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South Australian Soil Capacity Gap Analysis

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Executive Summary

The Soil Capacity Gap Analysis for South Australia was developed by the Regional Soil Coordinator under the Australian Government's National Landcare Programme. The purpose was to assist with identifying the local soil capacity gaps, current soil issues, extension needs and barriers to adoption within the local region to align with the National Soil Strategy and National Soil Action Plan 2023-2028. The Regional Soil Coordinator conducted interviews, attended soil events and collected survey data between 2022 and 2024 to develop this report.

Key finding from the gap analysis that provide a snapshot in time are outlined below:

- Soils in South Australia are variable and complex and agricultural productivity is limited by a dry climate.
- Summaries grouped by Landscape Board regions demonstrate the level of complexity and diversity of soil issues across the state. They also highlight six main recurring soil themes discussed across the districts: erosion, acidity, salinity, sandy soil constraints (and associated soil issues), soil health and carbon.
- Soil carbon is gaining attention for its potential to generate revenue through carbon markets, mitigate climate change, and improve agricultural productivity. However, challenges like accurate measurement, carbon permanence, and equitable market access remain key considerations.
- Soil health is gaining attention for its links to increasing land productivity and for potential soil carbon market benefits. Higher land price is encouraging farmers to maximise productivity on current land rather than expand land holdings.
- Soil extension, research, advisory and advisory capacity is hosted in farming systems groups, private consultancies, State Government agencies and research organisations.
- Each of the State's three Universities has soil education and research capacity.
- There is a lack of soil-specific and career pathways available, no soil extension focused graduate positions or soil internships available, and jobs at the early to mid-career level are limited. It is noted that soil is integrated into other disciplines including agronomy, viticulture, biology and engineering where more opportunities can be found.
- Soil expertise capacity in the state is largely held within an ageing population of experts and there are very limited opportunities for younger people to work alongside these experts in a consistent manner to learn and facilitate succession planning. Fleeting opportunities as organisations collaborate on projects is the best available.
- Soil and extension priorities are mixed within Primary Industry organisations and industry groups within South Australia. Grain Producers SA and Sheep Industry Blueprint have soil themes in their framework and policy goals, while others such as the Horticulture Blueprint, SA Dairy Action Plan and Beef Industry Blueprint do not mention soil specifically but do refer to carbon offsetting and sustainability.



Background

The Regional Soil Coordinators (RSC) program was conducted between June 2022 and June 2024 as part of the National Landcare Programme Building Landcare Capacity and Community program, funded by the Australian Government Department of Agriculture, Fisheries and Forestry (DAFF). Eight positions were established across Australia hosted by the Future Drought Fund Drought Resilience, Adoption and Innovation Hubs. The aim of these positions was to provide a network with researchers, primary producers, and community groups to work together to deliver more integrated and targeted soil services and broker partnerships with industry stakeholders to build capability. The RSCs form a National Community of Practice (CoP) with the National Soil Science Extension Team at Soil Science Australia, to create a national network and share the latest soil science resources. A deliverable of the program was to develop a plan for each Drought Hub region, summarising the soil capacity gaps, soil extension needs and current barriers to adoption. This report aims to provide DAFF with local information relevant for South Australia (SA).

The Soil Capacity Gap Analysis was developed by the South Australian RSC in July 2024. Information was collected through multiple methods including attending ten farming systems group meetings, farmer field days, soil events and seven conferences (Australian and New Zealand Biochar Industry Group conference in 2022, South Australian Grains Industry Trust conference 2022, Soil CRC conference 2022, Soil Science Australia 2023 conference, Jamestown Regional Soil conference 2023, Acid Sulfate Soils Conference 2023 and the Grains Research and Development Corporation (GRDC) updates conference 2024).

Stakeholder interviews were conducted in person, online and over the phone with twenty-five key stakeholders, employed as farming systems group staff, researchers, private consultants, advisors and State Government representatives working across the region. Interviews were undertaken in a flexible format, consisting of open-ended questions on soil research, development, and capacity in their areas of expertise. Depending on the stakeholder, these may have included soil data, soil extension, adoption, and current soil issues and priority questions. A draft report was released for consultation via the Sustainable Agriculture Network until December 2024, and further feedback was sought via a workshop session with State Government soil stakeholders. Edits and comments were incorporated in 2025 prior to public release.

Soil Overview in South Australia

Background - Soil Types

South Australia is a diverse area with complex soil issues that vary greatly at all scales from within paddock, across farms and across regions. The soils are largely formed from ancient, highly weathered materials and are inherently infertile and relatively fragile due to a long and varied geological history. The soils require careful management tailored to their soil properties, land use, topography, and climate as they are often fragile and prone to degradation (Hall, Maschmedt and Billing, 2009). The state can be divided into two distinct regions:

- The non arable rangelands, which cover 84,564,654 hectares (DCCEEW 2023), which is over 80% of the state land mass. Very limited soil data and information is available for this region as it is remote, hot, dry and sparsely inhabited. The Landscape Board regions of Alinytjara Wilurara (AW) and South Australian Arid Lands (SAAL) cover the rangelands of South Australia (Figure 1).
- The arable region of the state, which cover the climatically temperate agricultural areas represent 16% of the state total area. This region has been extensively mapped and described through the State Land and Soil Mapping Program. This program was primarily conducted between 1986 and 2001 (Maschmedt, 2002) at a scale of 1:100,000 and 1:50,000 in high rainfall/intensive land use regions (Rowland et al 2016). Fifteen primary soil groups were formulated, listed in Table 1, and illustrated in Figure 2. Detailed soil type maps for this region can be viewed online are publicly available via the NatureMaps website hosted by the Department of Environment and Water (DEW). A further 61 secondary subgroups are described extensively in the book, The Soils of Southern South Australia (Hall, Maschmedt and Billing, 2009). The landscape board regions of Eyre Peninsula (EP), Murraylands and Riverland (MR), Northern and Yorke (NY), Kangaroo Island (KI), Hills and Fleurieu (HF), Limestone Coast (LC), and Green Adelaide cover the arable areas of the state (Figure 1).





Figure 1: South Australian Landscape Board Boundary Map. The report describes information with reference to Landscape Board boundaries as a method for grouping soil information and themes spatially. Note that Green Adelaide is not discussed in this report as it represents the metropolitan region of the state.

Source: Department of Environment and Water (2026)

Table 1: Primary Soil Groups of Southern South Australia. Source: Hall, Maschmedt and Billing 2009.

Soil Type	Area (hectares)	% Total area
Calcareous soils	3,681,700	23.4
Shallow soils on calcrete or limestone	3,101,400	19.7
Deep sands	2,204,300	14
Hard red brown texture contrast soils with alkaline subsoil	1,637,500	10.4
Sand over clay soils	1,403,000	8.9
Gradational soils with highly calcareous lower subsoil	690,900	4.4
Shallow soils on rock	612,200	3.9
Wet soils	431,500	2.7
Deep loamy texture contrast soils with brown or dark subsoil	427,100	2.7
Waterbodies, tidal areas, rockland, mine and unmapped urban areas	388,600	2.5
Shallow to moderately deep acidic soils on rock	360,000	2.3
Deep uniform to gradational soils	234,200	1.5
Ironstone soils	222,300	1.4
Cracking clay soils	209,300	1.3
Highly leached sands	128,300	0.8
Volcanic ash soils	15,900	0.1

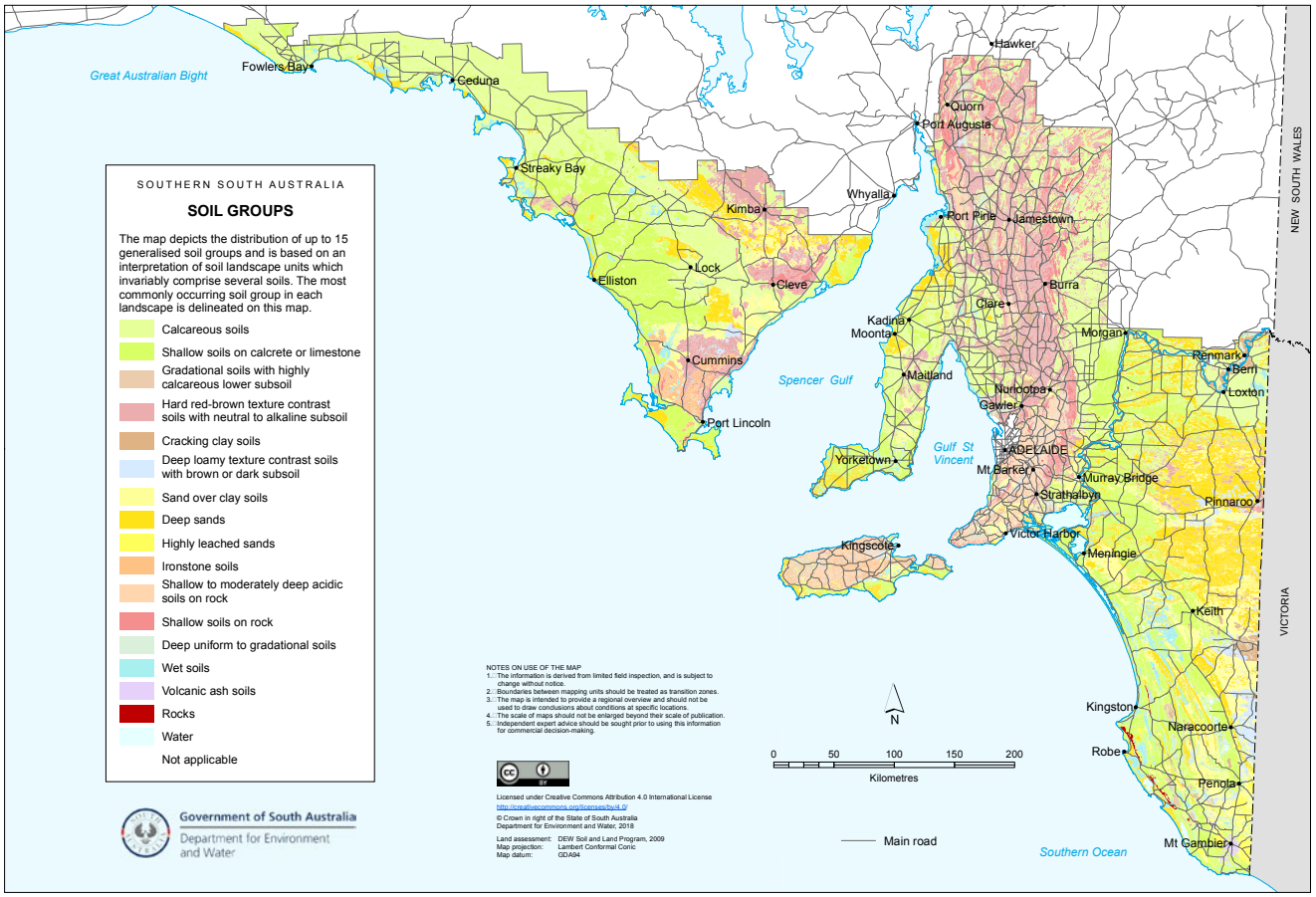


Figure 1: Soil groups in Southern South Australia. Detailed soil type maps can be viewed at the following hyperlink SoilAttrib_SA_SoilType.pdf (environment.sa.gov.au).

Regional Summaries

To provide an overview across the state, the Landscape Board regions described in Figure 1 are used to generate regional summaries. The sections below provide a brief introduction to the regions key agricultural land practices, an overview of the soil capacity in extension, research and development and advisory services in the area, the key soil issues currently relevant in the region and some opportunities identified.

In South Australia, the key organisations working on soils in a research and development, extension and policy context are farming systems groups, private consultancies, Department of Primary Industries and Regions (PIRSA) including the South Australian Research and Development Institute (SARDI), Department of Environment and Water (DEW), Landscapes SA and the individual Landscape Boards, CSIRO, Adelaide University (AU) and Flinders University.

Each region has been assigned an overall soil capacity ranking based on comparison between the availability of soil expertise in research, development, extension and advice in each region. It is important to note this ranking is based on comparisons between regions across South Australia.

Low ranking = These regions have comparatively lower access to soil specific support. These regions may be further from research institutions, have fewer farming systems groups available, and involve systems that have less research and development project investment.

Medium ranking = These regions currently have satisfactory access to soil extension support. Some farming systems groups are present with soil expertise available from staff, board members or via project collaboration. The region has some private consultants with soil-specific expertise available within the region.

Good ranking = These regions have more access to soil extension and research expertise availability compared to other regions in the state. Locally based soil experts are available to service the district. The region is well connected to other soil subject experts via project collaborations with farming systems groups. Some key local consultants are well versed in soil issues and management.

The capacity, issues and opportunity information are a summary of discussions and event attendances which were undertaken with the RSC over two years from 2022 to 2024.

Alinytjara Wilurara (AW) South Australian Arid Lands (SAAL)

These two regions cover a significant proportion of the state spanning more than 80% of the land area of SA, referred to as the rangelands. These regions are grouped together for the purposes of this report as there is significant overlap in the soil issues and land management practices. Rangelands have cultural, conservation and pastoral land management focuses where maintaining groundcover, biodiversity and carbon are key soil topics of interest. The key agricultural industry in this region is livestock. Grazing, rest, and fire are the key land management tools for soil management in the rangelands. Management strategies that are available to pastoralists are governed by the pastoral board and the South Australia Pastoral Land Management and Conservation Act 1989 (South Australian Legislation 1989).

Capacity

These regions rank ‘low’ soil expertise and extension support. For AW region, Sustainable Agriculture support is available via the AW Landscape Board however soil knowledge is low among their extensive skillsets. Soil advice and support is available via private consultants in agronomy organisations (such as Elders). There is limited research and development support for district farmers available from Minnipa Agriculture Centre via SARDI and Ag Innovation and Research Eyre Peninsula (AIREP) in the neighbouring region, but these organisations focus on broadacre farming and mixed farming enterprises, and less for rangeland systems.
In SAAL, soil extension is primarily available through the Landscape Board who have internal extension staff who have adequate soil knowledge skillset among staff and regularly engage subject experts from other regions of the state to collaborate on projects. This Landscape Board collaborates with private consultants, other Landscape Boards, University students and SARDI to assist with the delivery of research and development projects. Recent soil projects have been delivered in the region receiving good attendance at local events by pastoralists and land managers.

Issues

Erosion is a major soil issue in these regions. Long dry periods are common, resulting in susceptibility to wind erosion, and heavy rain events can cause significant water erosion. Erosion risk is increased with low groundcover levels, often caused by poor land management practices such as overgrazing, poor grading technique on roads, and land clearing for tracks, roads, and dams. Management of total grazing pressure, which incorporates the grazing pressure of native animals

and feral animals as well as stock grazing needs is important for these regions. Limited soil data is available for this region, and land systems mapping is too variable and large scale for detailed and specific use. The people working on land management extension in these regions are passionate and driven, but few and far between. It is a challenge to attract and retain people, and to maintain the continuity required to develop familiarisation with the local conditions and build trust and integrity with local communities. There are generally fewer opportunities for incentivised practice change in the rangelands compared to other agricultural industries.

Opportunity

Technological advancement for increased connectivity and availability of resources, such as virtual fencing, has potential in these regions, but large infrastructural and cost barriers are prohibitive at present. Increases in satellite technologies, such as Starlink internet, are increasing availability in these remote regions. There is a want and a need to bring experts to the region to train machinery and water operators, facilitate grading workshops, and create opportunities for shared learning to improve practices in the region. Soil health education provides an opportunity to 'get back to basics' with soil knowledge and can promote messages about how improving soil health can prevent erosion and increase organic matter. Although soil biology is not widely discussed in the region, it is well-received in holistic contexts that connect pasture root development in a soil pit with livestock nutrition needs and animal health. These audiences are interested in the biology messaging and have had high engagement in recent programs delivered by Meat and Livestock Australia (MLA).

The importance of soil water infiltration, often discussed in paddock demonstrations, is well received, and 'soil your undies' demonstrations that introduce soil biology concepts in a fun and hands-on manner, work to increase interest in soils. There are young people moving into the regions with trade and mining backgrounds who choose the rangelands as a lifestyle choice. The most successful soil events and programs to date have arisen from community driven and supported activities. Opportunities for incentivised practice change for methods such as crash grazing, intensive cell grazing and bush grazing methods to encourage practice change could be of benefit. Soil discussed in a holistic context around soil health, interactions between soil and plants, and links to animal nutrition is most effective for pastoralists. There is increasing interest in soil carbon due to carbon farming opportunities in the region, but there is also caution and apprehension about markets reported among stakeholders, and rainfall is limiting.

Eyre Peninsula (EP)

Key agricultural practices are broadacre mixed farming systems that produce grains, fodder and livestock. Systems are rainfed.

Capacity

Eyre Peninsula is ranked 'medium' as there are currently adequate soil extension and research capabilities in the region, provided by a few local people with soil expertise, knowledge and experience. Farming systems group Ag Innovation and Research Eyre Peninsula (AIREP) has good collaborations with soil expertise and has delivered numerous soil projects recently. SARDI Agronomy teams at the Minnipa Agriculture Centre and Port Lincoln Research Centre have soil research, development and extension capacity, and regularly engage experts from other regions of the state as required on projects. There is good engagement and interest from growers and producers on soil information and field days in the region. Local private consultants in agronomy and research businesses also have good soil expertise. Local information sharing and support is also available to farmers through the Agriculture Bureaus: Franklin Harbour, Goode, Streaky Bay, Tuckey, Wangary and Buckleboo Farm Improvement Group.

Issues

Soil issues are highly variable across the Eyre Peninsula. Acidic soils, wind and water erosion, shallow soils, dry saline land and water table induced salinity, as well as hard setting soils are all present within this region. Sandy soils and their associated challenges such as risk of erosion, water repellence, compaction, acidity, and low water holding capacity require effective management. Highly calcareous soils pose challenges for nutrient availability and root disease incidence due to their extreme alkalinity. Ironstone soils also pose challenges for soil management in affected areas.

Opportunity

Advisors have suggested there are emerging acidity occurrences on acid prone soils across the region. Producers in these regions require support on what to look for and how to manage it. In regions where acidity is emerging, the priority is to increase farmers knowledge and skills in identifying patchy acidic soils and assisting them to identify suitable lime sources for managing them. Reviewing the local rules of thumb to recommend soil sampling at 5cm intervals rather than 10cm intervals to identify acid stratification, aiming for higher $pH_{(CaCl)}$ targets of 5.5 with liming, and applying manganese to address deficiencies may help to address the issue. Dry saline land in the form of salt and magnesia patches and their expansion are concerning for growers on the EP. Sand and manure spreading is occurring, as well as chaff dumping, and hay spreading which are generating inconsistent results on farm. There is strong messaging from advisors urging producers to test what you are spreading as an ameliorant prior to application to ensure the additions don't make the issue worse. Local demonstrations providing information on suitable cover cropping options is an effective method for increasing awareness and increasing adoption of improved land management. Highly calcareous soils have issues associated with

hard setting soil, increase in soilborne disease and phosphorus fixation. To manage for this, producers use tillage as a strategy to mitigate the issues. Tillage can increase the water erosion risk of the soil.

Increases in legumes such as lentils and faba beans have occurred in the low to medium rainfall districts in recent years. In this region soil interest is increasing with regards to weed management and nutrient management. Soil moisture retention is important for effective plant establishment in this region. Growers are quite willing to take up new technologies, such as strip and disc systems but due to the cost of buying the infrastructure they require demonstrations in their localised communities to see the benefits, to assist with increasing adoption. pH mapping is occurring in the district, with potential for wider adoption. Soil carbon is a topic of increasing interest. Soil health interest in extension sessions can be hit and miss with audiences, but overall interest in soil knowledge the region is growing.

Northern and Yorke (N&Y)

Key agricultural industries are broadacre cropping, livestock and viticulture. Irrigation is available in some regions of the Barossa and Clare Valley, and isolated areas elsewhere however most agriculture in the district is rainfall dependent.

Capacity

The Northern and Yorke region has good soil expertise and extension support. There are numerous private consultants and agronomists available in the region. Farming systems groups such as Upper North Farming Systems (UNFS) and Northern Sustainable Soils (NSS), have board members which specialise in soil management and mapping, and Mid North High Rainfall Zone (MNHRZ), Hart Field Site Group and Barossa Improved Grazing Group (BIGG) have also delivered soil focused projects recently. SARDI has local soil expertise and extension capacity based at the Clare and Nuriootpa Research Centres. Local information sharing and support is also available to farmers via the Agriculture Bureaus (Arthurton, Boor's Plains, Bute, Laura, Minlaton, Moonta, Nelshaby, Paskeville, Petersville, South Kilkerran, Angaston, Freeling, Halbury / Whitwarta, Koonunga, Lone Pine / Tanunda, Mallala, Owen, Point Pass, and Rowland Flat).

Issues

In this region soil acidity is a topic of concern and areas affected are expanding into lower rainfall cropping areas. Lime supplies have been below what is required in recent years. Farms have increased in productivity, utilising high rates of nitrogen fertilisers and high volumes of product removal at harvest which speeds up the acidification processes. Waterlogging, water repellence and low soil fertility are soil issues commonly identified across the district. Soil erosion via wind is an issue, particularly in lower rainfall districts to the north of the region. Recent fires and an increase in sowing low residue crops such as legumes have been linked to more severe cases of soil erosion in this district. Salinity is also present, and seasonal field days and trials focusing on salinity management demonstrating targeted amelioration techniques for sand spreading and chaff dumping are well attended across the district.

Opportunity

Regional acidity issues in this district are increasing and there are grower concerns on where to access lime from in the future. Dryland salinity is prevalent in some areas of the Yorke region and the severity is increasing. This is influencing some areas to change land use from cropping systems to pasture systems. More support in assisting farmers make this change is needed in low rainfall regions, including cost benefit information and subsidy programs to support growers make the change. Saline land treatment in the N&Y district include utilising sand spreading from within farm and within paddock to improve growth on dry saline land, and treatments for addressing water table induced salinity include a range of options such as growing salt tolerant species such as *Puccinellia sp*. There is a gap in knowledge of salinity management in younger farmers, and an opportunity to target these stakeholders through extension programs to increase their knowledge on recognising and improving salinity management across this region. For example, there would be benefit in refreshers in simple agronomic rules of thumb such as to recognise that seed barley grass presence can be an indicator of salinity presence. This needs to be taught to extension staff and the knowledge to be distributed across the district to those younger farmers to increase awareness and recognition of underlying soil issues.

Controlled traffic farming is demonstrating benefits on regions sandy soils, and 40% of farmers in the Northern Sustainable Soils (NSS) group are utilising controlled traffic practices. Precision soil testing is increasing in interest. Farmers discussed that adopting the technology in the past has been too clunky due to incompatibility between programs and equipment, and therefore this tool has been underutilised. Recently, methods have been improving and there are examples of variable rate lime application having successful results increasing interest among farmers. Tailoring the technology to assist in variable rate fertiliser may be an opportunity worth revisiting for extension in this region. Ground truthing variable rate recommendations with soil test data is needed, but the overall cost savings can be substantial. Demonstrations on soil amelioration and improving 'overall productivity' are drivers that appeal to producers.

Soil health interest is moderate, with regenerative practices increasing in popularity among some farmers. There is minor interest in mixed species cropping in the region, but the practice is not well adopted. Peas and canola, (peola), can be separated at harvest easily, however there is very limited marketability of other mixed grains harvested together. Summer crops are not common in the region however some mixed farming enterprises in

the higher rainfall areas are beginning to trial the practice. The viticulture industry has a high interest in soil and soil biology due to sustainability drivers which can be used in marketing when selling their produce.

Soil support is more readily available and targeted to grains producers than livestock producers in this region. The low rainfall area of this region (around Goyder regional council districts) has overall lower extension and soil project activity. Building self-reliance is important to producers in this region. There is a vast range of producers in proximity with the rainfall gradient, where some can afford advice and inputs comfortably, some would need the money for inputs and not have extra to pay for advice, and some wouldn't have money for either in a given year. This region would benefit from flexible programs that could target and support each of these groups separately to support their unique challenges. There is a need for extension of basic soil knowledge for graziers to better understand soil types, pH and the implications they may have on grazing management decisions. Farmers in the Goyder region are predominantly graziers and stud stock focused enterprises, therefore businesses in this region generally have a stronger focus on animal health and quality, with less priority given to soil management. Soil extension in this region requires tailoring to focus on how soil management can benefit to animal nutrition and animal health to align with their specific values and priorities.

Murraylands and Riverland (M&R)

Key agricultural industries are broadacre cropping, livestock, horticulture (both annual and perennial), viticulture, and poultry. Agriculture utilises irrigation and rainfed systems.

Capacity

Murraylands and Riverland are ranked medium/good as they have adequate soil extension capabilities currently in the region. The Landscape Board has soil extension capacity, private consultants are quite abundant in region and SARDI service the region on projects frequently. Farming systems group Mallee Sustainable Farming (MSF) employ soils expertise within their staff and have had numerous recent soil projects with strong soil interest and engagement from their growers. Murray Plains Farmers (MPF) group regularly deliver soil focused projects which receive good engagement from members. Adelaide University have projects in the region with a soil focus. For extension pathways with growers, local information sharing and support is also available to farmers by the Agriculture Bureaus: Barmera, Coomandook, Lowbank & Districts, Wunkar, Karoonda, Loxton Irrigation and Monarto.

Issues

Soil issues are highly variable across the Murraylands and Riverland districts. Acidity and dry saline land issues are prevalent, and water table induced salinity is also observed in areas. Sandy soil constraints and related issues such as compaction, wind erosion, low water holding capacity, water repellence and trafficability are present. Alkaline soils and calcareous soils also pose management challenges in the district with implications for plant nutrient management. Shallow soils and low fertility soils are present. In 2022, flood management and managing soil post flooding were of high importance.

Opportunity

Increases in the extent of dry saline land and expanding mallee seeps is a focus of current research and extension projects, but ongoing demonstration and extension support is needed in this region. Whilst there is information available on the causes and management of this issues, there is still a lack of understanding among farmers. There is increasing interest in adopting soil technologies, such as utilising variable rate technology and improving amelioration strategies with new tools. Extension messaging focused on managing soil trafficability and reducing risk of wind erosion after soil amelioration is important in the region. Projects trialling strip amelioration to improve soils and mitigate these risks are receiving high interest and good outcomes for producers. Research trials demonstrating ripping with inclusion plates and various other sandy soil modification techniques to improve acidifying soil and sandy soil constraints, including utilising on row/off row sowing strategies to manage water repellence, trialling strip and disc systems to increase organic matter residual for increased ground cover, are currently being researched and demonstrated in this region.

Acidity is emerging in areas it has not been seen previously in this district, which will require more extension and demonstration in these areas to support farmers and increase their awareness of the issue. Conversely, alkaline soils and calcareous soils also pose management challenges in the district with implications for plant nutrient management. The annual horticultural areas have management issues associated with soil variation across paddock and increasing alkalinity. Extension and support for growers to manage these issues requires more investment and support. There is evidence of adoption of Reefinators (tractor-drawn rock crushing machines) to break up rock and increase soil fertility in this district as a method to improve productivity on shallow soils, which are common.

There is an increasing interest in soil biology and soil health in the region, with extension support available via the Landscape Board to encourage adoption. The use of manures, composts, biochar and regenerative agriculture practices are increasing with some producers. Currently, carbon farming uptake is low in this region.

Hills and Fleurieu (H&F)

The Hills and Fleurieu district is a high rainfall region for South Australia. Key agricultural industries are viticulture, perennial horticulture, livestock, and dairy cattle. Some small areas of annual horticulture occurs, and dryland cropping is the main land use in the eastern districts. The region is a mix of irrigation and rainfed industries.

Capacity

This region has good soil expertise and extension support as there are many private consultants and agronomists are available locally. This is contributed to the region's proximity to the metropolitan region. SARDI and the Landscape Board have soil extension capacity. There is a low amount of soil focused on projects delivered by the local farming systems groups, Fleurieu Farming Systems (FFS) and Fleurieu Beef Group (FBG), and when soil is discussed, it is generally delivered in a holistic context. Local information sharing and support is also available to farmers by the Agriculture Bureaus: Clarendon, Lenswood / Forest Range, Longwood, Meadows, Milang, Mount Barker and Parawa.

Issues

Acidity and water erosion are the predominant issues identified for this region. Water erosion can impact significant areas by mass erosion processes including gullying, tunnelling and landslips.

Opportunity

Acidity is well understood among landholders in the region however the causes and appropriate treatments for acidity are misunderstood. Some small landholders have had difficulty finding contractors to treat acidity on their properties due to the smaller scale required. Water erosion is natural and caused by inherent soil properties, however impacts can be reduced by maintaining groundcover, reducing stock access and maintaining native vegetation cover near water courses and wetlands, maintaining perennial pastures and controlling feral herbivores such as goats, deer and rabbits. Mass erosion sites can pose opportunities to take areas out of agricultural use and repurpose for biodiversity or carbon options.

Interest in soil health, soil biology and soil carbon topics are increasing. Increasing soil cover is key for reducing water erosion. Many soils in this region have higher soil carbon comparable to other regions in the state, largely due to the higher rainfall and lack of cultivation. Soil carbon project opportunities may have potential in this region with extension support which is available via the Landscape Board. Scattered peat soils are present in this region, which pose an opportunity for improved management and conservation via research and natural capital, carbon and biodiversity market opportunities.

Kangaroo Island (KI)

Kangaroo island is a high rainfall district with the logistical challenge of being an island. Key agricultural industries are livestock, grains, horticulture and viticulture. The island is predominantly rainfed, with some irrigation used in horticulture and viticulture.

Capacity

Kangaroo Island has ranked good for soil expertise and extension support. Kangaroo Island is a small region that is well serviced, noting there is a low number of soil experts on the island overall. PIRSA and the Landscape Board have local soil extension capacity, and local private agronomists are quite well versed in soil issues. Soil project delivery has had a good history in the region, with a long-standing local soil testing service and farmer technical support provided by PIRSA. The farming systems group Agriculture Kangaroo Island (AgKI) delivers soil projects regularly in partnership with PIRSA to encourage local information sharing, and tailored soil support to farmers.

Issues

Soil acidity, management of soil nutritional issues for macronutrients and trace elements, salinity, water repellent sands and erosion are priority soil issues for the island.

Opportunity

To manage acidity issues, advisors are recommending targeting pH $_{(CaCl)}$ of 5.5 when liming. Previously subsoil stratification issues were still being detected post liming when pH 5 was targeted due to the slow movement of lime. The early adopter farmers are more open to adopting the target rate of pH 5.5, while other producers, largely due to financial constraints, aim to keep pH >5. Access to lime stocks on the island is an issue, and while more local sources are available, many are located under native vegetation areas with conservation significance. An analysis for the viability and cost of accessing local lime needs to be addressed, and alternative lime source options require further investigation to support this region. The KI soil testing program (run through the Kingscote PIRSA Office) and its associated historical database dating back to the early 1990's requires more support to continue. The service offers assistance for soil testing, interpretation of results and independent advice. The consistent use of the same laboratory ensures consistency with results over time. This service provides opportunity to visit properties and suggest other issues as they are observed. The uptake of soil testing is variable with some producers testing regularly, but the majority only testing ad hoc or rarely.

There is increasing interest in soil health and microbiology, with recent demonstrations by the Landscape Board using biochar, compost and inoculants which analysed soil microbes being well received by some growers. Summer fodder crops have been trailed and opportunistically grown on Kangaroo Island for many years. The results have been variable depending on seasonal conditions and the level of farmers management and expertise. Carbon farming extension opportunities will be available to farmers via the Landscape Board.

Limestone Coast

The Limestone Coast region is a variable rainfall district, with medium to low rainfall in the northern districts, and medium to high rainfall in the southern districts. Key agricultural industries are dryland cropping and lucerne seed production, livestock, horticulture, viticulture, dairy and forestry. Rainfed and irrigated farming systems are common throughout the region.

Capacity

This region ranks low to medium for soil expertise and extension support relative to other regions in the state. A few key private consultants are delivering majority of the soil expertise and extension to this region. The Landscape Board has soil extension capacity, and SARDI service this region on projects but do not have expertise regionally based. Local farming systems group Mackillop Farm Management Group (MFMG) and local council community organisation Coorong Tatiara Local Action Planning Group (CTLAP) have recently delivered soil projects and producers indicate high interest in soil management projects. Local information sharing and support is also available to farmers by the Agriculture Bureaus: Lochaber, Mil Lel, Millicent, Sherwood and Wolseley and linked groups such as the Sherwood Farm Management Group.

Issues

Soil issues associated with sandy soils, including acidification, erosion, water repellence, low water holding capacity and trafficability are present in this region. Water table induced salinity issues and dry saline land are present. The southern high rainfall areas are prone to soil issues associated with the installation and management of landscape drains, soil sodicity impacting soil structure and waterlogging. Nutrient management issues are recognised such as nitrogen leaching and low fertility including potassium, iron and manganese deficiencies. Nutrient management is a priority for the dairy industry. Acid sulfate soils are uncommon but also present in this region and can be an issue if drained.



Opportunity

Sandy soil management and acidity has been researched and extended successfully in the region recently, but the challenges of the issues associated with them are ongoing and complex due to farm, paddock and regional variability. Continual extension and research support will be required on these topics. Clay re-acidification has been discussed across many districts in the Southeast areas of this region, and a need was identified for further extension on reducing nitrogen leaching. There are opportunities to extend lessons learnt for erosion on sandy soils in cropping systems in the region to apply to grazing systems, with a need to focus on acidity, non-wetting sands and water holding capacity management.

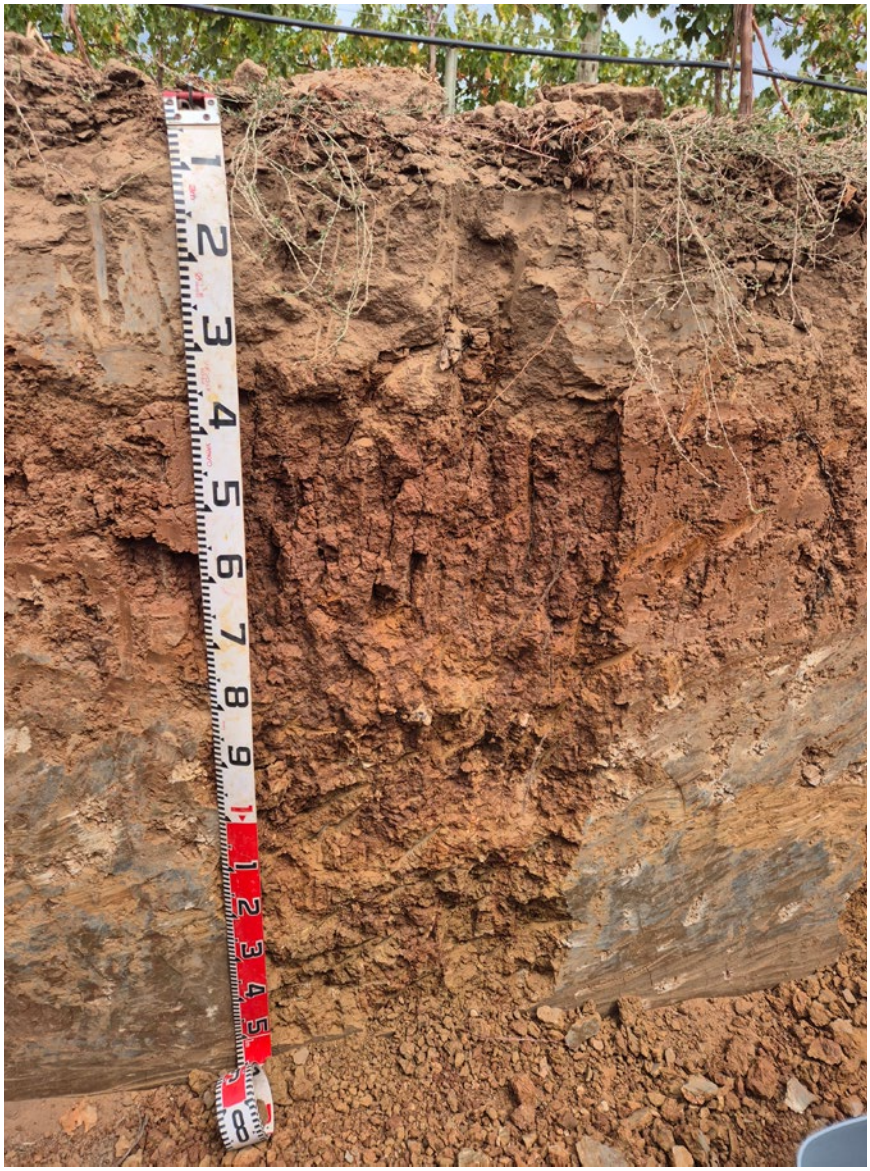
There is increased interest in soil biology, with recent workshops well attended. Scattered peat soils are present in this region, which pose an opportunity for improved management and conservation via research and natural capital, carbon and biodiversity market opportunities.

Overall Snapshot:

Soil capacity is unevenly distributed across the state. It is important to note that the rankings defined in this report compare among districts of SA and does not infer that the region has a sufficient supply of extension personnel to meet the regional demand. Districts that are ranked as ‘good’ may be comparatively lower to other regions across Australia, but they do have more availability and access than other SA regions ranked ‘low’.

The level of complexity and diversity of soil issues across the state is highlighted throughout the regional summaries. It also emphasizes six main recurring themes discussed across the districts: erosion, acidity, salinity, sandy soil constraints (and its associated soil issues), soil health and carbon. In terms of opportunity, these soil issues are not new, and these findings are not unexpected. In fact, there is ample evidence of research, development and extension on each of these key areas, both historically and at present for SA. Ongoing research, extensions and support is required for addressing these issues is important because the agricultural systems are dynamic, technologies are advancing, and new improved management methods are constantly being developed. Agricultural ecosystem functions are constantly changing, climate is changing and demands on the soil to support higher productivity is ever increasing. Some issues such as acidity, water repellence and salinity are continuously developing in new areas, or reforming in areas that have previously been ameliorated. Localised support and context are also required for producers to manage these soil issues and how techniques and methods are relevant to their business. The key themes may be the same, but the localised context is critical for extension and adoption. This includes local demonstrations to validate methodologies in local conditions, climates, farming systems and soil types. This involves extension delivered by trusted local advisors and information sharing networks such as farming systems groups.

Soil carbon and soil health are increasing in popularity across all regions. Soil organic carbon is a component of soil organic matter which is important for overall soil health, condition, land productivity and landscape resilience. It can alter and improve soil chemical, physical and biological properties. Soil carbon interest is driven by potential for access to carbon markets, and industry, community and government focus on greenhouse gas emissions potential of market access and climate change mitigation. Sustainable agriculture practices as recognised under the Emissions Reduction Fund agriculture method can provide incentivised opportunities for growers to alter their land management strategies. No till and low till systems are well adopted in SA, and maintaining groundcover, rotational grazing and stubble retention is increasing in adoption. Increasing soil health also promotes increasing productivity of land. Land price increases are encouraging a shift in farmers to maximise productivity on current land as its too expensive to buy up more properties. Soil health is also popular among regenerative farming practices and with producers that aim to reduce their reliance on synthetic fertilisers. Defining soil health benchmarks among climatic variations, land uses, and local regions is complex. Soil biological testing is also now commercially available, however there is a lack of information on how the results link to productivity gains.



Statewide Soil Capacity

Careers in soil and extension expertise:

All regions report lower soil expertise availability and lower overall extension support now than there was in the past, particularly during the 1990s and early 2000s period. Careers in soil are not a distinct standalone pathway as they have been in the past. Soil knowledge and expertise is integrated into agronomy, viticulture, horticulture, and industry related training and is becoming more cohesive as a component into these broader roles and careers. However, there is an overall decline in independent soil advice available.

Some of the key soil topic and extension experts in South Australia are reaching retirement age. The model in which some of them started out as soil conservation officers no longer exists to train the next generation. Most people working in these types of roles now work on project-based funding which does not provide an opportunity for smooth succession planning or the ability to focus on specific soil topics for extended periods of time to build the level of expertise that was developed previously. Soil issues and management often take time to take affect and show their effectiveness and value. Seasonal conditions can influence outcomes, and this project-based funding model is prohibitive to allow people to focus a career on a single topic to develop a level of expertise and deep understanding of soil issues that is needed

Applied research project-based roles, which help sustain Universities, CSIRO, SARDI, farming systems groups, and private consultancies that conduct research rely on funding rounds and short-term projects, which poses a challenge for maintaining expertise beyond the program durations. Most programs supporting the experts working in soil research and extension roles across the state are employed on term contracts linked to grant rounds and projects. Funding rounds are driving the jobs available. There are advantages of this grant rounds and projects system, as topics funded are written by the local regions on topics that are needed and relevant at the time, and short turnovers provides opportunities to diversify and evolve priorities and projects as necessary. However, it also has disadvantages of short-term funding providing job insecurity, a high administration and reporting load, and the lack of continuity to become an expert in any specific local region or topic. Project funding models are also less conducive training of younger soil experts and supporting succession planning due to tighter budget submissions to keep grant applications competitive.

Adelaide University is training approximately 100 Agriculture and Viticulture students per year with soils integrated into the degrees which is providing skilled young people to the industry. There is a gap in soil focused opportunities for internships, graduate roles, mentoring, and on the job training opportunities beyond pursuing further education and higher degrees. Also there is a gap at the early-mid-career step, where students have completed PhDs or are seeking new opportunities and avenues in their careers with limited soil positions available. There are also challenges with enticing people to undertake PhDs, as the current cost of living pressures now require people to choose between study with a low income or entering industry roles, which offer greater income and perks. Funding for post-doctoral research positions is highly competitive and highly dependent on external funding, resulting in low job security and limited options for people that would like to find employment locally. For those who may want to exit from academia there is limited specific soil roles available in industry.

Extension requires strong interpersonal skillset and a level of trust and respect between clients and the facilitators. It requires training and knowledge of effective methods, theories and strategies for effective communication and providing adequate support. Trust and relationships are essential for this, which take time to build, and conscious effort to maintain. Effective extension requires an understanding of the issues at hand and knowledge of the community drivers and local nuances. Extension work is a specialist skillset and craft which is developed over time. For any given soil issue, there are a magnitude of management practices. Best management practice varies from region to region and farm to farm, to fit within business and farming type. Highly variable environments, soils, climates and logistical challenges influence best practice in any given situation. Extension needs are equally unique and require flexibility to be most effective. The combination of having both comprehensive soil knowledge and extension skillset is highly valuable and is difficult to foster in the future workforce with current project funding models.

The opportunity here is to generate targeted programs within grant rounds that support the hiring and training of early career graduate positions as part of the project delivery. As more people working soil extension roles are employed by farming systems groups or private consultants, funding support would need to be openly accessible to these audiences. Likewise state government directed funding could require specific allocation to capacity building, upskilling and training. This would be ideally in longer term projects, but short-term projects

also provide opportunity to increase exposure for employees to specialise and focus on soils in projects would also be beneficial.

Cross-organisational connectivity:

Awareness of activity outside own organisation

Many organisations promote their events information tools and resources within their own sharing platforms and organisational newsletters, which can result in different organisations scheduling events at the same time or on similar topics and duplication of resources. There are issues associated with establishing calendars and keeping them up to date, as the process is manual and time consuming. In the past, efforts have tried to create broad calendars, which start of good but diminish over time as other tasks take priority. The AgExcellence Alliance calendar of events is one of the most comprehensive calendars for the state that shares upcoming events from numerous farming systems groups (https://agex.org.au/events/). The State Government has an abundance of resources online via NatureMaps and Enviro Data SA Sharing within government organisations is good, via the Sustainable Agriculture Network hosted by the Department of Environment and Water (DEW). Whilst good connectivity is demonstrated, there is potential for better coordination among government organisations, farming systems groups and other organisations to coordinate their events in a more efficient manner. It would be beneficial to improve connectivity in a public domain that is accessible to private consultants, university students and broader grower communities. This concern has been raised by farming systems groups, State Government Agencies and University staff. Ideas for apps, sharing calendars and online platforms have been suggested, however funding, logistics and time requirements for development and maintenance have been identified constraints. New opportunities via the Soils Connect website and Mallee Sustainable Farming, the PIRSA Soil Collaboration Centre Project and the Regional Soil Coordinator role are working to increase that knowledge sharing and connectivity.

Soil and extension specific mentoring, support, and networking:

Extension training and skill development is available via the Australasian Pacific Extension Network (APEN). This organisation offers professional development via mentoring programs and webinars to upskill and connect experts with new members and share methods resources and experiences. The SA Drought Hub have recently funded local programs delivering extension training across South Australia to build capacity in this skillset. On ground driven projects, delivered by locals and developed with producers from the early stages have greater grower engagement as it keeps the research relevant for adoption. Extension is needed to facilitate this.

Soil Science Australia's accreditation programs are key for generating soil professionals across Australia. Their certification programs, Certified Professional Soil Scientist (CPSS) and the newly developed Registered Soil Practitioner (RSP) are highly valuable in developing and maintaining credibility and level of professionalism to the agricultural industry. They provide training resources and promote upskilling opportunities and require a level of continuous learning via ongoing professional development requirements. The Soil Science Australia local SA branch support the soil community via annual lectures, networking opportunities, and outreach at field days and community events.

Increasing connectivity for students and early and mid-career people working in soils or extension roles is beneficial in fostering a supportive network. A great initiative being undertaken here in South Australia is the Young in Soils and Earth Sciences student group. This is organised through volunteers from the local Soil Science Australia branch who organise soil pit days for university students to network, build confidence and practice their soil characterisation skills and techniques. They have established their own committee to ensure the activities are developed by students and remain relevant to their interests. The group also organise networking evenings where students can meet people working in various soil careers from across the Soil Science Australia membership to ask questions, build connections and network. An opportunity is to support and build upon this network to boost their volunteer capacity and provide resources for them to grow and develop further.

Increased connectivity between early and mid-career soils experts, researchers and extension personnel would also be beneficial in SA. Many of the senior soil extension experts have worked together or were trained together in past government programs, while now people are coming into soil and extension careers through various paths. Places and platforms for these people to meet one another, network and share skills and experiences would be of benefit. The Regional Soil Coordinator role aims to assist collaboration across SA by increasing connectivity and providing networks to connect researchers with farming systems groups and share soil information and tools among stakeholders. The creation of the South Australian Soils Collaboration Centre by PIRSA under the Partnering to Implement the National Soil Action Plan 2023-28 program is another new exciting opportunity to increase collaboration as it develops.

Overall Snapshot

Overall, there are less people in traditional soil extension roles and therefore less independent soil advice available to producers. Whilst South Australia has excellent state and nationally recognised experts within key soil specialties, they are often delivering their subject area for research, development, and extension across the whole state or within a

specific industry. Collaboration on projects and sharing of soil expertise is observed extensively across the region. This demonstrates SA's ability to be efficient when limited resources are available. An issue associated with this model is there is limited opportunities for people to become an expert on any specific local region, which would be beneficial at understanding they system and issue in greater depth. This high efficiency model is also less able to foster succession planning and training of younger soil experts, as resources are stretched to cover larger areas with less resources available. Training and upskilling in extension and soil expertise are available through key organisations such as APEN and SSA There are gaps in opportunities for graduates, and early mid-career people in both research and industry roles to further their careers in soil due to lack of opportunity of soil specific roles and the highly competitive nature of grant opportunities. Local programs such as the Young in Soils and Earth Sciences group, the Regional Soil Coordinator program and the new Soil Collaboration centre program offer opportunities to increase connectivity and capacity building within SA.



Policy - Soil Priorities

Soil conservation and management is a priority that is recognised by agricultural industry organisations and State Government agencies within SA. A review of seven industry plans and blueprints relevant to agriculture and land management was undertaken to identify whether soil is identified a priority in these organisations. The nine Landscape Board strategic plans were also reviewed, as well as the Pastoral Board strategic plan and SARDI strategic plan to understand soil prioritisation among government organisations. The state plan links, key soil topics and brief summaries to provide context are summarised in the table below.

Policy	Key themes	Context
Industry Blueprints		
Primary Producers SA Policy platform | Primary Producers SA (ppsa.org.au)	No specific mention of soil Carbon Farming	Under their Productivity and Sustainability Policy section, Carbon Farming is discussed. Carbon farming is an evolving area of policy in Australia and overseas, and a great body of work is required to ensure integrity and confidence in carbon accounting and the development of a functioning carbon market. This will require strong engagement of government and industry. South Australian producers need trusted and independent sources of information or advice to navigate both the opportunities and risks of carbon farming, including understanding carbon decision support tools to identify baseline emissions, and then in making business decisions around balancing and/or participation in carbon markets.
Grain Producers SA SA-Grain-Ind-Blueprint_online.pdf (membes-ams.com)	Soil type suitability Soil amelioration on marginal land	Soil is mentioned under Pillar 1: Market opportunities: Expanding the South Australian pulse industry is a key initiative of the Blueprint. This recognises the opportunities and importance of pulses in the cropping rotation for South Australian growers, who have a wealth of experience in growing pulse crops. Pulses also offer growers more flexibility in the types of crops that can be grown across a range of soil types. and rainfall zones. It is also a priority under Pillar 4: Innovation. Increase the production base of SA's grain industry through sustainable intensification of agriculture. Project areas: Investigate the benefits of soil amelioration on marginal land.
Sheep Blueprint SASIB-Booklet_Insides_FA_online_single-pgs.pdf (livestocksa.org.au) Livestock SA	Soil health Carbon capture	Soil is mentioned in Priority Area 1: Supporting productivity with sustainable practices. This addresses soil landscape vegetation strategies to support healthier soils can offer enhanced carbon capture and storage capabilities. This will be critical to accessing future carbon markets and more broadly, establishing sustainability credentials. Two initiative areas are soil relevant: Support carbon capture and biodiversity through improved soil health. Improve feed base productivity and resilience through adoption of multi-species pastures. Priority Area 4: Optimising market outcomes aims to develop a sustainability measurement and accreditation system and support end-to-end traceability systems.
SA Beef Industry Blueprint – Livestock SA SASIB-Beef-Blueprint_ONLINE_LR_single-pgs.pdf (livestocksa.org.au)	No specific mention of soil	Resilient and profitable production systems are discussed as priorities.
SA Dairy Action Plan Action-Plan-2024-2029-v3.pdf (sada.asn.au)	No specific mention of soil	A key goal is sustainability, both in presentation and practice.
The South Australian forestry products association South Australian Forest Products Association Strategic Vision 2022 – 2025 2023-V6-SAFPA-Strategic-Plan-003.pdf	No specific mention of soil	Document states an aim to encourage the adoption of evidence-based research that innovates and benefits the modernization of forestry and connected industries. Ensure forestry is seen as an environmentally sustainable sector and a major renewable source for the future.
Horticulture blueprint booklet Horticulture-Blueprint-Booklet-2021.pdf (ppsa.org.au)	Investment in soil	Soil is mentioned under the Supporting Policy section of the document, where the blueprint asks to keep NRM levies to a minimum for primary producers and ensure that there is adequate investment in soil and land management, animal and plant control, innovation and technology and on farm capital investments for NRM outcomes.

Landscape Board Regional Landscape Plans		
Alintjara Wilurara Landscape Board Regional Landscape Plan 2021-2026 aw_landscape_board_landscape_plan_2021_26a.pdf (environment.sa.gov.au)	Soil condition Soil erosion Carbon farming	Priorities include soil condition, biodiversity, native vegetation cover and sustainable land management practice across APY pastoral lands. Focus Areas include supporting the adoption of sustainable pastoral practices to reduce soil erosion and participate in carbon farming opportunities that support sustainable pastoral practices.
South Australian Arid Lands Landscape Board Regional Landscape Plan 2021-2026 6100_saal_landscape_plan_webfinal.pdf (environment.sa.gov.au)	Soil cover Biological soil crusts Erosion and sedimentation Carbon storage	Soil is mentioned under Priority 3: sustainable land management, land management practices that protect soil, vegetation and biodiversity are mentioned. It discusses soil cover, including soil crusts (lichens and mosses), water filtration and storage, flood mitigation, carbon storage and pollination. Overgrazing by livestock and other herbivores. Excessive total grazing pressure - from the combined impacts of over-abundant kangaroos, livestock and feral herbivores – leads to the decline or loss of palatable species, reduced soil cover, increased wind and water erosion risk, reduced landscape hydration, reduced capacity to recover after dry years, and long-term decline in landscape productivity. The effects of severe degradation may last for decades or longer, and affected areas may require active rehabilitation Inappropriate placement or maintenance of infrastructure, such as roads, tracks and pipelines, can alter surface drainage and lead to gully erosion and sedimentation of waterways.
Eyre Peninsula Landscape Board Regional Landscape Plan 2021-2026 EP-landscape-plan-2021.pdf (environment.sa.gov.au)	Restoration of soil Soil acidity Dryland salinity Soil cover erosion	The regional plan has a focus area on facilitating regenerative land management to improve soil health and vitality. Sustainable Agriculture Regional priority: Reducing the risk of land degradation to protect the region's valuable soils and facilitating regenerative land management to improve soil health. Soil cover- erosion risk is ranked good and condition is stable. Soil acidity is fair for the region, condition is stable.
Northern and Yorke Landscape Board Regional Landscape Plan 2021-2026 2021_26_landscape_plan_final.pdf (environment.sa.gov.au)	Soil health Groundcover Erosion risk Soil condition	In this regional plan, the regional condition for soil is ranked as good. The focus areas within plan that address soil are: Sustainable Agriculture, to protect and improve the condition of soil, groundcover and vegetation. Promote and demonstrate best management practices to improve soil health, retain groundcover, reduce erosion risk and address total grazing. Under the priority pest plant and animal control, the goal is to encourage collaborative land management practices that reduce economic (production, livestock, and management) and environmental (biodiversity, competition, predation, soil condition, and disease) impacts of pests.
Murraylands and Riverland Landscape Board Regional Landscape Plan 2021-2026 final_2021-2026_board_landscape_plan_web_ready.pdf (environment.sa.gov.au)	Soil constraints Carbon markets Soil acidity Salinity	Under the priority Sustainable Agricultural and pastoral landscapes, the priority is to work with industry and farming groups to identify and address soil management issues to improve soil health and build resilience. They aim to promote and demonstrate best management practices to retain ground-cover and reduce erosion risk. The plan defines soil health as the ability of the soil to function as a living ecosystem in relation to its natural capacity. A healthy soil sustains biological productivity, maintains environmental quality and promotes plant, animal and human health. Healthy soils are vital for productive, sustainable and profitable farming systems and are fundamental to cultural wellbeing and the environment. In the Murraylands and Riverland region, the soil constraints and management issues that impact our soils include wind erosion, soil salinity and saline seeps, soil acidity, compaction, non-wetting (sands), shallow soils, and low fertility. Each of these issues can limit the productive potential of crops and pastures. Over the past 30 years the region has seen a significant increase in the adoption of improved land management practices for both pest and soil management. Overall, the regional soil health is improving, however as farming systems evolve issues emerge which require investigation and specific solutions Subregional issues of soil acidity and salinity are highlighted.

Adelaide Hills and Fleurieu Landscape Board Regional Landscape Plan 2021-2026 hf_landscape_plan_2021-26.pdf (environment.sa.gov.au)	Soil acidity Soil health	Within this plan, soil acidity is ranked in poor condition and trend is declining. Soil is described as fundamental in the plan, managing weeds, pests and soils are essential parts of the Land priority, but also critical for the integrity of nature. Maintaining soil health Industries are adapting to climate change, have transitioned to low carbon farming methods, and are benefiting from carbon sequestration opportunities. Support the uptake of regenerative agriculture and land management, increase understanding of localised soil issues and how to improve soil health. Explore and support carbon reduction activities, including uptake of carbon farming, uptake of emissions reduction and carbon sequestration opportunities in soils, vegetation, forestry and livestock management.
Kangaroo Island Landscape Board Landscape Plan Regional Landscape Plan 2021-2026 kangaroo_island_landscape_plan_2021-2026.pdf (environment.sa.gov.au)	Soil moisture Soil erosion sedimentation and nutrient runoff destabilisation of water courses Soil contamination Soil acidity Waterlogging	The KI Landscape Boards has identified the following issues as their priorities : Soil erosion and bank destabilisation due to riparian vegetation removal and diminished water quality from runoff containing sediments and nutrients as threats to wetlands and watercourses. Increased nutrients and sediment from run-off resulting in losses of seagrasses from smothering with sediment and increased algae to coast and marine ecosystems Related to their 2019/202 Bushfire, Reduced ability for plants to regenerate and potential loss of soil seedbank due to high fire severity. Increased flow of sediments into coastal ecosystems, smothering coastal plants, saltmarshes, seagrass meadows and reefs. Loss of coastal dune native vegetation leading to erosion from rainfall, wind and tidal events, Loss of pastures/ground covers making soils susceptible to erosion, Soil contamination through the burning of farm infrastructure. Increasing soil acidity negatively impacting production and environmental health. Climate change risk of Lower rainfall, reducing surface and ground water and potentially increasing surface water salinity educed soil moisture and water stress due to lower, less reliable rainfall leading to more and longer periods of drought. The report also stated overall soil statistics in the report: KI's soil is critical for agricultural productivity and natural biodiversity. • 78% of KI's agricultural soil surface is acidic (below pHCa 5.0). • Over 48% of KI soil has the potential to be affected by waterlogging. • 22% of KI soils are affected by water repellance. • 28% of KI soil is at risk from wind and water erosion The pest management priority also refers to surveillance programs for sites soilborne disease *Phytophthora cinnamomi*.



Limestone Coast Landscape Board Regional Landscape Plan 2021-2026 lclb_regional_landscape_plan_2021-2026.pdf (environment.sa.gov.au)	Soil health	This plan acknowledges soil in the document foreword: These key economic activities rely on our natural resources including land, soil and water. Soil is referred to in the growing sustainable primary production section - A thriving primary production sector will rely on a joint approach to protecting and improving soil health, managing water delivery and security, controlling pest plants and animals, and adapting to the impacts of climate change. References to supporting projects like Carbon Roadmap: investigating opportunities to sequester carbon in our favourable soils. Improved biodiversity Protection and restoration of native vegetation, soils, wetlands, watercourses, and coastal habitats
Green Adelaide GA-Regional-Landscape-Plan_approved.pdf (environment.sa.gov.au)	Erosion	Under Coastal management section, reducing erosion and sedimentation is identified as priority. Under the priority Water resources and Wetlands, stormwater management, including the application of water sensitive urban design principles, goes hand in hand with best practice land management to minimise watercourse erosion, protect and enhance biodiversity, and prevent polluted discharge going to the sea. Soil type diversity is referred to as a consideration for controlling pest animals and plants
Other		
Pastoral Board Strategic Plan Pastoral-Board-Strategic-Plan-2023-25.pdf (environment.sa.gov.au)	No specific mention of soil Carbon farming	With the objective to encourage integration of conservation land management with pastoral uses, the action listed is to improve ability of pastoral lessees to connect with conservation, native vegetation, carbon farming and nature repair instruments and markets
Department of Primary Industry and Regions, South Australian Research and Development Institute SARDI Strategic plan 2023-2028 SARDI Strategic Plan 2023–2028 (pir.sa.gov.au)	Soil constraints Biosecurity - soil borne pathogens Sustainable management soil constraints Novel soil amelioration Training in extension	Soil is mentioned specifically in 3 out of 7 of the Strategic pillars, and one Pillar is focused on adoption and extension capability. In Pillar 1 Improved productivity in a changing climate mentions soil constraints, Pillar 2 Enhanced biosecurity preparedness and management mentions ongoing commitment to diagnostic services for soil borne pathogens, Pillar 3 Sustainable management of natural resources that underpin primary production states to develop soil strategies to deliver research on overcoming constraints with novel soil amelioration practices. It also aims to inform management of soil constraints such as acidity, salinity and sodicity.

Many of the blueprints and plans above refer to soil priorities, but it is important to note that not all do. Four out of the seven industry blueprints did not specifically mention soil, which identifies a gap in soil being recognised as a key priority. Soil is fundamental to all agricultural enterprises, and the policy at current is not reflecting this. There is an opportunity to increase soil awareness and priorities within those organisations in which plans did not mention soil to ensure impact for on ground change and programs where there is known demand and knowledge gap in soil management. Goals for improved soil management are difficult to achieve when they are not explicitly defined and prioritised. All organisations which did not specifically mention soil or soil issues all refer to sustainability, resilient systems or carbon, of which soil can be relevant. Carbon farming opportunities may provide a gateway for beginning these conversations.

The Landscape Board Landscape Plans all identified soil and soil issues as priorities in sustainable agriculture and environmental contexts. These reports reflect similar recurring themes of carbon, soil health, acidity, erosion and salinity which align with priorities identified through the regional summaries discussed earlier in the report. There is opportunity to increase collaboration and support with these organisations to implement changes and support their soil relevant goals.

Other key policy documents with a strong soil focus available for SA include:

The Carbon Forward Plan: Soil Carbon Forward Plan for SA Tech Note v1 March 2021.pdf (environment.sa.gov.au)

The Carbon Farming Roadmap: Carbon Farming Roadmap for South Australia (pir.sa.gov.au)

The SA Government Trend and Condition Report Cards: SA_2023_ReportCards_FullReport.pdf (environment.sa.gov.au) (Note: new report cards with carbon estimates are currently being developed by DEW)

The Blue Carbon Strategy for South Australia: blue-carbon-strategy-for-south-australia.pdf (environment.sa.gov.au)

The State Landscape Strategy: 828374-LSA-Statewide-Landscape-Strategy-V15-FIN3-web.pdf (environment.sa.gov.au)



Conclusions

The soil gap analysis presented here outlines the capacity, issues, opportunities within soils across each region of South Australia. It has identified some key target areas for future focus and highlights the opportunities that exist to continue to strengthen the soil network and delivery pipeline throughout each region in South Australia.

The key recommendations are:

- More investment to support local on ground driven activities in improving soil management.
- Targeted programs to increase future capacity in soil research, development and extension including internships, postgraduate studies and fellowships, and facilitated training activities and workshops.
- The delivery of co-designed locally driven programs supporting research, development and extension training to overcome identified soil issues in each region working directly with landholders are most effective at driving on farm adoption.
- There is opportunity to get soil management goals recognised within agricultural industry organisational priorities. Soil is fundamental to all agricultural enterprises, and the policy at current is not reflecting this. Carbon may be an opportunity to increase soil awareness.
- As a collective, South Australia has a dedicated team of soil scientists, extension officers and landholders willing to engage in improving and maintaining soil condition and this report identifies the suitable areas for a targeted approach going forward.

Glossary

AG KI: Agriculture Kangaroo Island

AIREP: Ag Innovation and Research Eyre Peninsula

APEN: Australasia Pacific Extension Network

AU: Adelaide University

AW: Alinytjara Wilurara Landscape Board

BIGG: Barossa Improved Grazing Group

CoP: Community of Practice

CPSS: Certified Professional Soil Scientist

CSIRO: Commonwealth Scientific Industrial and Research Organisation

CTLAP: Coorong Tatiara Local Action Plan Group

EP: Eyre Peninsula

DAFF: The Australian Government Department of Agriculture, Fisheries and Forestry

GRDC: Grains Research Development Corporation

H&F: Hills and Fleurieu

KI: Kangaroo Island

LC: Limestone Coast

MNHRZ Group: Mid North High Rainfall Zone Group

NSS: Northern Sustainable Soils

N&Y: Northern and Yorke

M&R: Murraylands and Riverland

MSF: Mallee Sustainable Farming Group

MLA: Meat and Livestock Australia

MPF: Murray Plains Farmers

MFMG: Mackillop Farm Management Group

PIRSA: Department of Primary Industry and Regions

RSC: Regional Soil Coordinator

RSP: Registered Soil practitioner

SA: South Australia

SAAL: South Australian Arid Lands

SA Drought Hub: South Australian Drought Resilience, Adoption and Innovation Hub

SAGIT: South Australian Grain Industry Trust

SARDI: South Australian Research and Development Institute

Soil health: a healthy soil is defined as soil which is fit-for-purpose, sustains biological productivity both above and below ground, maintains landscape function and environmental quality, regulates climate promotes plant, animal and human health and is productive, resilient and profitable.

UNFS: Upper North Farming Systems

WoTL: Women Together Learning

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SMART SOILS FOR AGRICULTURE

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