



# MPUMALANGA GREEN CLUSTER AGENCY

## INDUSTRY BRIEF:

Carbon credits - An opportunity to improve the uptake of regenerative agricultural practices



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### **List of acronyms:**

CA	Conservation agriculture
CNG	Climate Neutral Group
GHGs	Greenhouse gases
ICP	Internal Carbon Pricing
NDCs	Nationally Determined Contributions
SOC	Soil Organic Carbon

### **Key insights:**

- Carbon farming in South Africa is a topic that is gaining a lot of traction because of the benefit of getting incentivized for regenerative agricultural production.
- Agricultural processes responsible for high GHG emissions include conventional tillage practices, crop production, transportation and agro-processing, monoculture, synthetic fertilizers and livestock farming.
- Regenerative land management practices enhance carbon capture, in addition to building agricultural resilience.
- The main benefits of carbon sequestration include increased food security, reduced methane production and a global transition towards competitive sustainability from farm to fork.

## **Intended audience**

This industry brief is written for decision makers interested in protecting soils and developing strategies for the mitigation of greenhouse gases in the Mpumalanga agricultural sector. This brief introduces the opportunity for carbon trading to farmers who take up regenerative agricultural practices.

## **1. Context**

The promotion of regenerative agricultural practices such as conservation agriculture (CA), sustainable livestock management and significant reduction in the use of chemical fertilizers aims to mitigate negative impacts on soil quality and preserve soil organic carbon (SOC). The estimation of the size and changes of SOC stocks is of great importance for decision makers to protect soils and to develop strategies for the mitigation of greenhouse gases (GHGs).

South Africa is the world's 14th largest emitter of GHGs, which is largely due to an over reliance on coal. As such, the country has pledged to peak its emissions between 2020 and 2025, allowing them to plateau before they start to decline. This means emissions will range from 398 million - 614 million TCO<sub>2e</sub> then decline in absolute terms from 2026 onwards.

The country introduced a carbon tax in June 2019 as part of policy measures to help achieve the cabinet-approved nationally determined contributions (NDCs) [14]. Although the first phase of implementation of the NDCs did not include agriculture, phase 2 has included the sector as it contributes to carbon emissions [3]. In South Africa, agriculture accounts for 9.5% (which is a total of 48 641Gg CO<sub>2</sub>) [10] of total GHG emissions. The main attributing factors include heavy use of synthetic fertilizers, conventional tillage systems, indirectly through transportation, processing and storing produce as well as through livestock management practices. Soils contain the largest terrestrial carbon (C) pool that is sensitive to changes in land use and agricultural management practices [1]. Conventional tillage systems have accounted for 45% and 65% of carbon loss over the past 50 and 100 years respectively, indicating that the current reserves for SOC are much lower than their potential capacity [2]. Methane emissions from the South African cattle industries have been calculated as 964Gg or 72.6% of the total livestock methane emissions [15]. Agricultural practices responsible for the emission of GHGs include:

- **Conventional tillage practices:** Increased GHG emission through the oxidation of organic matter through soil turn-over. Other detrimental effects include soil erosion, leaching and runoff of agrochemicals [1,3].
- **Crop production:** Production of cereal crops accounts for 68% of national total field crops' GHG emissions followed by other field crops (14%). Cultivations of maize, wheat and sugarcane result in highest commodity emissions [2]. Highest GHG emissions per area planted are in the production of maize with 1.65 t of CO<sub>2</sub>-eq ha<sup>-1</sup> [2].
- **Transportation and agro-processing:** 18% of GHG emissions are the result of transportation, storage and agro-processing of crop produce.
- **Monoculture:** Producing the same crop over many years on the same piece of land without diversifying crop production results in extractive agricultural practices. This production method upsets the balance of soils in nutrients and increases the use of agro-chemicals which leads to additional GHG emissions. This approach also results in a high risk of disease and pest outbreaks.
- **Synthetic fertilizers:** Excessive application of synthetic fertilizers, such as urea, results in nitrous oxide emissions while applications of a combination of lime and urea result in CO<sub>2</sub> emissions. This accounts for 57% of national total crop CO<sub>2</sub>-eq emissions.
- **Livestock:** Livestock production accounts for 27% of emissions with methane as the primary GHG. The primary source for methane emissions are cattle which, like all ruminants, produce methane during their digestive process.

The South African economy is carbon intensive and therefore extremely vulnerable to impacts of climate change. According to the Trade and Industrial Policy Strategies (TIPS) "South Africa must achieve a **Just Transition** to avoid exacerbating inequality, maintain social cohesion, eradicate poverty and plan for the physical impacts of climate change" [5]. In order to achieve this, transitioning into a low-carbon economy through regenerative agricultural practices and incentivizing farmers to undertake the journey is a good start in the agriculture sector. In line with the **European Union's (EU) green deal**, a shift to a sustainable food system can bring environmental, health and social benefits, as well as offer fairer economic gains.

This brief introduces the opportunity for carbon trading to farmers who take up regenerative agricultural practices.

## 2. Carbon farming

Carbon farming is an agro-ecosystem framework aimed at optimizing carbon capture by implementing practices that improve CO<sub>2</sub> capture from the atmosphere and stored it in plant material and/ or soil organic matter [5]. This framework was introduced in 2021 and draws on farm-generated data to reward farmers who adopt better farming methods. It is essentially the shift from extractive farming to more resilient regenerative farming practices (Figure 1).

### Extractive Farming

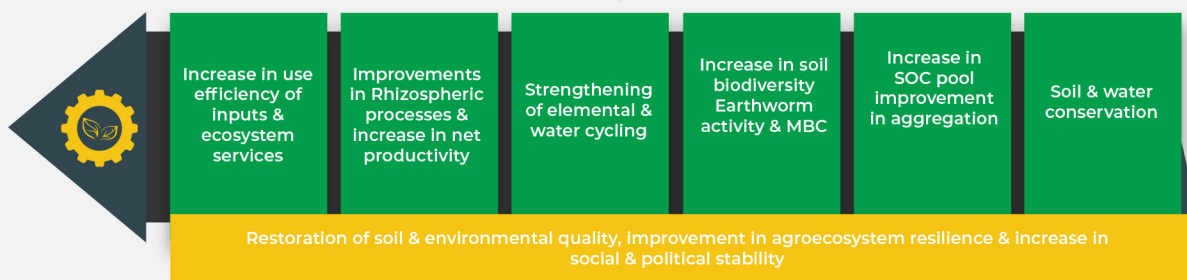
Residue removal, excessive tillage, negative SOC budget, negative nutrient and energy budgets



Decline in resilience and quality of soil and environment

### Carbon Farming/ Conservation Agriculture

Residue retention, cover cropping INM, minimum tillage, agroforestry, livestock integration.



Increasing soil & environmental quality.

**Figure 1: A transition from extractive agriculture to regenerative land management practices [5]**

## Land management within this framework

- enhances rates of carbon capture;
- increases the provision of important ecosystem services (including water);
- builds agricultural resilience; and
- mitigates climate change.

The framework relies on sound policies, technical assistance, public-private partnerships, quantification methodologies and innovative financing mechanisms that ultimately empower land managers to efficiently implement on-the-ground, effective solutions. Transitioning to this framework generates carbon credits which can be sold to companies looking to offset their carbon footprint. A carbon credit is a permit that allows the owner to emit a certain amount of carbon dioxide (CO<sub>2</sub>) or other greenhouse gases. One credit permits the emission of one ton of CO<sub>2</sub> or the equivalent of other greenhouse gases. In South Africa, the Carbon Tax Act No15 went into effect in 2019 to help the country meet its climate commitments. The current tax rate is set at R144 per tonne CO<sub>2</sub>e. Currently, the first carbon credit payments are expected to be paid out by the end of 2022 for the first phase of carbon farming [10].

## 2.1 Improved land management practises for carbon sequestration

South Africa set up an ambitious climate commitment by pledging to reduce emissions by up to 55% by 2030 (as in the EU's Green Deal) and ultimately reach a net zero carbon economy by 2050 according to the Paris Agreement. In 2021, SA released its latest national climate commitment under the Paris Agreement. The country intends to limit GHG emissions to 398-510 Mt CO<sub>2</sub>e by 2025 and 350-420 MtCO<sub>2</sub>e by 2030. Although not fully explored, it is estimated that with the use of cover crops, composts, crop rotation and reduced tillage; it is possible to sequester carbon and reduce GHG emissions. Table 1 identifies the potential impact of migrating from extractive agricultural practices to improved land management and their impact on carbon emissions. The main benefits for carbon sequestration include:

- Ensuring food security in the face of climate and biodiversity loss;
- Reducing the environmental carbon footprint;
- Strengthening food system's resilience;
- Leading a global transition towards competitive sustainability from farm to fork;
- Significantly reducing methane emissions in livestock production systems.

**Table 1: Migrating from “extractive practices” to improved land management practices improves opportunities of carbon credits for both smallholder and commercial farmers.**

Extractive Practices	Improved Land Management practice	Average increase in SOC tonnes/ha/year	Average carbon dioxide removals tonnes CO <sub>2</sub> -eq/ha
Conventional tillage	Reduced tillage/No till/Strip Till	0.66	2.4
Conventional fertilization regime	Adding compost and other soil amendments (e.g. Bio-stimulants, mycorrhizae)	0.15	0.6
Cropping systems with no cover crop	Cover cropping every year with at least 75% crop residue reincorporated into soil (incorporation of manure, non-invasive grass species as mulch, usage of bagasse and/ or wood chips as mulch, etc.)	0.32	1.2
Monoculture production	Adoption of crop varieties with more below and/ or above ground biomass (nitrogen fixing crops such as legumes)	0.12	0.4
Single pastures	Multi-species sown in intercropping systems	0.43	1.6
Sugarcane burning	Sugarcane thrashing	0.41	1.5
Injudicious use of pesticides	Integrated pest management (IPM) <sup>1</sup> ensures resistant crop varieties, certified seed, protective seed treatments, disease-free transplants	0.26	0.49



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## 2.2 How does it work?

According to Carbon Cycle Institute, the carbon farming framework is important in providing a foundation for value-added direct marketing, sustainable supply-chain creation, and other corporate sustainability initiatives. Most importantly, carbon farming is applicable to farmers and has been an excellent vehicle for increasing on-farm climate and carbon cycle literacy.

Globally, carbon crediting has received a lot of positive attention from farmers through the initiatives of companies such as Farm progress and Anthesis Group. Drawing on insights from South Africa's first verified AgriCarbon programme facilitated by Climate Neutral Group (CNG): Farmers are paid for the carbon credits they generate from their sustainable land management practices. There are key easy steps to get incentivized for carbon credits (further detailed in Figure 3). According to CNG, these high-quality carbon credits connect farmers with international and local carbon credit buyers for them to off-set their carbon footprint. The Internal Carbon Pricing (ICP) is a mechanism by which companies can put a value on their GHG emissions in a way that drives positive change in their business. It has been efficient in setting prices for carbon credits. The National Treasury is eyeing a domestic carbon credit market of 10 million to 20 million tonnes of CO<sub>2</sub> a year, and has set a baseline price of between R115 to R120 a tonne for 2022, less than the \$15 to \$25 potentially on offer for AgriCarbon credits. The current market size for carbon credits in SA is R2.4 billion with a high potential to increase as farmer's transition to regenerative agricultural practices.

According to CNG, there are 8 steps to get into the AgriCarbon program to be generate clean carbon credits (Figure 3). However, it is important to highlight that in order for the farm to qualify for carbon trading, it must be doing one or more of the following practices:

- Sustainable crop production
- Reduced nitrogen fertilizer applications
- Involved in minimum soil tillage
- Water management and irrigation
- Sustainable grazing practises

The above mentioned are the qualifying criteria for carbon trading as verified by VERRA . Therefore, regular tests are done for SOC to monitor carbon levels in an accredited laboratory. A farm therefore qualifies for carbon trading on the basis of having sequestered carbon over a given period of time. This period is usually 18 months before you can start getting paid for carbon credits [16]. Considerations to get into the carbon trading program are highlighted in **Figure 4**.



**Figure 3: 8 steps to get paid for Carbon Credits (CNG , 2022)**



**Figure 4: Steps to consider before getting into the carbon trading market**



<sup>1</sup>VERRA The VCS Program is the world's leading voluntary program for the certification of GHG emission reduction projects. <sup>2</sup>CNG Carbon neutral group: Climate Neutral Group is South Africa's leading carbon consultancy and offset provider.



## 2.3 Detailed cost benefits of calculating carbon footprint

South Africa's proposed carbon price of R144/tCO<sub>2</sub>e, places it well below the existing median in global carbon price. The real financial benefit comes from saving in inputs in the agricultural production system. As an example, at a carbon price of R144/tCO<sub>2</sub>e, it is expected that a farmer implementing CA could earn an additional R187/ha/annum of carbon income through reduced CO<sub>2</sub> emissions from the decreased consumption of diesel, lime and nitrogenous fertilisers as well as an increase in soil organic carbon. This is in addition to the R872/ha of savings in input costs for diesel, lime and nitrogenous fertilisers [16]. Nitrogen-based fertilizers are the highest contributor to a farmer's carbon footprint, averaging 60% to 70%. A reduction by 15 to 20% on heavy nitrogen as fertilizer could have a significant impact on the credits generated.

## 2.4 Projects currently benefiting from AgriCarbon trading in South Africa

### Credible Carbon

The Spier project adopted regenerative agricultural practices with an emphasis on the mob-grazing technique which involves frequent stock rotations aimed at using livestock to mimic nature and restoring carbon and nitrogen contained in livestock and poultry urine to the soil profile. This is a 154-hectare farm of irrigated pasture and vineyards. The audited carbon savings resulting from this project are 8 785 CO<sub>2</sub> to date through Credible Carbon over a three-year period [13]. The credits were obtained through a significant reduction in methane emissions through regenerative agricultural practices. The farm also sequesters carbon, which is all vital for all plant life and through the program, they were able to receive R100 000 through the project.

### Climate Neutral Group

Through implementation of rotational grazing, cover cropping, reduced tillage, and other practices which improve soil quality; the company has been able to collect data on over 18 000 hectares and looking to offset over 200 000 CO<sub>2</sub> by the end of 2021. Lancewood farm is among 40 dairy farms where the AgriCarbon is being piloted by CNG to help curb greenhouse gas emission. According to the research report by Trace & Save, the farm has already reduced its nitrogen use per hectare by half in 2022 (from 2018) through the carbon tracker information. The Climate Neutral group are in the process of rolling out their payments for carbon credits.

Regenerative agriculture is proven to reduce dependence on expensive and environmentally toxic pesticides, particularly on smallholder farms. All this while playing a vital role in climate mitigation, through the restoration of soil in land use sectors. Practices that encourage self-renewal should be encouraged, including keeping the soil covered, minimizing soil disturbance, increasing plant and animal diversity, and managing livestock according to planned grazing principles. Many of the practices and principles embodied in carbon farming have demonstrated their value globally but remain underutilized by farmers and ranchers, raising the question of how to inspire their adoption more widely.

Cultivating carbon has a value proposition of 70% of carbon revenues generated through to participating farmers. This is for projects involving the implementation of no-till, cover crops and grazing system that reduce inputs over time and ultimately the reduction of the carbon footprint. In return for its 30% share, cultivating carbon will bear the cost of carbon development, monitoring, evaluation and verification through an international carbon standard as well as provide technical assistance for farmers. The intention is to remove the technical and financial barriers to entry that are often associated with carbon markets, to develop a project at scale that reduces the cost per farm and maximises returns for each farmer.



## Conclusion and way forward

Carbon farming in South Africa is a topic that is gaining a lot of traction because of the benefit of getting incentivized for regenerative agricultural production. The crediting program provides efficient access to carbon revenues through conservation and regenerative agriculture. Although there is not much financial benefit from the credits themselves, there is a significant reduction in input costs through reduced fertilizer usage, implementation of no-till which cuts down production costs to highlight a few. Unlike other major GHG producers, agriculture has the capacity to not only reduce its carbon emissions, but to draw carbon down from the atmosphere and store it back in the soil. This can be achieved through the adoption of regenerative agriculture.

**For more information on the study, please contact:**

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**For more resources produced by the Mpumalanga Green Cluster Agency, including the latest Water Market Opportunity Brief, please visit:**

**<https://mpumalangagreencluster.co.za/resources/>**

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This work was made possible  
through the partnership  
between GreenCape and GIZ.



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