SDGs). The 'new normal' of climate change – rising seas and more intense storms and droughts – poses a real risk to meeting several of the goals, even as these objectives recognize the need for ambitious climate action (SDG 13). It is imperative that sectoral approaches to achieving the SDGs take climate change into account in a holistic way. Climate-smart agriculture (CSA) offers a wealth of opportunities to serve as this comprehensive approach, especially given its potential to advance so many of the SDGs. CSA's triple bottom line focus on sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing greenhouse gas emissions, where possible, offers significant opportunities to address rising food insecurity, among many other sustainable development challenges. As such, CSA should be a priority supported by countries and their development partners.

Part 2 of this publication assesses and maps the interlinkages between the three pillars of CSA and key implementation steps for this approach (expand the evidence base; support enabling policy frameworks/planning; strengthen national and local institutions; enhance financing options; and, implement practices in the field) and SDG goals and targets. It finds that climate-smart agriculture can support all the Sustainable Development Goals, providing synergies with nearly 90 targets. The authors note that there could be trade-offs between specific CSA actions and SDG targets, and where possible, offer suggestions for avoiding or reducing these. It should be clear that many of these trade-offs are not unavoidable. This assessment and mapping of CSA-SDG interlinkages can serve as a useful starting point for national authorities tasked with implementing CSA and/or achieving the SDGs or their country's nationally determined contribution (NDC) objectives.

Part 3 describes how nationally determined contributions to the Paris Agreement are a critical element in efforts to advance achievement of the SDGs through climate-smart agriculture at national level. This section also articulates how agriculture is considered critical by many countries for jointly advancing sustainable development and climate action.

Part 4 of this publication provides guidelines for implementing climate-smart agriculture in the context of a country's integrated efforts to achieve the SDGs and its NDC objectives. Focused on the CSA implementation steps mentioned above, and adding one more step critical for iterative implementation of CSA – monitoring, evaluation and reporting – the authors describe ways in which a country could design and implement a CSA approach so as to advance efforts to achieve the SDGs and its NDC objectives. Given the importance of the subnational level when it comes to implementing CSA and many SDG and NDC priorities, suggestions are also made of how national governments can support subnational authorities to advance CSA in the context of a country's integrated efforts to achieve the SDGs and its NDC objectives. Again, these guidelines provide an outline of steps to be taken and topics to consider, as CSA proponents develop their country-specific approach.

Limitations

The assessment and mapping, as well as the guidelines presented in this publication, should be considered a first step in an effort to understand actual and potential contributions of climate-smart agriculture to the achievement of a number of Sustainable Development Goals and, by extension, to nationally determined contribution objectives. The authors note that there are some significant limitations in this publication, which could be addressed in future, related efforts. For instance, the assessment does not suggest a methodology for determining the specific contributions of a given CSA intervention to an SDG target. This level of specificity would be useful for countries to develop implementation plans with a high level of detail. In addition, the paper does not provide a methodology for assessing specific synergies and trade-offs associated with a given CSA action, nor the degree to which they exist. Finally, the publication does not consider the relationship between CSA actions and SDG indicators. A future mapping effort focused on CSA contributions to SDG indicators would be a useful next step.

In terms of the guidelines, these are based on related literature and experiences of case study countries, but in neither case direct experience of the systematic implementation of CSA in relation to the SDGs and NDCs was available. As practical experience is accrued, the guidelines should be reviewed and potentially amended, based on new information and experience.

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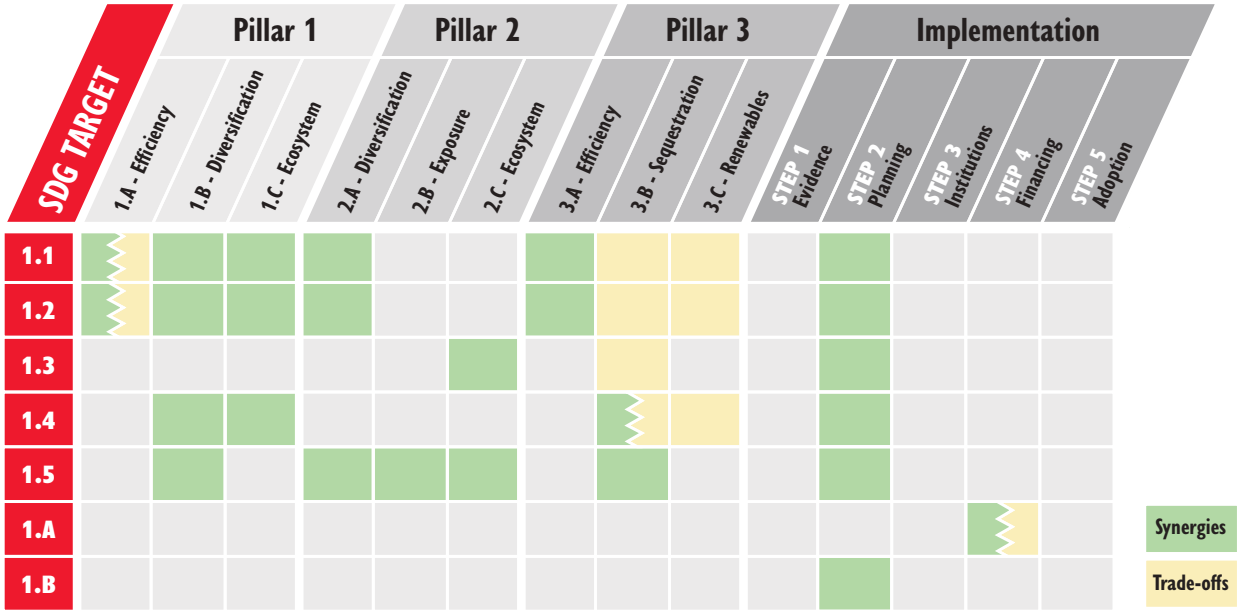
Appendix 1

Mapping of CSA action categories and implementation steps against SDG targets

This appendix presents in visual form the assessment of CSA-SDG interlinkages described in Part 2 by mapping potential synergies and trade-offs of climate-smart agriculture to each of the Sustainable Development Goals. A table for each SDG is presented in the following pages, with a listing of the targets for which the authors find CSA interlinkages (based on the three CSA pillars and five implementation steps, listed in the Methodology). In addition, each table is accompanied by a description of the relationships between CSA activities and SDG targets. It should be noted that several potential trade-offs between various CSA objectives and SDG targets are identified in this mapping exercise. The aim of the mapping in this section, in combination with the assessment in Part 2 of this publication, is to make CSA and sustainable development planners and practitioners aware of the potential synergies and trade-offs between climate-smart agriculture and the SDGs from the beginning of the planning process. This provides an opportunity to enhance synergies and avoid – or at least minimize or compensate for – trade-offs from the outset. Many of these potential trade-offs depend on governance and policy decisions, and can therefore be resolved through an inclusive decision-making process that involves coordination between stakeholders across sectors.

SDG 1 : End poverty in all its forms everywhere

Table A1.1: Interlinkages between climate-smart agriculture and SDG 1



Nearly all CSA initiatives can contribute to SDG 1, as increased incomes and productivity are a central tenet of a CSA approach. When CSA interventions target the poorest, SDG 1.1 and 1.2 can be advanced; when CSA interventions are co-designed with social protection measures, such as conditional cash transfers, SDG 1.3 and 1.B can be advanced; SDG 1.4 can be supported indirectly, in that increased incomes allow for greater household expenditure on basic services, and directly by CSA measures focused on improved land tenure. Finally, SDG 1.A. is advanced when additional finance is invested in climate-smart agriculture.

Relevant SDG targets:

1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than USD 1.25 a day.

1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions.

1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable.

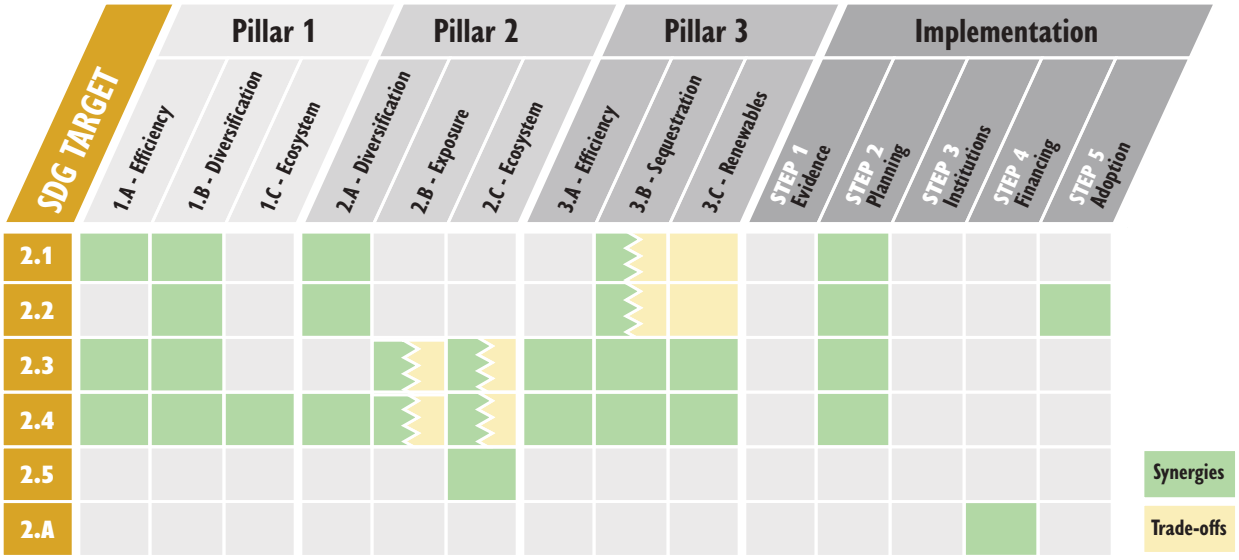
1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance.

1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.

1.A Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions.

1.B Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions.

Table A1.2: Interlinkages between climate-smart agriculture and SDG 2



SDG 2 is one of the goals for which CSA can add most value. CSA Pillar 1 focuses on sustainably increasing the productivity of food systems (SDG 2.3, 2.4, 2.5), and thereby contributes to increased food availability, an important aspect of ending hunger (SDG 2.1). That said, if CSA activities focused on reducing emissions, e.g. through afforestation, the resulting reduced land availability for crop production, especially among subsistence farmers, may lead to a trade-off with SDG 2.1 – which could potentially be addressed through afforestation focused on agroforestry. Diversified production systems can help to reduce hunger and malnutrition (SDG 2.1, 2.2), unless the diversification focuses on non-food crops, such as bioenergy for GHG emissions reduction. CSA can also lead to increased investment in agricultural research and extension (SDG 2.A).

Relevant SDG targets:

2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.

2.2 By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons.

2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.

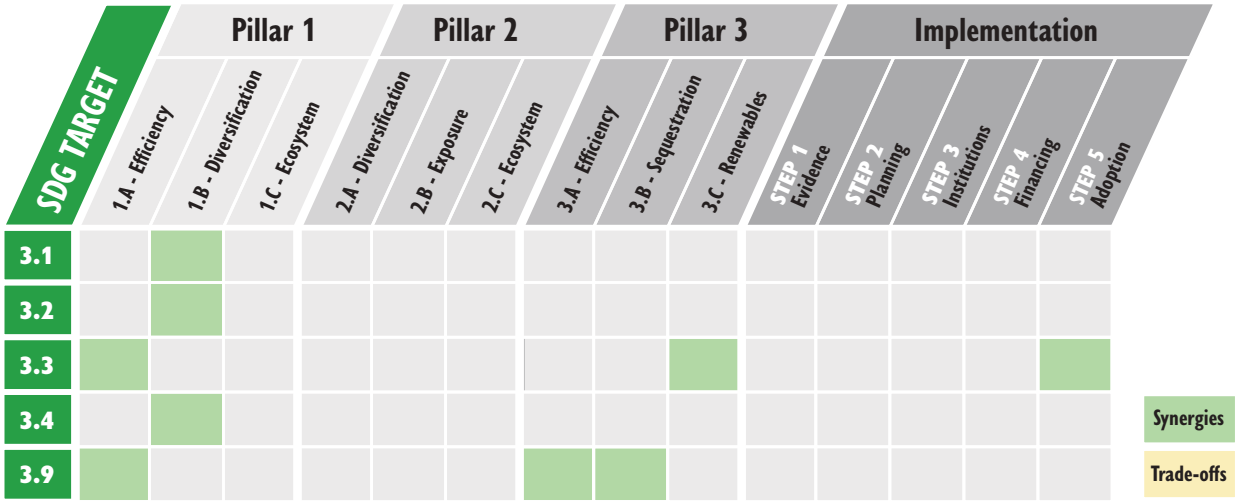
2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.

2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed.

2.A Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries.

SDG 3: Ensure healthy lives and promote well-being for all at all ages

Table A1.3: Interlinkages between climate-smart agriculture and SDG 3



Climate-smart agriculture can contribute to reduced maternal and child mortality, as well as to reduced mortality from non-communicable diseases, by improving nutrition status, especially when animal products become more available and diets are more balanced as a result of a CSA intervention (SDG 3.1, 3.2, 3.4). Improved livestock and manure management, as well as the integration of health topics in CSA training curricula for farmers, can support the control of communicable diseases (SDG 3.3). Through CSA actions such as integrated pest management and the introduction of cleaner cook stoves, illness from air, water and soil pollution can be reduced (SDG 3.9).

Relevant SDG targets:

3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100 000 live births.

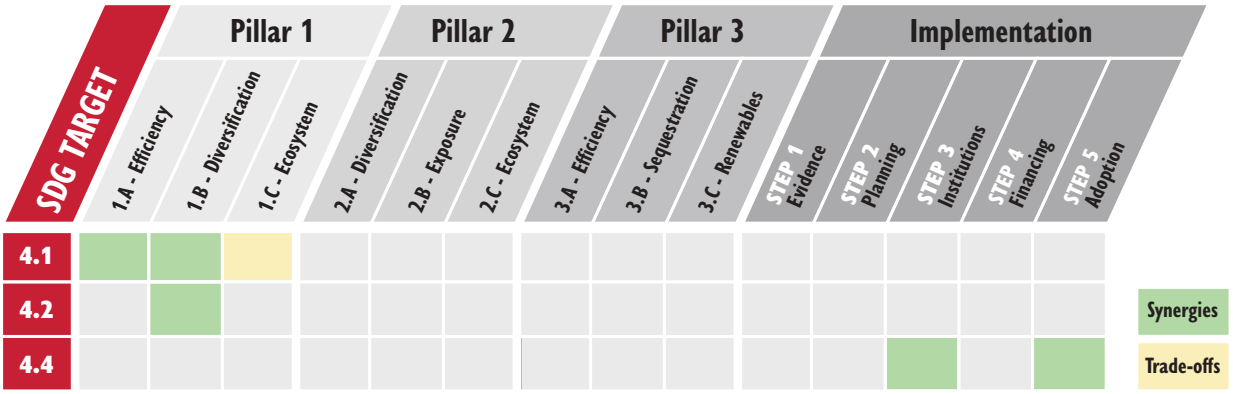
3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1 000 live births and under 5 mortality to at least as low as 25 per 1 000 live births.

3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases.

3.4 By 2030, reduce by one-third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being.

3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

Table A1.4: Interlinkages between climate-smart agriculture and SDG 4



Climate-smart agriculture could support boys and girls to access and complete education (SDG 4.1, 4.2) through improved diets, which are key for effective learning. It could also help to generate increased household incomes, enabling families to afford school fees. However, if CSA practices require additional labour, children may be removed from school in order to provide it, creating a trade-off for this same target. Capacity development and training of stakeholders throughout the CSA implementation process, including government officials, farmers and other actors in the food system, contribute to adult learning and the acquiring of professional skills (SDG 4.4).

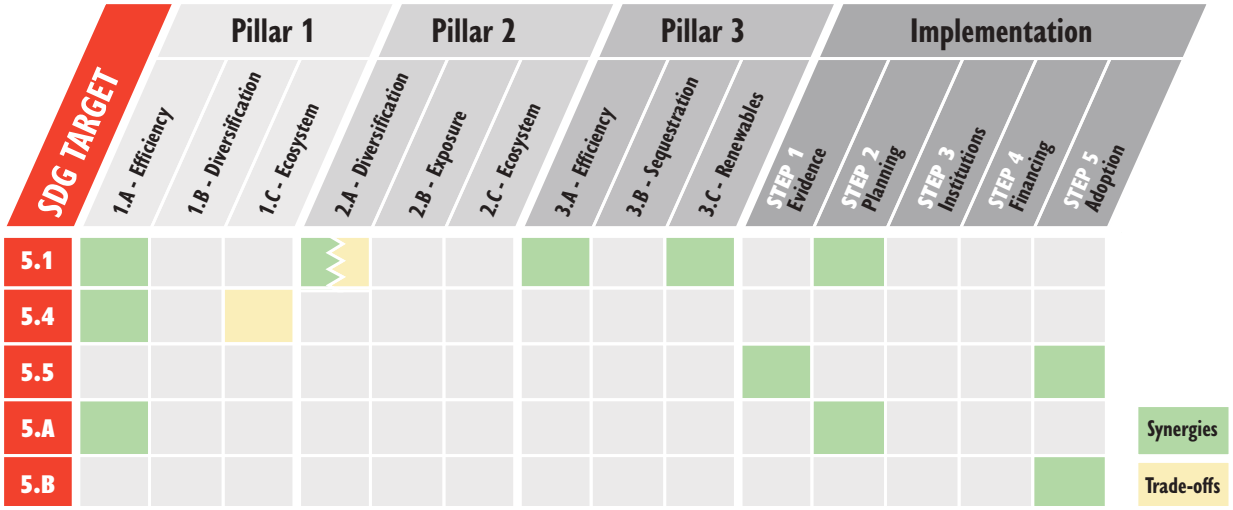
Relevant SDG targets:

4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes.

4.2 By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre primary education so that they are ready for primary education.

4.4 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.

Table A1.5: Interlinkages between climate-smart agriculture and SDG 5



Climate-smart agriculture practices, such as decentralized renewable energy systems that replace biomass collection, could reduce labour required of women and girls, helping to advance SDG 5.1. However, some CSA practices could create a trade-off for the same target if the practice increases labour needs. Women and girls could also benefit from improved tenure as a result of CSA initiatives (SDG 5.1, 5.A). Inclusive and gender-sensitive processes in CSA implementation can strengthen women's participation in decision-making (SDG 5.5), and their equal access to empowering technologies promoted through CSA initiatives (SDG 5.B).

Relevant SDG targets:

5.1 End all forms of discrimination against all women and girls everywhere.

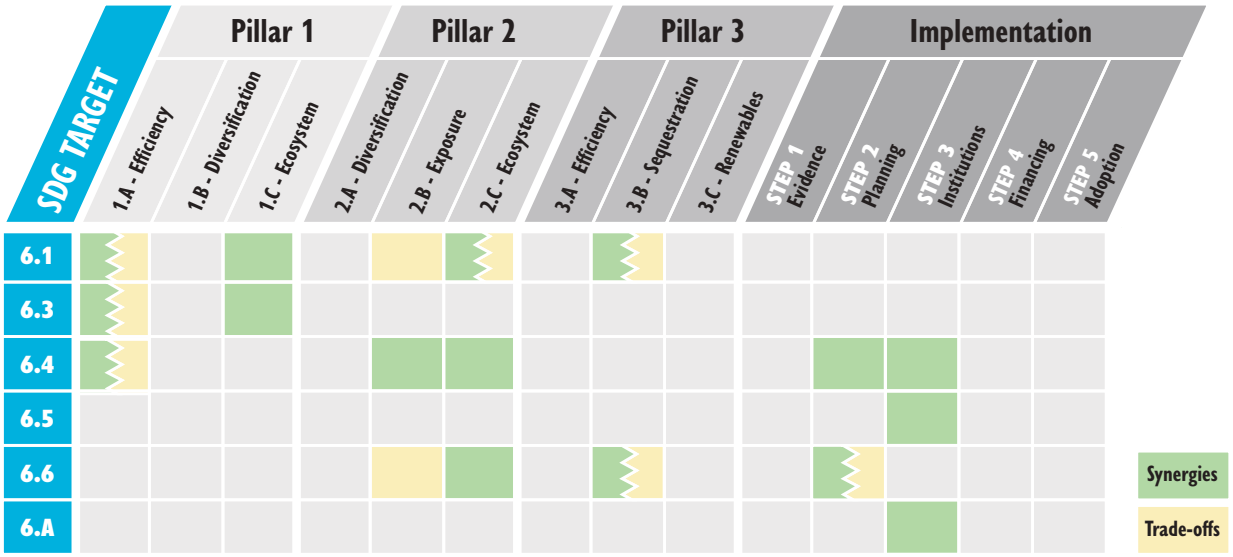
5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate.

5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life.

5.A Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws.

5.B Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women.

Table A1.6: Interlinkages between climate-smart agriculture and SDG 6



Climate-smart agriculture activities can support universal access to safe water (SDG 6.1, 6.4) by improving soils' water infiltration, retention and filtering capacities, and by introducing water-efficiency measures. However, they can also create a trade-off for the same target if irrigation-related measures create more demand for water. CSA can also improve water quality through enhanced soil quality and resultant water filtering and denaturing of chemicals (SDG 6.3), though it could potentially reduce water quality by introducing synthetic fertilizers into a system. CSA can benefit water-related ecosystems, including through restoration and enhancing of water retention capacity (SDG 6.6). However, it can disrupt natural water cycles and thus affect downstream ecosystems, for example if increased biomass leads to increased evapotranspiration. CSA activities can encourage more integrated planning, coordination and capacity development on water-related issues (SDG 6.5, 6.A).

Relevant SDG targets:

6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all.

6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

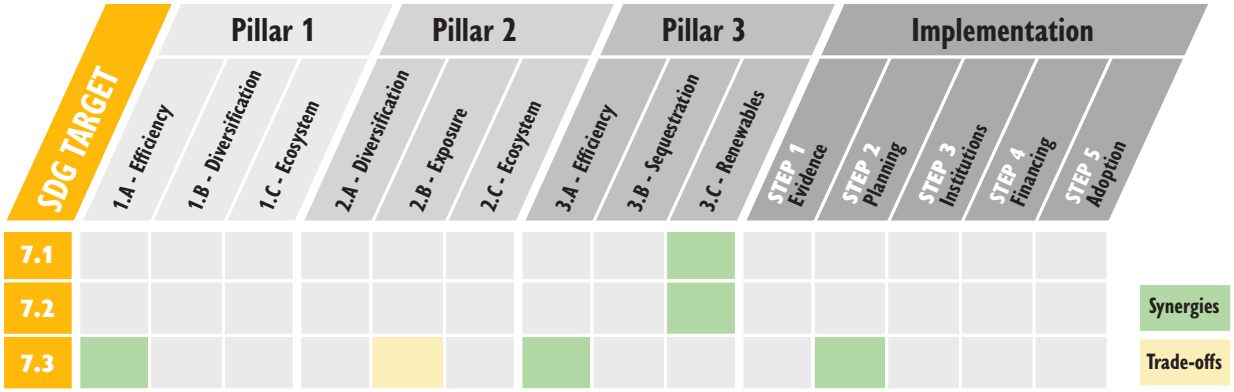
6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.

6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.

6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

6.A By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies.

Table A1.7: Interlinkages between climate-smart agriculture and SDG 7



Climate-smart agriculture can contribute to SDG 7, mainly through initiatives that promote the use of renewable energy sources (Target 7.2), efficient use of energy in farming operations, and efficient use of energy-intensive external inputs (Target 7.3). Such initiatives can reduce both the cost of production (CSA Pillar 1), and GHG emissions (CSA Pillar 3). Furthermore, development of renewables for CSA can provide access to electricity in rural areas (Target 7.1). On the other hand, adaptation measures, such as cooling systems for livestock stables (CSA Pillar 2), may result in increased energy consumption and reduced energy efficiency. Efficient energy use in agriculture will also contribute to resource use efficiency in production in general (Targets 8.4 and 12.2), and to mitigation of climate change (SDG 13).

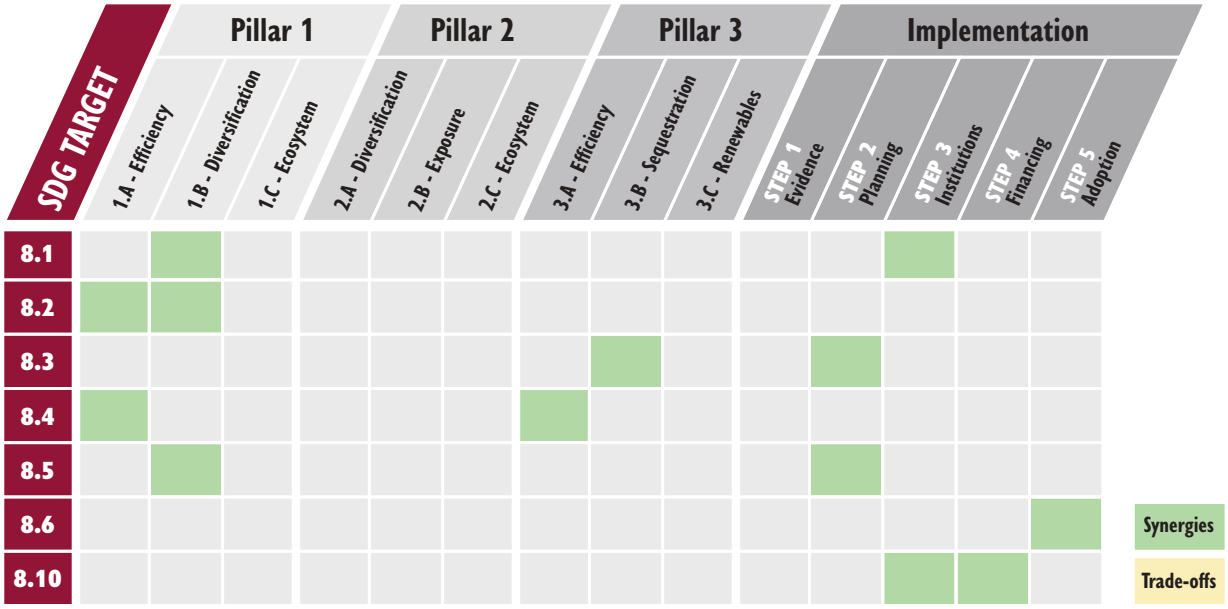
Relevant SDG targets:

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services.

7.2 By 2030, increase substantially the share of renewable energy in the global energy mix.

7.3 By 2030, double the global rate of improvement in energy efficiency.

Table A1.8: Interlinkages between climate-smart agriculture and SDG 8



Through its focus on improving productivity and incomes, diversification and enhancing economic opportunities, CSA can contribute to sustained economic growth and economic productivity (SDG 8.1, 8.2). In pursuit of both economic and environmental sustainability objectives, CSA seeks to improve the resource use efficiency in food production (SDG 8.4). CSA also promotes productive activities in agriculture, for example through social protection schemes, and the creation of decent jobs, such as in responsible timber sourcing from sustainable forest management, thereby supporting productive employment, including for women and youth (SDG 8.3, 8.5, 8.6). Finally, CSA interventions may involve national and local banking, insurance and financial services institutions, helping to build the capacity of these institutions generally (SDG 8.10).

Relevant SDG targets:

8.1 Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 percent gross domestic product growth per annum in the least developed countries.

8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors.

8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services.

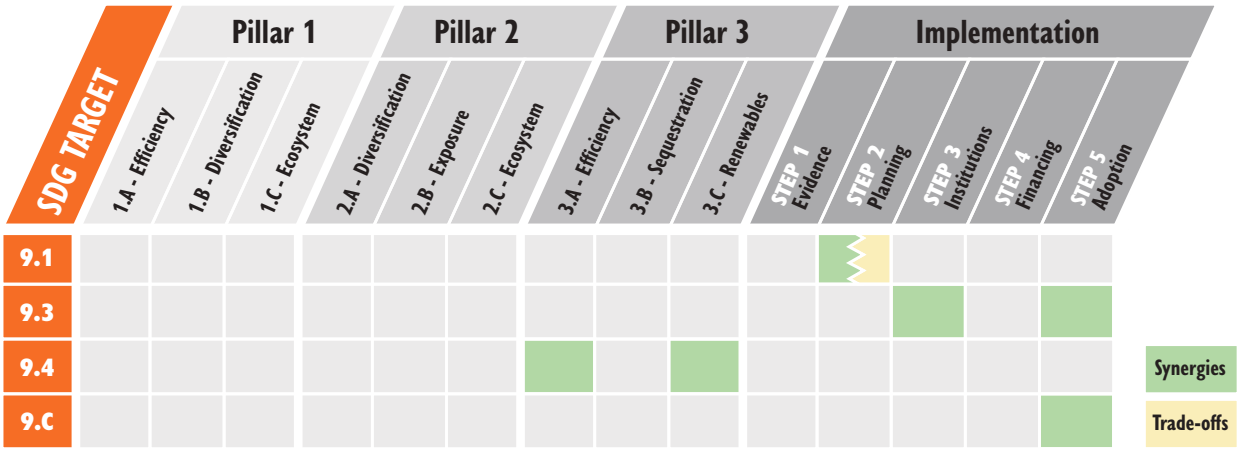
8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10 Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead.

8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value.

8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training.

8.10 Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all.

Table A1.9: Interlinkages between climate-smart agriculture and SDG 9



A climate-smart agriculture approach can entail development of sustainable infrastructure, such as roads connecting farmers to markets, or climate-resilient processing and distribution centres (SDG 9.1). Access to financial services for food producers is often a component of CSA activities (SDG 9.3). CSA activities focusing on improving resource use efficiency and use of renewable energy in food storage and processing contribute to making food industries more sustainable (SDG 9.4). Field implementation of CSA may also involve the use of ICTs to improve food producers' access to climate, market and other relevant information (SDG 9.C).

Relevant SDG targets:

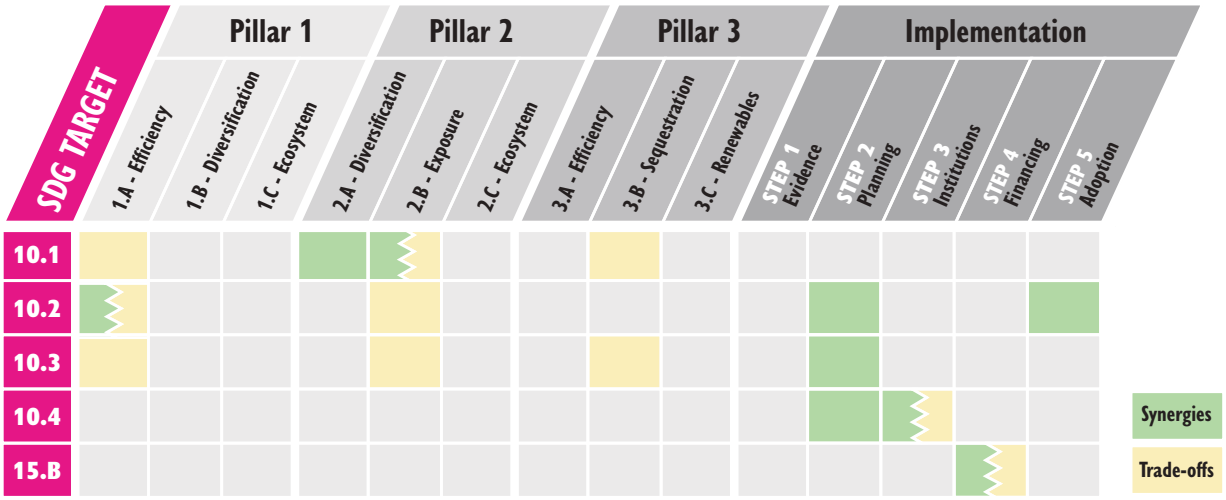
9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.

9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets.

9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.

9.C Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020.

Table A1.10: Interlinkages between climate-smart agriculture and SDG 10



Climate-smart agriculture can be effective in increasing the incomes, resilience and inclusion of the poorest and most marginalized members of society (SDG 10.1, 10.2), such as subsistence farmers, especially women, when they are explicitly the focus of CSA interventions. Care should be taken, of course, to ensure that initiatives such as afforestation or REDD+ do not negatively impact the poorest and most marginalized through dispossession, and that CSA solutions are also accessible to the poorest farmers. CSA can reduce inequalities and eliminate discriminatory laws (SDG 10.3) through actions such as tenure formalization. Climate-smart agriculture can involve the adoption of social protection policies (SDG 10.4), such as insurance or social safety nets, when CSA interventions are paired with social protection measures. CSA can be an avenue for developing countries to access official development assistance (SDG 10.B).

Relevant SDG targets:

10.1 By 2030, progressively achieve and sustain income growth of the bottom 40 percent of the population at a rate higher than the national average.

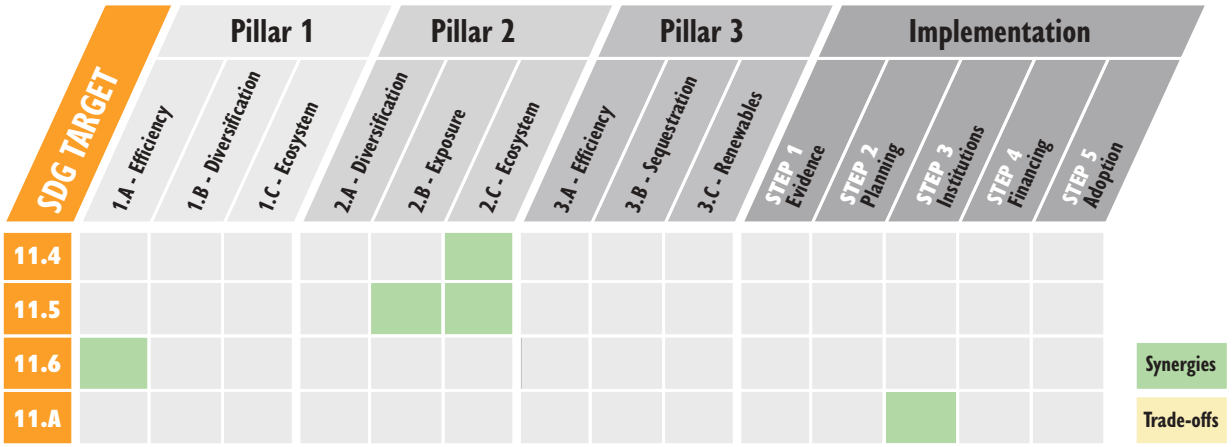
10.2 By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status.

10.3 Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard.

10.4 Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality.

10.B Encourage official development assistance and financial flows, including foreign direct investment, to States where the need is greatest, in particular least developed countries, African countries, small island developing States and landlocked developing countries, in accordance with their national plans and programmes.

Table A1.11: Interlinkages between climate-smart agriculture and SDG 11



Climate-smart agriculture can help to safeguard the world's natural and cultural heritage, for example through promotion of Globally Important Agricultural Heritage Systems (SDG 11.4). SDG 11.5 is advanced through efforts to build the resilience of agricultural systems, thereby reducing the economic losses and damage associated with disasters. The negative environmental impact of cities can be reduced by CSA activities, such as composting organic materials produced by the city, and used in surrounding farms. This could be part of a city's climate change mitigation and/or adaptation plan (SDG 11.6, 11.B).

Relevant SDG targets:

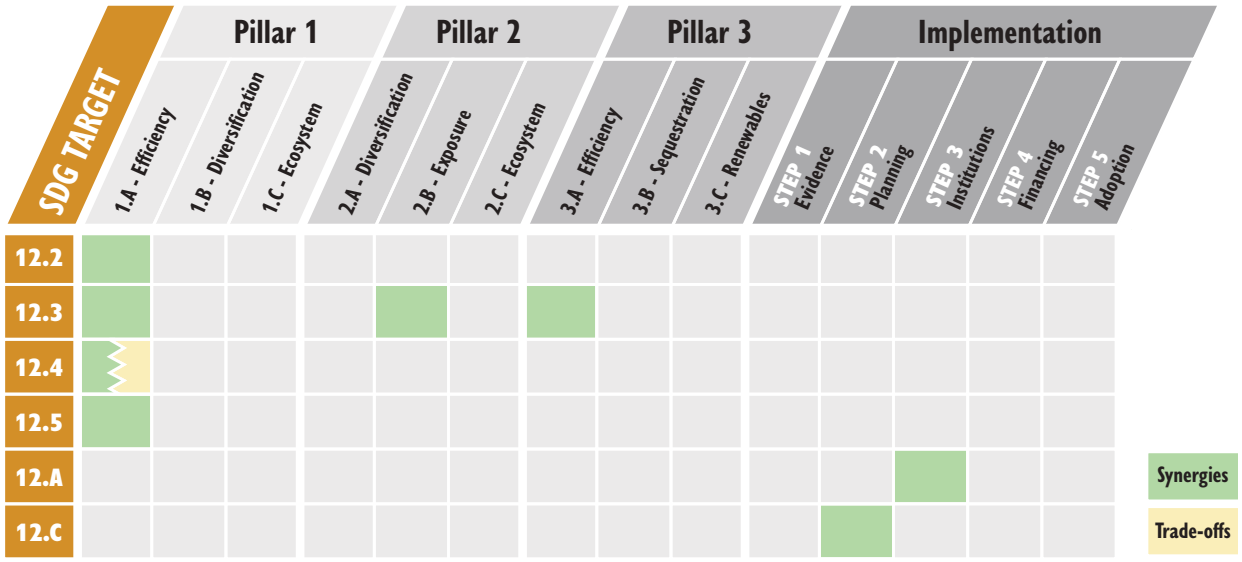
11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage.

11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.

11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

11.A Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning.

Table A1.12: Interlinkages between climate-smart agriculture and SDG 12



Climate-smart agriculture promotes the sustainable management and efficient use of resources in food production, including recycling of waste, as well as the environmentally sound management of agro-chemicals (SDG 12.2, 12.5, 12.4). Reducing and avoiding food losses (SDG 12.3), in particular in post-harvest processes and storage, is an important component of a CSA approach because food losses translate into GHG emissions from unproductive resource use, as well as a reduction of food available for household consumption or sale. The implementation of CSA may also involve capacity development of research institutions on sustainable production patterns (SDG 12.A), and the redesign of inefficient fossil fuel subsidies (SDG 12.C).

Relevant SDG targets:

12.2 By 2030, achieve the sustainable management and efficient use of natural resources.

12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.

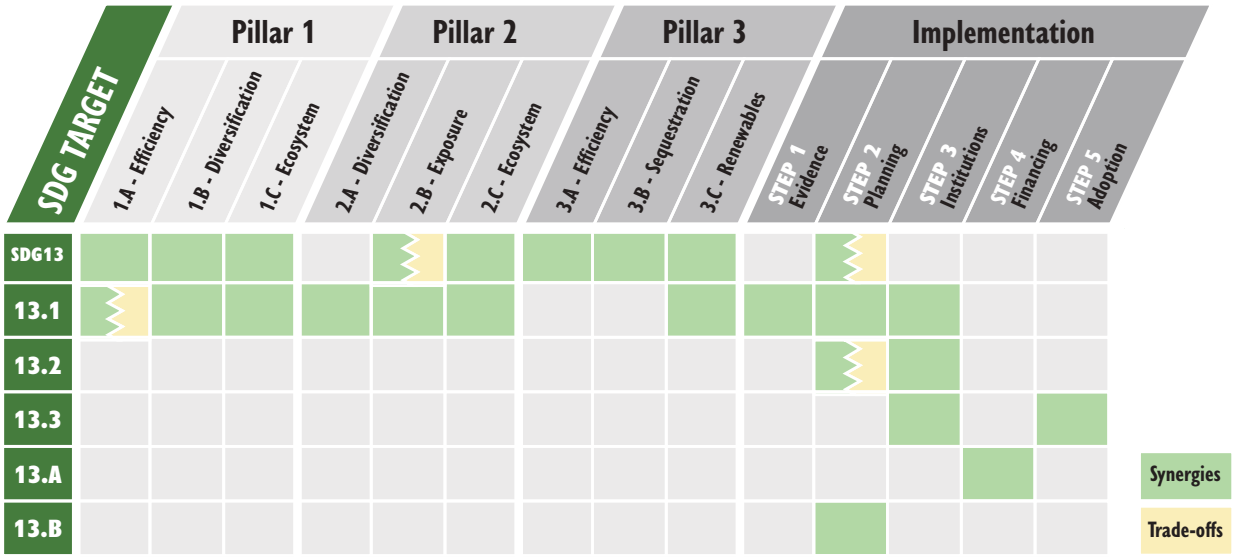
12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.

12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.

12.A Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production.

12.C Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities.

Table A1.13: Interlinkages between climate-smart agriculture and SDG 13



Any climate-smart agriculture action focused on increasing climate resilience or adaptive capacity (one of three central tenets of the CSA approach) would advance SDG 13.1, either in the field or at policy/institutional level. It should be noted that CSA actions related to GHG emission reductions are mapped at goal level (SDG 13), as there is no target explicitly accounting for climate change mitigation actions. Since it is recommended that CSA be codified in national planning processes and policies, and that institutional capacity-building be part of a CSA approach, SDG 13.2 and 13.3 are often advanced through CSA. Any CSA finance provided by donor countries to developing countries, as well as private climate finance directly leveraged by such CSA finance, can support SDG 13.A, and any CSA efforts focused on building the capacity of small island developing states and least developed countries can advance SDG 13.B.

Relevant SDG targets:

13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.

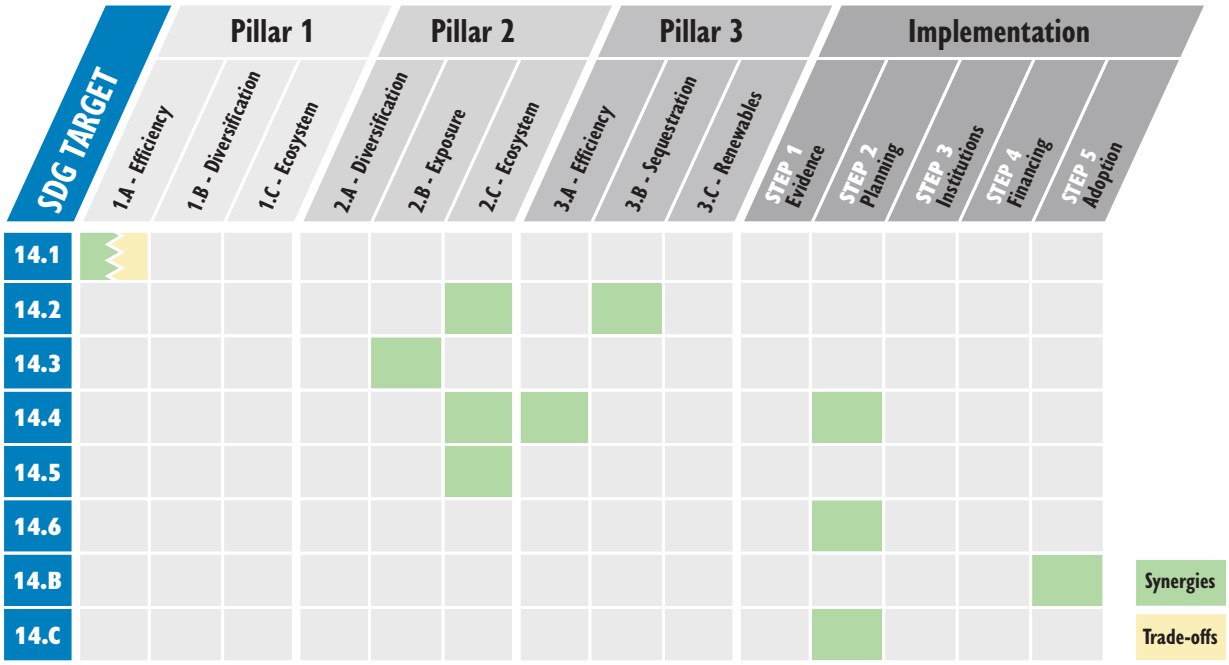
13.2 Integrate climate change measures into national policies, strategies and planning.

13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.

13.A Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly USD 100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible.

13.B Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities.

Table A1.14: Interlinkages between climate-smart agriculture and SDG 14



The sustainable management of nutrients in crop, livestock and aquaculture systems, in line with CSA Pillar 1, can lead to reduced leaching and marine pollution (SDG 14.1), although there is a risk that unregulated intensification under the banner of CSA may have a contrary effect. Climate-smart agriculture activities to develop sustainable and resilient fish stocks and marine ecosystems, including promotion of the Code of Conduct for Sustainable Fisheries and the international Law of the Sea, regulation of overfishing and fishing fleet overcapacity, mangrove management and protection of marine areas, support SDG 14.2, 14.4, 14.5, 14.6 and 14.C. In aquaculture, a CSA adaptation strategy is the promotion of acid-tolerant species to cope with acidification of the oceans (SDG 14.3). Connecting food producers to markets, as an integral aspect of CSA Pillar 1's focus on increasing incomes and improving livelihoods, can advance SDG 14.B.

Relevant SDG targets:

14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.

14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.

14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels.

14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics.

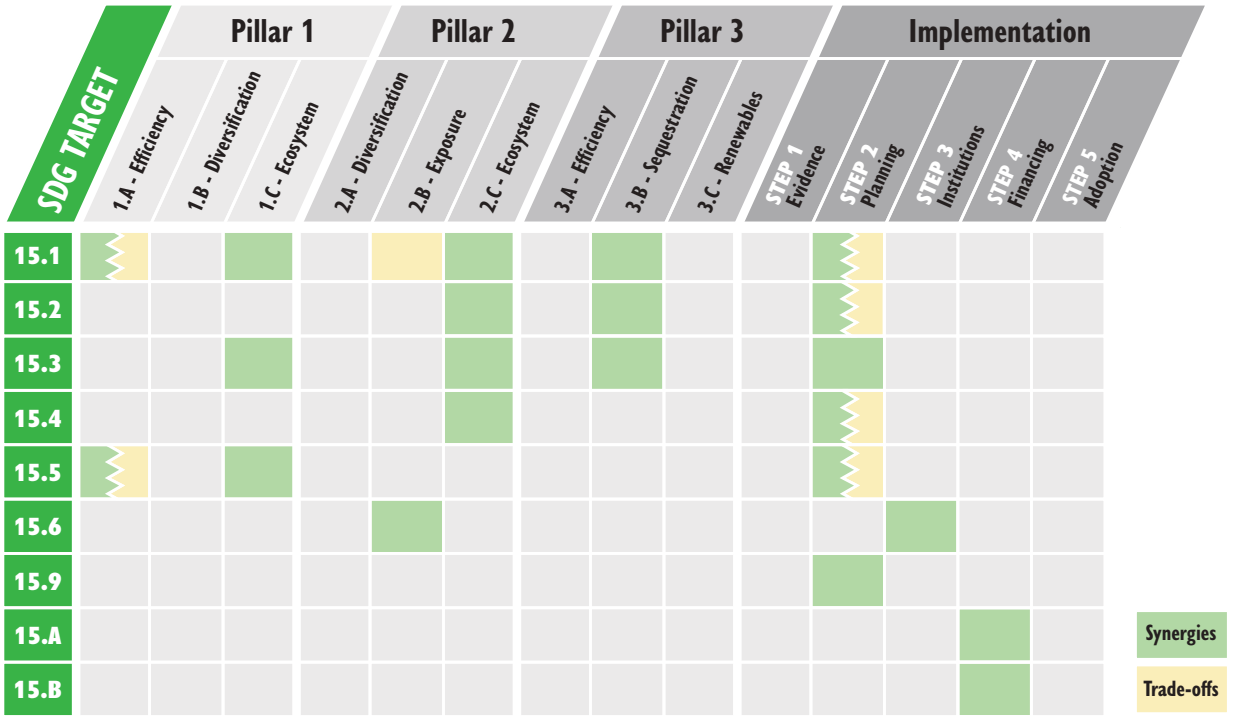
14.5 By 2020, conserve at least 10 percent of coastal and marine areas, consistent with national and international law and based on the best available scientific information.

14.6 By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation.

14.B Provide access for small-scale artisanal fishers to marine resources and markets.

14.C Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in the United Nations Convention on the Law of the Sea, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of "The future we want".

Table A1.15: Interlinkages between climate-smart agriculture and SDG 15



Climate-smart agriculture activities that comply with the sustainability imperative of CSA Pillar 1 generally support the sustainable use and preservation of ecosystems and enhance ecosystem services and biodiversity (15.1, 15.5), although sustainable intensification may lead to decreased biodiversity on the arable land itself. Afforestation, reforestation and sustainable forest management practices can contribute to all three CSA pillars and advance SDG 15.2. Many CSA practices, such as sustainable grazing management, restoration of degraded pastures and agroforestry, can contribute to the restoration of degraded land (SDG 15.3) and preservation of mountain ecosystems (SDG 15.4). Facilitating access of national research institutions and food producers to genetic resources for breeding through CSA initiatives supports SDG 15.6. By consistently integrating the preservation and restoration of ecosystems and the enhancement of ecosystem services into CSA-related planning, the reflection of such values in agriculture sector planning can be advanced (SDG 15.9), and synergies created between resources mobilized for CSA and ecosystem/biodiversity conservation (SDG 15.A, 15.B).

Relevant SDG targets:

15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements.

15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally.

15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.

15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development.

15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.

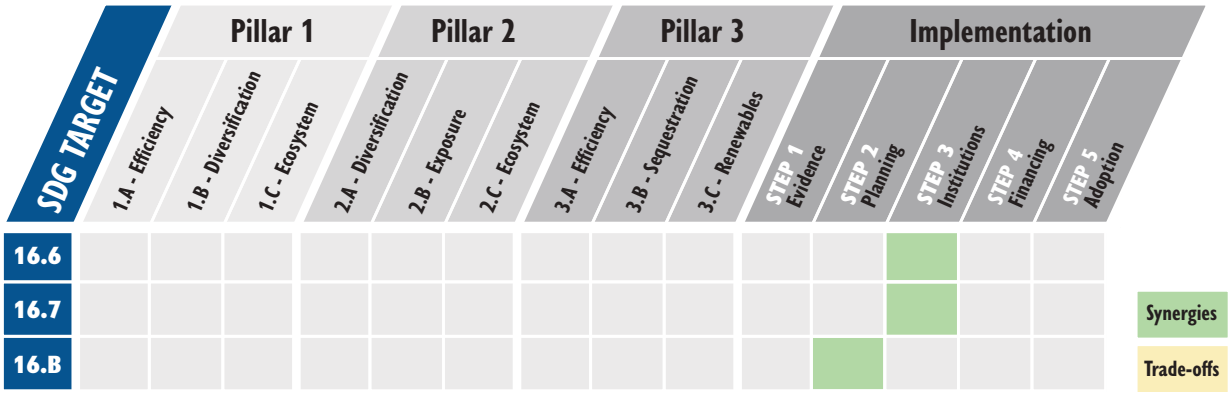
15.6 Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed.

15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts.

15.A Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems.

15.B Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation.

Table A1.16: Interlinkages between climate-smart agriculture and SDG 16



A climate-smart agriculture approach often requires institutional capacity-building and development of institutional coordination mechanisms, which can enhance the efficiency, accountability and transparency of governance processes related to CSA (SDG 16.6). CSA implementation also encourages and supports participatory processes and the capacity of stakeholder groups to organize themselves and engage in decision-making (SDG 16.7). CSA can promote non-discriminatory laws and policies through, for example, codifying tenure claims (SDG 16.B).

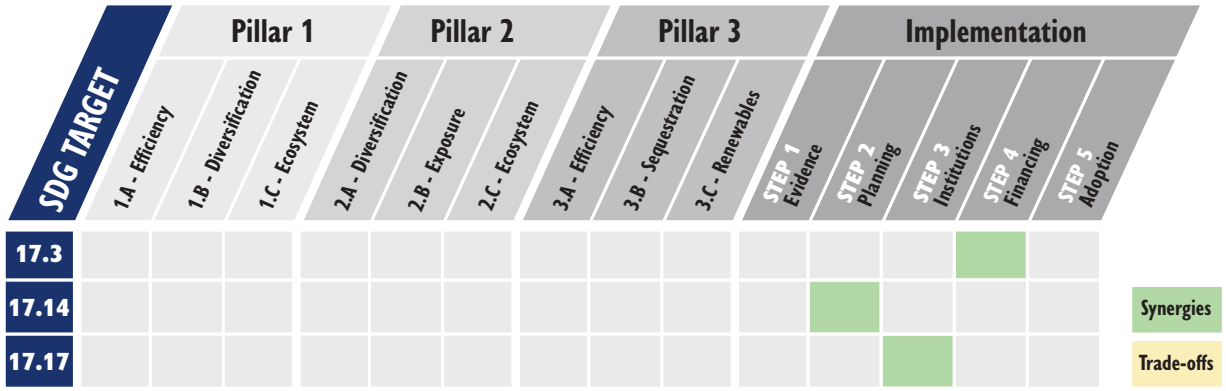
Relevant SDG targets:

16.6 Develop effective, accountable and transparent institutions at all levels.

16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels.

16.8 Broaden and strengthen the participation of developing countries in the institutions of global governance.

Table A1.17: Interlinkages between climate-smart agriculture and SDG 17



Climate-smart agriculture offers an avenue to mobilize additional resources, especially climate finance, for developing countries (SDG 17.3). Cross-sectoral coordination and participatory planning processes promoted by the CSA approach – particularly if informed by the possible synergies between CSA and the SDGs – contributes to enhanced policy coherence for sustainable development (SDG 17.14). In addition, because partnerships are critical for the success of CSA, SDG 17.17 can be advanced.

Relevant SDG targets:

17.3 Mobilize additional financial resources for developing countries from multiple sources.

17.14 Enhance policy coherence for sustainable development.

17.17 Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnership.

Summary table of CSA-SDG interlinkages

Table A2.1: Mapping of CSA-SDG interlinkages

The table shows **a)** the share of targets per SDG for which interlinkages with climate-smart agriculture were identified; **b)** targets of each SDG for which synergies and/or trade-offs were identified with a CSA pillar and/or the CSA implementation process.

		SDG 1	SDG 2	SDG 3	SDG 4	SDG 5	SDG 6	SDG 7	SDG 8	SDG 9	SDG 10	SDG 11	SDG 12	SDG 13	SDG 14	SDG 15	SDG 16	SDG 17
Synergies with targets		7/7	6/8	5/13	3/10	5/9	6/8	3/5	7/12	4/8	5/10	4/10	6/11	5/5	8/10	9/12	3/12	3/19
Trade-offs with targets		5/7	4/8	0/13	1/10	2/9	4/8	1/5	0/12	1/8	5/10	0/10	1/11	3/5	1/10	4/12	0/12	0/19
Pillar 1	Synergy	1.1 1.2 1.4 1.5	2.1 2.2 2.3 2.4	3.1 3.2 3.3 3.4 3.9	4.1 4.2	5.1 5.4 5.A	6.1 6.3 6.4	7.3	8.1 8.2 8.4 8.5		10.2	11.6	12.2 12.3 12.4 12.5	SDG13 13.1	14.1	15.1 15.3 15.5		
	Trade-off	1.1 1.2			4.1	5.4	6.1 6.3 6.4				10.1 10.2 10.3		12.4	13.1	14.1	15.1 15.5		
Pillar 2	Synergy	1.1 1.2 1.3 1.5	2.1 2.2 2.3 2.4 2.5			5.1	6.1 6.4 6.6				10.1	11.4 11.5	12.3	SDG13 13.1	14.2 14.3 14.4 14.5	15.1 15.2 15.3 15.4 15.6		
	Trade-off		2.3 2.4			5.1	6.1 6.6	7.3			10.1 10.2 10.3			SDG13		15.1		
Pillar 3	Synergy	1.1 1.2 1.4 1.5	2.1 2.2 2.3 2.4	3.3 3.9		5.1	6.1 6.6	7.1 7.2 7.3	8.3 8.4	9.4			12.3	SDG13 13.1	14.2 14.4	15.1 15.2 15.3		
	Trade-off	1.1 1.2 1.3 1.4	2.1 2.2				6.1 6.6				10.1 10.3							
Implementation	Synergy	1.1 1.2 1.3 1.4 1.5 1.A 1.B	2.1 2.2 2.3 2.4 2.A	3.3	4.4	5.1 5.5 5.A 5.B	6.4 6.5 6.6 6.A	7.3	8.1 8.3 8.5 8.6 8.10	9.1 9.3 9.C	10.2 10.3 10.4 10.B	11.A	12.A 12.C	SDG13 13.1 13.2 13.3 13.A 13.B	14.4 14.6 14.B 14.C	15.1 15.2 15.3 15.4 15.5 15.6 15.9 15.A 15.B	16.6 16.7 16.B	17.3 17.14 17.17
	Trade-off	1.A					6.6			9.1	10.4 10.8			SDG13 13.2		15.1 15.2 15.4 15.5		

Appendix 3

Country case studies

The following case studies were developed to provide concrete information and examples of national governments' efforts to implement climate-smart agriculture in the context of integrated efforts to achieve the SDGs and NDC objectives, thereby complementing evidence found in the literature on the same and similar subjects. Focusing on Bangladesh, Ecuador and Ethiopia, these case studies are based on interviews with representatives of the ministries tasked with implementing CSA, and the Paris Agreement and SDG agendas. In the case of Bangladesh, a representative of the NGO community was also interviewed. The information gathered from these interviews is complemented by data from publicly available documents on these three countries. The case studies are structured in a similar way to the guidelines presented above: An overview of CSA, SDG and NDC implementation in each country is followed by a description of its experience with expanding the evidence base, supporting enabling policy frameworks/planning, strengthening national and local institutions, enhancing financing options, implementing practices in the field, and monitoring, evaluation and reporting.[1]

A3.1 Bangladesh case study

Overview of CSA, SDG and NDC implementation in Bangladesh

Agriculture in Bangladesh is still predominantly subsistence-based, and dominated by small-scale and marginal farmers. However, in recent years, there has been a robust upturn in commercial farming, and production of high value crops, fisheries and animal products. In fact, 90 percent of the rural poverty reduction in Bangladesh that has occurred in the past five years can be attributed to increases in farm income (CIAT, 2017). Despite these efforts, the Government of Bangladesh (GoB) estimates that climate change will reduce agricultural GDP by 3.1 percent per annum for the period 2005–2050 (GoB, 2017a). The agriculture sector is highly vulnerable to climate variability and change. Saline intrusion, related to sea level rise and storm surge, is a major challenge, especially since so many smallholders occupy low-lying, flood-prone deltas. Examples of CSA interventions to support adaptation include the following: promotion of the traditional *Sorjan* system – tall beds for crop production that alternate with trenches for submergence-tolerant fish and crops; vertical gardens; and floating bed cultivation (CIAT, 2017). Bangladesh's largest source of agricultural GHG emissions is irrigated rice paddy production, due to the country's focus on rice production and its abundant water resources. In recent years, as a result of various interventions, farmers have increasingly adopted alternate wetting and drying to reduce these emissions (CIAT, 2017). The very real intersecting challenges that Bangladesh faces linked to rural poverty, vulnerability and agriculture-related emissions have led the country to pursue climate-smart agriculture unreservedly.

In term of the Sustainable Development Goals, the country has already made significant progress in its priority areas. Of the 244 indicators agreed at global level, Bangladesh is focusing on 39 (across all 17 goals) as its priorities. Many of these are taken directly from the global list, but in some instances, Bangladesh has refined a global indicator to better reflect its national circumstances. It should be noted that, under Goal 13, Bangladesh focuses only on SDG

1 It should be noted that not all implementation steps are discussed in each case study. Rather, the focus is on steps for which the given country has the most experience.

Indicator 13.1.1, with its target set to "reduce the number of deaths, missing persons and directly affected persons attributed to disasters to 1 500 per 100 000 population" (GoB, 2017b). Bangladesh was part of the 2017 Voluntary National Review at the High Level Political Forum, and will also participate in the 2020 review (UN SDG Knowledge Platform, 2019).

Despite the importance that Bangladesh places on agriculture, and the sector's centrality to its economy, agriculture does not figure prominently in the country's first NDC. This is because, as noted in the country's NDC Implementation Roadmap (GoB, 2017a), robust baseline (emissions) data for the sector do not currently exist. In its NDC, Bangladesh commits to "reduce GHG emissions in the power, industry and transport sectors by 5 percent below 'business-as-usual' GHG emissions by 2030 using only domestic resources, or by 15 percent […] if sufficient and appropriate support is received from developed countries" (GoB, 2015a). Bangladesh is, however, contemplating actions to reduce agricultural emissions if funding is received, and considering how it might include agriculture in the mitigation component of its next NDC (GoB, 2017a). Agriculture, in particular the improvement and cultivation of varieties that are stress-tolerant (drought, saline, flood), is mentioned under the adaptation component of the NDC, which is being implemented mainly through the country's nascent National Adaptation Plan (NAP) process.[2] Adaptation and mitigation aspects of the NDC are aligned through the NDC-NAP Implementation Coordination Committee, a structure set up by the Government to ensure coherence in its NDC-NAP agenda (GoB, 2017a).

Expanding the evidence base

To date, Bangladesh has partially engaged in aspects of the full process recommended by FAO for expanding the evidence base for CSA. However, it is not clear if any of these efforts have explicitly been undertaken with the intention of integrating CSA efforts into those related to the SDGs and NDC-NAP. The first step for the country is to engage in baseline data collection, which the Bangladesh Agricultural Research Council is spearheading. Among tools being used to gather data are surveys, and one outcome that the Government hopes to achieve from this data collection and analysis is the level of financial support that would be needed for CSA. The data collection process is still at a preliminary stage; at this point, the data are insufficient to fully inform decision-making (M. Saifullah, personal communication, 2019).[3] In its 2018 progress report on SDG implementation, the Government notes that data paucity has emerged as a major constraint in monitoring progress on the SDGs, and calls on UN agencies and other development partners to support the country in strengthening this capacity (GoB, 2018). While this SDG data collection capacity, whether for baseline data collection or ongoing monitoring, is not necessarily focused on CSA practices, it can be assumed that the lack of capacity related to SDG data for monitoring is a systemic issue facing the government.

Bangladesh has partially undertaken an agriculture sector vulnerability assessment (conducted by the Ministry of Environment, Forests and Climate Change (GoB MoEFCC) (M.A. Rouf, personal communication, 2019). In addition, as part of its 2nd National Communication to the UNFCCC (2012), Bangladesh carried out climate impact and vulnerability assessments, including for priority sectors such as agriculture (UNDP, UNE and GEF, 2017).

Supporting enabling policy frameworks/planning

Implementation of CSA and efforts related to achieving the SDGs and NDC objectives in Bangladesh are governed by two main policy documents and associated processes: the Five Year Plan (FYP), the country's overarching economic growth and development planning process, and specific to climate change, the Bangladesh Climate

2 It should be noted that sectoral implementation plans for Bangladesh's three priority sectors – power, industry and transport – of the NDC do include adaptation.

3 Interviewees for the Bangladesh case study were: Md. Abdur Rouf (Additional Secretary for Policy, Planning and Coordination, Ministry of Agriculture), Md. Saifullah (Principal Scientifi c Offi cer, Bangladesh Agricultural Research Council), Md. Sirajul Islam (Head of Agriculture and Food Security Programme, BRAC).

Change Strategy and Adaptation Plan (BCCSAP). The 7th FYP (7FYP; 2015–2020) was under development as the SDGs and Paris Agreement were being negotiated, offering Bangladesh an opportunity to seamlessly integrate these international agendas into the development plan (GoB, 2017c). The 7FYP includes a number of activities focused on mitigation and adaptation, including enhancing understanding on low-carbon development; improving capacity, coordination and communication among key institutions; promoting a whole-of-government approach to climate readiness; and encouraging innovation and research (GoB, 2017a). Implementation of the 7FYP entails development of sectoral action plans across the 13 sectors incorporated in the 7FYP, including agriculture. The GoB MoEFCC, tasked with coordinating NDC implementation, has worked closely with the national-level Planning Commission, tasked with overseeing implementation of the 7FYP, to ensure that climate considerations are integrated throughout the 7FYP sectoral action plans (GoB, 2017a). The BCCSAP was created in 2009 and forms the basis for the country's NDC and associated NAP process, as well as the climate elements of the 7FYP. The BCCSAP includes six pillars (five related to adaptation and capacity-building, one related to low-carbon development), including one focused on food security. It comprises 44 programmes and 145 projects, several of them related to agriculture (GoB, 2017a).

At this point, Bangladesh does not have a stand-alone climate-smart agriculture strategy (M. Saifullah, personal communication, 2019). However, CSA, both as a cohesive approach, and as its component parts, figures prominently in both the 7FYP and BCCSAP. For example, the development vision for the agriculture sector under the 7FYP is to "ensure food and nutritional security, through sustainable intensification and diversification of climate resilient agricultural systems […]", and the plan also mentions the country's commitment to reducing emissions from agriculture. The sector objective in the 7FYP is to ensure sustained agricultural growth through more efficient and balanced utilization of land, water and other resources, while carefully addressing climate change concerns, especially building resilience of local communities (GoB, 2015b). In addition, the Government recently approved the 2018 Agricultural Policy, which focuses on mainstreaming consideration of climate change into the agriculture sector (M.A. Rouf, personal communication, 2019), and explicitly links to the SDGs and NDC, including by using some of the same targets prioritized for the SDGs (M. Saifullah, personal communication, 2019).

Strengthening national and local institutions

Bangladesh has made significant efforts to ensure a coherent, whole-of-government approach to implementation of the SDGs and NDC, to which nascent CSA efforts are contributing. While the Prime Minister's office and the Planning Commission lead implementation of the SDG agenda, and the GoB MoEFCC leads implementation of the NDC-NAP agenda, there is robust involvement of relevant line ministries and appropriate delegation of responsibility for implementation based on topical area and mandate. The Ministry of Agriculture (GoB MoA) leads implementation of SDG Goal 2 (End hunger, achieve food security and improved nutrition and promote sustainable agriculture), and takes a lead role in advancing five targets, acts as co-lead on four targets, and has an associate role on 16 targets (M.A. Rouf, personal communication, 2019). When it comes to CSA in the context of the SDG and NDC agendas, the GoB MoA works closely with the GoB MoEFCC and the Ministry of Fisheries and Livestock (M. Saifullah, personal communication, 2019).

In terms of implementation and monitoring of the SDGs, the Prime Minister established an interministerial committee, comprising secretaries from 20 ministries to coordinate efforts. The committee is headed by a new, high-level position in the Prime Minister's office: the Principal Coordinator (SDG Affairs). The General Economics Division of the Ministry of Planning acts as secretariat for the committee, and coordinates policy-level implementation, and monitoring and reporting efforts. The committee led the process to align the goals with the Bangladesh national context, and to work with relevant ministries for target setting and mainstreaming of targets in sectoral planning efforts. The committee reports on progress biannually to the Cabinet (GoB, 2018). The process to develop the NDC was led by the Prime Minister's office, and included all relevant ministries, among them the GoB MoA (M. Saifullah, personal communication, 2019). For implementation purposes, the Government has set up an NDC-NAP Advisory Committee, which meets quarterly. It is chaired by the Secretary of the GoB MoEFCC, with senior representatives from nearly all ministries, including the GoB MoA (M. Saifullah, personal communication, 2019). In addition, a NDC-NAP Coordinating Committee has been formed to act as secretariat to the advisory committee, and serve as focal point for the UNFCCC. The coordinating committee comprises working-level representatives of all the same ministries as the advisory committee (GoB, 2017a). For implementation of CSA in the context of a country's integrated effort to achieve the SDGs and its NDC objectives these types of interministerial coordination are critical, so as to ensure that synergies are enhanced and trade-offs reduced, both between the three CSA pillars and between CSA and other sectors.

Engaging non-state actors: In keeping with its approach to engage stakeholders in all national development plans and policy document processes, Bangladesh has made significant strides in involving non-state actors in the SDG process, which again, is closely aligned with its NDC-NAP agenda priorities and other development efforts, including CSA. Even Bangladesh's preparations for the SDG negotiation process involved multiple stakeholders such as national experts, civil society representatives, the private sector and development partners. This robust stakeholder engagement has continued, now that the Government is in implementation mode. The Government regularly conducts consultations with representatives from NGOs, ethnic minorities, labour associations and professional groups, women's networks, and the media. The aim is to raise awareness of, commitment to, and engagement in the SDG agenda. A particular focus has been on engaging with the private sector, given the pivotal role of this stakeholder group in achieving the SDGs (GoB, 2018). For example, the Government has undertaken efforts to engage the private sector in providing microinsurance for smallholder farmers (World Bank, FAO and IFAD, 2018). One approach that the Government uses to engage non-state actors is the NGO Bureau, within the Prime Minister's Office. This is tasked with implementing certain SDG and NDC priorities, and it then engages the NGOs working in the country to conduct the relevant activities. In turn, NGOs are able to access funding through the national Government for implementation (M. Saifullah, personal communication, 2019). As described in the guidelines section of this publication, this type of multistakeholder engagement is also fundamental for successful CSA implementation, given the breadth of issues that CSA encompasses; non-state actors will often bring a diversity of views and connections to the table that a government is unlikely to be able to provide on its own.

Implementing practices in the field

The GoB is in the early days of implementing climate-smart agriculture projects, but is expected to draw on its long history of implementing agricultural and rural development projects as its CSA efforts expand. As confirmed by one source, there is already some early evidence of co-implementation of agricultural development interventions with other SDG priorities, such as maternal health (M.A. Rouf, personal communication, 2019). Agricultural development projects are implemented by the GoB MoA's Department of Agricultural Extension, which has 460 offices across the country's 64 districts. Extension officers use different organizing techniques, depending on the focus topic (M. Saifullah, personal communication, 2019). The government extension service often collaborates with NGOs to disseminate technologies, if an NGO has better reach or expertise in a given topic.

One of the major NGOs advancing the CSA agenda in Bangladesh is BRAC, a development NGO operating in Bangladesh and 10 other countries in Asia and Africa. BRAC's implementation approach is to focus on group formation at community level. The NGO will organize 50 farmers on a 12-hectare plot of land, and teach them how to implement the CSA practices. Each farmer will implement one or two practices on those 12 hectares; then adjacent farmers, regardless of gender, are invited to learn about the CSA approaches, enabling the further spread of knowledge and practices. BRAC will, at times, collaborate explicitly with the Government on a given intervention, but often, the NGO and the Government will simply operate separately around overlapping missions (S. Islam, personal communication, 2019).

Monitoring, evaluation and reporting

The Government of Bangladesh does not have a stand-alone CSA monitoring and evaluation system in place, but where climate-smart agriculture features in implementation of the SDGs or NDC-NAP agenda, performance of CSA is captured through those M&E systems. For SDG monitoring and evaluation, the Government has developed a framework to track progress until 2030. This includes baseline data for each of the 39 priority indicators for which data are available, and the target for 2030 with two milestones – 2020 and 2025. For transparency purposes and ease of use, information on the agency responsible for generating the relevant data and the data source are also provided (GoB, 2018). In its 2018 SDG Progress Report (GoB, 2018), the Government highlights the complexity of this framework. For example, in the case of many targets, a composite of various indicators is used to track progress, rather than a single measure. In addition, to date the statistics bureau has not tracked data related to some aspects of Bangladesh's development plans, or to SDG indicators. Additionally, data generation has historically been conducted through surveying at intervals ranging from three to five years. The ability to generate data more frequently, and to generate disaggregated data, for example by gender or ethnicity, will require additional human and financial resources (GoB, 2018).

For the NDC, the Department of the Environment, within the GoB MoEFCC, has overall responsibility for managing the national monitoring, reporting and verification system associated with NDC implementation (GoB, 2017a). In addition to the two aforementioned M&E systems, a development results framework (DRF) is embedded in the 7FYP for monitoring plan progress. The outcomes and targets in the DRF, which are aligned with the SDGs, focus on poverty reduction, macroeconomic development, employment, health, education, water and sanitation, transport and communication, power, energy and mineral resources, gender and inequality, environment, climate change and disaster management, ICTs, urban development, governance, and international cooperation and partnership (GoB, 2018). The level of interactions between these three systems is not immediately clear. Data collection for these systems depends on the 64 districts (all of which are considered part of the national government) into which the country is divided. Data collection takes place at district level, and is aggregated at national level (M. Saifullah, personal communication, 2019).

Conclusion

From the aforementioned discussion, it is clear that Bangladesh is taking meaningful steps to align its priorities related to national development with the SDGs and NDC-NAP. In addition, climate-smart agriculture is gaining prominence in the country as a tool to advance multiple objectives simultaneously. As CSA becomes a higher priority for the country, the Government may want to pursue more of the steps recommended by FAO for CSA implementation, and to undertake these in a way that allows for maximal integration with the SDG and NDC-NAP agenda. For example, solidifying the evidence base for CSA and developing a stand-alone CSA strategy that explicitly focuses on supporting the 7FYP, SDGs and NDC-NAP targets might be valuable early steps. With a strong whole-of-government approach in place, the Government of Bangladesh may want to take additional steps to build the capacity of institutions working at the nexus of CSA/ SDGs/ NDC-NAP. Finally, while not specific to CSA, the Government may want to clarify the relationships between its various monitoring and evaluation and reporting frameworks, taking CSA into account. In this way, opportunities for resource efficiency can be maximized.

A3.2 Ecuador case study

Overview of CSA, SDG and NDC implementation in Ecuador

All development planning and action in Ecuador is based on the iterative National Development Plan, which the constitution mandates will be the guiding process for development policies, programmes and projects. As such, all public resource allocation is also aligned with the National Development Plan. The National Development Plan 2017–2021 'Toda Una Vida' (NDP) is intentionally and explicitly aligned with the SDGs. The NDP is organized into nine objectives and over 140 goals that the Government has aligned with the 17 SDGs. For example, SDG 13 (climate action) is aligned with NDP Objective 3 (Protect the rights of nature for current and future generations), and SDG 2 (zero hunger) is aligned with NDP Objective 1 (Guarantee a dignified life with equal opportunities for all), 5 (Promote productivity and competitiveness for sustainable economic growth that takes redistribution and solidarity into account), and 6 (Develop rural productivity and capacities for food sovereignty and well-being)[4] (GoEc, 2018).

In its 2018 Voluntary National Review (VNR), Ecuador finds links between several NDP policies explicitly focused on agriculture, and particular SDGs. These include:

- SDG1, SDG 2:
    - Strengthen the organization, association, and participation of family and peasant farmers in food supply markets.
- SDG2:
    - Combat malnutrition, eradicate malnutrition and promote healthy living habits and practices, generating mechanisms of co-responsibility among all levels of government, citizens, the private sector, and actors of the popular and solidarity economy within the framework of food security and sovereignty.
    - Promote national production with social and environmental responsibility, promoting the efficient management of natural resources and the use of durable and environmentally clean technologies, to guarantee the supply of quality goods and services.

While neither the Paris Agreement, nor Ecuador's NDC is specifically discussed in the NDP, two of the nine objectives include policies focused on climate change. Objective 1 (Guarantee a dignified life with equal opportunities for all) includes a policy focus related to promoting comprehensive risk management, including for climate-related risks. In addition, Objective 3 (Protect the rights of nature for current and future generations) includes a policy focus on advancing climate mitigation and adaptation, domestically and globally (GoEc, 2017).

Ecuador's first NDC, which covers the period 2020–2025, contains both mitigation and adaptation components. The mitigation component focuses on emissions reductions in the following sectors: Energy; Agriculture; Industrial processes; Waste; and Land use, land-use change and forestry (LULUCF). For all the aforementioned sectors other than LULUCF, the Government commits unconditionally to a 9 percent reduction in emissions below the business-as-usual (BAU) scenario in 2025, and conditionally to an additional 11.9 percent reduction. For the LULUCF sector, the Government commits unconditionally to a 4 percent reduction in emissions below the BAU scenario in 2025, and conditionally to an additional 16 percent reduction (GoEc, 2019). Table A3.1 highlights actions listed in Ecuador's NDC to which CSA could contribute.

4 Note that 'well-being' is used here as a translation of 'buen vivir', a nuanced concept that is not easily translated into English.

Table A3.1: Climate actions in Ecuador's nationally determined contribution to which climate-smart agriculture could contribute

A distinction is made between unconditional actions and conditional actions, that depend on financing by developed countries.

Sector	Action
Unconditional actions	
Agriculture	▪ develop research and generation of information systems for strengthened management of climate change in the agriculture sector ▪ promote sustainable livestock development at national level
LULUCF	▪ conserve natural resources ▪ strengthen sustainable forest management ▪ strengthen the restoration of natural resources ▪ strengthen and increase the establishment and management of sustainable commercial forestry plantations ▪ strengthen forest controls ▪ strengthen the national system of protected areas
Conditional actions	
Agriculture	▪ develop research and generation of information systems to strengthen the management of climate change in the agriculture sector (additional to unconditional actions) ▪ promote sustainable livestock development at national level (additional to unconditional actions) ▪ develop and implement sustainable agro-productive systems (livestock and forestry agriculture) at national level
Waste	▪ generate public-private partnerships for the reduction of greenhouse gases in waste management (solid and liquid), through the implementation of mitigation measures
LULUCF	▪ strengthen and increase the area under conservation mechanisms ▪ strengthen sustainable forest management ▪ promote actions for the restoration of natural resources ▪ strengthen and increase the establishment and management of sustainable commercial forestry plantations ▪ strengthen forest management ▪ strengthen the prevention of forest fires ▪ strengthen and increase the area in the National System of Protected Areas ▪ conserve important water resource areas

In terms of the adaptation component of the NDC, Ecuador highlights the six priority sectors identified in its 2012 National Climate Change Strategy. One of these sectors is Food sovereignty, agriculture, livestock, aquaculture and fisheries. Ecuador's approach to the adaptation component of its NDC is to develop a National Adaptation Plan that will guide the integration of resilience into "policies, strategies, plans, programmes, projects, processes and

initiatives of social, economic, environmental or other nature", thereby building resilience and adaptive capacity in the six sectors prioritized for adaptation (GoEc, 2019). The Ministry of Agriculture and Livestock is tasked with leading adaptation efforts related to Food sovereignty, agriculture, livestock, aquaculture and fisheries. The following high-level priorities have been identified for adaptation efforts related to this sector:

- design and implementation of public policy to strengthen the climate resilience of agri-food systems;
- promotion of responsible governance on land use and management that ensures sustainable, climate-resilient agricultural production.

The Government notes that these are both unconditional and conditional priorities, i.e. they will be implemented to varying degrees based on the amount, if any, of international assistance provided to support the Government's efforts (GoEc, 2019). The NDC also highlights the interlinkages between adaptation efforts in the six sectors and corresponding SDGs. For the Food sovereignty, agriculture, livestock, aquaculture and fisheries sector, Ecuador sees linkages with SDG 1 (no poverty), SDG 2 (zero hunger), SDG 8 (decent work and economic growth), SDG 10 (reduced inequality), SDG 12 (responsible consumption and production) and 13 (climate action).

Ecuador is in the early stages of advancing climate-smart agriculture, having launched its first official CSA project in mid-2016. The livestock sector is a major source of emissions in the country. It also tends to have relatively low productivity, and experiences high levels of vulnerability to climate variability and change. The GEF-funded project *Climate-Smart Livestock Management, Integrating Reversion of Land Degradation and Reduction of Desertification Risks in Vulnerable Provinces* – hereafter referred to as *Climate-Smart Livestock* (CSL) project – focuses on both mitigation and adaptation in the livestock sector, and pilots approaches in seven provinces to reduce emissions and sequester carbon and build resilience in livestock systems. Given its focus on both climate and agriculture, the project is jointly managed by the Ministries of the Environment and Agriculture, Livestock and Fisheries (FAO, 2017f). The project was designed to advance the agriculture focus of the NDC; its ability to contribute to the 2025 target was analysed by the aforementioned ministries, and as noted above, mitigation in the livestock sector is included in the NDC as an unconditional action. In addition, the project also contributes to SDGs 1, 2, 8, 12, 13 and 15. The idea behind this pilot is eventually to mainstream CSA into national agriculture planning (S. Avalos, personal communication, 2019).[5]

Another project funded by the Government of Italy and implemented by FAO targets the cocoa sector (FAO, 2019e). It supports the adoption of the traditional *Chakra* cocoa-agroforestry system. This system augments carbon stocks in cocoa production (compared with the widespread cocoa monoculture), is more resilient to climate change, and provides additional income sources from (food and non-food) tree products. The integration of cocoa production with natural forest can serve as a mechanism to slow the clearing of forests for agricultural production. The project further seeks to improve the entrepreneurial skills of smallholder cocoa producers, and enhance their economic opportunities in international cocoa trade. It therefore has a wide range of potential touchpoints with the SDGs.

Expanding the evidence base

In terms of expanding the evidence base in the context of Ecuador's efforts to achieve the SDGs and its NDC objectives, the CSL project provides a prime example. The project generates information for the construction of emissions factors related to the livestock sector. The information is being used to construct an update to Ecuador's national GHG inventory; this will mark an improvement on the current inventory, which uses IPCC default values. The updated inventory is expected to be used to create the second NDC (for the post-2025 period) (J. Merino and P. Sangoluisa, personal communication, 2019).

5 Interviewees for the Ecuador case study were: Eddie Pesantez (Undersecretary of Livestock Production, Ministry of Agriculture and Livestock), Stephanie Ávalos (Undersecretary of Climate Change, Ministry of Environment); Pamela Sangoluisa Rodriguez (FAO and Government of Ecuador Ministry of Agriculture and Livestock/Ministry of Environment); and, Juan Merino Suing (FAO and Government of Ecuador Ministry of Agriculture and Livestock/Ministry of Environment).

Data for these emissions factors are generated through sampling of 419 farms in the seven provinces in which the project operates. This sampling has been used to produce a number with a 95 percent confidence rate. The data are validated by a group of technical experts from the Ministries of Environment and Agriculture and Livestock. One interesting finding to emerge from the data collection process is that a large portion of livestock emissions come from feed management. As a result, the project now focuses heavily on management of cattle feeding, and as a direct consequence of this analysis, related measures have been prioritized in the country's first NDC, released earlier this year (J. Merino and P. Sangoluisa, personal communication, 2019).

The CSL project is also expanding the evidence base through bottom-up and top-down approaches to the intervention; the bottom-up portion consists of vulnerability analyses and participatory rural diagnoses, which are carried out with the target producers. Through this process, the livestock owners go through a step-wise approach of systematizing, prioritizing and proposing potential solutions for their particular contexts. The top-down approach involves the collection and analysis, from other contexts, of alternatives that have a technical potential to achieve the productivity, adaptation and mitigation goals of the project.[6] Since this is a pilot project, all the options generated, as well as their related analyses, will support the eventual expansion of CSA to other parts of the country.

Strengthening national and local institutions

The process to develop and implement the NDP, which provides the basis for Ecuador's SDG priorities, is guided by the National Planning Council, chaired by the President, and comprises representatives of the national government, subnational authorities and a technical secretariat (GoEc, 2017). In terms of implementation of the NDP and SDGs, the secretariat is charged with coordinating a number of sectoral committees, headed by Ministers and convened by the President's office, which meet monthly in order to report on progress that their respective ministries are making in achieving the SDGs (S. Avalos, personal communication, 2019).

Partly because Ecuador is a highly decentralized republic, the national government focuses heavily on engaging subnational authorities in development plans and policies of national importance. In its 2018 VNR, the Government highlights the various entities that are explicitly engaged in the SDG agenda. These include:

- Civil society: Several initiatives that have become part of the SDG agenda were identified through civil society consultations, including ones focused on livelihood recovery in the regions most affected by the 2016 earthquake.
- Subnational jurisdictions, all of which align their Territorial Development Plans with the SDGs.
- Private sector: Through a consultation process, the private sector has been engaged in a number of initiatives, including ones focused on sustainable productivity and on eliminating child labour.
- Universities: Several universities and research institutions around the country are engaging in efforts to produce knowledge and train practitioners to further the SDG agenda.
- International entities and NGOs: These organizations provide technical, political and, in some instances, financial support for implementation of the SDG agenda.

Specific to climate change, the Inter-institutional Committee on Climate Change (ICCC) was created by executive decree in 2010. The committee is political in nature, and was created to direct the country's engagement on climate change at national level, and in accordance with international frameworks (GoEc, 2019). The committee comprises high-level representatives from national government institutions responsible for the environment, foreign relations, agriculture and livestock, electricity and renewable energy, industry, water, and risk management. In addition, the committee reserves non-voting seats for two subnational representatives from the Association of Municipalities and the Consortium of Provincial Governments (GoEc, 2019). The logic behind the inclusion of subnational

6 Subsequent steps are further described in PART 4 in the section: Implementing practices in the field.

representatives in this planning and decision-making body is that decisions taken at national level are implemented at subnational level, and should be feasible for subnational implementation (S. Avalos, personal communication, 2019). In addition to this national structure, the committee also has a subnational committee that informs the ICCC about priorities and needs at subnational levels, thereby influencing the committee's planning process (S. Avalos, personal communication, 2019).

Enhancing financing options

As regards budgeting for and financing climate-smart agriculture (as well as national SDG priorities and the NDC, for that matter), Ecuador is looking to develop a coherent approach through a single Sustainable Financing Strategy. This would serve as the sole entry point for funding programmes and projects related to achieving the SDGs and NDC. Climate change will be a focus area within this strategy, and sources suggest that CSA would be fundable through the climate focus area (S. Avalos, personal communication, 2019).

Ecuador is looking for opportunities to scale-up finance for CSA. One approach that the country is pursuing is to create a green credit line. Ecuador's state bank, BanEcuador, has an agreement in place with FAO, which is providing implementation support on the project, to evaluate a green credit line as an incentive for climate-smart livestock (CSL) (J. Merino and P. Sangoluisa, personal communication, 2019). The idea behind such a credit line is to be able to provide qualifying producers with expedited payments and lower interest rates (E. Pesantez, personal communication, 2019). One barrier in rolling out this type of credit is absence of tools that could easily be used by the banking system to monitor and evaluate the positive environmental impact of CSL. As a result, the CSL project is developing a tool that will serve to evaluate the potential mitigation impact of the practices for which the green credit line is being developed. The Ministries of Agriculture and Environment, along with BanEcuador, hope eventually to make the green credit line available nationally, thereby supporting positive social, environmental and climate outcomes associated with the livestock sector (J. Merino and P. Sangoluisa, personal communication, 2019).

Ecuador is also making efforts to advance CSA by accessing innovative financing sources in the form of multilateral climate finance. The CSL project is financed through the Global Environment Facility (S. Avalos, personal communication, 2019). In addition, one project activity has been the generation of a Nationally Appropriate Mitigation Action (NAMA) proposal, which the Government intends to use soon in order to access multilateral support. The proposed project would focus on demonstrating the mitigation potential and co-benefits that could be obtained if additional financing was provided (J. Merino and P. Sangoluisa, personal communication, 2019).

When it comes to financing agricultural development projects (not specifically related to CSA), government officials state that the financial needs of subnational jurisdictions are taken into account as much as possible in national financial planning processes, including in order to link subnational jurisdictions' efforts with multilateral, bilateral and private sector finance. As such, some funding flows from national to subnational jurisdictions, but subnational jurisdictions often provide a portion of project finance themselves (S. Avalos, personal communication, 2019).

Implementing practices in the field

Since Ecuador is in the early stages of engaging on climate-smart agriculture, the CSL project is a learning experience implementing CSA practices in the field. The project uses the range of options amassed through the top-down and bottom-up approaches described in Section 4.1 'Expand the evidence base' to develop specific interventions that are tailored to the local context. These intervention plans are developed through collaboration between the two lead ministries on the project, with strong involvement of local partners to support the field implementation process. Producers are also directly involved in the process of developing implementation plans. In each of the seven target communities, they were consulted on each CSA action, which enabled a customization process to be set up for each particular community. For example, in Imbabura, one of the target provinces, 10 consultative workshops

were held, attended by nearly 330 producers. Through this process, the key issues were identified (low productivity, poor use of pastures, lack of irrigation and poor milking conditions). The producers then brainstormed potential solutions such as use of energy banks, implementation of electric fencing, and capacity-building related to milking hygiene (J. Merino and P. Sangoluisa, personal communication, 2019).

Monitoring, evaluation and reporting

As noted above, the National Development Plan is the vehicle through which the SDGs are mainstreamed, implemented and monitored. The National Secretariat of Planning and Development is the entity with responsibility for coordinating monitoring and evaluation of the National Development Plan, and as such, has responsibility for the monitoring and evaluation of SDGs (GoEc, 2018). While not explicitly encompassing the NDC, nor the monitoring and evaluation of the NDC, one source notes that, because the National Development Plan includes a climate focus, some degree of climate M&E occurs through monitoring and evaluation of the plan (S. Avalos, personal communication, 2019). Data for monitoring and evaluation of the National Development Plan are managed by the National Institute of Statistics and Census (GoEc, 2018).

Sources note that, while there is currently not an alignment between the indicators used for the CSL project and those used for the SDGs and NDC, the Ministry of Environment is building a coherent measurement, reporting and verification (MRV) system for climate-related projects. This system is being developed as part of the CSL project, and the MRV system will be aligned with the domestic monitoring and evaluation system related to the National Development Plan. This is expected to enable better data interoperability and cost-effectiveness when it comes to collection and analysis of data. For now, monitoring of the CSL project follows an approach whereby the project leadership meet on a monthly basis with implementation teams in each of the seven provinces, and review the activities planned against those implemented in the given month. The status of each activity is then recorded on a percentage complete basis (J. Merino and P. Sangoluisa, personal communication, 2019).

Conclusion

It is clear that Ecuador is taking steps to advance climate-smart agriculture. While the country's experience with CSA is still limited, the approach has already been included as a vehicle for meeting NDC targets. It does not appear that CSA is, as yet, being used to achieve specific SDG targets. That said, the fact that there is substantial alignment between the SDG and climate agendas through the National Development Plan means that the CSL project will also positively affect SDG targets. Since Ecuador is beginning its experience with CSA by piloting a project, as the experience grows, the national government may want to mainstream CSA as part of agricultural, climate, SDG and development planning. Initial steps might include: undertaking a comprehensive vulnerability assessment of the sector, cataloguing appropriate options, ensuring that existing policies and plans allow for the advancement of CSA, and allowing for CSA to be further integrated into the SDG- and NDC-related efforts. The country is already exploring innovative options for financing CSA, and may want to further develop these by integrating climate risk consideration across budgeting processes, for example in agricultural sector budgeting. In terms of monitoring and evaluation, sources confirm that indicators associated with the CSL project are not directly aligned with SDG or NDC indicators; this type of alignment, in the future, would also support further integration of climate-smart agriculture with SDG- and NDC-related efforts.

A3.3 Ethiopia case study

Overview of CSA, SDG and NDC implementation in Ethiopia

The Growth and Transformation Plan is Ethiopia's national development plan, and serves as the blueprint for the country's economic growth and development process. Running in five-year cycles, Ethiopia is currently implementing its Second Growth and Development Plan (GTP II) for the 2015/16–2019/20 period. The primary focus of GTP II is the achievement of Ethiopia's vision to become a lower middle-income country by 2025. The process to create GTP II concluded in early 2016, and the plan explicitly takes the SDGs into account (T. Bemnet, personal communication, 2019).[7] Given that agriculture continues to be the mainstay of the Ethiopian economy, agricultural development and productivity feature prominently in the GTP II. The plan includes targets related to: subsistence and specialty, such as coffee and horticultural crops; livestock productivity; natural resource conservation and utilization; agricultural research; biodiversity conservation and benefit-sharing; and disaster-resilient food security (GoEt, 2016).

Integrated into the GTP II is the Climate Resilient Green Economy Strategy (CRGE), the country's roadmap for addressing climate mitigation and adaptation objectives (GoEt, 2015a). The CRGE was created in 2011, and also contributes to the national vision of achieving lower middle-income status by 2025, while recognizing that following the conventional development path would lead to a dramatic increase in GHG emissions and unsustainable use of natural resources (GoEt, 2011). The CRGE sets out to limit the country's 2030 GHG emissions to around 150 megatonnes carbon dioxide equivalents ($MtCO_2eq$) – about 250 $MtCO_2eq$ less than in a business-as-usual scenario – through four primary approaches:

1) improving crop and livestock production practices for higher food security and farmer income while reducing emissions;
2) protecting and re-establishing forests for their economic and ecosystem services, including as carbon stocks;
3) expanding electricity generation from renewable sources of energy for domestic and regional markets;
4) leapfrogging to modern and energy-efficient technologies in transport, industrial sectors and buildings.

Ethiopia's NDC is based on the CRGE and commits to limiting greenhouse gas emissions in 2030 to 145 $MtCO_2eq$ or lower, a 64 percent reduction from the BAU scenario in 2030, and based on the same four mitigation approaches described above (GoEt, 2015a). In its NDC, the country also highlights several climate resilience priorities. Many of these are related to agriculture (T. Bemnet, personal communication, 2019), including:

- making available improved varieties of crops that were previously grown but have become unsuitable;
- improving economic opportunities from agroforestry and sustainable afforestation;
- enhancing irrigation systems through rainwater harvesting and conservation of water;
- enhancing ecosystem health through ecological farming, sustainable land management practices and improved livestock production practices;
- developing climate risk insurance systems to support farmers and pastoralists;
- reducing the incidence and impact of fire and pest epidemics;
- strengthening and increasing the capacity for breeding and distributing disease resistant crop and fodder varieties to farmers and other land users in order to deal with the emergence and expansion of diseases and pests.

7 Interviewees for the Ethiopia case study were: Bemnet Teshome (Technial Officer, Ministry of Environment, Forest and Climate Change), Berhanu Assefa (Ministry of Agriculture), Solomon Tesfasilassie Tegegne (Director, Monitoring Directorate, National Planning Commission).

It is clear from the above discussion that Ethiopia strongly prioritizes agricultural productivity, as well as climate mitigation and adaptation in the agriculture sector. As such, the country is perfectly poised to advance these objectives simultaneously through climate-smart agriculture, and has begun to do precisely that. The International Center for Tropical Agriculture and the Bureau for Food Security, United States Agency for International Development (CIAT and BFS/USAID, 2017) provide a thorough overview of CSA in Ethiopia, highlighting the many CSA practices currently being implemented as a result of various interventions, such as precise fertilization application, use of climate-resilient crop varieties, use of weather information, improved livestock feeding systems and agroforestry. In addition, a number of policies are actively advancing CSA in the country. In addition to the GTP II, CRGE and NDC, these include the 2011 Agricultural Growth Programme, the 2015 Ethiopian Livestock Breeding Policy, and the 2009 Comprehensive Africa Agriculture Development Programme, to name a few. In fact, policies dating back to the 1997 Environmental Policy of Ethiopia have been advancing CSA in the country (CIAT and BFS/USAID, 2017). It should be noted, however, that the various policies advancing CSA focus on the intersections of productivity and climate adaptation, while less attention has been paid historically to climate mitigation in the agriculture sector (CIAT and BFS/USAID, 2017). While this is not unexpected, given Ethiopia's necessary focus on poverty reduction, achievement of the CRGE and NDC goals will require additional focus on mitigation in agriculture.

Expanding the evidence base

Ethiopia has undertaken many of the steps recommended by FAO as part of the process to expand the evidence base for climate-smart agriculture. Since CSA is already considered an integral aspect of achieving the SDG and NDC agendas, it can be assumed that these efforts to expand the evidence base would allow for deeper integration of CSA with efforts to achieve the SDGs and NDC objectives (and national development goals).

As part of the CRGE, in 2015 Ethiopia finalized a Climate Resilience Strategy for agriculture (GoEt, 2015b). This included an agriculture sector vulnerability assessment consisting of two steps: examination of the historic economic impacts of extreme weather, which provided an overall sense of the scale of the issue and solidified the case for action; and mapping of the livelihood systems and related climate stress exposure of various types of food producers across the country. This latter step enabled the design of risk profiles for each of the 14 Adaptation Planning Zones (based on biophysical conditions) that the country created for the resilience strategy (GoEt, 2015b).

This vulnerability assessment was the precursor for another key aspect of the agriculture sector resilience strategy: identification and evaluation of adaptation options. The Government first reviewed a series of plans and good practices, and identified around 350 unique, potential adaptation options. These options were then prioritized based on four criteria: relevance and feasibility in the local context; ability to contribute to the Growth and Transformation Plan targets; ability to alleviate poverty, address distributional and equity issues and ensure food security; and, ability to reduce costs associated with current and future climate variability and change. This screening process resulted in a shortlist of 41 promising programmatic options, all of which, according to the Government's analysis, are relevant to most Adaptation Planning Zones and regions. However, the resilience strategy notes that the relative priority of an option or the most appropriate sub-option will differ based on local factors. These 41 options relate to both the enabling environment and production practices, such as crop and water management, information and awareness, capacity-building and institutional coordination, social protection and livestock production (GoEt, 2015b).

Since the prioritization process was based largely on expert judgment, the next step by the Government was to run each option through a rigorous multi-attribute analysis (MAA) process and conduct a costing exercise. As part of the MAA, each option was scored in relation to: economic cost and benefit, climate resilience and robustness, synergies and co-benefits, urgency, distributional effects, and gender and institutional feasibility and phasing. This analysis led to the final step of developing an implementation plan for prioritized actions (GoEt, 2015b).

Also contributing to the CSA evidence base was the technical analysis of emissions undertaken for preparation of the CRGE. Sub-Technical Committees (STCs) – interministerial working groups – were tasked with producing emissions inventories for a number of sectors that were both economically important and had high emissions associated with them. This included the following agriculture sub-sectors: soil, livestock and forestry. The STCs:

1) developed a BAU projection to 2030 of both economic growth and related emissions for each focus sector;
2) identified and analysed potential levers or initiatives that would contribute to growth and development while lowering emissions in relation to the BAU scenario;
3) evaluated and then prioritized the initiatives identified based on abatement costs, feasibility, finance and implementation requirements; and
4) documented and summarized the findings for the CRGE strategy.

Policy/planning

As described above, the Growth and Transformation Plan is the overarching policy and planning process for development in the country, and encompasses both the CRGE (which is the basis for the NDC) and the SDGs. As such, through the GTP, there is integration of the SDG and NDC agendas. In addition, because agriculture is such an important sector in the economy, efforts to increase resilience and/or reduce emissions in the sector while increasing productivity and incomes have long been mainstays of national development goals.

In terms of the CSA policy and planning landscape, CIAT and BFS/USAID (2017) note that Ethiopia "has shown progress in bringing CSA on the policy arena and closer within farmers' reach, through investments in research, capacity building of extension workers and field demonstrations. As such efforts continue to grow in number and scope, coordination of interventions and alignment with existing policies will be key for effective resource spending and value addition." This said, Ethiopia does have mechanisms in place to coordinate planning processes. For example, the National Planning Commission, mandated to lead the planning process for the country (GoEt, 2016), ensures the mainstreaming of key national goals in sectoral planning processes by providing a checklist to line ministries, so as to facilitate the process of integrating climate and sustainability in their plans (B. Assefa, personal communication, 2019).

Strengthening national and local institutions

Ethiopia has a structure in place to enable a whole-of-government approach to development through the GTP planning and implementation process, coordinated by the National Planning Commission.

The CRGE strategy is coordinated by an Inter-Ministerial Steering Committee (ISC), which answers to the Prime Minister's office and is mandated to oversee implementation of the CRGE. All ministers of sectoral institutions are members of this steering committee. Under the ISC, there is a management committee co-chaired by the Ministry of Environment, Forests and Climate Change and the Ministry of Finance, and also comprising sectoral representatives. In addition, Ethiopia has created an Advisory Board consisting of multilateral organizations, international NGOs, civil society, the private sector and academia. This Advisory Board reviews sectoral action plans and provides comments to the management structure described above.

The aforementioned structure was established immediately after the launch of the CRGE in 2011, but has more recently been refined. It was observed that many decisions were made by the ISC, but were not fully implemented, mainly because subnational representatives were not present at or part of the committee, i.e. the committee only comprised federal-level ministers (T. Bemnet, personal communication, 2019). Since Ethiopia is a federation of regional states, these are directly involved in implementing the CRGE Strategy. In fact, the strategy states that regional states, in collaboration with relevant federal institutions, have responsibility for implementing the majority of the CRGE strategy initiatives, and that coordination between regional and federal levels is the responsibility of the respective environmental agencies of the national regional states (GoEt, 2011). In order to remedy the implementation gap, Ethiopia changed the structure of the meetings of the ISC to also include regional presidents and the heads of regional environmental agencies, so that awareness and buy-in from the subnational level is increased (T. Bemnet, personal communication, 2019). In addition, the implementation responsibility of regional states is directly supported by the federal level, through capacity-building programmes and tools for mainstreaming CRGE priorities in subnational planning processes (T. Bemnet, personal communication, 2019).

Enhancing financing options

To address financing implementation of the GTP II, including the SDGs and related CSA measures, the Government recently commissioned studies to better understand its financial needs and opportunities (S. Tesfasilassie Tegnene, personal communication, 2019). The Government is also exploring opportunities for financing through improved

national capacity to mobilize and utilize domestic resources. The Government notes that tax revenue, which would be a main source of financing for the GTP, has increased over the past decade, but that revenue collection levels remain low in comparison with the revenue-generating potential of the economy, as well as with the anticipated resource demand associated with implementation of national goals (GoEt, 2017). As a result, Ethiopia is focusing heavily, as part of GTP II, on increasing domestic resource mobilization by widening the tax base, enforcing tax laws, and strengthening institutional capacity for revenue and customs. The Government has set a stretch goal of increasing tax revenue from 12.7 percent of GDP in 2014/15 to 17.2 percent of GDP in 2019/20 (GoEt, 2017).

In terms of financing the CRGE (and thus the NDC and related CSA measures), the Government notes in its NDC that the country requires predictable, sustainable and reliable support in the form of finance, capacity-building and technology transfer. The Government estimates that in order to fully implement the CRGE strategy it will require USD 150 billion by 2030, in the form of government expenditure and finance from other sources, including the private sector and development partners. For a clearer understanding of financing needs, the NDC highlights that additional research is needed related to: quantifying and assigning the emissions reduction commitments that the Government will support by itself; quantifying and emissions reduction commitments for which the Government would require international support; and identifying technical support needed to introduce new or additional policies for stimulating investment to meet the CRGE/NDC targets (GoEt, 2015).

Despite this ongoing analysis, the CRGE strategy shows the Government's efforts to attract private investment in order to meet targets (GoEt, 2011). The strategy highlights the fact that the Government has already made efforts to create investment-ready mitigation opportunities through the following projects with potential returns:

- credits associated with reduced emissions from the livestock sector;
- credits associated with REDD-like (afforestation and reforestation) projects;
- financing for electric power generation infrastructure;
- rural energy efficient stoves.

In terms of the institutional infrastructure for implementing CRGE projects, one source highlights that the Government created a multi-donor trust fund, the CRGE Facility, to pool all monies – domestic, private, bilateral and multilateral, but with a particular focus on attracting bilateral support – to implement the various priorities; any finance specifically allocated to CSA is tracked by the CRGE Facility (B. Assefa, personal communication, 2019). The Government notes that the idea behind establishing the facility is to move away from project-based finance in order to ensure that funding is pooled and deployed strategically and coherently (GoEt, 2015b). When establishing the facility, the Government identified more than 30 sources of international public finance that could potentially be accessed, and categorized these based on sectoral and geographical focus; the types of financing instruments provided, such as grants, loans, etc.; whether Ethiopia has previously received support from the source; and, if yes, the amount of unused finance from the particular source (GoEt, 2015b).

Monitoring, evaluation and reporting

Monitoring and evaluation of CSA activities that support GTP II objectives are captured in the M&E system for the GTP II. In its 2017 Voluntary National Review, the Government states that all levels of government administration engage in monitoring of implementation of the SDGs and their targets, as part of the GTP II monitoring process. The M&E process is sector-specific. The National Planning Commission issues directives each fiscal year to the entities with a mandate for implementation of a given GTP II objective (and associated SDGs) to submit performance reports. These institutions submit their reports to the National Planning Commission, which then systematically analyses them. When data associated with a given report are incomplete or inconsistent, the commission works with the relevant sector entity to correct them. The commission then prepares a comprehensive national performance review report, which is submitted to the Prime Minister's office, and is also presented to

the legislature for review and action (GoEt, 2017). In an effort to conserve resources and capacity, one source notes that monitoring and evaluation, and reporting specifically on CSA does not occur separately from the aforementioned GTP II M&E process. Rather, the Government has designed the GTP II M&E and reporting system to be sufficiently comprehensive to provide an overarching picture of progress and challenges, but with a more detailed and disaggregated view of the sectors from the constituent sectoral reports (S. Tesfasilassie Tegnene, personal communication, 2019).

In terms of monitoring and evaluation and reporting on the CRGE strategy (including related CSA measures), the structure described under the institutional arrangements section above is also used in this regard. The Environmental Protection Authority has a team of sectoral experts who monitor projects and provide the public with access to information about these and their outcomes (GoEt, 2011).

Conclusion

From the above discussion, it is evident that Ethiopia has taken meaningful steps to implement its SDG and NDC priorities in an integrated manner. Since agriculture continues to be the main driver of the economy and people's livelihoods, agriculture – and climate-smart practices in particular – feature prominently in Ethiopia's efforts to implement the country's SDG and NDC goals. It is also clear that Ethiopia has taken steps to build the evidence base for CSA, largely through its CRGE planning process, and that the country has a robust policy and institutional framework in place for implementing both the GTP II and CRGE. What may require additional effort is achieving coherence and integration between the many other agriculture-related policies in existence. In addition, while information is not readily available to make a full assessment, the Government may want to take steps to better mainstream climate-smart agriculture in budgeting processes.

Notes

Climate-smart agriculture and the Sustainable Development Goals

Mapping interlinkages, synergies and trade-offs and guidelines for integrated implementation

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