



# Report card on sustainable natural resource use in agriculture

Status and trend in the agricultural areas  
of the south-west of Western Australia

Supporting your success

Soil organic carbon

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**Cover photo:** Harvesting the wheat crop at Mingenew.

## 2.4 Soil organic carbon

### Key messages

#### Condition and trend

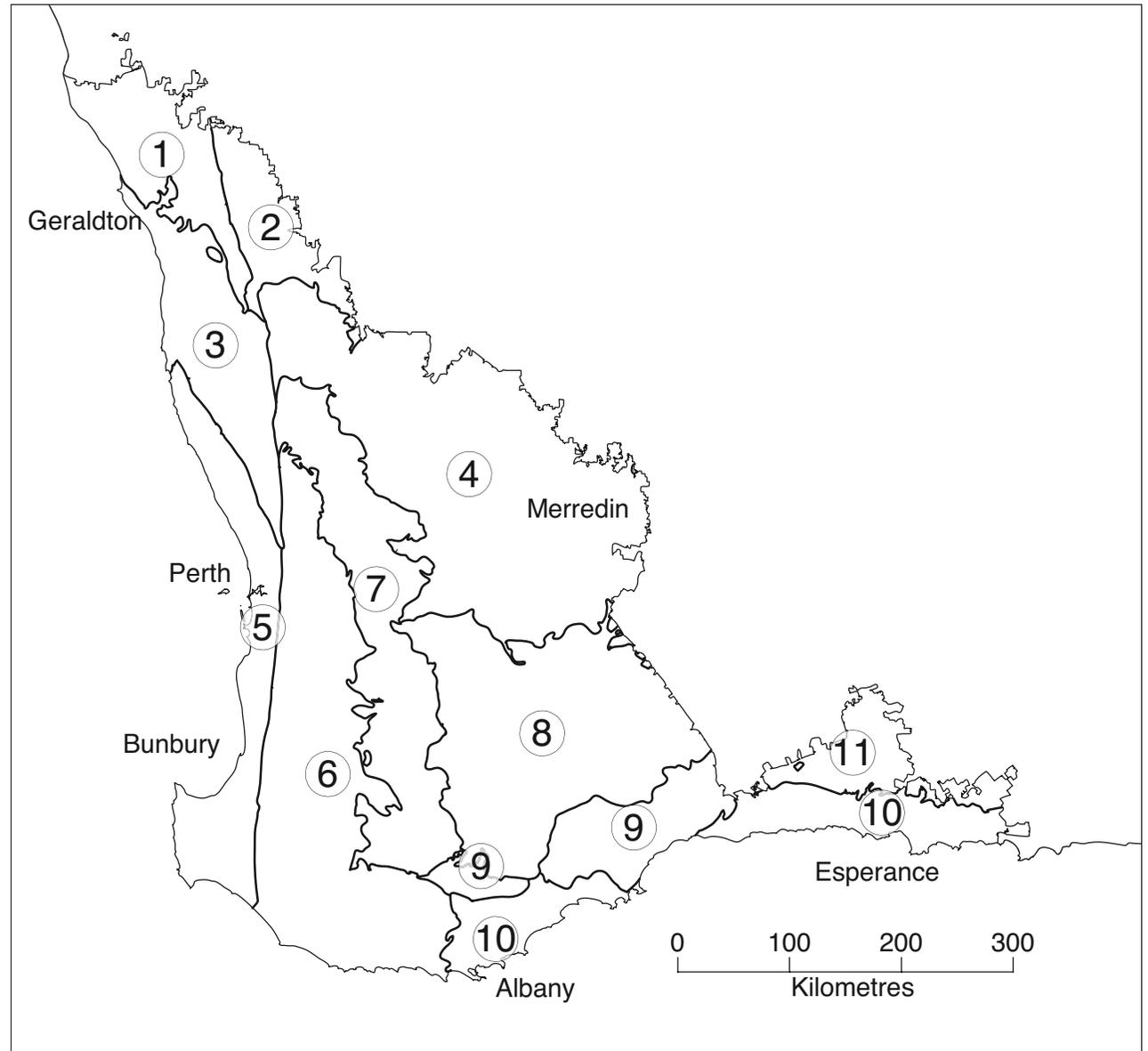
- WA soils are low in soil organic carbon (SOC) by global standards.
- SOC levels are positively related to rainfall and increased biomass production.
- Highest SOC levels (and variability) occur in areas of higher rainfall that support increased biomass production, and on soils that are unconstrained by water availability.
- It is likely to take a decade or more of monitoring to detect significant changes in SOC because of its high spatial and temporal variability.
- SOC levels are likely to decline in response to predicted declining rainfall where there is a corresponding decrease in biomass production.
- Actual SOC stocks are only known for a small portion of the south-west of WA.

#### Management implications

- Detecting differences in SOC levels due to existing land use and management in the south-west of WA is difficult because of:
  - large influences of rainfall and soil moisture on SOC levels
  - land use and management practices are applied selectively to soil types and across regions.
- For SOC levels to be maintained or increased, management should focus on:
  - increasing plant biomass production by addressing soil constraints, and improved agronomic management
  - minimising organic matter and soil loss from water and wind erosion
  - increasing the frequency and amount of organic matter returned to soil
  - applying organic inputs where profitable.
- Management systems that support a greater proportion of the year under an actively growing crop or pasture are more likely to result in potential gains in SOC.
- Increasing SOC is widely regarded as beneficial to soil function and fertility and has been associated with increased agricultural productivity.

## Soil organic carbon (SOC) abundance and trends

The Agricultural Soil Zones (Ag Soil Zones) in the south-west of WA as shown in Figure 2.4.1 are used in Table 2.4.1 to regionally represent summarised data on abundance and trend.



**Figure 2.4.1** Ag Soil Zones of the south-west of WA.

**Table 2.4.1** Resource status and trend summary for soil organic carbon (SOC)

Ag Soil Zone	Summary	Abundance and trend					Confidence	
		Very low	Low	Mod	High	Very high	In condition	In trend
1 Mid West*	SOC levels vary with rainfall gradient. High temperature and soil constraints limit biomass production and SOC.							
2 Mullewa to Morawa*	High temperature and low rainfall limit biomass production and SOC.							
3 West Midlands*	SOC levels vary with rainfall gradient. Lighter textured (sandy) soils are lower in SOC. Soil constraints limit biomass production.							
4 Central Northern Wheatbelt*	Greater variability in SOC levels associated with rainfall gradient and high temperatures.							
5 Swan to Scott Coastal Plains	SOC levels related to wide rainfall range. Very high levels often associated with irrigated, fertilised pastures. Decline in SOC under intensively cultivated horticultural systems.							
6 Darling Range to South Coast	SOC levels vary with rainfall gradient. SOC maintained in conservation areas and areas of reliable rainfall. Risk of SOC decline with increased cropping.							
7 Zone of Rejuvenated Drainage*	SOC levels vary with rainfall gradient. Possible decline where cropping is increasing and pasture declining. Soil constraints can limit biomass production.							
8 Southern Wheatbelt*	SOC levels declining along west to east rainfall gradient.							
9 Stirlings to Ravensthorpe*	SOC levels vary with rainfall gradient. Dominance of pastures in high rainfall likely to have highest SOC.							
10 South Coast – Albany to Esperance	SOC levels relating to wide rainfall range; high rainfall supports greater biomass production. Highest levels likely under perennial pastures.							
11 Salmon Gums Mallee	SOC levels declining with lower rainfall and soil constraints. Higher clay soils may support greater storage capacity but these are in the lower rainfall areas.							

<b>Soil carbon condition grades**</b>		Very high	>4% in 0–10 cm	<b>Recent trends</b>		Improving		Unclear	<b>Confidence</b>		Adequate high-quality evidence and high level of consensus
		High	2-4% in 0–10 cm			Deteriorating		Variable			Limited evidence or limited consensus
		Moderate	1-2% in 0–10 cm			Stable		Evidence and consensus too low to make an assessment			
		Low	0.5-1% in 0–10 cm								
		Very low	<0.5 in 0–10 cm								

\* Reliability of information is low.

\*\* Soil organic carbon condition grade terms of very low to very high are only relative to the range of SOC values that occur in the south-west of WA. High does not necessarily relate to a high value at the global level.

## Overview

Soil organic carbon (SOC) is derived from organic matter which ranges from living organisms to decaying plant material to charcoal. Organic matter has beneficial physical, chemical and biological influences on soil condition and plant growth; and in some soils is the major source of plant available nutrients. The inorganic carbon present in soil minerals (e.g. CaCO<sub>3</sub>) is not considered in this assessment.

WA soils are generally low in SOC by global standards and for the south-west of WA, SOC levels typically range from 0.7 to 4%. Historically, drier regions of the south-west of WA were inherently low in SOC because of the strong influence of climate on the amount of organic inputs and the prevalence of sandy textured soils. While in some areas changing land use to agriculture actually increased SOC (e.g. where biomass production has increased under land uses such as pasture), large areas of land converted from native vegetation to agricultural systems experienced a decline in SOC associated with cultivation. While the attainable SOC content is defined by climate (rainfall and temperature) and soil clay content, management and site factors interact to influence the actual amount of SOC.

Increasing SOC is widely regarded as beneficial to soil function and fertility and has been associated with increased agricultural productivity. With soil being considered a major world carbon sink (as well as a source of carbon emissions), increasing the amount of organic carbon in agricultural and rangeland soils is seen as one way of decreasing atmospheric carbon dioxide (CO<sub>2</sub>) concentrations and mitigating climate change. Consequently there is great interest in quantifying the ability of various soil types and land management practices to increase net organic carbon inputs to the soil and understanding how these changes will impact soil health and carbon sequestration in the medium and long term.

The amount of SOC can vary greatly over time due to a variety of processes. However, with climate modelling predicting decreasing rainfall and increasing average temperatures for the south-west of WA,

it is possible that in areas with decreasing biomass production that a decline in SOC will be observed over time.

This chapter reports the present knowledge of SOC levels and trends in agricultural soils in the south-west of WA.

## Assessment method

Since the amount of geo-located SOC data is limited, efforts were made to use as much data as possible and extend its relevance to areas where no data exists, which required standardisation of the measurements and examining ways to maximise its utility.

### Standardisation of data

#### Source data

Five primary data sources were used in this assessment with samples procured between 1999 and 2012 (Table 2.4.2).

**Table 2.4.2** Sources of data for soil organic carbon in WA

Code	Source	Sampling period	No. of 0–10 cm samples	Analytical method*
P	DAFWA profiles database	1999–12	214	WB
LC	Albany Catchments	2007–08	192	WB
SWCC	Lower Swan Coastal plain	2007–08	317	WB
SH	Soil Quality Research Program (Wheatbelt NRM, GRDC, UWA, DAFWA)	2006–09	512	WB
SCaRP	Soil Carbon Research Program WA node (DAFF, GRDC, UWA, DAFWA)	2009–11	1456	LECO

\* WB Chemical oxidation (Walkley-Black); LECO Dry combustion

The bulk of the data tend to be localised in terms of space, time and purpose. While it is assumed that their combination provides a reasonable representation of a range of land uses and soils across the south-west of WA, it is likely that data in some areas is biased, largely through major omissions in sampling.

### Measurement differences

Because different methods (e.g. WB or LECO) and different laboratories can give different results, standardising data is important (Skjemstad et al. 2000). The WB results were multiplied by a factor of 1.3, as described by Walkley and Black (1934), to give an adjusted value close to what would be expected from the LECO method.

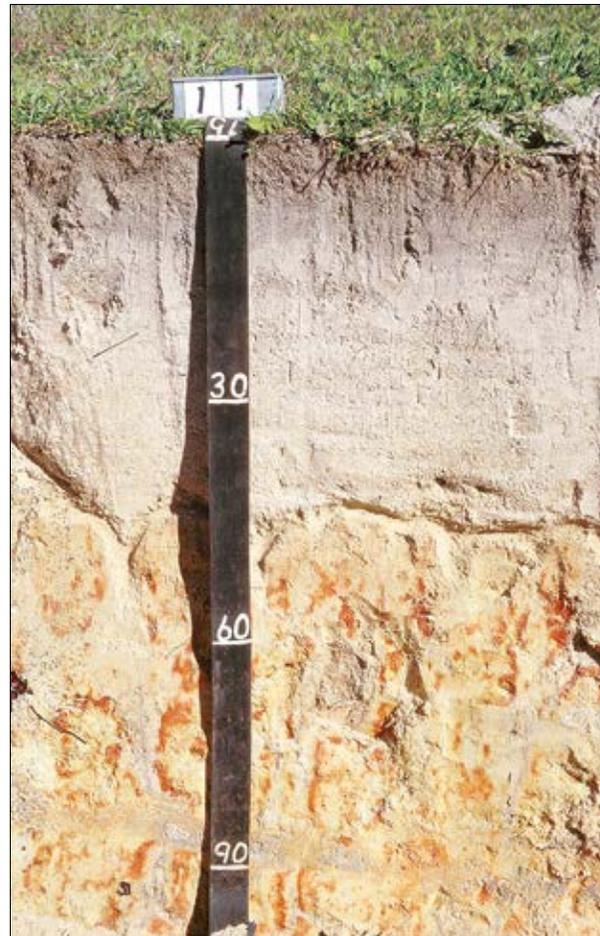
### Temporal influence

Using data from a wide range of sampling times may be a poor indicator of current condition. A comparison of SOC maps generated as defined below for two temporal intervals (1999–2005 and 2006–11) were not obviously different (data not presented). Significantly, they had little spatial overlap meaning that comparison between these sampling periods was not reasonable.

Therefore, the analyses presented here are for all available data from 1998 to 2012. This is inferring that having more data over a wider coverage is more important than the possible temporal differences or accurate current values.

### Sample depths

Organic carbon is predominantly concentrated in the surface layers of soil and the amount declines rapidly with depth. This is especially true for agricultural soils. This surface concentration is associated with the relative location of organic inputs and biological activity.

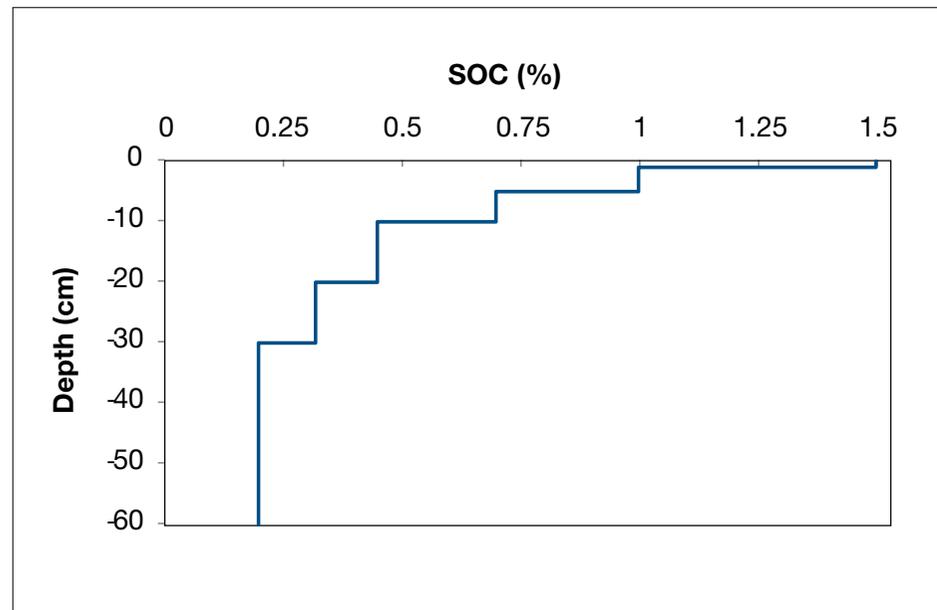


Soil profile photos for two common soils in the south-west of WA showing the concentration of soil organic carbon as indicated by the dark colours in the surface layers of a Deep sandy duplex (left) and Pale deep sand (right).

Because SOC is concentrated at the surface, different sampling intervals produce different results (Figure 2.4.2). For this reason, sampling intervals for SOC comparison and monitoring (nationally and internationally) are generally standardised to 0–10, 10–20, 20–30 cm, and commonly integrated over 0–30 cm.

Consequently, the available data was standardised to the SOC in the top 10 cm using a strong correlation which exists between the percentage of SOC in 0–10 cm and the percentage of SOC in 0–30 cm (SCaRP data).

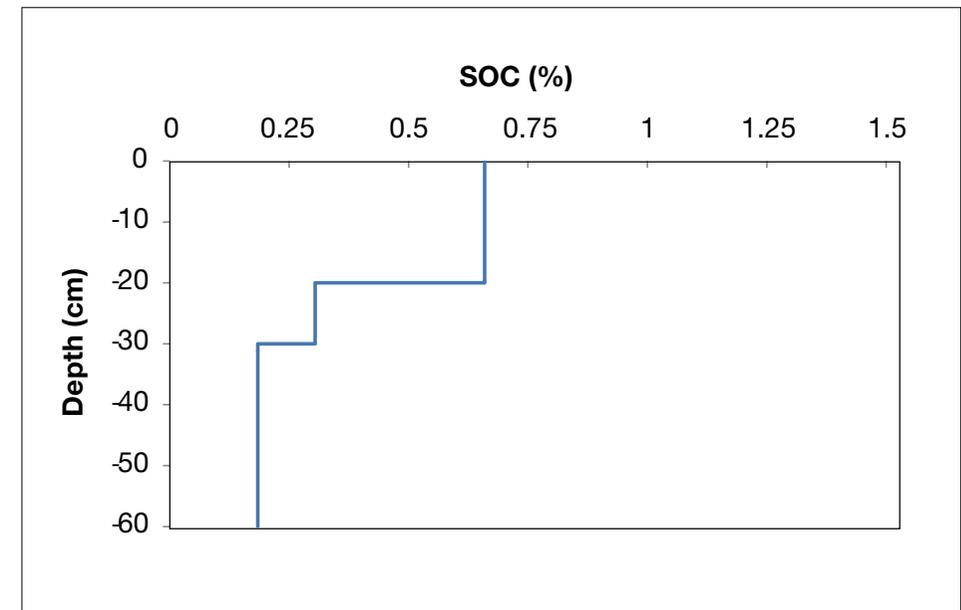
This assessment uses the 0–10 cm interval since it contains about 60% of the SOC in the top 30 cm, and this interval is the common testing interval for agricultural soils so values reported here will have immediate relevance to landholders.



## Analysis

The SOC data were analysed for the opportunity to infer the level and trends for SOC (i.e. condition) across the south-west of WA. Despite a significant volume of work in sampling different areas, extensive gaps in SOC measurement remain. The data is highly localised (at the regional scale), and often with large variation in SOC at the local scale. These patterns rule out the use of computer-based interpolation methods to model the geographic variation across the south-west of WA because the products of such data are often very “noisy”.

However, as described in Appendix 1, pooling the data using the soil-landscape mapping framework provided a consistent way of interpreting the data. In this, the soil-landscape subsystem map unit became the primary analysis framework. Statistics, such as minimum, mean, maximum, standard deviation and count, were computed for each map unit which contained measured samples.



**Figure 2.4.2** The influence of a change in sample depth intervals on the distribution of soil organic carbon in the same soil profile.

As a result of the spatial distribution of samples, the available data in this format remains highly clumped. Only 7% of the soil-landscape units contained the 2490 samples measured for SOC at 0–10 cm. Furthermore, about half of these subsystems had only 1 or 2 samples, which are not reliable. Thus, even modestly reliable estimates are available for just a small percentage of the south-west of WA. These contribute to low confidence in aggregate statistics at a regional scale (e.g. Ag Soil Zones) and for the whole of the south-west of WA.

SOC stocks in tonnes of carbon per ha (t C/ha) is the standardised method of carbon accounting. Bulk density values are required to convert the concentration measurements of SOC (%) to SOC stocks (t C/ha). Only one-quarter of the available data had bulk density measurements which allowed this conversion. Analyses for this report were performed using both the concentration of SOC (%) and SOC stock (t C/ha) in the top 10 cm.

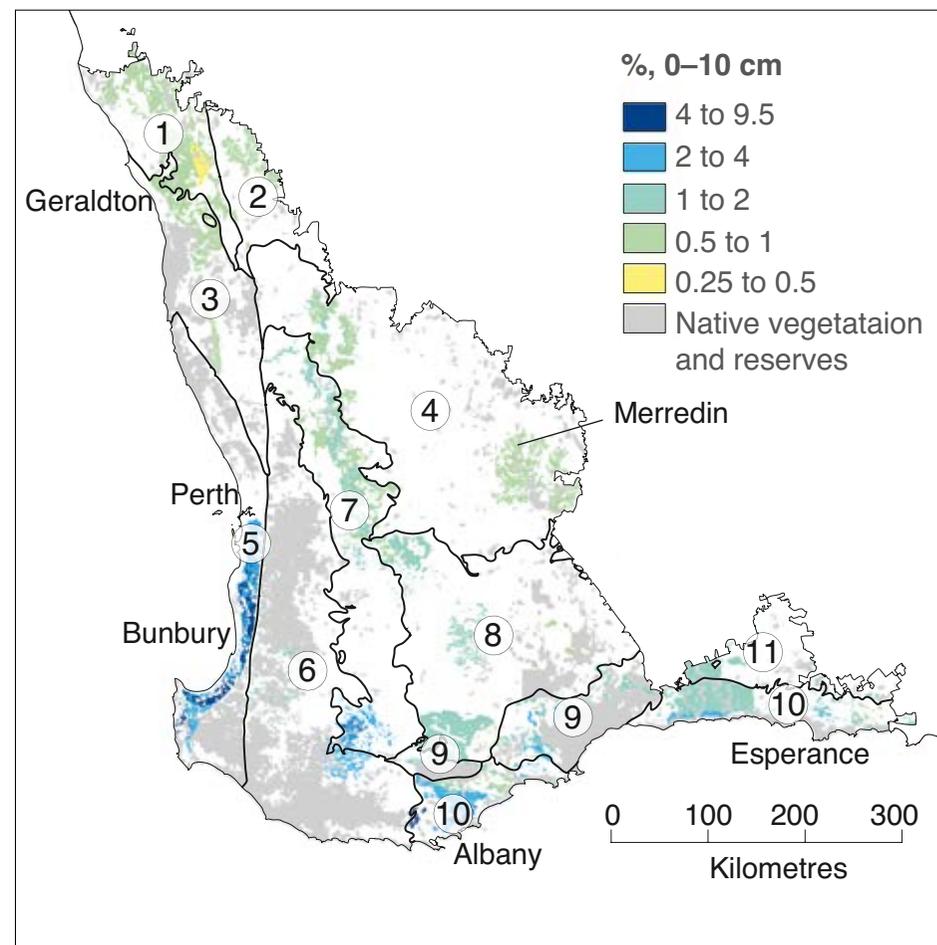
## Current status and trends

### Condition

The amount of SOC (0–10 cm) is presented as both a concentration (%) and a stock (t C/ha). It is noted that the standard carbon accounting interval is 0–30 cm, which can be roughly inferred by dividing the concentration of SOC from the 0–10 cm layer by 1.6, and multiplying SOC stocks by 1.6.

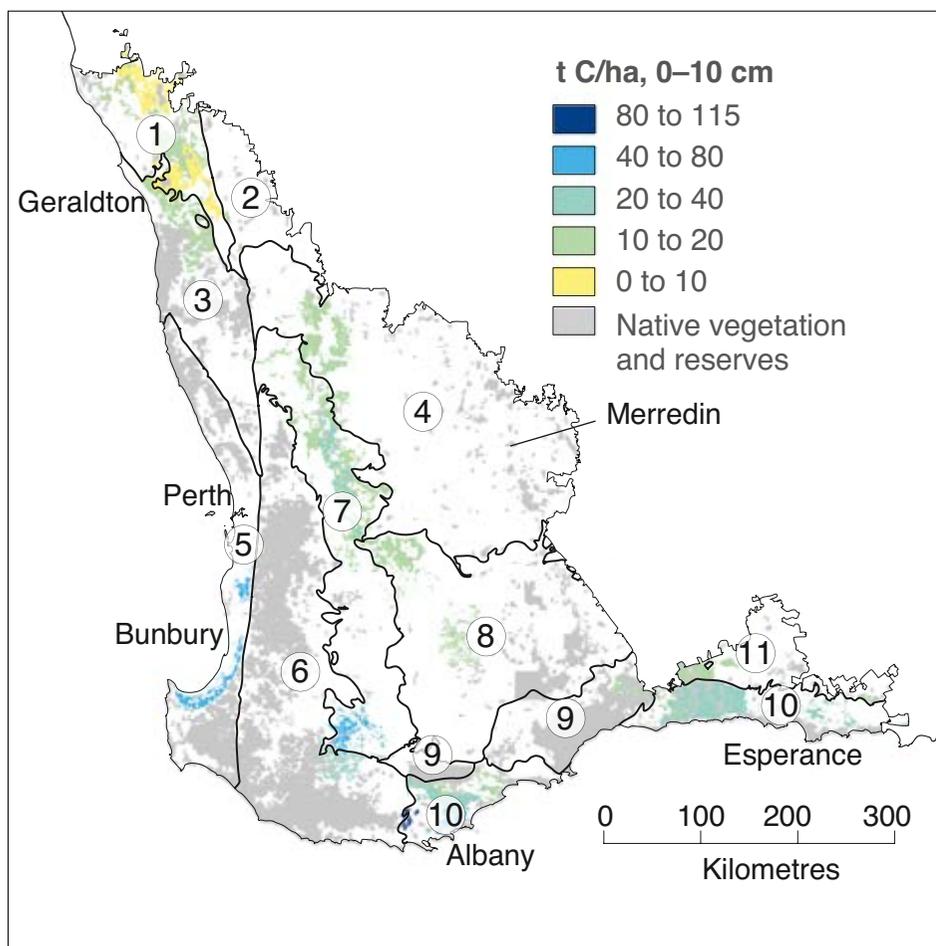
Maps are the most effective form of presentation as they display patterns in abundance and the location of available data. While it was possible to infer values for map units with similar soil and location as was foreshadowed in Appendix 1, the products appeared to misrepresent the geographic patterns. Therefore such extrapolations were considered to be unreliable.

In the south-west of WA, SOC ranged between 0.1 to 14.8% in 0–10 cm samples. Averaged by map unit, this range was narrowed to between 0.3 and 9.3%. The average SOC (0–10 cm) in a map unit is represented in Figure 2.4.3 as a concentration (%) and in Figure 2.4.4 as SOC stocks (t C/ha).



**Figure 2.4.3** Soil organic carbon concentration (%) in 0–10 cm. Areas of low confidence (e.g. subsystems with less than two sites) are white; grey areas represent native vegetation and reserves.

Despite the paucity of data, broad geographic patterns are obvious. There is considerably more SOC in the south-west corner of the south-west of WA compared to remaining areas. While to some degree this variation is reflected in differences between the Ag Soil Zones, there is significant variation within some zones.



**Figure 2.4.4** Soil organic carbon stocks (t C/ha) in 0–10 cm. Areas of low confidence (e.g. subsystems with less than two sites) are white; grey areas are native vegetation and reserves.

## Summaries by Ag Soil Zones

While the variation in SOC is large across the south-west of WA, and also within some Ag Soil Zones, it is useful to present summary statistics (Table 2.4.3). These are estimates based on what is known about the SOC levels in these areas. The values in any location may vary considerably from these and our knowledge of this variation is represented by the standard deviation. The SOC stocks for 0–30 cm are estimated from the 0–10 cm value multiplied by 1.6, which was derived from a relationship developed from the SCaRP data.

**Table 2.4.3** Summary of soil organic carbon concentration and stocks

	Concentration (%) mean (SD)	Stock (t C/ha) mean (SD)	Stock t C/ha*	
Ag Soil Zone	Interval 0–10 cm	Interval 0–10 cm	Interval 0–30 cm	Comment
Mid West	0.7 (0.2)	10 (3)	16	Low SOC levels associated with high temperature in low rainfall. Lighter textured (sandy) soils are lower in SOC largely because production constraints (nutrients and pH) limit biomass production.
Mullewa to Morawa	0.7 (0.2)	12 (1)	18	Low SOC levels associated with high temperature and low rainfall. Very little data.
West Midlands	0.8 (0.2)	12 (3)	19	Low to moderate SOC levels along steep rainfall gradient. Lighter textured (sandy) soils are lower in SOC and production constraints limit biomass production. Little data in higher rainfall areas.
Central Northern Wheatbelt	1.0 (0.4)	13 (4)	21	Low to moderate SOC levels along rainfall and temperature gradients. Little data, particularly in driest areas.
Swan to Scott Coastal Plain	4.2 (1.7)	56 (15)	90	Moderate to high SOC levels relating to wide rainfall range; high rainfall supports greater biomass production. Very high levels often associated with irrigated, fertilised pastures. SOC decline is likely under intensively cultivated and managed horticultural systems. Little data in northern drier areas.
Darling Range to South Coast	1.9 (1.2)	27 (15)	43	Moderate SOC levels probably varying along rainfall gradient. Likely decline where cropping is increasing. Very little data.
Zone of Rejuvenated Drainage	1.4 (1.2)	19 (13)	31	Moderate SOC levels probably varying along rainfall gradient. Likely decline where cropping is increasing and pasture declining. Significant production constraints limiting biomass production of some soils.
Southern Wheatbelt	1.2 (0.5)	17 (5)	27	Moderate SOC levels probably declining along west to east rainfall gradient. Little data in driest areas.
Stirlings to Ravensthorpe	1.8 (0.7)	14 (3)	23	Moderate SOC levels but levels probably varying along rainfall gradient. Dominance of pastures in high rainfall areas are likely to have highest SOC. Little data.
South Coast – Albany to Esperance	2.3 (1.6)	31 (20)	49	Moderate to high SOC levels relating to wide rainfall range; high rainfall supports greater biomass production. Highest rainfall areas tend to have pastures and are likely to have highest SOC. Generally, areas under perennial pasture and cropping with nutrient additions have higher SOC.
Salmon Gums Mallee	1.2 (0.6)	16 (7)	26	Moderate SOC levels, but probably low in lower rainfall areas. Soils with higher clay content may support greater storage capacity of SOC, but these soils are in the lower rainfall areas. Subsoil constraints, where present, will limit SOC gains. Very little data in lower rainfall areas.

\* SOC stocks for 0–30 cm interval calculated by multiplying 0–10 cm mean value x 1.6

Notes: SD standard deviation.

Values are for available points in each Ag Soil Zone with no area weighting.  
The cells are coloured consistent with the classes in Figures 2.4.3 and 2.4.4.

## Trend

An attempt was made to compare the SOC in samples from 1999–2005 with those of 2006–11. However, the inconsistent geographic extent of these samples meant it was not possible to interpret any trend in the amount of SOC in the south-west of WA from this source.

There are currently no monitoring sites that would detect trends at even a local scale. The thousands of data points are highly localised with little temporal aspect to them and they are not suitable to make any inferences of trend across the south-west of WA.

Furthermore, were any trends identified, attaching a probable meaning or cause would be challenging given significant changes in both rainfall and management have occurred in the last few decades.

## Discussion and implications

The amount SOC is related to the balance between organic matter inputs (i.e. biomass production) and organic matter losses (i.e. microbial decomposition rate and erosion). While biomass production and decomposition are primarily driven by rainfall, soil type and temperature (Hoyle et al. 2011), they are also influenced by management and soil constraints. Biomass production influences attainable SOC levels, within the context of soil type and local moisture conditions. Management logically contributes to actual levels at individual sites.

SOC underpins a number of critical soil functions, such as nutrient turnover. However, no “desirable” level can currently be set for any soil-location-management situation as there might be for soil pH in relation to crop production. In general, the loss of SOC is considered to have adverse effects on nutrient supply, soil water storage and carbon storage. Gains in SOC will generally have the reverse effects.

Increasing SOC requires increased plant growth, increased organic matter inputs or decreased decomposition of organic matter, or a combination of these. In principle, better water use efficiency and agronomic management to improve crop yields provides more plant

growth and should support either maintenance or growth of SOC stocks. Decreasing plant residue losses also increases the potential for organic matter accumulation in soil.

Biomass removal, burning and erosion are associated with a loss of organic matter but are considered within the scope of management to influence. While burning would decrease fresh residues entering soil, photodegradation (King et al. 2012) and stubble microbial decomposition can also be significant. Therefore, if most of what is burnt is destined to be lost through photodegradation, burning might result in an increase in the amount of resistant (charcoal) carbon where ash is retained. In this case, while a decrease in total soil SOC may not be detectable, a loss of function is often associated with the removal of the labile SOC pool which can contribute to changes in biological function and nutrient turnover.

Wind and water erosion can also result in massive losses and redistribution of surface plant residues as well as SOC in surface layers (Photo 2.4.1a, b). Many years of organic matter and SOC accumulations can be lost in one event. The predominantly loose, sandy topsoil in the south-west of WA provides little resistance to wind erosion or sheet water erosion. However, increasing the amount and persistence of ground cover should decrease the potential for loss through erosion.

Microbial decomposition is related to the temperature and water status of the soil, as well as the availability of substrates. Regardless of decomposition rates where organic inputs outweigh organic matter losses, SOC should increase, albeit slowly.

Higher SOC levels are often associated with soils which have inherently higher clay content. While in theory adding clay could increase the amount of SOC protected in soil aggregates from microbial degradation, it is unknown whether added clay acts in the same manner as clay that is inherently present. Increases in SOC measured where clay has been added to soils, is more likely a result of increased plant growth and production associated with agronomic benefits which the added clay provides.

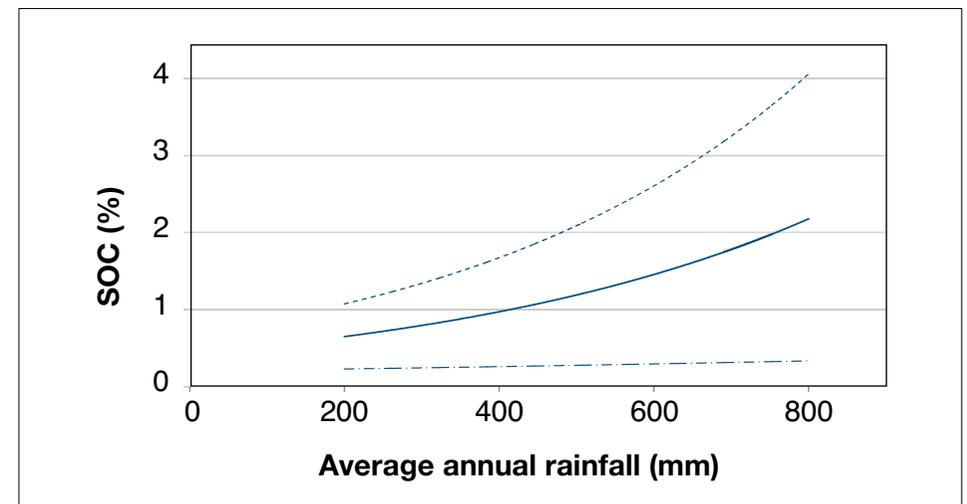


Stubble accumulation from wind erosion (left) and sheet wash removing organic matter (right).

### Status and trend

The SOC levels (0–10 cm) in the south-west of WA varied a hundred fold (0.1 to >10%). There is both strong geographic (regional) and strong local variation in these levels. Much of the cropping areas have about 1% SOC in the top 10 cm of soil (roughly 15–25 t C/ha SOC in 0–30 cm). The geographic pattern in the south-west of WA is clearly correlated to rainfall (Figure 2.4.5).

Nevertheless, the wide range of values of SOC within a given rainfall range is testimony that soil type, local soil water conditions and management have significant influences on SOC levels. While there is no strong soil type influences obvious in the present data, wet soils (e.g. swamps and seasonally waterlogged soils) generally showed higher SOC than the rest (Griffin and Schoknecht 2002). Such areas would have a longer growing period (potentially higher biomass production)



**Figure 2.4.5** Soil organic carbon % (0–10 cm) against average annual rainfall (2000–11). Curves are the mean (solid line) and mean within one standard deviation (dashed lines).

and potentially lower microbial decomposition under anaerobic conditions.

This assessment has not considered the different forms of organic matter or SOC (e.g. particulate, humus or resistant fractions) which differ in their characteristics, stability and function. There is insufficient data currently to provide any geographic overview of the relative amount of different forms of SOC. The amount of charcoal varies widely between sites which is a legacy of previous land use and clearing for agriculture.

### Trends

The lack of temporal SOC data for the south-west of WA limits the ability to determine any current trends in SOC stocks. Previous studies using measurements to calibrate the RothC model have determined changes in SOC due to land management (1975–94) and following the conversion of native vegetation to agriculture (Skjemstad and Spouncer 2003; Griffin et al. 2003). However, there was no consistent trend over time in the amount of SOC, either measured or modelled for the south-west of WA. Importantly, the year to year and site to site variation was also high.

Thus, it is inferred that SOC levels in the south-west of WA are highly variable from site to site which suggests the influence of a number of factors in controlling SOC.

### Climate trends

While there are no measured trends in SOC levels over time as yet, current knowledge allows us to predict possible changes in SOC associated with a changing climate. The possible influence of changing climate on driving factors and impact on SOC trends is presented in Table 2.4.4, with many scenarios associated with a decline in SOC. While some hypothetical climate change scenarios have been presented, there are no expectations that these will occur or that they will occur in isolation.

**Table 2.4.4** Predicted influence of future climate trends on soil organic carbon in WA

Climate trend	Influence and impact	SOC trend
Lower average growing season rainfall; shorter growing season	lower biomass production	lower
Higher average growing season temperatures	i) higher water use efficiency ii) increased opportunities for early growth	higher (where < 2°C increase in average temperature)
Higher CO <sub>2</sub> levels	higher photosynthetic capacity and water use efficiency, increased biomass	higher
Lower growing season rainfall	i) decreased incidence of water-logging in medium and high rainfall regions leading to increased plant biomass ii) land use change from pasture to cropping	higher lower
Lower rainfall at seeding	more bare seeding and more wind erosion losses, later sowing resulting in lower plant biomass production	lower
Lower summer rainfall	i) lower biomass in summer to protect soil from wind erosion ii) less decomposition	lower static
Higher summer rainfall	i) increased decomposition ii) more summer biomass growth iii) potential for summer/cover crops and pastures	lower higher higher
More severe summer storms	higher risk of water erosion and removal of organic matter	lower
Higher summer temperatures	higher microbial decomposition (only valid where there is soil moisture)	lower

\* unless summer weeds are sprayed

## Management implications

Land use (e.g. crop types) and management practices (e.g. types of cultivation) can influence the amount of SOC (Hoyle et al. 2011). Many practices have been advocated for increasing soil health, including the management of farming systems for increased SOC. The possible impact of common practices on SOC have been generalised in Table 2.4.5.

**Table 2.4.5** Predicted influence of management influences on soil organic carbon in WA

Management practices and trends	Likely SOC trends
Farming systems that result in decreasing biomass production (e.g. low yielding environments)	lower
Farming systems that result in increasing biomass production	higher
Increased stocking pressure	lower
Increased long-term fallowing (12 months or more)	lower
Decreased stocking rates in cropping cycle→lower organic matter detachment→lower wind erosion losses	static/higher
Larger paddocks with less wind and water erosion mitigation→higher erosion	lower
Adoption of zero tillage redistribution within soil profile	static/higher, redistributed in soil profile
Overcoming constraints e.g. water repellence, soil acidity, low nutrients→increased biomass production	higher
Precision farming and variable rate technologies where increased plant production is achieved	higher
Introducing perennial pastures and crops	higher
Stubble burning	possibly lower
Applying off-paddock carbon inputs e.g. compost, straw, biochar	higher, dependent on rate

While the likely trend is noted, it is important to recognise that a measureable change in SOC may take decades and vary due to both climate and soil type. In many systems, the rate of SOC build-up is slow. Implementing these strategies should be considered within both an economic and sustainability perspective.

Despite the limited amount of data available, this assessment demonstrates that within a rainfall zone of the south-west of WA, there is a wide range in the amount of SOC in the soils. This range suggests that biomass production and organic matter decomposition may differ widely in response to soil type, local moisture conditions and management. If this variation is an indication of potential, then the higher the rainfall, the greater the potential SOC levels and SOC increase.

To date, research shows regional differences in SOC relating to different crop and pasture types (Murphy et al. 2013). In principle though, increasing biomass production by overcoming constraints offers the greatest potential to increase SOC. It is difficult to compare the relative merits of options, such as claying, adding lime and nutrients, ripping and mouldboard ploughing, without more research.

While knowing the amount and rate of change for SOC in the south-west of WA is valued by a range of users, further research on the role of SOC in supporting soil functions for agricultural production systems and ecosystems services is required. Providing an evidence base in relation to questions such as “What does it matter?” and “How will it benefit us?” will continue to be integral in demonstrating the value of SOC.

## Recommendations

- Promote management actions which boost biomass production as a strategy for increasing SOC.
- Promote erosion mitigating actions as a strategy for increasing SOC and soil health.

- Determine how soil and water conditions and land use and management types influence the levels of SOC in the medium and high rainfall areas as a way of identifying areas of highest potential for increase in SOC.
- A method be developed to predict the climate change related biomass production and consequential trends in SOC in the south-west of WA.

## Acknowledgements

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### Further reading

- Soil health website ([soilhealth.com](http://soilhealth.com))
- Soil quality website ([soilquality.org.au](http://soilquality.org.au))
- Soil health knowledge bank ([soilhealthknowledge.com.au](http://soilhealthknowledge.com.au))