Fact sheet

Co-benefit of trees on farm: Carbon sequestration

Carbon sequestration

Trees pull CO_2 from the atmosphere and as they grow, store the carbon as wood. Planting trees can therefore be used to reduce net farm emissions. Several factors influence the amount of carbon trees sequester, including:

- tree age
- rainfall and general site productivity
- tree species
- planting design.

Tree age

Carbon sequestration peaks early in a tree's growth (age 4–11 years depending on species) and levels off as trees reach maturity[1]. Thus, the sequestration benefits decline over time without additional planting.

The figure below shows three planting scenarios: 20ha planted all at once, gradually over 20 years, and a staged approach, where half are planted in the first three years and the rest over the next 17. Staged planting can maintain carbon sequestration rates over a longer period, rather than all trees peaking at one time.

Productivity and species

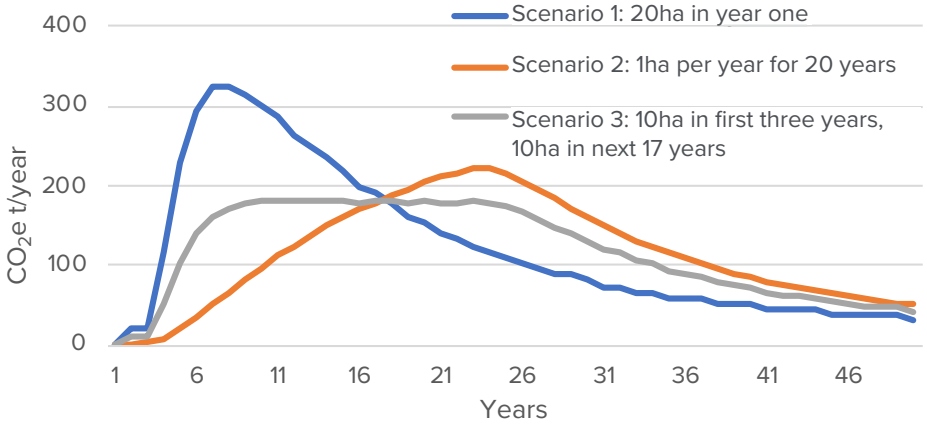
The rate of tree growth (and carbon accumulation) depends in large part on site characteristics and species composition. In the 300–350mm rainfall zone of Western Australia, an average sequestration rate over 30 years of 3.79 tonnes CO_2e/ha/year was reported for Mallee[2]. Conversely, a primarily shining gum and radiata pine plantation on a Tasmanian property with 700mm annual rainfall[3] sequestered 35.1 tonnes of CO_2e/ha in one year.

Although timber plantings typically sequester more carbon than environmental plantings, mixtures with timber and other species can achieve sequestration rates over 10t CO_2e/ha/year[4].

Planting design

Plantings in belts less than 40m wide can sequester more carbon per unit area than trees planted in a block. Modelled average sequestration rates over 25 years in environmental plantings in belts were about 50% more than block plantings at three sites in Victoria with different levels of productivity (Table 1). It should be noted that the difference between belts and blocks on your farm will depend on productivity and the width of the belt.

Figure 1: Carbon sequestration in 20ha environmental plantings with differing timings in Victoria (770mm annual rainfall; 6.6–8.6t CO_2e/ha/year sequestered over 30 years)



1 Paul K.I., Roxburgh S.H., England J.R. 2022. Sequestration of carbon in commercial plantations and farm forestry. *Trees, Forests, and People* 9:100284.

2 Shea S. et al. 1998. The potential for tree crops and vegetation rehabilitation to sequester carbon in WA. Carbon Sequestration Conf, Melbourne.

3 Hall R. 2010. Agricultural Greenhouse Gas Emissions Audits. Report prepared for Private Forest Tasmania.

4 Cunningham S. et al. 2015. Reforestation with native mixed-species plantings in a temperate continental climate effectively sequesters and stabilizes carbon within decades. *Global Change Biology* 21(4):1552–1566.

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Table 1: Modelled average carbon sequestration (tCO_2e/ha/year) over 25 years in environmental plantings in blocks and belt plantings (<40m wide) at three farms in Victoria with different levels of productivity

Site	Block	Belt
Dunkeld	12.7	17.8
Rosewhite	11.9	16.7
Tambo crossing	21.5	30.0

Net farm emissions

The extent to which trees offset farm emissions depends largely on sequestration and stocking rates. A case study analysis of high productivity farms (14–18 DSE/ha) found that annual average sequestration rate over 30 years from proposed plantings reduced net farm emissions by 21%, 35%, and 50% with plantings taking up 4.7%, 6.1% and 11.6% of the farms' area, respectively.

A modelling investigation found that in productive areas with stocking rates up to about 20 DSE/ha, 20% of the farm planted to trees would often result in carbon neutrality. Beef operations required slightly more area planted to trees than wool or prime lamb. All modelled farms with 6–10 DSE/ha and with 20% trees, stored more carbon than they emitted[5].

What to do with the carbon?

Carbon sequestered in trees can be used towards a net zero target for market purposes or sold into the carbon market as Australian Carbon Credit Units (ACCUs). Be aware, selling ACCUs means you cannot use this sequestered carbon to claim emissions reduction on your farm. There are several things to consider when deciding whether to retain carbon rights or to create and sell credits.

Scan this QR code to access the Agriculture Victoria website for assistance in your decision making

Figure 2: Mixed species planting at Yan Yan Gurt

Image: Hugh Stewart

If you intend to sell the carbon, you will need to follow ACCU method requirements. This means planting sufficient trees to meet the definition of forest (taller than 2m at maturity, at least 0.2ha and being able to achieve more than 20% canopy cover). You will also need to meet conditions for project registration, pay for audit and verification costs, and are legally required to maintain sequestered carbon for the long-term (25 or 100 years). These costs are high, so a significant area of trees is required to make it worthwhile. You cannot start planting until a project is registered.

Claiming carbon sequestered in trees for a net zero grazing objectives also requires assessment and monitoring, although this is not as stringent as for selling ACCUs. For example, you can include carbon sequestered in growing trees planted in the past. Specific accounting rules will depend on the standard (e.g. Climate Active, GHG protocol, etc.). You will still need to pay for an independent assessment.

5 Doran-Brown N. et al. 2017. Offsets required to reduce the carbon balance of sheep and beef through carbon sequestration in trees and soils. *Animal Production Science* 58(9): 1648–1655.

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