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Boosting Soil Carbon, Nth Vic
Final project results

Sequestering Soil Carbon in an Irrigated Landscape turned Dry Ecological Grazing

This *Action on the Ground* project* has aimed to demonstrate on-farm practices that may boost soil carbon levels in dry inland Victoria. The practices are based on the conversion of historical flood-irrigated cropping to dryland cell grazing on native forage in conjunction with protected biodiversity. The project is located near Lake Boga in northern Victoria.

This fact sheet summarises the final technical results of this project as well as implications for similar soil carbon initiatives in the future.

Headline outcome

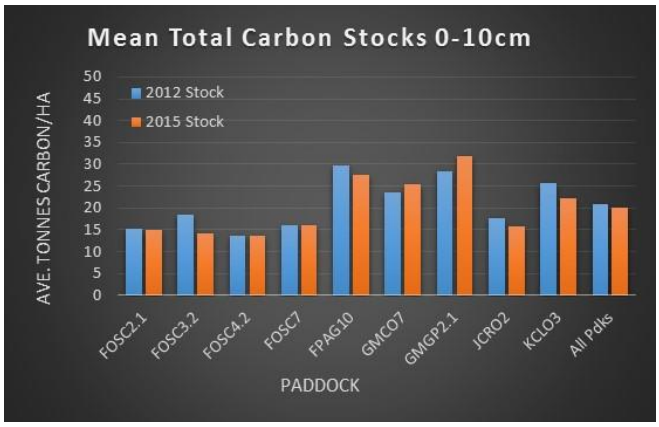
The key assumption of the project was that the return of permanent dryland groundcover to the landscape should result in more perennial vegetation, less cultivation, and therefore a gradual increase in and retention of soil organic carbon compared to the previous irrigated land use.

However, in the timeframe of this project, and especially in a likely circumstance of low accumulation rates in a naturally low soil carbon environment, it was not possible to demonstrate a statistically significant increase in soil carbon levels under the tested land use change scenarios between the 2012 baseline year and 2015. This conclusion held for both individual and grouped land use paddocks.

Soil carbon change

When combining all data together the average Total Carbon (TC) stock declined over the course of the project by only 1.4 t C/ha (or 3%) over the 0-30cm sampling depth. However, this result was well under the change of 7 t C/ha required for statistical significance. Confidence in the result was greatest in the 0-10 cm interval where behaviour of the data appeared more reliable. Stock changes were also within the magnitude of seasonal fluctuation reported in other relevant studies.

Soil carbon change for individual paddocks and for paddocks that could be grouped by their land use treatment varied, but these results were almost all statistically insignificant. There were a few very large changes in individual paddocks evident in the 10-30 cm subsoil interval that, while significant in a statistical sense, would seem to be the result of methodological or analytical issues that affected some of the data.



Average 0-10cm Total Carbon (TC) Stocks by paddock (and all paddocks combined) in 2012 and 2015. All change was statistically insignificant.

The pattern of spatial distribution, magnitude and change in soil carbon levels appears complex. It is likely that differences in landscape position and paddock histories are important factors in the baseline levels of soil carbon, with the overlay of seasonal variation likely masking any change brought about by the land use change being tested.

Project challenges

It became apparent following statistical analysis of the baseline dataset that with the sampling density employed (18 sites per paddock) it would be unlikely that the project would discern a statistically significant

change in carbon stocks within its timeframe. The chances of a statistical increase would perhaps also be diminished by a substantially drier than average climate experienced during the project. Nevertheless it was hoped that some positive patterns in trends would be able to be discerned in the data.

A further challenge in the project was the unreliability of samples taken October 2014 (the survey was subsequently repeated in July 2015). The 2014 sampling experience highlighted that a critical threshold of soil moisture is required to enable the extraction of intact soil cores critical for an accurate analysis of soil carbon. Recognition of suitable soil moisture conditions is essential before proceeding with sampling.

Ultimately there were some perplexing aspects to the soil carbon data that provided a challenge in its analysis. Several large fluctuations were evident in the 10-30 cm data that may revolve around the lab treatment of the higher Inorganic Carbon content of this interval. The behaviour of the 0-10 cm data was much more consistent and reliable and was subsequently used as the main basis for conclusion of soil carbon in this project.

Pdk FOSC4.2, May 2013

Pdk FOSC4.2, May 2014

The wide seasonal variation in vegetation growth is a source of fluctuation in soil carbon levels that masks longer term trends over short timeframes.

Project Activity 2012-2015

This project entailed sampling of 9 trial paddocks reflecting 4 management treatments (grazing, protected biodiversity and whether these had been passively or actively revegetated). Sampling and analysis for soil carbon was undertaken in October 2012 and again in July 2015. Each paddock was sampled at 18 randomised locations on each occasion.

Activities to support interpretation of the soil data included the collation of knowledge on soils and landform; paddock land use history; and documented paddock management during the course of the project. A number of ancillary datasets were also collected including daily grazing records; a 6 monthly paddock photo history; and paddock vegetation surveys.

Refer to the project website to access all project reports

Implications of the project

This project has demonstrated that a multi-decadal approach is likely required to statistically determine soil carbon changes in dry, semi-arid (<350 mm) environments. It will require significant discipline to maintaining appropriate paddock management practices and monitoring over long periods.

This commitment will be further tested in a drying climate with the anticipation of reduced effective rainfall for vegetation growth. The successfully entry of like-projects into carbon markets will require development of cost efficient, accurate and repeatable measurement methodologies where there is only slow growth (and in $ value) of soil carbon.

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