Research Case Study

"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."

Jeff Baldock, CSIRO

Soils ain't soils – soil carbon in southern Australia

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.

“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.”

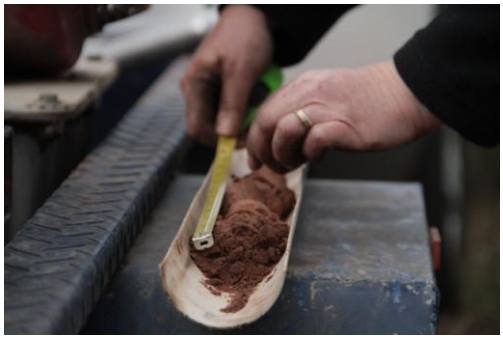
“To be in a position to measure and potentially reward landholders for soil carbon improvements with carbon credits it is vital that we have baseline measurements of soil carbon across Australia and sound and scientifically defensible methods for monitoring soil carbon changes over time ,” Dr Baldock 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 results will be highly specific to climatic regions and soil types. We may end up recommending certain management strategies within one region and soil type and quite different ones in different circumstances within the same region or in another region.”



Soil sampling

Until now one of the major barriers to research into soil carbon has been the cost of the soil tests – however that may be changing with the work being done by Dr Baldock and his team from CSIRO and State agencies.

“Past analysis techniques were very expensive and labour intensive – costing literally thousands of dollars,” Dr Baldock says.

The team is assessing a new method for measuring the concentration of organic carbon using mid-infrared spectrometers that provide a “fingerprint” of soil carbon content and composition. While it’s still early days, the method shows promise.

“If the technique can be successfully developed, it will provide a more rapid and cost-effective means of measuring soil organic carbon content and its composition than is currently available.”

Of immediate and practical use to farmers, the team's work is also showing the role that perennial plants can play in improving soil carbon.

"In areas where soil carbon has been run down by intensive agriculture, introducing perennial grasses including kikuyu can capture additional soil organic carbon," says Dr Baldock. "We are investigating other farm practices, including fallow management, tillage, grazing practices, crop rotations and fertiliser use to measure their long term effects on soil carbon."

"I believe it will be beneficial for us to increase the organic carbon in our soil." Roger Lange

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But what does the program mean for Australia's farmers in the longer term?

"At the end of the day, our research will be used to advise farmers on a regional level about the management practices that may lead to higher soil carbon stocks," Dr Baldock says.

"Improving soil carbon levels for productivity and as a greenhouse gas measure is an important part of sustainable, long term farming in Australia.

"At the national level, our data will be of use to policy makers to develop realistic sequestration options and targets based on sound science.

"Increasing the amount of carbon stored in soils will help us sustain agricultural productivity and increase the health of our soils and may help reduce or offset Australia's agricultural emissions of greenhouse gases

Roger Lange, who runs a 2750-hectare cropping/grazing enterprise in a 375-400mm rainfall zone near Appila in South Australia's upper north, has had his soil carbon tested as part of the project.

"I've always been interested in soil carbon and thought there had to be better ways of measuring it," he says.

"We run a continuous cropping operation on 2600 hectares of the property and I'm looking forward to seeing how the organic carbon in the soil relates to cropping rotations.

"I believe it will be very beneficial for us to increase the organic carbon in our soil. Retaining stubble has really helped us manage our hard setting red brown earths and increasing soil carbon is going to improve the soil's water holding capacity and structure, improve the mineralisation cycle and generally make it more friable and workable.

"Those things all help what happens under the ground by increasing microbial activity and making nutrients more available – leading to better crop establishment and crop growth.

Roger says he's not holding out for carbon trading in the long term. "The real benefit of increasing carbon in the soil is in the short term, immediate effects on productivity," he says.

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.