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Soil Wealth
NURTURING CROPS



**Integrated
Crop Protection**
PROTECTING CROPS

THE CARBON SERIES

Part 1: Carbon farming and its relevance to Australian vegetable growers

This four-part Carbon Series from the Soil Wealth ICP project breaks down the practicalities of carbon farming for vegetable growers and soil carbon management.

KEY MESSAGES

- ✓ While the details of carbon farming in Australia is constantly changing, it generally refers to a deliberate set of agricultural practices or land uses to:
 - a) increase carbon stored in the soil and vegetation (sequestration) and
 - b) reduce greenhouse gas emissions from livestock, soil or vegetation (avoidance).
- ✓ Australian vegetable growers should consider the management of carbon in their growing operations not only to increase carbon sequestration and reduce greenhouse gas emissions, but also to increase productivity through sustainable land and vegetation management which can result in reduced input costs and potential market benefits.



WHAT IS CARBON FARMING?

Phrases such as 'carbon neutral', 'carbon accounting', 'soil carbon sequestration' and 'carbon emission reduction' are becoming increasingly common when policymakers talk about Australian agriculture. These terms can be summarised under the heading of 'carbon farming'.

Carbon farming in Australia is constantly changing. Generally, it refers to a deliberate set of agricultural practices or land uses to increase carbon stored in the soil and vegetation (**sequestration**), and reduce greenhouse gas emissions from livestock, soil or vegetation (**avoidance**).

Carbon farming can offer landholders financial incentives to reduce greenhouse gas emissions within their production system or sequester carbon, in addition to achieving economic and environmental co-benefits through increased productivity and sustainability.

'Carbon farming' can range from a **single change in land management** – such as introducing no-till cultivation, cover crops or changing grazing management – to a **whole-of-farm integrated plan** which maximises carbon capture and reduces emissions.

The good news is that vegetable growers can build on their existing production processes, particularly around improving soil health, to make the transition to 'carbon farming'.

CARBON FARMING INVOLVES PRACTICES THAT:

- Improve the rate at which carbon dioxide (CO₂) is removed from the atmosphere and converted to plant material and/or soil organic matter
- Reduce greenhouse gas emissions, measured as CO₂ equivalents, from agriculture.

ABOUT THE CARBON SERIES

This four-part Carbon Series from the Soil Wealth ICP project breaks down the practicalities of carbon farming for vegetable growers and looks more closely at soil carbon management. It provides links to further information and project resources on the following topics:

- **Part 1: Carbon farming and its relevance to Australian vegetable growers**
- **Part 2: Soil carbon and carbon sequestration**
- **Part 3: Carbon emissions in vegetable production**
- **Part 4: Carbon accounting and the Emissions Reduction Fund.**

Additional resources were produced including a [podcast on certified carbon neutral sweet corn](#) developed by Mulgowie Farming Company in Queensland and a webinar recording of [Carbon management on vegetable farms – emissions, sequestration and beyond](#).

The Carbon Series has been produced to help Australian vegetable growers to:

- Make decisions to manage soil carbon for increased productivity
- Calculate current emissions and assess the potential for emission reductions within their business
- Assess the viability of participating in an official carbon credit scheme
- Consider carbon neutrality as a path to differentiate products and their business on the market.

Part 1 provides an overview of carbon farming and its relevance to Australian vegetable growers.



WHY SHOULD VEGETABLE GROWERS CARE ABOUT CARBON AND EMISSIONS?

Vegetable growers should consider the management of carbon in their growing operations not only to reduce greenhouse gas emissions, but to increase productivity through sustainable soil management practices.

There may be potential market benefits for a vegetable production business through the promotion of sustainable farming practices and resource use efficiency. Reducing emissions and capturing carbon can increase resilience to future climates, market demands and industry targets into the business.

While there may be opportunities to receive income from participation in the Emissions Reduction Fund or other carbon trading projects that sequester carbon in soil or vegetation, the co-benefits of carbon farming should not be overlooked.

In fact, growers sometimes decide to undertake carbon farming practices while not participating in carbon trading schemes.

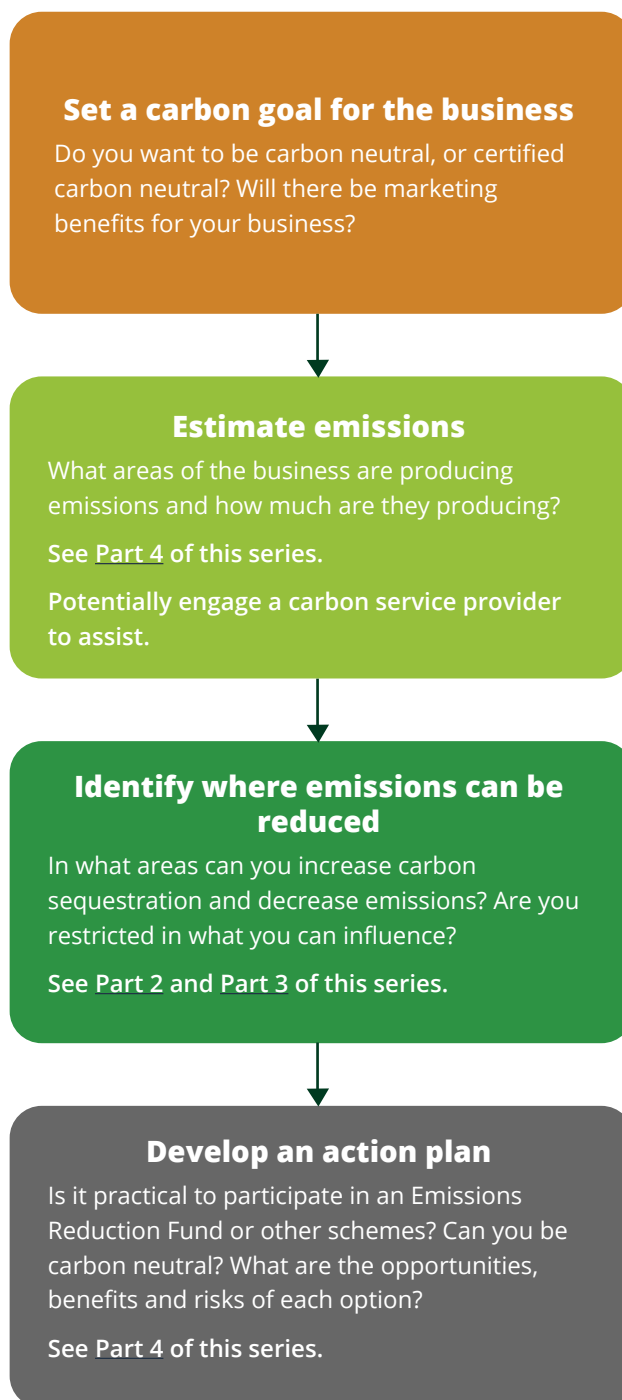
KEY CONSIDERATIONS FOR CARBON FARMING

The majority of carbon farming is part of good farming practice. In many cases it can be achieved using standard approaches that improve soil health, increase biodiversity for integrated pest management (IPM) and offer wind protection for crops.

Choices about carbon farming can be made at many levels on-farm. These choices are influenced by a grower's underlying reason for carbon farming and the emissions profile of the business or product.

See Figure 1 for a possible way to approach carbon farming for a vegetable growing operation.

Figure 1: An approach to carbon farming





THE ROAD TO CARBON FARMING: WHAT IS THE BIGGER PICTURE?

The United Nations (UN) developed 17 [Sustainable Development Goals](#) (SDGs) as a call for action by all countries to promote prosperity while protecting the environment. They link closely with the UN Framework Convention on Climate Change, which aims to stabilise greenhouse gas concentrations in the atmosphere to prevent harmful effects on the climate.

Australia ratified the Kyoto Protocol in 2007, which operationalises the UN Convention on Climate Change.

The Conference of the Parties (COP) – the decision-making body of the Convention – meets annually to review progress. Australia is also a signatory to the Paris Agreement, a legally-binding international treaty on climate change which aims to limit global warming and achieve a climate-neutral world by 2050.

Australian context

Several relevant initiatives and plans exist in Australia; they are listed below.

The Australian Government's [Plan to Deliver Net Zero: The Australian Way](#) assumes that up to 17 million tonnes of carbon dioxide equivalent could be sequestered in soil carbon projects by 2050, generating \$400 million in additional revenue for landholders.

The 2021 report [Towards Net Zero: A practical plan for Australia's governments](#) cites agriculture as representing 15% of Australia's total emissions (of which 75% are related to animal production). The report strongly advocates that agriculture should not be exempt from the national net zero target.

The Australian Department of Agriculture, Water and the Environment (DAWE) engaged the National Farmers' Federation to develop and trial the [Australian Agricultural Sustainability Framework](#), which identified the following objectives:

- Integrate productivity, sustainability and biodiversity on Australian farms to provide lasting benefits to farmers and the community
- Ensure Australian farmers can showcase best practice sustainability/biodiversity management of natural resources – and ensure these actions are recognisable by supply chains, markets, investors, the community and other farmers.

For the horticulture industry, Hort Innovation's [Australian-Grown Horticulture Sustainability Framework](#) developed four pillars, including 'Planet and Resources' which describes how the efficient use of resources is vital to the sector.

This pillar includes a goal for horticultural crops to sequester carbon and production systems to minimise greenhouse gas emissions from land use (direct emissions) and associated production inputs and outputs, for example life cycle emissions such as those from fertiliser production or transporting produce to markets (indirect emissions).

NEXT IN THE CARBON SERIES

- **Part 2: Soil carbon and carbon sequestration**
- **Part 3: Carbon emissions in vegetable production**
- **Part 4: Carbon accounting and the Emissions Reduction Fund**



APPENDIX 1: CARBON DICTIONARY

Please refer to the following “carbon dictionary” to understand the common terms and phrases used throughout the Carbon Series.

Table 1: Carbon dictionary

Carbon	<p>Carbon is a chemical element found in all living things. It is also stored in rocks, sediments and fossil fuels. In nearly pure form, it is in diamonds and graphite.</p> <p>Carbon is released into the atmosphere when plants decompose or when fossil fuels are used for energy. It also occurs as a gas (carbon dioxide, CO₂) in the ocean and the atmosphere.</p> <p>Plants utilise carbon from the atmosphere to produce carbohydrates (e.g. sugars). They release some of the carbohydrates into the soil, but the main way they return carbon to soils is via decomposition, when they eventually turn into soil organic matter. Organic matter is the foundation of healthy soils.</p>
Soil carbon	Soil carbon refers to the measure of carbon contained within soil organic matter, which is usually around 50% on average.
Carbon dioxide equivalent	Carbon dioxide equivalent (CO ₂ -eq) is the standard measurement which accounts for global warming potentials of all the greenhouse gases (i.e. carbon dioxide, methane and nitrous oxide), on the basis of their global warming potential (GWP). This is done by converting amounts of other gases to the equivalent amount of CO ₂ with the same global warming potential.
Carbon farming	Carbon farming relates to a deliberate set of agricultural practices or land uses to increase carbon stored in the soil and vegetation (sequestration) and reduce greenhouse gas emissions from livestock, soil or vegetation (avoidance).
Carbon footprint	<p>A carbon footprint refers to the net amount of emissions produced by an activity or business, both on-farm and within the supply chain. This therefore includes both direct on-farm activities such as fertiliser application and fuel use as well as indirect off-farm activities both from upstream and downstream activities.</p> <p>Upstream pre-farm emission include all electricity and energy used for inputs to farm while downstream post-farm processing emissions includes, for example, transpiration and emissions from disposal.</p>
Carbon sequestration	Carbon sequestration involves increasing carbon within your farming system by capturing and storing carbon dioxide in soil and vegetation.
Circular economy	<p>A circular economy is a concept for systematic redesign and is based on three core principles:</p> <ol style="list-style-type: none"> 1. Design out waste and pollution 2. Keep products and material in use 3. Regenerate natural systems
Emissions	Emissions are greenhouse gases lost to the atmosphere.
Emissions Reduction Fund (ERF)	<p>The Emissions Reduction Fund provides businesses (including agricultural businesses) with the opportunity to earn Australian carbon credit units (ACCUs) for every tonne of carbon dioxide equivalent a business stores or avoids emitting through the adoption of new practices and technologies.</p> <p>ACCUs can be sold to the government or on the secondary private market to generate additional income streams.</p>
Greenhouse gas (GHG)	<p>A greenhouse gas is defined as any gaseous compound that is capable of absorbing infrared radiation, thereby trapping and holding heat in the atmosphere.</p> <p>Increasing greenhouse gases in the atmosphere have been linked to global warming and climate change.</p> <p>Carbon dioxide (CO₂) is one of several recognised greenhouse gases. Others of major relevance to vegetable producers include nitrous oxide (N₂O), and methane (CH₄) if you also run livestock.</p>