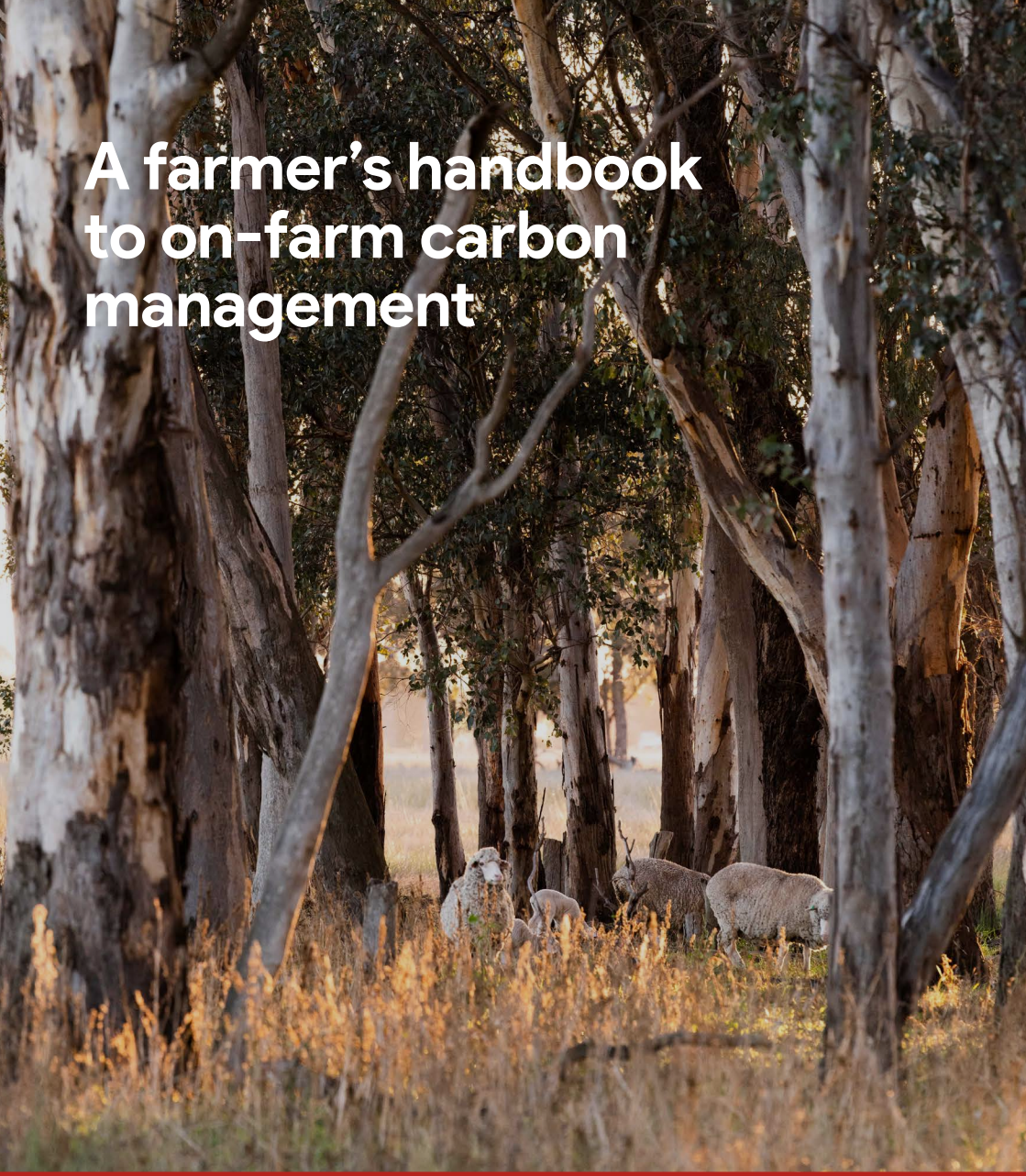
A farmer's handbook to on-farm carbon management



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CarbonCount

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Foreword

Australia’s rural industries and businesses have potential to participate in carbon markets that are rapidly being developed around the world. International top 500 companies are quickly learning how they can participate in formal and voluntary carbon schemes, undertake abatement activities and sequester carbon through creating carbon sinks or purchasing carbon credits; agricultural communities and business have an opportunity to be part of this conversation.

Participation in the carbon market is already occurring on some farms as a means of creating an additional income stream or changing existing land use. As uptake grows, producers are looking to understand their options and evaluate whether carbon activities are right for their business.

A farmer’s handbook to on-farm carbon management aims to support producers with practical information on the feasibility of carbon sequestration activities on their farm. As carbon storage and sequestration becomes more prominent in rural industries, producers may be considering the opportunities and challenges that come with participating in a formal carbon sequestration scheme.

This handbook is a handy introduction to carbon concepts and the requirements of participating in a carbon scheme. The handbook details practical carbon sequestration activities and the potential cost and income implications. It provides audience-specific information that outlines the steps to participate and the potential risks and returns for a farm enterprise.

AgriFutures Australia invested in this work in consultation with other Rural Research and Development Corporations (RDCs). Together, we recognise the need for producers to better understand carbon sequestration activities, potential obligations, the risks and requirements to participate, and potential options to sequester carbon on farm.

This handbook has been produced under AgriFutures Australia’s National Rural Issues (NRI) Program. NRI focuses on thought-provoking and horizon-scanning research to inform debate and policy on issues of importance across rural industries. Most of AgriFutures Australia’s publications are available for viewing, free download or purchase online at www.agrifutures.com.au.

Michael Beer
General Manager, Business Development
AgriFutures Australia

Contents

1 How to use this handbook

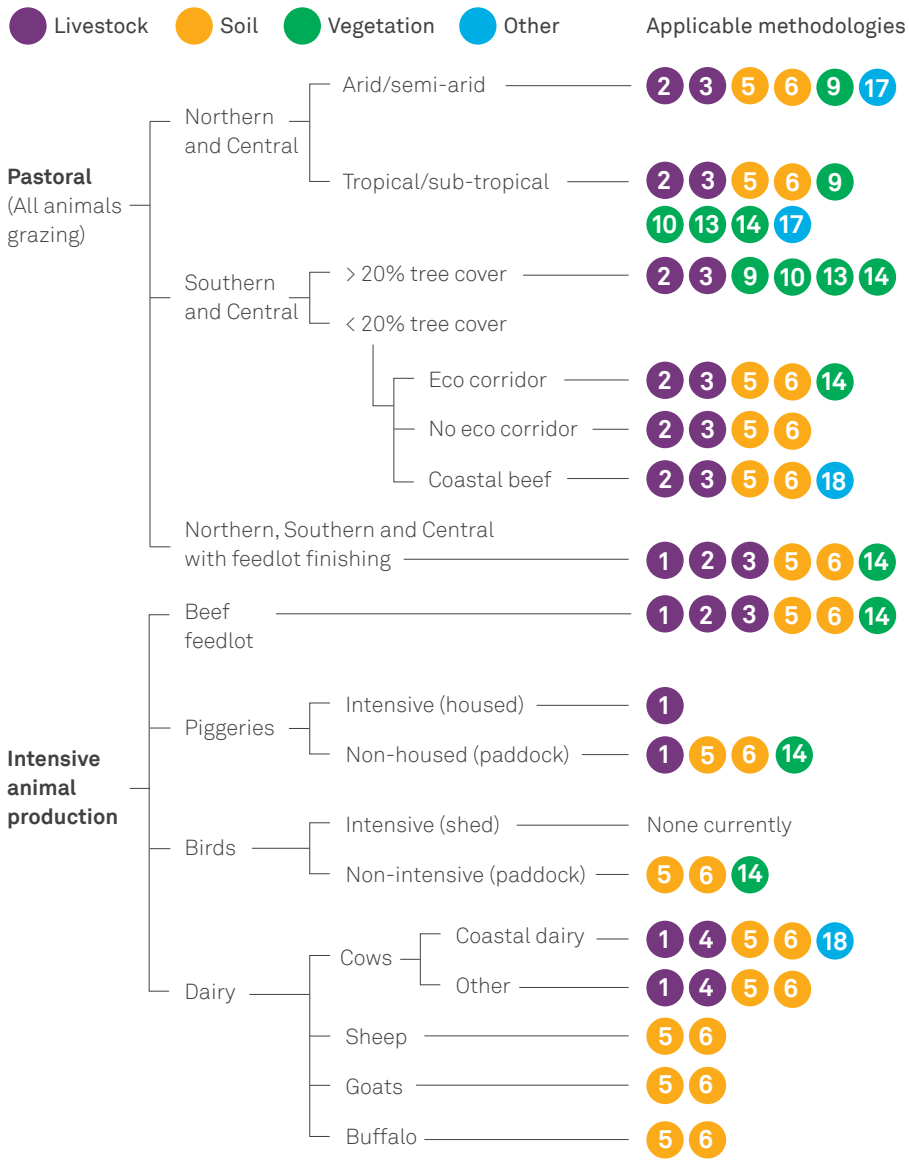
This handbook was designed with you, the Australian primary producer, in mind. It gives a practical introduction to carbon sequestration, emission reductions and carbon farming, and outlines the benefits, risks and methodology summaries for a farming enterprise.

The handbook is divided into three sections: carbon theory; carbon methodology summaries; and methodology extended guides. The theory section details the fundamental knowledge you should know when implementing a carbon project. The carbon methodology summaries provide a one-page overview of the methodology. And the extended guides provide an in-depth process on how to implement some of the more popular methodologies.

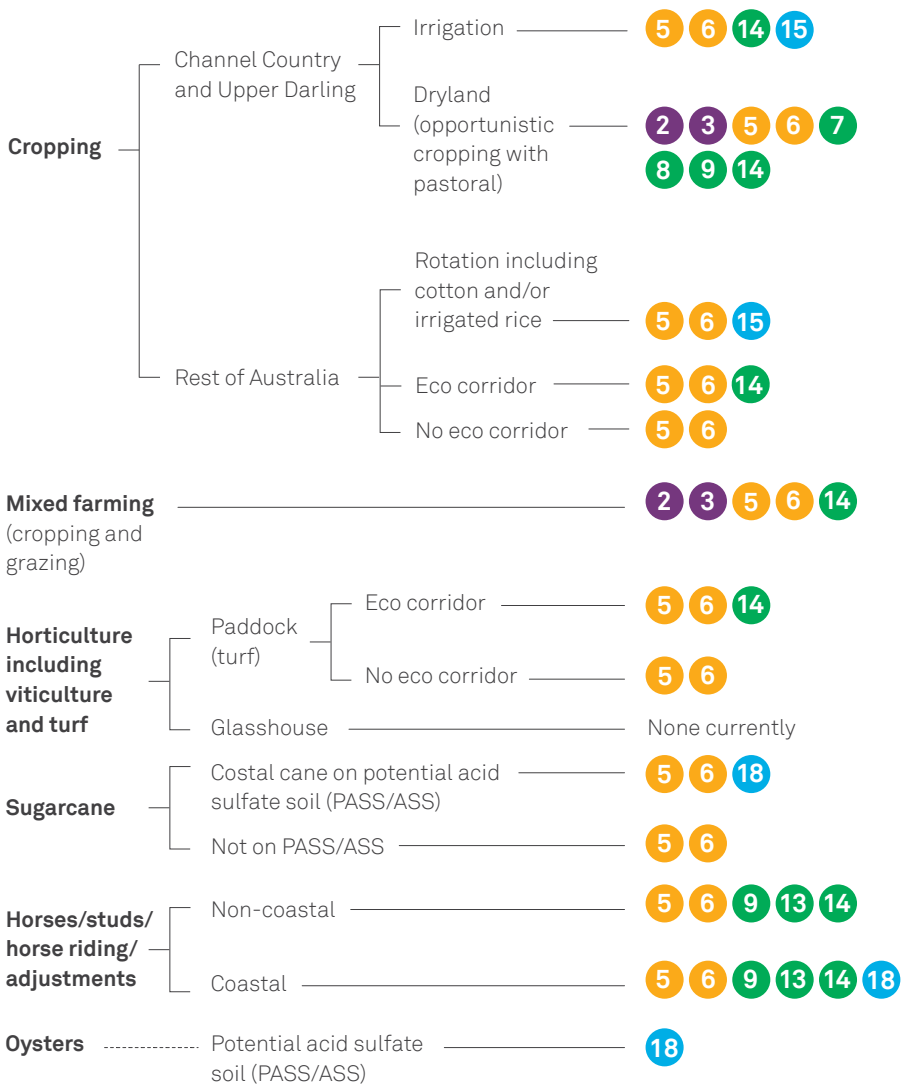
The best way to get started is by first identifying which carbon management methodologies apply to you by following the decision tree on the following pages. Short summaries of the methodologies (each allocated a number from 1 to 18) follow the decision tree, and long descriptions are found on the pages listed.

How to use this handbook

2 Carbon management methodology decision tree



Find out which carbon management methodologies apply to your farm enterprise by using the following decision tree, starting off with your farming practice. Once you have identified your applicable methodologies, head to pages 12-13 to read short summaries of each. Long descriptions of each methodology can be found on the pages listed.



Carbon management methodology decision tree

Carbon management methodology decision tree

Livestock

1. Animal effluent management – page 52

Gives piggeries and dairies the option to develop facilities for treating animal effluent to either destroy emissions, avoid them, or create biomethane to be used as a natural gas substitute.

2. Beef cattle herd management – page 54

Efficient management of large herds of cattle to reduce emissions per kilo of beef produced, by implementing practices that assist in maintaining weight gain, such as adding additional water points and improving genetics.

3. Reducing greenhouse gas emissions in beef cattle through feeding nitrate containing supplements – page 56

Replacing urea supplements with nitrate supplements in cattle to reduce methane emissions. These come in the form of lick blocks.

4. Reducing greenhouse gas emissions in milking cows through feeding dietary additives – page 58

For milking cows that are pasture fed at least nine months of the year, methane emissions can be reduced by increasing fat content of diets and/or improving the quality of feed.

Soil

5. Estimating sequestration of carbon in soil using default values – page 60

Involves implementing a new land management activity out of three options to sequester carbon in soil, such as halting tillage practices, rejuvenating pasture through cropping, and applying nutrients to the land.

6. Estimating soil organic carbon sequestration using measurement and models – page 64

A more holistic soil carbon methodology, it involves implementing a set of land management activities to sequester carbon in soil and estimates the level of carbon in soil through measurement and/or modeling.

Vegetation

7. Avoided clearing of native regrowth – page 68

For those with a valid clearing consent and land that has been cleared at least twice in the past, this method involves retaining areas of forest which would otherwise be cleared.

8. Avoided deforestation – page 70

For those with a valid clearing consent, credits can be generated in native forest areas that would have otherwise been cleared for crops or grassland.

9. Human-induced regeneration of a permanent even-aged native forest – page 72

For land that has been suppressed or cleared in the last decade, these projects restore forest through stopping the destruction of native regrowth, allowing it to naturally regenerate.

10. Native forest from managed regrowth – page 76

Allows native vegetation to grow into forest by stopping activities that have previously suppressed or destroyed the vegetation's regeneration.

11. Measurement-based methods for new farm forestry plantations – page 78

This method is based on establishing and maintaining trees on land that was previously used for grazing or cropping.

12. Plantation forestry – page 80

If you have a plantation forest or are looking to establish a forest, this method focuses on the creation and maintenance of both plantation and permanent forests.

13. Reforestation and afforestation – page 84

This method applies to land that has been used for either grazing, cropping or fallow in the past five years, and involves planting seeds or seedlings to create a permanent forest.

14. Reforestation by environmental or mallee plantings – page 86

Projects that create and maintain native vegetation, including trees, shrubs or mallee eucalypts, on land that has been cleared of forest for at least five years.

Other

15. Reducing greenhouse gas emissions from fertiliser in irrigated cotton – page 88

The method involves taking actions that help to raise the efficiency of synthetic nitrogen fertiliser on crops, reducing emissions and improving fertiliser efficiency.

16. Verified Carbon Standard projects - page 89

These projects are only those running under the Verified Carbon Standards method. They must have been registered under the Emissions Reduction Fund before 30 June 2015. No summary is provided for this method as it is not applicable anymore.

17a. Savanna fire management – emissions avoidance – page 90

Fire management projects run burning activities in the early dry season where burnable biomass is cooler and moister. This in turn reduces the frequency and extent of fires in the late dry season.

17b. Savanna fire management – sequestration and emissions avoidance – page 90

In terms of project activities, this method is identical to 17a. The difference is that this method also measures the amount of carbon sequestered in dead organic matter.

18. Tidal restoration of blue carbon ecosystems – page 94

Involves projects that allow the introduction of tidal flow into a plot of land, including the management of any potential tidal inundation, to establish coastal wetland ecosystems.

3 About this handbook

A farmer's handbook to on-farm carbon management is a practical introduction to carbon concepts for the Australian farmer.

Focusing specifically on agricultural land, the information presented throughout this handbook outlines current and emerging carbon sequestration and emission reduction schemes available under the Emissions Reduction Fund (ERF).[1]

Emissions Reduction Fund projects either work to avoid emission of greenhouse gases into the atmosphere or to remove carbon dioxide (CO_2) from the atmosphere by storing – or sequestering – carbon in soil or vegetation.

The goal of this handbook is to help primary producers like yourself better understand the opportunities and requirements of participating in carbon management activities for a farm enterprise. It outlines the whole-of-farm management implications of the available schemes – potential income, costs, risks, challenges, rewards – and provides step-by-step guidance on how to participate.

[1] http://www.cleanenergyregulator.gov.au/ERF

4 Introduction

Emission offsetting through carbon credits is set to become a key contribution to the way Australia and the world achieves 2050 net zero emissions targets. The opportunity for primary producers is big.

Put simply, on-farm carbon management involves carbon farming – managing vegetation, fire, soil or livestock to increase the storage of carbon in our landscapes as well as reducing the amount of greenhouse gases that are emitted.

Carbon farming has been a time-tested practice in sustainable agriculture for more than 30 years. Today it is garnering both country-wide and international recognition and uptake as it gives farmers and landholders the opportunity to access an additional income stream if practised in accordance with certain legislative frameworks.

Not only does carbon farming significantly contribute to achieving our climate goals, there are also important-to-understand on-farm benefits that can potentially be attained when running a carbon project, including:

- Reduced erosion from water runoff;
- Improved soil fertility;
- Higher biodiversity, which provides ecosystem benefits such as pollination for crops, pest control and better nutrient cycling and recycling;
- Improved on-farm productivity, including improved yields, improved crop resilience, and reduced reliance on synthetic fertilisers;
- Increased employment opportunities for rural communities through additional income streams from credit sales;
- Less stress in farm management through on-farm benefits, resulting in more time to connect with the community;
- Reduced inputs from ecosystem benefits resulting in additional cost savings for the farming business.

In Australia, carbon farming is a growing industry that's making an important contribution to Australia's emission reduction targets. This is because mitigating farm emissions through a change in farm management practices can make a considerable contribution to reducing the amount of greenhouse gases that enter the atmosphere. If done in accordance with the methodologies outlined by the Clean Energy Regulator (CER),[2] this can also generate sellable carbon credits, explained in detail further below.

[2] http://www.cleanenergyregulator.gov.au/

5 Setting the scene

Our agricultural lands are degrading fast

In Australia, about two-thirds of agricultural land is degraded. The main types of degradation are soil erosion; sodicity, salinity and acidity; chemical contamination; nutrient decline; and loss of soil structure.[3]

One of the major causes of our land degradation is the permanent removal of native vegetation, particularly through farming practices. When vegetation has been removed from soil surfaces, these surfaces become susceptible to erosion – either by wind or water – and often both agents combine to remove surface soil.

What's important to appreciate is that erosion has been occurring over millennia in Australia. However, since European settlement, the rate of soil loss has increased dramatically.[4,5] Soil degradation has increased exponentially, doubling in rangelands, being five times as great in higher-rainfall areas where native grasses have been replaced by cultivated ones, and being as much as 50 times as great on slopes where cereals are grown.[6]

How does storing carbon help combat climate change?

Carbon is the building block of all living things – humans, plants and animals. In trees, approximately 50% of the biomass is carbon. In soils, approximately 45% of soil organic matter (SOM) is carbon.

In most cases it's carbon dioxide (or more generally, greenhouse gases) that people are referring to when they talk about carbon. Carbon dioxide (CO_2) is a naturally occurring gas in our atmosphere and it cycles through to organisms on Earth and then back into the atmosphere over and over again, as shown in Figure 1.

Sequestering carbon removes carbon from the atmosphere and stores it in soil, plants, geological formations and the ocean. Forests naturally store, or sequester,[7] carbon in trees and soil. Forests do release carbon as well; this happens naturally when a tree dies or through bushfires, for example. The movement of gases like CO_2 between forests and soil is cyclical; forest management can influence these cycles to capture more CO_2.

[3] http://www.australiancollaboration.com.au/pdf/FactSheets/Land-degradation-FactSheet.pdf
[4] https://soe.environment.gov.au/sites/default/files/soe2016-land-final-web.pdf?v=1492063205
[5] https://soe.environment.gov.au/
[6] http://www.australiancollaboration.com.au/pdf/FactSheets/Land-degradation-FactSheet.pdf
[7] Sequester is a commonly used term in carbon markets to indicate the storage of carbon over long periods of time.

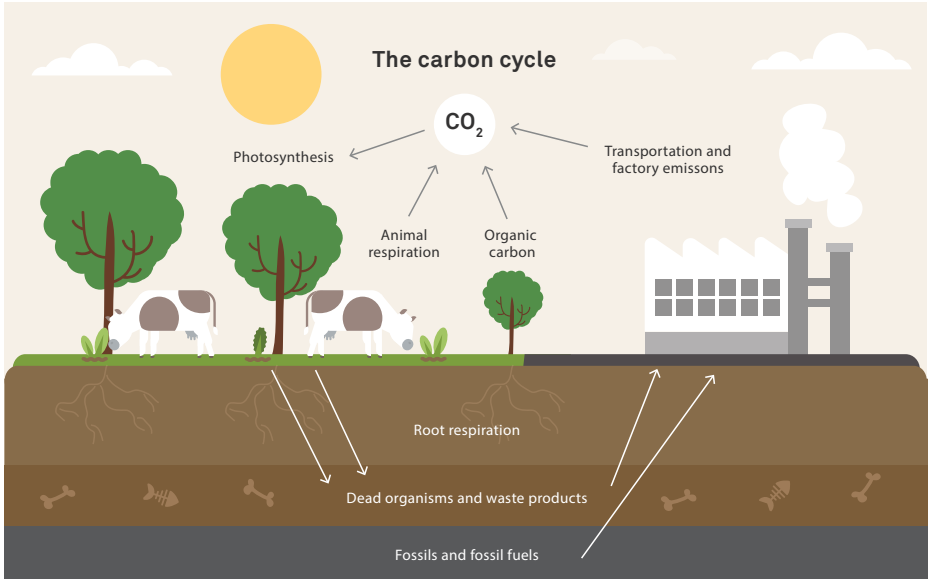


Figure 1: The carbon cycle

CO_2 isn't inherently bad. It's the excess carbon dioxide emissions in the atmosphere that causes the carbon cycle to be out of balance; one of the key reasons our climate is heating up. In soil, carbon is at the epicentre of a complex interplay that exists between living matter, dead matter, organic matter and mineral matter; it's the key ingredient that makes a soil not only fertile but healthy. Without carbon there is no soil, and without soil almost the entire terrestrial ecosystem collapses.

Furthermore, all microbiology eats carbon. As soil microbes are a key medium for plant growth, it is important to ensure they have access to a plentiful supply of carbon.

Climate change – why it is happening and what we can do?

Climate change refers to long-term changes in temperature and weather patterns. There are and have always been natural variations in climate, such as changes in the solar cycle.

It is human activity, however, that has been primarily responsible for accelerating climate change over the past two centuries, particularly in the form of human-induced emissions of greenhouse gases (GHGs) and the clearing of forests for agriculture; both of which increase our planet's temperature. The use of fossil fuels like coal and gasoline generates GHGs that act like a blanket wrapped around Earth's atmosphere, trapping heat from the sun that is then reflected back into the atmosphere from Earth's surface (Figure 2).

Examples of GHG emissions include fuel consumption in vehicles, releasing CO_2 by clearing forests, and landfills that produce methane. Energy production, industry transport, buildings, agriculture and land usage are among the main producers/emitters of GHGs that cause climate change.

Mitigating greenhouse gas emissions alone will not stop Earth from heating up. Climate change is initially and almost primarily controlled by loss of precipitation from continents, resulting in degraded soils and bare ground.

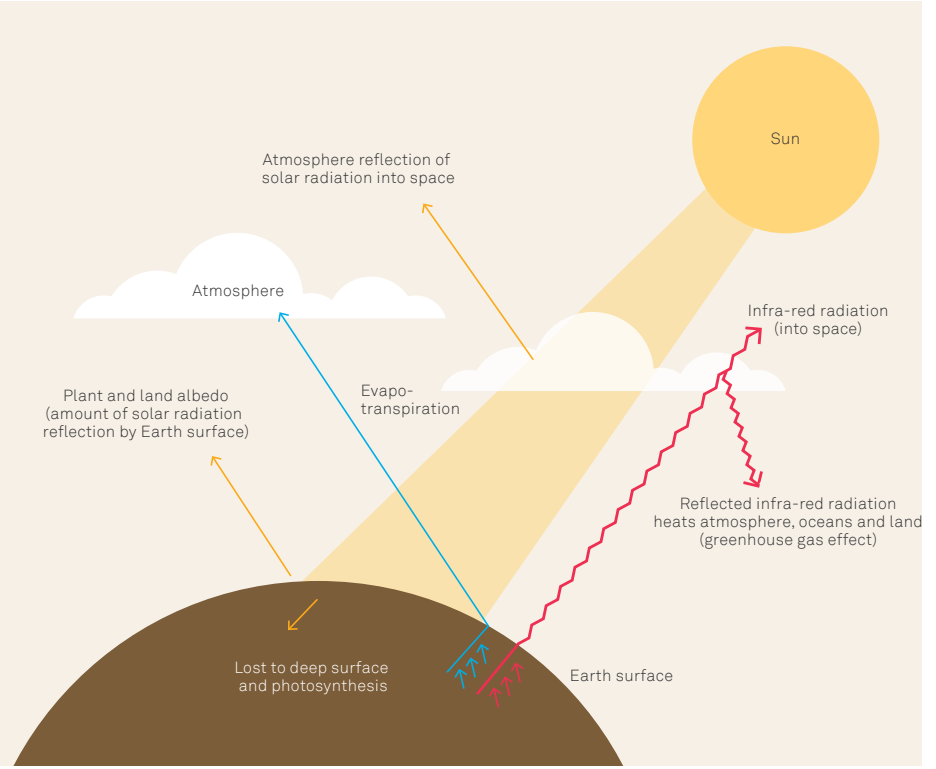


Figure 2: Diagram showing how greenhouse gases cause the earth to trap heat. Source: *Ground Breaking: Soil Security and Climate Change* by Philip Mulvey and Freya Mulvey[8]

[8] https://www.groundbreakingpress.com/

Setting the scene

The small water cycle

Degraded soil and bare ground drastically increase infrared radiation, a primary driver of climate change, which leads to increased ground temperatures, heatwaves, increased droughts, floods and bushfires.

It is for this reason that increasing soil health and vegetation cover is so important, as precipitation and water storage from plants and vegetation bring back the small water cycle, which enables the earth to regulate the climate once more – a key aspect of mitigating and reversing climate change.

The small water cycle is a lesser-known phenomenon that occurs in the presence of extensive stretches of healthy soils and vegetation from the coast.

It consists of water evaporating from land and then falling down again as precipitation over the same land as mists, fogs, light rain and thunderstorms, as part of a closed water cycle. A process called the 'biotic pump' draws water in from the oceans in cycles of precipitation, carrying water hundreds of kilometres from the coast into the interior of continents through the small water cycle (Figure 3).

Under extensive forests or saturated flood plains, the small water cycle can move water inland up to 2000 km from the coast. In the Amazon and Congo basins, almost all precipitation is sourced from the small water cycle. Ocean water contributes about 10% to runoff from river systems.

Even in unsaturated environments away from the tropics, the biotic pump moves water up to 1000 km inland. In these instances, between 40–70% of rainfall is produced from the small water cycle. When agriculture dominates the landscape, however, the small water cycle can be vastly reduced or completely lost due to a loss of latent heat (evapotranspiration).

It is important to understand that the small water cycle plays a big part in on-farm water management and, on a bigger scale, is required to bring stability back into the climate.

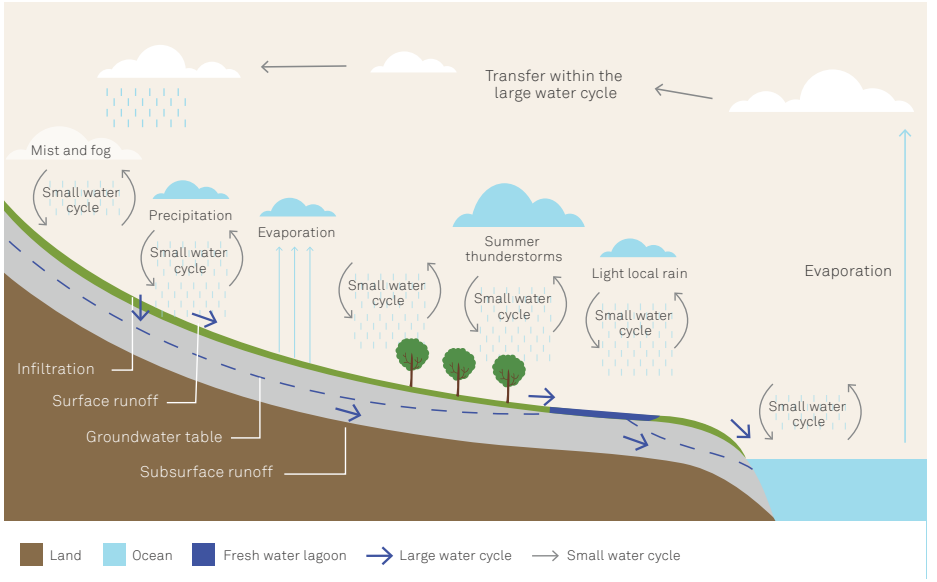


Figure 3: Visualising the (large) water cycle and the small water cycle. Source: *Ground Breaking: Soil Security and Climate Change* by Philip Mulvey and Freya Mulvey

6 What is carbon farming?

Carbon farming involves either changing the way some agricultural activities are performed on the land, or implementing new activities that are known to either store carbon (carbon sequestration) or reduce greenhouse gas emissions (emissions reduction or emissions avoidance).

As a result of carbon farming, more carbon is sequestered into soil and plant material, improving farm productivity and soil health, and less atmospheric carbon dioxide is emitted from productive activities.

Carbon credits can be earned by achieving a net reduction in emissions while following the set methodologies outlined by the Australian Government's Clean Energy Regulator (CER), or by sequestering carbon into soil and vegetation for an extended period of time. These methodologies set out rules for carbon projects and how to calculate the carbon that is stored or avoided.

To better understand what activities contribute to carbon farming, we must first clarify what we mean by carbon sequestration and emissions reduction, and how each of these principles work for on-farm carbon management.

Carbon farming principles

Carbon management activities can be split into two categories based on their respective outcomes:

1. **Emissions reduction/avoidance:** Reducing the amount of carbon being emitted by farm activities;
2. **Carbon sequestration:** The removal of carbon from the atmosphere by storing (sequestering) it into water, land and vegetation.

The Australian Government's Clean Energy Regulator (CER) has developed and regulates a number of schemes that fall into one of these categories. The next sections will explain the principles behind the two categories.

Carbon sequestration explained

The principle of carbon sequestration is to draw carbon down from the atmosphere into biological-based solutions called 'carbon sinks'. The three main carbon sinks leveraged in carbon farming practices are soil, vegetation and coastal ecosystems, and the process is generally the same for all three.

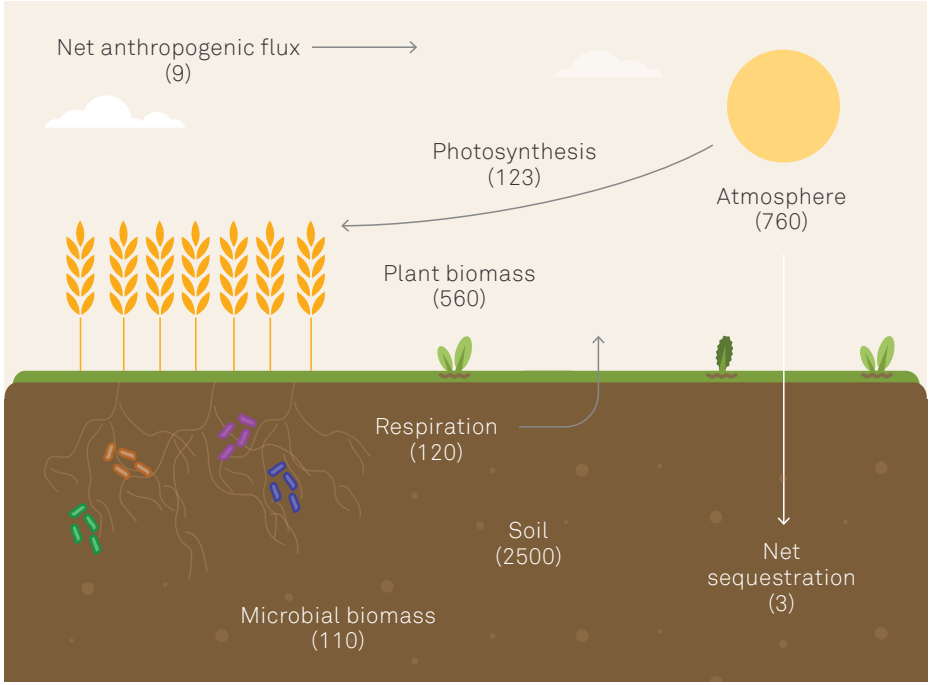


Figure 4: The soil carbon cycle – how carbon from the atmosphere ends up in the soil. The numbers in brackets represent gigatonnes (GT) of carbon stock, and the arrows show GT fluxes per year.

The removal of carbon

Carbon dioxide is removed from the atmosphere through photosynthesis, which is the process used by plants to convert light into chemical energy. Carbon dioxide is one of the primary reactants in this process.

The transformation of carbon

Plants then transform carbon dioxide and water into oxygen and organic compounds (carbohydrates such as sugars and starches) for the plants to use. These materials are used in many areas throughout the plant, such as building biomass or excreting it through their roots.

The storage of carbon

Each carbon sink has a different method of storing carbon. In soils, known to be the second-largest carbon sink in the world, the carbon is stored in a stable form called soil organic matter (SOM) and created through a symbiotic relationship between plants and microorganisms (Figure 4).

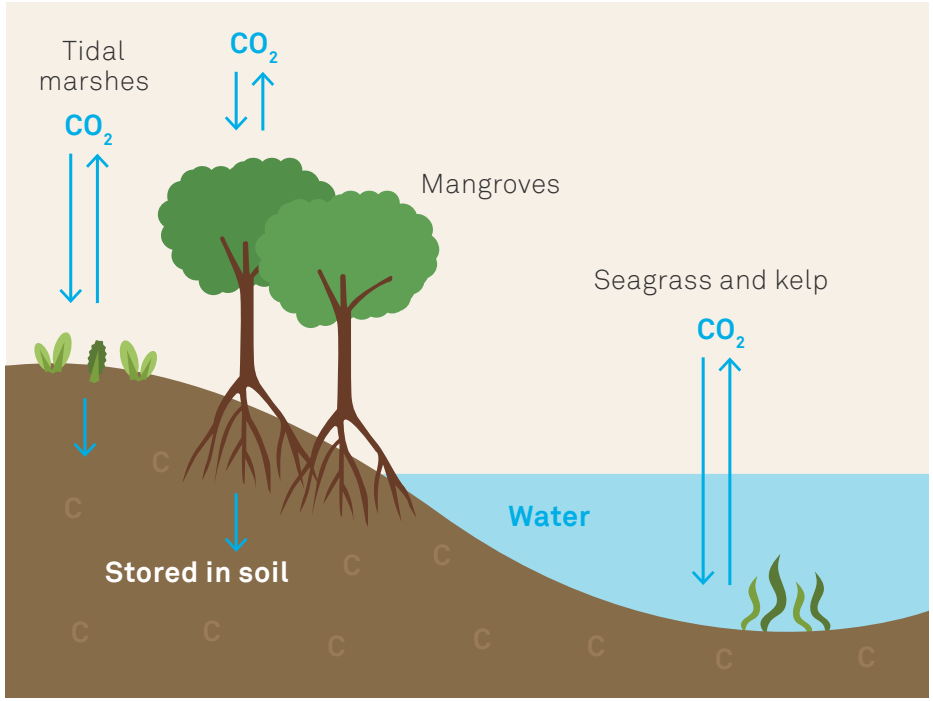


Figure 5: The blue carbon cycle – how carbon from the atmosphere ends up in soil and vegetation along the coast. Source: Carbon Count Pty Ltd

In coastal ecosystems, the carbon is stored in the form of the biomass in vegetation such as mangroves, tidal marshes and seagrasses, as well as in the sediments beneath the water (Figure 5). In theory, these ecosystems have the potential to lock up carbon at faster rates and store higher amounts of carbon than soil and vegetation.

In vegetation, such as grasslands and forests, the carbon is stored primarily in the biomass of the vegetation itself, both above ground in the form of the trunk and leaves, and below ground in the form of the roots and soils surrounding them (Figure 6). Vegetation has the ability to store large amounts if well supported by the surrounding environment and ecosystem.

Increasing vegetation cover in the landscape will increase the in-land evapotranspiration effect, which can increase in-land rainfall events (see small water cycle).

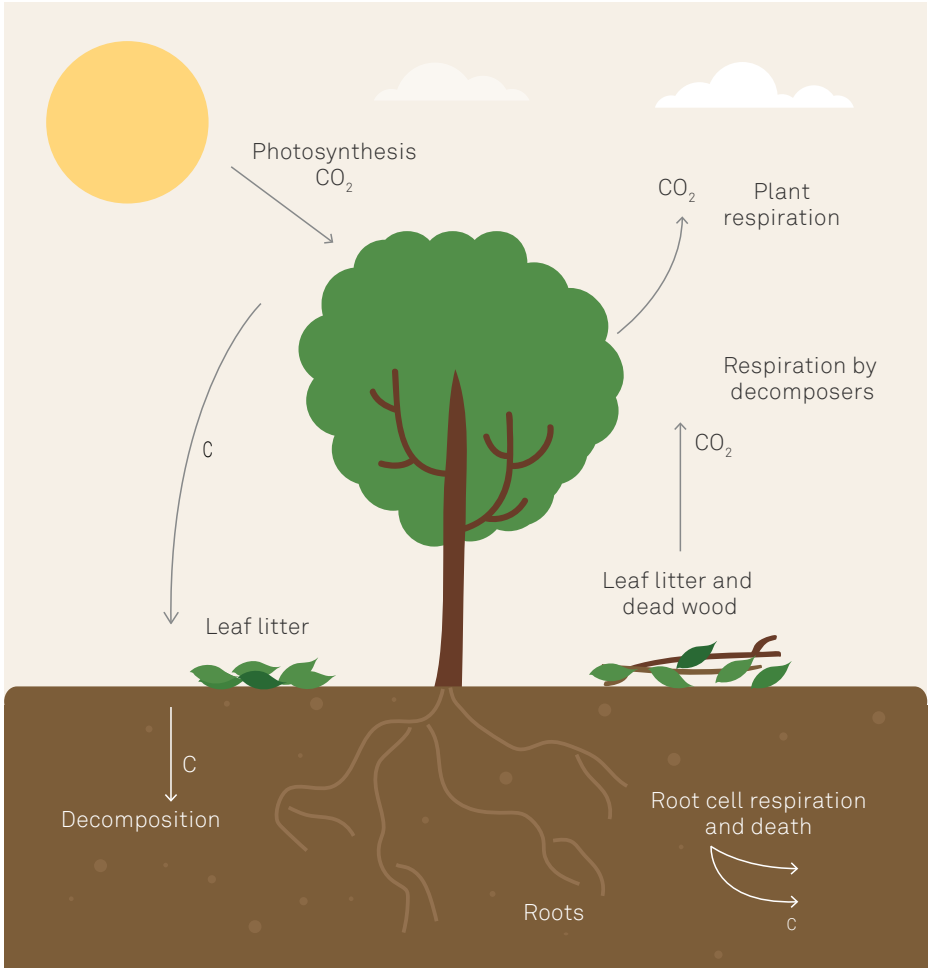


Figure 6: The vegetation carbon cycle – how carbon from the atmosphere ends up in vegetation

What is carbon farming?

Emissions reduction/ avoidance explained

Conversely, emissions reduction and avoidance revolves around either decreasing or eliminating emissions being released into the atmosphere. This can come in many forms but must be implemented through a change in practice that results in a reduction in emissions. For example, reducing the level of methane (CH_4) that cattle produce through enteric fermentation falls into emissions reduction, as visualised through Figure 7.

Savanna burning is another example of emissions reduction, where the carbon released during the burning of savanna can be reduced if the burning occurs during the early season rather than the late season, as visualised through Figure 8.

Avoided deforestation (i.e. not cutting down existing vegetation that was planned to be cut down) is an example of emissions avoidance, as the clearing of vegetation would have released CO_2 emissions into the atmosphere.

There are a number of methodologies in the Emissions Reduction Fund that are classed as emissions reduction and emissions avoidance activities. Both will be explained in greater detail later in this handbook.

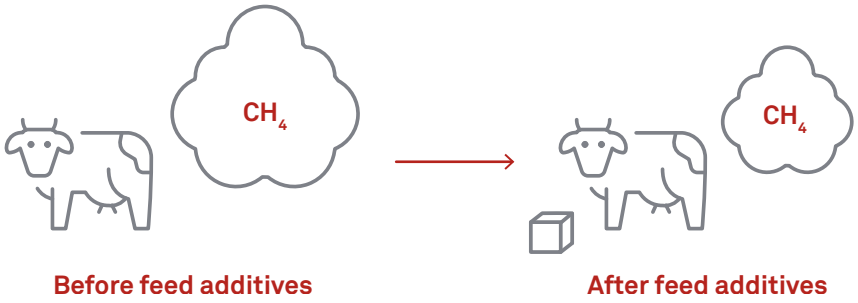


Figure 7: Visualisation to demonstrate the reduction in methane that gets released before and after feed additives. Source: Carbon Count Pty Ltd

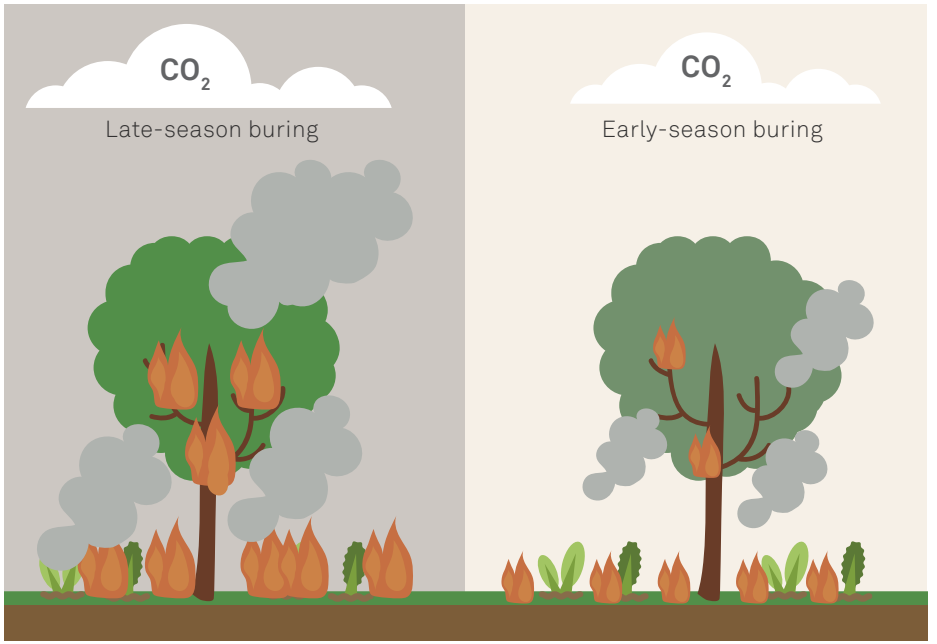


Figure 8: Demonstration of the reduction in carbon emissions from burning in the early dry season compared to the late dry season. Source: Carbon Count Pty Ltd

What is carbon farming?

What is a carbon credit?

Carbon credits are a mechanism allowing those who are involved in carbon farming to be rewarded for doing so. A carbon credit equates to one tonne of carbon dioxide equivalent (CO_2-e)[9] being sequestered or reduced/avoided through a carbon project. In Australia, the Commonwealth Government issues carbon credits known as Australian Carbon Credit Units (ACCUs), in units of CO_2-e.

These credits can be used for one of three purposes: you can choose to either hold, sell as offsets, or use to offset your own emissions (known as insetting). Holding ACCUs will allow you to sell at a later date when the price is right for you, noting that carbon prices behave like any other commodity market. Selling the offsets will convert the credits to cash, noting that there will be additional tax implications to be aware of. Offsetting your own emissions can be done if you want to claim carbon neutrality for your farm or products and low carbon product certifications such as Climate Active Certification.[10]

Figure 9: One tonne of CO_2 stored is equivalent to one Australian Carbon Credit Unit

[9] A carbon dioxide equivalent (CO_2-e) is another term for any other greenhouse gas, such as methane and nitrous oxide, that is converted to 'carbon dioxide units' based on their greenhouse warming potential.

[10] https://www.climateactive.org.au/

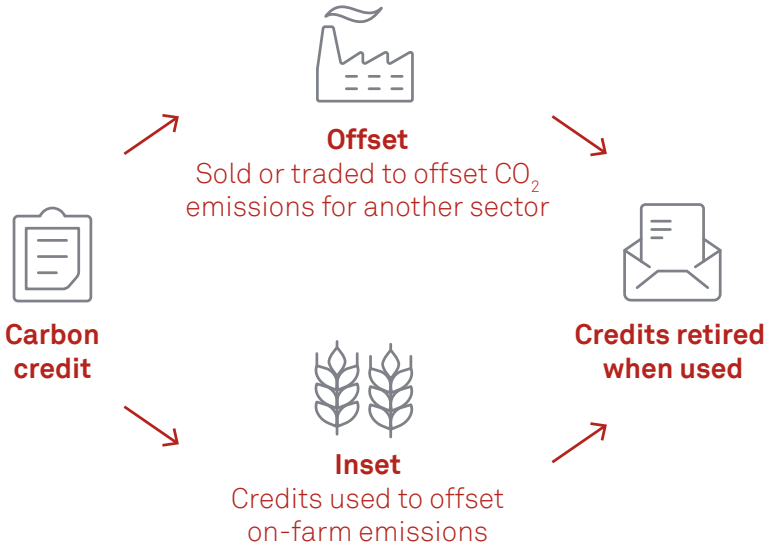


Figure 10: Carbon credits can be either sold off to offset emissions in another sector or used to offset your own emissions (i.e. insetting). Source: Carbon Count Pty Ltd

Generating high-quality carbon credits

Not all carbon credits are equal. The value of a carbon credit depends on the integrity of the scheme that the credit-generating project was executed under.

Not all carbon projects are regulated by government bodies. There are other carbon farming schemes that apply globally, such as Verra[11] or Gold Standard[12] that are regulated by private bodies. This handbook focuses on the Australian Government's carbon farming schemes as they are recognised as producing high-quality[13] carbon credits that usually result in higher market value.

Carbon schemes have been put in place by governments and private bodies to ensure carbon farming projects are run according to certain standards and thus deemed as credit-worthy. This ensures that the removal of carbon is genuine and will contribute to our net zero target. Across all schemes, generally the five key criteria as required by international convention are:

1. **Additionality (or newness):** The practice is new and is additional to what would have occurred anyway.
2. **Permanence:** The practice results in permanent removals to ensure that carbon is not returned to the atmosphere for a defined period.
3. **Avoid leakage:** Occurs when sequestration actions in one area lead to an increase in carbon emissions elsewhere.
4. **Measurable:** Project outcomes can be monitored, measured and calculated according to scientific data through a set process.
5. **Verifiable:** Project outcomes can be monitored and verified by an independent third party (often an auditor).

When do you get credited?

You get ACCUs at the end of an offset period. A project's offset period is the time between two quantification events, or, in other words, when the project calculates its sequestration or emission reductions.

What is important to note is that the gross amount of carbon you sequester or reduce is not the amount you can claim as carbon credits at the end of an offset period. The following sections will explain how the credits are calculated and the discounting mechanisms in place to protect the integrity of the scheme and prevent over-crediting.

[11] https://verra.org/

[12] https://www.goldstandard.org/

[13] The word integrity is used interchangeably with the word quality when describing the standard of the credits.

Calculating your carbon credits

When conducting a carbon farming project to produce carbon credits, it is important to understand the concept of net abatement as well as when and how discounts apply.

Your net abatement, or final amount of carbon credits for a reporting period (offset period), is calculated from the amount of emissions sequestered or avoided/reduced above baseline minus your unavoidable on-farm emissions due to farm operations above baseline. Examples of unavoidable emissions include diesel fuel use, emissions from fertiliser use or methane emissions from cattle (Figure 11).

Net abatement is the final amount of carbon credits that will be credited after each reporting period. A higher net abatement will result in more carbon credits provided.

Therefore, to maximise credits, both emissions generated and avoided and carbon sequestration will need to be addressed.

A holistic farm plan will need to consider both aspects, including the management of on-farm emissions without affecting productivity. Ways to reduce on-farm emissions are listed in the appendix.

Figure 11: How net abatement is calculated

Discounting mechanisms

Permanence obligations

When dealing with sequestration projects, there is a chance that the sequestered carbon escapes back into the atmosphere from soil and vegetation through both man-made and natural disasters (i.e. droughts or bushfires). Because of this, sequestration is considered 'permanent' only if it is maintained for more than 25 years. As such, sequestration projects are subject to permanence obligations – a requirement to maintain the carbon stores for which credits have been issued.

For landholders participating in sequestration projects, they may nominate either a 25-year or 100-year permanence period for their sequestration project, and will be audited regularly until the obligation concludes. A project must be maintained for the permanence period nominated even if the project's crediting, reporting and delivery periods may have ended.

The permanence period starts on the date carbon credits are first issued to a project. For example, if the project has committed to a 25-year permanence period and gets its first credits at five years, then the total project lifetime will be 30 years.

At various points during your project, you will be required to submit a 'permanence plan' to demonstrate actions you have taken or will take to protect sequestered carbon during the permanence period.

Permanence and risk of reversal discounts

Permanence discounts will be applied to your net abatement at the end of each offset period, reducing the amount of carbon credits you receive.

Discounts refer to a percentage of your net abatement to be deducted from your final amount/credited amount.

A 25-year permanence is subject to a 20% discount, while a 100-year permanence is not subject to any discount. This is because for projects with a 25-year permanence, there is a risk that carbon may be released into the atmosphere in the 75 years following the project.

Additionally, all sequestration projects are subject to a 5% risk of reversal buffer. This is a flat 5% reduction in credits awarded, designed to protect the ERF against temporary losses of carbon, e.g. carbon lost through natural disturbance events that remove vegetation or soil biomass (note that this buffer may be adjusted over time in the legislative rules). Table 1 outlines the discounts applied to these projects.

Table 1. Carbon sequestration permanence discounts

Sequestration permanence	Risk of reversal	Permanence discount	Total credits received
25 years	5%	20%	75%
100 years	5%	0%	95%

Why additionality matters

The new practice must be implemented only ***after*** your project has been registered. If the practice has already been started, then this may lead to projects not being accepted by the regulators since they won't be seen as 'additional'.

Assessing additionality (or newness) is a key requirement for all carbon offset projects, whether it be emissions reduction/avoidance or carbon sequestration.

An additionality test assesses whether a project and its activity creates 'additional' emissions reductions that would not have occurred outside normal farm operations. In other words, whether a proposed activity is distinct from its baseline.

Additionality is important to ensure that the scheme does not pay for emissions reductions that would have occurred anyway.

For example, if you have a forest area on your property you never intend to clear, you cannot claim it as additionality (under the avoided deforestation method for example) as it was never going to be cut down in the first place.

This is in place to ensure reductions in carbon maintain a high level of environmental and economic efficacy, as reductions following additionality represent genuine abatement created through the existence of the scheme.

For an activity to be classified as additional, there are two requirements that will be assessed on a case-by-case basis during registration and crediting:

1. The activity is not currently being practised; and
2. If the scheme had not been introduced, the activity would not have otherwise occurred.

New practices may not be started before registering the project with the Clean Energy Regulator, unless otherwise stated in the project's method. This is because the Emissions Reduction Fund is not intended to support projects that are already underway as their emissions reduction/avoidance does not count as additional.

Unfortunately, farmers already implementing the listed 'new' practices before they register for a project will not be eligible to claim that practice as additional. However, depending on the level of stringentness that a prematurely executed 'new' practice is being practised, there may still be enough ways to improve upon that practice to meet the requirements. For example, one of your farming activities may be cell (techno) grazing, but changing the duration and intensity of the rotation could be seen as additional if such a change is known to increase carbon levels.

Every farm enterprise is unique. Finding the practice that is right for you is imperative to achieving success. A carbon project developer or agronomist can assist you to create a land management strategy (LMS) that surveys the possibilities on your land and follows the methodology to determine which practices will apply to you.

7 Ways to manage your carbon farming project

When executing a carbon farming project, there is a lot of additional paperwork for monitoring and reporting on projects to the Clean Energy Regulator. It is important that you meet all the monitoring requirements and reporting deadlines to ensure that you are credited for your carbon farming efforts.

There are multiple ways a project can be managed. Management will depend on diligence, willingness and skillset.

You may be able to do the work yourself if you have the required skills, or you may opt for a totally hands-off approach where a third party handles the entire process on your behalf.

Each approach will ultimately impact the amount of time you spend and the amount of money you can potentially receive from a carbon farming project.

Who will be the project proponent?

A project proponent is the person that is responsible for carrying out a project and has the legal right to do so. They can be an individual, a group of people or an organisation. The project proponent's role will be to oversee the project and ensure that all practices are being carried out until the end of the permanence period and all reporting obligations to the regulators throughout the project are met. They will be the direct point of contact with the regulators. The project proponent will also be the recipient of the carbon credits when credits are issued. These carbon credits, or Australian Carbon Credit Units (ACCUs), are stored in Australian National Registry of Emissions Units (ANERU) accounts.

If you choose to partner with a project developer, they will usually take up the role of the project proponent and will thus be the one managing the project and handling all interactions and communications with the Clean Energy Regulator. The responsibility of carrying out the defined land management practices remains with the primary producer.

If you want to maintain the legal rights for the project, but lack the technical experience to undertake some of the reporting requirements, you can seek help from an independent external party, who can then consult you on who best to engage and what sort of professional support you would most benefit from.

Working with carbon project developers

Carbon project developers or project managers are one of the external party options who can assist in designing and implementing a carbon farming project, as well as providing all the necessary services required to run a project on your behalf.

Project developers will consider things like the type of carbon farming project suited to your situation, the size of eligible area, additionality requirements and the potential net abatement in the area. It is worthwhile talking with a few project developers to find the right one that works best for your situation. This handbook provides a collated list of service providers in Australia – see page 117.

Project developers have a range of different business models that can help support your situation. One of the main barriers that impedes project uptake is the initial upfront investment required to establish a carbon project. Project developers can mitigate some of these initial costs by receiving payments in carbon credits rather than money. They can also help pay for the upfront costs of sampling and project establishment but will expect a higher percentage of the credits earned. On the other hand, there are developers who project manage only to ensure all reporting requirements are met. The industry averages are generally about 20–30% of the credits or profits from selling the credits, depending on a number of factors (Figure 12).

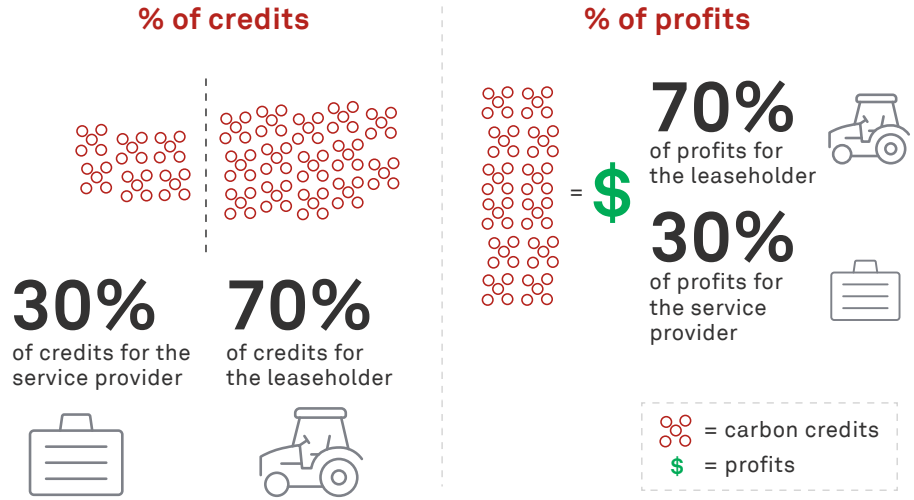


Figure 12: Carbon project developers sometimes charge a percentage of the credits or profits earned from selling the credits

Working with farmer cooperatives

Another alternative could be through your local farmer cooperatives (co-ops), who may have a carbon development head who can provide independent advice and/or be in charge of local farm aggregations for carbon farming projects underway in your area. They might also be able to provide the necessary skills for running projects in-house.

This could be a good alternative if you want to keep the profits within the community and work with people you already know and trust.

If your co-op doesn't have a carbon project set up, there is a good opportunity to start one to allow the local community to benefit. However, starting a farmer co-op carbon project requires skills to support the technical work required in each methodology, so external parties' fee-for-service models work well in this situation. The co-op model is new but the likely charges would be 6–12%, with the landholder paying all implementation costs.

For smaller landholdings, it might make sense to find and join an aggregation in your area, where neighbouring land is grouped into a single registered project, since the financial return and cost mean running a project only makes sense when the property size is medium to large. Aggregations can introduce economies of scale, reduce transaction and other business costs, and help manage performance risk.

The do-it-yourself model

The do-it-yourself (DIY) model is the most time-consuming and difficult approach, but also the most profitable. This mode of operation requires you to learn the methodology you want to undertake and source the skills required to execute on your carbon project.

Skills required include digital mapping to ascertain farm boundaries, mathematics for net abatement calculations, and project management skills for the monitoring and reporting that will be required.

In cases where these skills are absent, it's possible to engage third-party providers to fill the gaps; however, coordination, diligence and consistency will be essential to successful project execution.

There will be substantial upfront time and costs involved at the beginning of the project to get it up and running, especially when doing it for the first time.

For landholders with large landholdings or multiple farms, this method may be the way to go to keep the profits within the farming business. The main benefit is that the carbon project process will be the same across multiple properties, given the same methodology. However, for single landholders, other approaches (i.e. not doing it solely by yourself) will likely be the best approach.

If you undertake a carbon project on your own (DIY approach), you will not need a financial licence to sell your credits, which can be at any time after they've been issued. However, keep in mind that the trade of carbon credits is not trivial; there are many factors to consider. Speak to an accountant or someone experienced with the trading of carbon credits; such a person will require a financial licence to provide advice.

Key considerations when working with external parties

When working with external parties, which might be project developers, agents, independent carbon advisors, holding companies or companies that provide a range of services, there are considerations that need to be kept in mind. We've compiled a list of the most common considerations.

Commission model vs fee-for-service model

Commission models and fee-for-service models are two of the most common types of payment modes that an external party will offer in exchange for their services.

A commission model will require less upfront investment to get the project up and running since the external party will take their payment relative to the carbon credits generated. This means that the more (or less) credits you generate, the more (or less) they get paid, so they're committed to the project with you.

The fee-for-service model will require more upfront investment since you're paying for the service at the time you require, before any cash flow is available from the credits being generated from the project. But this model allows you to keep most of the credits being generated from the project. Like the sale of any agricultural commodity such as livestock at saleyards, sales commissions are common, so the trade of carbon credits may have fees associated with it in a similar fashion to using the assistance of external parties to broker a trade.

Risk vs return – modes of operations

There are several common modes of operation when it comes to financing your carbon projects, depending on the level of financial risk you choose to take on. Each varies with different risk and return profiles:

Low risk

- Some return
- Little to no upfront investment
- Landholders assume minimal financial and legal responsibility
- Implementation costs are paid by an external party
- External managing advisor takes a higher percentage of carbon credits

Medium risk

- Medium return
- Landholders assume some or most financial and legal responsibility
- Implementation costs are paid by the landholder
- External managing advisor takes a medium percentage of the carbon credits

High risk

- High return
- Sole management of the entire project
- Landholder manages the entire project and assumes all operating costs, financial and legal responsibility
- External managing advisor usually operates a fee-for-service model
- Standard sale of credit commissions may apply

[14] https://carbonmarketinstitute.org

[15] https://carbonmarketinstitute.org/code/

Choosing an external party based on the Carbon Industry Code of Conduct

The Carbon Industry Code of Conduct was put in place by the Carbon Market Institute (CMI)[14] to improve the integrity, transparency and accountability in Australia's carbon industry.

Signatories to the Code of Conduct are held to a higher standard of client engagement, ensuring that consumers are provided with enough information to make informed decisions, are contacted early and appropriately, and are engaged in a meaningful and transparent way.

The Code of Conduct is designed to protect you, so it's recommended that you look for a project developer or external party that is a signatory to it. A copy of the Code can be found on the Carbon Market Institute website.[15]

8 Opportunities, rewards and income implications

Everyone will have different motives to undertake a carbon project. The opportunities are diverse both financially and non-financially.

Financial incentives through carbon credits, which offer landholders a chance to diversify their income, are often a deciding factor, but other reasons include increasing farm profit and providing a more consistent income, improving farm resilience, environmental sustainability, social benefits, having a positive impact on the climate, and lifestyle goals.

In addition to financial incentives, other non-financial factors can be important motivators. Environmental benefits apply both on and off-farm and include improved biodiversity, mitigation of soil erosion, increased soil fertility, improved soil health and provision of new habitats or shelter to improve animal wellbeing. Carbon is the only product that you can sell (carbon credits) and keep the benefits on-farm. Lifestyle and social benefits for rural areas may include giving you back more time as a result of a more resilient farm, bringing additional income to the community, and increased local employment.

Depending on the nature of the activity and the schemes available in your state, it might be possible to incorporate other schemes, such as biodiversity funds, and receive additional payments for focusing on the co-benefits. You can find these additional schemes in the 'Available grants' section on page 107.

"Carbon is the only product that you can sell (carbon credits) and keep the benefits on-farm."

9 Pitfalls, risks, barriers and obligations

While there are many benefits in running a carbon project, there are also some risks and pitfalls to look out for. Also discussed here are some of the financial barriers to entry, the responsibilities landholders are required to uphold during the project, and the ramifications of not doing so.

Pitfalls

Landholders who are inexperienced with carbon farming often fall into these traps, so it is wise to be cautious and informed in this emerging market.

1. Do not start your new land management practices until the project is approved by the regulator and the correct process is followed. It is recommended that you understand the entire process for the methodology you're implementing or have appropriate guidance before you get started.
2. Any contracts presented by third parties should be independently reviewed before signing since a carbon project is a long-term commitment.
3. When the carbon yield looks surprisingly high, it is worthwhile to confirm the figures with independent data or advisors and understand the climatic conditions the farm that was quoted is in.
4. Many concerns have been raised about carbon projects locking up land. This may be the case with vegetation projects, so ensure you understand the ramifications and conduct vegetation projects only on land you intend to return to nature.
5. Ensure you receive a fair portion of credits when working with an external party who gets paid in the form of commissions, as you own the land and will ultimately be executing the land management strategy.
6. Understand that a completely new farm management strategy that is tailored to your farm enterprise and known to sequester carbon or reduce emissions is required to be followed for the lifetime of your project. This may result in additional infrastructure costs or other costs associated with this change in practice.
7. Since a carbon project is tied to the land on which it operates, make sure that all members who have a stake in the land have given their approval to run the project. For example, banks or other stakeholders such as co-owning family members may need to provide signed approvals in order for the project to go ahead.
8. A carbon project will run for a number of years. If you plan to sell the land at that time, the carbon contract will be tied along with the sale, so the new owner will need to continue to follow the farm plan.

9. A carbon project is a long-term investment. Succession planning is an important part of making sure the project finishes successfully and that all parties involved receive their fair share of long-term benefits, whether they are financial or environmental in nature.
10. Ensure you factor in climate-related risks such as bushfires, droughts and floods into your project planning. The following 'Risks' section discusses common natural disasters that occur in Australia and how they affect carbon sequestration rates.
11. Converting to your new land management strategy may result in a loss of revenue in the first few years of the project before you experience an increase in profit. This will be explained further in the 'Managing the transition' section.

Risks

Natural disasters

Natural disasters are an inevitable risk associated with all farms. Specifically in carbon sequestration projects, disasters will affect the carbon stored.

In the event of a fire or other disturbance that results in a reduction of stored carbon, there are two options available:

1. Manage regrowth to allow carbon stocks to return to their previously reported levels; or
2. Relinquish ACCUs equivalent to the loss of carbon to the Clean Energy Regulator.

Therefore, when considering a sequestration project, it is important to understand the impact of natural disturbances on potential ACCU gains.

The most common natural disasters in Australia that will affect carbon farming projects are bushfires, droughts, floods and cyclones. Each disaster is discussed below in relation to how they affect carbon sequestration.

Bushfires: Considered a net zero event since carbon will be recaptured when vegetation grows back. However, for vegetation projects, you will need to replant the vegetation lost in the bushfires to ensure the carbon is recaptured and restored to at least your previously reported values. Bushfires are less of a concern for soil carbon projects, as these fires do far less damage to soil compared with vegetation. The burnt ash and vegetation can also function as a soil ameliorant in the form of biochar for soils.

Drought: The loss of carbon from soil due to drought can be significant as the soil is dry and rainfall is essential for the sequestration of carbon. This may cause a reversal in carbon stores depending on the duration of the drought. For vegetation projects, there will be a slowdown in tree growth due to the lack of water. Increasing soil carbon will help with drought resilience as carbon improves water retention and plant-available water within soils.

Floods: Bare-top soils with low organic carbon are prone to be washed away in floods, reducing stores of previously sequestered carbon that has yet to become deeply embedded in the soil. Sequestration rates won't be affected much as excess water can potentially help drier regions; however this does depend on the frequency and duration of the floods. If the area is considered a frequent-flood zone, then soils can have significantly less total organic carbon than soils in no-flood zones. Increasing soil organic carbon in soils will help mitigate this since the soil will provide better drainage and aggregate the potential to hold the soil in place.

Cyclones: Depending on their intensity, cyclones can cause severe damage to vegetation. Lost vegetation will need to be replanted (in the case of plantation projects) and a stall in carbon sequestration will occur in the case of regeneration projects as vegetation will need to naturally grow back. Cyclones won't affect soil carbon levels much (see previous section on floods).

Managing the transition

The biggest cost to any landholder is time. Changing your farming operation from a land management system that has created reliable and predictable returns to a new system may lead to a period of reduced returns as your enterprise and land adapt to the changes. There is often two to three years of revenue reduction during the transitional period before the landholder sees any profits or gains from increasing farm carbon.

However, once transitioned to the new land management strategy, the on-farm benefits and co-benefits should outweigh the initial disadvantages and provide more consistent and measurable positive outcomes for the farm, leading to further incremental improvements that optimise and improve upon the new strategy and ensure a thriving farming operation.

Barriers

One of the biggest barriers to entry is the upfront financial commitment. There are two types of costs that will be incurred when running a project: management costs and implementation costs.

Implementation costs involve preparation of the new farm strategy and the purchase of any new equipment, seeds, plants or technology to implement the new land management practice. These costs will usually be incurred by the landholder, so be sure to consider the costs associated with implementation when working out whether a carbon project is financially viable for your operation.

Management costs are incurred when you monitor, measure and report on your project. For instance, purchasing management software, performing soil sampling or hiring an external party to manage the project on your behalf. As discussed in the 'Working with project developers' section, depending on your agreed mode of operation, these costs can be subsidised through a percentage of the credits earned on the project.

An example of the estimated costs associated with implementing a new practice on a 1000 ha farm is outlined on the following pages.

Estimated costs for implementing new practices

Please note that the following cost estimates have been made at the time of writing and are subject to market fluctuations.

Soil carbon infrastructure costs

One of the most common activities for soil carbon projects for graziers is intensifying grazing operations. The example below shows that through active management of the land, soil organic carbon levels and stocks can be increased, resulting in additional income. This can be achieved by implementing a soil carbon project. The implementation costs will include additional equipment and installation associated with this new management practice.

Fencing: Additional fencing will be required to create smaller paddocks that contain relatively large numbers of stock for short periods of intense grazing, followed by relatively long periods of pasture recovery. For example, 25 paddocks might become 50 through subdividing them with additional fencing and laneways.

Water: A significant increase in water points and associated infrastructure will need to be planned for. Not only because of the large increase in the number of paddocks, but also because of the increased animal numbers due to increased productivity. These costs will be variable depending on how much new infrastructure is required, but are estimated to be between $150,000 and $200,000

Livestock capital costs

If managed successfully, this kind of project will realise substantial productivity gains due to increased utilisation of dry matter compared with standard rotational grazing practices. In most broadacre livestock businesses, pasture utilisation is approximately 30–35%. If a well-constructed paddock layout is combined with exceptional management skills, a 30–40% increase in livestock numbers can be expected over time. For example, you could increase your ewes from 2500 to 3000 and build to 3500. These costs will be variable and subject to market conditions.

Stock handling infrastructure costs

As stock numbers increase, yards and other infrastructure will need to cope with larger numbers. Stockyard costs vary depending on whether they are of new construction or extensions of existing stockyards, as well as the degree of extension and whether they are covered or uncovered, and the provision of supporting structures. A large stockyard for approximately 3500 ewes in western NSW will vary in cost from $150,000 to $250,000 depending on whether specialised handling areas, tanks and covered areas are included. But additional costs to accommodate 5000 ewes would increase costs by $25,000. Cattle yards tend to be more expensive.

Pasture seeds and fertiliser costs

An improved pasture with a legume component will increase the available nitrogen (N) in the soil and provide the livestock with a quality feed. The majority of the nutrients can naturally come from animal manure but additional fertilisers may be needed if there is a nutrient deficiency in either phosphorus (P) or sulphur (S) to enable carbon to be retained in the soil instead of being cycled through the soil and released back into the atmosphere. For a legume-based pasture system, the estimated cost for fertilisers is between $66 and $90/ha, but with significant recent price rises we recommend that generic prices be confirmed with your farm's specific situation.

Obligations

It's important to remember that being regulator compliant is essential when you're embarking on a carbon farming journey. There are monitoring and reporting requirements that need to be met under each methodology.

Usually, a third party can assist with the reporting requirements, but it is still up to you to note down anything required by the project methodology, such as the number of days livestock are in the project area each year, broken down per age class and season. Failing to meet any monitoring or reporting requirements can result in credits not being issued.

It is a requirement that your chosen land management practices be maintained for the duration of the project and through to the end of the permanence period. The carbon project will need to show that carbon levels have been sustained or improved since the last reported amount, otherwise credits may need to be relinquished, depending on how much reversal happens.

A commitment of 25 to 100 years

A realisation that might be daunting to landowners but that is important nonetheless: sequestration-based projects are usually a 25-year commitment, and can last up to 100 years. As a result, project developers will often require a signed agreement before work commences so that both parties are aligned on the commitment and are protected if anything goes wrong.

If you are unable to manage the land at any time, say you choose to sell the land during the project, then the next person who inherits the land will need to continue the management practices until the permanence period is completed, otherwise credits may need to be refunded.

External parties such as project developers will have their own methods of dealing with these special cases. Speak to them about your circumstances to find the right one that works for you.

Pitfalls, risks, barriers and obligations

10 Is carbon farming a good fit?

Some considerations when deciding whether a carbon farming project is right for you:

- Does a carbon farming project fit with your long-term property/business goals?
- Is a carbon farming project a viable option for your business?
- Are you willing to change your current farming practices to new practices that may be required?
- Can you manage any additional maintenance that may be needed?
- Are you prepared to undertake benchmarking, ongoing sampling and measurement activities to verify carbon stocks?
- Has your farm plan identified sensible areas you are willing to use for the revegetation of trees or long-term perennials?
- Do you wish to achieve additional benefits such as farm shelter, biodiversity gains and ecosystem corridors, water quality improvement, productive pastures, and erosion or salinity control? Which projects will enable you to attain them?
- Instead of selling your carbon credits, is there a case where it would be beneficial to retain them to offset your own farm emissions (i.e. insetting)?
- If you wish to change land use on your farm in the future, does a carbon contract restrict future management options (i.e. can you shift from perennial pastures to crops if markets change over time)?

11 Lifecycle of a carbon project and steps to get started

After personal deliberation, speaking to independent advisors and deciding on a carbon farming project that is right for your operation, the next step is to understand the different phases of a carbon project.

Regardless of which methodology you decide on, the project lifecycle follows the same general four phases: planning, registration, delivery and reporting and crediting.

The following is a guideline on these steps, however it should be noted that this is not a complete guide for a DIY solution and is provided as a starting point for navigating carbon projects.

Planning phase

During the planning stage, you will need to determine whether a carbon project is right for your situation. You will assess things like eligibility and viability as well as the different types of risks and activities associated with running a project.

- Decide on the area of land for your project.
- Decide on which carbon farming methodology best suits your situation.
- Decide on who will manage your project – a third party project developer, a project manager, your local farmer cooperatives (if they have carbon project management capabilities) or yourself.
- Work out the viability of your project. This can be done via calculators found online, through project developers or through other providers.
- Consider the types of activities you will need to take up and what change in practices you would need to implement.
- Consider the costs of implementing your chosen methodology. These may relate to operational infrastructure changes, sampling, lab work and third-party commissions or fees.
- Determine what monitoring parameters need to be captured and their monitoring intervals.
- Determine how you plan to capture these parameters and how you will report these to the regulator.

Registration phase

During the registration phase, whoever is the project proponent will need to complete the documentation required to register a project. Some steps will require technical expertise in the area to produce the necessary files.

- Create a digital geospatial map using GIS software (such as QGIS, available online) of your farm boundary or project area. GIS skills are required for this step and may need to be outsourced. A digital geospatial map will also need to include areas excluded from the project (i.e. dams, roads and properties).
- Prepare a land management strategy (LMS). This needs to be completed by a qualified agronomist who is experienced in developing whole-of-farm carbon farming plans for the methodology you choose to run.
- Complete a national police check via the Australian Federal Police website or an organisation accredited to use the National Police Checking Service.
- Complete the eligible interest holder consent form. This form involves obtaining consent from any persons or organisations holding an eligible interest in the land on which your project will run. This may include mortgagees, people or other parties that share, have ownership of, or lease the land.
- Create a Clean Energy Regulator Client Portal account. This portal is where you will submit all your reports to the regulator.
- Once set up within the Client Portal, open an ANERU account, which is where your carbon credits will be issued at the end of the crediting period. You may opt to have an authorised representative (such as a carbon project developer) manage the units and transactions within your account instead.
- Complete client enrolment and project registration through the Clean Energy Regulator Client Portal. This will involve providing regulatory approvals, relevant licences and permits to carry out land management activities, and fit and proper person assessments. Additional information is available on the Clean Energy Regulator's website.

There may be additional steps required depending on the methodology you undertake. The regulator requires up to 90 days to review your application to ensure compliance and that new project activities are considered additional. You must not start any of the project activities until the regulator has confirmed the registration.

Project delivery phase

The project delivery phase is where you will start implementing your new practices that have been detailed in the land management strategy. Each project will have tailored steps for what needs to be done.

- Implement the project activities as per your planning.
- Record and report on the monitoring parameters required as per your planning.
- Report any events outside normal operation (e.g. sale of land, changes to the agreed land management strategy, natural disasters) to the regulator or the project proponent.

Each methodology will have a section on what parameters need to be monitored and to what extent. This monitoring could be through your current farm management software or new emerging tools dedicated to carbon farming.

The project delivery phase will continue until the end of the permanence period for sequestration projects, which is 25 or 100 years, and until the end of the project period for emissions reduction projects.

Reporting and crediting phase

At certain points in the project (end of an offset period), the monitored values will be used to work out the amount of carbon reduced and/or sequestered and the credits earned. Depending on the project, this can happen as often as every six months, or as late as every five years after the project has started.

- Calculate the net abatement amount according to the methodology.
- Create an offsets report (refer to the methodology for information about what needs to go into one).
- Get your project audited by an independent auditor. There are a minimum of three audits that a project must go through, with the first occurring before the first offsets report is submitted.
- Submit offsets report and audit report to the regulator to gain credits.

12 Carbon farming methodologies

This section will explore the methodologies in greater detail, providing information on areas including project activities, eligibility, potential costs, risks and benefits.

Under the Emissions Reduction Fund, there are a number of methodologies that fall under agriculture. They are structured here into four categories: Livestock; Soil; Vegetation; and Other.

To determine which methodology is right for you, a decision tree is provided at the start of this handbook along with brief summaries of each method to help you decide.

The full legislation can be found on the Clean Energy Regulator website under the full determination title if you intend to carry out a project using one of these methods.

Carbon farming methodologies

Livestock methods

There are currently four methods that allow for generation of carbon credits through reducing livestock emissions without affecting productivity.

1 Animal effluent management

Carbon Credits (Carbon Farming Initiative—Animal Effluent Management) Methodology Determination 2019[17]

Overview

The animal effluent method contains various approaches for the destruction and/or avoidance of emissions through the treatment of animal effluent at a treatment facility. This method can be applied to both piggeries and dairies. In the case of small farming operations, the offset value alone is unlikely to justify the high capital cost of infrastructure.

Projects in this method involve the use of an onsite treatment facility to either destroy emissions, avoid them, generate biogas for methane, or a combination of the three.

Facilities that destroy emissions treat animal effluent by capturing biogas from the effluent through an anaerobic digester, then destroying the gas using a combustion device such as a boiler or a generator.

Facilities that avoid emissions treat animal effluent by removing volatile solids using a solids separation diversion method.

This deals with the material in a way that results in fewer emissions of methane and nitrous oxide than if it were treated in an anaerobic pond. It does this through a method of stockpiles or composting. Stockpiles involve the storage of solid materials in a heaped pile that is not turned, while composting stores material in a pile or line of heaped material that is passively managed.

Facilities that generate biogas for methane treat animal effluent by capturing biogas from the effluent using an anaerobic digester, then sending the biogas to be converted to biomethane. This biomethane production occurs at a project biomethane facility and biomethane produced by the project must be combusted as a natural gas substitute within Australia.

Eligibility

A facility for effluent management must not already exist unless it is either part of a trial or pilot, contains a solids separation device that has not been used for some time, or is part of a project that is being varied from an older effluent management method.

[17] https://www.legislation.gov.au/Details/F2022C00226

Project owners must also provide details to show how the materials to be processed are eligible, and also demonstrate that effluent would have otherwise been treated in an anaerobic pond.

Limitations

Some specialist skills may be required to carry out the project. Examples of specialists potentially required are registered professional engineers, certified energy managers, and certified measurement and verification professionals.

There are also various restrictions on when ineligible material is allowed to be combined with eligible material at facilities. For destruction and biogas generation facilities, any ineligible material needs to be measured, have no significant negative impact on the facility performance, and not be largely inconsistent in its methane-producing capacity. Not meeting these standards will result in no credits being issued.

For emissions avoidance facilities, if ineligible material is combined with eligible material, net abatement will be zero, which will affect the ability to claim credits.

Potential costs

Costs associated with these projects can include employing specialists to advise, design and construct the facility to treat effluent. Costs to maintain and monitor the facility, and any costs associated with meeting monitoring, reporting and auditing requirements should also be considered.

Benefits

The method provides a multitude of benefits, including the acquisition of carbon credits, control of odour, and potential to pelletise sludge waste (digestate) for use/sale as a nutrient-rich fertiliser.

Risks

Ensuring ineligible materials do not contaminate eligible material is a key risk as it has the potential to set abatement values to zero, affecting the potential to earn carbon credits. It is also important that all biohazard legislation and safety requirements are followed in the handling and transport of methane and effluent.

Monitoring

Various parameters that need to be monitored during the project include:

- Parameters used in the calculation of net abatement as a CO_2 equivalent, including methane avoided, methane combusted, ineligible material emissions, and project emissions
- The equipment or devices used to measure the parameters
- Requirements for the equipment/device to be calibrated based on manufacturer specifications.

Livestock methods

2 Beef cattle herd management

Carbon Credits (Carbon Farming Initiative—Beef Cattle Herd Management) Methodology Determination 2015[18]

Overview

This method enables producers of pasture-fed beef cattle to reduce emissions from their herd through better management methods, in an attempt to either raise the weight-to-age ratio, reduce average age, or reduce the proportion of unproductive animals.

Farmers can choose what management processes to undertake depending on their circumstances, but some examples include:

- Establishing a higher-quality pasture
- Culling or selling unproductive cows to improve weaning percentages
- Expanding watering points, allowing cattle to graze more widely.

It is beneficial to seek expert advice prior to undertaking one of these projects to determine what activities best suit your land and business needs.

Eligibility

There are various requirements that must be met to be eligible for one of these projects. Firstly, each herd must consist of cattle grazed in Australia and fed mainly with grazing or forage.

Each herd must also have its livestock inventory maintained in isolation, managed separately from any other herds that are not in the project. The exception to this is in the case of an 'arm's length agreement', where one herd with excess grazing space provides space to another herd (i.e. agistment).

Limitations

Cattle cannot move to linked herds, unless in the case of a genuine business purpose. Transfers to non-linked herds must be a purchase or sale at a fair value.

Activities that are excluded include feeding cattle on land cleared of woody vegetation, feeding the herd non-protein nitrogen (urea, nitrates), and projects where the only management activity is grazing cattle on a different area of land.

[18] https://www.legislation.gov.au/Details/F2017C00466

Potential costs

There may be costs associated based on the management activity chosen, along with any costs that may be incurred due to project reporting, monitoring and auditing requirements.

Benefits

This method not only allows for the earning of carbon credits, but can also result in higher productivity and improved animal health within various herd communities.

Emissions from a herd are related to productivity. By increasing productivity, the cattle spend less time on the farm and therefore produce fewer emissions. Implementing practices such as providing high-quality feed and improving breeding can directly improve the performance of a herd.

Additionally, there is a strong opportunity for aggregation. It is likely that farmers increase profits by reducing their project management costs when this method is run through an aggregation since the costs are shared. These projects usually need relatively large herd numbers to be viable. As such, it is worth researching potential ways to aggregate.

Risks

Any external disturbances that negatively affect herd productivity will have an impact on the ability to earn credits. These will need to be mitigated where possible.

When implementing changes in herd management, it is important to manage herd dynamics, keep suitable breeding replacements, and maintain cattle stress levels in order to maintain their health.

Monitoring

The method requires the landholder to monitor the information in the below categories so it can be inputted into the herd management calculator to calculate net abatement:

- The number of cattle in each class and their liveweight
- The dates that cattle entered and left the herd
- Details of any changes in diets as part of the project.

Refer to the methodology for the specifics in each category.

Livestock methods

3 Feeding nitrates to beef cattle

Carbon Credits (Carbon Farming Initiative) (Reducing Greenhouse Gas Emissions by Feeding Nitrates to Beef Cattle) Methodology Determination 2014[19]

Overview

Many cattle producers feed non-protein nitrogen to cattle (in the form of urea) to improve animal productivity. Urea increases nitrogen, which bacteria can use in the digestive system of cattle, allowing them to better utilise the pasture they consume.

As pasture becomes easier to digest, cattle will tend to consume more, improving productivity. Through partially or fully substituting urea supplements with nitrate, the amount of methane emissions for the same feed intake can be reduced. This also still provides nitrogen to aid in digestion.

Producers undertaking this method would replace urea supplements with nitrate in the form of 'lick blocks'. It is important to note this method will only avoid emissions and benefit livestock health if the protein levels of the pasture are too low to match the needs of the herd.

Unless a supplementation period has been run in the previous 30 days, projects will begin with a two-week adaptation period of reduced nitrogen supplementation.

Once the adaptation period is completed, projects will continue to run until the herd either no longer has access to the lick blocks, or the blocks have been consumed in their entirety.

Eligibility

The method can only be used on land that has fed urea to cattle at least once in the past five years. This is because if cattle had not been fed nitrates previously, then their introduction would increase greenhouse gas emissions.

While not required by the methodology to run a project, to see a creditable change in emissions reduction it is likely producers will need to operate projects with a large number of cattle (e.g. 40,000–50,000 head of cattle) and in areas containing a protein deficit. This is in part to account for limits on nitrate feeding levels, which are aimed at ensuring cattle safety.

Limitations

These projects cannot be run with feedlot beef cattle, since their dung and urine produce significantly more emissions compared with pasture-grazed cattle. As such, it's very unlikely that giving feedlot cattle nitrate supplements would reduce emissions.

In addition, the requirement of having used urea supplements in the past is based on the land where cattle were fed urea, not the cattle themselves. For example, if cattle have been fed urea supplements on land A, and are then moved to land B (where cattle have not been fed urea), then only land A is eligible for a nitrate supplement project.

Potential costs

There are several costs that may be associated with these projects. Some of these include the cost of supplements, the cost of auditing and any other costs that may be incurred to meet record-keeping and calculation requirements.

Benefits

The main benefit of feeding nitrates to cattle is the reduction of methane emissions produced. At an environmental level, this helps reduce emissions entering the atmosphere, and at an economic level avoiding these emissions allows project owners to apply for carbon credits for financial gain.

Risks

The main risk associated with the method is that it is important to keep the levels of nitrates at a safe level, as overfeeding may cause toxicity and even death.

Monitoring

The following are some of the key metrics to be monitored for these projects:

- The number of animals per livestock class, and the average weight of each class
- Consumption amounts for nitrate lick blocks
- Consumption of non-protein nitrogen that isn't nitrate

[19] https://www.legislation.gov.au/Details/F2015C00580

Livestock methods

4 Feeding dietary additives to milking cows

Carbon Credits (Carbon Farming Initiative) (Reducing Greenhouse Gas Emissions by Feeding Dietary Additives to Milking Cows) Methodology Determination 2013[20]

Overview

Cattle produce a substantial amount of methane as part of their normal digestive processes. However, some feed additives are able to inhibit the microorganisms that produce methane in the rumen. In turn, this reduces the level of carbon emissions output by the cattle.

In the case of lactating dairy cows, by supplementing their diets with additional fats through grains and meals, enteric emissions are reduced and credits can be generated through calculating the reduced emissions using the Carbon Farming Initiative's Dietary Fats Calculator.

Eligibility

The use of dietary additives is currently only approved for grazing milking cows, and includes the addition of eligible additives to increase fat content in their diets. There are currently five approved additives that can be fed to dairy cattle: canola meal, cold-pressed canola meal, brewers' grain, hominy meal, and dried distillers' grain.

Milking cows are only eligible if they have been pasture grazed for at least nine months of the year, however these do not need to be consecutive months.

Limitations

Dietary fats and oils must be maintained below 70 grams of fat per kilogram of dry matter feed in any season.

Potential costs

Potential costs in running a project include the costs of purchasing the additives and any potential costs associated with reporting, auditing and monitoring required as part of the method.

Benefits

Along with the environmental benefits that come with reduced carbon emissions and the ability to earn credits, the reduction in emissions can help a farm realise its net zero target. A co-benefit is better efficiency for feed utilisation.

[20] https://www.legislation.gov.au/Details/F2015C00579

Risks

One risk to consider is the amount of additives ingested through paddock grazing can be difficult to regulate. This can lead to potential inconsistencies if not managed correctly.

Monitoring

Projects will be required to monitor and record the number of milking cows in the herd through a unique identifier, such as an identification tag. Cows will need to be counted at least once per month during baseline and each project year.

For each project year, you will also need to keep records of the number of cows and their liveweight, the volume of milk they produce daily, the mass of each feed type, and additives fed to the herd.

Soil methods

Soil carbon methods involve improving upon current land management practices to build and maintain soil organic matter (SOM) over long periods of time. There are currently two methods that the Clean Energy Regulator has available that support this idea. The newest method, 'Estimating soil organic carbon sequestration via measurement and models', is the most holistic and up-to-date method available, and includes a range of additional practices that can be implemented. The older 'Estimating sequestration using default values' method is limited to a small number of practices and uses older techniques to estimate soil organic carbon (SOC).

5 Estimating sequestration of carbon in soil using default values (model-based soil carbon)

Carbon Credits (Carbon Farming Initiative—Estimating Sequestration of Carbon in Soil Using Default Values) Methodology Determination 2015[21]

Overview

Using this method, you can be credited for adopting a new farming practice not currently in use. This method uses generic modelled values of increases in carbon depending on the practice you implement and doesn't take into account ground-truthed information.

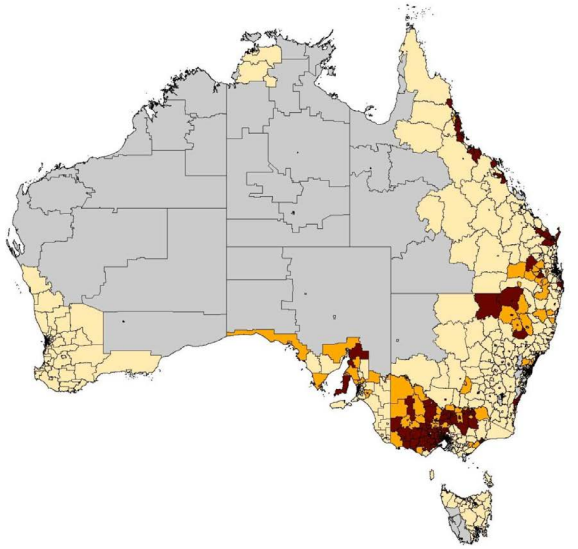
There are no direct measurement costs involved in this method since this is a modelled-only approach. However, a modelled-only approach could result in a lower-quality carbon credit without ground-truthing and might not represent the true value of carbon on your farm. You could be sequestering more carbon than the model predicts but not credited for the actual amount you sequester.

Eligibility

There are three activities that can be Implemented through this method, and at least one activity must be undertaken:

- Sustainable intensification: Implement new ways of land management to raise soil carbon (e.g. managing nutrients and acidity, introducing new irrigation)
- Stubble retention: Retain stubble after harvest where traditionally it was burned or baled
- Conversion to pasture: Convert land to pasture where previously it was either under cropping or bare fallow.

The parcel of land will need to be located in Australia and have FullCAM data available for it (Full Carbon Accounting Model; www.fullcam.com). Also, it needs to be in a region with a Sequestration Value Maps value. Figure 15 below shows the sequestration value for sustainable intensification.



Project management activity	Not modelled	Sequestration value, t CO_2-e/ha/year		
	1.0 Ineligible Grey	1.1 Marginal benefit Beige	1.2 Some benefit Orange	1.3 More benefit Brown
Sustainable intensification	No value	0.11	0.59	1.65

Figure 13: Sequestration value map for sustainable intensification. Source: Department of Industry, Science, Energy and Resources[22]

[21] https://www.legislation.gov.au/Details/F2018C00126

[22] https://www.industry.gov.au/sites/default/files/2020-07/sequestration-values-maps-sustainable-intensification.pdf

Soil methods

Limitations

In preparation for a project area, you cannot clear woody vegetation, except where you are clearing woody weeds or have a valid clearing permit that is already in force before project commencement.

You will also not be eligible for this method if you're already doing or have done all the eligible activities listed.

Potential costs

Depending on the practice chosen, there will be costs involved in purchasing the required seeds, nutrients and/or new farm infrastructure. A carbon project professional may be needed to calculate net abatement through FullCAM. There may also be costs associated with meeting monitoring, auditing and reporting requirements.

Benefits

There are no direct measurement costs involved with this method. Implementing a soil carbon project brings many benefits to the farm. The on-farm benefits of increasing soil carbon include less water runoff, better water retention and more plant-available nutrients.

Risks

The primary risk for this method is when depletion events occur, which is when soil carbon starts to be released back into the atmosphere (i.e. drought). In the methodology, a depletion event occurs when there is less than 70% ground cover over three monitoring events (every three months). This either needs to be addressed to continue to build carbon, or credits will need to be relinquished.

Monitoring

There are a number of items that need to be monitored throughout the project and the list changes depending on the practice chosen. In general, you will need to monitor material to demonstrate that each management action nominated for a carbon estimation area has been carried out.

Additionally, any depletion events and when a carbon estimation area has less than 70% vegetation groundcover need to be recorded.

For livestock scenarios, you will need to monitor the number of animals and the number of days of each season that the animal is within a carbon estimation area.

Soil methods

6 Estimating soil organic carbon sequestration via measurement and models

Carbon Credits (Carbon Farming Initiative—Estimation of Soil Organic Carbon Sequestration using Measurement and Models) Methodology Determination 2021[23]

Overview

This method aims to credit you for increased soil organic carbon resulting from a change in land management activities. As a sequestration methodology, it is subject to the newness principle. This means any project activity you undertake needs to be one that you are only actioning as a result of the ability to earn carbon credits. See the 'Why additionality matters' section for more information. At the time of writing, the method permits 13 activities that can be implemented. If you do not meet the newness criteria for these, or they are not suitable for your operations, then this method is not for you.

Note that the suggested practices in the methodology alone will not likely increase your soil organic carbon when performed in isolation. It is recommended that a full systemic change of farming practice, tailored to your operations, location and climate zone, be undertaken to maximise the increase of your soil organic carbon levels.

Eligibility

To be eligible for a soil carbon project, the methodology requires that the land was either pasture, cropping or bare fallow for the past five years. It is also expected that the land can be sampled consistently without much disruption, e.g. not on land that has long rotation cycles of perennitals or land that has a high degree of slope and is inaccessible for the safe operation of soil sampling equipment. Eligible activities need to promote vegetation cover or improve soil health, such as undertaking new irrigation, modifying landscape to remediate land, or applying lime to repair acidic soil.

Limitations

At this stage, if the land is already registered under another sequestration project (e.g. 'Human-induced regeneration'), it will not be eligible. You also won't be able to clear native forests or drain wetland to participate in this methodology as those activities emit large amounts of carbon dioxide from the land.

Some soil additives are also restricted and the amount added to a project area will need to be monitored. Currently, biochar and non-synthetic fertilisers (such as manure) will need to be monitored. Any soil amendments cannot be applied at a rate greater than 100 kg of carbon per hectare per calendar year.

[23] https://www.legislation.gov.au/Details/F2021L01696

Potential costs

Costs will include the cost of developing a land management strategy, and any costs associated with registration, ongoing management (if applicable), soil sampling and lab analysis for soil cores, and auditing. When new technology is available, other potential costs will be the use of sensor technology and probes to supplement or replace traditional soil sampling and lab analysis.

Practice establishment costs will vary depending on your new activities. For example, if you decide to establish a new pasture, costs will involve purchasing the seeds, time involved in planting, and additional costs involved in maintaining the pasture, such as for nutrients that need to be applied. A land management strategy will detail the practices you'll undertake and will help determine your practice establishment and ongoing operation costs.

Benefits

Implementing a soil carbon project brings many benefits to the farm. The on-farm benefits of increasing soil carbon include less water runoff, better water retention and more plant-available nutrients. There are also off-farm environmental and social co-benefits.

Figure 16 below outlines the various beneficial duties performed by soil organic matter, highlighting the importance of having healthy, high-carbon soil.

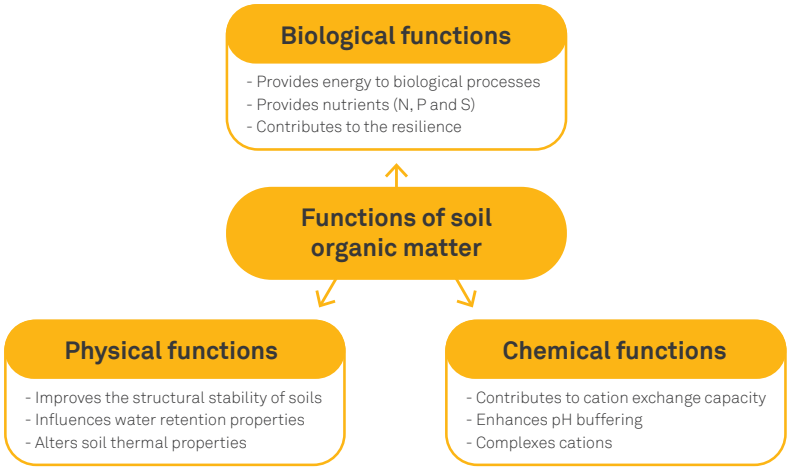


Figure 14: Functions performed by organic matter present in soils. Source: Grains Research & Development Corporation[24]

[24] https://grdc.com.au/~/media/refocus-media-library/document/grdc-document-store/publications-media-and-communications/factsheets/carbon-farming.pdf

Soil methods

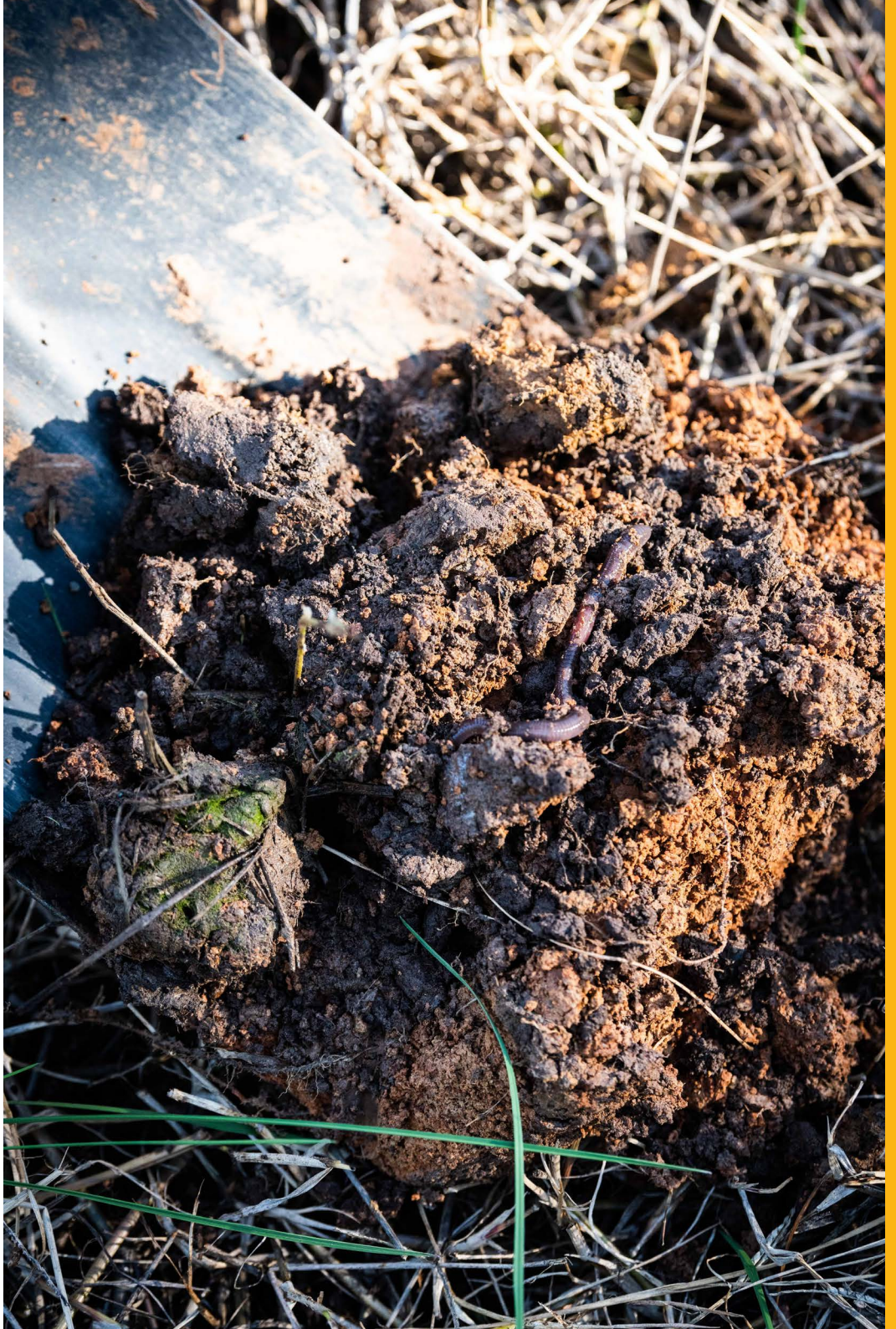
Risks

Risks associated with soil carbon projects include potential loss of soil carbon if it is released back into the atmosphere due to dry soil, either through exposure to the sun or extended drought periods (see the 'Risks – Natural disasters' section for more information). The other risk is not achieving the right nutrient ratio in your soil resulting in poor carbon sequestration, cycling carbon through the soil and back into the environment. These risks can be managed by implementing the right land management strategy for your conditions and operations.

Monitoring

Monitoring parameters are necessary to enable accurate reporting of carbon emissions from your ongoing farm operations. These are: cropping residue, fertiliser use, livestock management, irrigation energy use and diesel use.

"The on-farm benefits of increasing soil carbon include less water runoff, better water retention and more plant-available nutrients. There are also off-farm environmental and social co-benefits."



Soil methods

Vegetation methods

The build-up of the biomass in vegetation and trees has great potential for long-term carbon storage. There are a few methodologies in the Emissions Reduction Fund (ERF) that support this idea.

Different methodologies are available depending on the land use change, region the farm is located, and rainfall zone. Each method can be classified as either regeneration or plantation. Regeneration involves vegetation on land that has been previously suppressed; you let the land regenerate naturally. Plantation involves direct seeding to re-grow vegetation.

7 Avoided clearing of native regrowth

Carbon Credits (Carbon Farming Initiative—Avoided Clearing of Native Regrowth) Methodology Determination 2015[25]

Overview

Avoided clearing projects involve managing land to retain areas of native forest that have been cleared in the past for either cropping or grazing. The act of clearing forest releases stored carbon into the atmosphere as emissions. In order to gain credits, you will need to retain native forest in the project area instead of clearing it.

Project activities are minimal in avoided clearing projects. Most activities will simply involve ongoing management activities to actively reduce the risk of damage from fire, weeds and feral animals to maintain a healthy level of native forest.

Eligibility

Projects can only be run on land that has native forest cover and is substantially uniform in tree coverage.

An unrestricted clearing consent is also required. The land must also have been cleared at least twice previously, having then been used for grazing or cropping after each clearing.

Plantations and environmental plantings are also excluded.

[25] https://www.legislation.gov.au/Details/F2015L00164

Limitations

For ecological reasons, thinning can occur as a management activity, but this must maintain native forest cover and resulting biomass must remain in the project area. Additionally, fertiliser cannot be used, and commercial harvesting is not allowed.

Potential costs

Due to the nature of projects, costs directly involved with project activities will be limited. There are, however, costs associated with the monitoring, reporting and auditing required to meet project requirements.

Benefits

Protecting native forests brings a multitude of benefits in addition to receiving carbon credits. The presence of forest cover helps reduce soil erosion and salinity, and native forests provide a vital habitat for species such as birds, insects and reptiles.

Risks

There exists a chance that events such as fire, drought or cyclones in the coming decades could detrimentally impact projects. While regenerative events following these are accounted for, they still act as a hindrance, e.g. emissions from fires must be taken into account. Other considerations could include the opportunity cost of not being able to use the land for its intended purpose prior to taking on this project.

Monitoring

The method requires that project owners monitor fires and any other natural disturbances. Records will need to be created of these events, as well as any thinning that occurs that fits project requirements.

Vegetation methods

8 Avoided deforestation

Carbon Credits (Carbon Farming Initiative—Avoided Deforestation 1.1) Methodology Determination 2015[26]

Overview

Avoided deforestation projects protect native forest in areas that would otherwise be cleared for crops or grasslands. At their core, projects revolve around not acting on clearing consents for forest land.

Projects using this method help reduce greenhouse gas entering the atmosphere as the carbon remains stored in the trees as they grow. It also avoids emissions created from clearing the forests.

Eligibility

Projects are only eligible for this method if the land has a clearing consent for the forest, issued before 1 July 2010. Importantly, the clearing consent must also state that clearing is permitted for permanently converting the forest to cropland or grassland.

In addition, projects are only valid if the land has forest cover, i.e. covers an area of at least 0.2 hectares, and is dominated by trees at least two metres tall with a crown cover[27] of at least 20%.

Limitations

Thinning is allowed for helping with biodiversity and/or vegetation growth, but at least 95% of thinned wood must remain in the area. This remaining 5% is only for personal use, e.g. fencing or firewood.

You cannot have a licence or permit to remove wood from the forest for commercial purposes or firewood.

The forest must also be managed to achieve a mix of trees, shrubs and understory plants. These must all occur naturally in the project area.

Potential costs

The input costs to this methodology are limited. Along with any potential costs associated with reporting and auditing, the main potential cost is the opportunity cost of not utilising the land for other purposes, such as cropping.

Benefits

Along with earning carbon credits, the maintained presence of the forest allows natural ecosystems to be maintained, carbon to continue to be stored in the trees and not released into the atmosphere, reduced salinity, and reduced soil erosion.

[26] https://www.legislation.gov.au/Details/F2015L00347

[27] The portion of land covered by the canopy of trees

Risks

There exists a chance that events such as fire, drought or cyclones in the coming decades could detrimentally impact projects. While regenerative events following these are accounted for, they still act as a hindrance, e.g. emissions from fires must be taken into account. Other considerations could include the opportunity cost of not being able to use the land for its intended purpose prior to taking on this project.

Monitoring

The project area must be monitored for disturbances through the use of remotely sensed imagery, which you will need to acquire. Here 'disturbance' means degradation of the forest in any way, or from natural disturbances such as fire.

"Along with earning carbon credits, the maintained presence of the forest allows natural ecosystems to be maintained, carbon to continue to be stored in the trees and not released into the atmosphere, reduced salinity, and reduced soil erosion."

Vegetation methods

9 Human-induced regeneration of a permanent even-aged native forest

Carbon Credits (Carbon Farming Initiative) (Human-Induced Regeneration of a Permanent Even-Aged Native Forest—1.1) Methodology Determination 2013[28]

Overview

Human-induced regeneration (HIR) is one of the most widely used methodologies in the ERF. At the time of writing, approximately 30% of total registered projects fall under this single method.

HIR projects involve establishing and maintaining permanent native forests through assisted regeneration (i.e. allowing the plants to grow themselves rather than direct planting of seeds) to sequester carbon. By carrying out eligible activities that encourage regeneration on tree species native to a project's local area, you can receive credits for the amount of carbon that is captured.

The trees must be able to reach a density to achieve forest cover. That is, the trees must have the potential to grow to two metres tall and have a crown cover of at least 20% of the project area.

Management activities could include managing the time and extent of livestock grazing on the land, reducing the number of feral animals, or active management of weeds.

The amount of carbon stored in the forest is calculated using a modelling tool called FullCAM, or Full Carbon Accounting Model (www.fullcam.com), and no direct measurement is needed. The tool estimates greenhouse gas emissions and removals within the tree and debris carbon pools based on data relating to the establishment method, management regimes and disturbance events.

The comparable 'Native forest from managed regrowth' methodology involves modelling early forest regrowth to estimate carbon levels; HIR projects assume there are no forest stocks at the start of a project.

Eligibility

To be applicable for this methodology, there are a number of requirements the land needs to meet. These are:

- You must be able to demonstrate that the land has been cleared of native vegetation and that regrowth has been suppressed for at least 10 years
- There must be evidence of trees present in the to-be project area
- There must be evidence that those trees will be able to develop into native forest
- There must be evidence that the area did not have forest cover during its 10-year baseline period

[28] https://www.legislation.gov.au/Details/F2018C00125

- The land is not conservation land and was subjected to mechanisms that contributed to suppression of native growth
- The land is conservation land where feral animals/non-native plants contributed to suppression of forest cover AND there was no mechanical/chemical suppression of native regrowth
- The area is expected to continue to not have forest cover unless human-induced regeneration activities are conducted.

Before project registration, the Federal Minister for Agriculture must assess whether the project may lead to an undesirable impact on agricultural production in the region.

Limitations

There are some limitations to running HIR projects. Firstly, biomass cannot be removed from project areas, aside from the following exceptions:

- If the removal is required by law
- If the plants are not native to the area, and the removal is likely to improve the growth rate and/or health of the remaining forest
- Dead biomass can be removed if it was not resulting from mechanical/chemical destruction, and can only be used as firewood.

Livestock must also be prevented from grazing in the project area until forest cover is reached. After that, the time and extent of grazing needs to be managed so that it does not impact the accumulation of carbon.

Lastly, the use of soil ameliorants such as lime or fertiliser is prohibited.

Potential costs

There are several potential costs associated with running a HIR project. These could include the initial upfront costs of project boundary mapping, identifying vegetation groups and calculating your expected carbon credits through FullCAM. Often a carbon project professional can assist if required.

Other costs may include the upfront and ongoing costs of working with external parties to manage the project, meeting reporting obligations, auditing and any other costs that may be incurred to meet record-keeping and calculation requirements.

Benefits

Additional benefits of running a human-induced regeneration project include improved quality of your land and water supply, reduced soil erosion and increased biodiversity, along with the ability to earn credits as an additional source of income.

Risks

As a landholder, you will need to consider how undertaking a HIR project will affect the productivity of your land since it may reduce stocking rate or feed available to livestock.

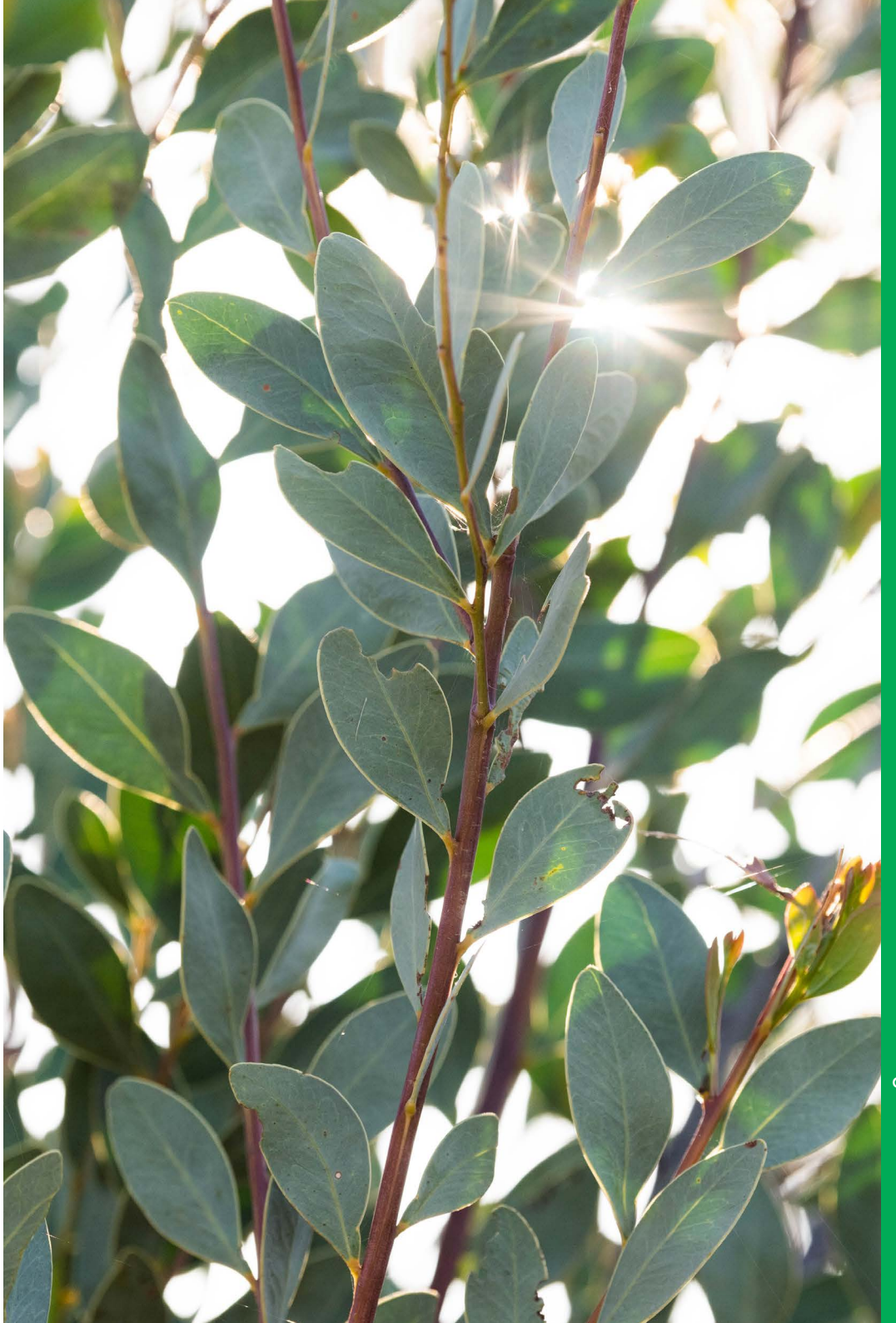
You should also consider the opportunity cost of the loss of grazing land due excluding livestock from grazing in HIR areas as they are regenerating.

If a fire or other disturbance occurs in the area during the project, causing a decline in the amount of carbon stock, regrowth must be managed to allow the carbon stock to return to previously reported values. Alternatively, ACCUs equivalent to the loss of carbon caused by the disturbance can be relinquished.

Monitoring

As well as the general monitoring requirements that apply to all carbon farming projects, HIR projects have specific monitoring requirements. These are:

- Monitor each project area to ensure compliance with all project restrictions/limitations
- Monitor both management activities and disturbances (e.g. fire) within each project area
- Record areas affected by disturbances (e.g. fire) during each reporting period
- Monitor whether or not each area is required to be re-stratified so each section within that area can be expected to become native forest and achieve forest cover.



Vegetation methods

Vegetation methods

10 Native forest from managed regrowth

Carbon Credits (Carbon Farming Initiative) (Native Forest from Managed Regrowth) Methodology Determination 2013[29]

Overview

Native forest from managed regrowth (NFMR) projects aim to cease activities that either suppress or destroy the regrowth of native vegetation. These activities will need to be stopped in order to allow native vegetation to regenerate into forests.

The trees must be able to reach a density to achieve forest cover. That is, the trees must have the potential to grow two metres tall and have a crown cover of at least 20% of the project area.

Changes in the carbon stock are measured through the use of the Full Carbon Accounting Model (FullCAM).

The comparable 'Human-induced regeneration' methodology assumes there are no forest stocks at the beginning of a project. Conversely, NFMR projects involve modelling using early forest regrowth to estimate carbon stock.

Eligibility

FullCAM data needs to exist for your land. The land also needs to have been subject to one or more instances of comprehensive cleaning for pastoral use. This cleaning is the destruction of trees and/or saplings, leaving the land in a non-forested state. As such, the land must have had forest cover before the cleaning.

Before project registration, the Minister of Agriculture must assess whether the project may lead to an undesirable impact on agricultural production in the region.

Limitations

Regardless of what activities you decide to run, regeneration needs to arise from existing natural seedbeds, rootstocks, or lignotubers in the area. Direct planting and/or seeding is not allowed. The use of lime or fertiliser is also prohibited.

Potential costs

These will vary depending on what project management activities you choose. In addition to project costs, you will need to consider any costs required to meet monitoring and reporting requirements. Lastly, you should consider the opportunity cost of running a project instead of continuing the current practices being run on the land.

Benefits

As well as the opportunity to earn carbon credits for financial diversity and gain, other benefits include improved biodiversity and improved air quality.

Risks

If you are contemplating a NFMR project, you need to consider the opportunity cost on your land. This is the next best use of the land if you were not going to run a project, e.g. pastoral use.

Additionally, while the FullCAM model accounts for fire or other disturbances in its calculations, you will need to manage regrowth to allow carbon stock to return to previously reported values. The alternative to this is that carbon credits equivalent to the loss of carbon would need to be relinquished.

Monitoring

Proponents running a project need to monitor two things:

- The project area to make sure it complies with CFI Mapping Guidelines
- Any disturbance events within the project area (e.g. fires, other natural disasters). This is so that the relevant data can be inputted into FullCAM for modelling.

You will also need to monitor the project so that it continuously implements your chosen project activities. This can be done through on-ground observation, remote imagery/ sensing, or derived vegetation cover data.

[29] https://www.legislation.gov.au/Details/F2018C00119

11 Measurement-based methods for new farm forestry plantations

Carbon Credits (Carbon Farming Initiative) (Measurement Based Methods for New Farm Forestry Plantations) Methodology Determination 2014[30]

Overview

This method revolves around establishing trees as either permanent plantings or rotational harvests. It involves establishing and maintaining trees on land that has previously been used for grazing or cropping.

The trees must be planted at a density to achieve forest cover. That is, the trees must have the potential to grow two metres tall and have a crown cover of at least 20% of the project area.

Eligibility

The area of land that will be used for the project will need to have been used for grazing or cropping, or be land that was fallow between grazing or cropping, for at least five years before the project begins.

Additionally, you will require access to forestry expertise to run measurements and calculations from the method.

Project sizes are also capped depending on annual rainfall in the farm area. Annual rainfall of more than 400 mm is capped at 100 hectares, or 30% of farm area (whichever is smaller). For annual rainfall below 400 mm, project size is capped at either 300 hectares or 30% of farm area (whichever is smaller.)

Limitations

If any harvesting is planned for the project, a regime needs to be developed at the beginning of the project. Activities under this include weed control, pruning, harvesting and rotation length.

Non-project trees cannot be removed from project areas, excluding some specific cases including being either required or authorised by law. Trees that are allowed to be removed include prescribed weeds and any non-native forest trees that are less than two metres tall when the project commences.

If harvesting, you must re-establish the project trees through planting, seeding or coppice growth, and begin a new regime cycle. In some instances, permanent plantings are able to be converted to harvesting projects, but not vice-versa

If projects involve permanent planting, project owners will need to ensure the project can achieve 20% crown cover.

[30] https://www.legislation.gov.au/Details/F2015C00577

Potential costs

There may be costs associated with seeking forestry expertise to complete the measurements and calculations as required. In addition, there are the costs linked to planting the forest and any activities to maintain and/or harvest the project area. There may also be costs associated with the monitoring, reporting and auditing required to meet project requirements.

Benefits

As well as being used to earn carbon credits, these projects can be a great opportunity to create shelterbelts and windbreaks. The presence of a forestry plantation will also help reduce soil erosion and salinity.

Risks

A major risk is that the forests are impacted by natural events, such as fire or drought, that lead to a loss of carbon. If any disturbance occurs, regrowth will need to be managed until the carbon levels reach what they were previously reported to be.

Another point of consideration is the opportunity cost of keeping the land for grazing, cropping or fallow.

Monitoring

Monitoring the project can be in the form of on-ground inspections and surveys, as well as remote monitoring through interpreting aerial/satellite images. Any changes or natural disturbances should be monitored to ensure trees have reached or will reach height and crown cover requirements.

“As well as being used to earn carbon credits, these projects can be a great opportunity to create shelterbelts and windbreaks. The presence of a forestry plantation will also help reduce soil erosion and salinity.”

12 Plantation forestry

Carbon Credits (Carbon Farming Initiative—Plantation Forestry) Methodology Determination 2022[31]

Overview

The plantation forestry method provides a mechanism to sequester carbon through one of four key strategies: establishing a new plantation forest; converting a short-rotation plantation to a long-rotation plantation; continuing rotational harvest cycles in a plantation forest; and converting an at-risk plantation forest to a permanent forest. Each strategy has different eligibility requirements depending on which you go with.

The trees must be planted at a density to achieve forest cover. That is, the trees must have the potential to grow two metres tall and have a crown cover of at least 20% of the project area.

Eligibility

Depending on which of the four methods is used, there are different eligibility requirements. You can choose one of the following activities depending on previous land use:

1. Creating a new plantation on land that has not previously had a plantation on it (the **new plantation project activity**)
2. Converting an existing short-rotation plantation forest into a long-rotation plantation forest (the **conversion project activity**)
3. Continuing an existing plantation forest (the **continuing plantation project activity**)
4. Transitioning an existing plantation forest to a permanent planting (the **permanent planting project activity**).

Leverage Figure 13 on the following page to identify which plantation forestry method your land falls under.

[31] https://www.legislation.gov.au/Details/F2022L00047

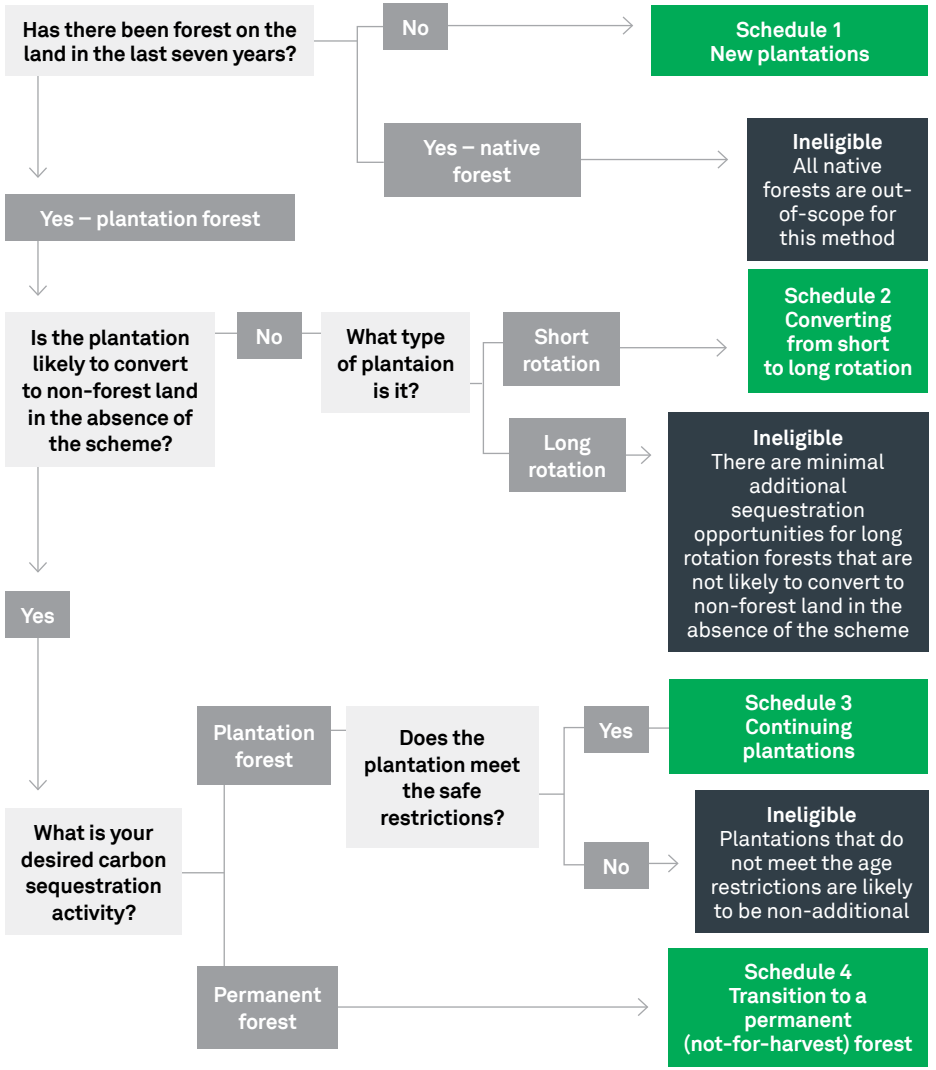


Figure 15: Flowchart to help identify which method the land falls under. Source: Clean Energy Regulator[32]

[32] http://www.cleanenergyregulator.gov.au/DocumentAssets/Documents/Understanding%20your%20plantation%20forestry%20project%20-%20Simple%20method%20guide.pdf

Vegetation methods

The areas applicable for the methodology will need to fall within or near a National Plantation Inventory (NPI) of Australia region, depending on the approach used. The NPI regions are shown in Figure 16.

Before project registration, the Minister of Agriculture must assess whether the project may lead to an undesirable impact on agricultural production in the region.

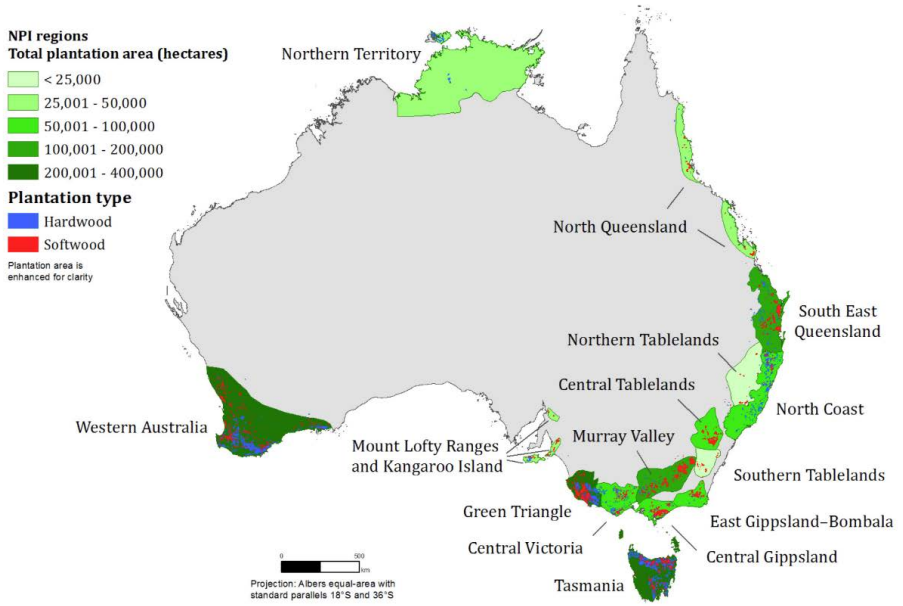


Figure 16: Australian plantation zones (NPI regions) Source: ABARES, via the Department of Agriculture, Fisheries and Forestry[33]

[33] https://www.awe.gov.au/sites/default/files/sitecollectiondocuments/abares/publications AustPlantationStats_2018_v.1.0.0.pdf

Limitations

Plantation forests cannot be managed under a forestry managed investment scheme, and projects cannot be established in regions that don't fall within the NPI regions.

Potential costs

Costs involved could include the establishment costs (e.g. buying seeds, planting), costs associated with developing a forest management plan and costs associated with independent reviews that confirm whether the management is continuing to sequester carbon throughout the project lifetime. There may also be costs associated with the monitoring, reporting and auditing required to meet project requirements.

Benefits

As well as generating credits, these projects have the benefit of improving soil quality, water quality and water salinity.

Risks

There is a risk before registering that the project won't be eligible for the Emissions Reduction Fund or carbon credits if the Minister deems it ineligible. Also, depending on the method chosen, there could be income implications for your business if plantations are harvested at different dates.

Additionally, there is the risk of natural disturbances such as fire and drought negatively affecting a project's ability to store carbon.

Monitoring

There are three key areas that must be monitored. Project owners must monitor what management actions are required, any natural disturbances that may affect the project (including fire, droughts and feral animal disturbance), and forest cover development.

13 Reforestation and afforestation

Carbon Credits (Carbon Farming Initiative—Reforestation and Afforestation 2.0) Methodology Determination 2015[34]

Overview

A reforestation and afforestation project involves planting forest trees in agricultural areas, thus sequestering carbon in the trees and reducing greenhouse gas that is entered into the atmosphere. These projects may be more attractive for those looking to undertake them on land with a low opportunity cost – land that currently has limited agricultural value.

Trees are able to be planted in either block or belt configurations, as long as they have the potential to reach forest cover. That is, having at least 20% crown cover at a tree height of at least two metres over an area of at least 0.2 hectares.

Eligibility

Projects must involve a permanent planting on land that has been either grazed, cropped or kept as fallow for at least five years before applying to take on the project.

The land must not be cleared native forest, and must also be suitable for supporting growth of the new forest.

Limitations

Trees already on the land must not be disturbed or removed from the project area.

You are allowed to carry out one preparation burn in each strata (smaller base land units showing consistent growing characteristics for all trees).

Fertiliser is allowed to be applied to each strata, but at most only once every 25 years.

Potential costs

The costs could include those associated with acquiring and planting trees, and any other costs associated with auditing, reporting and reviewing. The additional trade-off is considering the opportunity cost of not using the land for other purposes, i.e. cropping or grazing.

Benefits

The acts of reforestation and afforestation can sequester a substantial amount of carbon per hectare. Doing so can improve resource conditions and provide ecosystem services (e.g. by ameliorating secondary salinity or providing a wildlife corridor or small bird habitat), as well as help to improve amenity and landscape value.

[34] https://www.legislation.gov.au/Details/F2015L00682

Risks

A major risk is that the forests are impacted by natural events, such as fire or drought, that lead to a loss of carbon. If any disturbance occurs, regrowth will need to be managed until the carbon levels reach what they were previously reported to be.

Monitoring

The project area must be monitored for disturbances through the use of remotely sensed imagery. Here 'disturbance' means degradation of the forest in any way, or from natural disturbances such as fire.

"The acts of reforestation and afforestation can sequester a substantial amount of carbon per hectare. Doing so can improve resource conditions and provide ecosystem services (e.g. by ameliorating secondary salinity or providing a wildlife corridor or small bird habitat), as well as help to improve amenity and landscape value."

Vegetation methods

14 Reforestation by environmental or mallee plantings

Carbon Credits (Carbon Farming Initiative) (Reforestation by Environmental or Mallee Plantings—FullCAM) Methodology Determination 2014[35]

Overview

Reforestation through environmental or mallee plantings are projects that create and maintain vegetation, including trees or shrubs, on land that has been cleared of forest for at least five years.

As part of projects, a mix of trees, shrubs and understory species native to the area, and species of mallee eucalypts can be planted.

Planted trees and shrubs, as well as dead plant material, store carbon as biomass, resulting in fewer carbon emissions in the atmosphere.

Trees can be planted as seeds or tubestock, in rows or at random, and in belts or blocks. They must, however, be planted at a density that allows them to reach forest cover. That is, the trees must have the potential to grow two metres tall and have a crown cover of at least 20% of the project area.

These projects will utilise the Full Carbon Accounting Model (FullCAM). FullCAM is a calculation tool for modelling greenhouse gas emissions for Australia's land sector.

Eligibility

Projects can be run anywhere in Australia that has FullCAM data available. The land needs to have been cleared of forest cover for at least five years previously.

Land used for the project cannot contain woody biomass or invasive species that would need to be cleared. This excludes any weed clearing required or authorised by law.

Mallee species are only allowed to be planted in areas with less than 600 mm of long-term rainfall.

Limitations

Certain activities, such as harvesting and grazing, are restricted. There are some cases where they can be conducted but it is not common. For example, up to 10% of fallen timber can be removed per year, but only for personal use. Commercial harvesting is not permitted.

Potential costs

Costs of the method may include the cost of acquiring and planting the vegetation, which could be expensive depending on the area size. Other costs could include maintaining the vegetation, replanting trees that have died off, and any costs required to meet auditing, monitoring and reporting requirements.

Benefits

Along with earning credits, the maintained presence of the forest allows natural ecosystems to be maintained, carbon to continue to be stored in the trees and not released into the atmosphere, reduced salinity, and reduced soil erosion.

Risks

A major risk is that the forests are impacted by natural events, such as fire or drought, that lead to a loss of carbon. If any disturbance occurs, regrowth will need to be managed until the carbon levels reach what they were previously reported to be.

Monitoring

On-ground observation and/or remote-sensing imagery should be used to monitor management events and disturbances, e.g. fire, and to demonstrate that any specific calibration requirements have been met.

[35] https://www.legislation.gov.au/Details/F2018C00118

Other methods

15 Reducing greenhouse gas emissions from fertiliser in irrigated cotton

Carbon Credits (Carbon Farming Initiative—Reducing Greenhouse Gas Emissions from Fertiliser in Irrigated Cotton) Methodology Determination 2015[36]

Overview

Irrigated cotton projects help to reduce levels of greenhouse gases entering the atmosphere through more effective management of fertiliser use. This can mean either reducing synthetic fertiliser use while maintaining yield, or increasing yield without a proportional increase in fertiliser use.

Due to the exponential nature of emissions that synthetic nitrogen fertilisers produce, their use has a negative impact on the climate as part of the nitrogen applied to the crops enters the atmosphere as nitrous oxide emissions.

This method can be especially effective for cotton growers who currently use large amounts of fertiliser. It supports a large range of management activities, and at least one must be undertaken to be eligible. Project owners do, however, have flexibility to select practices to fit their situation. The new practice must be demonstrated to have the potential to increase the nitrogen fertiliser use efficiency of the cotton area. Some potential practices can include:

- Changing the type of nitrogen fertiliser used
- Changing the rate, timing or placement of fertiliser
- Improving drainage
- Growing different crop varieties to raise yield.

These activities must also be consistent with relevant myBMP (best management practice) standards[37] published by the Cotton Research and Development Corporation.

Eligibility

To be eligible, project areas must be growing cotton crops under irrigation, where emissions of nitrous oxide can be linked directly to the rate of synthetic nitrogen fertiliser used.

Additionally, at least three previous years of cotton crop data is required, including information on the area of cotton plantations, green manure planted, lint yield, and all fertiliser use.

[36] https://www.legislation.gov.au/Details/F2015L00584

[37] https://www.mybmp.com.au

Limitations

Dryland cotton production is excluded from these projects, as emissions from fertiliser application for dryland cotton depends on both rainfall intensity and duration, as well as the fertiliser rate. As such, dryland cotton emissions can't directly be linked to the rate of fertiliser use.

Potential costs

Project costs may vary depending on the activities undertaken, such as purchasing any additional seeds to grow in the field during the off-season or undertaking renovation works. There may additionally be costs to meet reporting, monitoring and auditing requirements.

Benefits

Through this method, in addition to earning carbon credits and reducing emissions, these projects may also help growers increase profits through more optimal fertiliser costs/use, raising lint cotton yield, or both.

Risks

One of the main risks associated with these projects is that due to the flexibility of project actions, it is important to ensure that the actions chosen ultimately reduce emissions or increase yield, otherwise credits will not be generated.

Monitoring

The items that must be monitored under these projects are:

- The cotton area, its seed planting density and the irrigation status in each field
- The lint yield for each field
- The amount of synthetic fertiliser used
- For green manure crops planted prior to the cotton crops, their area and planting density.

16 Verified Carbon Standard projects

These projects are only those running under the Verified Carbon Standards method. They must have been registered under the Emissions Reduction Fund before 30 June 2015. No information is provided for this method as it is not applicable anymore.

Other methods

17 Savanna fire management – sequestration and emissions avoidance

Carbon Credits (Carbon Farming Initiative—Savanna Fire Management—Sequestration and Emissions Avoidance) Methodology Determination 2018[38]

Overview

Savanna fire management projects revolve around strategic burning in northern Australia's early dry season (January to July), as opposed to the late dry season (August to December). This is done to reduce the size, intensity and frequency of wildfires in the later dry season. In the early parts of the season, vegetation is less dry than it is towards the end of the season. As the vegetation is less dry, fires burn cooler, reducing the emissions released.

The West Arnhem Land Fire Abatement project demonstrated these early fires typically emit 52% less nitrous oxide and methane per hectare than late-season equivalents (Ryan, 2022).

Projects come in two types – as emissions avoidance and savanna sequestration. While both projects earn credits from reducing emissions, sequestration projects also earn credits through storing carbon in dead organic matter. Sequestration projects need to then keep this carbon stored through fire management for whichever permanence period they choose (25 or 100 years).

The burnings can be carried out in several ways, such as lighting the fires from aircraft, lighting the fires from vehicles, or through walking with hand-held drip torches. This is to be done in the early dry season each year.

If managed fires don't occur in the early dry season, more widespread and intense fires are likely to result. Due to the size and scale of these fires, along with the greater emissions released into the atmosphere, there are potential harmful effects such as:

- Destruction of stock feed
- Reduced pasture quality in the long term as perennial grasses become annuals
- Infrastructure damage, e.g. fences and bores.

Eligibility

Land in your project must be in either a high or low-rainfall zone in northern Australia. Figure 17 outlines these zones.

[38] https://www.legislation.gov.au/Details/F2018L00562

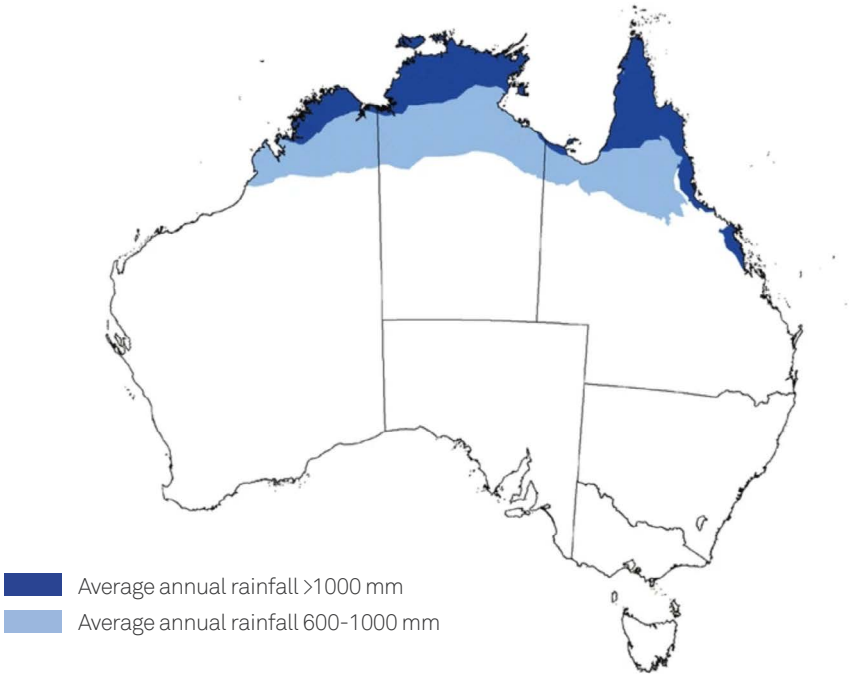


Figure 17: Map showing high and low-rainfall zones in northern Australia. Source: Carbon Balance and Management[39]

[39] Maraseni, T. N., Reardon-Smith, K., Griffiths, G. et al. (2016). Savanna burning methodology for fire management and emissions reduction: a critical review of influencing factors. *Carbon Balance and Management* 11, 25. https://doi.org/10.1186/s13021-016-0067-4

Other methods

It must also contain one or more of the following vegetation types:

- Eucalypt open forest
- Eucalypt woodland
- Sandstone woodland
- Sandstone heath.

These projects are also subject to the newness and additionality requirements. The newness requirement specifies that emissions avoidance or sequestration projects have not been undertaken in any part of the project area, or if they have, no carbon credits have been issued. The additionality requirement means that land cannot be included that already uses fire management to either reduce emissions from fire or sequester carbon in dead organic matter.

Additionally, areas containing relevant weeds (currently only gamba grass) are not valid.

Limitations

Activities managing fire cannot include raising cattle grazing beyond what occurs under business as usual.

Potential costs

Costs will vary from project to project, but there are several costs that you may need to consider, including costs associated with annual fire management and generating required documents (e.g. fire management plans and vegetation mapping), and any costs to meet auditing and reporting expectations (e.g. calculations).

Benefits

The benefits of running savanna burning projects are detailed in Figure 18. Early-season burning also reduces fuel loads and creates fire breaks in the land. These lower the risk of hot fires spreading in the later dry season. For more information on additional benefits, refer to the book *Ground Breaking: Soil Security and Climate Change.*[40]

[40] https://www.groundbreakingpress.com/

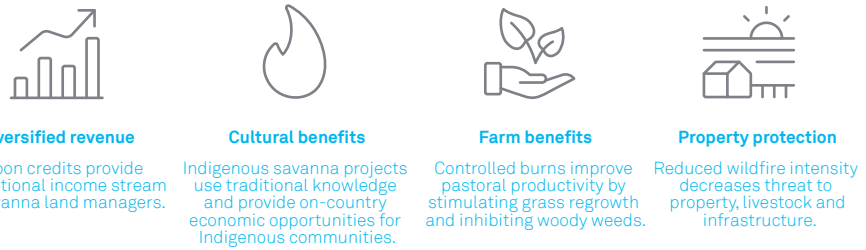


Figure 18: Benefits for running savanna burning projects. Source: Clean Energy Regulator[41]

Risks

Due to the inherent nature of fire, it is important to take all precautions necessary when running fire management projects to ensure the safety of all. Many factors, including weather, landscape and fuel, will affect the result of a fire, and the conditions of these must be checked prior to burning.

Monitoring

Currently, the only weed species required to be monitored and removed is gamba grass. Project areas that contain gamba grass cannot be used to claim carbon credits.

If, when running a project, you identify gamba grass in an area, it needs to be excluded by either:

- Removing the grass from the area before the end of the reporting period in which it is identified. A map and evidence of clearing needs to be provided with the offset report
- Subdividing the project and removing the area that contains the gamba grass. It is important to note that removing an area from the project is irreversible.

[41] http://www.cleanenergyregulator.gov.au/DocumentAssets/Documents/Factsheet%20-%20Savanna%20burning.pdf

Other methods

18 Tidal restoration of blue carbon ecosystems

Carbon Credits (Carbon Farming Initiative—Tidal Restoration of Blue Carbon Ecosystems) Methodology Determination 2022[42]

Overview

This method involves the introduction of tidal waters on some or all of a project area to create wetland ecosystems. These environments support the growth of mangroves, tidal marshes and seagrasses. Through their soil (sediments), roots and plants, these ecosystems are able to store carbon from the atmosphere with greater capacity than traditional vegetation methods, reducing emissions by a potentially significant amount.

Eligibility

In the past seven years, there must be some mechanism excluding or restricting tidal flows. This mechanism can either be currently restricting flows or would do so during the project's 25-year crediting period. Regardless, the removal of these restrictions should impact the land with tidal inundation.

You will need to work with qualified experts to prepare assessments and management plans. A hydrological assessment for the extent of inundation will need to be created, as well as a qualified engineer engaged to prepare an operations and maintenance plan. An acid sulphate soil management plan and a mosquito management plan will also need to be developed during project planning.

Limitations

The illegal draining of wetland or clearing of native forest are ineligible activities. Non-illegal draining and/or clearing is allowed if it has occurred within seven years of project registration with no land ownership change, or within five years if there has been ownership change in the past seven years.

Potential costs

Part of your project may require the removal, modification or construction of new infrastructure to manage inundation. Engaging professionals to undertake a hydrological assessment and develop an operations and management plan will also be a huge initial project cost. There may also be some costs associated with assessing and reviewing the area when the project is running. Lastly, there may be costs associated with meeting monitoring, auditing and reporting requirements.

[42] https://www.legislation.gov.au/Series/F2022L00046

Benefits

Along with storing carbon from the atmosphere and earning carbon credits, the ecosystems spawning from these projects can bring benefits such as protecting your land from storms and sea level rises, preventing shoreline erosion, regulating coastal water quality, and providing habitats for marine species.

Risks

There are risks associated with managing tidal inundation to ensure it is controlled and does not affect land outside of the inundation map without valid consent. There is also the risk that natural disturbances have a negative impact on the project land.

There is an associated opportunity cost if the land is currently used for pasture or cropping. However, low-lying land is usually salty or contains acidic soils, and has low productivity. It is likely that returns from blue carbon will exceed the returns from agricultural activity.

Monitoring

There are key areas to monitor in a tidal restoration project, which come with negative consequences if you fail to meet the requirements.

For the crediting period of the project, the project owner must monitor each project area to identify and record the year a coastal wetland ecosystem begins to establish, and its location. This must be done using on-ground observation (including time, date and geolocated images), digital geolocated images, or vegetation cover data.

Natural disturbances also need to be monitored for the entire permanence period (25 or 100 years) of a project. This can be done with the same monitoring methods as above. Fuel use is also required to be monitored.

Excluding exceptions from regulators, failure to meet these monitoring requirements can negatively affect net abatement for a reporting period, impacting the number of credits that can be claimed.

Other methods

13 Participation guide

This section will walk you through some of the more popular methodologies and go over some of the steps involved in getting started with the schemes.

1. Savanna fire management – sequestration and emissions avoidance

Decide on project details

Once you have determined you meet the eligibility requirements for a project, you can begin the planning and registration process.

In order to register a project, you need to provide details on various aspects of your proposed project, including:

- Proposed activities
- Whether the project is occurring on Native Title or Indigenous land
- Whether state and territory bodies have been notified
- When fire permits will be needed
- Calculated expected carbon credits.

Additionally, you will need to decide whether you will undertake an emissions avoidance, or emissions avoidance and sequestration project. The difference between these projects is the permanence requirements, where sequestered carbon will need to remain stored for either 25 or 100 years. Permanence requirements only apply to sequestration offset projects.

Prepare a project management plan and fuel type map

Each year, you will be required to prepare a project management plan describing the burning intended in each area for the year. These can be updated throughout the year as required.

For each project area, a vegetation fuel type map needs to be created. This also is required for any time you wish to add a new project area.

Before undertaking new fire management, producers need to determine the historical average of baseline emissions from fire for either a 10 or 15-year period for the project area. This baseline is found by analysing vegetation maps and satellite fire maps for the area using a geographic information system (GIS), which requires technical expertise.

After fire management practices are adopted, you can use vegetation maps and satellite fire maps to determine emissions under the new strategy.

Conduct project activities

Once your project has been successfully registered, follow your project management plan and carry out all required activities. If the plan needs to be adjusted, a formal process must be followed, which is outlined in the methodology.

Monitor relevant weed species

During your project's lifecycle, you will need to actively monitor and remove relevant weed species from your project area/s. At the time of writing, the only relevant weed is gamba grass, and its handling is laid out in the monitoring section in the 'Schemes available under the Emissions Reduction Fund' section under this methodology.

Calculate abatement

For both sequestration and emission reduction methods, you will need to calculate net abatement to determine the amount of carbon credits you will receive. You can either complete the required calculations manually or use the government-provided SavBAT tool to calculate abatement. All parameters gathered during monitoring will be used in SavBAT to calculate net abatement.

2. Estimating soil organic carbon sequestration via measurement and models

Decide on project details

Once you have determined you meet the eligibility requirements for a project, you can begin the planning and registration process.

During the planning phase, you'll need to prepare the following yourself or have it prepared for you. Each decision in establishing your project will have its own pros and cons, so speak to an experienced advisor if you are unsure of the best course of action.

You will need to decide which paddocks on your farm you want to undertake the project on. This can either be a few of them or the entire farm. You will need to split your project into one or more Carbon Estimation Areas (CEAs). A CEA is an area of land with similar management practices, allowing carbon stocks to be accounted for accurately. You will also need to delineate the rest of the project area into Emissions Accounting Areas (EAA) and Exclusion Zones (EZ). Exclusion Zones are areas that cannot sequester carbon, such as roads, buildings or dams on the property. Emissions Accounting Areas represent the rest of the project area in which emissions are accounted for (Figures 19 and 20).

This step is quite complex and important to get correct to ensure you map out the parcels correctly for accurate accounting and crediting. A third party who has extensive experience in remote sensing and geographic information system (GIS) mapping will be able to assist with this.

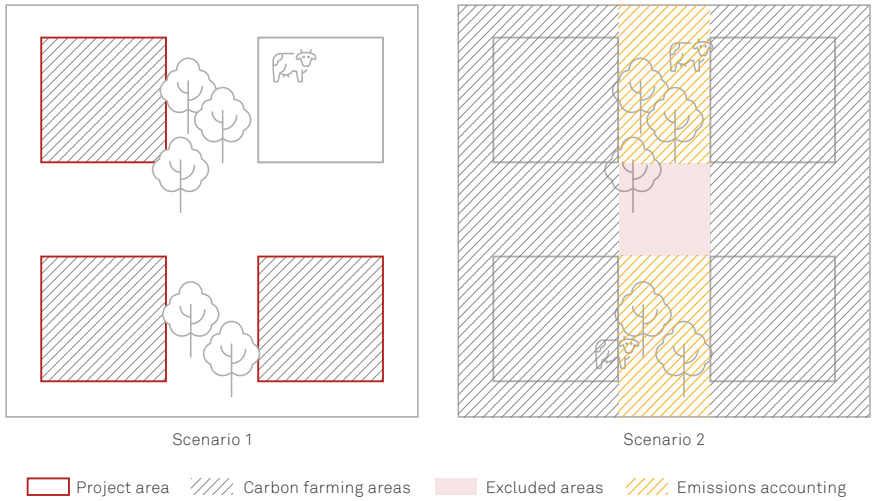


Figure 19: Illustrative example of project area mapping.

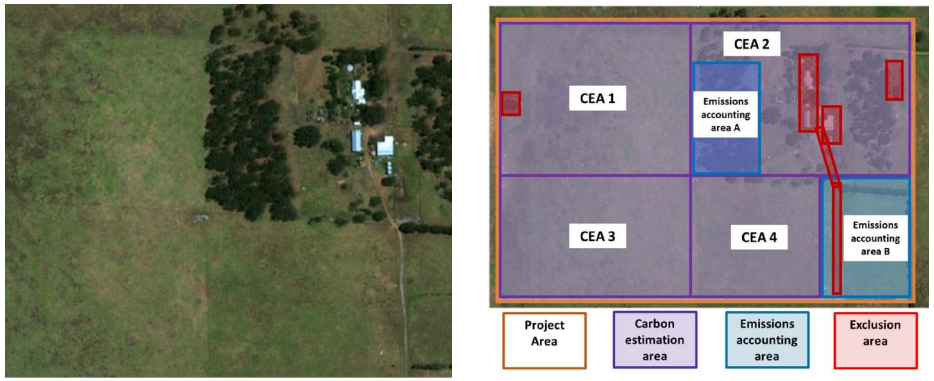


Figure 20: Illustrative example of project area mapping. Source: Clean Energy Regulator[43]

[43]http://www.cleanenergyregulator.gov.au/DocumentAssets/Documents/Understanding%20your%20soil%20carbon%20project%20-%20Simple%20method%20guide.pdf

Once you have decided on the land parcels, you will need to demonstrate that the land has been used either for cropping, pasture or bare fallow for the past five years. Additionally, at least one of the eligible management activities must have not been performed in the past to be considered a change in practice.

In determining project viability, take into account both potential revenue and expenditures required to run the project. There are tools online to assist you in determining the viability of your projects. It is also important to keep in mind that the price of carbon credits will fluctuate throughout the life of your project, and that carbon credits will be delivered over time, not all at once. Input costs will also fluctuate from year to year. As a result, use the information generated by the tools as a guide rather than as the sole source of truth.

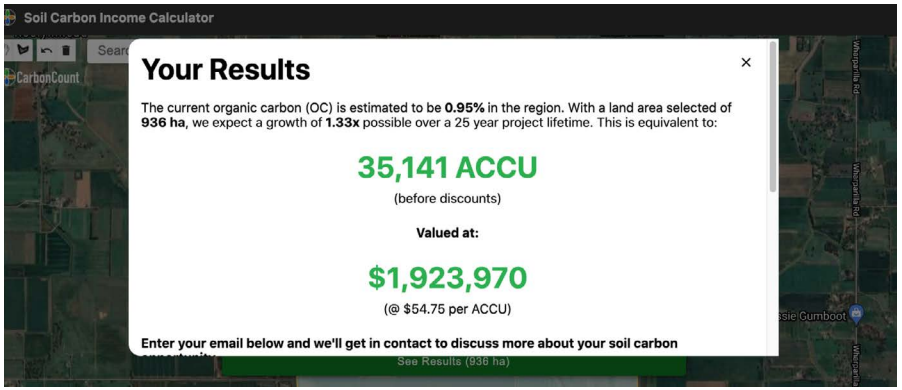


Figure 21: The Soil Carbon Income Calculator tool can help you figure out soil carbon potential for a given land parcel. Source: Carbon Count[44]

In order to run a project, you must also get consent from all stakeholders. These could include other family members who have their names on the land title, banks you have an ongoing mortgage with, or any other people or organisations with shared interests in the land. This step will require a signed document from all stakeholders.

For baseline emissions accounting (required in net abatement calculations to receive credits down the line), you will need to gather farm records from the past five years for livestock, urea and lime application, irrigation use, residue and land modification activities.

[44]https://scic.carboncount.com

You will also need to decide on who is going to be the project proponent. The project proponent is the party who has the legal right to undertake the project. This means that they control the project, will be issued carbon credits generated by the project, and are legally responsible for meeting all obligations. This can either be yourself or an external party such as a carbon project developer. There are risks associated with becoming the project proponent yourself or letting a third party be the project proponent.

Preparing a land management strategy

A land management strategy (LMS) will act as your game plan for sequestering carbon.

It is important to be thorough and take care when developing the LMS. A poor LMS that does not account for aspects such as current farm activities, soil conditions and environmental factors will result in a minimal amount of carbon sequestration. It is best that the LMS be implemented into a new whole-of-farm plan.

It is likely that an overhaul of the current farming system and infrastructure will have to be implemented. Developing a land management strategy requires a qualified person experienced in carbon farming to prepare a written strategy. A carbon project developer would be able to recommend someone qualified, or your local independent agronomist may also have the necessary skills. The land management strategy must include at least one eligible management activity to be conducted for each parcel of land included in the project. There are templates available online to use as a starting point, including one produced by the Department of Primary Industries and Regional Development in Western Australia: https://bit.ly/3mxrBtd

Prepare a project area map

The project areas you have outlined will need to be translated into a digital format through a geographic information system (GIS) tool such as QGIS or similar. These tools require some technical knowledge to operate, as well as an understanding of projection systems to ensure the map is completed to the standard the regulators are expecting.

Once you have completed the necessary paperwork and preparations required, you can register your project through the Clean Energy Regulator Client Portal.[45] The registration process includes information about you, so that the regulator can be sure of your identity and assess you against the 'fit and proper person' test requirements. This test requires you to provide various personal details and undergo a police check.

Conduct project activities

Once your project has been successfully registered, a baseline measure will need to be conducted to determine the project areas' initial soil carbon levels. Baseline emissions will also be calculated with the aid of historical records.

Once a baseline has been completed, the next step is to follow your land management strategy and carry out all required activities. It is possible to adjust the plan, but a formal process must be followed, which is set out in the methodology.

[45] https://portal.cleanenergyregulator.gov.au/

Future measurements will occur at a time when soil carbon is believed to have increased (the government requires a minimum of one year and a maximum of five years between measurements). After this, emissions accounting will be performed again, allowing net abatement to be calculated from the results.

Calculate abatement

Net abatement is calculated through prescribed equations specified in the methodology. The inputs for these calculations will be taken from the baseline rounds and the subsequent measurement round. If the project has gone through only two measurement rounds, there will be a temporary 25% discount on credits from the first crediting round, which will be refunded after three measurements.

3. Human-induced regeneration of a permanent even-aged native forest

Decide on project details

Once you have determined you meet the eligibility requirements for a project, you can begin the planning and registration process.

Before you register, you will need to stratify your project into one or more Carbon Estimation Areas (CEAs). A CEA is an area of land with forest potential that fits the following:

- Land that your project activities will be undertaken on
- Land that has started to become native forest through regeneration
- Land in which carbon stock and emissions are going to be calculated under this method.

CEAs will need to be grouped in such a way that there are similar vegetation types in each CEA, allowing carbon stocks to be accounted for accurately. This step is quite complex and important to get correct. A third party who has extensive experience in remote sensing and geographic information system (GIS) mapping will be able to assist with this (Figure 22).

You will also need to decide on your project mechanism, which consists of at least one activity that can be expected to stop the suppression of vegetation and allow your project area to regenerate to become native forest and achieve forest cover.

For example, if you had land that has been subject to uncontrolled grazing for the 10-year baseline period, you could fence off the project area to keep livestock and feral animals out of the area, allowing regeneration to occur.

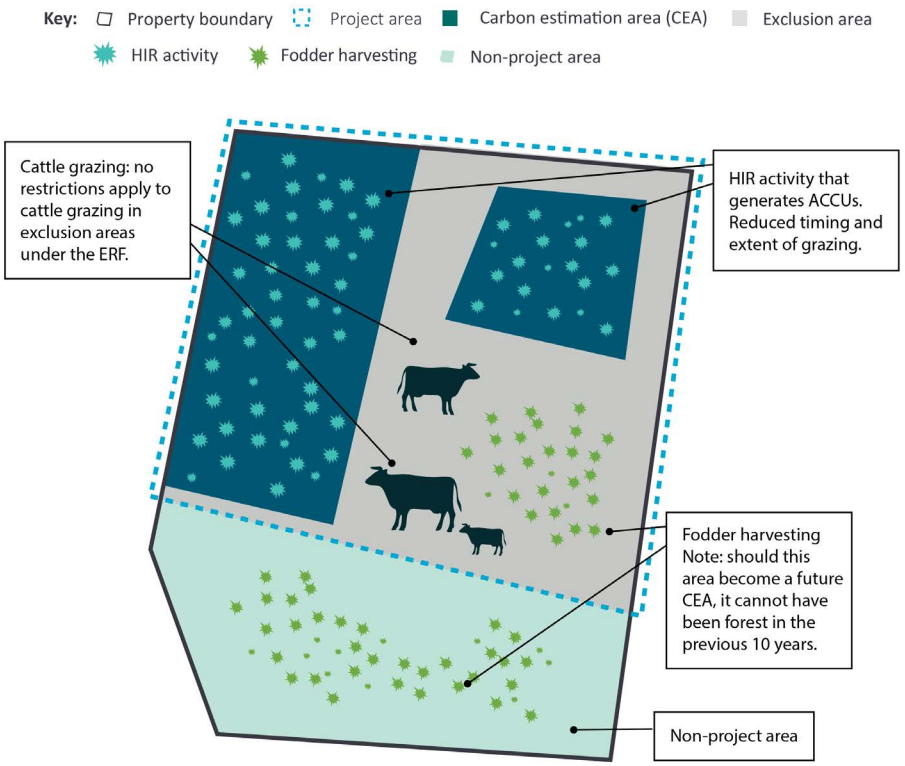


Figure 22: Illustrative example of project area mapping. Source: Clean Energy Regulator[46]

[46] http://www.cleanenergyregulator.gov.au/ERF/Pages/Forms%20and%20resources/Regulatory%20Guidance/Sequestration%20guidance/Human-Induced-Regeneration-projects-and-how-they-affect-the-management-of-land-at-a-property-scale.aspx

Run your project mechanism

While you are operating the project, it is important you abide by your agreed practices to assist with regeneration and fulfil your ongoing monitoring requirements.

Calculate abatement with FullCAM

For each reporting period, net abatement is the change in carbon stored minus emissions resulting from fire and fuel use. Human-induced regeneration (HIR) projects use FullCAM to calculate both carbon stored and emissions generated.

You need to use FullCAM to determine the following for each CEA:

- Initial carbon stock – the mass of forest debris and trees before the start of the reporting period
- The mass of forest debris and trees after the reporting period
- The mass of methane and nitrous oxide emitted in the reporting period from biomass burning.

This requires having the model point location, modelling commencement date and FullCAM event queue for each CEA. These are:

- Model point: A location as close to the centre of the CEA as possible (this does not need to be in the CEA itself)
- Commencement date: A date as close to, but not earlier than, the date sufficient regeneration has occurred that can demonstrate the land has forest potential
- Event queue: A list of events that affected the forest system, e.g. forest fires.

With this data, FullCAM is able to model the carbon to produce annual totals, which can be used for crediting. The operation of FullCAM can be quite technical so you may require the assistance of a third party.

4. Reforestation by environmental or mallee plantings

Decide on project details

Once you have determined that you meet the eligibility requirements for a project, you can begin the planning and registration process.

The first step in setting up a project is to establish the project area. Through a CFI mapping tool, or similar, you will need to divide (stratify) your project area into a set of Carbon Estimation Areas (CEAs) and Exclusion Zones (Figure 23).

CEAs are areas in which carbon is going to be stored. They need to have uniform characteristics, including soil type and slope. For projects under this method, they also need to include either a mixed species or mallee planting.

Conversely, Exclusion Zones are the areas that won't store carbon, and where project activities won't occur, e.g. dams, roads and buildings.

In the event of a disturbance or change in characteristics, e.g. a fire, the CEAs and Exclusion Zones for a project may need to be redefined before the next offset report.

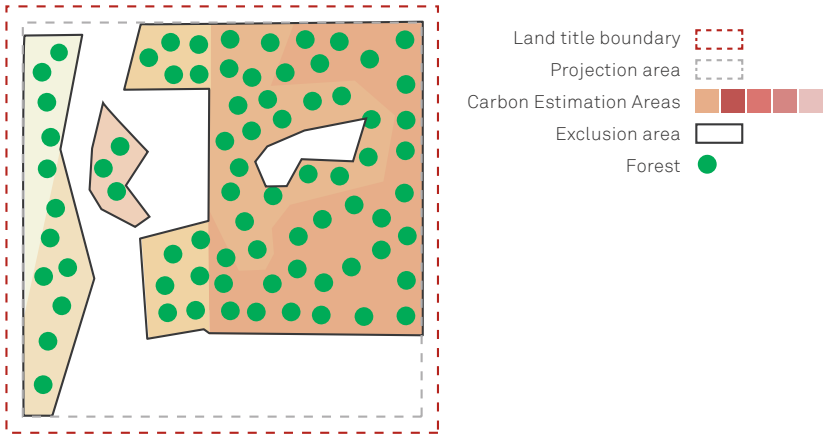


Figure 23: Illustrative example of project area mapping. Source: Clean Energy Regulator[47]

Choose a planting type

Plantings for these projects come in two forms: A mixed species environmental planting or a mallee eucalypt planting.

Mixed species plantings need to be species that are native to the area. These can either be grown from tubestock or from seeds from the natural distribution of the species. As far as composition goes, you are able to plant a mix of tree, shrub and understory plants that reflect the composition of the local vegetation community.

Mallee plantings are able to use any species of the genus Eucalyptus, which has multiple stems. Modelling criteria will be affected by which species is chosen.

Complete FullCAM calibration

FullCAM uses a set of calibrations (or settings) to model and estimate the amount of carbon stored in plantings. These can fall under either specific or generic calibration. If you are able to meet the requirements of a specific calibration, you may deliver a faster yield growth than under generic calibration. This means you may be able to apply for and receive carbon credits earlier.

Specific calibrations require field data to be collected, including samples taken to measure planting density. For smaller projects, the cost of collecting this data may outweigh the benefits of specific calibrations. Information for Western Australian producers is available on the Department of Primary Industries and Regional Development website.[48]

[47] http://www.cleanenergyregulator.gov.au/DocumentAssets/Documents/A%20guide%20to%20the%20reforestation%20by%20environmental%20or%20mallee%20plantings-FullCam%20method.pdf
[48] https://www.agric.wa.gov.au/sites/gateway/files/Land%20Management%20Strategy%20Guide%20-%20Reforestation_3.pdf

Establish the project baseline

The baseline is the amount of emissions that would occur if your project was not going to be run. The aim of this is to act as a reference point to measure changes in carbon stored. For projects under this method, the baseline is taken to be zero.

Calculate project emissions

Projects will also need to account for any emissions that come from running the project. FullCAM is used to model emissions from fires, but emissions for methane and nitrous oxide are calculated separately. This is also the case for project fuel use.

Along with the initial carbon stocks, emissions are subtracted from the total amount of carbon abatement to get the net abatement.

Calculate abatement

You will be required to submit your offsets report at the end of a reporting period. In doing so, you will be able to earn carbon credits so long as you have a positive net abatement.

For every CEA that you have, FullCAM with either a generic or specific calibration will need to be provided (see FullCAM calibration). Carbon stocks modelled by this are counted as being held within stems, crowns and roots of project trees, as well as within dead plant material.

14 How to get started today

Now that you have read through this handbook and informed yourself on carbon farming and the methodologies applicable to you, here are some practical steps that can start you off on your carbon farming journey today.

Firstly, decide on the methodology that is best suited to your situation. Part of this includes deciding on the appropriate areas of land you wish to use for your carbon farming project.

For your chosen area, there are various tools available online to help you assess potential revenue. Be sure to seek out a tool that is relevant for your chosen methodology.

Note down your current farming practices. This includes things like crop rotation cycles, grazing timing and location, livestock heads, fertilisers used, irrigation, native forest locations and farming history. This will greatly aid in determining activities that meet additionality requirements. This will be incredibly useful to determine what practices can be implemented and how additionality applies in your situation.

As part of your information gathering, you should also gather lot and DP numbers of the farm as a starting point for establishing project areas.

Discussing your intentions to run a carbon farming project with other stakeholders of the land is also required. These include all landowners or family members, or banks if you are a mortgagee. These discussions can help guide your decisions.

Due to the long-term nature of projects, find out what it means for you if your situation changes in the future (should you retire or sell the land, for example). Ongoing land management and permanence requirements will need to be met regardless as the project is tied to the land it's registered on, so having a plan of what will happen in the event of change is key.

With all of this in mind, the next step is to prepare the paperwork necessary for registration. This can be done either by yourself or through reaching out to an external party such as a project developer. For the most up-to-date information on the registration process and running a project, visit the Clean Energy Regulator website.

Available grants

Carbon farming grants available to producers and landholders at the time of writing are listed below. Information on further grants may be found on the AgriFutures Australia website.[49]

$5000 Soil sampling grant for soil carbon methodology (active) – https://bit.ly/3mAldjl

Conditions: Must be in a fixed contract with the Australian Government to be able to apply for this grant.

Carbon Farming Advice Rebate Pilot Program (active) (Tasmania only) – https://bit.ly/3NDNd2N

Western Australian Carbon Farming and Land Restoration Program (active) – https://bit.ly/3Qfs5Sr

[49] https://www.agrifutures.com.au/

How to get started today

15 Case studies

The following section aims to delve into several case studies of existing carbon farming projects. Additionally, the Clean Energy Regulator lists all registered projects online on their project register.[50]

Olsen's Farm – groundskeeping carbon project

The Olsen family, with the help of soil carbon project developer AgriProve, has improved its pastures through using the 'SoilKee Renovator'. The improved pastures have significantly increased soil moisture content and carbon levels.

As a result, not only have carbon credits been generated for the project, but also pasture growth has improved, biodiversity has increased, and landslips and washouts have stopped.

Methodology	Soil carbon
Project partner	AgriProve
Location	Victoria
Property size	124 ha
Project activities	Increased paddock numbers to facilitate rotational grazing
ACCUs issued to date	1,904
ACCU breakdown by year	FY18-19: 406 FY19-20: 1,498
Project permanence	25 years

[50] http://www.cleanenergyregulator.gov.au/Infohub/case-studies/Pages/erf-case-studies/Emission-Reduction-Fund-case-studies.aspx

AACo's beef cattle herd management project

The Australian Agricultural Company has been able to reduce emissions intensity per unit of live weight through working with carbon finance consultancy South Pole.

By implementing new management methods that improve the cattle's productivity, the project has resulted in a strong reduction of emissions.

Methodology	Beef cattle herd management
Project partner	South Pole
Location	Northern Territory and Queensland
Property size	N/A
Project activities	Herd genetic improvement Installation of new water points for wider grazing Installation of additional fencing
ACCUs issued to date	185,231
ACCU breakdown by year	FY20-21: 97,804 FY21-22: 87,427

Mount Mulgrave fire management project

The Mount Mulgrave project, in partnership with carbon finance consultancy South Pole, aims to reduce late-dry season wildfires through early-dry season savannah burning and strategic fire management.

It seeks to both lessen greenhouse emissions caused by extensive late-season blazes and minimise the damage those blazes cause. This may help to preserve cultural sites, infrastructure and local wildlife.

Methodology	Savanna burning
Project partner	South Pole
Location	Mount Mulgrave, Queensland
Property size	281,459 ha
Project activities	Strategic fire management planning Early-dry season burning
ACCUs issued to date	107,486
ACCU breakdown by year	FY16-17: 55,166 FY17-18: 18,099 FY18-19: 7,201 FY19-20: 10,652 FY21-22: 16,368

Case studies

16 Appendix

On-farm emissions explained

The primary gases that contribute to global warming come from three main gases: carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4). Each gas has a different effect on the atmosphere due to its global warming potential. They are collectively referred to as greenhouse gases, or GHGs.

Carbon dioxide is primarily released by the burning of fossil fuels through diesel fuel use or electricity consumption, plant decay, and insect and microbe activity in soils.

Nitrous oxide is mainly released from nitrogen-based fertilisers, animal dung and urine, and biomass burning. The global warming potential of nitrous oxide is 310 times that of carbon dioxide.

Methane is mainly released from ruminant animals such as cattle, sheep, goats and buffalo after digesting plant material (through enteric fermentation). The global warming potential of methane is 21 times that of carbon dioxide.

On-farm emissions come from many different sources across the farm, such as direct emissions (scope 1) from tractors burning fuel to harvest crops, emissions from electricity use (scope 2) through using electric irrigation pumps and from the GHGs released while manufacturing or transporting the products to the farm, or indirect emissions (scope 3) (Figures 24 and 25 contain visualisations of these). Currently, there are no requirements to account for scope 3 emissions.

It is important to manage on-farm emissions in a proactive way to ensure that you can minimise your carbon footprint. Through implementing a carbon farming project, you can monitor and report on your farm's emissions, allowing you to determine how to reduce your impact further.

Appendix

Greenhouse gas cycles in agriculture

Nitrous Oxide

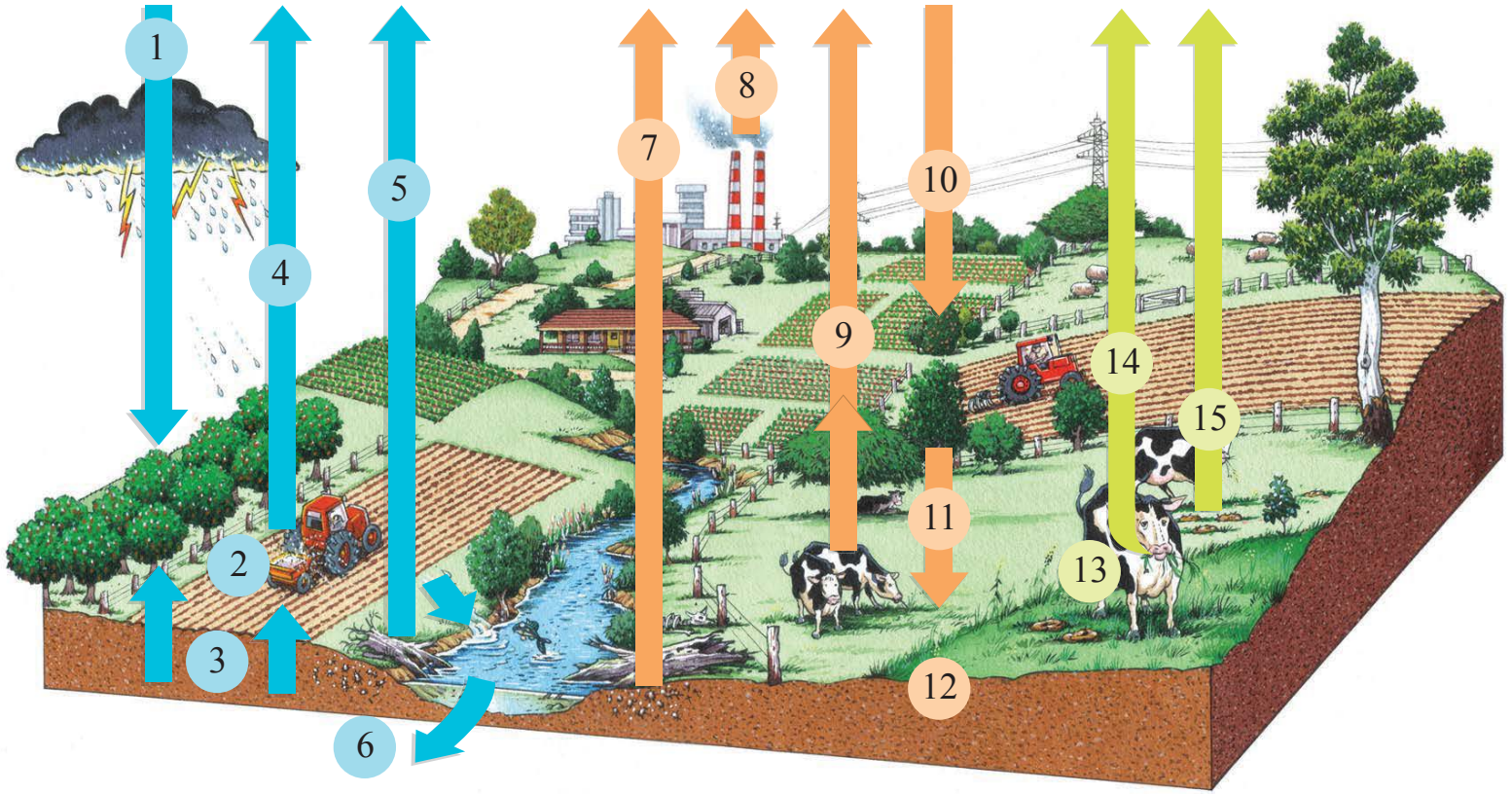
is mainly released through soil disturbance, nitrogen fertilisers, urine and dung. The global warming potential of nitrous oxide is 310 times that of carbon dioxide over a 100 year period.

Carbon Dioxide

is mainly released through burning of fossil fuels, plant decay and insect and microbial activity in soils. It is also absorbed by plants through photosynthesis and stored in soils and trees.

Methane

is mainly released from cows and sheep following digestion of plant matter. The global warming potential of methane is approximately 21 times that of carbon dioxide over a 100 year period.



1. Nitrogen absorbed by lightning (falls in rain) and nitrogen fixing bacteria in legumes
2. Nitrogen-based fertilisers applied to pasture or crops
3. Nitrogen taken up by pasture, crops and trees
4. Nitrous oxide released through volatilisation of urea fertiliser
5. Nitrous oxide released through process of denitrification
6. Nitrogen loss through runoff and leaching from fertilisers and nitrification process in soil
7. Carbon dioxide released through plant decay, and insect and microbial activity in the soil
8. Carbon dioxide released from burning fossil fuels to produce electricity and fuel
9. Carbon dioxide released by animals and plants through respiration
10. Carbon absorbed by trees, pasture and crops through photosynthesis
11. Animals consume carbon by eating plants
12. Carbon from organic residues (e.g. dead leaves, roots, manure & urine) absorbed into the soil
13. Methane (CH_4) is produced within the rumen (fore-stomach) during digestion, via a chemical reaction between carbon and hydrogen
14. Methane released by cows and sheep burping following ruminant digestion
15. Small amounts of methane released from fermentation of animal dung and urine under anaerobic (no oxygen) conditions

Figure 24: Visualising sources of farm emissions. Source: Agriculture Victoria[51]

[51] https://agriculture.vic.gov.au/__data/assets/pdf_file/0010/578719/Cents-of-Carbon-artwork-MG_030620-email-spreads.pdf

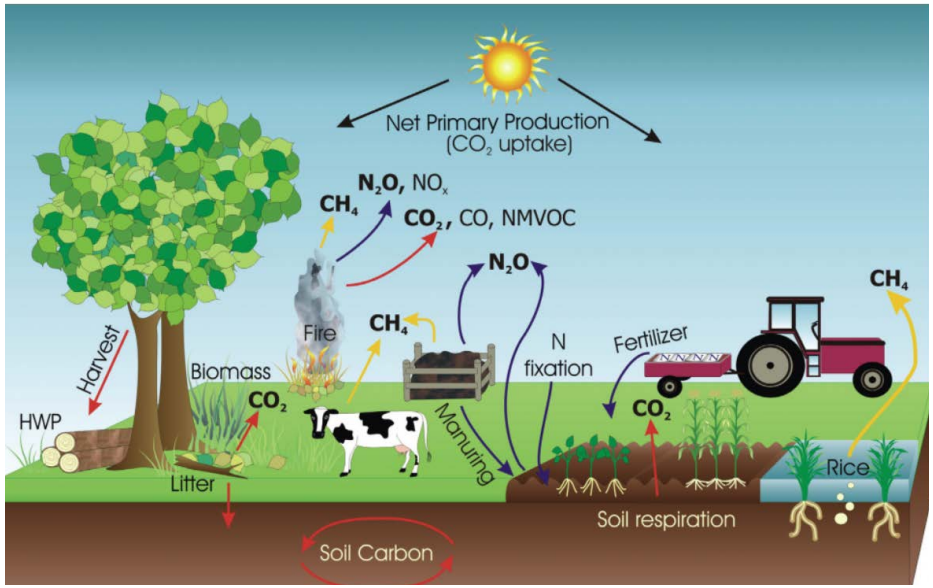


Figure 25: Visualising sources of farm emissions. Source: Agriculture Victoria[52]

Reducing on-farm emissions

Reducing on-farm emissions cannot be done in isolation. You need to consider the farming system as a whole, and the methods available to reduce emissions will depend on what your farming operations involve.

Currently, reducing these emissions does not generate additional credits. Emissions do, however, reduce net abatement and the amount of carbon credits you can earn as a result. As such, it is important to reduce your overall footprint for both sustainable farming reasons and to maximise credits.

Examples of reducing on-farm emissions include:

- Pumping CO_2 from the boiler to the greenhouse (scrubbing)
- Installing solar panels and running equipment from clean energy (e.g. electric pumps for irrigation rather than diesel pumps)
- On-farm generation of organic inputs through planting trees on-farm and, in mixed cropping and livestock enterprises, using manure and waste as a supply of organic fertiliser (supplement with synthetic when needed).

[52] https://www.wri.org/insights/everything-you-need-know-about-agricultural-emissions

Carbon service providers

Carbon project service providers active in Australia at the time of writing are listed below.

Aboriginal Carbon Foundation
https://www.abcfoundation.org.au/

AgriProve
https://agriprove.io/

Australian Integrated Carbon (AI Carbon)
https://aicarbon.com/

Biodiverse Carbon
https://www.greeningaustralia.org.au/biodiverse-carbon/

Carbon Count
https://www.carboncount.com/

Carbon Farmers of Australia
https://carbonfarmersofaustralia.com.au/

Carbon Farming Foundation
https://carbonfarming.org.au/

Carbon Link
https://carbonlink.com.au/

Carbon Neutral
https://carbonneutral.com.au/

Carbon Sync
https://www.carbonsync.com.au/

Climate Friendly
https://www.climatefriendly.com/

CO2 Australia
https://www.CO2australia.com.au/

Corporate Carbon
http://www.corporatecarbon.com.au/

Evolve Environmental Solutions
https://evolveenvironmental.com.au/

Green Collar
https://greencollar.com.au/

Natural Capital Co
https://natcapco.com.au/

Natural Carbon
http://naturalcarbon.com.au/

Planning 4 Sustainable Development
http://www.planning4sd.com/sustainabledevelopment/

Regen Co
https://regenco.earth/

Select Carbon
https://www.selectcarbon.com/

South Pole
https://www.southpole.com/

Tasman Environmental
https://www.tasmanenvironmental.com.au

TerraWise
https://www.terra-wise.com.au/

Upscale Carbon
https://www.upscalecarbon.com.au/

Appendix

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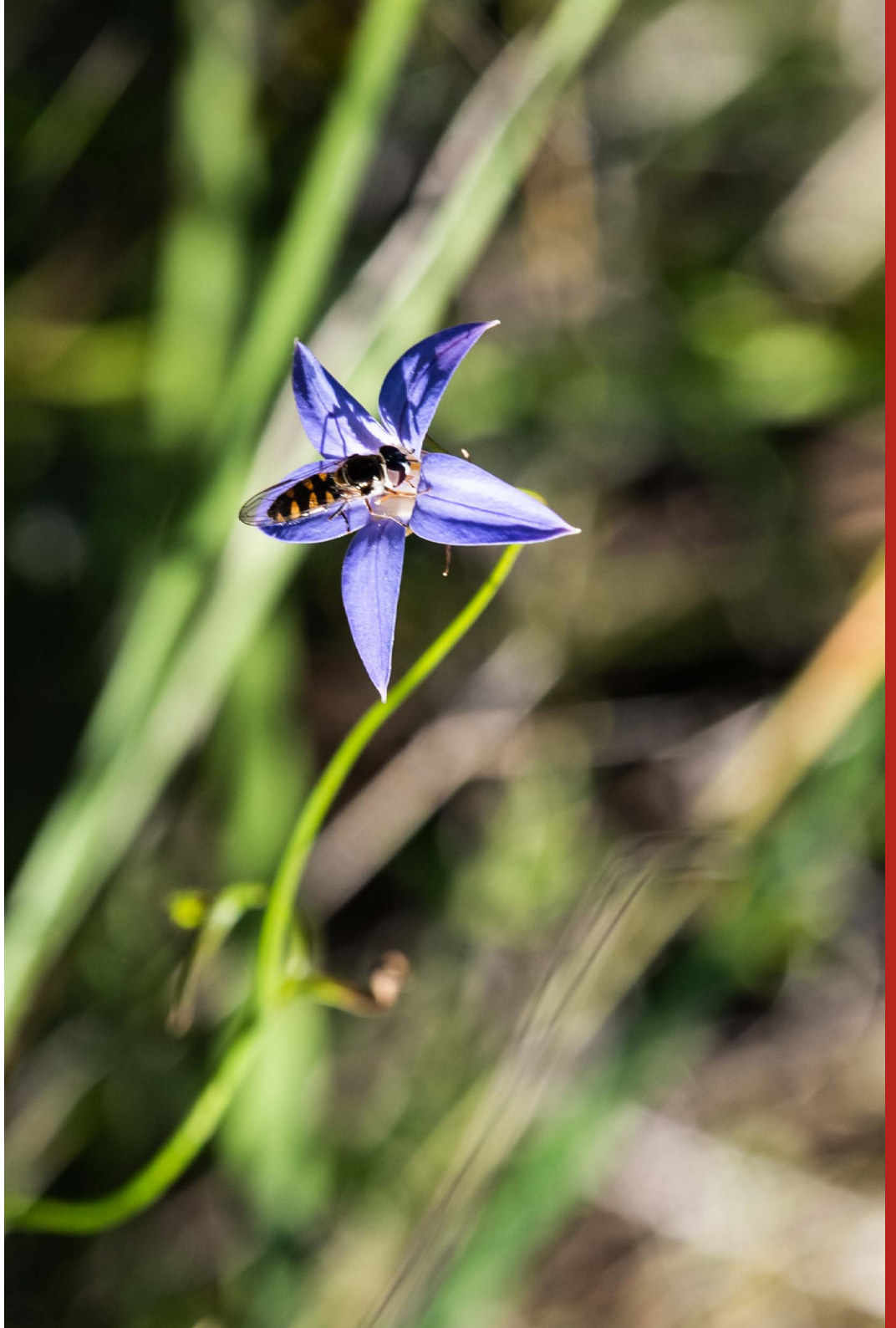

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"Emission offsetting through carbon credits is set to become a key contribution to the way Australia and the world achieves 2050 net zero emissions targets. The opportunity for primary producers is big."

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