

Building Resilient Agriculture Systems

Soil Health Monitoring Results at Demonstration Farms

Background

The Kangaroo Island Landscape Board (KILB) has delivered the Building Resilient Agriculture Systems on Kangaroo Island project for the last 4 years from 2019 to 2023. Through this project, and in line with the Kangaroo Island Landscape Plan 2021-2026, there has been a focus on improving the health of the soil, water and biodiversity that supports KI's economy and strengthening the viability of primary production through sustainable practices.

Following a call for participants through an EOI process, four farms were selected to undertake regular monitoring and sampling of nominated paddocks where a range of practices to improve soil health were to be implemented. The farms are located in the Hundreds of Duncan, MacGillivray and Seddon, and included ironstone soils, sands, loams and clay-loams. At the beginning of the project the farmers attended an initial workshop with Nicole Masters from Integrity Soils to learn the principles of soil health. They were then mentored by agriculture coach Kim Deans who worked with the farms to help improve their soil management; and by Grazing Naturally advisor Dick Richardson who worked with the farms to help manage animal nutrition and pasture levels. Each farmer chose their own types of inputs and methods of management.

What was done

Transects and photo points were established in each paddock and monitoring along the transects was undertaken in spring and autumn each year. This monitoring included Visual Soil Assessments (VSA) and the measurement of other parameters including pasture species and abundance, leaf sap measurements, water infiltration rates, temperature and weather. In addition to this, micro-biological soil testing occurring in spring 2020 and spring 2022 and soil mineral testing was taken in autumn 2021 and autumn 2023.

At each site, measurements and samples were taken from the permanent transect, to minimise spatial variability within each site over time. The VSA was made by digging out a 20cm³ cube of soil, assessing the colour, porosity and mottling of the profile, then shattering the soil naturally by dropping the cube from a height of 1m three times to determine the soil structure

(size of lumps or aggregations) and to find the number of earthworms in the cube. The surface profile was also noted. Other measurements recorded in the process include the soil type, smell, root depth, rhizosheath, nodulation and any other invertebrates present. These are supplementary details which contribute to the soil health assessment but do not contribute to the VSA score.

During this project, each farm altered their animal management to subject the pasture to shorter more intensive grazes with a longer rest period in between. To increase the soil biological processes by having more living plant roots in the soil for more of the year, all farms established a diverse range of perennial pasture species. Farm chemical inputs were substantially reduced and artificial fertilisers were not applied to the demonstration sites.



Figure 1: Farmer Carly Bussenschutt taking measurements along her transect in 2023.

Results

The VSA scores at all sites improved between 2020 and 2023 (see Table 1 below).

Micro-biological soil testing results indicate that the total mass of microorganisms increased at almost all sites between 2020 and 2022 (see Figure 1 below).

Likewise, almost all sites improved in the key biological factors for important soil processes (see Table 2 and Table 3 below).

Micro-biological soil testing was analysed using laboratory testing from Microbe Labs:

“Microbe Wise for Soil measures the living biomass of key microbial groups important for soil health and productivity directly from the sample. It uses molecular (‘DNA type’) technology to analyse the unique cell membrane ‘fingerprint’ of each microbe group to identify and quantify well-known microbial groups essential to important soil processes. The Microbe Wise method allows for some unique features, such as a measure of microbial diversity, a valuable indicator of soil system resilience.” (Microbe Labs website)

Take home messages

- Soil is the foundation of our farm businesses.
- Visual soil assessments are easy to conduct and can provide an indication of whether your farm practices are improving your soil or leading to declining soil health. Take photos of your soil profile annually, to track changes over time.
- It takes time to build soil health. The changes are incremental, hence the benefit of having a timeline of photos to reference.
- Having more living plants growing for more of the year improves soil structure and health.
- Diverse pasture species maximise the soil area utilised by the plant roots and the increase in the associated soil biology improves soil health.
- Time controlled grazing management assists in building soil health and plant diversity.



Figure 2: Soil cube from an ironstone soil site in 2020 (left) and from the same site in 2022, showing good soil structure and colour change at the top of the profile.



Figure 3: Soil cube from a grey sandy soil site in 2020 (left) and from the same site in 2022.



VSA	ASSESSMENT
<10	Poor
10-20	Moderate
>20	Good

Table 1: Visual soil assessment (VSA) score by site from 2020-2023

	DW01	DW02	DW03	JS01	JS02	JS03	JS04	CB01	VB01	VB02	VB03	VB04
2020	14	18	14	17	17	18	16	17	15	15	12	12
2021	16	12	18.5	19	19	17	16	17	16.5	18	13	17
2022	19	23.5	20.5	17	22	22	20.5	-----	20.5	22	20.5	22
2023	20.5	24	21	18.5	22	20	18.5	28	16.5	22	17.5	20

Table 2: Key microorganism aspects from soil biological laboratory testing

Low		Fair		Good	High

Site	Total Micro-organisms		Bacteria		Fungi		AMF		Protozoa		Anaerobes		Diversity	
	2020	2022	2020	2022	2020	2022	2020	2022	2020	2022	2020	2022	2020	2022
CB1														
DW1														
DW2														
DW3														
JS1														
JS2														
JS3														
JS4														
VB1														
VB2														
VB3														
VB4														



Table 3: Change in key soil processes between 2020 to 2022 indicated by soil biology and arranged by soil type

ASSESSMENT
Decrease from fair to poor
Decrease from good to fair
Decrease from good to good or from fair to fair
Improvement

Site	Soil Type	Nutrient Solubilisation	Nutrient Cycling	Disease Resistance	Drought Resistance	Nutrient Accessibility	Residue Breakdown
DW02	brown loam	Improvement	Improvement	Improvement	Improvement	Improvement	Improvement
CB01	ironstone soil	Improvement	Improvement	Improvement	Improvement	Improvement	Improvement
JS02	ironstone soil	Improvement	Improvement	Improvement	Improvement	Improvement	Improvement
JS03	ironstone soil	Improvement	Improvement	Improvement	Improvement	Improvement	Decrease from good to good or from fair to fair
DW01	brown sand	Decrease from good to good or from fair to fair	Decrease from good to fair	Decrease from good to good or from fair to fair	Decrease from good to good or from fair to fair	Decrease from good to fair	Improvement
VB03	brown sand	Improvement	Improvement	Improvement	Improvement	Improvement	Improvement
VB04	brown sand	Improvement	Decrease from good to fair	Improvement	Improvement	Improvement	Decrease from good to good or from fair to fair
DW03	grey sand	Improvement	Improvement	Improvement	Improvement	Improvement	Improvement
JS01	grey sand	Improvement	Improvement	Improvement	Improvement	Improvement	Improvement
JS04	grey sand	Decrease from good to fair	Decrease from good to fair	Decrease from good to fair	Decrease from good to good or from fair to fair	Decrease from good to fair	Decrease from good to fair
VB01	grey sand	Decrease from good to fair	Decrease from good to good or from fair to fair	Improvement	Improvement	Improvement	Improvement
VB02	grey sand	Decrease from good to fair	Decrease from good to fair	Improvement	Improvement	Improvement	Improvement

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Further Information

Kangaroo Island Landscape Board

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