Subsoil Carbon Dynamics in Long-Term Grazing Systems of Northeast NSW

Evanna McGuinness

Supervisors: Dr Abe Gibson, Dr Joanne Oakes, Dr Mark Farrell, Dr Naomi Wells

Background

Did you know that subsoils are often overlooked in **soil organic carbon (SOC)** studies?

However, since subsoils (30~100 cm) are often a bigger proportion of the profile, they actually account for a large amount of SOC stocks.

If we don't know what's below the topsoil, how can we monitor change and effects?

Figure 1. Soil pit, showing the depth of soil studied and the largely overlooked subsoil

Project Aims

1. Quantify subsoil C content and stocks in the 30-100cm depth; across long-term grazing systems of Northeast NSW.
2. Determine primary factors influencing SOC at this depth, and the source of this carbon.
3. Explore the influence of soil type and mineralogy in the sequestration potential of soils with differing subsoil properties.

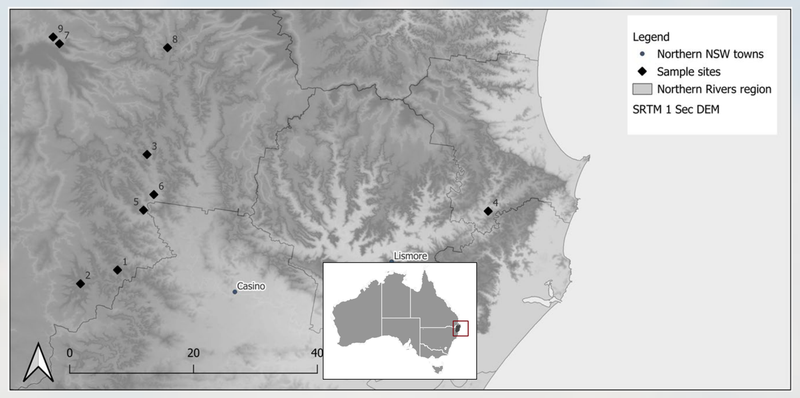

Figure 2. Map of study region and sites, with a DEM overlay, including locality map of Australia

Findings and Future Directions

Findings:

Subsoils account for 20–80% of total C stocks (fig. 3).

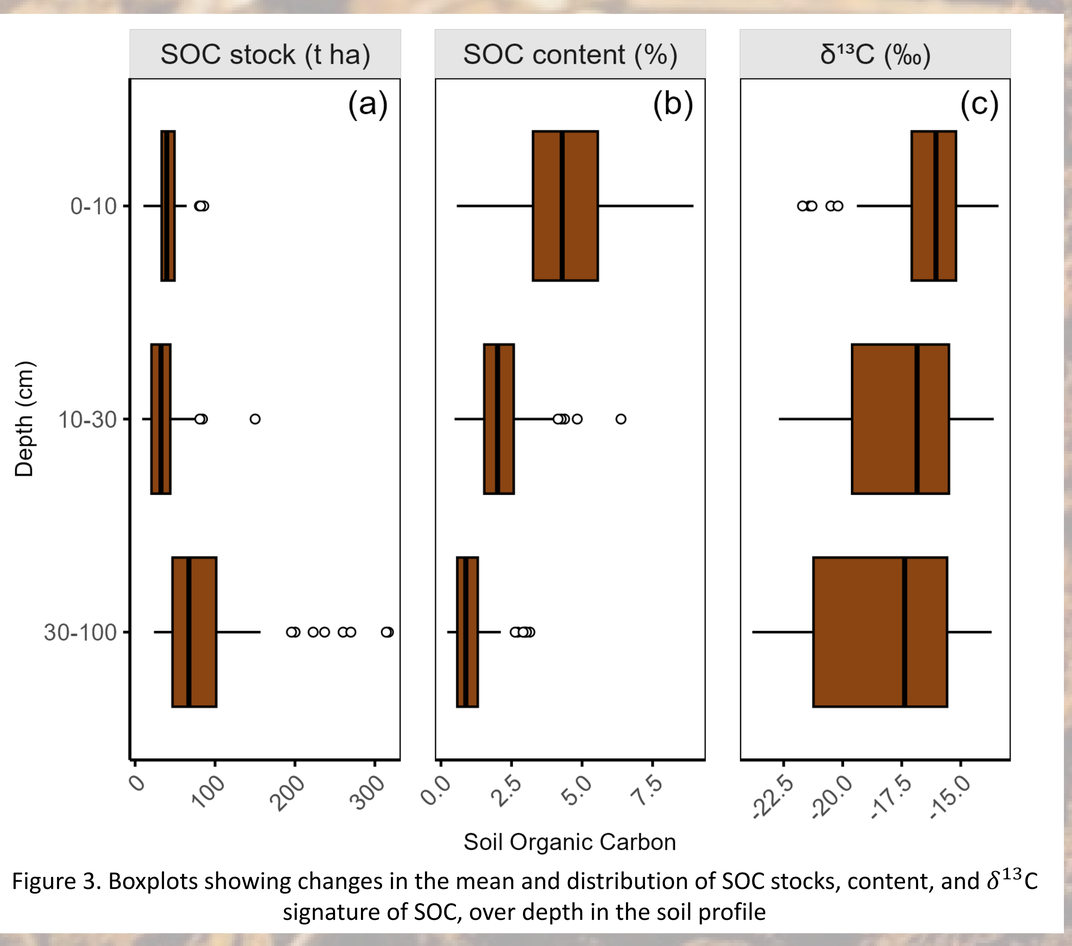

Figure 3. Boxplots showing changes in the mean and distribution of SOC stocks, content, and $\delta^{13}C$ signature of SOC, over depth in the soil profile

Isotope signatures indicate that much of this SOC is derived from the perennial pastures (fig. 4).

Subsoil variability indicates site specific processes for the retention of C from other (older?) sources (fig. 4).

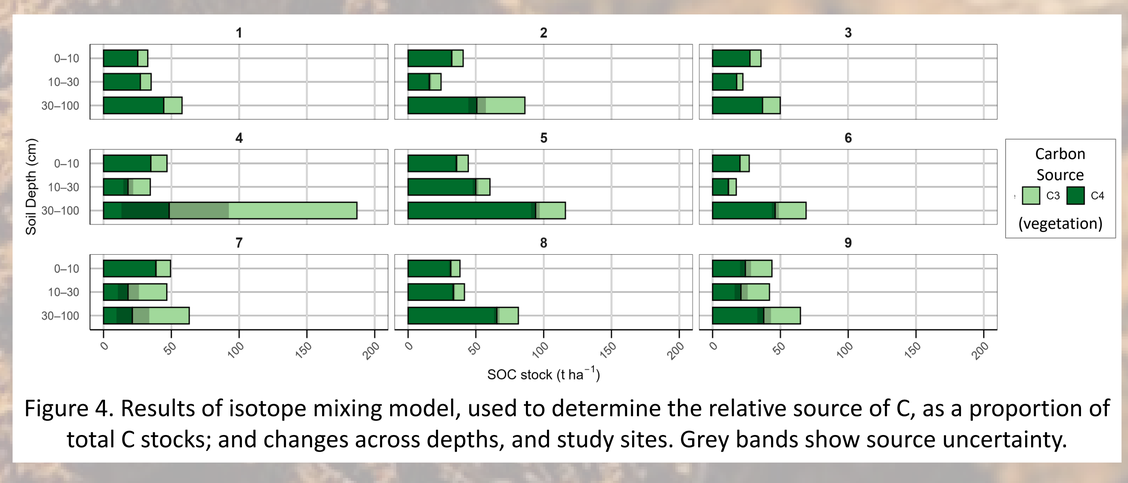

Figure 4. Results of isotope mixing model, used to determine the relative source of C, as a proportion of total C stocks; and changes across depths, and study sites. Grey bands show source uncertainty.

Future directions:

Batch sorption experiments will be conducted to better understand the processes responsible for the stabilisation of C in the subsoil. These results can inform land managers and policy makers about soils with greater potential to promote C sequestration outcomes, deep down the soil profile.

Failure to account for subsoils in SOC research overlooks a large and important potential C sink, or source.

Do your growers know what's beneath their topsoil?

SOIL CRC
Southern Cross University
LINCOLN UNIVERSITY
TE WHARE WĀNAKA O AORAKI
Australian Government
Department of Industry, Science and Resources
Cooperative Research Centres Program

e.mcguinnesss.13@student.scu.edu.au