CCARDESA

Centre for Coordination of Agricultural Research and Development for Southern Africa

Climate Change mitigation through Climate-Smart Agriculture in Southern Africa: challenges and emerging opportunities

Brief

Abstract

This brief explains how CSA practices have mitigation co-benefits, how mitigation co-benefits relate to other policy objectives, and the challenges and opportunities for climate change mitigation through CSA in Southern Africa.

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Climate Change mitigation through Climate-Smart Agriculture in the Southern Africa: challenges and emerging opportunities

Key messages

• Although food security and adaptation to climate change are policy priorities, most countries in the Southern African Development Community (SADC) region have included mitigation of agricultural greenhouse gas (GHG) emissions in the scope of their national climate change commitments (Nationally Determined Contributions, NDCs) and are increasingly integrating agriculture and climate change.

• There are four ways in which GHG mitigation can be a co-benefit of CSA: reducing agricultural GHG emissions; reducing the pressures on land use change that cause emissions from deforestation and conversion of other land uses; reducing GHG emissions per unit of agricultural output; and increasing carbon stocks in soils and shrubs or trees.

• Delivering on countries' NDC commitments requires addressing both technical and policy/ governance challenges. Some challenges are common to all agriculture or CSA initiatives, but some are specific to initiatives targeting mitigation co-benefits.

• Growing experience with CSA in the region points to some instructive experience and emerging opportunities that can help harness the mitigation co-benefits of CSA.

About this document

This information brief on mitigation co-benefits of Climate Smart Agriculture (CSA) is one of four information briefs that highlight the relevance of greenhouse gas (GHG) mitigation as a co-benefit of CSA in Southern Africa. This brief explains

1. how CSA practices have mitigation co-benefits,
2. how mitigation co-benefits relate to other policy objectives, and,
3. the challenges and opportunities for climate change mitigation through CSA in Southern Africa.

þ Climate Change Mitigation through CSA: Challenges & Opportunities

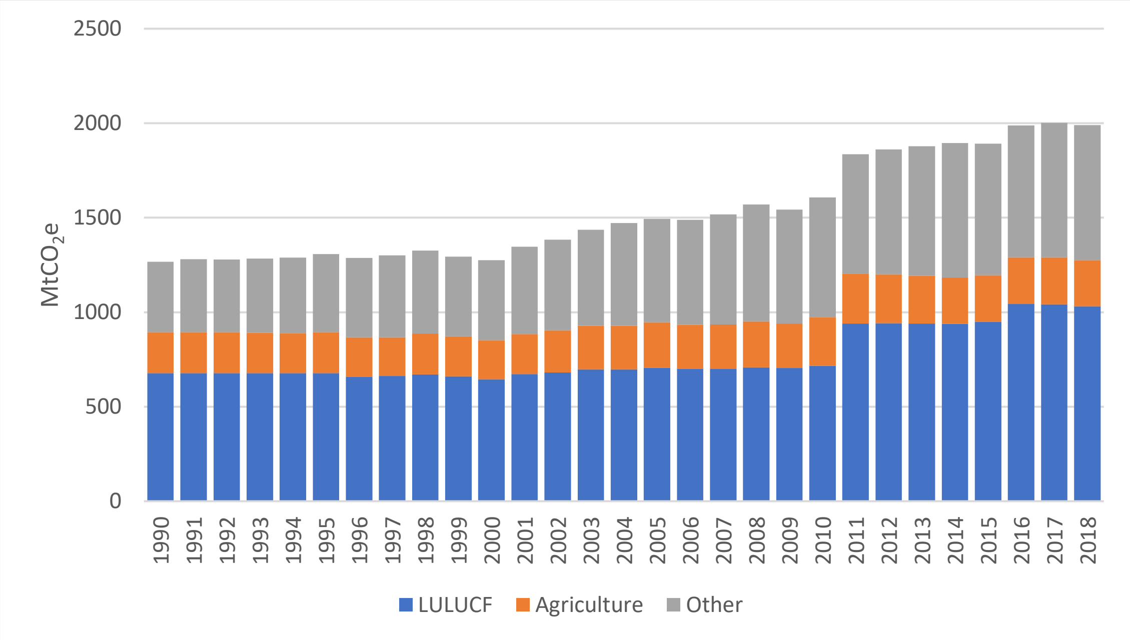
Other briefs in this series:
o Climate-smart crop production
o Climate-smart livestock
o Climate-smart landscapes

Agricultural GHG emissions in Southern Africa

Agriculture, forestry and other land uses (AFOLU) are closely interlinked. In the SADC region, the AFOLU sector was responsible for approximately 1,280 million tonnes of carbon dioxide equivalent (tCO_2e) of GHG emissions in 2018.[1] This accounts for 64% of total GHG emissions in the region, with just 713 million tCO_2e from all other sectors combined (Figure 1). Of the AFOLU emissions, just over half was from land use change – in particular deforestation – and livestock accounted for about 30%, while crop production emitted only about 5% of total AFOLU emissions (Figure 2). However, cropland expansion is one of the main drivers of emissions from land use. Within crop-based agriculture emissions, almost two thirds are due to carbon dioxide (CO_2) and nitrous oxide (N_2O) emissions from synthetic fertilizers, and 20% due to N_2O emissions from crop residues. There has been a slight increasing trend in GHG emissions from crop production in the region, mainly driven by increasing use of synthetic fertilizer, but emissions from livestock have decreased because of declining livestock numbers due to the adverse effects of drought in recent years. Beyond production, GHG emissions also originate from transport, processing and packaging in agricultural value chains.

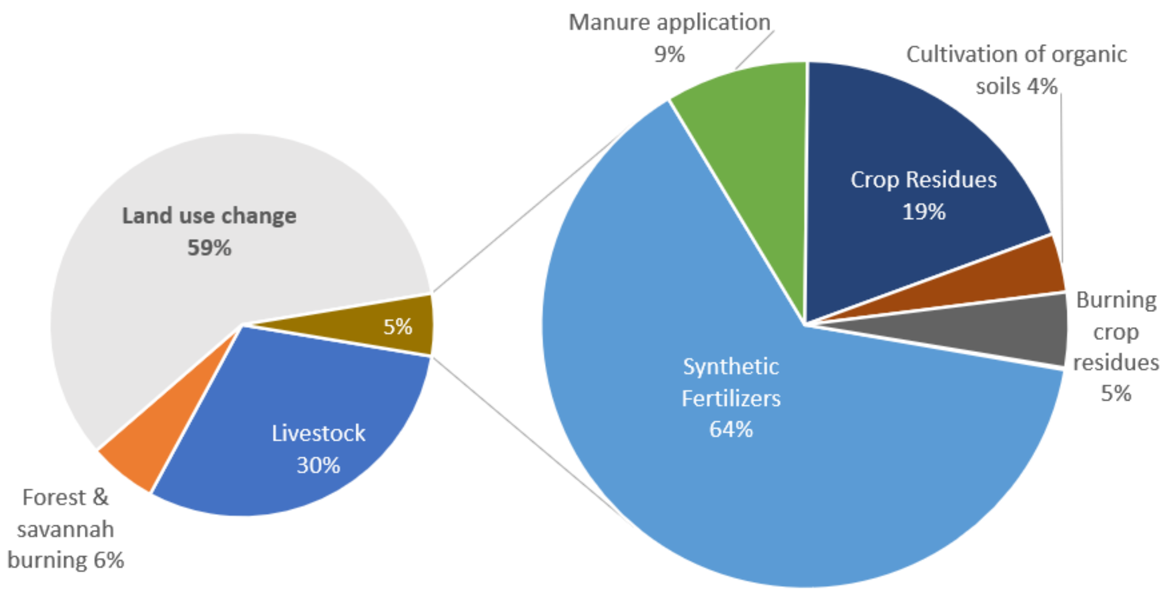
This structure of emissions indicates the importance of sustainable management of agricultural landscapes and food systems, because aside from the effects of land use change on GHG emissions, these trends are suggestive of declining ecosystem services, such as soil conservation, water storage and flood regulation, which are essential for resilience to climate variability and climate change. Agroecological approaches and practices are recommended to foster the transformation of agricultural food production systems.

Figure 1: Sources of GHG emissions in the SADC region, 1990-2018



Note: Other includes energy, industry and waste Source: WRI CAIT database.

Figure 2: Sources of agriculture, forestry and other land use GHG emissions in Southern Africa in 2018



Source: *calculated from data in FAOSTAT 2021* (*http://www.fao.org/faostat/en/#data/GT)*

GHG mitigation co-benefits of climate-smart agriculture

What is Climate-Smart Agriculture?

Climate-smart agriculture (CSA) aims to improve food security by increasing productivity and producer incomes, strengthening resilience to climate change, and reducing GHG emissions wherever possible (Figure 3).[2]

Figure 3: The three pillars of climate-smart agriculture

Climate Smart Agriculture		
Productivity Sustainably increase productivity and incomes from agriculture, while minimising environmental impacts	Resilience Reduce exposure of farmers to short-term risks, while building capacity to adapt in the face of shocks and stresses in the longer-term	Mitigation Reducing GHG emissions and/or increasing carbon stocks, wherever possible

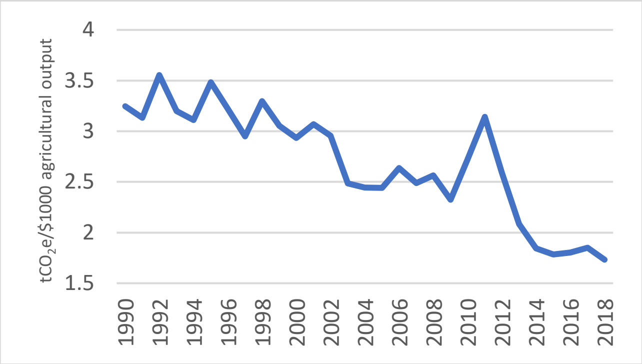
In line with national policy priorities in the Southern Africa region, CSA is mostly promoted for its potential to improve food security in the face of a changing climate, and to increase farmers' and livestock keepers' abilities to cope with climate shocks and adapt to longer-term change. Many CSA practices can have benefits for reducing GHG emissions (mitigation). These benefits can be achieved in different ways:

1. Reducing GHG emissions from agricultural activities: With high levels of food insecurity in the region and a growing population, agricultural output will continue to increase. In general, this implies increasing GHG emissions. Some agronomic and animal husbandry practices can support increased production with lower GHG emissions. Examples include leguminous (fertilizer) shrubs and trees as a partial substitute for synthetic fertilizers, using animal manure to produce compost or biogas, intercropping and crop rotation or minimizing tillage in fields.

2. Reducing GHG emissions from land use change: Agricultural expansion is a major driver of land use emissions in Southern Africa. Increasing productivity on existing arable land and maintaining soil fertility or restoring degraded cropland soils can reduce the pressure on farmers to expand the cropland area. This can have indirect GHG mitigation effects by reducing the role of agriculture as a key driver of deforestation, forest degradation, or conversion of other land uses to cropland or to grassland for livestock production.

3. Reducing GHG emission intensity: Farmers' and policy makers' objectives of meeting growing demand for food can be achieved by reducing GHG emissions per unit of agricultural output – producing more with less. GHG emissions often represent inefficient use of inputs and natural resources, so increasing resource use efficiency is a good way to meet growing demand with less environmental impact. Total GHG emissions may continue to increase in order to boost agricultural production, but the rate of increase would be lower than if less efficient methods were used. Figure 4 shows that at the macro-level, the greenhouse gas intensity of agriculture in Southern Africa has been decreasing in recent years.

Figure 4: Emission intensity of agriculture in Southern Africa, 1990-2018 (tCO_2e/$1000 agricultural output)



Source: FAOSTAT (2021)

4. Increasing carbon stocks in agricultural soils and trees: Although agricultural emissions may increase due to increasing productivity, these emissions can be balanced against carbon sequestration in soils, trees and shrubs. Healthy soils and soil fertility are critical to support sustainable agricultural production, and sequestration of carbon in soils can be a co-benefit of better land management. Trees and shrubs can have multiple roles both on-farm and in the wider agricultural landscape. They provide important ecosystem and watershed services, such as regulation of microclimatic conditions and water flows to withstand the effects of drought and prevent flooding, as well as providing a range of productive uses, such as timber, fuel wood and non-timber forest products that improve rural people's livelihoods.

Examples of practices that illustrate these four pathways to climate-smart, low-emission agricultural development are given in the companion briefs on mitigation co-benefits in the crop sector, climate-smart livestock, and climate-smart landscapes.

The policy context for CSA mitigation co-benefits in Southern Africa

The synergies between adaptation and mitigation in the agriculture sector are well reflected in national climate change commitments of countries in southern Africa. Fifteen out of 16 southern African countries' Nationally Determined Contributions (NDCs) explicitly mention agriculture as a priority sector for adaptation, and 11 explicitly target a contribution from agriculture to national GHG mitigation goals (Figure 5). While 'CSA' is often not specifically mentioned, a wide range of CSA practices are listed in several countries' NDCs (Table 1). Some countries in the region have also adopted specific CSA strategies.

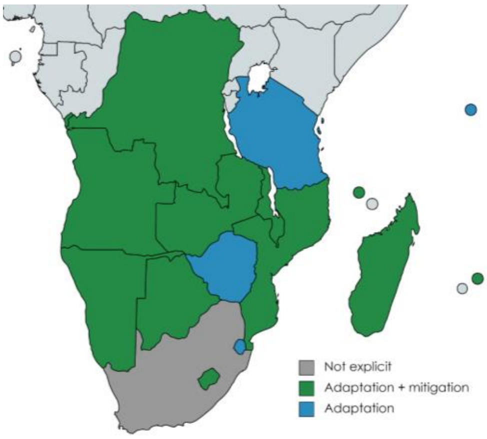


Figure 5: Agriculture in the NDCs

Box 1: Regional policies on climate change

Reflecting the national priorities of its member states, SADC's *Vision 2050* and the *Regional Indicative Strategic Development Plan* (RISDP, 2020-2030) identify strengthened climate change adaptation and mitigation as an important cross-cutting issue. The SADC *Climate Change Strategy and Action Plan (2015)* emphasizes the fundamental importance of food security and adaptation to climate change, while also recognizing "that there is greater scope for delivering adaptation goals through some mitigation actions in the agricultural sector". The action plan promotes the adoption of green, sustainable agricultural practices, including CSA practices and measures that maintain or sequester carbon in the landscape.

The Regional Agriculture Policy also recognizes the importance of tackling climate change impacts and variability and mitigating GHG in the agriculture sector.

Table 1: Exemplary climate-smart agriculture practices in selected Southern African countries' NDCs

Country	Adaptation measures	Mitigation measures
Angola	Land rehabilitation, rangeland management, sustainable land management and agroforestry Disaster risk reduction in agro-pastoral communities	Efforts to mitigate GHG emissions from the agriculture sector Afforestation and reforestation of degraded forest lands and mangrove habitats
Botswana	Improve livestock genetics Improve livestock diet through supplementary feeding Switch to drought and heat tolerant, short maturity crops	Mitigation measures for the livestock sector to reduce methane (CH_4) emissions mainly from enteric fermentation
Lesotho	Conservation agriculture Sorghum breeding for yield and drought tolerance Improved crop and livestock systems Land rehabilitation	Improving crop and livestock production practices for food security while reducing emissions
Madagascar	Resilient Agriculture Integrated Model pilot projects Improved rice farming	Improved rice farming Conservation agriculture / CSA Arboriculture
Malawi	Smallholder irrigation, water conservation Drought tolerant varieties Insurance	Livestock intensification, agroforestry, fertilizer optimization, fertilizer trees, reduced and zero-tillage
Mozambique	Increase the resilience of agriculture, livestock and fisheries Reduce soil degradation	Forestry and agriculture are included in the scope of mitigation efforts
Namibia	Coordinating timing of ploughing planting with rainfall events; drought-resistant crop varieties and livestock breeds; shifting livestock to alternative grazing areas; soil and water conservation practices	Grassland restoration Arboriculture and afforestation Cattle feedlots
South Africa	Sector adaptation plans integrated into broader sector plans	Working on wetlands programme Land restoration
Zambia	Adaptation of strategic productive systems (agriculture, forests, wildlife and water)	Conservation agriculture Rural biogas plants Rural biomass electricity generation
Zimbabwe	Conservation agriculture Drought tolerant crops and resilient livestock breeds Sustainable intensification	-

Source: UNFCCC NDC Registry, https://www4.unfccc.int/sites/ndcstaging/Pages/Home.aspx

In some countries, adaptation and mitigation actions are built on existing agriculture or rural land management policies and programmes. Other countries are still in the process of integrating climate change into sectoral policies and programmes. Throughout the region, as in other parts of the world, work is continuing to better understand the GHG effects of agricultural development and adaptation measures, to inform future policies and plans.

Challenges to delivering on mitigation commitments

Although many countries have announced their intentions to adapt to climate change and reduce GHG emissions, including from agriculture, there are a number of challenges specific to realising GHG mitigation co-benefits in the agriculture sector (Table 2).

Table 2: Key challenges in delivering on mitigation commitments through CSA

	Policy and governance challenges	Technical challenges
Understanding the context	Awareness, evidence to support decision-making	Lack of data on effects of measures on CSA 3 pillars
Developing CSA policies & measures	Multi-stakeholder collaboration in design of policies and measures	Targeting CSA measures
Delivering CSA policies and measures	Policy implementation mechanisms Mobilizing finance	Building capacities at local level
Measuring progress and outcomes	National monitoring and evaluation (M&E) systems	Capacities for measuring GHG effects

Understanding the context: Which CSA measures are feasible and appropriate depends on the context specific and the outcomes that stakeholders prioritise. There may be synergies or trade-offs between GHG mitigation and the other benefits of CSA practices. Decisions by stakeholders would ideally be informed by evidence in order to weigh and prioritise CSA practices and their outcomes. The lack of data to support evidence-based decision making on the effects of agronomic and animal husbandry measures on adaptation and GHG emissions constrains the ability of decision-makers at all levels to promote CSA measures with mitigation co-benefits. Figure 6 illustrates the scale and scope of the challenge. ERA, a dedicated database for evidence on the three pillars of CSA, contains data from 275 studies in the region. Not only is this a relatively small number, but the studies are unevenly distributed geographically and across agricultural sub-sectors. Scientific studies are not the only source of knowledge on CSA, but knowledge on CSA in the region is often dispersed and not available in forms that can support decision-making.

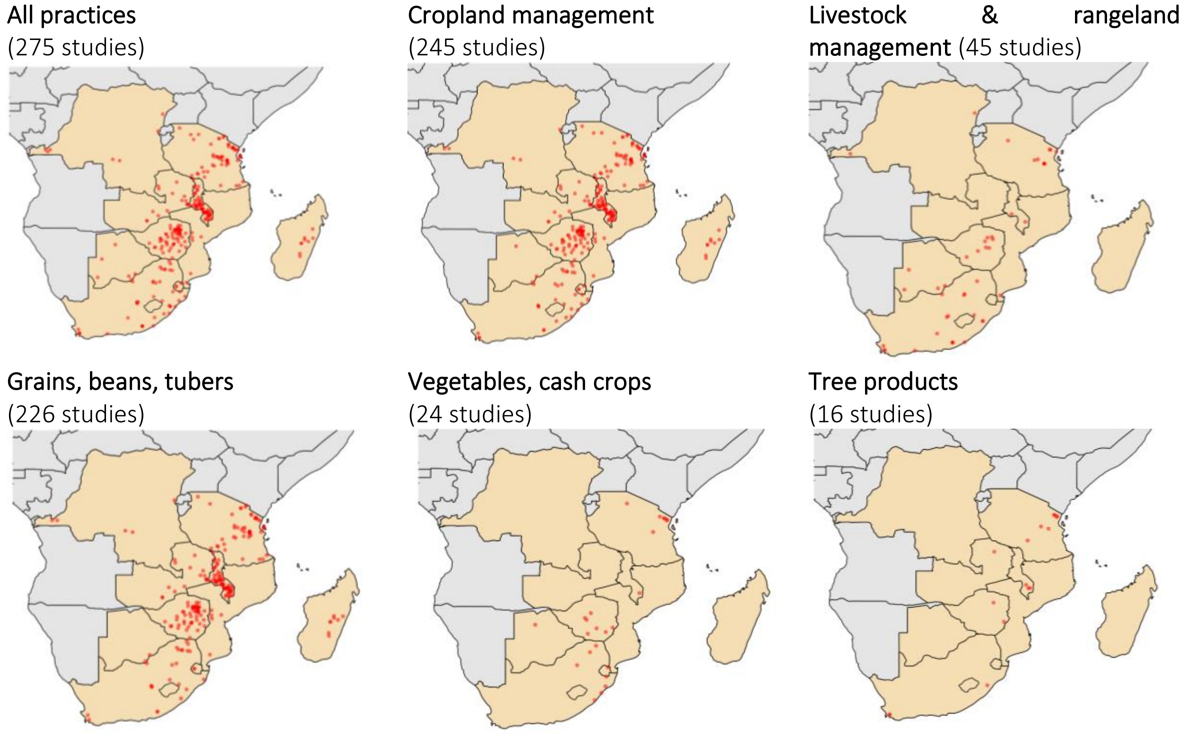
The Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) is actively gathering and disseminating knowledge on CSA from different sources to help address this constraint (https://www.ccardesa.org/climate-smart-agriculture).

Evidence for Resilient Agriculture (ERA)

ERA is a living data base and a web portal that provides access to data and tools on the performance of agricultural technologies for development decisions. It builds on the last 30-plus years of agriculture research and syntheses the effects of shifting from one technology to another in different places. Key indicators are applied, including productivity, resilience and GHG mitigation.

World Agroforestry (2021)

Figure 6: Availability of scientific evidence on CSA practices in southern Africa



Source: Evidence for Resilient Agriculture, https://era.ccafs.cgiar.org/analysis/csa-map/

Developing CSA policies and measures: Development of CSA policies and measures should involve all relevant stakeholders. Because agriculture is multi-functional and CSA relates not just to crops and livestock but to agricultural landscapes, there are many stakeholders with interests and influence at different levels. For example, stakeholders as diverse as energy companies, reservoir management agencies and trading standards bodies may all have an interest in issues related to agriculture. CSA and landscape approaches are cross-sectoral in nature and require consultation and collaboration beyond core agriculture stakeholders with key players in water, energy, environment, trade and transport, among others. Farmers vary in many ways, living in areas with different climate and soil conditions, farming at different scales, some more subsistence and others more market-oriented. CSA practices need to be catered to farmers' needs, and there is no 'one size fits all' solution. This increases the complexity of designing policies and measures, and of delivering support at the local level. Also, strengthening local capacities for prioritization and decision making are key for success to increase resilience and productivity while mitigating GHG emissions as a co-benefit.

Delivering CSA policies and measures: Many CSA practices are knowledge- and resource-intensive. Some require longer time spans, such as restoring soil fertility or introducing trees on agricultural land. Capacity building is required not only for farmers but also for extension workers and others who support the adoption of CSA, and the institutionalization of knowledge generation, learning and sharing. Although capacity building is critical, funding for agricultural extension is often limited, which constrains the ability of actors at all levels to select, prioritise and promote CSA measures applicable for each specific context. Farmers often face multiple barriers to adoption in addition to lack of awareness and knowledge. These may include lack of secure land tenure, limited access to inputs or finance, and vary between farmers. Policy mechanisms should target barriers to adoption, and this presents a challenge for designing effective policy delivery mechanisms that can bring about change at scale. Government budgets and international finance are both limited. Farmers' own savings are the largest single source of investment in agriculture, but many farmers have limited access to additional finance to make investments and finance the costs of adopting CSA practices.

Measuring progress and outcomes: A growing number of countries are developing CSA strategies and plans. These rarely include fully developed monitoring and evaluation (M&E) frameworks. An assessment of CSA stakeholders' information needs in four southern African countries identified between 21 and 78 information needs per country, of which a very small proportion were currently being met by existing data management systems.[3] Unmet needs included basic information such as which organisations in the country is doing what, as well as more complicated needs, such as improved GHG inventories to track the GHG effects of CSA adoption (Box 2).

Box 2: Livestock GHG inventories in southern Africa

Livestock account for more than two thirds of agriculture sector emissions (excluding land use change) in the region, and are important to food and nutrition security and agricultural development. Methane emissions per head of livestock vary depending on animal performance (e.g., live weight, daily weight gain, milk yield) and feed quality. GHG inventories compiled following the Intergovernmental Panel on Climate Change (IPCC) guidelines can use either a Tier 1 method, for which the only data needed are total population of each species, or using a Tier 2 method which estimates emissions based on animal performance and feed quality. Only the Tier 2 method is capable of tracking change in GHG emissions due to improvements in productivity, feeding or animal management. Of the 16 SADC member countries, only South Africa and Namibia use the Tier 2 method. Data on animal performance have yet to be collated in most countries, despite their relevance to livestock sector planning. Improving countries' abilities to track their livestock-related NDC commitments will therefore require improvements in agricultural statistics systems as well as GHG inventories.

Experience and emerging opportunities in Southern Africa

Despite these challenges, there are examples of initiatives in the region and globally that point to options for addressing the challenges faced, some of which are illustrated in the sections that follow.

Understanding the context: Recognizing that knowledge of CSA is rarely available in ways that can inform country-specific decision-making, the World Bank has supported development of Climate Smart Agriculture Investment Plans (CSAIPs, Box 3).

Box 3: Climate Smart Agriculture Investment Plans in Southern Africa

The World Bank has supported the development of CSAIPs in Lesotho, Namibia, Zambia and Zimbabwe. The plans are developed on the basis of national development plans, supplemented by rigorous analysis of available data and consultation with governments and other stakeholders. The plans identify concrete actions governments can take to boost adoption of CSA. CSAIPs can be used to:

- **inform investments:** In Lesotho, the CSAIP informed the design of the $50 million second phase of the Smallholder Agricultural Development Project (SADP 2)
- **develop policies:** In Zambia and Zimbabwe, CSAIPs have informed the formulation of National Agriculture Investment Plans. Countries can also use the CSAIPs to inform their NDCs and ensure closer integration of agriculture sector and climate policies and plans.

The Adaptation for African Agriculture (AAA) Initiative has taken up the idea of CSAIPs and aims to support more countries to undertake similar analysis.

Source: https://www.worldbank.org/en/topic/agriculture/publication/climate-smart-agriculture-investment-plans-bringing-climate-smart-agriculture-to-life

Box 4: CCARDESA's roles in regional CSA knowledge management

CCARDESA, in partnership with the German Development Cooperation and since recently also the with the International Fund for Agricultural Development & the European Union, has been actively supporting regional and national partners with capacity strengthening in CSA since 2016. These activities have included direct training to staff in both the private and public sectors, dissemination of CSA technologies, reviews of national policies in SADC countries, and dissemination of information on CSA. CCARDESA's activities target different levels, including policy makers, extension workers, farmer organizations and the private sector, with the aim of transforming farming systems in the SADC countries to become resilient to climate risks. As a regional organization, it works through national partners.

There is a wide range of data, innovations, statistics and trends related to CSA technologies at national, regional and global levels. The value of data, scientific facts and statistics is enhanced when it is collated and made easily accessible to stakeholders who use it for different purposes. CCARDESA is playing a key role in collating, curating and disseminating data, statistics, knowledge products and other materials targeted to meet the needs of different stakeholders. Knowledge sharing also strengthens partnerships with stakeholders at different levels in the SADC region and internationally, including with the Consortium of International Agricultural Research (CGIAR). CCARDESA's knowledge products, including more than 24 specific CSA briefs for maize-, rice-, sorghum and cattle-based production systems, can be found at https://www.ccardesa.org/knowledge-products/" https://www.ccardesa.org/knowledge-products/. Readers are invited to contribute to this growing regional knowledge hub.

Box 5: Tools to measure agricultural GHG emissions and assess mitigation potential

The CGIAR research programme on Climate Change, Agriculture and Food Security (CCAFS) provides a range of tools to measure agricultural GHG emissions and assess mitigation potential to support decision-making and enhance the monitoring and reporting:

• The Agro-Chain Greenhouse Gas Emissions (ACE) calculator estimates total GHG emissions associated with a food product or food loss and waste (https://ccafs.cgiar.org/resources/tools/acge-calculator).

• The Standard Assessment of Agricultural Mitigation Potential and Livelihoods (https://samples.ccafs.cgiar.org/about-samples/) research program of CCAFS provides an online platform that supports tropical countries to measure GHG emissions from agriculture and to identify options to reduce these compatible with food security. Resources provided on the SAMPLES website include emission factors for agricultural greenhouse gas emissions, measurement methods and tools for prioritizing action.

Developing CSA policies and measures: Practical experience from CSA interventions in the region and scientific research is increasing the ability to target CSA practices to areas where they are likely to be most effective. Within communities, however, gender remains a key factor influencing the adoption of CSA practices. Here too, experience is being gained in community-based approaches to identify and address gender relations for better outcomes for both men and women (Box 6).

Box 6: Gender action learning systems (GALS) in Zimbabwe

Gender is a key factor influencing adoption of CSA practices with mitigation co-benefits. Gender also influences who benefits from changes in farming practices. For example, if women don't own dairy cattle, or don't control the income from milk sales, they may have little incentive to adopt practices that reduce GHG emissions or to engage with schemes aiming to incentivize climate smart livestock production.[4]

GALS methodology is an approach for opening up conversations about gender relations within communities and households. The goal is to improve the gender equity in intra-household decision-making processes and to improve how household members of both sexes work together to manage farming and other activities and resources. The GALS approach supports men and women to develop a common vision for the household and then explores the gender relations that could enable these visions to become reality. GALS can then be extended to the wider community and other supporting actors. GALS has been used as an integral part of agricultural extension activities in many countries in the region.

An evaluation of its application by Oxfam in Zimbabwe found that it was effective in shifting household gender relations, and can be used to reach large numbers of rural men and women at relatively low cost.[5] The evaluation findings suggested that GALS has potential to significantly contribute towards the development of a commercialized smallholder sector because it enables households to systematically plan farming and off-farm activities and makes adoption of new technologies more likely.

Delivering CSA policies and measures: Finance and effective financing mechanisms remain key constraints to upscaling CSA in Southern Africa. The companion information briefs give examples of food-for-work and carbon credit projects that are upscaling CSA practices. The Green Climate Fund – the main funding mechanism for the Paris Agreement – has supported several adaptation projects in the region. One recently approved project targets both adaptation and mitigation outcomes in Botswana's communal rangelands, perhaps providing an indication that stakeholders are now gaining increasing capacity to leverage the mitigation co-benefits of adaptation measures to attract climate finance investments.

Box 6: Input subsidies to support adoption of Climate Smart Agriculture practices[6]

The number of agricultural input subsidy programmes in Africa has been increasing, especially since a fertilizer subsidy programme in Malawi was credited with turning the country from an importer to an exporter of maize and substantial reductions in rural poverty. Many of these recent subsidy programmes follow new design principles, operating through the private sector and fertilizer markets, targeting beneficiaries (e.g., small farms or areas where fertilizer use can be profitable), are linked with improvements in supply of other complementary inputs, and are designed to phase out when farmers have realized the benefits of input use.

Overall, many programmes have increased grain production, but less so than expected. This is partly because the private sector is crowded out and partly because of lower-than-expected yield responses in smallholder farms. Work continues on how to improve the design of smart subsidy schemes, and to developing supporting measures, such as research into how to optimize fertilizer use in combination with other inputs in different agroecological conditions. Agroecological measures, such as intercropping with fertilizer trees, can also improve soil fertility and increase crop yields while reducing the need for inorganic fertilizers.[7]

Measuring progress and outcomes: Government and donor-funded interventions often have their own M&E systems, which tend to serve donors' information needs. But stakeholders at all levels can benefit from greater capacity to measure and report GHG mitigation co-benefits of CSA activities (Box 7).

Box 7: Quantifying livestock GHG emissions is useful at different levels

Ethiopia's Climate Resilient Green Economy Strategy was issued in 2011 and quickly integrated into the mid-term national development plan. Livestock was one of four sectors prioritised for GHG mitigation. Measures included increasing smallholder and commercial dairy cattle milk yields and increasing the share of poultry in both smallholder and commercial sectors and promoting mechanization to replace oxen. The M&E framework for the national development plan required reporting on GHG emissions reduced, but initially there was no data system or methodology for doing so. The first step was to develop a national GHG inventory using a Tier 2 method that can reflect changes in productivity, oxen work hours and the distribution of animals in different production systems. This work is now providing the basis for other livestock sector initiatives to quantify their GHG emissions. At sub-national (regional) level, the Oromia Forested Landscape Programme (OFLP) is a World Bank initiative to reduce deforestation through performance-based payments. That is, the World Bank will make payments to Oromia Region for GHG emission reductions achieved. As one of the main GHG sources, livestock should be included in the programme. The national inventory is providing a basis for regional stakeholders to improve estimates of livestock GHG emissions, which may unlock the potential for the livestock sector to be included in the programme's emission reduction purchase agreement. The World Bank Livestock and Fisheries Sector Development Project also has an explicit aim to reduce the GHG emission intensity of dairy production. The project is now using the data collated for the national inventory as the basis for developing its own GHG monitoring system to track and report on mitigation co-benefits of dairy development.

Future perspectives

Agriculture has many functions critical to people's well-being and a healthy environment. GHG emissions are only one of the effects of agricultural production, and GHG mitigation benefits are rarely sufficient to motivate adoption of CSA. However, there is growing experience in the region with harnessing the GHG mitigation co-benefits of CSA to guide planning and to leverage finance for sustainable agricultural futures.

Acknowledgements

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References and further reading

CCARDESA Knowledge Products on CSA
CCAFS CSA Country Profiles
FAO Climate Smart Agriculture Sourcebook
Climate Smart Agriculture 101
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