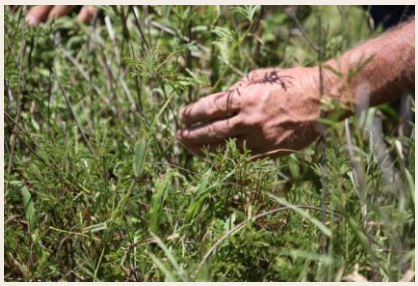
Research Case Study



"Any reduction in emissions from Australian agriculture will contribute to Australia's efforts to mitigate future climate change."

Jeff Baldock, CSIRO

Soils ain't soils – a Queensland perspective

With the commencement of the Carbon Farming Initiative, farmers are asking if they can trade the soil carbon they store beneath their feet – and when this might be feasible.

While trading in soil carbon may still be a long way off, there are more immediate and practical reasons why farmers, scientists and policy makers need to better understand soil carbon or soil organic carbon as it is more accurately known.

One of the problems for scientists and farmers interested in soil carbon is the lack of information about how much carbon is currently stored in Australia's soils and could be stored through altered management practices.

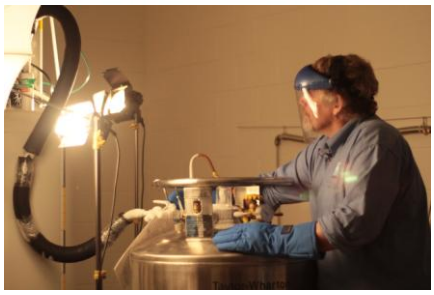
Dr Jeff Baldock from the CSIRO is leading the national Soil Carbon Research Program, an Australian Government funded research effort that is applying a nationally consistent assessment of soil carbon across different agricultural regions. The team is identifying region-specific land management practices that result in higher soil carbon, and developing fast, cost effective ways of measuring soil carbon content and composition.

"Past agricultural practices have typically led to reductions in the amount of carbon stored in Australian soils," Dr Jeff Baldock says.

"Some of the carbon captured by agricultural plants is removed every time a crop is harvested or an animal leaves the system. Over time, some agricultural systems have lost of up to 70 per cent of carbon held in the soil.

australia's farming future

“That has significant impacts on day-to-day agriculture as well as contributing to greenhouse gas emissions over the long term. For example, soils with lower levels of carbon may hold less moisture, so the potential productive use of rainwater would be lower.



Jeff Baldock is assessing soil carbon levels across different agricultural regions

“Our challenge for sustainable agriculture is to be able to build our soil carbon and reduce greenhouse gas emissions while boosting agricultural and food production for a growing world.

“This will become a bigger problem as a warmer, dryer climate means less water is available. The ability of the soil to hold on to that moisture will be critical.”

“To be in a position to measure and potentially reward landholders for soil carbon improvements with carbon credits it is vital that we have baseline measurements of soil carbon across Australia and sound and scientifically defensible methods for monitoring soil carbon changes over time ,” Dr Baldock says.

“This accurate baseline data on soil carbon and best bet opportunities are needed to help us set realistic sequestration options and targets for Australia and identify practical ways of reducing greenhouse emissions.

Progress has been good with research teams in each state collecting more than 16 000 individual soil samples from 3 500 locations across Australia’s agricultural regions.

“The results of the soil samples are paired with detailed history of the paddocks they’ve come from so we can build up a picture of the levels of soil carbon under different management regimes and soil types in different agricultural regions,” Dr Baldock says.

The most immediate and practical information coming from the research is the role perennial plants can play in improving soil carbon.

“We’ve looked at whether introducing perennial grasses such as kikuyu can help capture soil organic carbon, especially in those regions where carbon stores have been significantly depleted.

“We are also investigating other on-farm practices, including fallow management, tillage, grazing practices, crop rotations and fertiliser use to measure their long term effects on soil carbon.”

In Queensland, researchers have collected another 300 soil samples from farmers in a bid to help them understand more about the role soil carbon plays in a productive farming system.

This Queensland research is part of the $4.9 million National Adaptation and Mitigation Initiative (NAMI) which has been running for two years.

Dr David Lawrence from the Queensland Department of Employment, Economic Development and Innovation (DEEDI) said research has shown that cropping has the biggest effect on soil carbon.

"Even on the best clay soils, cropping reduces soil carbon from over 3 per cent as it was under native timber to 1 per cent or less over a period of 30 years," said Dr Lawrence.

"Productive pastures can bring soil carbon back up to levels over 2 per cent, but only if the soils are not deficient in nutrients, like soil phosphorus.

"Traditionally, farmers in this neck of the woods crop the country until they need to apply fertilizer and then they put it back to pasture.

"If we can help people to understand more about how organic matter works, perhaps they will be more likely to retain the productive capacity of the country as they go in and out of cropping."

David Lawrence, DEEDI

"But what we've found is that when people do that they often don't have enough nutrients, especially phosphorus, to grow decent legumes. Unfortunately, their pastures can remain pretty ordinary with low productivity and little benefit to soil organic matter and soil carbon until they fix it."

"If we can help people understand more about how organic matter works, perhaps they will be more likely to retain the productive capacity of the country as they go in and out of cropping."

The tests conducted in the Brigalow area found that farmers had soil carbon levels of between 0.5 to -3.8 per cent (roughly five to 40 tonnes per hectare) in the top 10cm of their soils with an average of 1.4 per cent organic carbon (roughly 14 tonnes per hectare).

Dr Lawrence said in the past there was concern that if farmers planted a crop every year they would quickly burn out their country but for soil organic matter and soil carbon the science is actually indicating the opposite may be true.

"If you are trying to boost soil organic matter, the amount of dry matter you produce and put back into the soil actually determines the levels of soil carbon."

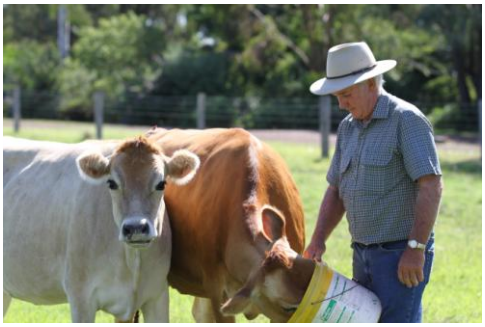
"So growing strong pastures that produce lots of dry matter is probably the best thing that people can do for soil organic matter. However, growing more crops with better yields, and returning the stubble, roots and dry matter back into the ground will also help maintain soil organic matter and soil carbon levels."

He said rather than burning paddocks or removing stubble for hay or green chop, producers should try to keep as much ground cover on their paddocks as possible.

"Burning occasionally won't cause too many problems, but if you want to run your soil organic matter down, burning your paddocks or making hay every year and then having really long fallows with no cover on it is the quickest way to do it."

One farmer keen to understand more about his soil carbon is Greg Olm who fattens yearling cattle at Yambella Park, a 320 acre former soldier settlement block in the Brigalow district of central Queensland.

Mr Olm said a lack of productivity in one of his paddocks prompted him to test his soil carbon levels.



Cattle producer Greg Olm has increased carbon levels in the soil, boosting productivity

”I hadn’t used fertiliser and did not really want to — I wanted to see if I could build up the production naturally,” Mr Olm said.

He initiated a ley pasture program which involved planting Purple Pigeon grass *Setaria incrassatea,* Bambatsi grass *Panicum coloratum* and snail medic *Medicago scutellate*.

“The cattle did extremely well. Up until then they were averaging about 0.5 kilograms per day in dry conditions,” said Mr Olm. “But after using the (grass and) medics as a ley pasture, the cattle put on just over one kilogram per day.”

Mr Olm said when the pasture began to show signs of stress after 10 years, he ploughed it out and re-planted the paddock to wheat which was harvested in October 2011.

“We were yielding about 18 bags to the acre and while the crop wasn’t making Prime Hard it was achieving 12.6 per cent protein,” Mr Olm said.

“Most of the crops in this district were getting between 9 and 10 per cent protein, so to get 12.6 per cent was a very pleasing result.”

He said he believes the ley pasture program helped put carbon back into the soil which in turn boosted productivity. Soil testing in the NAMI project confirmed this, and showed that the total soil carbon levels increased from 0.92 to 1.38 per cent, an increase of 50 per cent.

“I know there were tests done on other farms in the region where a lot of fertiliser was applied. While the nitrogen may have been higher, the soil carbon stores were significantly lower. So I think the ley pasture program has been very beneficial from both an environmental and profit perspective.

“The two go hand-in-hand. You can’t be environmentally friendly and go backwards. You have to be environmentally friendly and make a dollar and that worked in my case.”

Dr Lawrence said while soil carbon may be profitable in a carbon based economy, the real benefit for farmers will be in the organic matter in the soil.

“While carbon is important, it is the nutrients that drive productivity that will continue to dominate decision making for the time being,” Dr Lawrence said.

According to Dr Baldock, the soil carbon research will be used to advise farmers on a regional level about the management practices that they can adopt to increase their soil carbon, or at least slow down the rate at which it is lost.

“Improving soil carbon levels for productivity and as a measure of greenhouse gas emissions is becoming an increasingly important part of sustainable, long term farming in Australia,” said Dr Baldock.

”Any reduction in emissions from Australian agriculture will contribute to Australia’s efforts to mitigate future climate change.”

About Australia’s Farming Future: Climate Change Research Program

The Australian Government’s Australia’s Farming Future: Climate Change Research Program is a significant research effort aimed at providing practical solutions for our primary industries to adapt to the changing climate. The Climate Change Research Program (CCRP) has provided funding for research projects and on-farm demonstration activities under the three priority areas of reducing greenhouse gas emissions, improving soil management and research into adaptation management practices.

The CCRP has laid the vital groundwork for further research, demonstration and extension that will now occur through the Australian Government’s $429 million Carbon Farming Futures Program.

For further information on the CCRP or any of the funded projects, please phone 1800 638 746 or visit www.daff.gov.au/aff

This case study is part of a series produced by the Department of Agriculture, Fisheries and Forestry as part of the Climate Change Research Program.