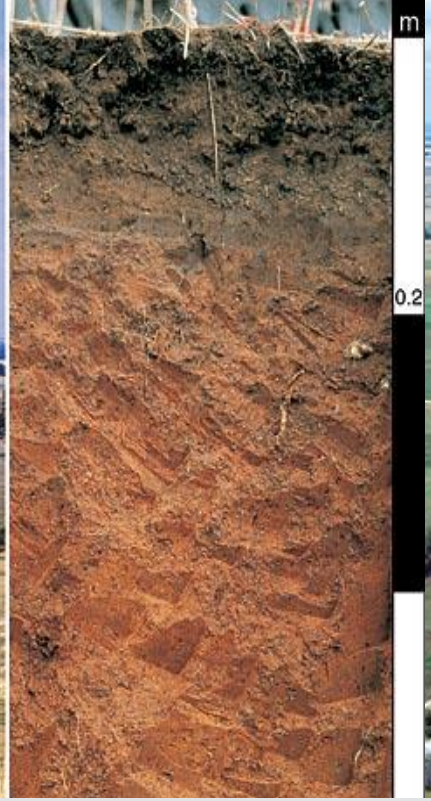


Soil carbon in a carbon accounting framework

Jeff Baldock
Soil carbon workshop
5 May, 2010

National Research FLAGSHIPS
Sustainable Agriculture

CSIRO

Outline

- Soil carbon cycle, fractions and profiles
- Issues for consideration
  - Absolute versus relative differences
  - Saturation and permanence
- Potential for increasing soil carbon
- Measured changes in soil carbon associated with management
- R&D needs – DAFF/GRDC soil carbon research program

What is soil organic carbon

Soil organic carbon

Crop residues on the soil surface (**SPR**)

Buried crop residues (>2 mm) (**BPR**)

Particulate organic carbon (2 mm – 0.05 mm) (**POC**)

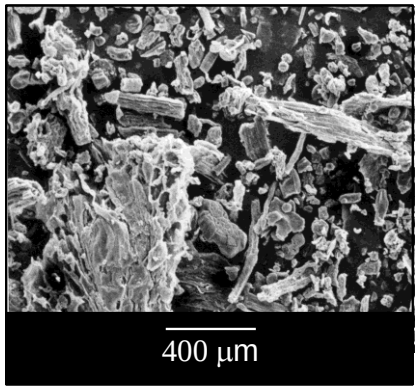
Humus (<0.05 mm) (**HumC**)

Resistant organic carbon (**ROC**): dominated by charcoal

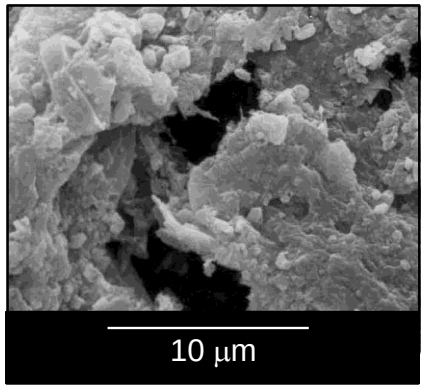
Extent of decomposition increases

C/N/P ratio decreases (nutrient rich)

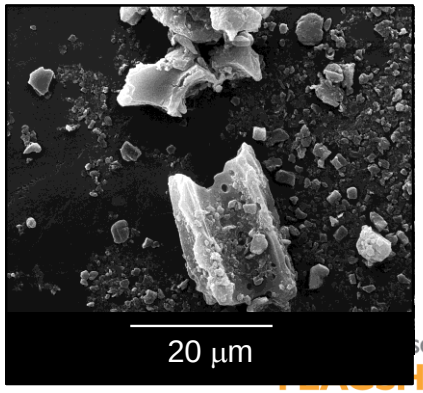
Particulate carbon (2mm – 0.05 mm)



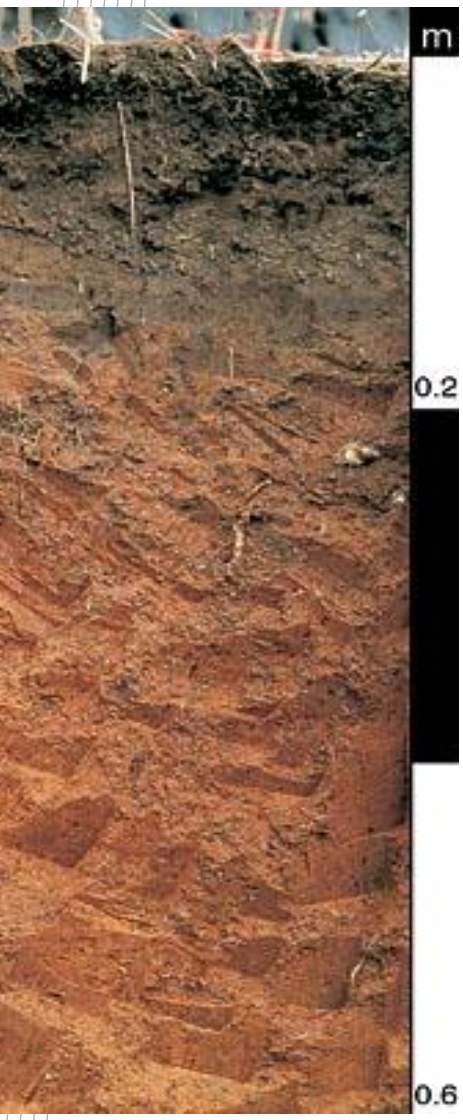
Humus carbon (<0.05mm)

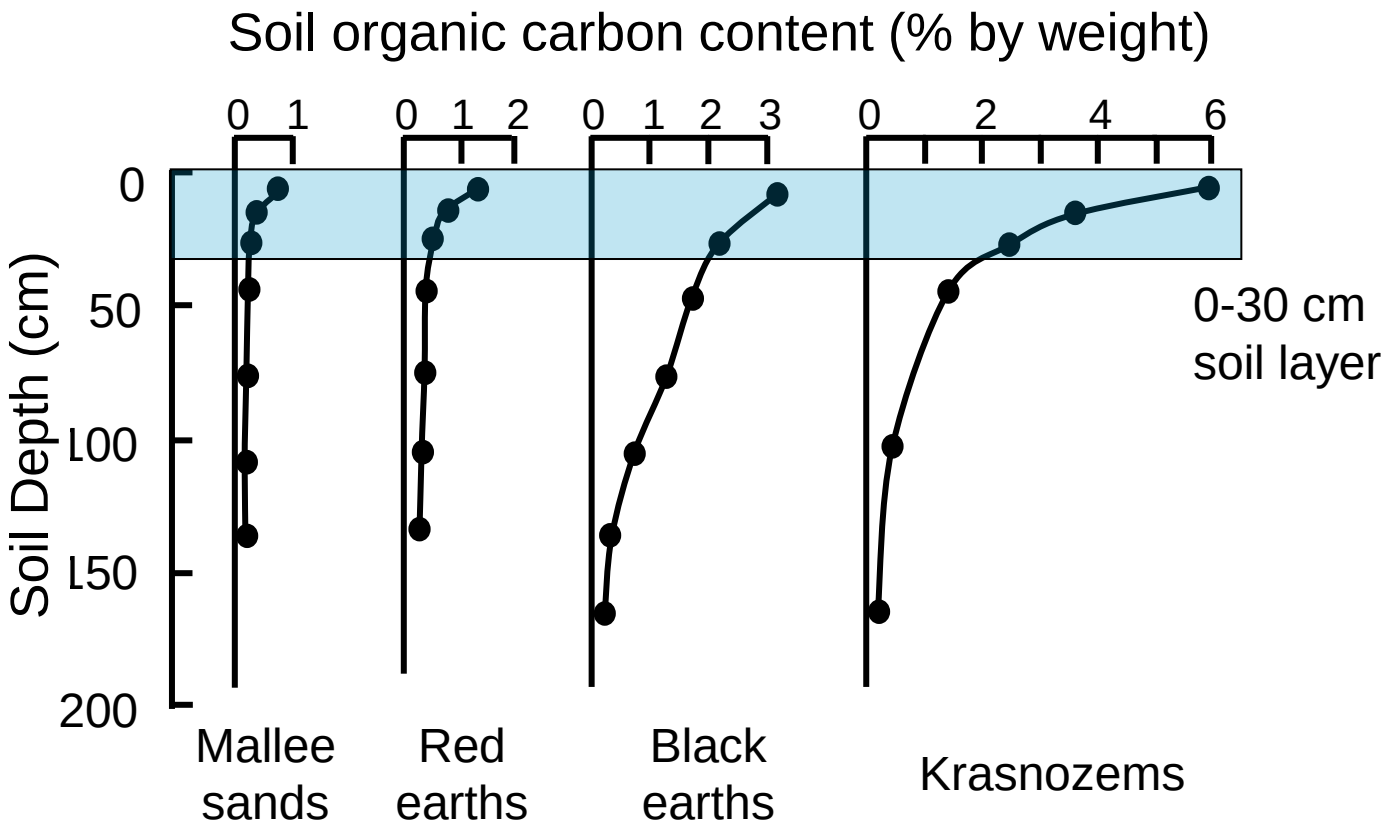


Resistant (charcoal <2mm)



Variation in soil organic carbon with depth for different soils

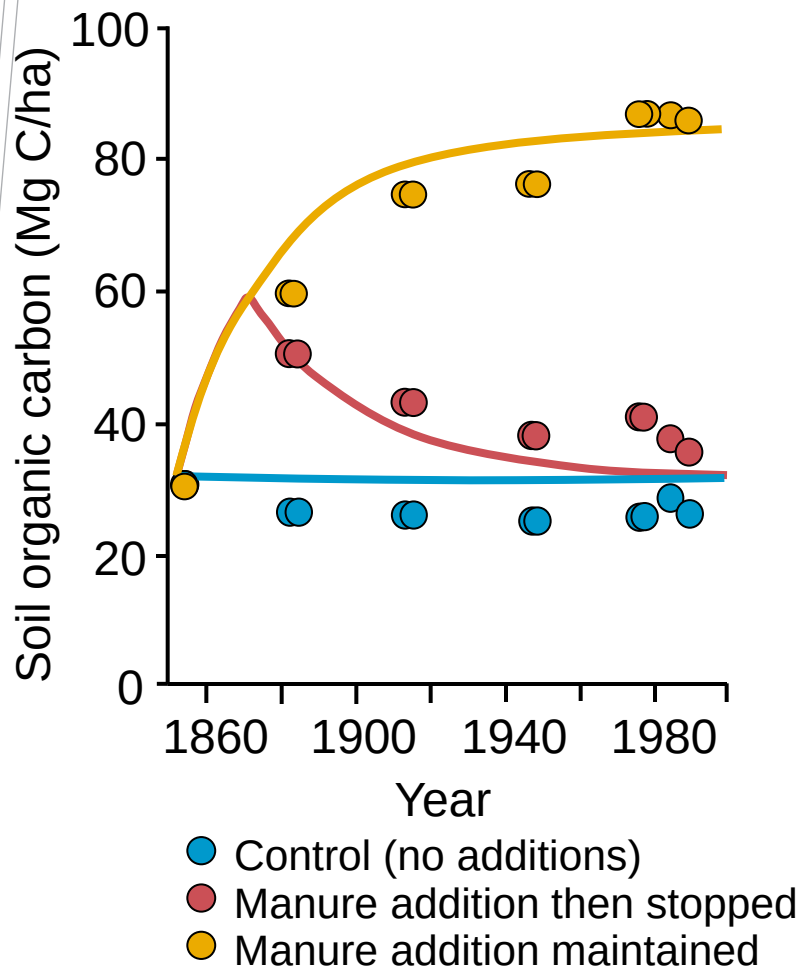




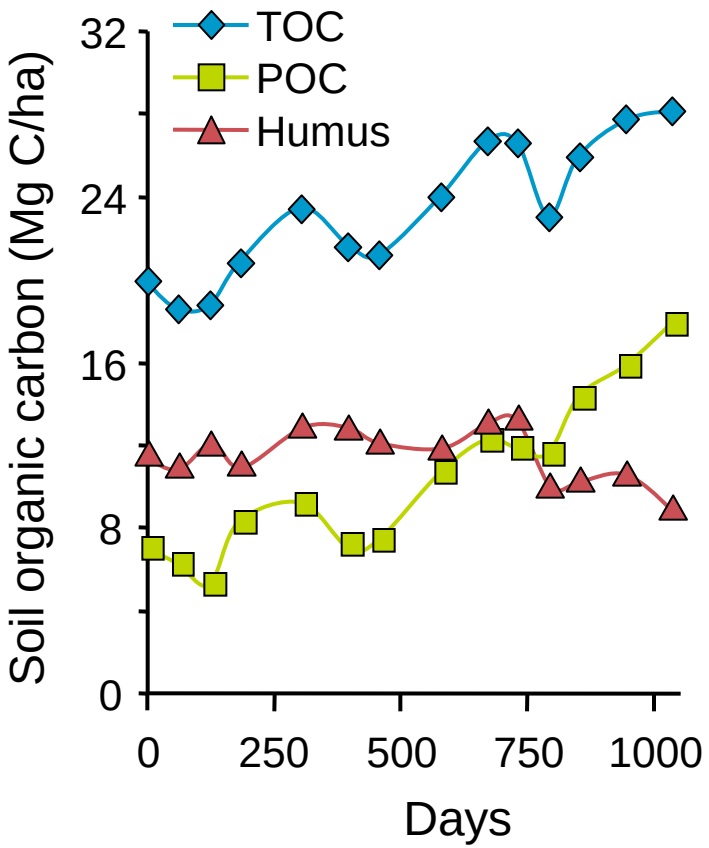
- Different soils contain different amounts of carbon due to variations in mechanisms of protection
- Surface soil carbon cycles faster

National Research FLAGSHIPS Sustainable Agriculture CSIRO

Saturation and permanence



From Petersen et al 2005

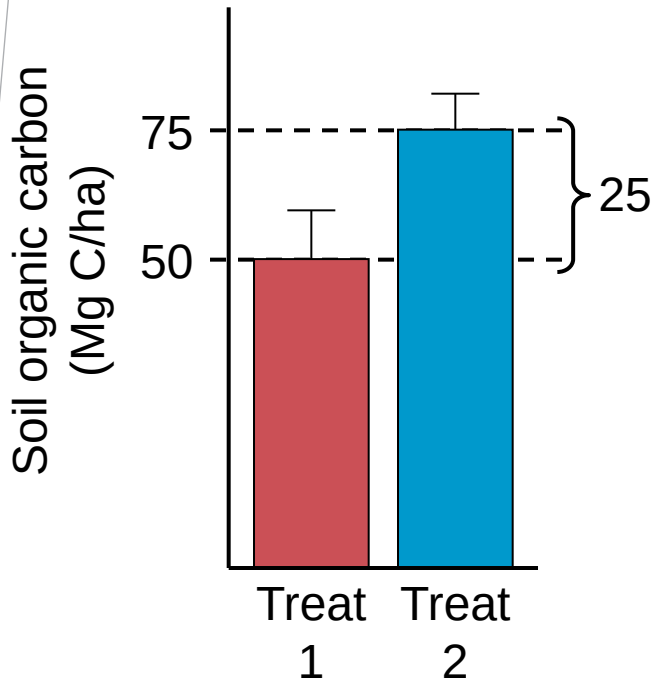


National Research FLAGSHIPS Sustainable Agriculture CSIRO

Relative versus absolute changes in soil carbon

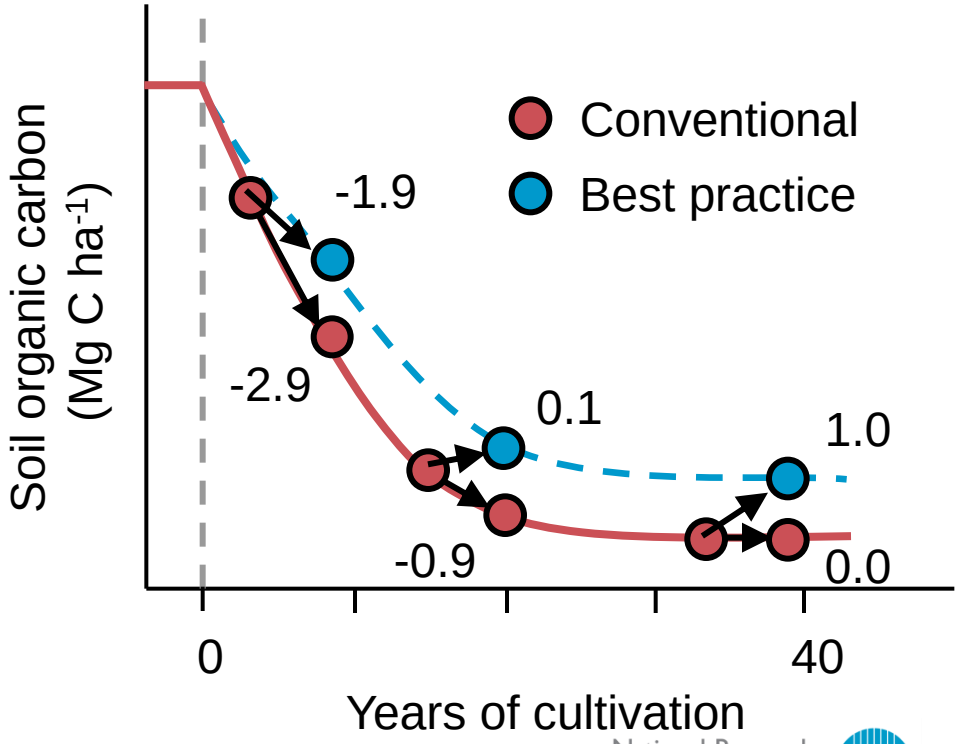
Relative differences

Single point in time comparison between treatments



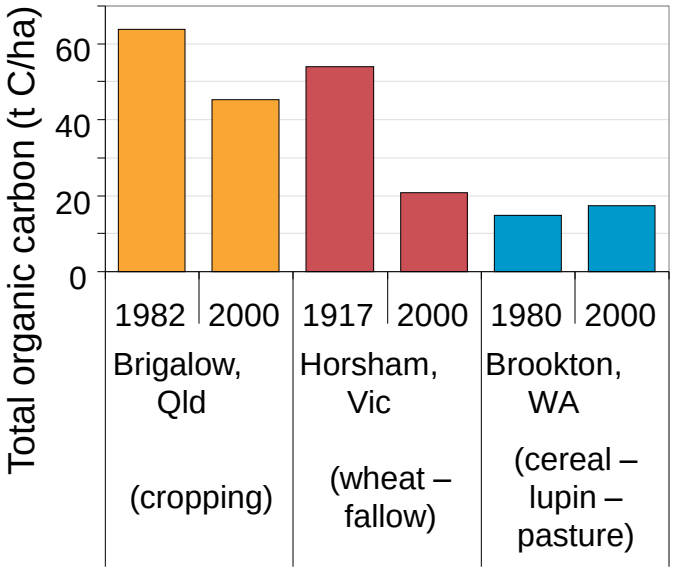
Absolute differences

Comparison against a previously measured value



Potential for Australian soils to sequester carbon

- The potential does exist to sequester carbon in Australian soils
- Soil carbon content balance between inputs and losses
  - Availability of water places a cap on amount of carbon
  - Maximise water use efficiency (within a production system or by changing)
- Challenge – increase soil C while maintaining or enhancing current productivity
  - 3% annual increase in productivity required to maintain profitability
  - Farmers are paid to remove carbon



Measured changes in soil carbon

Cropping lands
(average values on adoption of 'carbon friendly management)

Relative change	Absolute change for 'carbon friendly' management	Absolute change for traditional management
0.3 to 0.3 t C/ha/yr	**-0.1 to -0.3 t C/ha/yr**	**-0.3 to -0.6 t C/ha/yr**

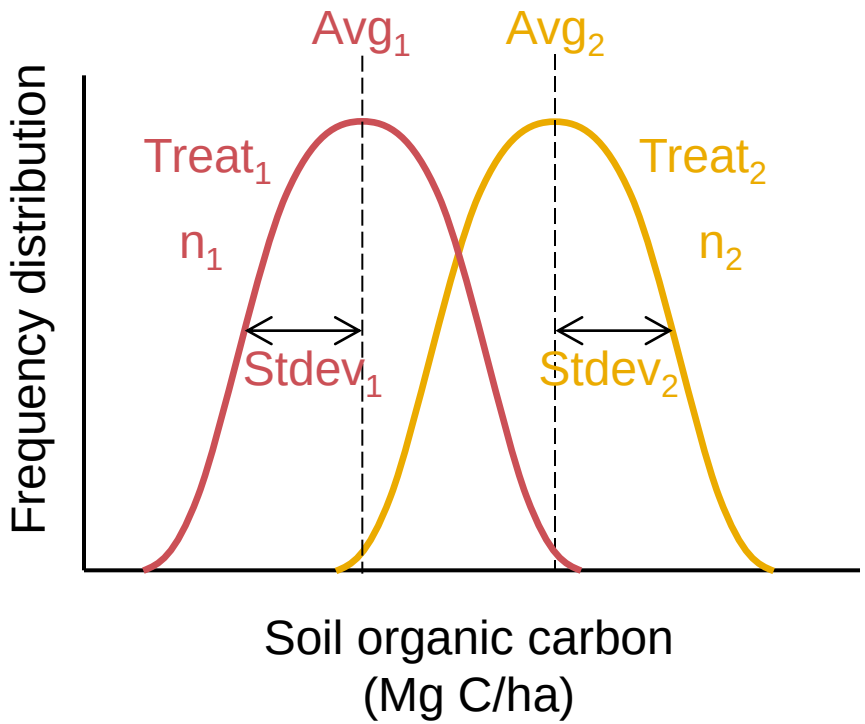
Conversion of cropping lands to pasture

Relative change	Absolute change
0.5 to 0.6 t C/ha/yr	**0.3 t C/ha/yr**

Soil carbon research program (SCaRP) objectives

- Define and use a nationally consistent methodology for quantifying soil carbon across Australia
- Identify land management strategies with the potential to build soil carbon at regional levels
- Provide data for further development of NCAS (National Carbon Accounting System)
- Quantify the inputs of carbon to soils under perennial pasture systems
- Develop rapid and cost-effective means for quantifying soil carbon stocks
- Test automated devises for measuring soil bulk density

Defining differences between management practices



Potential data analyses

1. Classical comparison of mean values uses a 95% confidence
2. Level of confidence associated with a given change in soil carbon
3. Covariate analysis
4. Regression against environmental and edaphic properties
5. Multivariate analyses (PCA, PLS, etc)

Jeff Baldock
Research Scientist
CSIRO Land and Water

Phone: +61 8 8303 8537
Email: Jeff.Baldock@csiro.au

www.csiro.au

Thank you

Contact Us
Phone: 1300 363 400 **or** +61 3 9545 2176
Email: Enquiries@csiro.au **Web:** www.csiro.au

National Research FLAGSHIPS
Sustainable Agriculture

CSIRO