CCARDESA

Centre for Coordination of Agricultural Research and Development for Southern Africa

Photo: Catalina Berger

GHG Mitigation through Climate-Smart Agriculture in Southern Africa: climate-smart landscapes

Brief

Abstract

This brief explains: links between agriculture and GHG emissions from other land uses, landscape approach to achieve synergies between agriculture and other land uses, and between adaptation and mitigation, and examples of initiatives that illustrate how landscape approaches can be implemented at scale in Southern Africa.

german cooperation
DEUTSCHE ZUSAMMENARBEIT

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

GHG Mitigation through Climate-Smart Agriculture in Southern Africa: climate-smart landscapes

Key messages

- Agricultural landscapes provide essential ecosystem services that support sustainable and climate-resilient agricultural production.
- Conserving and restoring agricultural landscapes can benefit agricultural production, and climate-smart practices in croplands can also reduce pressures on natural resources in the landscape.
- An integrated landscape management approach can support collaboration between stakeholders at different levels for coordinated action across the landscape.
- Many landscape management practices have co-benefits for mitigating GHG emissions by reducing emissions from forest loss and land degradation or by increasing carbon stocks in the landscape.
- The landscape approach, based on 10 principles, is an emerging approach to achieve synergies between adaptation and mitigation.
- Examples of scaling landscape approaches show how these 10 principles can be put into practice.

ABOUT THIS DOCUMENT

This information brief on mitigation co-benefits of landscape approaches to 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:

✓ the links between agriculture and GHG emissions from other land uses

✓ a landscape approach to achieve synergies between agriculture and other land uses, and between adaptation and mitigation, and

✓ examples of initiatives that illustrate how landscape approaches can be implemented at scale in Southern Africa.

☑ Climate-smart landscapes

Other briefs in this series:

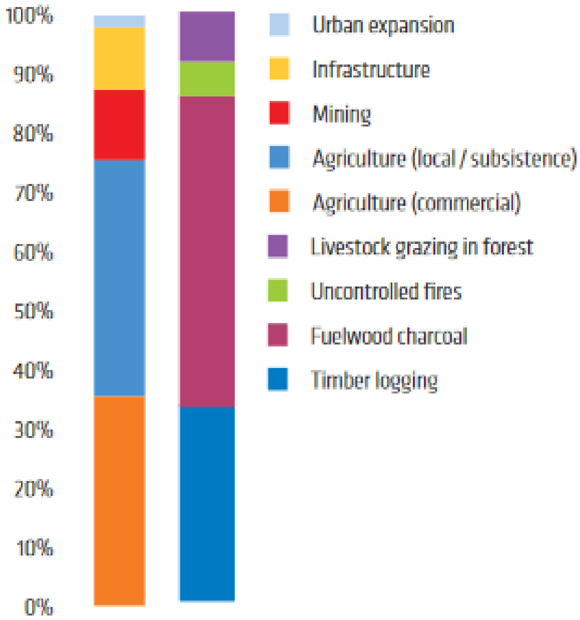
☐ Climate Change Mitigation through CSA: Challenges & Opportunities

☐ Climate-smart crop production

☐ Climate-smart livestock

LAND USE GHG EMISSIONS IN SOUTHERN AFRICA

Figure 1: Proportion of deforestation (left) and forest degradation (right) drivers in Africa



Source: Kissinger et al. 2012. Drivers of Deforestation and Forest Degradation. Lexeme Consulting, Canada.

Across most of Southern Africa, the energy and agriculture, forestry and other land use (AFOLU) sectors are the highest greenhouse gas (GHG) emitters. The AFOLU sector was responsible for approximately 1280 million tCO_2e of GHG emissions in 2018.[1] Changes in the region's total AFOLU emissions are driven strongly by agricultural activities, particularly in Zambia, Angola, South Africa, Zimbabwe, Botswana, Mozambique and Madagascar. The historic trends vary between countries in the region (Box 1).

The main direct drivers of land use change are shown in Figure 1 and include:

- Harvesting or using forest resources for energy in the form of charcoal, firewood, or other biomass;
- Clearing land for agriculture (both subsistence and commercial agriculture for food and cash crops), including small scale, shifting cultivation;
- Urbanization and industrial (including mining) activities;
- Bush fires (natural and man-made savannah burning); and
- Timber harvesting, and commercial logging.

Indirect drivers underlying these trends include rising demand for energy and poverty linked to population growth, market and policy failures, weak forest sector governance and institutions, unclear or insecure tenure rights, and high dependence on natural resources.

It is clear that agricultural activities, besides producing emissions from livestock and fertilizer use, are directly linked to forestry and land use, and can drive GHG emissions across the entire landscape. For example:

- Burning grasslands or clearing forest areas to transform into agricultural land results in loss of carbon sequestration capacity across the landscape and releases methane (CH_4), nitrous oxide (N_2O) and carbon dioxide (CO_2) into the atmostphere.
- Converting forest into rice paddies removes the forest carbon sink from the landscape and instead releases CH_4 into the atmostphere.
- The use of charcoal and firewood (whether for domestic or agricultural use) reduces carbon stocks and releases carbon into the atmostphere.
- Uncontrolled livestock grazing results in forest and land degradation, resulting in loss of carbon sequestration capacity.

- Poor farm practices can cause soil erosion or degradation outside the farm, which further contribute to emissions.

Box 1: Historic trends in land use emissions in Southern Africa

There are different trends in the historic AFOLU emissions pathways in different Southern African countries. Some show increasing, stable or decreasing trends:[2]

↑ Comoros, Madagascar, Malawi & Mozambique

= DRC, Eswatini & Zimbabwe

↓ Angola, Botswana, Lesotho, Mauritius, Namibia, Seychelles, South Africa, Tanzania & Zambia.

Although DRC's land use emissions are stable, they are the highest in the SADC region. And although Zambia's emissions are on a moderate downward trajectory, it has the highest proportion of forested land in the SADC region, but is experiencing the highest (and increasing) deforestation rates, which will impact future emissions.

Therefore, it makes sense to consider agricultural GHG mitigation in the context of the broader agricultural landscape:

- Activities in each sector that affect environmental conditions and drive GHG emissions are interlinked. So, although government strategies, projects and GHG accounting are all sector-based, addressing environmental issues (of which GHG emissions is only one) requires a cross-sectoral approach.
  - Cross-sectoral approaches can have multiple benefits. Off-farm investments in afforestation or restoration, soil and watershed rehabilitation, wetlands management or sustainable aquaculture can bring adaptation benefits for farmers and other stakeholders while also bringing benefits for mitigation of GHG emissions in the region through avoided emissions and enhanced carbon sequestration. Beyond climate change, cross-sectoral approaches within landscapes and among various land use demands also lead to environmental, social and economic benefits.

LANDSCAPE APPROACHES TO GHG MITIGATION

What is the landscape approach? Relying only on sectoral approaches to land management and GHG mitigation is insufficient to meet inter-related challenges of climate change, poverty alleviation and land degradation. CSA applied through an integrated landscape management approach links agricultural practices, institutions and policies with other landscape-scale activities and value chains, so that different activities are coordinated to achieve multiple objectives in the target area.[3]

Figure 2: Ten principles of a landscape approach

Source: Vianen J. et al., 2015. From global complexity to local reality: Aligning implementation frameworks with Sustainable Development Goals and landscape approaches. CIFOR, Bogor.

Figure 2 illustrates the key elements of a landscape approach, grouped into three main categories:

1. **Flexible landscape planning**: (1) Adoption of an adaptive management approach, (2) identifying a common concern entry point for intervention, and driving a (6) negotiated and transparent change logic.
2. **The 'multi' factor**: Operate at (3) multiple scales, aiming for (4) multiple functionalities, and (5) involving multiple stakeholders, who are (7) clear about their rights and responsibilities, and (8) take part in participatory and user-friendly monitoring.
3. **Holistic outcomes**: A landscape approach ideally results in (9) increased resilience across the target area, and (10) increased stakeholder capacities.

Resilience and adaptation outcomes could range from improved human well-being, food and fibre production, disaster risk reduction, to conservation of biodiversity and ecosystem services, while seeking positive synergies with GHG mitigation as a co-benefit.

Box 2: Strengthening climate resilience in the Kafue River Basin, Zambia[4]

The Pilot Program for Climate Resilience (PPCR), part of the Climate Investment Fund, supported a project in the Kafue River Basin, the headwater catchment of the Zambezi River, to foster sustainable water and land management, and promote climate-smart agricultural practices. These aimed to help local communities better address the current and future impacts of climate change (increasing drought and flooding) and precipitation variability. Without adaptation, it was estimated that over 300,000 people would remain in poverty in the region[5].

The project put into action Landscape Principles 1, 2, 4, 5, 7, 9 and 10. It financed participatory climate resilient Integrated Development Plans and Local Area Plans, engaging communities in the decision-making process and empowering them to implement these plans in partnership with NGOs and other development agencies. The project ultimately resulted in adaptation (resilience) benefits for the community, in addition to mitigation co-benefits, through integrated planning and tree planting activities.

Why is the landscape approach relevant in Southern Africa? Achieving the sustainable development goals (SDGs) remains a challenge in the SADC region. There is a pressing need for more productive agricultural systems and environmental sustainability, while simultaneously addressing food, nutrition and economic security. It is increasingly recognized that poverty alleviation, food security, a resilient natural resource base and functioning ecosystem services are all interrelated.

Agriculture and food systems drive resource degradation, and malnutrition and food insecurity are still all too common. To meet growing food and nutritional demands, agricultural production must increase substantially. At the same time, the environmental and carbon footprint of agriculture activities (which has direct effects on other land uses in the landscape), must be reduced dramatically. Related to the concept of CSA, the *Climate Smart Landscape* has emerged as a promising approach to realize these multiple objectives on a landscape level, taking into account agriculture as well as forestry and other land uses.

CLIMATE SMART LANDSCAPE PRACTICES

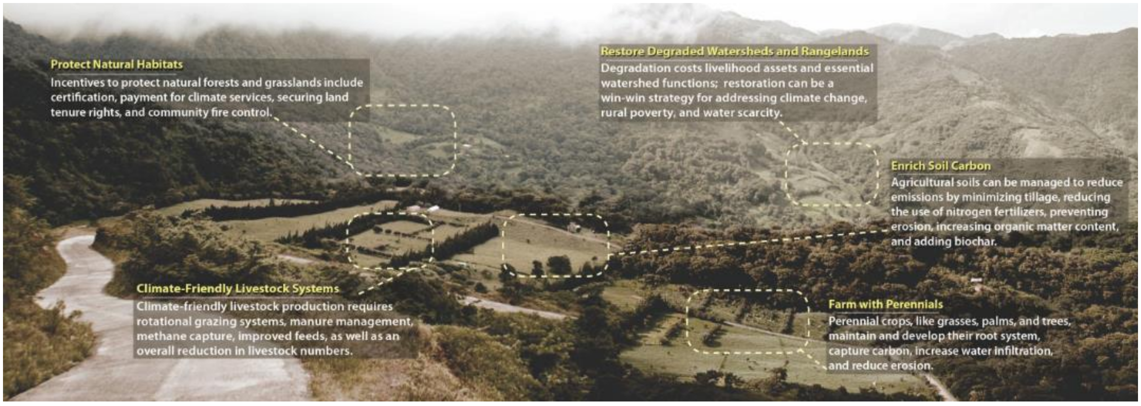


Figure 3: Capturing synergies from agriculture and forests interventions for climate change mitigation at landscape scale

Source: Shames S. et al. 2011.Integrating Agendas for Forests, Agriculture and Climate Change Mitigation: Rationale and Recommendations for Landscape Strategies, National Policy and International Climate Action. Ecoagriculture Discussion Paper No. 7.

Many climate-smart agriculture practices are well known and are described CCARDESA's various CSA knowledge products. Less attention is often paid to the links between agriculture and other land uses. These links run both ways: improving agricultural production can reduce pressure on environmental resources, while conservation or restoration of degraded landscapes can ensure the conditions for resilient agricultural production. Implementation of climate smart landscape measures can have benefits across the entire landscape and related value chains. For example, improving soil structure and organic matter through tree-based and watershed management activities improves ecosystem adaptive capacity by increasing soil water holding capacity and soil fertility, while also sequestering carbon. Figure 3 clearly illustrates how the benefits of landscape measures can extend to all the farmers in the landscape. Nature-based solutions is another increasingly common term for ecosystem management measures with adaptation and mitigation co-benefits (Box 3).

Box 3: Nature-based solutions for climate smart landscapes[6]

Nature-based, or ecosystem-based solutions comprise a broad range of 'no-regret' approaches to achieve both climate change adaptation and mitigation. On the mitigation side, GHG emissions are reduced and carbon stocks conserved or increased through activities such as afforestation, planned grazing and other conservation activities. On the adaptation side, the goal is to preserve ecosystem services that are necessary for human well-being and to reduce the impact of anticipated adverse effects of climate change. Strengthening the functional relationships within the ecosystem is fundamental to increase their resilience. CSA and nature-based solutions both seek to increase the resilience of ecosystems and thereby to stabilize the provisioning of essential ecosystem services.

Some common practices that can be implemented in agricultural landscapes in Southern Africa are shown in Table 1. These practices can to different extents benefit food security and climate change adaptation, as well as GHG mitigation as co-benefits. The interventions are further described below.

Table 1: Climate smart landscape practices

	Potential synergies and trade-offs with other objectives		
	Food security	**Adaptation**	**Mitigation**
Tree-based or mixed tree-crop interventions			
Planting forests or woodlots	(-)	+	+
(Assisted) natural regeneration	+	+	+
Agroforestry / planting fruit trees	+	+	+
Farmer Managed Natural Regeneration	+	+	+
Agro-silvopastoralism	+	+	+
Watershed management and erosion control			
Riverbank stabilization (riparian buffer)	(+)	+	
Wetland / peatland management	(+)	+	+
Establishment or restoration of coastal mangroves	+	+	+
Range and livestock management			
Improved pastures	+	+	+
Rangeland management	+	+	+
Fire control	(+)	+	+

Legend: + means likely positive impact, (+) means possible positive impact, (-) means possible negative impact

Tree-based or mixed tree-crop interventions

Trees in the landscape can have significant benefits for maintaining or restoring ecosystem services. Managing forests well can reduce losses of carbon stocks, and planting trees rebuilds and increases carbon stocks. Types of intervention include:

Afforestation: Where original forest cover was lost through grazing, fuelwood extraction or fire, forests or woodlots can be planted using native or introduced species selected for their ability to contribute to adaptation and mitigation. Land users can boost incomes and food security by sustainable harvesting of fuelwood, timber, medicinal plants, building poles or other products. The boundaries of woodlots are often planted with fruit trees, which provide additional food and incomes. Secondary forests also contribute to biodiversity conservation, water regulation and erosion control, which benefits farmers across the landscape. Trees can sequester substantial amounts of carbon and store it for longer periods than annual crops.

Assisted natural regeneration (ANR): ANR is a forest management practice that liberates tree species from its competitors to encourage their growth and therefore facilitate their long-term establishment. It uses the natural regeneration of forest trees (from wildlings and sprouts), assisting it by protecting desired species from fire, controlling weeds, attracting seed-dispersing wildlife, and by planting additional trees (known as 'enrichment planting'). ANR is an attractive option for farmers, as it is often quicker and cheaper than conventional reforestation, and requires a very low amount of infrastructure and capital investment.[7] It can enhance the supply of ecosystem services that have been depleted by land degradation by protecting and rehabilitating watersheds, recovering native biodiversity, and providing timber or non-timber forest products (NTFPs) for additional incomes. Increased carbon storage is a mitigation co-benefit.

Integrating trees into agricultural systems: Farmer-managed natural regeneration (FMNR) and agroforestry are two ways to integrate trees into agricultural systems. In FMNR, farmers facilitate the systematic regrowth and management of trees and shrubs from felled tree stumps, sprouting root systems or seeds on their farmland. Regrown trees and shrubs help restore soil structure and fertility, reduce erosion and soil moisture evaporation, which can rehabilitate springs and the water table, and increase biodiversity. Crop yields often increase, and farmers can access building timber and firewood, fodder and shade for livestock, wild foods for nutrition and medication, and increase their incomes.

Box 4: Widescale adoption of FMNR in the Sahel[8]

The widescale adoption of Farmer Management Natural Regeneration (FMNR) across the Sahel shows the significant potential for adaptation and mitigation synergies at the landscape level. Successful adoption and upscaling have occurred in Ethiopia, Niger, and areas. While the individual circumstances vary across these cases, FMNR generally applies Landscape Principles 1, 2, 4, 7, 8, 9 and 10.

Over 5 million hectares of Faidherbia-dominated farmlands have been generated in Niger through FMNR. In this approach, farmers encourage the systematic regeneration of existing vegetation by regrowing and managing trees and shrubs from felled stumps, sprouting root systems, or self-sown seeds. The adaptation benefits for farmers include income diversification, water regulation (improved infiltration), protection from landslides, and increased fodder and fuel wood supply, while mitigation benefits include enhanced storage of carbon above and below-ground. In the Maradi Region of Niger, a study found that crop production of FMNR adopters was almost 60% higher than of non-adopters[9]. In the Sahel region, carbon sequestration rates are likely to be in the range of 0.2–0.8 tonnes of carbon per hectare per year, which implies removing 0.7-2.9 tCO_2 from the atmosphere per ha per year.[10]

Agroforestry is a broader concept involving all forms of trees in the agricultural landscape, such as boundary trees, shade trees, fruit trees, or leguminous trees with benefits for soil fertility. Particularly for farmers facing dry or low soil fertility conditions, agroforestry can prevent soil erosion while providing a wide range of services such as food, shade, increased soil fertility, and fuel wood. Increasing tree cover in the agricultural landscape has other benefits too, such as enhancing ecosystem connectivity and maintaining landscape-level propagation capabilities. Maintaining healthy soil structure and planting trees produces mitigation co-benefits through carbon sequestration. More information can be found in CCARDESA's KP 12 on agroforestry options.

Silvopastoralism: This practice integrates shrubs and trees into rangelands with animals in the same land unit, though not necessarily at the same time. Specific practices include planting high densities of trees and shrubs in pastures; cut and carry systems (where livestock are fed with the foliage of fodder trees and shrubs); and using fast-growing trees and shrubs for fencing and windbreaks.[11] Silvopastoralist practices can have positive benefits for food security, adaptation as well as mitigation. Trees provide fodder for animals and nutrients for crops; crops provide food for the farmers, forage for the animals and organic matter for the soil; and animals provide organic manure that improves soil fertility and enhances crop and tree growth can effectively promote economic, ecological, and social sustainability. Shade trees reduce heat stress on animals and help increase productivity. Trees also improve the supply and quality of forage, which can help reduce overgrazing and curb land degradation.

Watershed management

Riparian buffer and river bank stabilization: Riparian forest buffers are trees, grasses and/or shrubs planted along the banks of streams or rivers. This practice provides watershed protection and prevents soil run-off and enables water ways to better regulate water flows to prevent flooding damage. In this way buffers can help maintain key landscape-level forest functions while providing important on-site benefits to farmers including the reduction of financial losses. It also provides habitats or corridors for local endangered wildlife populations. Healthy soil structure and presence of trees further adds mitigation co-benefits by boosting carbon capture potential.

Wetland conservation and management: Wetlands, peatlands and river systems serve to store water, and when managed well, can regulate the function of entire ecosystems. Land around wetlands and alongside drainage canals in irrigation schemes provide excellent growing conditions for trees. Wetland conservation and management provides farmers and entire landscapes with storm protection, flood mitigation, shoreline stabilization, and erosion control (adaptation benefits). They are also a large carbon sink. Human-caused drainage of coastal wetlands releases carbon from soils, turning them into a strong net source of GHG emissions. The most effective way to maintain wetland carbon pools and prevent emissions to the atmosphere is therefore avoiding conversion and drainage. Restoration and proper management can facilitate the return to a state where biological processes are preserved, and resilience benefits for communities are maintained.[12]

Mangrove establishment: Coastal areas can be protected through mangrove establishment. Mangroves provide a buffer by capturing sediment high in organic carbon that can accumulate in tandem with sea level rise. Mangrove forests are extremely productive. Farmers interested in aquaculture can uses mangrove areas for shrimp farming and small-scale fisheries, which supplements their income and contributes to food security. While studies on mitigation potential of mangroves in the Southern African context are lacking, studies from East Asia also show that depending on the system, GHG mitigation benefits from mangroves may be up to 3 times that of terrestrial forest carbon projects. This is due to their very high carbon storage and sequestration potential compared to terrestrial habitats.[13]

Rangeland and pasture management

Rangeland and pasture management: Natural rangelands are the most widespread land cover in Southern Africa. Sustainable grazing management is a key measure in rangeland management. Pasture management entails the sowing of improved varieties of pasture, typically replacing native grasses with higher yielding and more digestible forages, including perennial grasses or legumes. When managed well, in addition to adaptation benefits to farmers in terms of increased food security and incomes, rangeland and pasture management can have mitigation co-benefits through soil carbon sequestration and avoided land degradation from overgrazing.

Fire management: This practice is a key component of rangeland management and has significant mitigation co-benefits at the landscape level when interventions are practiced to control or avoid bush fires. On the other hand, periodic burns across grasslands are practiced as they can promote the overall health and growth of the rangelands. For example, the increased plant productivity that is achieved after rangeland has been burned may more than compensate for the loss of plant carbon by ignition. However, this form of fire management in rangelands can have short-term trade-offs with GHG mitigation.[14] The use of trees also increases production and adaptation benefits.

Challenges in implementing landscape GHG mitigation options

Challenges in implementing landscape approaches in Southern Africa include economic, social, knowledge, policy and institutional constraints:

A) Economic factors

- By definition, landscape level mitigation options imply the need for wide scale application, so large investments are needed. Many countries' existing system of farm subsidies and policies do not incentivize farmers to adopt integrated landscape management techniques.
- Landscape approaches are implemented on long timescales, where returns to investment can take years to materialize. Compared to the short-term, tangible returns from alternative land or resource uses (e.g. farming, livestock keeping, charcoal or wood production), landscape approaches can be a less attractive option for communities. However, there are examples of Payments for Ecosystem Services (PES) schemes to overcome these challenges, such as World Bank support to the Forest National Corporation to engage the private sector to invest in large-scale gum arabic tree plantations with communities, and watershed PES schemes in some areas of Uganda.[15]

B) Social factors

- Land tenure: Farming households and communities are the ultimate land stewards and beneficiaries, and their ownership and implementation of land management practices are key to long term success. Clarifying and providing some form of ownership or rights over land and natural resources can be an incentive for communities to invest into them.

- Technical and institutional capacity: Farmers often lack the awareness and technical capacity to engage in landscape level (off-farm) practices. Coupled with their high level of dependence on natural resources for subsistence or livelihood purposes, this poses major challenges to the adoption of alternative land use and management practices. Institutional capacity (e.g. social organizations, self-help groups, saving groups, farmers associations etc.) are needed to facilitate engagement. To overcome these constraints, an integrated approach with targeted awareness raising, developing a joint vision of the communities' "landscape" for a sustainable development, reliable extension services, and investments into capacity development are needed.

C) Knowledge, policy and institutional constraints

- Planning and implementing CSA and landscape approaches are knowledge intensive tasks. Limited awareness, the conventional division of responsibilities along sectoral lines, and the lack of a localized evidence base of CSA benefits have all contributed to delayed uptake by policy makers globally, not just in Africa. A primary technical barrier is the lack of quantitative evidence on how different management practices, systems, and landscape configurations affect mitigation and adaptive benefits, as well as agricultural yields, food security and biodiversity conservation. Accessible, simplified and place/context-based information and guidelines, and local level trials and studies can help overcome these constraints. CCARDESA's website provides information and guidelines targeted to different users about many aspects of CSA.
- Climate smart landscape approaches require a multi-level, multi-stakeholder participatory process. This is a complex task considering the sectoral, sometimes siloed or top-down natural resource governance structure and policy making process predominant in most countries. Technical capacities at the local levels to undertake landscape level planning, implementation and monitoring are also often lacking. Where participatory, decentralized approaches are already institutionalized into land use planning processes, better conditions for landscape approaches are in place.

Scaling landscape GHG mitigation options

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. Three key features characterize a climate-smart landscape that delivers adaptation and mitigation co-benefits:

- climate-smart practices at the field and farm scale;
- diversity of land use across the landscape to provide resilience; and
- management of land use interactions at landscape scale to achieve social, economic and ecological impacts.[16]

Mainstreaming these ideas into policy and scaling up landscape approaches with mitigation co-benefits requires a combination of technical, financial and institutional mechanisms (Figure 4).

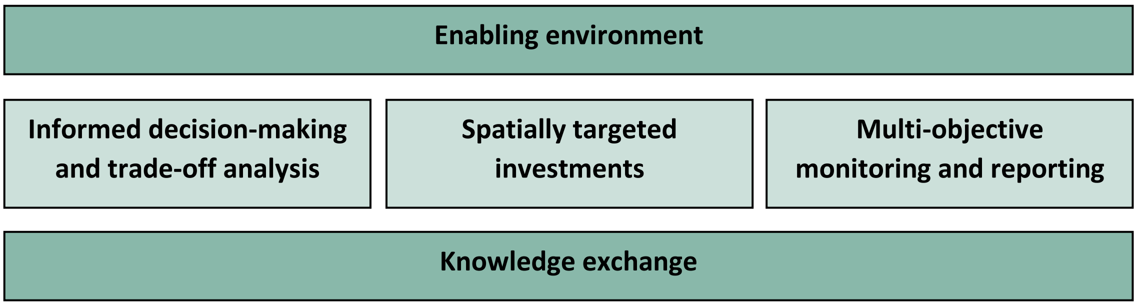


Figure 4: Approach to upscale GHG mitigation at landscape level

A supportive framework and **enabling environment** for landscape governance and resource tenure is a basic requirement to upscale realize GHG mitigation effects at landscape level.[17] This entails mobilizing political support for initiating multi-stakeholder engagement, and undertaking planning at multiple levels and across sectors. The process should be participatory and inclusive of men and women land stewards to ensure maximum buy-in and ownership. Investments must be made to strengthen technical and institutional capacities of decision makers as well as practitioners.

Within this framework, **informed decision-making** is required to pursue synergies between the different elements of the landscape, by analyzing and address trade-offs. This can be achieved by undertaking gender-sensitive cost-benefit analyses, climate risk and vulnerability assessments, feasibility studies etc. A broader and more localized evidence base of CSA benefits is key for wider adoption; this can be established through farmer-led trials and demonstration plots.

Based on these results, **spatially targeted measures** may be applied across entire landscapes, taking into account connectivity between areas, land uses and value chains. This should go hand in hand with innovative mobilization of necessary financing to support the formulated climate-smart objectives. **Multi-objective impact monitoring** of these measures (focusing not only on outcome and output indicators, but also input and process and indicators) is required to determine if social and climate goals are being met at different scales. Finally, the results and lessons learned from the process must be documented and shared with key stakeholders across landscapes to ensure **learning and exchange** of best practices.

Box 5: Scaling agroforestry in Kenya and Zambia[18]

There are positive experiences upscaling agroforestry (fodder shrubs) in Kenya, and improved tree fallows in Zambia. Both approaches put farmers at the centre. Per Landscape Principle 1, farmers could take on an adaptive approach that could be altered over the course of the project. Per Principle 2, farmers could identify their common entry point for interventions, and per Principle 4, select options that guaranteed multiple benefits.

In Kenya, farmers self-tested the viability of fodder shrubs planted along 'neglected niches' such as on farm boundaries, around the homestead, or intercropped with grasses, trialling different species and densities. The practice was then upscaled through the use of an extension facilitator, working with a range of government and NGO partners, who was able to reach a large number of farmer-development groups across seven districts to establish nurseries and plant fodder shrubs. This approach proved to be very effective for facilitating the spread of the practice.

In Zambia, farmer-led trials tested the use of *Sesbania sesban* for improved fallow. Extension agents supported uptake through farmer-to-farmer site visits and demonstrations. International visits from Malawi were facilitated, leading to cross-boundary learning and uptake. The key

elements contributing to strong impact were a farmer-centred research and local public extension approach, a range of technical options developed by farmers and researchers (Landscape Principle 5), building local institutional capacity, sharing knowledge and information, learning from successes and failures (informed by participatory monitoring; Landscape Principle 8), and strategic partnerships and facilitation. Critical for upscaling were considerations of marketing tactics, germplasm production and distribution systems, and suitable policy options.
Many studies show that men and women are equally able to plant, manage and benefit from agroforestry plots.[19] However, women are often disadvantaged in access to information, inputs and markets for some types of tree crops. To ensure that extension services benefit women, gender sensitive interventions could include training more women extension staff, working with women's groups and ensuring that extension support targets women's needs, improving women's access to finance and supporting women's groups to engage with markets.

Box 6: Miombo conservation in Southern Africa[20]

Miombo woodlands cover vast areas of southern Africa and are part of a complex system of rural land use that integrates woodland management with crops and livestock. Community participation in miombo restoration is widely reported, especially in Zimbabwe and Mozambique, and is possible due to incentives such as access to woodland resources for household consumption and sale. Livestock owners invest in restoring miombo woodlands, as it yields fodder in the dry season. Scaling up this approach has been achieved through three factors:

- Communities are becoming more active in managing local natural resources as a result of policy interventions; mainly decentralization and land reforms (Landscape Principles 2 and 5).
- New and integrated conservation-development approaches are emerging, which suggests promising scope for providing PES to further increase the value of these managed woodlands. This makes conservation a viable and rewarding activity for farmers, who otherwise would rather invest exclusively in agricultural activities with higher returns.
- Tree product-based markets throughout the region are developing and expanding which provides further incentives for communities to adopt these practices.

Interventions that would further enhance the upscaling of this practice include the greater devolution of rights and responsibilities for miombo woodlands to the local level, exploiting opportunities for leveraging PES, increasing the value of woodland production and enhancing forest-based markets by removing restrictive legislation and strengthening local producers and forest enterprises. Reorienting forest sector institutions to strengthen their ability to provide services to support land users would also strengthen alignment of environmental and poverty alleviation goals.

Box 7: Ethiopia scales up afforestation programmes in collaboration with communities[21]

Ethiopia is undertaking large-scale landscape restoration as part of its national climate change strategy and various international commitments. Planning is undertaken at the watershed level, on a scale of 30,000 to 40,000 ha (i.e., landscape level). Applying Landscape Principle 5, communities have been engaged in tree-planting campaigns under a "food for work" programme. Increasingly, their role has expanded with the implementation of participatory natural resource management in Ethiopia. Acknowledging Principle 4, it aims to exploit multiple functionalities of forests, including for soil and water conservation and as carbon sinks. The initiatives aim to both reduce deforestation and alleviate poverty. However, the predominant focus has been on livelihoods (Principle 2: common concern entry point for farmers) rather than biodiversity or climate-related priorities. Greater focus on issues of insecure land tenure would contribute to the further success of the initiatives. Other policy relevant developments that facilitate the scaling up afforestation include the recognition of participatory forest management as a vehicle through which to engage communities; incentives for private forest developers through mechanisms such as lease-free land, better access to land use and forest ownership certificates, and tax incentives; and strengthening of penalties for infringement on forest resources.

Box 8: Integrated watershed management for climate-smart development in the Karamoja region, Uganda[22]

In 2014, FAO, with funding from DFID and in partnership with IUCN and IIRR, launched a project to implement micro-landscape management plans for Lokok and Lokere sub-catchments in the Karamoja region. The process began with a landscape assessment using scientific and participatory approaches, capacity-building activities, and field demonstrations that promoted 'learning by doing' among farmers and communities. Interventions were designed and prioritized based on the results of hydrological, climate risk and vegetation loss studies. Communities were supported to implement CSA priority interventions, which included live fencing of homesteads; establishing woodlots and orchards; riverbank demarcation and rehabilitation; micro-catchment rehabilitation; soil and water conservation; rainwater harvesting; and various income generating activities. Revolving and community conservation funds were used to strengthen local governance and build social cohesion and economic resilience to catalyze the implementation of landscape management practices. Through tree planting and watershed management activities, the project also contributed to mitigation co-benefits at a landscape level.

A gender assessment identified wide gender inequality within the catchment, including heavier work burden and longer working hours for women and girls; women having no control of income generating resources in the household; low participation of women in decision making at both the household and community levels; and gender-based violence.[23] Activities to address these were proposed to focus on practical gender needs (e.g., reducing women and girls‘ water collection burden by bringing water supply closer to homesteads and improved house construction methods) and strategic gender needs (e.g., supporting women’s participation in decision-making in the project and at community level).

Box 9: Climate Smart Rice in Madagascar[24]

The Promoting Climate Resilience in the Rice Sector project (UNEP, 2011) was designed to build upon already ongoing activities to introduce soil and water conserving practices in the Alaotra-Mangoro subregion, such as mulching, intercropping, cover cropping, and agroforestry, and to apply integrated pest management and the system of rice intensification (SRI). Starting with a 3-site pilot, plans were created to scale first to the broader region, then to the entire rice producing area in the country. The project explored a suite of practices including tree selection, improved livestock and land management, and preservation of ecosystem services (including the mitigation of climate change through building carbon stocks). The process was developed based on consultations from national government level down to vulnerable communities. The existing Intersectoral Rice Platform was mobilized to become operational. From the producer side, a participatory and integrated approach involved not only lowland paddy cultivators, but the livestock herders and uphill growers that affect the production downstream. NGOs, producer groups, forest management associations, community-based natural resource management entities, and ongoing projects and active research institutions were included in consultation and the implementation of project activities, to ensure wide-scale awareness and upscaling at the landscape level.

Acknowledgements

This information brief was prepared by UNIQUE forestry and land use and the Global Research Alliance on Agricultural Greenhouse Gases (GRA) with support from CCARDESA and the SADC/GIZ Adaptation to Climate Change in Rural Areas (ACCRA) programme, implemented on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ). Inputs were also provided by the GIZ Sector Programmes Sustainable Agriculture (NAREN), Sustainable Rural Areas, and Climate-Smart Livestock Systems, and the GIZ Global Project Soil Protection and Rehabilitation for Food Security, all implemented on behalf of BMZ.

Further reading

CCARDESA and GIZ. 2019. Knowledge Product 15: Climate Smart Pasture/Rangeland Management.

FAO 2017. Climate Smart Agriculture Sourcebook.

World Bank 2016. Greenhouse gas mitigation opportunities in agricultural landscapes: A practitioner's guide to agricultural and land resources management.

LPFN, Landscape Partnerships for Sustainable Development: Achieving the SDGs through Integrated Landscape Management. http://sdgs.peoplefoodandnature.org/

Reed, J., Deakin, L. and Sunderland, T., 2015. What are 'Integrated Landscape Approaches' and how effectively have they been implemented in the tropics: a systematic map protocol. *Environmental Evidence*, *4*(1), pp.1-7.

Scherr, S.J., Shames, S. and Friedman, R., 2012. From climate-smart agriculture to climate-smart landscapes. *Agriculture & Food Security*, *1*(1), pp.1-15.

[1] WRI CAIT database, https://cait.wri.org/
[2] WRI CAIT database, https://cait.wri.org/
[3] Reed, J. et al. 2015. What are 'Integrated Landscape Approaches' and how effectively have they been implemented in the tropics: a systematic map protocol. *Environmental Evidence*, 4(1): 1-7.
[4] FAO. 2017. Landscape-level integrated watershed management for climate-smart development in the Karamoja region, Uganda. http://www.fao.org/climate-smart-agriculture-sourcebook/concept/module-a3-landscapes/a3-case-studies/case-study-a3-10/en/
[5] ZNCCS, n.d. Strengthening climate resilience in the Kafue Sub-basin. https://www.mndp.gov.zm/wp-content/uploads/filebase/Brochures/STRENGTHENING-CLIMATE-RESILIENCE-IN-THE-KAFUE-SUB-BASIN.pdf

[6] Naumann, S. et al. 2014. Nature-based approaches for climate change adaptation and mitigation. German Federal Agency for Nature Conservation. https://www.ecologic.eu/sites/default/files/publication/2014/eco_bfn_nature-based-solutions_sept2014_en.pdf
[7] FAO, 2020. Assisted natural regeneration of forests. http://www.fao.org/forestry/anr/97764/en/
[8] Sawadogo, P. et al. 2015. How climate-smart is the farmer managed natural regeneration method? https://ccafs.cgiar.org/news/how-climate-smart-farmer-managed-natural-regeneration-method
[9] Westerberg, V. et al. 2019. The Case for Farmer Managed Natural Regeneration (FMNR) in the Upper West Region of Ghana. Report for the Economics of Land Degradation Initiative. www.eld-initiative.org
[10] Chomba, S. et al. 2020. Opportunities and constraints for using farmer managed natural regeneration for land restoration in sub-Saharan Africa. *Frontiers in Forests and Global Change*, 3: 122.
[11] Maginnis, S. et al. 2007. The Forest Landscape Restoration Handbook. IUCN
[12] Braimoh, A. et al. 2016. Greenhouse gas mitigation opportunities in agricultural landscapes: a practitioner's guide to agricultural and land resources management. World Bank.
[13] Cameron, C. 2019. High greenhouse gas emissions mitigation benefits from mangrove rehabilitation in Sulawesi, Indonesia. *Ecosystem Services*, 40: 101035.
[14] Braimoh et al. op. cit.
[15] Gaworecki, M. 2017 Cash for conservation: do payments for ecosystem services work? https://news.mongabay.com/2017/10/cash-for-conservation-do-payments-for-ecosystem-services-work/
[16] Scherr, S. et al. 2012. From climate-smart agriculture to climate-smart landscapes. *Agriculture & Food Security*, *1*(1), pp.1-15.
[17] Williams et al. 2015. Climate smart agriculture in the African context. https://www.afdb.org/fileadmin/uploads/afdb/Documents/Events/DakAgri2015/Climate_Smart_Agriculture_in_the_African_Context.pdf
[18] Franzel, S. et al. 2004. Scaling up the impact of agroforestry: Lessons from three sites in Africa and Asia. *Agroforestry systems*, 61(1): 329-344.
[19] Kiptot, E. and Franzel S. 2011. Gender and Agroforestry in Africa: are women participating?
[20] Dewees, P. et al. 2010. Managing the miombo woodlands of southern Africa: policies, incentives and options for the rural poor. *Journal of natural resources policy research*, 2(1): 57-73.
[21] Mansourian, S. 2020. Enabling Factors to Scale Up Forest Landscape Restoration. WWF Germany and IUCN.
[22] FAO. 2017. Landscape-level integrated watershed management for climate-smart development in the Karamoja region, Uganda. http://www.fao.org/climate-smart-agriculture-sourcebook/concept/module-a3-landscapes/a3-case-studies/case-study-a3-10/en/
[23] Namuhanda, R. 2016. Gender assessment in Lokere and Lokok Catchments. GIZ, Eschborn.
[24] Scherr, S. et al. op. cit.