

UPPER NORTH

Soil carbon benchmarks

Soil organic carbon (SOC) concentration benchmarks and baselines for the South Australian agricultural zone were determined from soil test data for the period 1990-2007 (Schapel et al 2021).

Key findings included:

- SOC concentrations increased linearly with increasing clay content for sand to loam textured soil. As clay content further increased there was an unexpected plateau for clay loam and a decline in SOC for clay-textured soil.
- Pasture soils had the highest SOC concentration followed by forestry, annual horticulture, cropping and the lowest were in orchard/vineyards (large variation within this land use)
- SOC concentration increased at a rate of 0.08% per annum (p.a.) during 1990 to 2007. This was largely driven by an increase in SOC of 0.11% p.a. in pasture soils with a smaller increase of 0.04% p.a in cropping soils.

Benchmarks were determined for individual agricultural districts based on PIRSA Crop and Pasture Report districts which correspond to Local Government jurisdictions. There are four agricultural districts within the Northern and Yorke Landscape Board region: Lower North, Mid North, Upper North and Yorke Peninsula.

A summary of SOC benchmarks using Walkley-Black analysis of the 0-10cm, and key land uses and annual changes in SOC is shown below.



Upper North snapshot

Key Land Uses	(% of total soil samples)	Key soil textures	(% of total soil samples)	Mean soil OC concentration	Mean annual change in SOC
Cropping	90%	Clay loam	43%	1.42%	0.035%
Pasture	7%	Clay	34%	<i>highest in</i> clay loam 1.33%;	<i>slight positive</i> <i>increase</i>
Orchard/Vineyard	2%	Loam	15%	orch/vineyard 1.46%	

Table 1: Overview analysis of soil organic carbon levels in soil samples for the Upper North agricultural district 1990-2007

Soil texture

Clay loam is the most common soil texture tested for SOC across the district. There is an increasing trend in surface SOC content from sand to clay loam textures. Soils with higher clay contents naturally have more SOC because of their ability to protect and store organic matter. However, these data indicate that clay soils have lower than expected SOC, which might be due to structural features or limitations in available water affecting plant growth, microbial activity and OC inputs.

Ag District SOC Benchmarks							
Texture	Count	Mean %	25%	40%	50%	60%	75%
Sand							
Loamy sand	29	0.62	0.49	0.51	0.53	0.54	0.64
Sandy loam	135	1.12	0.76	0.93	1.03	1.13	1.36
Loam	284	1.20	0.86	1.00	1.10	1.27	1.50
Clay loam	804	1.33	1.05	1.20	1.29	1.40	1.52
Clay	632	1.24	1.00	1.12	1.20	1.30	1.46
<i>Weighted Mean (all texture)</i>	1884	1.25	0.97	1.11	1.20	1.31	1.47

Table 2: Soil organic carbon benchmarks based on soil test data for the Upper North agricultural district

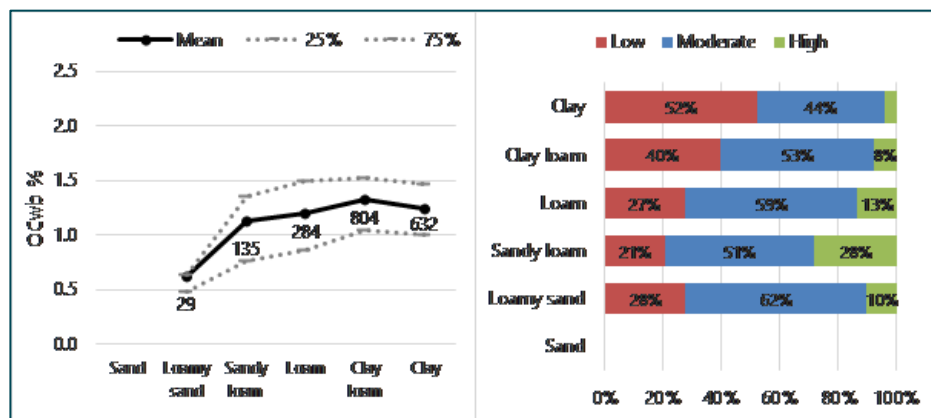


Figure 1. Upper North topsoil average SOC %, number of samples, upper (75%) and lower (25%) bands (left) and proportion of texture samples in the high, moderate and low SOC range (right) for texture.

This data shows where there is potential opportunity to increase SOC based on surface soil texture class. For example, if SOC concentrations are at or below the 40th percentile level, there are likely to be significant opportunities to increase OC, a moderate opportunity if between the 40th and 60th percentile (taking into account land use and climate). However, if SOC concentrations are above the 60th percentile, there is probably little opportunity to increase them unless major land use change occurs.

Land use

Land use	Benchmark SOC Concentration					Proportion in SOC range			
	Count	Mean%	25%	50%	75%	District Prop (%)	Low	Moderate	High
Cropping	1233	1.25	0.97	1.21	1.49	90	39%	51%	9%
Pasture	94	1.33	0.90	1.27	1.68	7	37%	46%	18%
Orchard/Vineyard	34	1.46	0.87	1.36	2.06	2	29%	32%	38%

Table 2. Benchmark topsoil SOC (%) values for land use displaying the mean and percentile values and proportion of land use samples in the high, moderate and low SOC range (right) for Upper North.

Reference:

Schapel A, Herrmann T, Sweeney S and Liddicoat C (2021). Soil Carbon in South Australia: Volume 4 - Benchmarks and Data analysis for the Agricultural Zone 1990-2007. Soil and Land Hub, Adelaide. Soil Carbon in SA Vol 4 - SA Ag Benchmark Analysis 1990-2007 June 2021 Final.pdf (environment.sa.gov.au)