

SOIL ORGANIC CARBON UPDATE 2022-2023

Summary Report
June 2023



PHOTO: Growing regenerative farming systems project,
Upper Goulburn Landcare Network

Goulburn Broken Catchment



National
Landcare
Program



GOULBURN BROKEN
CATCHMENT MANAGEMENT AUTHORITY

from the **ground up**

This project is supported through funding from the Australian Government's National Landcare Program

Introduction

This report provides an update on the state of soil organic carbon in the Goulburn Broken Catchment and farmer actions towards its management.

Soil test data collected in 2022-2023 provides a snapshot of soil carbon levels.

Farmer survey data, collected from 2019-2023, provides insight into current land management.

What is SOC and why are we interested in it?

The term soil organic carbon (SOC) refers to organic carbon found in the organic (derived from plant or animal) component of soil.

Soil organic carbon is a critical component of soil health and has a major influence on soil biological processes, soil chemistry and fertility, and soil physical properties, such as structural stability and soil water-holding capacity.

Soil organic carbon levels are driven by soil type, climate and, to a lesser extent, land management. This is because soil type and climate drive plant growth and therefore carbon cycling.

**Goulburn Broken
Regional Catchment
Strategy (2021) target:
SOC levels above 2%, and
where possible,
increasing.**

Where land has been cultivated or continuously cropped, with and without irrigation, we often see SOC levels below 2%. This issue is well recognised by industry as it results in reduced productivity and issues such as non-wetting soils. Industry is working on management approaches to address it.



PHOTO: Increasing soil carbon to ameliorate soil compaction in cropping soils project, Irrigation Farmers Network Inc.

From the Ground Up project 2018-2023

For the last five years, From the Ground Up was our primary investment opportunity to meet the Regional Catchment Strategy (RCS) SOC target. The project worked with farmers, industry and community groups to improve soil health, native vegetation and biodiversity on-farm to boost the region's agricultural productivity and profitability.

From the Ground Up project goal: 356 farmers across 4,640ha have adopted practices to increase or maintain SOC levels above the baseline of 2.7%.

In 2018, the project adopted a baseline of 2.7% SOC based on the median SOC percentage across the Goulburn Broken Catchment from 1,398 soil samples collected between 2011-2017.

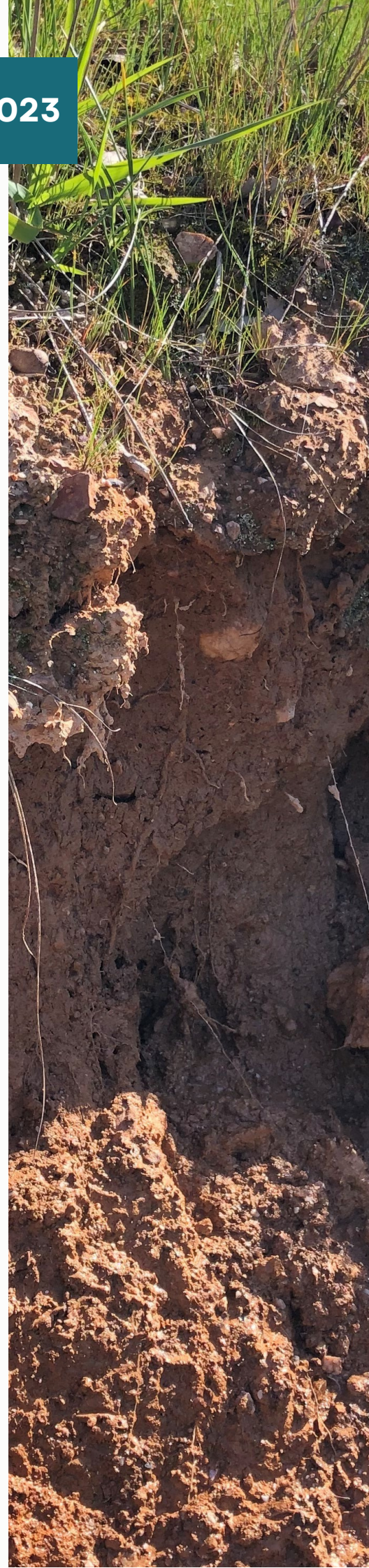
The baseline is different from the RCS target, set in 2021, as the RCS target recognises the challenges of maintaining SOC in some farming systems with current practices, which brings the catchment average down. Meanwhile, From the Ground Up worked to meet and/or increase SOC levels from the measured baseline.

Soil sample collection and analysis

In 2022, the Goulburn Broken CMA released an Expression of Interest (EOI) to farmers to access free soil chemical tests. Farmers with up to 40ha were eligible for one soil test, 41-80ha-two tests, 81ha and over-three tests.

Soil samples were mostly collected from participating farms by Goulburn Broken CMA staff using Victorian DPI Property Snapshot 9 (2009) methodology whereby 25-30 10cm cores were taken from the sample area, bulked and sub-sampled. Consistent samples from From the Ground Up sub-projects were included in the analysis.

269 samples were analysed for this report. Soil organic carbon was measured using the Walkley-Black method.



Results

Soil samples were undertaken across all but the Southern Forests Socio Ecological System (SES) (Figure 1), where no EOIs were submitted.

The average SOC from 269 samples was 3.22% and the median SOC was 3.29% which indicates that most farmers were managing their SOC at or above the baseline of 2.7% in 2022-2023 (Table 1).

The Agricultural Floodplains and Productive Plains SESs had median SOC levels of 1.8% and 2.1%, respectively (Table 1), lower than the baseline 2.7%. These SESs are located in a lower rainfall zone of the catchment with a high proportion of annual cropping land use, which could explain lower SOC levels in these areas.

In 2019, we found that a greater portion of the samples submitted from the Agricultural Floodplains and Productive Plains had SOC of 2% and above (Costin, 2019). Whether there is a shift in SOC levels, or it is explained by the variability in samples, we cannot say from this dataset. 2022-23 was a good rainfall year and many areas in these SESs were flooded in October 2022. This may have reduced participation in the soil testing program in 2022-23.

The Upland Slopes SES can be characterised as higher rainfall with grazing land use dominant.

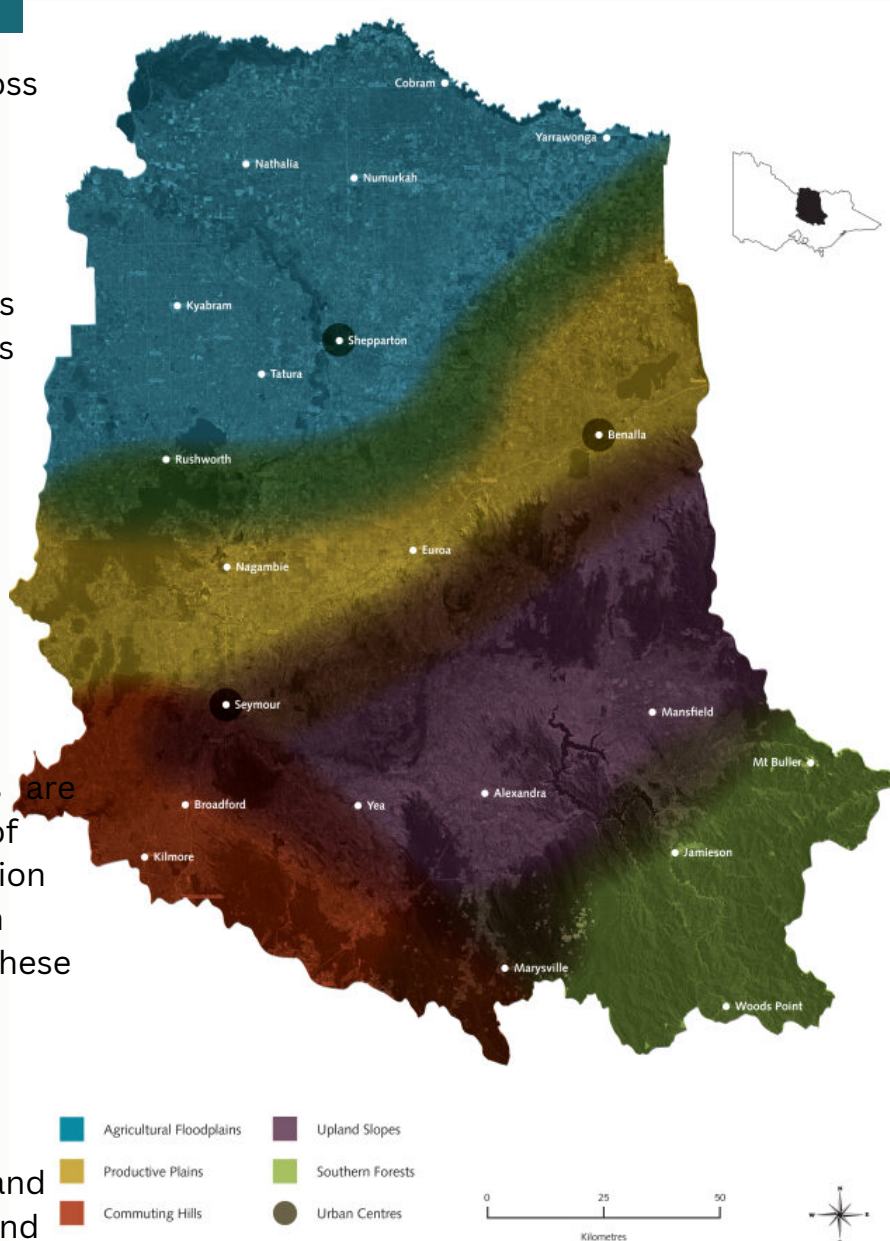


Figure 1. Socio Ecological Systems in the Goulburn Broken Catchment.

This is important because pasture-based systems usually have higher SOC levels than annual cropping systems. The Upland Slopes SES has shown a shift to more results in the 3-3.99% range from the 2-2.99% range found in 2019 (Costin, 2019). This may be influenced by three La Nina years since 2019 but further data and investigation is needed.

Table 1. Soil organic carbon figures from each Socio Ecological System.

SES	No. samples (n)	Average SOC (%)	Median SOC (%)	Range SOC (%)
Agricultural Floodplains	46	1.8	1.8	0.8-3.16
Productive Plains	48	2.3	2.1	0.87-5.5
Upland Slopes	118	3.6	3.7	2.06-6.08
Commuting Hills	57	4.3	4.3	1.95-6.11
Southern Forests	<i>Not tested</i>	-	-	-
Total	269	3.22	3.29	0.8-6.11

The Commuting Hills SES showed a positive shift in SOC levels between the 2019 assessment (Costin, 2019) and 2022-23 assessment. In 2022-23 there were more samples in the 4-4.99% range than the 3-3.99%. The Commuting Hills SES had the highest median and mean SOC across the Catchment of 4.3% with a range 1.95-6.11% (Table 1). This SES has a mixed land use dominated by grazing.



PHOTO: Multispecies pastures, Grasslands Society of Southern Australia Sustainable and Profitable Grazing Systems symposium.

Evaluation surveys

Over the 5 years from 2019-2023, 1,383 people participated in SOC-related extension activities. Of these, 805 were farmers managing more than 116,000 hectares. Activities were delivered by the Goulburn Broken CMA and partnering Landcare and industry organisations.

439 event evaluation surveys, representing 32% of participation, were collected from 31 SOC-related workshops and field days. Evaluations were completed by farmers/landholders (73%) and service industry members (agronomists, consultants etc) (27%).

Service industry workers were asked how many clients they were likely to share their learnings with. They indicated they would engage a further 2,185 people with information about SOC and its management gained from the project.

97.4% of respondents (n 155) indicated they had better awareness of SOC and its management after participating in events.

The average understanding of SOC management before participating was 4.8 out of 10 (n 214) and after participating increased to 7.9 (n 214). Importantly, 89% (n 357) of respondents indicated they would do something different on their farm because of their participation. 114 of these respondents nominated an area of 14,887 hectares on which they would change or trial new management practices.



Conclusions

Soils sampled in each SES reflected broad land uses and SOC levels; the more intensive the land use the lower the SOC levels as a rule. However, to understand the impact of management practices related to land use we need further data.

There was a very positive shift in knowledge, awareness and skills reported due to attending extension activities as part of the From the Ground Up project. Most participants expected to implement changes in their management as a result.

The evidence presented here indicates that the From the Ground Up project met its goal of 356 farmers managing soils to maintain or increase SOC levels at or above 2.7%. It engaged with over 800 farmers, 78% of whom reported they had adopted change related to SOC management. At the same time, the average soil organic carbon level of 3.22% across the catchment exceeded the baseline of 2.7% set in 2019 and the RCS (2021) target of 2%.

References

Costin, B. (2019). Goulburn Broken Soil Carbon Mapping Report. Victorian Department of Jobs Precincts and Regions.

Department of Primary Industries.
(2009). Property Snapshots 9.

Goulburn Broken Regional Catchment Strategy 2013-2019. Goulburn Broken Catchment Management Authority. Goulburn Broken RCS (2021).

We would like to thank our delivery partners:

- Goulburn Murray Landcare Network
- Upper Goulburn Landcare Network
- Irrigation Farmers Network Inc
- Riverine Plains Inc
- Hughes Creek Catchment Collaborative
- Vic No Till Farmers Association
- Agriculture Victoria

For the full version of this report
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PHOTO: Dr Cassandra Schefe, AgriSci, presenting at 'Soil Carbon - what is it all about', Strathbogie