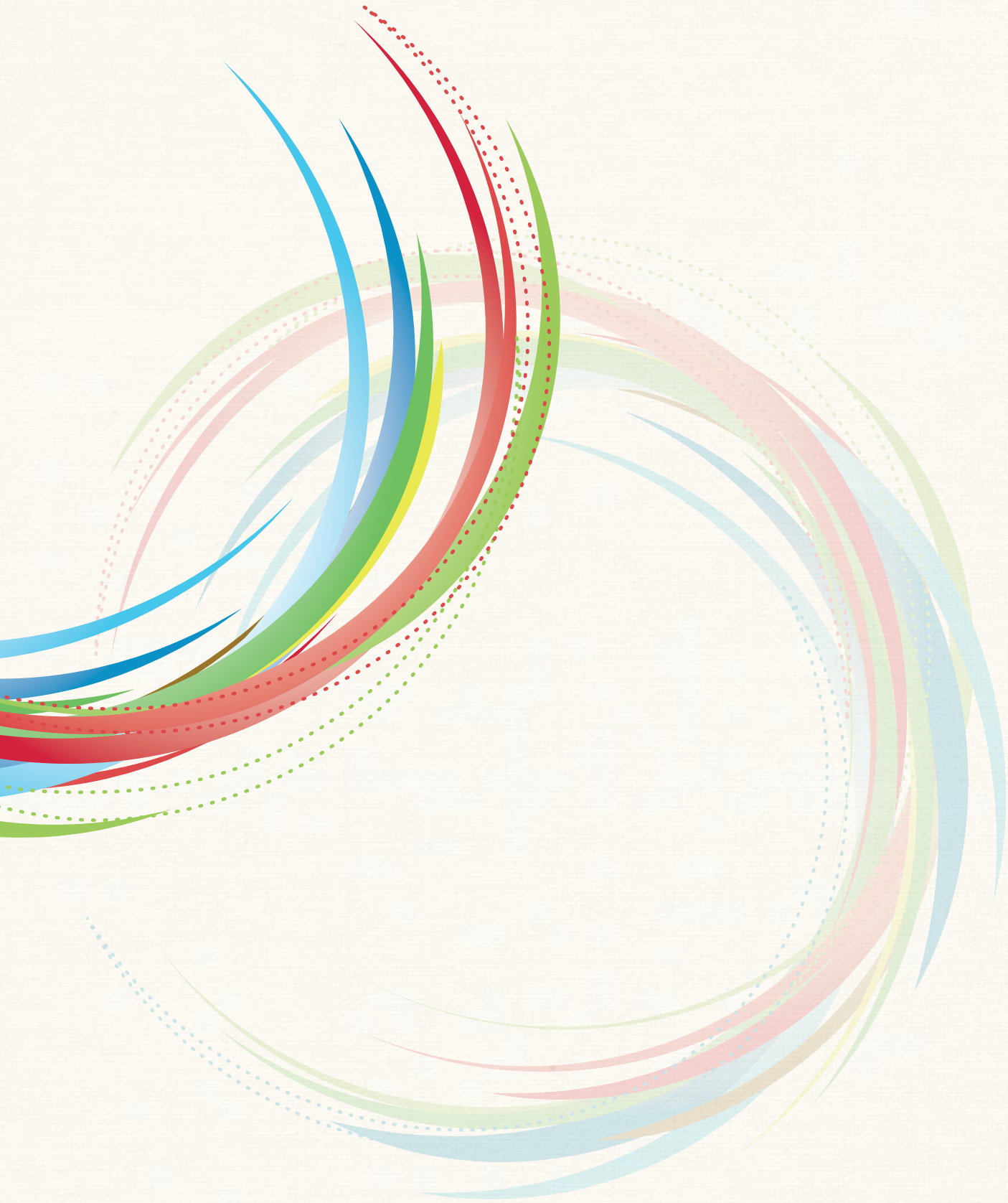
Food and Agriculture Organization of the United Nations

Climate-smart agriculture

case studies 2021

Projects from around the world



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Contents

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Acronyms

AFOLU	Agriculture, Forestry and Other Land Use [sector]
AMMAR	Agriculture Modernization, Market Access and Resilience [project] (IFAD)
CA	conservation agriculture
CARDI	Caribbean Agricultural Research and Development Institute
CARICOM	Caribbean Community
CBIT	Capacity Building Initiative for Transparency
CCAFS	Research Program on Climate Change, Agriculture and Food Security (CGIAR)
CGIAR	Consortium of International Agricultural Research Centres
CIAT	Alliance of Bioversity International and the International Center for Tropical Agriculture
CNR	National Research Council of Italy
COSOP	Country strategic opportunities programme (IFAD)
CPF	country Programming Framework (FAO)
CSA	climate-smart agriculture
CSAIP	Climate-Smart Agriculture Investment Plan
DANIDA	Danish International Development Agency
ESG	Earth Security Group
ETF	Enhanced Transparency Framework
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field School
GALS	Gender Action Learning System GAP Good agricultural practice
GCF	Green Climate Fund
GDP	gross domestic product
GEF	Global Environment Facility
GHG	greenhouse gas
GIZ	German Agency for International Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit)
HLPE	High Level Panel of Experts on Food Security and Nutrition
IBE	Institute for BioEconomy (CNR)
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT	information and communications technology
IFAD	International Fund for Agricultural Development
INDC	intended nationally determined contributions
IPCC	Intergovernmental Panel on Climate Change
IRECRP	Inclusive Rural Economic and Climate Resilience Programme (IFAD)
M&E	monitoring and evaluation

IMET	Italian Ministry of Ecological Transition
NAMA	Nationally Appropriate Mitigation Action
NAP	National Adaptation Plan
NAPA	National Adaptation Programme of Action
NAIP	National Agriculture Investment Plan
NDC	nationally determined contributions
NGO	non-governmental organization
ODA	official development assistance
OECS	Organisation of Eastern Caribbean States
OG	Operational Group
RCP	Representative Concentration Pathway
RDP	Rural Development Programme
REDD+	countries' efforts to reduce emissions from deforestation and forest degradation, and foster conservation, promote sustainable management of forests and enhance forest carbon stocks
SAIL	Sustainable Agriculture Investments and Livelihoods [project] (IFAD)
SDG	Sustainable Development Goal
SFM	Sustainable forest management
SIDS	Small Island Developing States
SIRP	sustainable intensification of rice production
SLM	sustainable land management
SME	small and medium enterprise
SRLI	Sustainable Rice Landscapes Initiative
SRP	Sustainable Rice Platform
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
WaPOR	Water Productivity Open-access Portal (FAO)
WBCSD	World Business Council for Sustainable Development

Executive summary

Addressing climate change and transforming agri-food systems are key to meeting the Sustainable Development Goals (SDGs). With nearly 690 million people around the world facing hunger today (FAO *et al.*, 2020), agri-food systems emitting one third of global anthropogenic GHG emissions (Crippa *et al.*, 2021) and a growing public demand for climate action, it is pressing to achieve food security while adapting to - and mitigating - climate change. Climate-smart agriculture (CSA) has grown from a concept into an approach implemented throughout the world, by all types of stakeholders. This publication describes climate-smart agriculture case studies that apply the five action points for CSA implementation. The action points are: 1) expanding the evidence base for CSA, 2) supporting enabling policy frameworks, 3) strengthening national and local institutions, 4) enhancing funding and financing options, and 5) implementing CSA practices at field level.

The five action points were created by the Food and Agriculture Organization of the United Nations (FAO) as a methodology for implementing the climate-smart-agriculture approach at a national scale. These action points provide the structure for this publication.

The case studies discuss context-specific activities that contribute to CSA's three pillars: sustainably increasing agricultural productivity and incomes, adapting and building resilience of people and agri-food systems to climate change, and reducing and/or removing greenhouse gas emissions where possible. Many of the case studies pay special attention to smallholder farmers, including women and indigenous groups, who are particularly affected by the impacts of climate change.

A diverse group of stakeholders contributed case studies, reflecting the importance of coordinating national-level CSA activities, for example by including research findings in policymaking processes, and leveraging public sector funding to attract private sector investment. The publication provides examples of the innovative roles that farmers, researchers, government officials, private sector and civil society actors can play to transform agri-food systems and help meet the SDGs; it also demonstrates how these actors can collaborate.

Key messages:

- Results under the **three pillars of CSA** are best achieved through a comprehensive strategy, such as the five action points approach highlighted in this publication.
- The **five action points of the CSA approach** are all crucial to effectively implement CSA; they have been applied in various contexts to achieve results under the three CSA pillars.
- Not all projects need to focus on all five action points. In addition, the action points are not necessarily consecutive actions, but rather actions that may or may not be undertaken at the same time; ideally, they reinforce each other to **create an enabling environment**. For example, a robust evidence base should support enabling policy frameworks, national and local institutions, funding and financing options, and the implementation of CSA practices at field level. Each of these actions may in turn generate valuable knowledge that feeds back into the evidence base.
- **Knowledge sharing** and working with diverse partners is essential for all five action points, as the sum of the knowledge and practices of various partners is larger than its parts.
- Regarding action point 1, **building the evidence base for CSA**, the case studies confirm that the linkages between agriculture and climate change are site-specific. Analysis based on site-specific findings may therefore lead to the selection of different climate-smart agricultural practices for different sites.
- On action point 2, **supporting enabling policy frameworks**, the case studies show that governments are already working to operationalize their approach to agriculture under climate change, working with partners at the regional, national and provincial levels.

- Action point 3, **strengthening national and local institutions**, is shown to require a capacity building approach which entails a range of activities, including the drafting of guidelines, the dissemination of best practices, and training.
- The case studies related to action point 4, **enhancing options for financing and funding**, expand the scope of this action point and emphasize the need for access to climate finance instruments, creating links between climate and agricultural finance and investments, and considering climate change in agricultural planning and budgeting. Innovative finance mechanisms are proposed, such as to help farmers invest in CSA practices and unlock the potential of large-scale public-private partnerships to attract resources.
- Finally, the case studies on **implementing practices at field level**, or action point 5, highlight the importance of gaining a good understanding of the diverse needs and priorities of farmers and working directly with them. The case studies demonstrate that CSA must be considered as encompassing a broad range of practices. The studies illustrate how tools such as Farmer Field Schools, demonstration plots and information and communications technology may prove valuable in a range of settings.

Introduction

Nearly 690 million people around the world are hungry today (FAO *et al.*, 2020). At the same time, more and more people around the planet, including youth, are pushing for action on climate change. Thus, the question of how to achieve food security while also adapting to climate change and reducing greenhouse gas (GHG) emissions becomes ever more relevant. Agriculture contributes a significant part of gross domestic product (GDP) in many economies; 2.5 billion people worldwide depend on agriculture for their livelihoods (FAO, 2016). Agri-food systems are believed to be responsible for one third of global anthropogenic GHG emissions (Crippa *et al.*, 2021). At the same time, the sector offers significant potential to contribute to global climate goals (FAO, 2019a). Therefore, transforming agri-food systems (including crops, livestock, fisheries, aquaculture, agroforestry and forestry) is pressing. This transformation should be achieved through integrated, multisectoral approaches that are gender-transformative, inclusive and pro-poor, and harness synergies such as those between climate change adaptation and mitigation. Agri-food systems must increase production in a sustainable manner in order to meet the Sustainable Development Goals (FAO, 2019a).

Against this background, climate-smart agriculture (CSA) is an innovative approach based on the following three pillars:

- sustainably increase agricultural productivity and incomes;
- adapt and build resilience of people and agri-food systems to climate change; and
- reduce or, where possible, avoid GHG emissions.

CSA interventions have been implemented successfully around the world. This success is underpinned by the five action points of CSA implementation, as formulated by FAO (FAO, 2021a):[1]

1. Expand the evidence base to identify:

- the effects of climate change on food production and on agri-food systems as a whole;
- vulnerabilities in the agriculture sector that affect food security;
- institutional and financial barriers and possibilities; and
- climate-smart adaptation and mitigation options.

2. Supporting enabling policy frameworks by, for example:

- developing relevant policies, legislation, plans and investments to support an enabling environment for CSA;
- modifying existing policies where needed; and
- coordinating policymaking processes to enable effective collaboration between institutions responsible for agriculture, climate change, food security and land use.

3. Strengthen national and local institutions by, for example:

- supporting institutions so that they can empower, enable and motivate farmers; and
- building capacities of national policymakers so that they can effectively participate in international policy fora on climate change and agriculture, and engage with local public authorities.

4. Enhance funding and financing options by, for example:

- accessing funding instruments such as the Green Climate Fund (GCF), the Global Environment Facility (GEF), official development assistance (ODA) and national sectoral budgets; and
- creating innovative links between climate finance and public and private agricultural investment; and
- integrating climate change in agricultural planning and budgeting.

5. Implement practices at field level:

- selecting locally suitable CSA options by engaging local farmers' knowledge, requirements and priorities.

[1] This table is based on information available on FAO's website at www.fao.org/climate-smart-agriculture/overview and on FAO's *Climate Smart Agriculture Sourcebook*, available at www.fao.org/climate-smart-agriculture-sourcebook/concept/module-a1-introducing-csa/chapter-a1-2 (module A1). The introductions to the chapters in this publication provide additional elements related to each action point.

In order to track progress towards results under the three pillars of CSA, it is important that monitoring and evaluation practices are streamlined across these five action points.

This publication aims to contribute to the Decade of Action to deliver the Global Goals that was declared by the United Nations Secretary General in 2020 to meet the SDGs by 2030. The publication presents examples of climate-smart agricultural research, policies, institutions, financial instruments and practices around the world. These case studies are grouped into chapters according to the five action points of CSA, to reflect the breadth of CSA implementation.

The aims of this publication are to demonstrate the relevance of all five action points of CSA implementation, inspire stakeholders to implement CSA actions in response to climate change, show how recent CSA projects are contributing to the SDGs, and formulate recommendations for future projects based on the five action points approach.

The case studies show how CSA enables food producers around the world to develop agricultural strategies to build sustainable livelihoods and ensure sustainable food security in the face of climate change. CSA allows stakeholders at local, national and international levels to identify agricultural strategies that are suitable to local conditions. CSA contributes to FAO's goal of making agriculture, forestry and fisheries more productive and sustainable, and thus fits in with FAO's vision for sustainable food and agriculture. Lessons learned from the case studies discussed in this publication include:

- The linkages between agriculture and climate change are site-specific. Analysis based on site-specific findings may therefore lead to the selection of different climate-smart agricultural practices for different sites.
- Results under the three pillars of CSA are best achieved through a comprehensive strategy, such as the five action points approach highlighted in this publication.
- The five action points of the CSA approach are all crucial to effectively implement CSA; they have been applied in various contexts to achieve results under the three CSA pillars.
- Not all projects need to focus on all five action points. In addition, the action points are not necessarily consecutive actions, but rather actions that may or may not be undertaken at the same time; ideally, they reinforce each other to create an enabling environment. For example, a robust evidence base should support enabling policy frameworks, national and local institutions, funding and financing options, and the implementation of CSA practices at field level. Each of these actions may in turn generate valuable knowledge that feeds back into the evidence base.
- Knowledge sharing and working with diverse partners is essential for all five action points, as the sum of the knowledge and practices of various partners is larger than its parts.

By providing examples of the operationalization of the five action points approach, the case studies may inspire international organizations, governments, researchers, private sector actors, non-governmental organizations (NGOs) and farmers to play an active role in CSA implementation and frame their actions in a wider process, which may lead to the identification of possible partnerships.

This publication contributes to and builds on FAO's ongoing efforts to broaden the knowledge base on CSA. After the FAO publications Climate-smart agriculture case studies. 2018. Successful approaches from different regions (FAO, 2018a), Climate-smart agriculture and the SDGs (FAO, 2019b) and Operational guidelines for the design, implementation and harmonization of monitoring and evaluation systems for climate-smart agriculture (FAO, 2019c), this publication highlights how recent CSA interventions apply the five action points of CSA and contribute towards the SDGs. This publication draws on FAO's Climate Smart Agriculture Sourcebook (FAO, 2021a) as the reference point for the descriptions of the action points.

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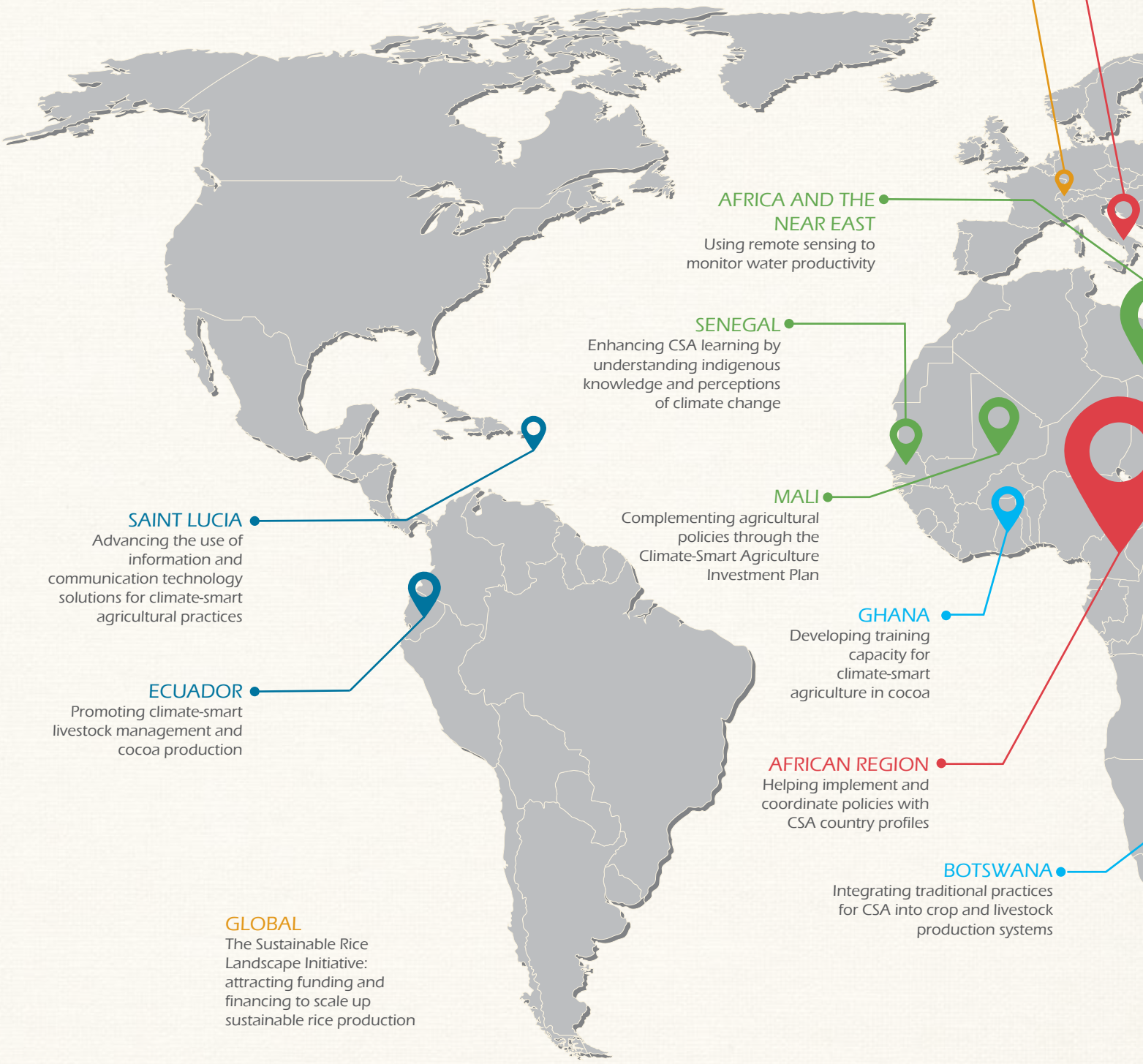
A regional overview of the CSA case studies



ITALY
Working with stakeholders in European Innovation Partnership Operational Groups to create climate-smart innovations in Emilia-Romagna

SWITZERLAND
Piloting a goal-oriented farmer payment system for climate-smart milk production

AFRICA AND THE NEAR EAST
Using remote sensing to monitor water productivity

SENEGAL
Enhancing CSA learning by understanding indigenous knowledge and perceptions of climate change

MALI
Complementing agricultural policies through the Climate-Smart Agriculture Investment Plan

SAINT LUCIA
Advancing the use of information and communication technology solutions for climate-smart agricultural practices

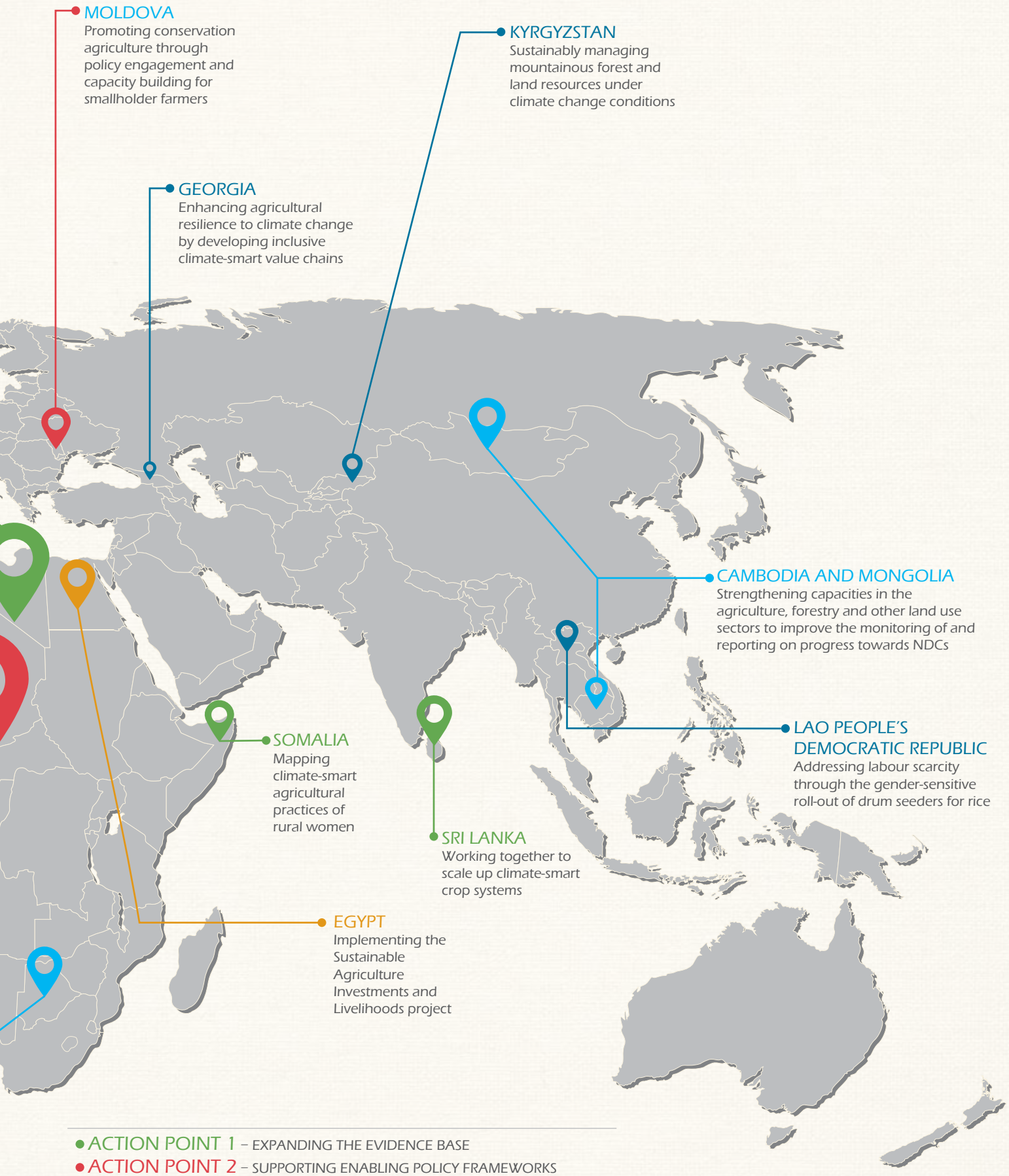
GHANA
Developing training capacity for climate-smart agriculture in cocoa

ECUADOR
Promoting climate-smart livestock management and cocoa production

AFRICAN REGION
Helping implement and coordinate policies with CSA country profiles

BOTSWANA
Integrating traditional practices for CSA into crop and livestock production systems

GLOBAL
The Sustainable Rice Landscape Initiative: attracting funding and financing to scale up sustainable rice production



- ACTION POINT 1 – EXPANDING THE EVIDENCE BASE
- ACTION POINT 2 – SUPPORTING ENABLING POLICY FRAMEWORKS
- ACTION POINT 3 – STRENGTHENING NATIONAL AND LOCAL INSTITUTIONS
- ACTION POINT 4 – ENHANCING FUNDING AND FINANCING OPTIONS
- ACTION POINT 5 – IMPLEMENTING PRACTICES AT FIELD LEVEL

ACTION POINT 1 – EXPANDING THE EVIDENCE BASE

Introduction to expanding the evidence base

Action point 1 of implementing climate-smart agriculture is expanding the evidence base. This introduction to action point 1 draws on FAO's CSA sourcebook (FAO, 2021a).[2]

Building the evidence base for CSA entails:

- stocktaking of current site-specific climate challenges and vulnerabilities, options for intervention and institutional capacities;
- collecting and analysing information to prioritize CSA options, while clearly identifying existing uncertainties;
- monitoring and evaluating implemented policies and practices, and sharing findings and lessons learned.

Expanding the evidence base contributes towards a better understanding of the challenges posed by climate change to the building of sustainable agri-food systems and improved rural livelihoods. It helps prioritize opportunities to work towards the SDGs and provides a foundation for monitoring and evaluating implemented policies and practices.

Policymaking and implementation choices that are based on evidence help exploit opportunities to the fullest and limit risks. For certain areas of CSA, a valuable evidence base is now available – as demonstrated by the case studies in this chapter. For other areas, additional or updated evidence is needed to build enabling policy frameworks, strengthen national and local institutions, enhance funding and financing options and implement effective practices at the field level.

Ideally, efforts to expand the evidence base for CSA implementation are guided by an understanding of site-specific challenges, opportunities and barriers; they should embrace collaboration with partners and stakeholders and promote the sharing and combining of various types of knowledge. In addition, efforts to build evidence should identify the synergies and trade-offs between various CSA policies and practices, and compare their impact to the baseline situation and to the impact of alternative interventions. Efforts to expand the evidence base on CSA greatly benefit from a good understanding of the institutional and financial requirements for CSA implementation.

The five case studies highlighted in this chapter demonstrate that building the evidence base underpins all other action points of CSA, as it provides information that can be used under these action points and thus increases the likelihood that they will be successful. Vice versa, the other action points help build a strong evidence base for CSA implementation by providing lessons learned on policy frameworks, national and local institutions, financing options and field-level practices. This two-way knowledge flow should enable the scaling up of sustainable agricultural practices that enable farmers to sustainably increase their incomes, adapt to the effects of climate change and reduce and/or remove GHG emissions.

[2] For more information, see www.fao.org/climate-smart-agriculture-sourcebook/enabling-frameworks/module-c10-evidence-based-implementation/chapter-c10-2.

Mali – complementing agricultural policies through the Climate-Smart Agriculture Investment Plan

Introduction

The 2019 Climate-Smart Agriculture Investment Plan (CSAIP) for Mali is the result of a consultation process led by the country's Ministry of Agriculture in which multiple stakeholders – including *inter alia* other governmental institutions, civil society actors and research institutions – were strongly involved. The consultation effort was supported by the World Bank under the Adaptation of African Agriculture initiative, under a multi-country effort coordinated by the World Bank as part of its IDA18 commitments (International Development Association, 2017). The CSAIP is based on scientific evidence; it was developed with technical assistance from the Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT), World Agroforestry and the Research Program on Climate Change, Agriculture and Food Security (CCAFS) of the Consortium of International Agricultural Research Centres (CGIAR).

Mali's CSAIP is based on the country's agriculture and climate change policies, strategies and plans, including its nationally determined contribution (NDC) and national agricultural investment plan (NAIP). It contributes to the evidence base for CSA in numerous ways, for example by identifying financial and institutional needs. The plan proposes 12 science-based CSA priority areas for investment, with project concepts that are packaged and ready for investors. The CSAIP foregrounds climate concerns and prioritizes CSA interventions that offer feasible and robust solutions. It also provides a monitoring and evaluation (M&E) framework that is aligned with other national programming processes. Mali's CSAIP helps understand how climate change is likely to impact upon agricultural production and trade and food security in Mali, highlighting how it is expected to have disproportionate negative effects on the rural poor. The CSAIP investments offer actionable solutions to reduce risk, build resilience and adapt to the identified climate impacts, as well as reduce GHG emissions. Mali's CSAIP also highlights the beneficial impacts the investments can have on the economy and the environment.

Rationale

The CSAIP provides an overview of Mali's agriculture sector and its climate change context. Over one third of Mali's total land area is used for agriculture. Farmers mostly grow subsistence crops on small holdings; over 85 percent of agricultural households also rear livestock. Overall agricultural productivity is low and there are significant yield gaps for most crops. Meanwhile, population growth is high and the pressure on land resources is increasing, resulting in land degradation. Droughts, floods and other adverse climatic events affect over 72 percent of Mali's population,

placing Mali in the medium-to-high vulnerability category for climate hazards. Rural poverty is extremely high at approximately 90 percent; a lack of access to agricultural inputs and financial (credit) and extension services has a limiting effect on possible productivity and resilience gains.

CSA is a multisectoral approach that focuses on improving agriculture, enhancing livelihoods, ensuring food security, building resilience and strengthening the economy in an environmentally sustainable manner. The goal of developing and implementing any CSA investment plan is to attract and channel financial resources towards priority CSA interventions, inform policymaking and help strengthen institutional and human capacities to implement CSA at a wide scale. CSA is particularly relevant for Mali, where agriculture accounts for 38 percent of GDP and employs over 80 percent of the workforce, while the country is highly vulnerable to the vagaries of climate change. Investment in the agriculture sector is currently relatively low. Only 5.5 percent of total private sector investment goes into agriculture, and most of that investment goes into the production of cotton. Mali's CSAIP is intended to help the country tap into the expanding climate finance landscape and unlock public, private and donor funding and financing for CSA.

Description

The development of Mali's CSAIP illustrates how the five action points of CSA implementation are connected, but not necessarily sequential. Besides identifying 12 key CSA investment areas with project concepts, the plan foresees the development of an M&E framework (action point 1). It is rooted in and complements Mali's agricultural policies and targets (action point 2). Mali is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement and has submitted its first NDC. NDCs provide policy targets that are often related to agriculture. However, they do not always offer information on necessary investments. Efforts to reach the policy goals formulated in NDCs (and in national agriculture strategies) therefore benefit from additional information about potential sources of funding and financing that can help meet targets. If investors decide to fund projects formulated in Mali's CSAIP, the plan will contribute to the implementation of CSA practices (action point 5). This implementation process can in turn contribute to building the evidence base for adequate CSA policy formulation.

Mali's CSAIP targets investments for CSA based on four components of CSA planning and implementation, all of which contribute directly to the building of the evidence base: (i) situation analysis, (ii) prioritizing interventions, (iii) programme/project design and (iv) monitoring, evaluation and learning. These components provide a framework to identify a theory of change and decide how to adapt and implement activities to achieve the desired changes. CSA planning and implementation components are fundamental to M&E. In turn, M&E allows the Government of Mali, development partners and implementing agencies to track progress on activities, outputs, outcomes and impacts towards their targets, and to raise flags when adaptive actions may be necessary. M&E activities create a mechanism for learning, promote accountability and generate information that can form the basis of success stories.

Outcomes

The negative impacts of climate change in Mali are visible and widespread. Changing weather patterns have a negative impact upon livelihoods and food security, especially of the rural poor. They are also altering traditional transhumance patterns, which greatly increases pressure on limited forage resources and causes conflict (World Bank, 2019). The 12 CSA investment areas identified by Mali's CSAIP are the result of stakeholder consultations; they are based on climate change scenarios and policy-related agricultural and economic analysis. This combination of analytical work and consultations with diverse stakeholders is an important part of the process of building the evidence base for CSA. In the case of Mali's CSAIP, this foundation enabled the authors of the plan to prioritize investments and identify potential barriers and opportunities related to those investments.

Mali's CSAIP identifies four investments at the national level, six commodity-specific investments and two restoration projects, for a total value of USD 300 to 500 million. These investments would help 1.8 million beneficiaries and their families adapt to climate change, boost crop resilience and enhance yields. They would support and build synergies between several SDGs, including SDG 1 (No poverty), SDG 2 (Zero hunger), SDG 5 (Gender equality), SDG 8 (Decent work and economic growth), SDG 10 (Reduced inequalities) and SDG 13 (Combat climate change and its impacts).

The four country-wide initiatives are (i) improving remote-sensing monitoring capabilities, (ii) including CSA in national agricultural extension services, (iii) developing agroclimatic information systems and (iv) monitoring soil fertility. These initiatives would help reduce poverty (SDG 1) and hunger (SDG 2) by increasing farm productivity and mitigating climate-related risks. They would enhance the capacities of beneficiaries to manage resources and access information needed to strengthen value chains. These processes would in turn contribute to decent work and economic growth (SDG 8).

The eight proposed climate-smart crop and livestock investments relate to value chains for non-timber forest products, flood recession agriculture, livestock, the integration of millet, sorghum and legumes, vegetables, the restoration of degraded lands, sustainable rice intensification and wheat. The CSAIP focuses on promoting resilience for some commodities and growth for others; where appropriate, it emphasizes both resilience and growth – a balance that is critical for the post-COVID-19 recovery strategy in Mali. The commodity-specific initiatives explicitly aim to bolster economic growth (SDG 8) and ensure the sustainable use of terrestrial ecosystems (to increase agricultural productivity) (SDG 2 and 15). Investments in value chains for non-timber forest products, integrated millet, sorghum and legumes systems, and production systems for vegetables target women producers (SDG 5) and youth (SDG 10) as beneficiaries.

Most of the investments address at least two of the three pillars of CSA jointly, primarily increasing productivity and enhancing resilience and adaptation. Indeed, these pillars are key objectives of the six commodity-specific initiatives and flood recession agriculture. GHG mitigation efforts (pillar 3) are an underlying goal of the proposed climate-smart investments and an integral objective of the investment towards restoring degraded lands.

Mali's CSAIP leverages CSA investment to support national policies, including at least 13 Malian policies or programmes that address climate change or adaptation. The plan strongly aligns with Mali's NDC in terms of higher-level objectives (e.g. national planning) and specific adaptation activities (e.g. water management) (World Bank, 2019).

This case study was submitted by Evan Girvetz (principal scientist and global programme leader, Finance and Investments for Climate Action with the Alliance of Bioversity International and International Center for Tropical Agriculture [CIAT] and the CGIAR Research Program on Climate Change, Agriculture and Food Security [CCAFS]) and Nkulumo Zinyengere (agriculture specialist) and Amadou Ba (senior agriculture economist) with the World Bank's Agriculture and Food Global Practice.

Sri Lanka – working together to scale up climate-smart crop systems

Introduction

Climate change particularly affects resource-poor smallholder farmers. Their agricultural operations tend to be barely profitable and are often environmentally unsustainable. In Sri Lanka, the combination of heavy rains, soil tillage and poor nutrient cycling results in soil erosion and soil fertility loss in the uplands. This reduces the productivity of fields in those areas and causes siltation of water reservoirs, with negative consequences for irrigation systems and water productivity in the lowlands.

FAO's Save and Grow project in Sri Lanka supports the transition to more productive and resilient smallholder farm systems and aims to reduce GHG emissions in rice production systems.[3] This is done through the adoption of climate-smart crop production practices, integrated landscape planning and management, and improved access to inputs, technical advice, credit and other financial services. The project contributes to the building of the evidence base for CSA assessments of the impact of climate change on crop yields in Sri Lanka, as well as of climate change adaptation options to strengthen Sri Lanka's agriculture sector in the face of climate change.

The project, which runs from 2019 to 2021, is implemented by FAO and supported by Germany's Federal Ministry of Food and Agriculture. Among the Sri Lankan partners that collaborate with the project are the Hector Kobbekaduwa Agrarian Research and Training Institute, the Department of Agriculture, the Rice Research and Development Institute, the Field Crop Research and Development Institute, the Farm Mechanization Research Centre, the Farm Mechanization Training Centre, the Department of Agrarian Development, provincial and interprovincial agriculture departments, and the Department of Meteorology.

Rationale

Climate change challenges agriculture in many ways; it directly and indirectly affects productivity, employment, food security and the wider economy. In Sri Lanka, high-intensity rainfall causes erosion in the uplands and siltation of water tanks in the lowlands, causing these tanks to operate at suboptimal capacities. This increases the vulnerability of farmers in both the uplands and the lowlands. Smallholder farmers lack access to inputs, technical advice, credit and other financial services. As a result, they are unable to access technologies that improve the resilience of crop systems to specific climate stressors and reduce yield gaps.

[3] For more information on FAO's Save and Grow project in Sri Lanka, see www.fao.org/in-action/save-grow-climate-smart/in-action/lka.

The Save and Grow project in Sri Lanka addresses a need to assess climate change impacts on crops as a fundamental first step towards developing evidence-based adaptation policies and strategies, and towards guaranteeing sustainable pathways for the mainstreaming of adapted agronomic practices.

The project recognizes that rather than adopting a one-size-fits-all solution, a range of proven agronomic practices can be adapted to address the needs and resource endowment of farmers and help them cope with climate change.

Description

Through the Save and Grow project, FAO is training farmers to optimize the use of water, labour and machinery to reduce drudgery and distribute the demand for labour more efficiently between lowlands and uplands throughout the year. The project contributes to the building of the evidence base for CSA through the assessment of future climate change impacts on six main crops i.e. rice, maize, green gram, onion, chilli and potato. These crops were selected based on their economic relevance, their importance in terms of food security, their agronomic health, their impact on employment, their climatic vulnerability and resilience, and market prices and price fluctuations.

Projected future changes for the six crops were calculated as the yield difference between future and historical yields for each combination of climate data modelled with six general circulation models, two representative concentration pathways (RCP 4.5 and RCP 8.5) and two future periods (middle and far future, up to 2100) (Amarasingha *et al.*, forthcoming). Understanding the potential impact of climate change on these crops helps identify vulnerabilities of farmers to the effects of climate change. The studies also provide a basis for proposing climate-smart practices that may strengthen farmers' resilience as compared to their previous (baseline) activities.

Furthermore, the findings of the climate impact assessment provide the evidence base that policy makers need to make informed decisions and formulate climate change adaptation strategies. The assessment process itself creates a framework for cooperation among national and international institutions.

Outcomes

By mitigating the causes and the impacts of climate change, the project directly contributes to SDG 2 (Zero hunger), SDG 12 (Responsible consumption and production) and SDG 13 (Climate action).

The outputs of this project include:

- Over 1 130 farmers and service providers received training on climate-smart crop production practices in six different villages in the district of Anuradhapura. One of these villages is the "CSA village" that was established in the country by the researchers and observes very strict CSA procedures in order to preserve the site. This project described in this chapter is the only project allowed in the CSA village. The lessons learned thanks to the collaboration between researchers will be used for training purposes. The monitoring of practices over time will also allow for adaptive management and consequent adjustment of agronomic protocols.
- Training videos for farmers and guides for climate-smart crop production were developed.[4]
- Agricultural machinery was procured, tested under local conditions and made available to farmers.[5]
- Government and small entrepreneurs worked together to provide farmers with access to sustainable production inputs, output markets and services. This enabled farmers to sell more high-quality produce on stable markets at higher prices.

Table 1 summarizes the outcomes (impacts on beneficiaries) of the project.

[4] The videos are available online at www.fao.org/in-action/save-grow-climate-smart/resources/videos.
[5] For news on sustainable agricultural mechanization, see www.fao.org/sustainable-agricultural-mechanization/resources/news.

Table 1. Outcomes of the Save and Grow project in Sri Lanka

OUTCOMES	OPTIMIZED PRODUCTION	CLIMATE CHANGE ADAPTATION	CLIMATE CHANGE MITIGATION
According to the Rice Research and Development Institute, farmers cut back total irrigation requirements for rice cultivation per season by 10 to 20 percent by adopting new water management practices. This allowed them to store water for the next cropping season. All farmers of the Meegassegama reservoir initiated land preparation early (at the beginning of the rainy season), instead of waiting for water reservoirs to fill and irrigation water to be released from the reservoir.	✓	✓	
Farmers were able to expand land under irrigation by 15 percent during the dry season. This expansion was made possible by the training received by farmers in the alternate wetting and drying technique, which allows them to save water during the main growing season.	✓	✓	
The community experienced the highest water capacity ever recorded at the end of the dry season. The combination of practices such as early planting, the use of rainwater (instead of irrigation water) and the alternate wetting and drying technique allowed this change.	✓	✓	
By using soil testing kits and leaf colour charts and by applying fertilizer to parachute trays, farmers were able to apply fertilizer more precisely, thus reducing the amount of fertilizer used by 27 percent.	✓	✓	✓

This case study was submitted by Sandra Corsi, agricultural officer, FAO and Mahnoor Malik, project communication consultant, FAO. NSP-Director@fao.org.

Senegal – enhancing CSA learning by understanding indigenous knowledge and perceptions of climate change

Introduction

Farmer Field Schools (FFS) are implemented by FAO in Africa, Latin America and Asia.[6] The FFS approach is a community-based learning-by-doing approach whereby local agricultural practices are compared to practices suggested by science and research. It enhances the understanding of complex agro-ecosystems. Communities are encouraged to change their agricultural practices and thus improve their production systems and define their future. The FFS methodology regards sustainable agriculture as anchored in ecology and farmer empowerment. FFS are based on the observation, analysis and understanding of local agro-ecosystems. In FFS, "the field is the book"; all activities are discovery-based and aim at finding solutions to local needs based on a thorough understanding of biological synergies and ecosystem functions.

In Senegal, FAO identified a need to better integrate indigenous knowledge and perceptions of climate change into the learning process. Under a GEF project entitled Mainstreaming Ecosystem-Based Approaches to Climate-Resilient Rural Livelihoods in Vulnerable Rural Areas through the Farmer Field School Methodology, which started in November 2015 and will last until the end of 2021, data are collected from local producers.[7] This investigation contributes to the evidence base for CSA implementation by providing key information that can be used to reduce communities' vulnerability and increase their adaptation capacity, as well as introduce new elements on climate change adaptation into FFS curricula.

Rationale

Climate change is worsening the already vulnerable conditions of smallholder farmers in Senegal, who depend primarily on crop and livestock production and natural resource management. Although smallholder farmers are those that are the most vulnerable to the effects of climate change, they are also the main agents of solutions and holders of climate knowledge, who have always mobilized their knowledge and capacities for complex human-environment interaction to deal with climate change.

Smallholder farmers actively engage with their natural environment in their daily lives and are experienced and attentive observers. As such, they have accumulated important and sophisticated knowledge and practices related to the environment, its variability and transformation. Local communities have faced environmental variability and unpredictability for centuries. They have developed a wide variety of technical, social and economic responses that form the basis of their resilience to change.

[6] For more information on Farmer Field Schools, please visit the Global Farmer Field School Platform at www.fao.org/farmer-field-schools/overview.
[7] For more information on the project, see www.fao.org/3/CA0842FR/ca0842fr.pdf.

Strong collaboration between farmers, extension service providers, climate and weather forecasting institutions and researchers is essential to explore options and find solutions to cope with the vagaries of climate change.

The research in Senegal described in this chapter was carried out to support the above-mentioned GEF project and identify important elements to strengthen the FFS learning process.

Among the main climate-related challenges faced by farmers in the intervention area (the Groundnut Basin, eastern Senegal and the agro-sylvo-pastoral zone) are the unpredictability of rainfall (early start and end of the rain season, delay of the winter season, rain out of season, rainfall breaks, floods), which impacts the water requirements of key crops; temperature rises (resulting in dry spells and droughts), which impact the temperature requirements of key crops and animals; and strong winds (which result in land erosion, destroy plants and increase the rate of moisture evaporation from the soil).

Description

The research examined farmers' perceptions and attitudes about climate change and climate variability to uncover the knowledge base of farmers' agricultural choices and practices. Climate change has always existed, and farmers have always adapted their choices to this change.

The objectives of the research were to:

- capture farmers' knowledge, perceptions and attitudes regarding climate change, climate variability and their impact on production as well as local adaptation strategies at the community level;
- pass on valuable knowledge from farmers to project managers, extension service providers and climate or weather forecast institutes (e.g. the Agence Nationale de l'Aviation Civile et de la Météorologie or Senegalese national agency for civil aviation and meteorology);
- test a research methodology to be used in projects on climate change adaptation using FFS and other participatory methodologies.

The research methodology included interviews, transect walks in communities and focus groups. The focus groups consisted of either male or female farmers, of one of four ethnic groups (Peul, Serer, Mandinka and Wolof). The farmers worked in one of two agro-climatic zones: the Groundnut Basin and the sylvo-pastoral zone.

The research project examined:

- farmers' perception of their villages' zones, based on their agro-ecological characteristics, land use and the value of these zones in terms of ecosystem services provided;
- key climatic events and their impacts on the different zones of the villages;
- villages' vulnerabilities, based on the impacts of extreme climatic events in terms of human and animal diseases, living expenses and livelihood activities;
- resilience and adaptation capacity, considering climate and meteorological predictors, resilient species and practices.

The research was inserted into the above-mentioned GEF project, which established two key pathways to translate the evidence and results of the investigation into actions. The first pathway is the mainstreaming and adoption of the FFS approach and climate change adaptation practices into the Senegalese national agricultural extension agency (or Agence Nationale de Conseil Agricole et Rural). The second pathway is the establishment of a resilience fund within the national fund for agro-sylvo-pastoral development (or Fonds National de Développement Agro-Sylvo-Pastoral) to finance community development plans and climate change adaptation plans proposed by farmer organizations with the support of the extension agents.

Outcomes

This research project contributes to the SDGs' overarching goal of "leaving no one behind" by providing insight into communities' basic needs for protecting the environment and landscape and improving livelihoods. This knowledge may support community development planning as well as FFS activities in the region. Indeed, the study helps improve FFS activities by:

- providing crucial information on local priorities and challenges, communities' needs and the ecosystem values of village zones through initial diagnostic activities;
- providing critical information on the local mindset, values and perceptions of spaces and seasonal priorities, which allows FFS facilitators to adapt the learning process to local perspectives and perceptions and local space-temporal categories;
- allowing training programmes, modules and field trials to be formulated based on local knowledge on land use, landscape, climate change, ecosystem services and adaptation strategies.

The research contributes to CSA action point 1 (building the evidence base for CSA) and action point 5 (implementing practices at field level). For action point 1, the results of the investigation provide evidence to determine the effects of climate change on food production and identify potential climate-smart adaptation and mitigation options. Key findings from the investigation that contribute to the evidence base for CSA include:

- the identification of the more vulnerable zones in each village;
- the identification of key ecosystem services in each village;
- the identification of extreme weather events and their impact on villages (socio-economic and environmental consequences);
- stocktaking of predictors (biophysical predictors, animal behaviours and changes in vegetation) related to the following climatic conditions: impending rains, early rain stops, coolness, the (early) start of winter, intense heat and droughts;
- stocktaking of resilient plant and animal species;
- stocktaking of adaptation practices related to specific climatic conditions.

As far as action point 5 is concerned, the research helps identify suitable CSA options by incorporating local farmers' knowledge and determining their requirements and priorities.

For each of the four case studies, data collected through focus groups provided relevant information to develop climate risk adaptation plans at community level. Farmers provided information regarding weather and climate impacts by village zone, ecosystem services, adaptation practices, resilient species and indicators used to predict climate events. This information enabled the assessment of the vulnerability and potential of the community and, based on that, the development of community adaptation plans. The case study for the village of Padaff, for example, found that one village area was suffering from a considerable deterioration of natural resources due to river salinization and overflow; as this was compromising important productive activities such as fishing and rice cultivation, the study argued that it was important to focus the village's adaptation plan on that particular area. The construction of a barrage and the creation of a flood defence zone by planting eucalyptus trees were identified as priority actions. The following additional adaptation practices were also recommended:

- using short-cycle varieties such as souna 2 or 3 millet, mélakh cowpea and different peanut varieties;
- reforestation with eucalyptus and vetiver, to build flood defence zones;
- fitting gabions to reduce erosion damage;
- putting in fascines;
- planting hedgerows (*euphorbia balsamifera*, *jatropha curcas*);
- using bags filled with sand to bend the direction of water flows during erosion and flooding;
- using compost, rotating crops and leaving crop residues in the field as forage (cowpea) or as mulch (millet and corn) to enhance fertility and reduce wind erosion.

This case study was submitted by Stefano Mondovì, agricultural officer, FAO. fieldschools@dgroups.org.

Somalia – mapping climate-smart agricultural practices of rural women

Introduction

A 2019 study aimed at building the evidence base for CSA identified the planting of trees to conserve soil and water resources, the cultivation of drought-resistant crop varieties and the raising of mixed herds as just 3 of more than 80 CSA practices applied by rural women in Somalia. IFAD funded the study to guide the design of its agricultural programmes aimed at helping crop and livestock farmers adapt to climate change.

Rationale

Somalia increasingly suffers from the effects of climate change, as drought and floods ravage the conflict-prone country in growing intensity and frequency. The Notre Dame Global Adaptation Initiative lists Somalia as one of the countries that are most vulnerable to climate change and least prepared to adapt to its effects (University of Notre Dame, n.d.).

There is little literature on women's engagement in agriculture in Somalia, and not much is known about the CSA practices they apply. This is why IFAD funded a study aimed at identifying the CSA practices of rural women in Somalia. The study provides an evidence base for future IFAD-funded projects by identifying CSA practices that are effective at improving the livelihoods of poor smallholder households in Somalia.

Description

The study described in this chapter was undertaken in 2019 by the Somali Disaster Resilience Institute, a national research institution based in Mogadishu. The institution carried out an extensive literature review, engaged with over 120 rural women through focus group discussions and interviewed 20 experts. Information was collected on CSA practices in five states in Somalia, including Hirshabelle, Jubaland, Mudug, Puntland and South West.

The study is part of IFAD's wider programme of work in Somalia. Since the 1980s, IFAD has invested a total of USD 140 million in agricultural development projects in Somalia, reaching 1 780 000 direct beneficiaries. The organization has three ongoing projects in the country that promote the adoption of climate-smart farming technologies, the improvement of food security and nutrition, the sustainable management of water, watersheds and rangelands, and small ruminant and livestock development.[8]

[8] The three projects are entitled:
-Resilient Livelihood Action to COVID-19;
-Food Security and Sustainability in Fragile Situations in Puntland; and
-Productivity Enhancing Technologies to Improve Pastoralists and Agro-Pastoralists Livelihoods in Dry Lands in Somaliland.

IFAD is committed to increase its financing to support smallholders adapt to the effects of climate change. The organization aligns its programmes to the targets on climate change mitigation and adaptation set by countries in their NDCs to the Paris Agreement.

Outcomes

Study findings

The study helps fill a knowledge gap by identifying over 80 CSA practices. A compendium to the study report (forthcoming) provides short descriptions of over 60 practices, classified into seven major categories (crops, livestock, energy, soils, water, forestry and aquaculture) with various subcategories. Many of the practices fit in with the three pillars of CSA. They have the potential to increase productivity and incomes, enhance resilience and adaptation, and reduce GHG emissions.

The findings of the study demonstrate the potential to change agricultural practices to reduce farmers' vulnerability to the effects of climate change. Most of the CSA practices applied by rural women concern crop production. Practices with a strong potential to increase production and resilience include the use of indigenous crop varieties that resist droughts and diseases, practising crop rotation to keep soils fertile, and using traditional methods to store seed. Several farmers said that they listened to weather forecasts on the radio to time the preparation of their fields. This finding suggests that the radio is a good way to disseminate information on CSA practices.

None of the women included in the study engage in nomadic herding, which is considered a job for men. However, women take care of livestock around the homestead. They feed their animals by fencing off land for grazing, growing fodder crops such as alfalfa and Sudan grass, and collecting wild fodder plants. Such adaptive practices help farmers cope with the dwindling of grassland resources due to drought.

The study revealed different perceptions of gender roles. Some women argued that irrigation is the responsibility of men, while others said that both women and men undertake tasks linked to irrigation. Irrigation enables farmers to grow food during the off season and in times of drought.

Several focus groups ranked agricultural practices according to their importance for the community. For example, focus groups in Galkayo ranked herd and grazing management, water storage and fodder production as their top priorities.

Many practices with the potential to increase the resilience of households are not applied. Several groups were aware of soil conservation practices such as erosion control measures and conservation agriculture, but stated that these are rarely applied.

The study further identified various constraints that hinder the wider adoption of CSA practices. Discussion groups highlighted the need for training, and argued that essential services – such as extension or veterinary services – are lacking. Interviews with experts revealed that rural women are often excluded from decision-making processes, are not allowed to possess fixed assets and do not hold the required financial capital.

Designing gender-sensitive projects to increase resilience

The study findings are of great value for organizations such as IFAD that fund agricultural projects in Somalia, especially in their efforts to promote progress towards achieving SDG 1 (No poverty) and SDG 2 (Zero hunger). It is important to leverage the current evidence base for CSA (action point 1) to provide information for future projects (including all other action points).

The study confirms that IFAD programmes should support rural women as a key target group to work towards SDG 5 (Gender equality). Women have important and diverse roles in agriculture and are key players in rural households in terms of adaptation to climate change. As cultural norms may hamper the participation of women in projects, project designers should consider using specific methodologies to target women farmers, such as the Gender Action Learning System (GALS).[9]

[9] For more information on GALS, see for example http://www.fao.org/3/cb1331en/cb1331en-01.pdf.

Agricultural projects that target female crop and livestock farmers should acknowledge the wide range of CSA practices that already exist. Interventions should build on existing good practices, improving them and promoting them across the country. This study specifically recommends investing in scaling up innovations related to solar energy, biogas, seed banks and food storage technologies. It also identifies training and the provision of rural finance as key mechanisms to promote CSA practices. These types of interventions help achieve SDG 13 (Climate action).

Project designers should be aware of the fact that farmers in different regions prioritize different CSA practices; they should therefore be flexible in the selection of CSA practices to promote. The study also shows that project teams that implement activities need technical expertise on different subject matters, ranging from crop production to energy management.

This case study was submitted by the Environment, Climate, Gender and Social Inclusion and the Near East, North Africa, Europe and Central Asia Divisions of the International Fund for Agricultural Development (IFAD). ecgmailbox@ifad.org.

Africa and the Near East – using remote sensing to monitor water productivity

Introduction

FAO employs satellite remote sensing technology for a wide range of tasks, including the monitoring of droughts and other climate hazards and their impact on agriculture and farmers worldwide. FAO hosts WaPOR (Water Productivity Open-Access Portal), a publicly accessible portal to monitor water productivity based on remotely sensed derived data.[10] The information collected through WaPOR is freely available and based on open source technologies. The database helps countries monitor water productivity in agriculture, identify water productivity gaps, formulate solutions to reduce these gaps and sustainably increase agricultural production.

By monitoring key variables on water and agriculture in near-real time, WaPOR directly contributes to the first action point of CSA (evidence base). WaPOR provides open access to high temporal and spatial resolution data on reference and actual evapotranspiration, biomass development and more from 2009 to date. The database currently contains data for the whole of Africa and the Near East, and is intended to grow into a global database. Reference evapotranspiration is a key parameter to capture the climatic conditions that influence water requirements in agriculture. Together with data on actual evapotranspiration (real water consumption), reference evapotranspiration data are crucial to improve the efficiency of the use of inputs. Thus, the WaPOR database is highly relevant to the sustainable production and adaptation pillars of CSA. In addition, WaPOR can provide information regarding progress under CSA's third pillar as it contains data on carbon uptake by vegetation through biomass development.

The WaPOR project, which is implemented by FAO with funding from the Netherlands, started in November 2016 and ran until 31 January 2021; its second phase is expected to run until December 2025.

Rationale

Guaranteeing food security for all while using water resources in a sustainable manner is one of the major challenges faced by society in the 21st century. The difficulty of this challenge is exacerbated by the climate crisis and other global changes. Agriculture is responsible for about 70 percent of global freshwater withdrawals for economic activities; it is even responsible for about 90 percent of global net freshwater consumption (i.e. withdrawals net of return flows) for economic purposes (FAO, 2020a). It is therefore of key importance to develop a system to monitor water productivity in agriculture and identify ways to improve this productivity.[11] Remote sensing technologies offer unprecedented opportunities to monitor water productivity in large areas and in near-real time, which is a suitable temporal resolution for action-oriented information in agriculture.

[10] For more information on WaPOR, visit FAO's website at www.fao.org/land-water/databases-and-software/wapor.
[11] Water productivity is defined as the ratio between agricultural output (typically yield, but also economic return or other types of output) and the water consumed to obtain this output. In the context of WaPOR, and in assessments of water productivity in agriculture in general, it is expressed as kg/m^3.

Climate change is increasing the frequency and intensity of extreme events such as floods and droughts. While the impact of floods is immediately apparent, drought is a slow process with devastating impacts on food production and on food and nutrition security. Episodes of drought have increased in frequency and intensity over the past two decades in many regions around the world as a result of climate change; this trend is expected to continue. Rainfed agriculture is the most vulnerable to increasing climate variability. Irrigated agriculture is far less vulnerable to variations and changes in climate than rainfed agriculture, and societies that practice irrigated agriculture are generally more resilient (as long as a reliable water supply can be secured) (FAO, 2020b). Yields from agriculture with some type of water management can be three or more times higher than yields from strictly rainfed agriculture (Molden, 2007). Thus, sound water management is essential for building resilience against increased risks in food systems. Timely and reliable information on the condition of irrigated and rainfed food crops all over the world is essential to mitigate the impact of droughts.

The data made available through WaPOR can be of great use to service providers who help farmers obtain consistent yields and improve their livelihoods, as well as to government agencies wishing to modernize irrigation systems or promote the efficient use of natural resources (FAO, 2021c).

Description

The data provided by WaPOR are of key importance to efforts to increase agricultural productivity while at the same time using water more efficiently, to address problems of land and water scarcity. The spatial satellite measurements of WaPOR offer unique insights into land and water productivity. In addition, the open source technologies developed in the context of WaPOR allow for the dynamic incorporation of technological advances (such as the growing constellation of the European Union's Copernicus satellites) and the data they produce. While the WaPOR project focuses on the collection of data, it explicitly aims for these data to be used by a variety of stakeholders. Policymakers at the national level, for example, can use WaPOR data in evidence-based decision processes on issues such as water scarcity or water allocation strategies in a changing climate. Meanwhile, researchers can tap into the wealth of seamless spatial data and time series (covering the period from 2009 to date), while end users (including service providers and farming communities) benefit from the development of problem-focused applications. The WaPOR project recognizes that barriers to its actionability may exist for certain stakeholders. For example, farmers must be able and willing to adopt innovative practices based on information and communications technologies (ICT) such as those provided by WaPOR. The enabling environment for the uptake of the information and suggestions provided by WaPOR therefore determines the project's ultimate success. This enabling environment is determined by existing policies and institutions and by the availability of financing for CSA practices.

Outcomes

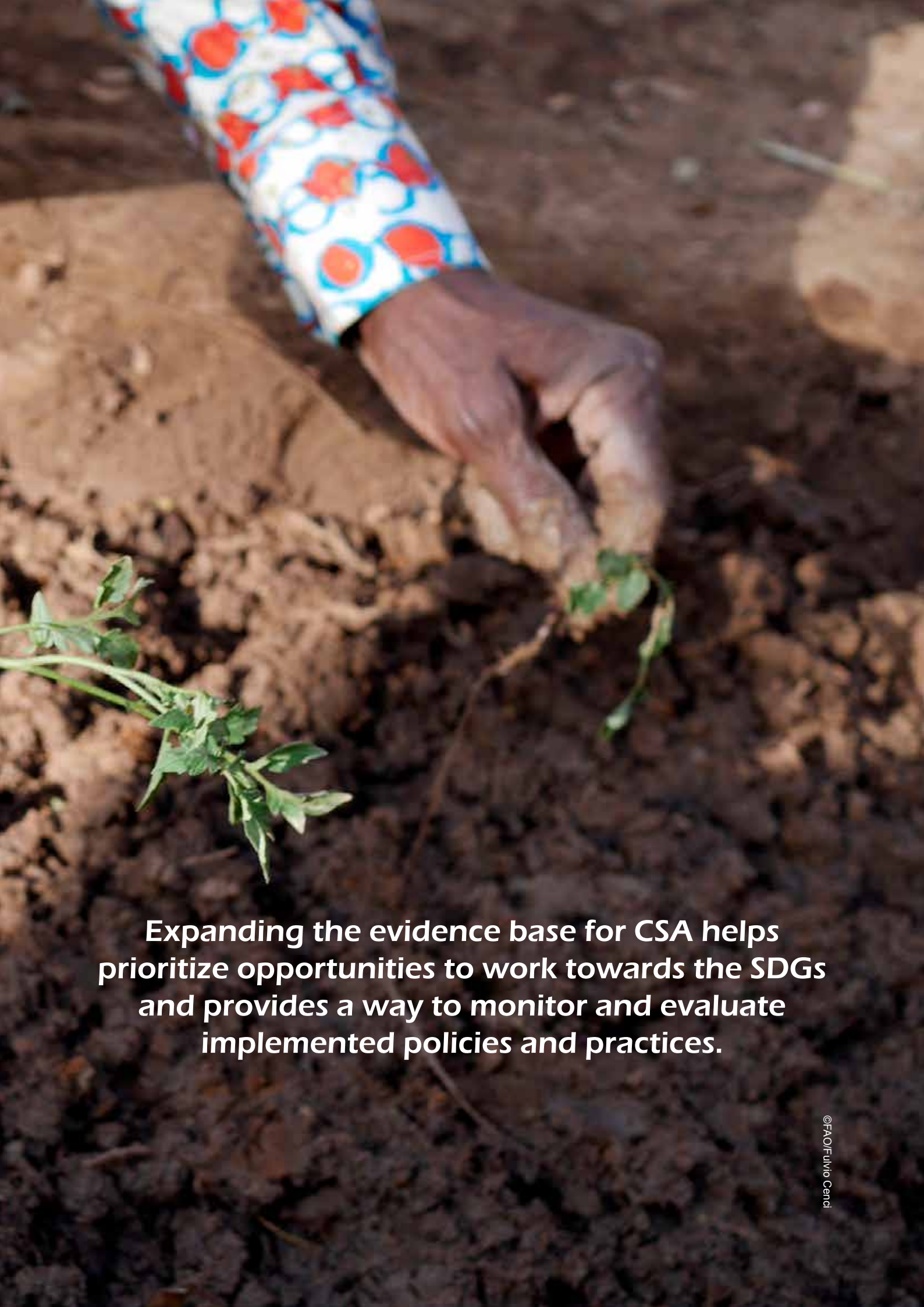
The first phase of the WaPOR project (2015–2021) paved the way for the design of potentially highly impactful agricultural policies by generating:

- an operational methodology and an open access data portal that publishes data in near-real time (usually every ten days), at spatial resolutions ranging from 250 m to 30 m for selected pilot areas;[12]
- specific assessments, in five river basins, of the consequences and sustainability of possible increases in water productivity in agriculture, analysed based on a water accounting framework;[13]
- capacity development of stakeholders to increase water productivity sustainably, including the development of locally relevant ICT applications for farmers. These applications were developed in collaboration with stakeholders to address relevant issues and tailored to local contexts, with technology ranging from smartphone applications to simpler soil moisture sensors.[14]

The current second phase of the project focuses on strengthening capacities to interpret data and develop demand-driven applications in target countries. The applications will be identified and developed in collaboration with different stakeholders. They will be aligned with national strategies on climate action, water and food security and agricultural development.

This case study was submitted by the WaPOR team in FAO's Land and Water Division. wapor@fao.org.

[12] See https://wapor.apps.fao.org/home/WAPOR_2/1.
[13] For more information, visit www.fao.org/in-action/remote-sensing-for-water-productivity/water-accounting/results.
[14] For more information, visit www.fao.org/in-action/remote-sensing-for-water-productivity/capacity-development/field-level-activities.



Expanding the evidence base for CSA helps prioritize opportunities to work towards the SDGs and provides a way to monitor and evaluate implemented policies and practices.

ACTION POINT 2 - SUPPORTING ENABLING POLICY FRAMEWORKS

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Introduction to supporting enabling policy frameworks

Action point 2 of implementing CSA is building enabling policy frameworks. This introduction to action point 2 draws on FAO's CSA Sourcebook (FAO, 2021a).[15]

Creating enabling policy frameworks for CSA is a country-owned process that involves:

- understanding the intended and unintended effects of current policies, and identifying gaps in them (action point 1);
- understanding the effects of climate change under various scenarios;
- aiming for a coherent strategic framework to obtain the best results and access international funding;
- taking into account international agreements, national priorities across sectors and local capacities for implementation;
- designing policies that consider socio-economic and gender-differentiated barriers and provide incentives to reach objectives;
- engaging with all relevant stakeholders, including private sector and civil society actors, to make sure the new policies catalyze synergies between the three pillars of CSA.

Many countries already employ policy frameworks that include (elements of) CSA. Relevant frameworks include NDCs, intended nationally determined contributions (INDCs), nationally appropriate mitigation actions (NAMAs), national agriculture investment plans (NAIPs), national adaptation plans (NAPs), national adaptation programmes of action (NAPAs) and REDD+ strategies and action plans. Taking stock of such existing policies is part of action point 1 of implementing CSA (building the evidence base). Some countries may have already compiled a list of potential CSA policies, legislation, practices and investments. Action point 2 refers to the assessment of these options with a view to building a coherent framework that best supports national priorities and the three pillars of CSA.

Efforts to build enabling policy frameworks may entail the creation of new policies or the modification of existing ones. Ideally, all relevant ministries are involved in building an enabling environment for CSA. Besides ministries of agriculture, ministries of labour and finance may play a pivotal role in ensuring that no one is left behind. A variety of policy topics should be considered, such as the building of effective national information systems and social safety nets, and disaster risk reduction.

A strong, coherent policy framework for CSA is important for all stakeholders. Governments play a crucial role in creating an enabling environment for the scaling-up of CSA by providing the policy and legal frameworks in which actors from the private sector and civil society work. The building of effective CSA policy frameworks therefore requires a sound understanding of the priorities of all stakeholders working on agriculture, climate change and other relevant fields.

The three case studies in this section discuss policy frameworks that are relevant to CSA in various countries; they also discuss the steps involved in the implementation of such policies (e.g. the case studies of CSA country profiles for Africa).

[15] For a more detailed description of action point 2, please see FAO's CSA sourcebook section C3 (www.fao.org/climate-smart-agriculture-sourcebook/enabling-frameworks/module-c3-policy/c3-overview) and section C10 2.3 (www.fao.org/climate-smart-agriculture-sourcebook/enabling-frameworks/module-c10-evidence-based-implementation/chapter-c10-2).

Italy – working with stakeholders in European Innovation Partnership Operational Groups to create climate-smart innovations in Emilia-Romagna

Introduction

This chapter discusses a recent study by the Institute for BioEconomy (IBE) of the National Research Council of Italy (CNR) that assessed how and to what extent the Italian region of Emilia-Romagna supported local initiatives promoting the adoption of CSA practices from 2014 until 2020. Italy is a forerunner in terms of agri-food excellence. Emilia-Romagna is one of the country's main production regions of high-quality foods, as well as a region where policymakers support innovative ideas and activities.

An important objective of CSA strategies is the development of locally acceptable solutions that increase agricultural productivity and incomes in a sustainable manner, adapting agricultural practices to climate change and reducing their emissions. The second pillar of the European Union's Common Agricultural Policy, the Rural Development Policy, creates possibilities for specific research into CSA innovation. Under Measure 16.1 of this Rural Development Policy, support is provided for the establishment and operation of operational groups (OGs) of the European Innovation Partnership. OGs aim to develop multidisciplinary solutions or identify new opportunities to improve agricultural productivity and sustainability through new techniques, processes, products and technologies. One of the main innovative aspects of the OGs is that they involve an array of stakeholders (including farmers, researchers, advisers and business representatives) who work together to achieve a common goal.

Rationale

The study undertaken by IBE aimed to assess to what extent the investments made by the region of Emilia-Romagna under Measure 16.1 helped local stakeholders promote and adopt CSA practices. As a first step, the study identified and categorized the main threats caused by climate variability and change. Eight types of threats were identified, including soil deterioration, water scarcity, the deterioration of water quality, shifts in vegetative seasons, the spread of pests and diseases, extreme weather events and increases in GHG emissions due to intensive livestock management practices. Then, 93 projects financed under Measure 16.1 were analysed to identify which projects demonstrated climate-smart properties and assess the inclusion of CSA in the region's rural development programme. The projects were then categorized based on the solutions they provided to the aforementioned threats.

Description

One of the entities that have invested most in rural development in the Region of Emilia-Romagna is the regional Directorate General for Agriculture, Hunting and Fishing. Emilia-Romagna is investing EUR 1.19 billion in rural development over the period 2014–2020, more than any other region in northern Italy. The Region has increased the funds invested in the agriculture sector through the current rural development programme (RDP) by EUR 131 million as compared to previous RDPs, and added an additional EUR 100 million for co-financing. Of the total investment of EUR 1.19 billion, EUR 20 million were spent on 93 projects related to agriculture and forestry under Measure 16.1. Emilia-Romagna has gone to great lengths to expand its CSA impact evidence base (Chieco, Rossi and Tadić, 2019). The analysis showed that 66 of the 93 projects were oriented towards CSA. The investments towards the creation of an enabling policy framework facilitated the formulation of innovative solutions. The diversity of the projects was most evident in their action goals, with some projects offering multiple solutions for a single threat or even tackling multiple threats. Fourteen projects promoted innovative solutions to address multiple threats simultaneously through a multidisciplinary and layered approach. The creation of OGs strengthened the interaction between private, public and research actors, who worked together towards a common goal.

Outcomes

The OG projects in Emilia-Romagna have promoted the development of many innovative solutions that facilitate the gradual adoption of climate-smart farming practices. A notable example is the project entitled "Irrigation system optimization in fruit farming for adaptation to climate change". This project was carried out jointly by the Department of Agricultural and Food Sciences of the University of Bologna, IBE and the Consortium for the Emiliano Romagnolo Channel in a commercial pear and apple orchard in Medelana, a municipality in the Ferrara province. The project aimed at devising a way to rationalize the use of irrigation systems by identifying best practices in water use and developing a protocol for sustainable orchard cooling irrigation. Indeed, as temperature fluctuations and heat waves are expected to become more frequent in the future, solutions for these extreme scenarios are needed. The two-year trial showed that this type of solution can reduce the temperature of the canopy by up to 4 °C, thus improving productivity.

The experiences of Emilia-Romagna have demonstrated that innovative solutions are more easily obtainable if researchers and policymakers collaborate towards a common goal. With 70 percent of rural development projects in the region being oriented towards CSA, it comes as no surprise that innovation has become a key term in the region's agricultural policies. Rural development measures are promoting CSA practices to help farmers adapt to and mitigate the effects of climate change, thus changing the agriculture sector's image of polluter. In addition to funding projects under Measure 16.1, Emilia-Romagna has formulated actions under Measure 16.2 ("Support for pilot projects and for the development of new products, practices, processes and technologies") to take the promotion of CSA one step further. This measure supports projects that concern entire supply chains. Eight of the 25 animal production projects and 9 of the 30 plant production projects financed under this measure involved the adoption of CSA practices.

Overall, the OG projects in Emilia-Romagna have been shown to promote climate change-related innovation in agriculture and food production. Thirty-five percent of the projects aim at mitigating the effects of climate change, 21 percent promote climate change adaptation, 11 percent concern carbon sequestration and 33 percent combine adaptation and mitigation efforts.

Strategic investments in specific sectors are key to achieve results on a macroscopic level. The rural development programme of the region of Emilia-Romagna provides a way to manage large investments. Indeed, by formulating specific and clear objectives, the programme has made it clear to stakeholders, including farmers, food producers and research centres, where to concentrate their efforts. Emilia-Romagna is spearheading the promotion of new forms of resilient, low-impact and sustainable agriculture by including CSA standards in its policies. The region has demonstrated that the best way to further the integration of CSA in day-to-day practices is to make all stakeholders, including policymakers, researchers and businesses, work together towards common goals. This collaboration enables faster and more impactful innovation.

This case study was submitted by Federica Rossi, Slaven Tadic and Camilla Chieco of the Institute for BioEconomy of the National Research Council of Italy. It is based on: Chieco, C., Rossi, F. & Tadic, S. 2019. How can policy influence innovation: an exploration of climate-smart activities in Emilia-Romagna. Italian Journal of Agrometeorology, 1: 25–31. https://doi.org/10.13128/ijam-288

Moldova – promoting conservation agriculture through policy engagement and capacity building for smallholder farmers

Introduction

Moldova's National Strategy for Agricultural and Rural Development for the period 2014–2020 acknowledges that the agriculture sector not only plays an economic role, but also environmental and social roles. The strategy recognizes the challenges faced by agriculture today, including price volatility, climate change and rural poverty. It identifies climate change adaptation priorities for the agriculture sector and aims to ensure that Moldova's agricultural products comply with the European Union's requirements for food security and safety. To support the strategy, IFAD established a country strategic opportunities programme (COSOP) for Moldova. This programme aims to build resilient livelihoods in marginal rural areas by promoting CSA and economic diversification, and improving talent retention and access to rural finance.

The Inclusive Rural Economic and Climate Resilience Programme (IRECRP), one of various IFAD programmes in Moldova, aims specifically to deliver on the opportunity of climate change innovation identified in the COSOP for Moldova. IRECRP promotes climate-smart agriculture to enhance the adaptive capacity of especially small-scale farmers in locations that are increasingly susceptible to climate shocks. The programme design reflects the links between various CSA action points, including the creation of an enabling policy environment (action point 2), strengthening the capacity of local and national institutions and stakeholders (action point 3), enhancing farmers' access to finance (action point 4) and implementing conservation agriculture practices (action point 5).

IRECRP is jointly funded by IFAD, Danish International Development Agency (DANIDA), GEF and the Government of Moldova. The programme became effective on 25 August 2014 and is expected to be completed by 31 March 2021.

Rationale

IRECRP was formulated based on the current and expected effects of climate change in Moldova. As evidenced by recent studies, the agriculture sector in Moldova is highly vulnerable to climate change and climate variability. Under a business-as-usual scenario with increased frequency and severity of climatic events (and particularly droughts), this leads to serious problems of production losses and threats to food security. Smallholder farmers in Moldova are highly sensitive and vulnerable to climate change due to their heavy reliance on subsistence rainfed agriculture. Their limited access to financial resources, technologies and adaptation knowledge results in a low adaptive capacity and

higher vulnerability to extreme climatic events, unpredictable climate variations and environmental degradation caused by climate change. IRECRP has been designed to address the impacts of climate change and identify the adaptation priorities of the Moldovan government for the agriculture sector.

Description

IRECRP is the sixth IFAD programme in Moldova. The programme builds on previous IFAD investments in conservation agriculture, value chain development, infrastructure, financial services and capacity building. The programme aims at improving the ability of the rural poor to cope with the vagaries of climate change and increasing economic volatility.

The climate change resilience and inclusive value chain development component of IRECRP is designed to contribute to the creation of an enabling policy environment (CSA action point 2) by triggering a policy process to boost the adoption of conservation agriculture (CA). This is to be achieved by mainstreaming CA into rural development planning, supporting small-scale private agro-forestry investments, enhancing institutional capacities and improving the policy environment for climate-resilient agriculture and soil protection. In the current stage of the programme, policy engagement in CA remains marginal; however, efforts are being made to meet the programme's targets. IRECRP has been very effective at helping Moldova's National Commission for Financial Markets draft regulations on licensing for saving and credit associations and establish internal procedures for identification, recordkeeping and risk management in this sector.

IRECRP aims *inter alia* to strengthen stakeholders' capacities to mainstream climate change adaptation activities, such as for example the planting of shelterbelts (CSA action point three). To this end, workshops and study tours are organized. So far, the programme's overall success at building the capacities of national institutions to mainstream CA and climate change activities has been limited. However, the programme has reportedly exceeded its targets for the training on climate-resilient agriculture of farmers and farmers' organizations (mainly through FFS). A set of recommendations on training, awareness raising on climate change adaptation and mitigation, and the mainstreaming of climate change is expected to improve the technical knowledge of the personnel of national institutions and of project staff. These capacity building activities are expected to be continued and strengthened by the upcoming IFAD programme for Talent Retention for Rural Transformation. This programme aims to further strengthen in-country capacities for the promotion of climate-resilient and CA through the development of a national CA curriculum, the creation of scholarships, research, consultations and dissemination of key lessons, with a strong focus on smallholder farmers.

IRECRP improves farmers' access to financial services by giving out small grants for the procurement of climate-resilient agricultural equipment (CSA action point 4). In the context of Moldova, where farming is subject to a gradual process of consolidation and commercialization, the programme has successfully targeted smallholders with a combination of grants and loans, which are relevant to smallholders. In addition, by supporting savings and credit associations and focusing on young entrepreneurs, IRECRP has been able to target the relatively smaller farmers among smallholders.

Outcomes

IRECRP contributes to multiple SDGs. The development goal of the programme is to enable poor rural people to raise their incomes and strengthen their resilience (SDG 1), promote inclusive rural economic development and create employment (SDG 8). The programme promotes CA practices to regenerate soils (SDG 15) and climate-smart irrigation techniques to strengthen farmers' resilience and capacity to adapt to climate-related hazards and natural disasters (SDG13).

Overall, IRECRP has exceeded its targets in terms of the number of beneficiaries reached and the involvement of women. IRECRP has brought more than 26 000 ha of land under climate-resilient practices (CSA action point 5) and helped nearly 9 000 smallholder household members cope with the effects of climate change. At the end of 2019, IRECRP had brought 104 ha of farmland under sustainable irrigation, thereby reducing the vulnerability of the agricultural supply to natural hazards.

IRECRP contributes to the first pillar of CSA i.e. sustainably increasing productivity. Annual impact assessments for IRECRP highlight that the farmers involved in IRECRP reported productivity gains over the years. In 2017/18, 71 percent of the beneficiaries of infrastructure schemes, the majority of whom are young micro-entrepreneurs, reported an increase in overall production. The 2019 annual report on the programme indicates that of the 321 beneficiaries of CA training, 44 percent reported increases in their yields per hectare of up to 10 percent, while 12 percent of beneficiaries reported an increase of 10 to 25 percent. Interviews with beneficiaries confirmed that the adoption of CA technologies had a positive impact on soil humidity levels, which helps farmers maintain acceptable yields during the increasingly frequent droughts. Furthermore, enterprises that had introduced mini-till and strip-till techniques reported increases in yields ranging from 10 to 25 percent following the introduction of CA techniques, depending on the type of crop.

CSA's second pillar is embedded in IRECRP's overall goal, which is to enable poor rural people to raise their incomes and strengthen their resilience. The programme promotes innovation as an answer to climate change, with a dedicated component aimed at promoting the adoption of CSA practices to enhance the adaptive capacity of especially small-scale farmers in locations that are increasingly susceptible to climate shocks. A grant of USD 4.26 million provided by GEF funds more than 65 percent of the programme's component on climate change resilience and inclusive value chain development. The programme has already reached 175 percent of its target beneficiaries and achieved a good geographical spread of interventions across Moldova. As a consequence of the programme's activities, the area under CA in the country is beginning to increase, as farmers are gradually accepting CA techniques as a viable option to deal with climate uncertainty and change. Overall, survey data show that the adoption of CA technologies has led to improvements in comparison with baseline data in terms of both yields and profitability. Farmers who have invested in shelterbelt protection and in the rehabilitation of grasslands, for example, report a positive impact on their productivity.

CSA's third pillar is the reduction of GHG emissions. The promotion of CA in Moldova has directly led to a reduction in the use of fossil fuels and an increase in soil carbon sequestration. Even though there are no instruments under the IRECRP to monitor the effective reduction in GHG emissions resulting from the implementation of the programme in the field, it is clear that the CA activities promoted by the programme have an important mitigation effect.

This case study was submitted by the Environment, Climate, Gender and Social Inclusion (ECG) and the Near East, North Africa, Europe and Central Asia (NEN) Divisions of IFAD. ecgmailbox@ifad.org.

African Region – helping implement and coordinate policies with CSA country profiles

Introduction

CSA aims to achieve food security in a context of changing climatic conditions and a continuous increase in food demand due to population growth. While the concept of CSA is relatively new and still evolving, there already exist many CSA practices that are being used by farmers to address various production challenges. Thus, when drafting CSA policies to support agricultural transformation, it is crucial to take stock of ongoing and promising practices and technologies and consider the context in which they are used.

This case study describes CSA country profiles developed by FAO and CGIAR for the African region. The country profiles provide a link between building the evidence base for CSA (action point 1) and supporting an enabling policy environment (action point 2).[16] They include a snapshot of baseline information, priorities, stakeholders, institutions, financial partners, policy enablers and barriers to adoption in various countries. With the country profiles and related regional synthesis on CSA, FAO and CGIAR aim to advocate the usefulness of the CSA approach and identify entry points for CSA investments at the national, regional and global levels to address challenges to agriculture under changing climatic conditions.

Rationale

Agricultural systems in Africa are largely dependent on rainfall. They are characterized by small land holdings, low input use and low productivity. This situation is exacerbated by factors including declining soil fertility, poor financial services, complex land tenure arrangements, limited infrastructure, underdeveloped markets, demographic pressures and extremely erratic weather and climate conditions.

Several additional constraints further complicate the situation in Africa's Small Island Developing States (SIDS). These constraints include remoteness, susceptibility to natural disasters, vulnerability to external shocks, excessive dependence on international trade and fragile environments. SIDS also face high communication, energy and

[16] The CSA country profiles for the African region which were developed over the past decade with the support of FAO are available on FAO's website at the webpages listed below. An overview of all CSA country profiles is available online at https://ccafs.cgiar.org/resources/publications/csa-country-profiles
Benin: www.fao.org/3/ca1323en/CA1323EN.pdf
Côte d'Ivoire: www.fao.org/3/ca1322en/CA1322EN.pdf
Gambia: www.fao.org/3/CA1673EN/ca1673en.pdf
Nigeria: Yobe state: www.fao.org/3/ca5417en/ca5417en.pdf; Borno state: www.fao.org/3/ca5416en/ca5416en.pdf; Adamawa state: www.fao.org/3/ca5411en/ca5411en.pdf
Cabo Verde: www.fao.org/3/ca5405en/ca5405en.pdf
Guinea-Bissau: www.fao.org/3/ca5406en/ca5406en.pdf
Seychelles: www.fao.org/3/ca5407en/ca5407en.pdf

transportation costs. In addition, they have limited natural resources and opportunities to exploit economies of scale, due to their small size. For all these reasons, the African agriculture sector in general, and that of SIDS in particular, is struggling to meet food and nutrition security needs.

In most African countries, GHG emissions are relatively limited. However, these countries do include mitigation goals in their national development policies in view of their extreme vulnerability to climate change, and to contribute to the implementation of the Paris Agreement. The implementation of adaptation measures has also been identified as a priority in most African countries' NDCs.

The interlinkages between the agriculture sector (including crop and livestock production, forestry and agroforestry, and fisheries) in African countries call for policymakers to explore the synergies between actions at the national, subregional and regional levels.

Coordinated policies may provide an effective way to address these multiple challenges. To formulate comprehensive and effective policies, policymakers need an overview of relevant climate challenges and solutions, as well as of the factors that influence or hinder the adoption of CSA practices and technologies. Together with CGIAR, FAO has over the past five years been working to help countries develop CSA profiles, with a view to providing essential baseline information for the development of integrated climate change adaptation and mitigation programmes and projects.

Description

To support countries in their efforts to transform agriculture in a context of climate change, FAO's Regional Office for Africa partnered with various GCIAR programmes and research centres (including CCAFS, the International Crops Research Institute for the Semi-Arid Tropics [ICRISAT] and CIAT) to develop CSA country profiles; these profiles provide an important contribution to the implementation of evidence-based climate actions.

The content of the country profiles is organized in various sections, including:

- description of the economic and social (demography, gender) context;
- land use and agricultural production systems;
- food security and nutrition;
- GHG emissions from agriculture;
- climate change's current and projected impacts due to changes in temperature and precipitation;
- an inventory of adapted CSA technologies; and
- the institutional, financial and policy framework.

The objective of the profiles is to provide an evidence base for decisions as to which actions to undertake. CSA technologies and practices that are already being used are assessed for their compliance with CSA principles, based on the three CSA pillars (productivity, adaptation and mitigation).

The CSA country profiles analyse the links between the evidence found, and gaps and opportunities in policymaking. Recognizing that there is no one-size-fits-all policy solution, the profiles present policy instruments related to climate change, agriculture and sustainability grouped under three main stages (formulation, formalization and active implementation).

As far as the strengthening of national institutions is concerned, the country profiles identify institutions that undertake key CSA-related activities and highlight opportunities to strengthen local institutions.

Most of the countries for which CSA profiles have been developed do not currently earmark funding specifically for CSA. The profiles therefore provide an overview of the countries' history of funding and financing efforts related to agriculture and environmental sustainability that contribute to the achievement of CSA; they also identify potential sources of funding and financing for CSA actions. In addition, the profiles highlight links between climate funding and financing and public and private agricultural investments.

CSA country profiles contribute to some major outputs of the FAO's Country Programming Framework (CPF) for Cabo Verde, Guinea-Bissau and Seychelles. In Cabo Verde, the CPF output targeted is the promotion of profit-oriented farming and ranching systems that implement environmentally friendly practices and help reduce poverty. In Guinea-Bissau, the CPF output targeted is the building of more efficient and inclusive crop, livestock and fish value chains, considering market opportunities and access. In Seychelles, the targeted CPF output is the creation of conducive and enabling policies and regulatory frameworks that create business opportunities that link tourism and agriculture.

Outcomes

The development by FAO and its partners of CSA profiles for countries in Africa has generated knowledge that is used to develop evidence-based interventions and CSA investment plans at national and regional levels. Thanks to this knowledge, the capacities of local institutions and of farmers to implement projects in the field have been enhanced.

At the country level, CSA country profiles have helped the Governments of Benin and Côte d'Ivoire formulate CSA action plans; Cote d'Ivoire also developed a CSA investment plan, with support from the World Bank. At the regional level, CSA country profiles contributed to the development of a CSA regional outlook for three of Africa's SIDS. The CSA profile for Ghana was instrumental in the development of a local (district-level) CSA investment plan and the formation of a CSA alliance comprising local organizations working on CSA in the country.

Several projects at field level that focus on the priorities of local farmers are currently being implemented. In Côte d'Ivoire, there is a project that aims to improve the production of rice and bioenergy, while in Ghana, there is an agroforestry project that focuses on cocoa. Meanwhile, FFS in Cabo Verde demonstrate CSA practices to local farmers.

The country profile for Benin has contributed to the development of a national CSA project proposal that is to be submitted to the GCF or other climate funds; this proposal focuses on the implementation of adaptation measures.

In Nigeria, the development of CSA profiles for the states of Adamawa, Borno and Yobe in the north-eastern region of the country has resulted in the establishment of a platform for dialogue on CSA policymaking that operates at the level of the state in each of the three states; these platforms bring together academics, policymakers and representatives of farmers' organizations and of NGOs working on CSA. The CSA profiles for the states of Adamawa, Borno and Yobe have led to the preparation of a joint proposal for an adaptation project focusing on the implementation of CSA best practices and technologies; the proposal is to be submitted to the GEF or the Adaptation Fund.

The initiatives that are currently being prepared or implemented in Benin, Cote d'Ivoire, Gambia and Nigeria demonstrate that country profiles provide useful baseline information that can support the development of projects and programmes related to climate change.

At the regional level, a synthesis report is currently being developed for three African SIDS (Cabo Verde, Guinea-Bissau and Seychelles) and for the Sahel (Burkina Faso, Chad, Mali and Niger). This report aims at identifying common and country-specific needs and priorities for CSA investments.

In the immediate future, projects may prioritize the development of profiles for the remaining African SIDS, as well as for landlocked countries such as Burundi, Central African Republic, Comoros, Lesotho, Mauritius, Rwanda, Sao Tome and Principe, South Sudan, Sudan and Zambia – depending on the availability of funding.

Outcomes in African SIDS

The CSA country profiles for Cabo Verde, Guinea-Bissau and Seychelles have provided a solid evidence basis for effective policy- and decision-making for development.

In Seychelles, for example, the CSA profile contributed to the formulation of a number of policies for the agriculture sector, including:

- a land reform policy, with guidelines and measures for more efficient and strategic land use and appropriation;
- a policy to facilitate access to financing for farmers and producers of agro-forestry products, aimed at promoting land improvement and ensuring the efficiency of agricultural production and transformation/processing systems; and
- the launch of a study to evaluate the potential of agro-tourism in the country and formulate legal and economic guidelines to promote this sector.

In Cabo Verde, the CSA profile allowed a better understanding of the role of water availability and use as key constraints to the adoption of most promising CSA technologies; this understanding led to an ongoing debate on effective policy decisions regarding water use that promote the adoption of promising CSA technologies.

The CSA profile for Guinea-Bissau highlights the country's heavy dependence on food imports and the high cost of food on the islands. These highlights have led to the adoption of policy measures aimed at substituting imports. Efforts to develop CSA capacities in the country include a recent study tour to the CSA training centre in Lokossa, Benin, where 11 young farmers and technicians from Guinea-Bissau received training over a period of 17 days. The trainees returned to their country with take-home projects that they had enthusiastically formulated during their training, and that are expected to contribute towards the country's campaign for import substitution.

This case study was submitted by Albert Nikiema (climate change officer), Atse Yapi (consultant on natural resources and climate change) and Fauziatu Ahmed (consultant on climate-smart agriculture) at the FAO Regional Office for Africa and Aminu Zakari (programme officer for climate change and energy) at FAO's sub-office in Maiduguri, Borno State, Nigeria. fao-raf@fao.org.

ACTION POINT 3 – STRENGTHENING NATIONAL AND LOCAL INSTITUTIONS

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Introduction to strengthening national and local institutions

Action point 3 of implementing CSA is strengthening national and local institutions. This introduction to action point 3 draws on FAO's CSA Sourcebook (FAO, 2021a).[17]

Efforts to strengthen national and local institutions ideally adopt a capacity development approach that involves:

- assessing system-wide capacities;
- designing contextualized and targeted capacity development interventions; and
- monitoring and documenting progress and results, in collaboration with stakeholders.

Institutions that implement CSA policies and practices may include governmental, informal, non-governmental and donor organizations. These actors are ideally mapped under action point 1 (building the evidence base). Under action point 3, national and local institutions may be strengthened, and potential capacity gaps may be addressed.

Capable national and local institutions play a very important role in supporting and empowering farmers to implement CSA practices. They also allow policymakers at the national and local levels to share knowledge and engage effectively in discussions and negotiations, including international discussions on climate change and agriculture.

Strengthening institutions in an integrated and inclusive manner benefits from the adoption of a capacity building approach. Such an approach allows institutions to best support the creation of an enabling environment for CSA. A wide range of institutions and actors may benefit from capacity building, including *inter alia* national governments, financial institutions, land tenure institutions, customary law institutions, community-based organizations, insurance providers and information and extension service providers. The wide range of potential beneficiaries of capacity building efforts demonstrates the importance of an inclusive process in which stakeholders across all sectors are involved.[18]

Ensuring that institutions have the necessary capacities to support the implementation of CSA helps maximize the impacts of investments towards evidence building and policymaking. Strong institutions can in turn contribute to efforts to update the evidence base and modify policies, when necessary. Local institutions in particular can improve understanding of site-specific circumstances and may therefore play a particularly valuable role in the process of implementing CSA.

The three case studies presented this chapter provide examples of how capacity building approaches are applied to strengthen institutions implementing CSA in various countries, and how the results of these processes contribute to the other CSA action points.

[17] For a more detailed description of action point 3, see section C1 of FAO's CSA sourcebook, available online at www.fao.org/climate-smart-agriculture-sourcebook/enabling-frameworks/module-c1-capacity-development/c1-overview.

[18] For more information on stakeholder engagement in CSA implementation, see module A1-2 of FAO's CSA sourcebook, available at www.fao.org/climate-smart-agriculture-sourcebook/concept/module-a1-introducing-csa/chapter-a1-2.

Cambodia and Mongolia – strengthening capacities in the agriculture, forestry and other land use sectors to improve the monitoring of and reporting on progress towards NDCs

Introduction

The Paris Agreement, which encourages countries to report on climate change mitigation and adaptation action under their NDCs, provides a useful basis for countries to plan, scale up and monitor CSA programmes. Like many developing countries, Cambodia and Mongolia acknowledge the importance of the agriculture sector for economic development, as well as the risks posed by climate change to the sector. Thus, both countries have included priority actions for climate change adaptation and mitigation in the agriculture and other land use sectors in their NDCs.

The parties to the UNFCCC have established, under Article 13 of the Paris Agreement, an Enhanced Transparency Framework (ETF) to build confidence that developed and developing countries alike are making progress towards the priorities outlined in their NDCs. To meet the requirements of the ETF to monitor and report on programmes of action, particularly in the agriculture sector, many countries require improved institutional and technical capacities to collect, analyse and report data in a transparent manner. To address these capacity needs, the Capacity Building Initiative for Transparency (CBIT) was established under the Paris Agreement, with the support of the GEF. With help from FAO, the Governments of Cambodia and Mongolia are working with CBIT to strengthen their capacities to measure, report and verify adaptation and mitigation actions in the agriculture, forestry and other land use (AFOLU) sectors from 2019 to 2022.

Rationale

Mongolia's landscapes range from mountains and forest steppe to pastureland steppe and desert regions. The country's climate is increasingly characterized by temperature and precipitation extremes. Annual mean temperatures range from -8 °C to +6 °C, while annual precipitation varies from 50 mm in the Gobi Desert to 400 mm in the northern mountainous areas. Mongolia is highly dependent on its agriculture and other land use sectors, which together contribute more than 18 percent to national GDP and employ around 40 percent of the labour force. Within the AFOLU sectors, the livestock sector dominates, accounting for 84.9 percent of total agricultural production. Observed climate trends include increased average temperatures, changes in precipitation patterns and an increased frequency of extremes, such as the combination of droughts and harsh winters (dzud). These trends pose significant risks to rural livelihoods.

While Cambodia's geographical and climatic features differ from those of Mongolia, the agriculture sectors in both countries face similar challenges. Cambodia's location in the Mekong river basin and its tropical climate provide the basis for a range of livelihoods in forestry, fisheries and crop and livestock production. In 2015, the agriculture sector accounted for 28.7 percent of the country's GDP and employed almost 45.3 percent of its labour force (Cambodia, Ministry of Environment, 2015). By 2018, the contribution of the agriculture sector to GDP had decreased to 23.5 percent, and the sector employed 37 percent of the total workforce (Cambodia, 2019). This decrease is linked to rural-urban dynamics and cross-border migration. Due to Cambodia's reliance on rain-fed agriculture and its relatively low adaptive capacity to changing rainfall patterns, droughts, floods and pests, the country's agriculture sector is highly vulnerable to climate change.

The contributions of both Cambodia and Mongolia to global GHG emissions are comparatively small. However, the agriculture sector accounts for a large share of these emissions in both countries due to its relative importance in the overall economy. Agriculture accounts for 48.5 percent of overall GHG emissions in Mongolia (Mongolia, Ministry of Environment and Tourism, 2018), and 41 percent in Cambodia (Cambodia, Ministry of Environment, 2015). Both countries have therefore focused on the AFOLU sectors as a priority area in their NDCs. However, their capacity to monitor and report on climate change programmes in these sectors is still weak. Self-assessments of national capacities carried out by the countries highlight institutional gaps (such as the absence of platforms to coordinate the collection of data or of harmonized systems for sector-specific reporting), as well as technical gaps (related to systems to measure, report and verify, and GHG inventories). CBIT projects help the countries address these gaps, particularly in the AFOLU sectors.

Description

CBIT projects in the AFOLU sectors in both Cambodia and Mongolia aim at building the countries' capacities to assess and report on mitigation and adaptation activities. They do this by strengthening institutional arrangements for ETF reporting and addressing technical needs. The projects address three of the key action points for CSA implementation, including:

Strengthening national and local institutions: CBIT AFOLU projects aim to improve national capacities to respond to climate change under the requirements of the ETF. Under the overall coordination of a national focal point, the projects work closely with key government institutions to strengthen capacities at the technical and policy levels. The national focal points engage with other sectors that are crucial to the achievement of NDC targets and provide them with information on good practices.

Expanding the evidence base: CBIT AFOLU projects work to improve systems for the monitoring of GHG emissions and of adaptation and mitigation actions, and thus help strengthen the evidence base for CSA. These efforts support policymakers in the formulation of national priority action plans based on reliable data on emissions and on progress towards adaptation and mitigation. The projects assist countries with the identification of emission sources and sinks and the quantification of the emission reduction potential of the AFOLU sector. Under the projects, national stakeholders participate in training sessions and workshops (on- and offline) where they learn to adopt appropriate tools and methodologies for emission tracking (e.g. the Collect Earth tool). CBIT AFOLU projects provide quality control protocols (aligned with guidelines of the Intergovernmental Panel on Climate Change [IPCC]) in project implementation. Efforts towards climate adaptation involve the preparation of assessments to identify suitable methodologies and frameworks, as well as the development of parameters, indicators and quality control tools to track progress towards adaptation in the AFOLU sector.

Supporting enabling policy frameworks: CBIT projects help countries evaluate and improve existing policy priorities and targets for climate action in national climate policies, and particularly in NDCs. CBIT projects provide platforms where technical ministries can coordinate and organize interministerial consultations to discuss and reach agreements on issues related to national management plans and strategies. National governments receive help with the evaluation of regulations, laws, protocols or acts that are needed to reach NDC targets and comply with ETF requirements.

Outcomes

Mongolia

The CBIT AFOLU project in Mongolia helps the national government prepare for the ETF process by organizing forums, meetings and training sessions to strengthen capacities of national stakeholders and improve institutional arrangements. A national measure, report and verify network is being established under the project, under the Ministry of Environment and Tourism. This network will engage with key ministries (e.g. the Ministry of Food, Agriculture and Light Industry and other sectoral ministries) and prepare measure, report and verify protocols for ETF reports and NDC updates, to promote coordination among institutions. As part of the current NDC updating process, the CBIT AFOLU project supported the organization of a national-level forum in November 2019 on NDC in which key government agencies, as well as representatives of the private sector, international organizations and civil societies participated.

One of the planned actions of the CBIT project in Mongolia is to help strengthen measurement protocols for mitigation actions in the AFOLU sector in the country. In partnership with the Agency for Land Administration, Management, Geodesy and Cartography, training sessions have been organized to introduce the Collect Earth tool. Based on this tool, an assessment of land use, land use change and forestry from 1990 to 2019 was carried out. The results of this assessment will help the country prepare its second biennial update report and fourth national communication to the UNFCCC.

Under the CBIT project, officials from the national government and from provincial authorities and other stakeholders received training on the 2006 guidelines of the IPCC , on ETF modalities, procedures and guidance, and on the updating of statistical surveys. In addition, the Climate Change Project Implementation Unit (the Mongolian entity responsible for ETF) received assistance from the project to develop an assessment of peatland changes over the period from 1970 to 2018. The unit is also developing a monitoring and reporting framework for adaptation in the AFOLU sector, and formulating quality assurance and control protocols for data and information to improve reporting on adaptation in the AFOLU sector. Furthermore, a national framework for climate change monitoring and evaluation is being developed under the CBIT project; this framework is consistent with ETF modalities, procedures and guidance for tracking progress towards climate change priorities in the AFOLU sector.

Cambodia

In Cambodia, the CBIT project is at an earlier stage of implementation, but progress is being made. The Cambodian National Council for Sustainable Development, the Ministry of Agriculture, Forestry and Fisheries and the Ministry of Environment are working together under the CBIT project to identify capacity needs for ETF reporting and for the collection of information to update NDC priorities for the agriculture sector. The CBIT project actively supported the preparation of the country's NDC update in 2020 by providing data and analysis to evaluate and prioritize past and potential new priority actions for adaptation and mitigation in the AFOLU sectors. The project provided technical support to the Ministry of Agriculture, Forestry and Fisheries through an interministerial consultation process.

In addition, the CBIT project is supporting further coordination and discussions between relevant national partners to identify policy framework needs, information and capacity gaps for ETF reporting, and appropriate tools and methodologies to improve data collection, quality control and reporting on GHG emissions and their reduction or removal. A detailed programme of technical support to strengthen systems and tools for monitoring and tracking mitigation and adaptation activities is under development.

The project is continuously exploring possibilities to build synergies between initiatives implemented in collaboration with FAO and other relevant partners. These efforts aim to fill information and data gaps and thus help the Government of Cambodia meet its reporting commitments towards its NDC, as well as localized SDGs.

This case study was submitted by Lina Jihadah (junior professional officer) and Beau Damen (natural resources officer) of the FAO Regional Office for Asia and the Pacific, Tuya Tserenbataa (project manager) and Saruul Dolgorsuren (project specialist) of FAO Mongolia, and Chansopheak Ann (operations coordinator – forestry programme) of FAO Cambodia. FAO-RAP@fao.org.

Ghana – developing training capacity for climate-smart agriculture in cocoa

Introduction

Ghana is one of the world's largest producers of cocoa, and over 4 million farming households rely on the crop as their main source of income (Lowe, 2017). Besides providing employment, the production of cocoa brings many other economic benefits for Ghana. The impact of climate change on cocoa production therefore constitutes a real threat to the country's economy. Indeed, climate change and climate variability are already having a significant impact on smallholder farming in the Ghanaian cocoa belt. New measures that can address those impacts need to be defined, and cocoa farmers should adopt site-specific climate-smart practices that can be implemented quickly and effectively. Scaling up CSA efforts requires engaging with multiple actors to understand how climate change is expected to impact specific sites and develop according responses.

From 2015 until 2019, the Rainforest Alliance implemented a project to promote the adoption of CSA practices by cocoa farmers in the world's leading producer countries, including Ghana. The project was implemented in collaboration with CIAT, Root Capital and the Sustainable Food Lab, and funded by CCAFS.

Rationale

The overall goal of the project was to build a foundation for the scaling up of pathways to create more resilient agro-ecosystems and livelihoods by enabling farmers to produce more cocoa while adapting to and minimizing the impact of climate change and reducing GHG emissions.

Together with the harvesting of timber, the production of cocoa plays a crucial role in Ghana's national economy and forms the basis for the livelihoods of millions of smallholder farmers. However, these activities continue to drive deforestation and land degradation, which add to the threats created by climate change. With demand for both timber and cocoa on the rise, climate-smart landscape approaches (e.g. agroforestry) are needed to secure the future of Ghana's forests, improve livelihood opportunities for farmers and forest users, and secure long-term resource security for the private sector. The promotion of such approaches requires the creation of a results-based, multi-actor governance model through which the government, the private sector, civil society and local communities can collaborate and establish a business case for private sector investment. Interventions to date have demonstrated which approaches and tools are effective at increasing farm productivity, making agriculture and forest production systems more resilient, and reaping opportunities that generate significant and lasting biodiversity, socio-economic and institutional benefits. However, these approaches and tools need to be developed further and adopted across landscapes to achieve results at a wide scale and promote self-governance.

Description

The project focused on mainstreaming CSA practices in cocoa-based farming systems, through applied climate science, certified supply chains and impact investing. Using existing value chain interventions, the project translated climate science into actionable strategies for farmers and supporting actors, including processors, certifiers and investors. This novel approach added value to existing efforts. By improving the knowledge and capacities of actors and institutions in the cocoa supply chain, the project aimed at promoting the adoption of locally relevant CSA practices at a wide scale.

In Ghana, the project first assessed the climate change exposure of cocoa systems at a subnational scale. It then developed appropriate CSA practices with farmers, incorporating additional cash and other food crops to increase the resilience of cocoa systems more broadly (economically and biophysically), and codified these practices into adaptation guidelines. These guidelines have since been mainstreamed through the Rainforest Alliance's existing certification training curriculum; they are currently being used to evaluate the potential of innovative impact investment products to further the adoption of selected adaptation strategies. The results of the project were shared with government officials and industry leaders and publicized on platforms such as the World Cocoa Foundation to strengthen the capacities of institutions and stakeholders and promote the implementation of the findings at a wide scale.

By engaging with national and subnational stakeholders, the project has built a dynamic partnership that allows public and private actors to engage in a constructive dialogue and discuss the promotion of inclusive climate change adaptation strategies. As a result of the project, the potential impacts of climate change on cocoa cropping systems in Ghana, segmented by degree of climate exposure, have been identified; these impacts are now being considered in national planning and policy development. The project has taught the partners how to use scientific climate data to promote sustainable and profitable business and livelihood decision-making in the face of climate change and variability. It has furthered systemic adaption that is inclusive of the rural poor (and particularly of the most vulnerable among them) and viable over the medium to long term.

Outcomes

Under the project, the Rainforest Alliance and its partners created, in collaboration with the World Cocoa Foundation, science-based training materials focusing on the climate risks faced in specific cocoa-growing regions. The Rainforest Alliance has already begun using these materials in and around five natural reserves in Ghana's Sui River landscape, a major cocoa-growing area in the Western Region.[19] The new climate-smart manuals are being used by lead farmers in the Sui River landscape, which helps them prioritize and tailor CSA practices to their particular locations. The new materials are freely available online, which makes them potent tools to scale up transformation in cocoa-growing landscapes around the world.[20] The World Cocoa Foundation is also divulging the manuals amongst its member companies.

The training materials enable farmers and other actors in the cocoa supply chain (including trainers) to make informed decisions about how to build resilience at farm level. The materials are not prescriptive, but allow for individual choices and different investment capacities. For example, the Hershey Company has, in collaboration with Farmerline, turned the materials into a smart phone application called CocoaLink; farmers can use this application to access CSA training materials based on an interactive risk map.[21] By offering interactive contents in a variety of digital media (including videos, pictures and interactive quizzes), the application is aimed at training and incentivizing the next generation of Ghanaian cocoa farmers.

In March 2017, the Ghanaian Government and dozens of cocoa companies adhered to the Cocoa and Forests Initiative, which aims to end deforestation in the cocoa supply chain. Conserving forests is part and parcel of building climate resilience, as forests not only absorb the emissions that contribute to climate change but also provide crucial ecosystem services. The Cocoa and Forests Initiative provides a framework for action that strongly relies on CSA;

[19] For more information, see www.rainforest-alliance.org/article/new-tools-for-climate-smart-cocoa-farming-ghana.
[20] To consult the training materials, see https://stichtingra.resourcespace.com/?r=1969&k=28a230f501.
[21] Farmerline is between Ghanaian enterprise that develops innovative ICT solutions (web and mobile applications) to help smallholder farmers increase their yields and income. For more information on Cocoalink, see Farmerline's website at https://farmerline.co/cocoalink.

this constitutes an excellent foundation for the use of the new materials and climate risk profiles developed under the project.

To promote the adoption of CSA practices at a wide scale, the Rainforest Alliance has continued organizing national and local workshops on climate-smart cocoa farming for lead farmers, licensed buying companies and technical officers from national entities such as the Ghana Cocoa Board, the Ministry of Foreign Affairs and Regional Integration, and the Forestry Commission.

The project outputs are summarized in a policy brief that lays out the economic implications of non-action on climate challenges.[22] The outputs have paved the way for the materials developed under the project to be considered as part of the national cocoa training curriculum. The Forest Investment Program is providing funding to help revise and update the training guides.

The Sector Partnership Program of the Rainforest Alliance (funded by the Dutch Government) has provided funding to replicate the approach applied in Ghana, in Cote d'Ivoire; this has led to the development of guidelines and the provision of training tailored to the local context in that country. These efforts have been complemented by the development of a publicly accessible online climate-smart cocoa guide that helps interested stakeholders understand the risks posed by climate change to global cocoa production and develop appropriate CSA strategies to address these risks. To consult the guide, visit https://climatesmartcocoa.guide.

This case study was submitted by Martin Noponen, Director, Environment at the Rainforest Alliance. info@ra.org.

[22] The policy brief is available online at https://cgspace.cgiar.org/handle/10568/97167.

Botswana - integrating traditional practices for CSA into crop and livestock production systems

Introduction

Several studies provide evidence that semi-arid Botswana is being increasingly affected by unpredictable weather connected to climate change (Nkemelang, New and Zaroug, 2018). Climate change impacts are likely to be severe for smallholder farmers whose livelihoods depend largely on natural resources (Batisani and Yarnal, 2010; Batisani, 2012). The agriculture sector is particularly vulnerable to current and future climate risks because of the low adaptive capacity of farming communities. Indeed, a lack of education and technical skills, poverty and insufficient access to assets and capital affect farmers' ability to recover from shocks or build alternative livelihoods. Even where research institutes have developed CSA technologies and practices, farmers are minimally, if at all, involved in this development. Yet, it is crucial to involve farmers and consider indigenous knowledge in the development of climate-smart technologies and the design of resilient farming systems if the country is to attain food security in the face of climate change.

Farmers in Botswana possess traditional knowledge and are implementing CSA practices that could be scaled up by raising awareness and strengthening the capacities of national and local institutions. Due to the lack of institutional capacity, successful CSA implementation currently remains limited to isolated cases. Institution capacity building would enable these practices to be universalized. This is what the project Integrating Traditional Practices for CSA into Crop and Livestock Production Systems aims to do. The project is coordinated by FAO in close collaboration with the Ministry of Agricultural Development and Food Security of Botswana, and funded by the Government of Italy. The project brings together researchers from the Botswana University of Agriculture and Natural Resources, farmers and extension workers to develop resilient farming systems. Institutional capacities are further strengthened by training trainers (i.e. extension officers) on CSA and resilient farming systems. These extension officers then provide training to farmers on CSA practices, under the supervision of university staff.

Rationale

Agriculture is a major pillar for Botswana's drive towards economic diversification and sustainable development. Indeed, while mineral mining currently accounts for the bulk of the country's GDP, agriculture contributes to the livelihoods of the majority of Botswanans and is the basis for economic sustenance in rural communities. The adoption of CSA practices would allow farmers to produce decent harvests even as climate change results in a reduction in rainfall and increased heat waves.

Botswana is an arid country, and only 5 to 6 percent of its arable land is deemed suitable for agriculture. Nevertheless, over half of the country's population is based in rural areas and is dependent on rain-fed agriculture (World Bank, 2008; FAO, 2005). Botswana's agriculture sector includes both livestock and crop farming systems, with farms being divided into small-scale (smallholder) farms and large-scale commercial farms. Livestock production (and especially beef) accounts for over 80 percent of the agriculture sector's contribution to national GDP. About half of the country's population is still dependent on subsistence crop and livestock farming. Botswana currently covers over 75 percent of its cereal food needs with imports (mainly maize and sorghum) (Botswana, 2015). Against this background, the main aims of the project are to help reduce the country's bill for agricultural imports and boost food and nutrition security, particularly in rural communities.

It is crucial to improve the capacities of local institutions and tailor CSA implementation to local contexts. The involvement of university staff and the training of extension officers and farmers addresses this need.

Description

The overall goal of the project is to develop resilient farming systems across the various agroecological zones of Botswana. Although drought is a reoccurring phenomenon in the country and communities have developed coping mechanisms over time, local institutions (extension service providers and universities) are still insufficiently conversant with CSA and its technologies. The project aims to close this gap based on evidence-based field practices. Specific objectives of the project include:

- evaluate current farming systems in three (sub)districts (Gantsi, Boteti and Bobirwa) and identify climate-smart practices within each district;
- identify alternative off-farm livelihood options in the districts;
- identify indigenous knowledge of agricultural practices (ethno-veterinary and ethno-botanical) to cope with the effects of climate change, and identify and recommend climate-smart agricultural practices in collaboration with farmers and extension workers; and
- enhance subregional learning and sharing of experiences. Share the lessons learned from this project (in the form of journal articles and policy briefs), so that regional institutions can also benefit.

Outcomes

The envisioned outcome of the project is the development or strengthening of national institutional and technical capacities to adopt a CSA approach for the sustainable development of crop and livestock production systems.

The project identified a number of CSA options to improve crop and livestock production systems that are based on the combination of indigenous practices and innovative technologies and practices. In addition, the project strengthened capacities for innovative research and for the provision of extension services (e.g. training) to promote the inclusion of both innovative and indigenous CSA practices into crop and livestock production systems. Academic staff who are experts in crop and livestock production and extension but were new to CSA were involved in the project under the guidance of FAO. As such, they improved their knowledge of CSA and passed this knowledge on to their students and peers. Furthermore, case studies of the successful implementation of CSA practices and innovations, as well as of interventions in prioritized value chains, were documented and shared with policymakers and stakeholders as part of the project.

To build institutional capacities, a series of technical workshops were conducted in different agroecological zones, for different value chain actors and policymakers in the agriculture sector. The objective of these workshops was to deepen participants' understanding of CSA approaches and practices, and improve their ability to use CSA in response to climate change. Extension personnel from governmental and non-governmental institutions were trained in innovative extension and advisory approaches considered compatible with CSA practices. In addition, workshops with technical experts were held to develop technical CSA materials, based on consultations with crop and livestock farming communities and other value chain actors. The materials developed include guidelines on CSA practices that integrate indigenous practices, as well as CSA manuals for extension service providers and farmers. Field visits were made to test the guidelines and manuals with crop and livestock farmers in the different agroecological zones. These field visits focused specifically on non-governmental actors, women and young farmers.

The project is currently organizing a national workshop with policymakers and other stakeholders to share and validate the results of the testing of the materials, and thus secure buy-in from these stakeholders and promote the wider use of the materials. A policy brief will be developed as a key output of the testing and validation processes.

In conclusion, the project has demonstrated the importance of institutionalization as a foundation for the design of CSA practices and technologies that are relevant in local contexts.

This case study was submitted by Nnyaladzi Batisani (consultant) and Federica Matteoli (natural resources officer) of FAO.

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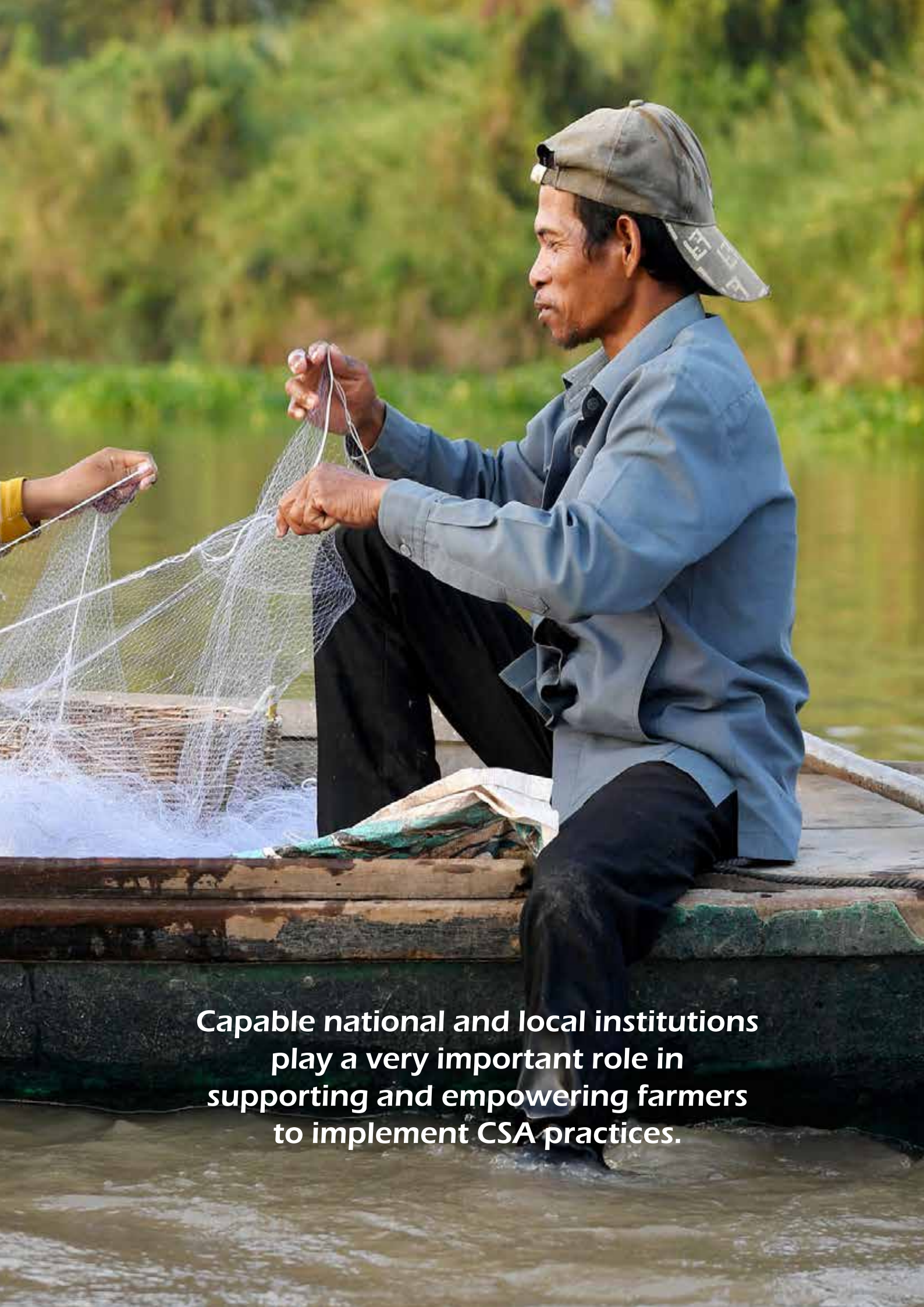

Capable national and local institutions play a very important role in supporting and empowering farmers to implement CSA practices.

ACTION POINT 4 – ENHANCING FUNDING AND FINANCING OPTIONS

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Introduction to enhancing funding and financing options

Action point 4 of implementing CSA is enhancing funding and financing options. This introduction to action point 4 draws on FAO's CSA Sourcebook (FAO, 2021a).[23]

Efforts to enhance funding and financing options for CSA may include:

- improving access to domestic and international funding and financing instruments (including the GCF, the GEF, ODA and national sectoral budgets) and ensuring that more public and private money becomes available for CSA;
- linking climate funds and financing to public and private agricultural investments in innovative ways; and
- integrating climate change considerations and CSA in agricultural strategies, plans and budgets, as well as in rural development programmes and projects.

Intergovernmental, governmental and private sector entities provide financial resources for the development and implementation of CSA policies and strategies. Climate funding and financing increasingly includes windows for agricultural investments. Links between climate and agriculture funding and financing are important. Strong monitoring and evaluation is required for adequate reporting on the benefits of adaptation and mitigation efforts.

The existence of a strong evidence base, a national strategic CSA framework and capable institutions can help countries take advantage of intergovernmental funding mechanisms such as the GCF and the GEF. To enhance access to such resources, it is also crucial to mainstream CSA in frameworks such as (I)NDCs, NAMAs, NAIPs, NAPs, NAPAs and REDD+ strategies and action plans. Finally, climate change issues may be integrated into sectoral planning and budgeting.

Importantly, government investment in CSA may serve as a catalyst for private sector investment; it may thus lead to the wider scaling up of CSA practices and therefore to greater and sustainable agricultural productivity, increased resilience and capability to adapt to climate change, and the reduction and/or removal of GHG emissions.

The three case studies in this chapter illustrate various aspects of CSA action point 4, including accessing and leveraging international climate funding and financing for CSA. The case studies highlight interventions at field level (e.g. improving access to financial resources and providing financial incentives to farmers) and illustrate how public-private partnerships can help attract resources for CSA implementation. As such, the studies expand understanding of the scope of this action point.

[23] For a more detailed discussion of action point 4, please consult section C4 of FAO's CSA sourcebook, available online at www.fao.org/climate-smart-agriculture-sourcebook/enabling-frameworks/module-c4-finance/c4-overview.


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Global – the Sustainable Rice Landscape Initiative: attracting funding and financing to scale up sustainable rice production

Introduction

Rice is a key staple crop in many parts of the world and an important commodity in agricultural trade. Rice production systems face a number of sustainability challenges that could be addressed by developing innovative financial mechanisms and promoting collaboration between public and private sector organizations. The 2019 Earth Security Group (ESG) report *Financing sustainable rice for a secure future: innovative finance partnerships for climate mitigation and adaptation* (ESG, 2019) highlights the important role that various funding and financing mechanisms can play in scaling up sustainable rice production.[24] It identifies three blueprints:

- create a digital finance platform for financing to reach smallholder farmers;
- issue a "rice bond" to finance sustainable value chains; and
- leverage international climate finance to attract private sector investment for climate-smart rice production.

One promising vehicle to leverage actions to scale up sustainable rice production are large-scale public-private partnerships. This case study focuses on the Sustainable Rice Landscapes Initiative (SRLI), launched in 2018 by the World Business Council for Sustainable Development (WBCSD), the Sustainable Rice Platform (SRP), FAO, the United Nations Environmental Programme (UNEP), the International Rice Research Institute and the German agency for international cooperation or Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). This collaboration initiative brings together diverse stakeholders to promote sustainable rice production practices, with the overall aim of delivering a range of local and global environmental benefits and contributing towards the achievement of the SDGs. SRLI helps meet the global demand for sustainable rice; its members recognize that this involves transforming rice-based production landscapes through multi-stakeholder action (FAO, 2021a). SRLI aims to attract resources, mainstream best practices and innovative technologies, and connect farmers to markets.

Rationale

The actions foreseen by SRLI are urgently needed. Worldwide, 144 million smallholder farmers produce rice and thus contribute to food security for the 3.5 billion people who consume rice as their main staple food (The Food and Land Use Coalition, 2021). Rice producers are often poor and have limited resources to manage climate and other shocks. Production often caters primarily to local consumption, and thus plays a critical role in meeting food security goals.

[24] This report was produced by the ESG in collaboration with the United Nations Capital Development Fund, the Sustainable Rice Platform (SRP), food and agribusiness company Phoenix, the World Business Council for Sustainable Development (WBCSD) and the Swiss Agency for Development and Cooperation.

Rice production both causes and is affected by climate change. It is estimated that rice production is responsible for 10 percent of global methane emissions (The Food and Land Use Coalition, 2021) and that irrigated rice production accounts for 34 to 43 percent of total global irrigation water use (Global Rice Science Partnership, 2013). At the same time, models suggest that climate change may lead to a decline in rice production of 14 percent in South Asia, 15 percent in sub-Saharan Africa and 10 percent in East Asia and the Pacific between 2000 and 2050 (Nelson *et al.*, 2009). Rising sea water levels present an additional problem in deltaic regions, as they lead to sea water intrusion and thus salinization, which negatively affects rice productivity (Earth Security Group, 2019; World Bank, 2015).

The multiple challenges faced by rice production are exacerbated by its scattered nature. At the same time, however, the rice sector presents opportunities to realize the three pillars of CSA, namely sustainably increasing incomes, adapting to the effects of climate change and mitigating GHG emissions. This potential is recognized in many countries' NDCs, with 48 countries indicating that they aim to invest in climate-smart rice production systems. Regions where rice production may be increased sustainably include South East Asia and West Africa. The ESG report helps countries identify opportunities for funding and financing to meet these goals. SRLI combines actions in the areas of policymaking and planning, the improvement of production practices, the development of market-based instruments and knowledge management. Actions are currently being implemented in South East Asia and South Asia.

Description

SRLI was launched in 2018 during the sixth GEF general assembly meeting in Danang, Viet Nam. In 2019, SRLI partners signed a partner statement of intent (Sustainable Rice Landscapes Consortium, 2019) to signal their commitment to work together towards results at scale. SRLI builds on the work of SRP and seeks to engage diverse stakeholders in efforts to reap the opportunities identified in the ESG report, starting in South Asia and South East Asia. The initiative has adopted a multi-stakeholder approach to reach results at scale. It works to attract funding from international climate funds and facilities. These results may be delivered based on financing given to the consortium, the relevant national governments, or implementation agencies who work with farmers and civil society (WBCSD, undated).

As laid out in the ESG report (ESG, 2019), the definition of a sustainable rice sector relates closely to the three pillars of CSA: "a sustainable rice sector is defined as one that is affordable, improves the livelihoods of rice producers and significantly reduces the environmental impact of rice production."

Outcomes

SRLI is currently collaborating with the national governments of rice-growing countries in South East Asia and South Asia. During a first phase, SRLI focused on working together with the GEF and national governments to develop a series of national programmes on sustainable rice landscapes. GEF projects supported by SRLI or projects with an SRLI-related component are now being developed in nine countries in Asia. Over USD 60 million in GEF resources and roughly USD 800 million in co-financing from the public and private sectors are dedicated to these projects. The projects bring together public and private sector organizations operating at national and regional levels to improve consumers' recognition of sustainable rice, and thus boost its demand. In addition, the projects aim to improve the sustainability of rice production systems by promoting the wide-scale adoption of the SRP Sustainable Rice Standard by farmers, as well as the widespread integration of these standards in corporate procurement guidelines.[25] A number of projects foresee the formation of national SRP chapters to strengthen country ownership of the SRP standards and provide a basis for the scaling up of sustainable rice production practices and products.

SRLI is currently moving into a next phase, focusing on three strategic areas:

- the sharing of lessons learned on sustainable rice production between countries;
- the harnessing of public-private partnerships to raise funds and financing for sustainable rice production; and
- the integration of next-generation knowledge management in rice production systems.

SRLI is considering opportunities to expand its activities into West Africa and Latin America.

[25] For more information on the Sustainable Rice Standard, see http://www.sustainablerice.org/Resources/#srp-standard.

Partnerships for sustainable rice production may contribute to numerous SDGs, as highlighted in the ESG report. In South East Asia, efforts to make rice production more sustainable may have an impact in terms of land tenure security (which is related to SDG 1), access to finance (SDG 8), infrastructure gaps (SDG 9), extreme weather costs and GHG emissions (SDG 13). In West Africa, partnerships for sustainable rice production may impact on food and nutrition security (SDG 2), basic education (SDG 4), water stress (SDG 6), access to electricity (SDG 7) and access to finance (SDG 8).

SRLI's actions have the potential to have an impact under all three pillars of CSA, namely sustainably increasing agricultural productivity and incomes, adapting and building resilience of people and food systems to climate change, and reducing and/or removing GHG emissions, where possible. In addition, SRLI may contribute to the conservation of biodiversity. According to the Sustainable Rice Landscapes Consortium's partner statement of intent, the adoption by smallholders of sustainable, climate-smart best practices may generate the following benefits:

- healthier watersheds and biodiversity protection;
- farm and landscape resilience;
- increased efficiency of water and fertilizer use;
- lower GHG emissions from rice production;
- reduced agrochemical pollution;
- improved farmer health and livelihoods; and
- strengthened consumer markets for sustainably produced rice (Sustainable Rice Landscapes Consortium, 2019).

The ESG report identifies a number of initiatives to bolster opportunities for funding and financing for climate-smart rice production. Each of the three blueprints for the development of initiatives (see the introduction to this section) is accompanied by action recommendations, including:

- convening a digital rice financing task force through SRP;
- demonstrating how partnerships between actors in technology and finance, governments and value chain actors can help smallholders access the financial resources they need to produce according to the SRP standard, through a digital finance pilot;
- integrating SRP performance indicators into the Climate Bonds Initiative's taxonomy for green bonds in agriculture;
- convening a working group that involves banks and agribusinesses to define the parameters of a rice bond;
- creating conditions for a rice bond through a global rice processor, trader, retailer or brand that has off-take agreements with sustainable rice farmers and creating an integrated value chain;
- developing a rice bond to leverage the purchasing power of the World Food Programme;
- to attract private investors, West African countries receiving donor funds for climate-smart rice could consider issuing a sovereign green bond;
- multilateral climate funds could consider supporting national governments in preparing such a sovereign green bond for climate-smart rice investments;
- blended finance funds could be developed jointly by agribusinesses and international donors to increase direct support and financing for smallholder farmers and help mobilize actors in the domestic financial sector;
- agribusinesses and international donors can also collaborate to develop and scale up nature- and landscape-based solutions for sustainable rice production.

This case study was submitted by Victoria Crawford, manager, Investment Partnership Network, WBCSD and Beau Damen, natural resources officer, FAO. FAO-RAP@fao.org.


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Switzerland – piloting a goal-oriented farmer payment system for climate-smart milk production

Introduction

Switzerland's agriculture sector emits 6 million tonnes CO_2eq annually (2018), of which 3.3 million tonnes CO_2eq are produced by cattle, the largest group of which are dairy cattle (Switzerland, Federal Office for the Environment, 2021). Hence, reducing the GHG emissions from dairy production plays a crucial role in the country's overall GHG reduction strategy. The project discussed in this section, the climate-smart dairy farming project (*Klimafreundliche Milch*, literally "climate-friendly milk"), tackles this challenge. It aims at reducing GHG emission intensity (kg CO_2eq per kg of fat- and protein-corrected milk) by 10 percent over the period from 2014/16 to 2020.

The project was created based on a participatory bottom-up approach that involved dairy producers from the start. It includes goal-oriented premium payments by Nestlé per kilogram of milk, based on effectively achieved GHG reductions. Farmers are financially incentivized to implement GHG reduction measures to assure scalability with limited funding.

The project is a public-private partnership between the Swiss Federal Office for Agriculture, milk processor Nestlé and Aaremilch AG, a producer organization. Scientific support is provided by the Bern University of Applied Sciences. The pilot project runs from 2017 to 2021 (an additional phase might follow).

Rationale

Dairy production has been present in Switzerland for centuries and is deeply rooted in Swiss culture. Switzerland's large alpine meadows and small farm structures provide ideal conditions for livestock production on family farms. Agriculture accounted for 12.9 percent of Switzerland's total GHG emissions in 2017, with more than one third of all agricultural emissions caused by dairy cattle, mainly in the form of methane from enteric fermentation (Switzerland, Federal Office for the Environment, 2018).

Switzerland has pledged to cut its total GHG emissions by 20 percent from 1990 to 2020 (Switzerland, Federal Office for the Environment, 2018). Emissions from agriculture are to be cut by one third by 2050 (Switzerland, Federal Office for Agriculture, 2011). Nestlé, the world's largest food and beverage producer and a major milk buyer in Switzerland, aims to achieve zero net GHG emissions by 2050. Together, these ambitions led to the formulation of the climate-smart dairy farming project.

Swiss farmers are economically challenged, as their income is far below the average income of the non-agricultural population. On top of that, climate change threatens biodiversity and even the entire sustainability of agricultural ecosystems in the country.

Multi-stakeholder approaches can effectively contribute to reducing GHG emissions and improving farmers' livelihoods by engaging relevant actors and building on their expertise. The climate-smart dairy farming initiative was therefore developed as a public-private partnership. The funds for research and training were provided by the Swiss Federal Office for Agriculture under its Quality and Sustainability in Agriculture programme, which financially supports innovative agricultural projects for sustainability and quality in the country. Adopting climate-smart practices can in the short run cause a reduction in farmers' incomes as they may have to change their structure, way of working, or invest in new technologies. This is the case, for example, for investments in on-farm biogas plants, which only generate financial benefits in the long term. Even where GHG reduction practices have a positive financial impact for farmers in the short run, they still need a financial motivation to start. Without financial compensation, it is difficult to motivate farmers to spend time to learn and implement new practices before the financial benefits become visible. Once farmers experience the financial benefits of new practices first-hand, these practices can be sustainably implemented in the long run without large payments.

To incentivize farmers to implement climate-smart practices, Nestlé funded goal-oriented premium payments and participation payments under this project. Switzerland is Nestlé's pilot country for GHG reduction in dairy production. Aaremilch receives milk from the 46 pilot farms included in the project. The Bern University of Applied Sciences contributes to the project through scientific support.

Description

Farmers can individually choose from a set of available measures and implement those measures that best suit their situation. The GHG reduction measures covered by the project are:

- increasing the number of lactations per cow, thus reducing the share of non-productive animals in the herd;
- increasing lifetime performance (kilogram of milk per life day);
- feeding manure and slurry into biogas fermenters; and
- increasing coupled dairy-beef production by using double-use breeds and sperm sexing, so that animals can be used for milk and meat production.

Two further measures are under research, namely:

- increasing feed efficiency; and
- using methane-inhibiting feed additives, such as linseed.

Farmers are financially incentivized to implement GHG reduction measures to assure scalability with limited funding. Given the difficult economic situation of many Swiss dairy farmers, financial incentives are crucial to upscale the project and assure its long-term sustainability. Therefore, an innovative payment system was elaborated together with the farmers to motivate farmers to participate and create an impact.

The goal-oriented payments are coupled to effectively achieved GHG reductions and paid directly to dairy farmers by Nestlé, based on the kilograms of milk produced using climate-smart livestock practices. These premium payments motivate farmers to implement climate-smart measures. Farmers' GHG reduction goals are set individually, based on their baseline GHG emissions per kilogram of milk. Farmers who already have low GHG emissions per kilogram of milk need to reduce their emissions by less than farmers with a higher GHG emissions baseline. The goal-oriented premium payments, which are paid per kilogram of milk delivered, favour larger farmers. The project therefore also pays a participation bonus to farmers who attend different trainings sessions and deliver certain farm data; this favours smaller farmers. The participation bonus is the same for all farmers, if they participate in all training sessions.

Outcomes

The 46 pilot farms, which together deliver 7.5 million kg of milk per year to Aaremilch, managed to reduce their GHG emissions significantly. In 2019, 22 million kg of milk were produced using climate-smart livestock practices

on the 147 farms, to test the scalability of the project. So far, the possibilities to scale up the project seem promising. The countrywide implementation of the project would result in a significant reduction of overall GHG emissions from the Swiss agriculture sector within a couple of years, and hence strongly support efforts towards SDG 13 (Take urgent action to combat climate change and its impacts).

The success of the project is the result of farmers' high rate of implementation of the four climate-smart agricultural practices. This high rate can in turn be attributed to the participatory approach that was used to identify and define those practices. Thanks to this participative approach, farmers feel treated fairly and are actively engaged in the project. Capacity development and face-to-face dialogue between farmers, industry representatives and scientists were consistent factors throughout the project, and helped build mutual trust and understanding.

Calculating robust GHG balances based on a limited set of input data (for efficiency reasons) turned out to be challenging. The refinement of the herd-level GHG calculator continues to stimulate the exchange of knowledge between scientists, industry representatives and farmers. The automatization and simplification of the collection of input data is another area that requires further refinement if the project is to be upscaled to a wider level.

The learnings from this project have influenced climate-focused agricultural policymaking in Switzerland. Increasing the number of lactations per cow and improving cows' lifetime performance are now heavily discussed topics; they are considered as potential measures to reduce the GHG emissions from Swiss agriculture. The new Swiss agricultural policy package, planned for 2022, is foreseen to include financial incentives for farmers to increase their cows' number of lactations; this would encourage them to keep older cows. Increasing cows' numbers of lactations over a longer lifespan is only possible if farmers adopt good animal welfare practices.

This case study was submitted by Alexandra Rieder, milk procurement manager, Nestlé Suisse SA and Jan Grenz, lecturer on sustainability, Bern University of Applied Sciences, School of Agricultural, Forest and Food Sciences. For research information, please email rise.hafl@bfh.ch. For press requests only, please email presse@ch.nestle.com.

Egypt – implementing the Sustainable Agriculture Investments and Livelihoods project

Introduction

IFAD's Sustainable Agriculture Investments and Livelihoods (SAIL) project aims to contribute to the reduction of poverty and increase food and nutrition security for poor rural women and men in newly reclaimed lands in Egypt. The project aims to enable small farmers in target areas to improve the profitability of their operations, diversify their livelihoods and increase their incomes. It is expected to contribute to CSA-related outcomes by reducing pressure on land and water resources, enhancing the productivity of natural resources in a sustainable way, and promoting the use of water- and energy-efficient technologies (IFAD, 2015).

SAIL's three pillars are: community and livelihood development, agricultural development and diversification, and rural financial services. This case study focuses on how SAIL helps enhance financing options for CSA in Egypt. The project helps smallholder farmers access capital by providing them with loans through a small and medium enterprise (SME) window and through microloans facilities. These loans allow communities to invest in CSA and diversify their livelihoods (e.g. by investing in livestock production or small off-farm enterprises) and thus improve their resilience. The rural finance component of SAIL complements investments in public infrastructure and training activities under other components and opens up opportunities to link with a broad range of private sector stakeholders.

The project is funded by IFAD and the GEF, with total financing amounting to USD 94.6 million. The project runs between 2015 and 2023 and is implemented by the Egyptian Ministry of Agriculture and Land Reclamation.

Rationale

Egypt's agricultural natural resources, including water, are increasingly exposed to climate variability and growing human pressures. Future climate change will likely exacerbate this problem and have significant impacts on *inter alia* hydraulic and agricultural ecosystems, as well as crucial socio-economic sectors – namely water, agriculture and health. The poorest people in rural areas are those that are most vulnerable to climate change; they are likely to be significantly affected by these evolutions. A sea level rise would reduce the area under cultivation in the Nile Delta and is likely to reduce agricultural production. The projected increase in temperature is expected to widen the gap between water availability and demands, and thus decrease overall agricultural productivity and increase competition over natural resources. Indeed, projected temperature rises in Egypt under climate change conditions are likely to increase crop water requirements, and thus directly decrease crop water use efficiency. Projections show significant reductions in the yields of wheat (down 11 to 12 percent), rice (down 26 to 47 percent) and maize

(down 40 to 47 percent) from 2012 until 2040. These changes in crop productivity are mainly attributed to the projected temperature increase, which affects grain filling periods and has detrimental effects on grain development stages, thereby reducing grain yield and quality (Egyptian Environmental Affairs Agency, 2016).

In rural areas, financial services not only fail to reach the poor, but the provision of services is usually also hampered by the lack of appropriate loan products. Traditional loan products were not designed to reflect the particular characteristics of agricultural lending and are often unable to resolve constraints along agricultural value chains. Prior to SAIL, there were no special loan products for settlers on newly reclaimed lands or for young entrepreneurs. SAIL is scaling up the successful experience of the West Noubaria Rural Development Project, which gave farmers access to credit for the introduction of efficient irrigation systems. Most of the credit provided under SAIL is used to increase the efficiency of water use and make the distribution of water more equitable, thus enhancing farmers' adaptive capacity to climate change-induced water scarcity. SAIL credit also supports investments by groups of farmers in solar-powered water pumps, solar panels for lighting and biogas units.

Description

The SAIL project aims to enable smallholder farmers to improve profitability, diversify their livelihoods and increase their incomes. With USD 7.8 million from the GEF Special Climate Change Fund and USD 5 million from IFAD's Adaptation for Smallholder Agriculture Programme, the project aims at contributing to climate change adaptation and mitigation as well as poverty reduction and food security objectives in the face of the predicted negative impacts of climate change on crop and livestock production in Egypt. The project aims *inter alia* at increasing the climate resilience of crop and livestock value chains in reclaimed lands by promoting the adoption of efficient irrigation technologies that build adaptive capacities towards climate-induced water scarcity.

SAIL consists of three main components:

- community and livelihood development;
- agricultural development and diversification; and
- rural financial services.

The project is a good illustration of how the five action points of CSA are interrelated. Its main interventions were formulated based on information from studies undertaken prior to execution (CSA action point 1). For example, a detailed technical study was completed on the lining of third-level canals or *mesqas*, an adaptation action to climate change. This study identified the most sustainable materials to be used as lining in view of the area's conditions.

SAIL is carried out in close collaboration with the Egyptian Government (CSA action point 2) and includes capacity building activities (CSA action point 3). In March 2019, for example, representatives of the SAIL project presented, on behalf of Egypt, the project's recommendations for climate change adaptation in the agriculture sector in the region at the ministerial meeting of the League of Arab States. Furthermore, the SAIL project has held 17 training sessions for representatives from government and civil society institutions on climate change downscaling methodologies to analyse climate change impacts and adaptation needs in agriculture and irrigation.

The project's credit component (CSA action point 4) creates two windows for loans for investments: SME lending and microloan facilities. The project aims to enhance access to capital for smallholder farmers. To this end, it provides credit funds that allow the government to disburse loans, as well as institutional support for the provision of innovative financial services. The credit line is currently channeled through the Egyptian Agricultural Development Programme and the Micro, Small and Medium Enterprises Development Agency.

In addition, the project promotes the adoption of energy-efficient technologies (CSA action point 5).

Outcomes

SAIL is effectively contributing to several SDGs. Its overall goals are to contribute to the reduction of poverty (SDG 1) and increase food and nutrition security (SDG 2) for poor rural women and men in Egypt. The project introduces a number of innovative technologies that improve the efficiency of irrigation systems and provide alternative sources of energy that can reduce the high costs in the agriculture sector and help smallholders adapt to climate change (SDG 13 and SDG 7). In addition, the project contributes to promoting gender equality (SDG 5) and building the resilience of youth in rural areas; it does so by establishing community development associations, building capacity and providing vocational training, and facilitating the provision of rural financing.

Sustainably increasing productivity

Efforts under SAIL to improve irrigation are helping to increase agricultural productivity in some of the target areas. The project has piloted soil-less hydroponic agriculture, which is an innovative technique to reduce water consumption and increase productivity. Through the organization of FFS, the project has promoted adaptive agronomic techniques based on the use of alternative crop types and varieties, cropping patterns and livestock breeds. These techniques are helping to reduce postharvest losses and increase the productivity of farmers in the target areas. Matching grants have allowed 112 women to improve the living standard of their families by developing alternative income-generating activities and thus diversifying the livelihood sources of their households.

Boosting farmers' resilience to the effects of climate change

The credit component of the project has allowed more smallholder farmers to implement adaptation and mitigation measures. The disbursement of loans started in early 2020. On 31 March 2020, 73 percent of all SME loans were used to modernize irrigation systems i.e. transform traditional irrigation systems into drip or sprinkler irrigation networks that help farmers cope with water scarcity. Other loans are used for investments in livestock production, agricultural processing or non-agricultural activities; these loans help communities diversify their livelihoods and thus build resilience to climate change impacts. While no loans have been disbursed for solar energy purposes as yet, the installation of solar-powered irrigation pumps during the project's remaining years is expected to encourage farmers to apply for loans that could help transform their irrigation networks into solar-powered networks.

The installation of drip irrigation systems by project beneficiaries has increased farmers' resilience to climate-induced water scarcity; at the same time, the construction of solar-powered pumps has brought mitigation benefits. The project is currently lining 10.5 km of *mesqas* and thus improving water management for 817 feddans (approximately 341 hectares) by reducing water losses. The project has also established five meteorological stations as part of an early warning system for climate change in the five target regions. The stations collect, process and provide weather-related information in a centralized manner. Meanwhile, efforts to improve drainage in 2 000 feddans (approximately 840 hectares) in Upper Egypt have helped improve water management systems and increased farmers' resilience to water scarcity.

Reducing GHG emissions

The project has introduced water pumping systems, as well as postharvest and processing equipment, that use renewable energy. The introduction of solar-powered pumping units in a number of targeted areas has increased energy efficiency and replaced diesel as the main energy source for pumping. In addition, the project has promoted biogas units as a renewable source of energy for domestic uses. Meanwhile, capacity-building activities have included workshops on recycling and the reuse of waste in composting.

This case study was submitted by the Environment, Climate, Gender and Social Inclusion (ECG) and the Near East, North Africa, Europe and Central Asia (NEN) Divisions of IFAD. ecgmailbox@ifad.org.

The existence of a strong evidence base, a national strategic CSA framework and capable institutions can help countries take advantage of intergovernmental funding mechanisms.

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ACTION POINT 5 – IMPLEMENTING PRACTICES AT FIELD LEVEL

Introduction to implementing practices at field level

Action point 5 is implementing practices at field level. CSA practices address at least two of the three pillars of the CSA approach (sustainably increasing agricultural productivity and improving farmers' incomes, building resilience and adaptation to the effects of climate change, and, where possible, reducing and/or removing GHG emissions) simultaneously. CSA is a context-specific approach. Indeed, what constitutes a climate-smart practice in one site may not be considered climate-smart in another site. The implementation of climate-smart practices at field level should be guided by site-specific socio-economic and environmental circumstances. This implies that several crucial factors should be considered during the design and implementation of the practices. This introduction briefly describes some of these factors, drawing on FAO's CSA Sourcebook (FAO, 2021a).[26]

The selection and implementation of CSA practices should be based on solid stakeholder consultations to ensure an engaged process in which valuable knowledge and networks are included. Local knowledge and priorities should form part of the evidence base used for the selection of CSA practices. Indeed, local knowledge on the environment, agro-ecosystems, crops and livestock, forests, fish and local climatic patterns is often a very valuable source of information when choosing the best CSA practices. Local knowledge should also be taken into account throughout the implementation of the selected practices. It is important to engage farmers, pastoralists, foresters and fishers, as well as local project managers and institutions, throughout the selection and implementation process.

CSA practices may influence and/or be influenced by differences in the circumstances of men and women, as well as the relationships between them. Climate change may affect women and men differently, and they may have different capacities to adapt to it. Globally, women play a crucial role in food and agricultural systems, and CSA practices may not reach their full potential if they are gender-blind.

CSA practices may also play a role in improving social protection and rural employment, and thus help ensure that no one is left behind. Where the implementation of CSA practices leads to job creation, this can contribute to the potential of the agriculture sector to provide environmental and socio-economic benefits. Improving social protection may boost food security, as well as increase resilience to the effects of climate change and support climate change mitigation.

If a CSA practice (partly) aims to contribute to climate change resilience, it may be important to explore potential linkages with disaster risk reduction.

A wealth of knowledge can be generated during and after the implementation of CSA practices. This knowledge may contribute to the creation of a knowledge feedback loop from action point 5 to action point 1 of CSA implementation.

The FAO CSA Sourcebook offers more information on climate impact assessments and appraisals of CSA options, CSA programme and project monitoring and evaluation, and the theory of change for CSA.

The five case studies in this chapter illustrate how the selection of climate-smart practices depends on the context. They also reveal how other CSA action points can create and enabling environment.

[26] For more information on CSA and the factors discussed in this introduction, please see the various modules of Section C of FAO's CSA sourcebook, available online at www.fao.org/climate-smart-agriculture-sourcebook/enabling-frameworks.

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Lao People's Democratic Republic – addressing labour scarcity through the gender-sensitive roll-out of drum seeders for rice

Introduction

FAO's Regional Rice Initiative in Asia and the Pacific was launched as a pilot project in Indonesia, the Philippines and Lao People's Democratic Republic. The project focused on the goods and services produced by rice ecosystems and landscapes, and aimed at identifying and implementing sustainable rice production practices to enhance resilience and improve efficiencies in rice production and thus improve food security. Pilot activities included training farmers in FFS on the Save and Grow-based sustainable intensification of rice production (SIRP).

The project was entitled Regional Rice Initiative: Curriculum Review, Consolidation and Results Assessment for Expansion of Save And Grow Farmers Field Schools in Lao PDR. Under the project, about 18 FFSs were organized in four provinces (Sayabouly, XiengKhuang, Savannakhet and Champasack) between 2016 and 2017 in a joint effort by the Laotian Government, smallholder farmers and FAO. In the province of Sayabouly, in the north-west of the country, smallholder farmers growing rice face problems of labour scarcity, especially during planting and harvesting periods. In the FFSs, smallholder farmers explored and field-tested labour-saving practices and technologies, including a drum seeder. The drum seeder supports two of the three CSA pillars. It increases labour productivity by allowing the direct seeding of rice, and increases the resilience of smallholder farmers to erratic weather.

Rationale

Smallholder farmers who depend on agricultural production, including rice production, must increase the productivity of their operations and their incomes in order to strengthen their livelihoods. Smallholders face many challenges, including a decline in the availability of water and agricultural land, lower productivity, the loss of ecosystem goods and services, and droughts, floods and the spread of pests and diseases induced by climate change (Abubakar, Ketelaar and Minamiguchi, 2015). In addition, in Asia agriculture is shifting from traditional labour-intensive operations to mechanized operations on farms and along the value chain. This shift is due to various reasons, including rising labour scarcity in rural communities in Asia, increasing labour costs and the feminization of agriculture (FAO, 2014a).

These challenges have led governments to encourage farmers to use the diminishing resources more efficiently, and promote the better management and use of agro-ecological processes for the sustainable intensification of rice production systems (Abubakar, Ketelaar and Minamiguchi, 2015).

Save and Grow in Asian rice production means increasing efficiencies to produce more, higher-quality rice while using inputs more sustainably; this is to be achieved by (i) choosing more appropriate management strategies, (ii) building on ecosystem services, (iii) using inputs more efficiently, and (iv) conserving and using natural resources in a sustainable manner (FAO, 2014b).

Description

In Lao People's Democratic Republic, the project supported capacity building interventions through FFSs on Save and Grow for SIRP. This involved the testing, adaptation and demonstration of technologies and agricultural practices in FFSs. In the province of Sayabouly, a common problem faced by smallholder rice farmers is labour scarcity, especially during planting and harvesting, which are peak periods for labour demand. Against this background, the Laotian Government organized the testing of a drum seeder by smallholder farmers, with technical support from FAO. A drum seeder is a manual technology that is pulled by the operator; it is used to seed pre-germinated rice seeds in lowland and irrigated rice production systems (FAO, 2018a). The technology is gender-sensitive as it can be adapted for use by both women and men.

The FFS curriculum was revised during the implementation of the project to include appropriate Save and Grow innovations such as rice-fish systems, based on FAO's project document (FAO, 2016b). The revised curriculum was pilot-tested over a rice cropping cycle in FFSs in four provinces in the country in 2016/17. The results of the FFS interventions were continuously assessed to collect evidence to guide future investments, and to broaden government policy support for Save and Grow-based SIRP interventions through FFSs in the country.

Outcomes

The following results are based on a study carried out by FAO in the province of Sayabouly into the use of drum seeders (FAO, 2018b). Using a drum seeder for direct seeding (also called drum seeding) offers benefits over manual transplanting and broadcasting. These benefits include a greater resilience against the effects of climate change, higher labour productivity, time savings and a reduction of the work burden and of production costs.

Greater resilience to the effects of climate change

Farmers who use a drum seeder can plant rice faster, which enables them to better cope with erratic weather. Another benefit is that drum-seeded rice matures 10 to 15 days earlier than transplanted rice (Swiss Agency for Development and Cooperation, 2008). This enables farmers to plant their next crop earlier and profit from residual soil moisture. In cases where rice fields are lost due to droughts or floods, farmers can replant their fields using a drum seeder, without relying on (scarce) external labour or help from other farmers (who may be busy replanting their own fields). Furthermore, the drum seeder is suitable for agro-ecological approaches such as alternate wetting and drying and rice-fish systems. According to the International Rice Research Institute (2016), alternate wetting and drying helps mitigate climate change by reducing the amount of water needed to produce rice and limiting GHG emissions. Rice diversification methods, such as rice-fish systems, also increase the resilience of smallholder farmers against climate change.

Higher labour productivity and incomes

The use of a drum seeder boosts agricultural incomes by 42 percent in comparison with manual transplanting (17 USD per day, compared to 12 USD per day, as labour productivity is high as compared to manual transplanting). Labour productivity and time spent in the field for planting are the same for drum seeding and broadcasting.

Time savings and reduction of the work burden

One person using a drum seeder can plant one hectare of land in one working day, while manual transplanting requires 29 persons to plant one hectare in one day.[27] Farmers who adopted the drum seeder after attending a FFS reported that they had more time available to rest, for other income-generating activities and to help other farmers in their fields. The reduction of the time and labour needed to plant rice fields translates into a reduction of production costs. By using a drum seeder, smallholder farmers save USD 146 per hectare and per planting season compared to manual transplanting, and USD 6 compared to broadcasting. The investment of a drum seeder (approximately 85 USD) is recovered during the first year if the technology is used in at least 0.6 ha of rice fields where rice was previously transplanted manually.

FAO (2018b) recommends to pay special attention to women in efforts to promote the use of drum seeders, to avoid displacing them as casual labourers in rural communities and thus increasing their food security vulnerability. FAO also states that the inclusion of women in field demonstrations and training sessions on the use of the drum seeder can boost the adoption of the technology and amplify its benefits. Finally, FAO underlines the importance of raising awareness and building the technical capacities of various actors (including local authorities, NGOs and farmers) on the use, maintenance, benefits and limitations of the drum seeder.

This case study was submitted by Mayling Flores Rojas, agricultural engineer, FAO. mechanization@dgroups.org.

[27] A working day consists of eight working hours.

Kyrgyzstan – sustainably managing mountainous forest and land resources under climate change conditions

Introduction

The project Sustainable Management of Mountainous Forest and Land Resources under Climate Change Conditions, financed by the GEF, is being implemented in Kyrgyzstan since September 2014. This project is executed by the Government of Kyrgyzstan through the State Agency for Environmental Protection and Forestry and the Ministry of Agriculture, Water and Regional Development, with support from FAO.

The objective of the project is to contribute to the sustainable management of mountainous agro-sylvo-pastoral ecosystems in Kyrgyzstan and improve their productivity, and thereby improve mountain livelihoods. The main components of the project include the improvement of the legal and institutional framework on forestry and land management, the reforestation and natural regeneration of 8 000 ha of forests and the improvement of the management of 20 000 ha of land, the promotion and demonstration of CSA (including climate-smart pasture management) on 20 000 ha of land, and the dissemination of CSA and other knowledge and best practices.

The project promotes new approaches and practices in sustainable forest and land management that are to increase the productivity of healthy forest systems and agro-ecosystems; this increased productivity is expected to improve the livelihoods of mountain people, including women and other disadvantaged groups that largely depend on agriculture-based incomes.

Rationale

Pursuant to the Kyrgyz Forest Code, which confers an exceptional nature protection status to all forests in the country, the Government of Kyrgyzstan undertook a major forest management and protection initiative with the National Forest Programme 2011–2015. The GEF project strengthened the activities of the National Forest Programme in various ways. First, the project introduced innovative practices for forest rehabilitation and sustainable forest management in five pilot oblasts and 12 rayons. Second, the project raised awareness and improved capacities in the State Agency for Environmental Protection and Forestry on the global climate change benefits of calculating and monitoring carbon sequestration and reducing GHG emissions through forest rehabilitation and sustainable management. Third, the project strengthened the capacities of associations of users of local resources (forests, pastures, water) for the management of forest areas, and improved collaboration between them. The project also assisted in the assessment of the country's existing forest policy (including the National Forest Programme 2011–2015) and the development of a new national "Forest Concept" for the period until 2040. The project payed

special attention to the representation of women in resource users' associations, where men are still overrepresented.

The GEF project helps deliver multiple global environmental benefits by:

- improving agriculture in drylands by demonstrating and adopting agricultural practices, such as practices that help preserve agricultural biodiversity to reduce GHG emissions and increase vegetation cover; and
- rehabilitating degraded agricultural land, including pastures and transition zones; this is done by adopting innovative technologies and practices and improving the management of soil and water resources and crop production methods in drylands to increase soil organic carbon concentrations and boost carbon sequestration.

In addition, the project will increase the resilience of agro-ecosystems to climate change, thus contributing to the socio-economic development and food security situation of the country.

Description

One of the project components is entitled Promoting and Demonstrating Climate-Smart Agriculture, including Pastures, as Part of Sustainable Land and Water Management in Drylands.

The objective of this component is to implement CSA (including climate-smart pasture management) by introducing improved land management and rehabilitation practices and reducing conflicts between the users of forests and rangelands. Eighty-eight percent of Kyrgyzstan's farmland is considered degraded. New and innovative approaches to sustainable and climate-smart land management of cropland and pastures have not been widely introduced due to the country's history of central planning and the lack of incentives for local land users to test new sustainable land management (SLM) practices. The project therefore supports demonstrations of innovative land management practices on cropland and pastures; it is expected to result in the improved management of 10 907 ha of cropland (and thus contribute to carbon storage of 58 530 tCO_2 eq/year) and the restoration of 20 000 ha of pastures (thus contributing to carbon storage of 62 088 tCO_2 eq/year).

Under this project component, cartographic material was developed in July 2015 for 10 000 ha of cropland, 5 000 ha of forest land and 20 000 ha of degraded rangelands, in collaboration with Kyrgyzgiprozem, the state design institute on land management. A geobotanical survey (considering *inter alia* habitat characteristics) was carried out for the pastures, while for the cropland soil analysis was undertaken, looking into humus content, soil structure, use and degradation. Based on the survey, recommendations regarding the rehabilitation of degraded lands, the use of technologies, the selection of plant species and the layout of planting were formulated. A pasture management coordination group was established under the Ministry of Agriculture, Water and Regional Development, involving FAO project experts. The project also cooperates with a number of NGOs (including the Kyrgyz Association of Forest and Land Users, Central Asian Mountain Partnership Alatoo and BIOM) that have experience in the building of capacities of pasture committees and communities.

Outcomes

The integrated and cross-sectoral approach to generating carbon benefits in the forestry and agriculture sectors promoted by the project is completely new to Kyrgyzstan. FAO has recently developed a national forest monitoring system for REDD+ (carbon monitoring system in the AFOLU sectors). This system will be underpinned by policy and institutional reforms that will integrate carbon emission reduction and sequestration targets into integrated land use plans at the national, provincial and local levels. On the ground, the project uses sustainable forest management (SFM) and SLM approaches and technologies that have not previously been widely applied in Kyrgyzstan, such as technologies related to multifunctional forestry, integrated forest and pasture management and organic agriculture. The project also works to upscale efforts to establish payment for ecosystem services schemes, FFSs and public-private partnerships.

The main activity undertaken by the project to achieve these results is the preparation of a manual that describes interesting innovative SLM technologies and practices based *inter alia* on the World Overview of Conservation Approaches and Technologies. These technologies and practices include practices that help preserve agricultural

biodiversity (for example, the reduction of arable land, crop rotation, crop residue management and the use of vegetation covers), the use of biofertilizers on degraded land, the implementation of life cycle management in organic agricultural systems, integrated land restoration to increase soil fertility in the face of climate change, modern water conservation systems for irrigation, composting by small farmers, etc. Demonstration plots for selected technologies will be created in the fields of both male and female-headed farming households in each of the 12 districts.

The adoption of all of these CSA practices involves key steps that are related to creating the evidence base for the approach (CSA action point 1), supporting enabling policies and planning (CSA action point 2), strengthening national and local institutions (CSA action point 3) and implementing practices in the field (CSA action point 5). The implementation of these activities strengthens the relevance of CSA in the context of Kyrgyzstan's efforts to achieve the SDGs and its NDC objectives. Further steps are planned to include the development of methods to assess context-specific synergies and trade-offs between CSA actions and SDG targets, as well as identify the relationships between CSA and SDG indicators, in the project's activities.

This case study was submitted by FAO's country office in Kyrgyzstan. FAO-KG@fao.org.

Ecuador – promoting climate-smart livestock management and cocoa production

Introduction

In Ecuador, FAO is providing technical support to promote climate-smart livestock management and cocoa production. These sectors present important opportunities to increase the productivity and incomes of farmers, help them adapt to climate change and contribute to the reduction of GHG emissions.

Recognizing the social and economic relevance, but also the environmental impacts of cattle production, the Ecuadorian Ministry of Agriculture and Livestock, together with the Ministry of the Environment and Water, has developed the Climate-Smart Livestock Management, Integrating Reversion of Land Degradation and Reduction of Desertification Risks in Vulnerable Provinces project, with support from FAO.[28] The project has been operational since 2016 in seven provinces of the country (Guayas, Santa Elena, Manabí, Imbabura, Loja, Napo and Morona Santiago), with funds provided by the GEF.

The project Strengthening the Climate-Smart Approach for Cocoa Production under the Chakra Agroforestry System in the Napo Province in Ecuador has been developed within the framework of the International Alliance for Climate-Smart Agriculture. It is being implemented since November 2019 by FAO, with funding provided by the Italian Ministry of the Environment and the Protection of the Territory and the Sea.

Rationale

Ecuador's agriculture sector accounted for 7.82 percent of the country's GDP in 2018, with the livestock sector accounting for 6.97 percent of this share (Central Bank of Ecuador, 2018). Cattle farming in Ecuador is predominantly extensive. It is estimated that there were 4.05 million of cattle heads (equivalent to 67.26 percent of the total livestock) and 4.23 million hectares of natural and cultivated grassland in the country in 2016 for an approximate animal load of 0.68 AU/ha (Economic Commission for Latin America and the Caribbean, 2016; Ecuador, Ministry of Agriculture and Livestock, n.d.). Meanwhile, Ecuador accounts for 6.7 percent of global cocoa production (International Cocoa Organization, 2021). Most cocoa farmers cultivate plots that are smaller than 5 ha.

There is a significant potential to increase productivity and reduce GHG emissions from cattle farming in Ecuador. The sector is currently inefficient. It occupies large areas of poorly managed pastures, while CO_2eq emissions

[28] For a video on the project, see https://youtu.be/It10qkmKC5s (FAO, 2021d).

per unit of milk or meat are indirectly proportional to the level of productivity. In addition, emissions from the livestock sector account for a significant part (8.56 percent) of the national GHG inventory (Ecuador, Ministry of the Environment, 2017).

The production of cocoa has allowed small indigenous communities to improve their living conditions. However, there are also problems related to cocoa production, including conflicts over land and limited institutional and financial support for small and medium-sized producers. Deforestation, pollution, a lack of access to export markets and limited knowledge of production costs constitute challenges. In addition, producers in the Napo province indicate that they perceive climate risks, including temperature increases and variation in the intensity and seasonality of rains (FAO, 2016d; GIZ, 2018). These climate change impacts are reported to have effects on the production of cocoa and other income-generating crops as they increase the spread of pests and diseases and exacerbate soil erosion and the loss of soil nutrients, which lowers yields. Other risks include strong winds, the overflowing of rivers and estuaries and dry periods. There is a need to strengthen small and medium cocoa producers' capacities to adapt to the effects of climate change, for example by promoting the transfer of ancestral knowledge to young people, disseminating information on agro-ecological management, diversifying incomes and connecting farmers to stable markets.

Description

FAO developed its work on climate-smart livestock and cocoa production in close partnership with the Ecuadorian Government. Under the climate-smart cocoa project, FAO is working with the Ministry of Agriculture and Livestock, the Ministry of the Environment and Water, the Autonomous Decentralized Provincial Government of Napo and the province's cocoa consortium. Under the climate-smart livestock project, FAO has helped the government formulate proposals for seven land use and development plans. It is also providing support for the development of the country's climate-smart livestock management strategy, which will strengthen the national livestock policy. In addition, FAO has helped build the capacities of national rural extension technicians of the Ministry of Agriculture and Livestock, strengthen their links with cattle producers and generate a training curriculum. At the provincial level, training sessions were organized for male and female technicians that are permanently linked to the climate-smart livestock project in seven provinces.

FAO further partners with BanEcuador, the main public bank of the country, to enhance financing options for the implementation of CSA practices. In 2018, BanEcuador signed an agreement with FAO to enhance national technical capacities for the analysis and design of green financial products. The climate-smart livestock project, which provides relevant web tools, is a key ally for BanEcuador in the design and development of a green credit line to promote sustainable livestock operations. Indeed, in May 2019, FAO and BanEcuador signed an agreement to develop a green credit line to support the implementation of climate-smart livestock practices.

In the case of the climate-smart livestock project, CSA project activities at field level are implemented through existing modalities, including FFS, co-financing with local counterparts, the provision of technical assistance, the monitoring of GHG emissions and the establishment of strategic alliances. Meanwhile, the climate-smart cocoa project is implementing actions to improve the quality of cocoa, strengthen entrepreneurial capacities and promote the adoption of biodiversity conservation measures in cocoa production.

Outcomes

A wide range of field-level activities are implemented under the two projects, including:

- FFS, which provide fully practical training using local scenarios and adult education techniques;
- raising farmers' awareness of the potential for carbon sequestration in the cocoa agroforestry system through training;
- developing an e-learning course on CSA for cocoa;
- co-financing with local counterparts to implement good livestock practices;
- developing a sustainable financing strategy for cocoa farmers' associations;

- providing technical assistance (by the project team and partner institutions) to facilitate the implementation of the acquired knowledge on climate-smart livestock management;
- promoting the conservation of the genetic diversity of cocoa (*in situ*) in local gardens;
- monitoring GHG emissions and climate risk to evaluate the impact of field interventions; and
- promoting the sustainability of the climate-smart livestock approach through strategic alliances for the implementation of interventions.

Contributing to the SDGs and scaling up CSA

FAO's work on climate-smart livestock management and cocoa production contributes to SDG 5 (Gender equality), SDG 2 (Zero hunger), SDG 13 (Climate action) and SDG 15 (Life on land). Under the climate-smart livestock project, participatory rural approaches focusing on gender issues were developed to assure the participation of women and equal leadership opportunities. In addition, focus groups analysed gender relationships in livestock production systems; the results were used to adjust the capacity development process to the requirements of men and women. The climate-smart cocoa project aims to empower women in decision-making processes; it highlights their role in cocoa producers' associations and as *chakramamas* in the chakra system. A *chakramama* is a mother of a family or wise woman who is responsible for the *chakra* and develops and transmits knowledge and practices to other women.

The projects include elements that can be relevant to the scaling up of CSA. For example, the development of tools to quantify GHG emissions and determine climate risk at farm level were among the activities of the climate-smart livestock project. These technological innovations have not only been crucial for the monitoring and analysis of the effectiveness of the approach; they also provide a first step towards sustainability and replicability of the project's activities at the national level.

The climate-smart livestock and cocoa projects contribute to the three pillars of CSA:

Sustainably increase agricultural productivity and incomes

The climate-smart livestock project organized 859 training events in 37 FFSs to implement the project in the field and develop producers' capacities. This field implementation was a joint effort by the provincial technical project teams, the Ministry of Agriculture and Livestock, the Ministry of the Environment and Water, universities, NGOs and local governments. As a result, climate-smart livestock management practices are now being implemented by 1 056 cattle farmers, on a total area of 40 388 ha; 1 046 beef and dairy cattle farmers (33 percent of them women) are permanently linked with the project. Between 2017 and 2020, the incomes of these farmers increased by 16.76 percent, their productivity by 12.85 percent and environmental production efficiency (more productivity with less emissions) by 27.18 percent.

In 2019, BanEcuador earmarked USD 13.6 million for microcredits with a preferential interest rate (9.76 percent). This pilot ended in May 2020. Over the course of the trial period, 66 credits were granted for a total value of USD 934 871. Together, these credits have the potential to reduce emissions by 1 011 015.57 kg CO_2eq/year.

The project established seven community funds that allowed cattle producers to acquire small loans to implement climate-smart livestock practices. To date, credit allocation by the community funds sums up to USD 25 000.

The project also promoted the development of six centres for agricultural services. These centres mobilized USD 37 900 to support local startups and promote the implementation of good livestock practices.

The climate-smart cocoa project aims to help small and medium-sized producers access markets by providing them with negotiation tools and market analysis. To achieve this aim, the project carried out a study on access to cocoa niche markets, and helped farmers identify additional sources of income.

Adapt and build resilience of people and food systems to climate change

The climate-smart livestock project aims to strengthen resilience and adaptive capacities to climate risk. The adoption of efficient cattle management practices under the project resulted in the conservation of forests on 3 275 hectares, and the restoration of forests on 438 hectares.

In addition, the climate-smart livestock project developed a climate risk study using 46 indicators to estimate the vulnerability level of beef and dairy cattle production systems to the most important climatic threats in the targeted provinces (Ecuador, Ministry of Agriculture and Livestock, Ecuador, Ministry of the Environment and FAO, 2019). The study used 11 indicators to quantify climate risk, adaptive capacity and vulnerability at farm level with a web application.[29] The project monitored the implementation of measures in the seven targeted provinces in 2019 and 2020, and found that adaptive capacity had increased by 10.61 percent, vulnerability had decreased by 5.20 percent and climate risk had fallen by 5.80 percent in comparison with 2017. As a result, the vulnerability status of the cattle production system in Ecuador decreased from "moderate" to "low" (Ecuador, Ministry of the Environment and Water and Ministry of Agriculture and Livestock, 2020).

The climate-smart cocoa project works on the basis of *chakras*, a term used by the Amazonian Kichwa population to refer to small agricultural plots. *Chakras* are millennial agroforestry systems of itinerant agriculture; they help preserve biodiversity and healthy soils, reserve spaces for forests and guarantee food security. *Chakras* provide the most effective and dynamic space for the conservation and *in situ* propagation of Amazonian agrobiodiversity. They are also spaces where families exchange and reproduce ancestral knowledge. By promoting the *chakra* system, the project helps farmers adapt to the effects of climate change.

Reduce and/or remove GHG emissions

The Global Livestock Environmental Assessment Model developed by FAO was used as a basis to develop two tools to monitor GHG emissions (one at the national level, and the other at farm level) under the projects in Ecuador. The farm-level tool, which is based on a web application, displays total farm emissions, the intensity of emissions and a reference value for the region. Based on this information, farmers can improve their productive systems and reduce their emissions.

The monitoring of the impacts of the implementation of good livestock practices indicate that 75 271.29 tonnes of CO_2eq were reduced over four years of field execution (Ecuador, Ministry of the Environment and Water and Ministry of Agriculture and Livestock, 2020). The methodology for the quantification of the sequestered carbon in pastures was developed by the project team. It showed a fixation of carbon in 2018 of 27 649.40 tonnes, in 2019 of 30 647.62 tonnes, in 2020 of 36 498.16 tonnes and in 2021 of 43 436.29 tonnes, for a total of 138 231.38 tonnes (Ecuador, Ministry of the Environment and Ministry of Agriculture, Livestock, Aquaculture and Fisheries, 2020).

Monitoring GHG emissions and adaptive capacity in the livestock sector after the implementation of climate-smart livestock practices is one of the most important activities of the project. The results of monitoring on the 165 pilot farms indicate that productivity has improved by 12.85 percent, GHG emissions have fallen by 26.27 percent and adaptive capacity has increased by 10.61 percent (Ecuador, Ministry of the Environment and Ministry of Agriculture, Livestock, Aquaculture and Fisheries, 2020).

The climate-smart cocoa project collaborates with the Ministry of the Environment and Water to develop a methodology to measure carbon sequestration. It also promotes low-emission cocoa products and views the Amazonian *chakra* system as a valuable carbon reservoir.

This case study was submitted by FAO's country office in Ecuador. FAO-EC@fao.org.

[29] The web tool to monitor adaptive capacity, vulnerability and climate risk at farm level is available at http://ganaderiaclimaticamenteinteligente.com.

Georgia – enhancing agricultural resilience to climate change by developing inclusive climate-smart value chains

Introduction

IFAD's Agriculture Modernization, Market Access and Resilience (AMMAR) project in Georgia (2015–2021) has provided a substantial contribution to the development of inclusive climate-smart value chains in the country. Thus, the project – which focuses on smallholder farmers and rural enterprises – has enhanced the resilience of Georgia's agriculture sector to climate change and boosted private sector investments. The project has mainstreamed a climate-smart approach throughout its various activities, which include the development of irrigation and value chain infrastructures, the restoration of landscapes through the expansion of windbreak surfaces, the facilitation of policy dialogue on climate-resilient value chains, the creation of demonstration plots and the provision of CSA training. The project is financed with an IFAD loan and grant, GEF grants, contributions from the Government of Georgia and private investments from farmers and agribusinesses. The AMMAR project is executed by the Georgian Ministry of Environmental Protection and Agriculture and is implemented by the Rural and Agricultural Development Fund.

Rationale

The agriculture sector in Georgia is highly vulnerable to climate change and climate variability, leading to serious problems of production loss and threats to food security under a business-as-usual scenario. Recent extreme weather events (including floods, windstorms and drought) have contributed to a marked trend of land degradation throughout the country, as well as a shifting aridification trend that is poised to heavily affect the already semi-arid eastern portions of Georgia by the end of the century. Smallholder farmers in the country are highly sensitive to climate change due to their heavy reliance on subsistence agriculture. Their lack of access to financial resources and technologies and limited adaptation knowledge results in a low adaptive capacity and higher vulnerability to extreme events, unpredictable climate variations and environmental degradation caused by the combined effects of anthropogenic factors and climate change. Against this backdrop, the AMMAR project is designed to address urgent climate resilience challenges as part of the Ministry of Environmental Protection and Agriculture's substantial ongoing investments to modernize agriculture in Georgia. The project is fully aligned with the country's Strategy for Agriculture Development (2015–2020) and its supporting action plan.

Description

The project activities are organized into two mutually supportive components (Component 1: irrigation and agricultural value chain investment, and Component 2: climate-smart agricultural and value chain development)

to accelerate the development of up to six priority climate-smart agricultural value chains. The AMMAR project has mainstreamed a climate-smart approach throughout its activities, with support from the GEF grant. Under Component 1, the project screened and prioritized product value chains that are expected to offer sustainable comparative advantages under future climate change scenarios, especially at the primary production level. The project has also promoted investments in efficient irrigation technologies, CA systems, the construction of windbreaks as a targeted landscape restoration measure, soil erosion control measures in sensitive farmland areas and the rehabilitation of irrigation schemes to create sustainable improvements in water-efficient irrigated production. The project has contributed to the widespread adoption of climate-smart good agricultural practices and technologies at the farm level.

Under Component 2, CSA technologies for improved water and soil health are transferred to the beneficiaries. Technology has been transferred and promoted at the village level through a combination of CSA demonstration plots, promotion events, short and longer practical field training and systematic follow-up with farmers by the local service providers delivering the training. CSA demonstration plots enable farmers to directly access know-how, training and networks of service and credit providers, and thus facilitate the adoption of the promoted technologies. They also allow interested farmers to get an objective farmer perspective on the technologies from the progressive farmers on whose land the CSA demonstration plots are established.

Outcomes

Implementing practices at field level

The AMMAR project promotes CSA practices by establishing demonstration plots in collaboration with selected lead farmers. Data on demonstration plots recorded by lead farmers and service providers help assess the economic benefits and impact of the demonstrations. The project organizes exchange visits to demonstration plots to promote good practices across Georgia. In 2020, more than 3 135 ha of land were brought under climate-resilient practices; of this total, more than 2 800 ha were improved with windbreaks. More than 14 300 ha of land (including more than 8 480 ha below the Iakublo dam) benefitted from new-built or rehabilitated water-related infrastructure.

Enhancing financing options

The project promotes access to financial services through its small grants. By 2020, 733 small grants to smallholders had been approved. The project strives to address the needs of economically active smallholder farmers through its grants. Unlike for other grant facilities implemented in Georgia by other development agencies, there is no minimum threshold to apply for a grant under the project; the project thus manages to attract even small investors. Grants proposed by the AMMAR project resonate very well with youth: they enable youth to implement new business ideas that they had in mind and but couldn't realize.

Supporting the creation of enabling policy frameworks

Based on the experiences regarding CSA, including the construction of windbreaks, and until the completion of the project, the AMMAR project is providing support for the elaboration of windbreak management plans (based on international best practices) and enforcement packages to strengthen Georgia's existing legal and policy framework on windbreaks and soils. These plans and packages will provide an incentive for the further elaboration of the country's laws and projects.

Strengthening national and local institutions

The AMMAR project organizes training of trainers in efficient irrigation technologies and CSA technologies. These training sessions target service providers and regional staff of the Ministry of Environmental Protection and Agriculture. These activities have now reached their target of training more than 50 trainers, who improved their capacities and abilities to support the implementation of the project on the ground.

Linking to SDGs

The development goal of the project is to sustainably increase incomes and reduce poverty for women and men

in rural Georgia (SDG 1). The development objective of the project is to stimulate investment in climate-smart agricultural value chains to increase incomes and strengthen the resilience of small farmers (SDG 13). The project is promoting CA to regenerate soils, for example by using compost and vermicompost and planting windbreaks of local tree species (SDG 15).

Overall, the project contributes to all three pillars of CSA:

Increasing productivity

Agricultural productivity is improved as a result of various interventions of the project, including the rehabilitation of irrigation canals to boost the availability of irrigation water, the improvement of CSA practices, the strengthening of market linkages and targeted investments to boost farm production (greenhouses, drip irrigation, mechanization, quality seedlings, etc.).

Enhancing resilience

The project has enhanced environmental sustainability by improving irrigation practices and soil health management at farm level, thus boosting the resilience of Georgia's agriculture sector. A survey into the project's outcomes for targeted households conducted in 2019 revealed that 48 percent of the beneficiaries of climate-smart grants reported that the quality of their harvests was better in 2018 than in 2016, compared with only 6 percent in the control group. The survey also showed that 30 percent of the households targeted by irrigation activities believed that the quality of their harvests had improved in 2017/18, against only 6 percent in the control group. The farmers that were targeted by the project irrigated a wider range of crop varieties than the control farmers. Climate-smart practices that improve soil resilience led to higher productivity and crop diversification, which has a positive effect on food security.

Reducing GHG emissions

The AMMAR project has promoted sustainable agricultural production practices to help preserve soil and water resources, for example by proposing efficient irrigation techniques. The project proposed adaptation technologies featured in the publication *Technologies for climate change adaptation – agriculture sector* (Clements *et al.*, 2011). In particular, the project promoted the use of pressurized irrigation systems (sprinkler or drip) to improve water management and efficiency, as well as the adoption of CA systems (combining practices such as reduced or zero tilling, soil mulching, vermicomposting, crop rotation and diversification, and integrated nutrient and pest management) to improve soil fertility and soil carbon and water storage. The resulting reduction in the use of fossil fuels and increase in soil carbon has an important mitigation effect.

This case study was submitted by the Environment, Climate, Gender and Social Inclusion (ECG) and the Near East, North Africa, Europe and Central Asia (NEN) Divisions of IFAD. ecgmailbox@ifad.org.

Saint Lucia – advancing the use of information and communication technology solutions for climate-smart agricultural practices

Introduction

The project discussed in this case study investigated and addressed the needs and challenges of farmers as to the sustainable production of food under climate change in Saint Lucia. ICT was selected as an appropriate tool to ensure the availability of locally produced food in the country. The adoption of ICT strategies can increase agricultural productivity and thus directly contribute to a nation's resilience by providing food security. The use of ICT along with the adoption of good agricultural practices can help reduce GHG emissions. The project was implemented by the Caribbean Agricultural Research and Development Institute (CARDI) between January and December 2019, with funds provided by the Japan-Caribbean Community (CARICOM) Friendship and Cooperation Fund. It was supported by Saint Lucia's Ministry of Agriculture, Fisheries, Physical Planning, Natural Resources and Co-operatives. The project supports the Ministry's Seven Crop Project for import substitution.

Rationale

Saint Lucia regularly experiences drought conditions during the dry season, with farmers in some areas being particularly affected. Many farmers cease to produce during the dry season. Irrigation systems tend to be operated manually, and generally consist of drip or shower irrigation lines fed by nearby rivers. This situation contributes to inconsistencies in the production of vegetable crops in Saint Lucia and affects market demand and supply. In addition, market information is not used to schedule crop production. The result is fluctuations in the availability of products. The aim of the project was to confirm and address these suspected challenges facing farmers in Saint Lucia. Two reoccurring challenges observed at farm level were:

- the absence of crop scheduling in function of seasonal and climatic conditions, as well as cultural festivals and activities; and
- the absence or inefficient use of irrigation technologies.

Description

The project aimed to teach farmers how to interpret the demand for food during festivals such as Jounen Kweyol (Creole festival) and carnival and schedule their production accordingly. It also aimed to improve irrigation techniques and increase the efficiency of irrigation systems by promoting the use of mobile applications and adjusting traditional drip line irrigation methods; by doing so, the project aimed to reduce the degree to which agricultural production is affected by climate change. Additionally, soil mapping and risk assessments were conducted on farms in Saint Lucia to guide farmers in their decisions as to what commodities to plant, based on farms' susceptibility to floods and landslides.

The project enjoyed a highly supportive enabling environment. Data were provided by the Water Resource Management Agency and the Marketing Unit of the Ministry of Agriculture, Fisheries, Physical Planning, Natural Resources and Co-operatives, as well as by the Saint Lucia Meteorological Office. This allowed CARDI to analyse 15 years' worth of climate and marketing data to demonstrate trends at farm level. It also allowed CARDI to showcase trends in market demand and supply based on cultural and other festivals and on weather data, thereby expanding the evidence base on agriculture in Saint Lucia (CSA action point 1). Farmers, officers of the Ministry of Agriculture, technicians and students in agriculture of the local college (Sir Arthur Lewis Community College) participated locally in the project, thereby strengthening their capacities. Regionally, officials from the ministries of agriculture of Antigua and Barbuda and the Commonwealth of Dominica, Grenada, Montserrat, Saint Kitts and Nevis, Saint Lucia and Saint Vincent and the Grenadines also received training, which contributed to institutional strengthening (CSA action point 3). The final workshop of this project was carried out over two days, with one full day being organized in a FFS setting. This allowed for practical demonstrations and hands-on learning by farmers on the setting up of automated irrigation systems and the efficient use of irrigation systems with buried or surface irrigation lines. It is hoped that these FFS demonstrations and training sessions will facilitate the implementation of CSA practices at field level (CSA action point 5).

Outcomes

The project provided an avenue for the improvement of agriculture in Saint Lucia and the other members of the Organisation of Eastern Caribbean States (OECS).

The project introduced a crop scheduling application that allows farmers to develop and follow production schedules. Farmers improved their understanding of market trends linked to seasonal climatic changes and the occurrence of cultural festivals. As a result, farmers are now equipped to increase their crop production by effectively and systematically scheduling their crops based on the demands of the market. Farmers are also better equipped to produce food to reduce their country's food import bills. This outcome has the potential to improve the availability of food for the local and regional population, and thus contributes towards the goal of achieving zero hunger (SDG 2).

The project also examined climate data, which are relevant to market intelligence for crops, and especially vegetables. The examination of climate data facilitated improvements in water use efficiency in farming. One example was the use of automated irrigation systems that are controlled via mobile devices during wet and dry seasons. The successful adoption of these technologies contributes towards the goal of climate action (SDG 13).

Overall, the project contributed to climate action by mapping farms in Saint Lucia according to their risk of landslides, floods and other hazards, which directly affect Life on land (SDG 15) and have an impact on the (agricultural) activities that persons can conduct in their communities. A WhatsApp group was created under the project to exchange information between regional and local stakeholders. This group grew to include participants from farming communities, OECS ministries of agriculture, CARDI, the University of the West Indies, the Inter-American Institute for Cooperation on Agriculture, the OECS Commission, and California State University, Fresno. As such, the project contributed towards Partnerships for the Goals (SDG 17).

Advancing the three pillars of CSA

The project attracted a lot of interest locally and regionally. It was successful at advancing the three pillars of the CSA approach. The project taught farmers and extension officers how to schedule crop production based on market demands and changing weather conditions, and thus increase productivity. The project shared a web application with participants to encourage crop scheduling, and divulged techniques for the efficient use of water through automated sprinkler irrigation and fertigation systems. Over 30 farmers and technicians of regional ministries of agriculture received training. When applied in the field, these techniques can boost productivity, and thus increase resilience.

Farmers' improved understanding of changes and trends in weather patterns and the climate allowed them to plan production accordingly. Crop scheduling allows production to meet demand even under varying climate conditions, and ensures that food is produced locally during drought periods in Saint Lucia. The project raised regional participants' awareness of the importance of crop scheduling, using Saint Lucia as an example. Thus, the project contributed to the strengthening of the region's resilience to climate change.

Resilience can be increased by improving productivity and adopting ICT. In addition, the adoption of good agricultural practices as a component of farm systems is vital. Together with the technologies and techniques taught under the project, good agricultural practices can help reduce GHG emissions from farming. The implementation of good agricultural practices and efficient water use by farmers allow for natural carbon, water and nitrogen cycles to function effectively and conserve the environment. Carbon sequestration can be increased, and loss of nitrates through leaching reduced. By using fertilizers and water efficiently, farmers in the region can improve the environmental sustainability of their operations.

While the project was a success, there is a need for follow-up projects that monitor the implementation of these interventions and help farmers adopt the technologies learned. Improving farmers' access to financing is another area that can be developed from this project; for example, loan packages may be offered to farmers to purchase the required equipment and technologies. These areas provide avenues towards CSA in the Caribbean that build on the foundation created by this project.

This case study was submitted by Andrea K. Veira, crop scientist, CARDI Saint Lucia. infocentre@cardi.org.

Conclusions

The case studies presented in this publication demonstrate that CSA has grown from the conceptual stage to being implemented by many development partners worldwide. CSA is recognized in the 2019 report of the High Level Panel of Experts on Food Security and Nutrition (HLPE) as an innovative approach for sustainable agriculture and food systems that enhances food security and nutrition (HLPE, 2019). CSA can provide an essential way forward to transform agricultural systems in a context of climate change.

As highlighted in the introduction to this publication, transforming agri-food systems is crucial to meet the SDGs. CSA may contribute to this transformation by sustainably increasing agricultural productivity and incomes, adapting and building the resilience of people and food systems to climate change, and reducing and/or removing GHG emissions where possible. The case studies presented in this publication show how CSA projects are contributing to many of the SDGs. They provide insights into the potential that is created by each of the action points, as well as by addressing multiple action points jointly. Indeed, the adoption of a comprehensive strategy – such as that of the five action points for the implementation of CSA – may be expected to improve results.

Regarding action point 1 (building the evidence base), the case studies confirm that CSA implementation requires a site-specific approach. What may be considered as a climate-smart practice in one location may not be considered as such in another location, given local circumstances (including agricultural and socio-economic circumstances) under climate change. Nevertheless, the sharing of knowledge may help build a more diverse and robust evidence base for CSA that partners around the world may draw on. Moreover, experiences related to the four other action points of CSA implementation should feed knowledge back into the evidence base, thus ensuring that research and practice are continuously connected.

As far as action point 2 (supporting enabling policy frameworks) is concerned, the case studies discussed in this publication provide insights into how various governments are already working to operationalize their approach to agriculture under climate change. The case studies show that this operationalization is taking place at regional, national and provincial levels and in collaboration with partners including organizations of the United Nations, research institutes and farmer communities.

Action point 3 (strengthening national and local institutions) is crucial in the process of implementing CSA. The case studies in this publication confirm that capacity building entails a range of activities, including the drafting of guidelines, the dissemination of best practices, and training.

Enhancing options for financing and funding, action point 4 of CSA implementation, is discussed in this publication in a broader scope than the one that is traditionally considered. Key actions to enhance these options include accessing climate finance instruments, creating links between climate and agricultural finance and investments, and considering climate change in agricultural planning and budgeting. The case studies in this publication illustrate the potential of these actions and propose innovative finance mechanisms, for example to help farmers invest in CSA practices and unlock the potential of large-scale public-private partnerships to attract resources.

The case studies highlighted under action point 5 (implementing practices at field level) highlight the importance of gaining a good understanding of the diverse needs and priorities of farmers and working directly with them. The case studies demonstrate that CSA must be considered as encompassing a broad range of practices. The studies illustrate how tools such as FFS, demonstration plots and ICT may prove valuable in a range of settings.

Each of the five action points is being implemented in CSA projects in various parts of the world. As CSA implementation is context-specific, the action points are not one-size-fits-all solutions. Indeed, rather than providing a strict sequential framework for CSA projects, they inspire actors to take a comprehensive look at how to better reach results, and what kind of partners to involve in the process.

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Climate-smart agriculture (CSA) is a context-specific approach and includes three pillars: 1) sustainably increasing agricultural productivity and improving farmers' incomes, 2)building resilience and adaptation to the effects of climate change, and, 3) where possible, reducing and/or removing greenhouse gas (GHG) emissions.

This publication describes climate-smart agriculture (CSA) case studies from around the world, showing how the approach is implemented to address challenges related to climate change and agriculture. The case studies operationalize the five action points for CSA implementation: expanding the evidence base for CSA, supporting enabling policy frameworks, strengthening national and local institutions, enhancing funding and financing options, and implementing CSA practices at field level. The publication provides examples of the innovative roles that farmers, researchers, government officials, private sector agents and civil society actors can play to transform food systems and help meet the Sustainable Development Goals; it also demonstrates how these actors can collaborate. The case studies discuss context-specific activities that sustainably increase agricultural productivity and incomes, adapt and build resilience of people and food systems to climate change, and reduce and/or remove greenhouse gas emissions where possible.

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