Carbon on your Farm - Soil Health & Salinity Update

Coomandook 2.00 - 6.00pm

followed by Ag Bureau Meeting

Includes BBQ tea

Wednesday 6th April 2022

REGISTRATIONS essential;

tstrugnell@coorong.sa.gov.au or

text on 0427 750 050

Register by Friday 1st of April

Roby update – Automated Weather Station, Soil Moisture Probe & Groundwater Piezometer

3 soil pits identifying limitations & management options

Overview of carbon flow in local farm businesses

See program below/on back **Drop in to sessions of interest**

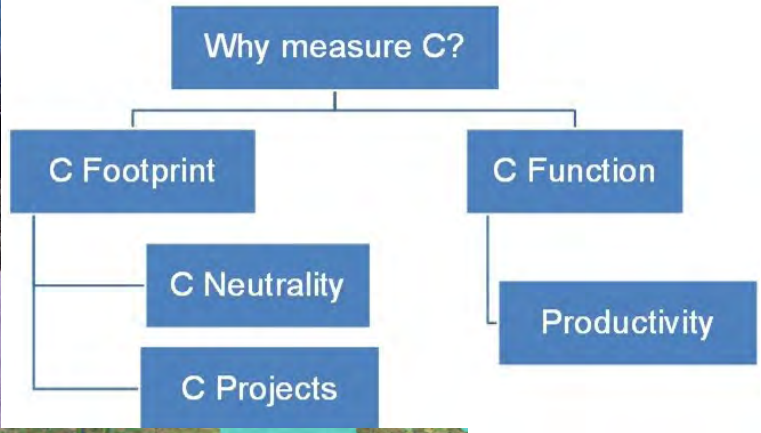
Soil Carbon Baseline levels in SA and the potential to build soil carbon

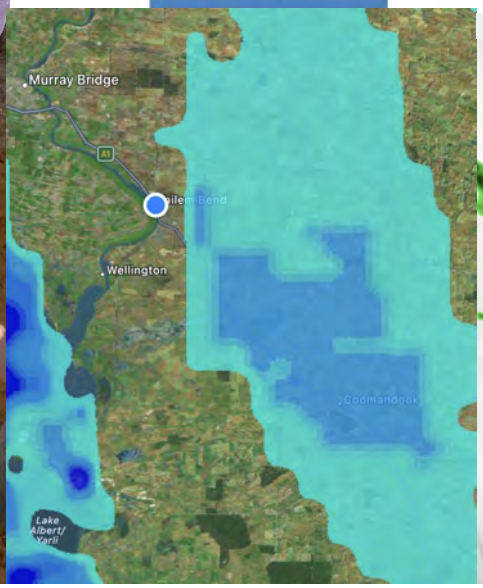
BBQ Tea & Coomandook Ag Bureau Meeting

Key Note Speaker at Ag Bureau Meeting:

Darren Ray Applied Consulting Climatologist

Building climate knowledge and looking at seasonal variability in our district





Australian Government
Department of Agriculture, Water and the Environment

Future Drought Fund

FRRR Foundation for Rural Regional Renewal

Australian Government

National Landcare Program

This project is supported by FRRR, through funding from the Australian Government's Future Drought Fund

COORONG DISTRICT COUNCIL

Coorong Tatiara Local Action Plan

Landcare Farming

National Landcare Network

Agricultural Bureau of South Australia Inc.
PATHWAY TO IMPROVEMENT

LANDSCAPE SOUTH AUSTRALIA

This project is supported by the Murraylands and Riverland Landscape Board and the Limestone Coast Landscape Board through funding from the Australian Government's National Landcare Program and the landscape levies

Coomandook: Carbon on your Farm – Soil Health & Salinity Update
Wednesday 6th April 2022

2.00pm – 6.00pm
Followed by BBQ & Coomandook Ag Bureau Meeting

Stop	Item	Speaker	Organisation	Location	Time	Pages
1	**MEETING POINT** 'Roby Downs' 601 Goodale Road COOMANDOOK At the Sheds	WELCOME & OVERVIEW OF THE DAY			**2.00pm**	
2	**Data update from Roby Downs – Automated Weather Station / Soil Probe / Groundwater Piezometer**	Felicity Turner	Coorong Tatiara Local Action Plan Independent Advisor	'Roby Downs' – Cnr Old Dukes Highway & Goodale Road COOMANDOOK	**2.10pm** – *2.30pm*	**3 - 5**
3	**Three Soil Pits across Soil Types** **Looking at soil tests results & interpretation, production limitations, soil carbon, non wetting sands, salinity & management options**	Brian Hughes Amanda Schapel	PIRSA Rural Solutions Principal Land Management Consultant		**2.30pm** – *3.45pm*	**6 - 18**
	Travel to			***Coomandook Uniting Church***		
	AFTERNOON TEA					
3	**An overview of carbon flow in local farm businesses in our landscape**	Felicity Turner	Turner Agribusiness Field	Coomandook Uniting Church Meeting Room	**4.15pm** – *4.45pm*	
4	**Soil, Carbon and Productivity** **Soil Carbon Baseline Levels** **Carbon Building Projects in SA** **Where to from here?**	Amanda Schapel	PIRSA Rural Solutions Carbon Specialist		**4.45pm** – *5.45pm*	**19 - 20**
5	**Questions**				**5.45pm** – *6.00pm*	

BBQ TEA SUPPLIED FOLLOWED BY COOMANDOOK AG BUREAU MEETING

SPECIAL GUEST SPEAKER **Darren Ray** **Applied Consulting Climatologist** **Climate Knowledge and Local Seasonal Variability**

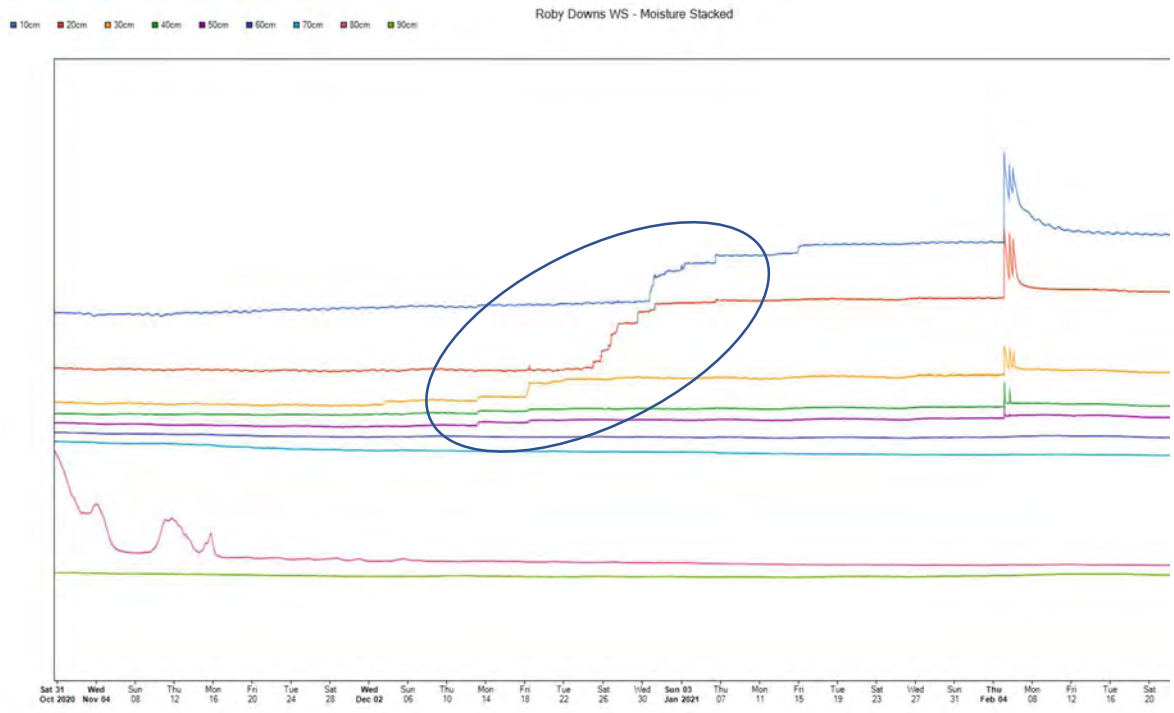
SOIL MOISTURE PROBE AND WEATHER STATION UPDATE – ROBY DOWNS March 2022

Felicity Turner on behalf of Coorong Tatiara Local Action Plan

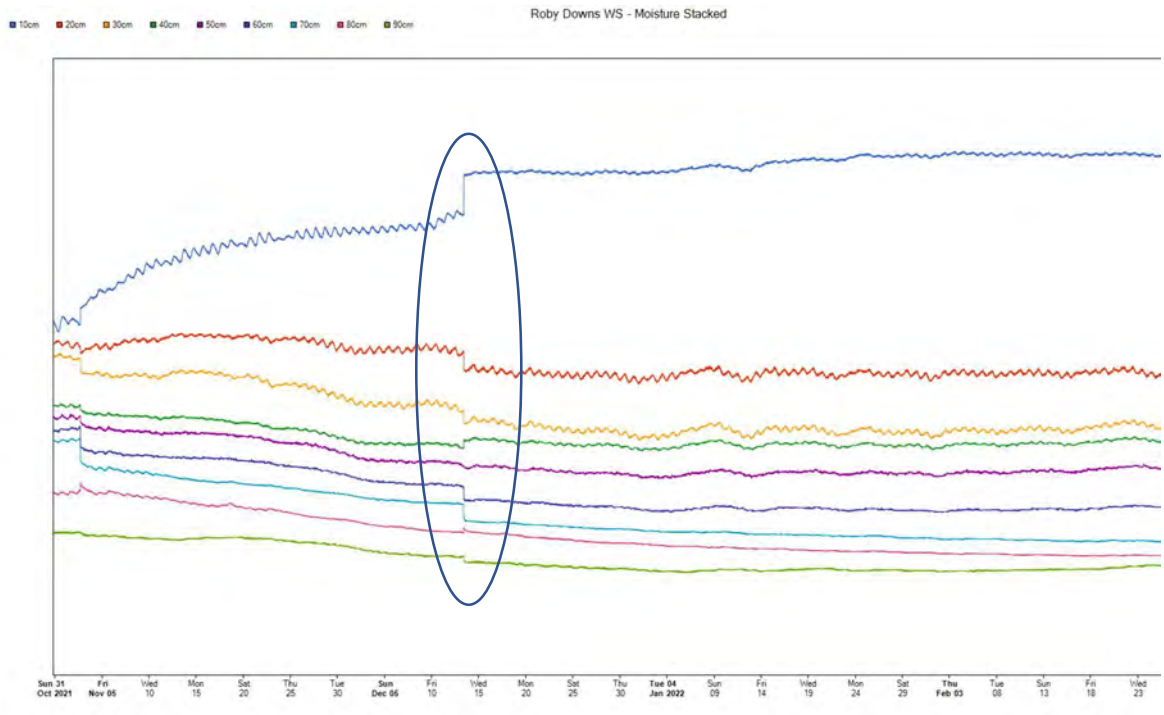
Last summer (2020-21) saw moisture rising from the surface from depth. This year (2021-22) the same level of moisture increase wasn't observed with the differences being much more subtle resulting in transfer of moisture from depth into the top 10cms.

It is thought that maybe in the process of installing the probe and disturbing the surface site the natural processes may have been exacerbated. It has however given us a greater insight into the potential processes that are occurring under the ground.

2021

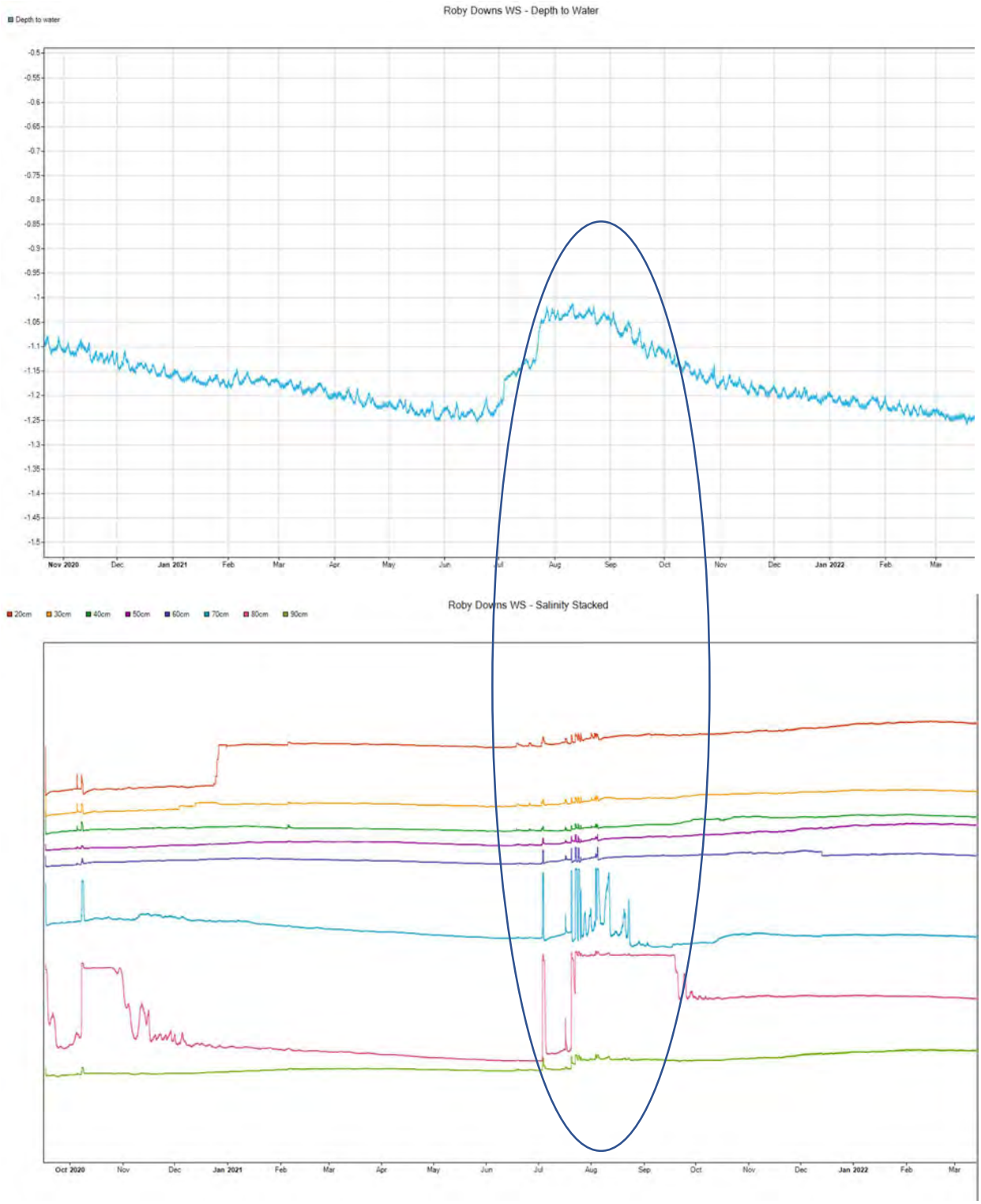


2022



WATER TABLE

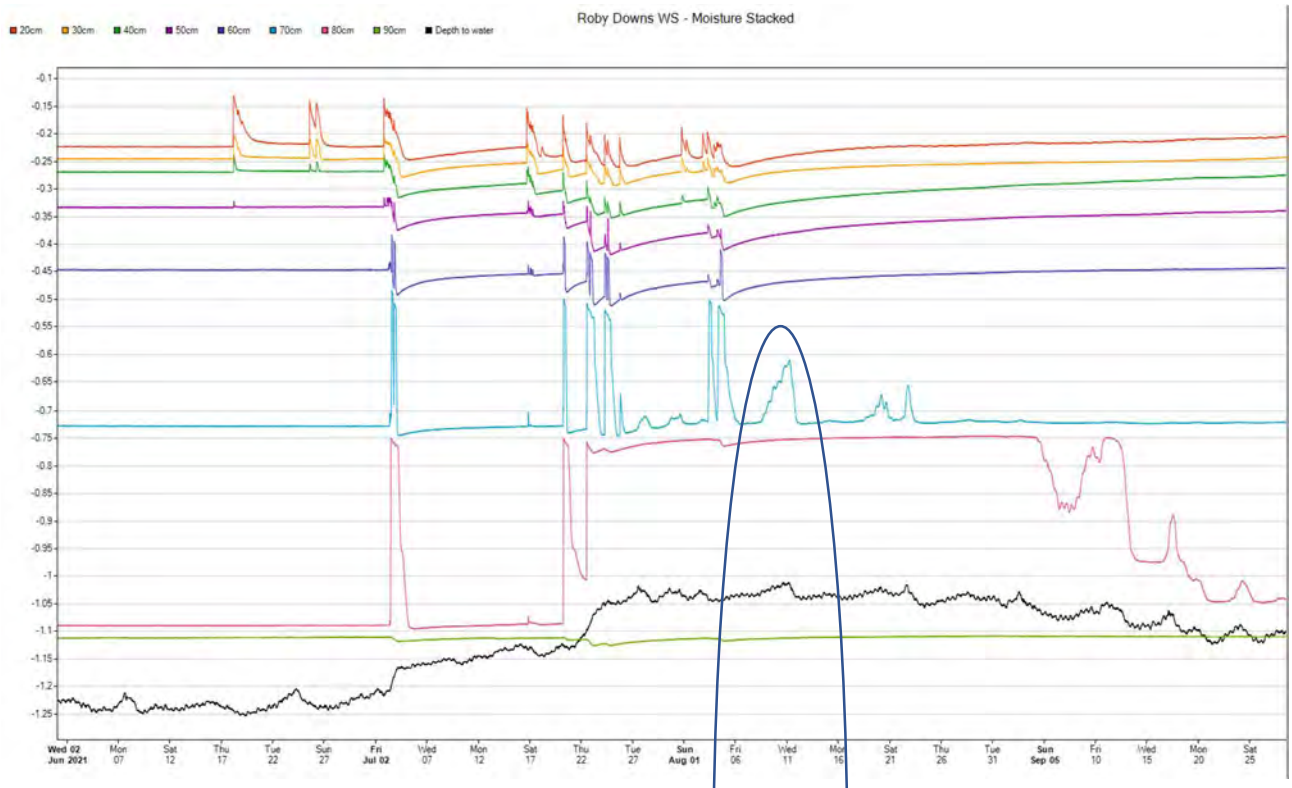
The water table has risen by about 25cms since the automated depth sensor was installed. The rise was over winter and it then subsided. It is currently sitting 5cms lower than this time last year. This seasonal variation is likely to be highly rainfall dependent and it will be interesting to observe changes over a long period of time.

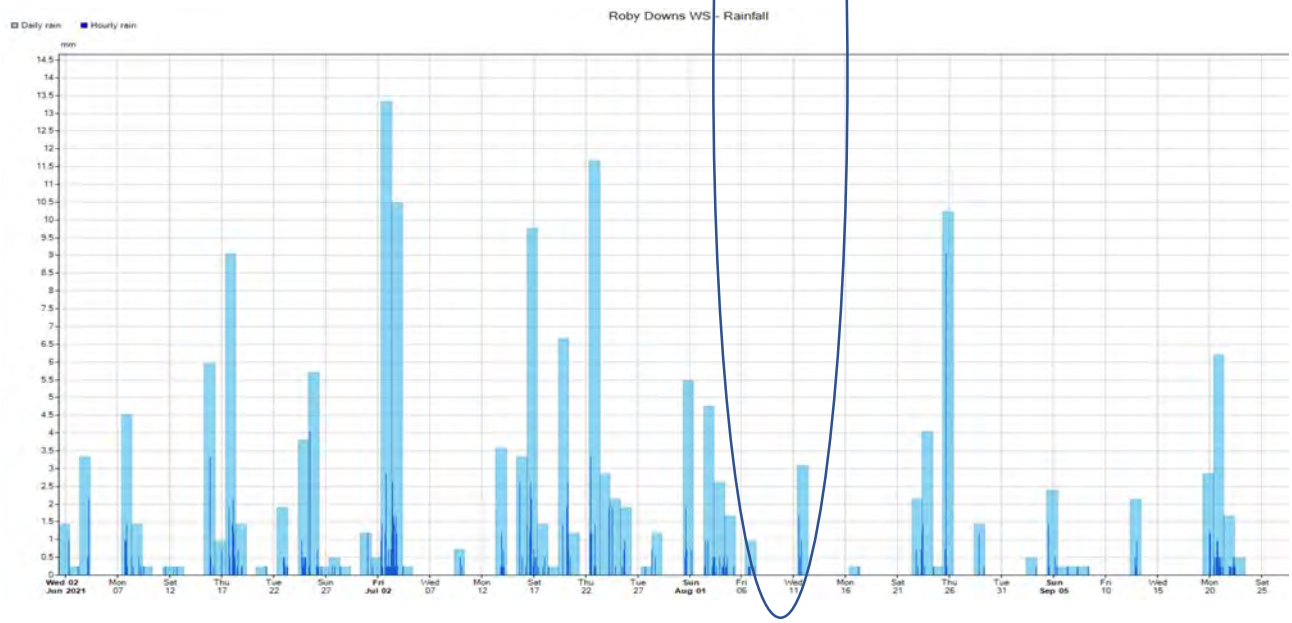


The rise in water table during July and August saw an increase in soil moisture at 80cms and an increase in the salinity level of the soil. As the water table subsided, it left behind salts in the 80cm zone.

The lack of movement in moisture at 90cms suggests that this soil layer is in the saturated water table zone constantly.

SOIL MOISTURE - WINTER





The above graphs show the impact of rainfall events on the soil moisture probe data during the winter months, and how far the events penetrate into the soil. Of particular interest is the rise in the 80cm sensor and more particularly the 70cm sensor in the absence of rainfall suggesting that this has been due to the groundwater rising during this time. This is reflected by increases in the depth to water sensor.

The on-going monitoring of this data has been made possible by the Coorong Saltland Pasture Redemption project funded by the Murraylands and Riverland Landscape Board.

BRIAN HUGHES & AMANDA SCHAPEL - PIRSA

General Description: Brown loamy sand over sandy clay over calcrete grading to highly calcareous pale brown sandy light clay.

Landform: Dunefield, low slope

Substrate: Molineaux sand over Bungunnia Limestone over ancient coastal sanddunes and old lake beds

Vegetation: Barley grass, some clover

Land use: grazing

Type Site:

Site No:	1	**Easting:**	0378558
Hundred:	Roby	**Northing:**	6080797
Sampling date:	9 July 2021	**Annual rainfall:**	410 mm

Soil Description

Depth (cm)	Horizon	Description
0-10	A1	Brown loose loamy sand. Clear to:
10-20	A2	Light brown sand with 2-10% segregations, 6-20 mm in size. Abrupt to:
20-40	B21	Reddish yellow very highly calcareous fine sandy light clay. Sharp to:
40-50	B22K	laminar calcrete cap with very pale brown very highly calcareous sandy light clay with. Gradual to:
50-80	B22K	Very pale brown very highly calcareous sandy light clay with <2% calcareous segregations, 2-6 mm in size. Gradual to:
80-100	B3	Pale brown coarse sandy clay loam
100 +		watertable at 90-100cm

Summary of Properties

Drainage: well drained, although water-table at base

Fertility: moderately low. Regular fertiliser input required and some trace elements for higher production

pH: Neutral surface, grading to strongly alkaline in subsoil

Rooting depth: depend on salt tolerance 50? cm

Barriers to root growth

Physical: calcrete restricts to some extent

Chemical: high pH and Boron from 20cm, moderate surface salt to high salt throughout, sodic from 10cm, EC 6 + dS/m restricts many plants

Water holding capacity: depends on salinity levels

Seedling emergence: slightly water repellent can affect germination

Workability: easily worked

Erosion potential

Water: low

Wind: moderately low

Laboratory Data

Depth (cm)	pH H_2O	pH $CaCl_2$	NO3 mg/kg	EC 1:5 dS/m	ECe	OC %	PBI	Colwell		Boron mg/kg	SO_4-S mg/kg	Trace Elements mg/kg (DPTA)			
								Avail. P	Avail. K			Cu	Zn	Fe	Mn
0-10	7.6	7.6	21	0.37	6	1.5	21	59	250	1.2	17	0.94	3.5	28	3
10-20	9.2	9.2	29	0.81	12	0.3	38	45	370	12	68	0.51	0.4	17	0.4
20-50	9.3	9.3	23	2	16	0.2	99	23	530	19	200	0.61	0.2	9.5	0.6
50-80	9.3	9.3	6.9	2.2	18	0.3	141	<5	480	16	230	0.41	0.23	6.9	0.5
80-110	9.4	9.4	2.4	2	18	0.2	106	<5	410	12	190	0.28	0.28	6.7	0.9
Critical / Ideal values	6-8	5-7	-	<0.7	<4	S: 0.5-1.0 SL: 0.7-1.4 L: 0.9-1.8 CL/C: 1.2-2.0	20-120	25-30	100	<15	>6-8	0.3	0.5		1

Depth (cm)	Cl mg/k	Sum cations cmol (+)/kg	Exchangeable cations cmol (+)/kg				ESP	Dispersion		Calcium carbonate Equiv %
			Ca	Mg	Na	K		2 hrs	20 hrs	
0-10	150	7.5	6.4	0.8	0.1	0.4	1	0	0	<0.4
10-20	610	5.6	3.5	1.1	0.6	0.4	11	2	2	<0.4
20-50	2300	14	8.5	2.9	1.7	1	12	0	0	7.4
50-80	2800	14.6	9	3.2	1.5	1	10	0	0	23
80-110	2300	12.3	7.9	2.7	1	0.7	8	0	0	25
Critical / Ideal values	S: <120 L: <200 C: <300	15	75% of CEC	20% of CEC	<6% of CEC	5% of CEC	<6-15			

General Description: Shallow dark brown sandy loam over brown clay grading to highly calcareous light to medium clay.

Landform: Dunefield, flat, bare salt affected

Substrate: Molineaux sand over Bungunnia Limestone over ancient coastal sanddunes and old lake beds

Vegetation: Bare

Land use: grazing

Type Site:

Site No: 1S
Hundred: Roby
Sampling date: 9 July 2021

watertable at 40cm

Easting: 0378555
Northing: 6080809
Annual rainfall: 410 mm

Soil Description

Depth (cm)	Horizon	Description
0-5	A1	Dark brown sandy loam with yellow and red mottling. 10-20% segregations, 6-20 mm in size.
5-25	B2	Strong brown very highly calcareous medium clay with gray mottling.
25-40	B21K	Light yellowish brown very highly calcareous coarse sandy light clay.
40-65	B22K	Very pale brown very highly calcareous light clay with yellow mottling.
65-95	2B21	Very pale brown highly calcareous medium clay with yellow and red mottling. 10-20% nodules, >60 mm in size.
95-110	2B22	Very pale brown highly calcareous medium clay with yellow and red mottling. 10-20% nodules, >60 mm in size.

Summary of Properties

Drainage: imperfectly drained, soil may remain wet for several weeks

Fertility: moderate fertility as indicated by CEC, regular P required, although very high at this site now. Surface levels of many nutrients are high linked to salinity issue

pH: alkaline surface to strongly alkaline subsoil

Rooting depth: 40 cm to water table although highly saline at surface

Barriers to root growth

Physical: medium clay would provide some restriction

Chemical: surface salinity EC 49 dS/m which allows only extremely salt tolerant plants or mostly bare ground, B at toxic levels

Water holding capacity: n/a

Seedling emergence: fine provided salinity overcome

Workability: satisfactory although underlying clay quite shallow

Erosion potential

Water: low

Wind: low

Laboratory Data

Depth (cm)	pH H_2O	pH $CaCl_2$	NO3 mg/kg	EC 1:5 dS/m	ECe	OC %	PBI	Colwell		Boron mg/kg	SO_4-S mg/kg	Trace Elements mg/kg (DPTA)			
								Avail. P mg/kg	Avail. K mg/kg			Cu	Zn	Fe	Mn
0-5	8.85	8.56	28	4.1	49	1.02	108	140	520	41	710	1.3	2.6	19	2.4
5-25	9.12	8.64	24	3.3	26	0.34	96	50	720	23	190	0.57	0.42	17	0.6
25-40	9.38	8.62	11	2	16	0.27	165	10	540	13	160	0.51	0.19	7.9	0.4
40-65	9.39	8.61	7.7	1.8	14	0.22	127	<5	520	11	150	0.45	0.5	8.6	0.6
65-95	9.34	8.52	6.2	1.7	14	0.22	112	<5	540	13	150	0.41	1.1	11	2.1
95-110	9.37	8.43	4.9	1.5	12	0.19	118	<5	590	12	150	0.42	1.3	12	5.1
Critical / Ideal values	6-8	5-7	-	<0.7	<4	S: 0.5-1.0 SL: 0.7-1.4 L: 0.9-1.8 CL/C: 1.2-2.0	20-120	25-30	100	<15	>6-8	0.3	0.5		1

Depth (cm)	Cl mg/k	Sum cations cmol (+)/kg	Exchangeable cations cmol (+)/kg				ESP	Dispersion		Calcium carbonate Equiv %
			Ca	Mg	Na	K		2 hrs	20 hrs	
0-5	4900	13.4	6.72	4.68	0.92	1.07	7	0	1	1.5
5-25	4600	13.6	7.01	3.09	2.35	1.19	17	0	0	3.6
25-40	2500	18.4	10.4	4.56	2.09	1.37	11	0	1	27
40-65	2200	15.4	8.89	3.92	1.51	1.06	10	0	0	23
65-95	2000	14.7	8.27	3.78	1.59	1.05	11	0	0	25
95-110	1900	14.7	8.19	3.7	1.73	1.06	12	0	0	28
Critical / Ideal values	S: <120 L: <200 C: <300	15	75% of CEC	20% of CEC	<6% of CEC	5% of CEC	<6			

General Description: Thick brown loamy sand over sandy light clay over a laminar calcrete at depth.

Landform: Dune, low slope

Substrate: Molineaux sand over Bungunnia Limestone over ancient coastal sanddunes and old lake beds

Vegetation: Cereal stubble

Land use: Cropping

Site Details:

Site No:	2G	**Easting:**	0378580
Hundred:	Roby	**Northing:**	6080801
Sampling date:	9 July 2021	**Annual rainfall:**	410 mm

Soil Description

Depth (cm)	Horizon	Description
0-12	A1	Brown slightly calcareous loamy sand.
12-30	A21	Brown loamy sand.
30-60	A22	Yellowish red sand.
60-110	B21	Yellowish red slightly calcareous sandy light clay. 10-20% calcareous segregations, 2-6 mm in size.
110-120	B22K	Calcareous lamination.

Summary of Properties

Drainage: well drained, soil rarely remains wet for more than a few days

Fertility: inherent fertility is low as indicated by low CEC. Regular P required and occasional trace elements.

pH: alkaline throughout

Rooting depth: 110cm, roots maybe restricted in red and brown sand layers due to compaction and low nutrients

Barriers to root growth

Physical: no major limitations laminar calcrete provides barrier to some roots at depth, possible hard pans at 20-50cm

Chemical: No toxicities in the surface although subsoil Cl and EC increasing at depth.

Water holding capacity: 127mm

Seedling emergence: satisfactory although can be water repellent

Workability: loose surface easy to work

Erosion potential

Water: low

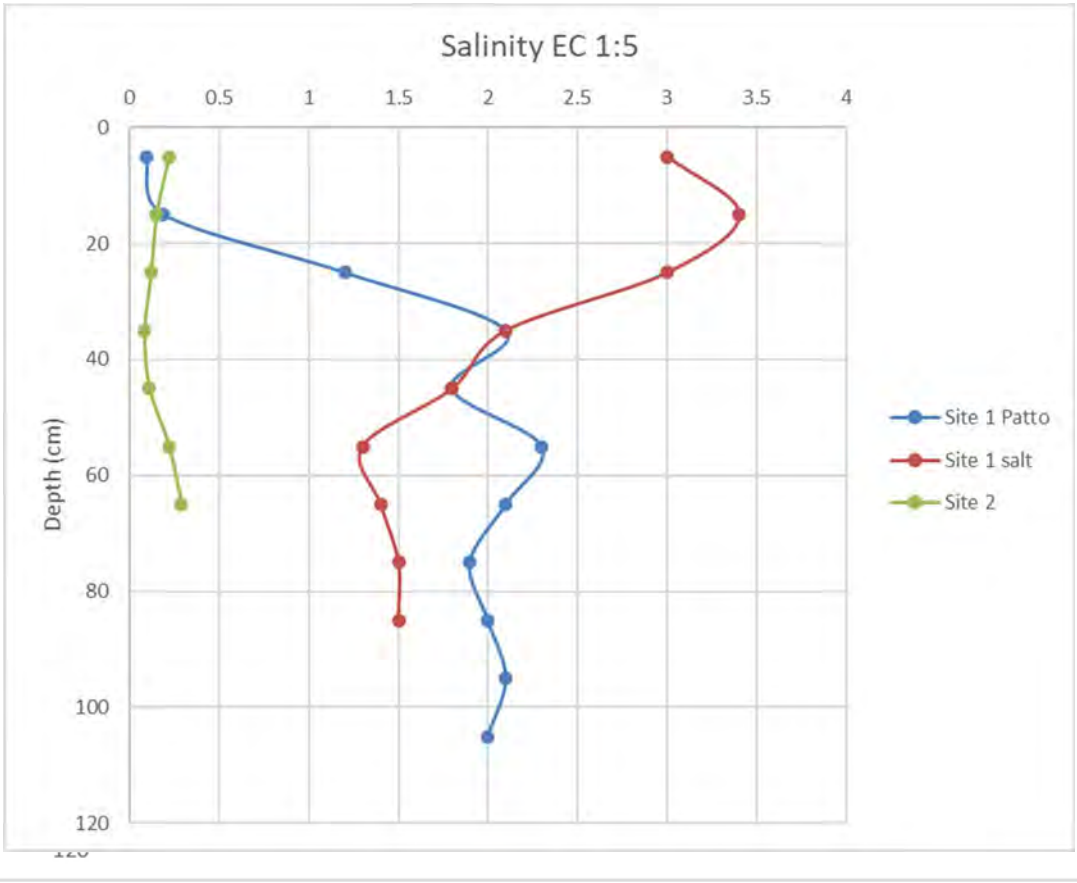
Wind: moderately low to moderate

Laboratory Data

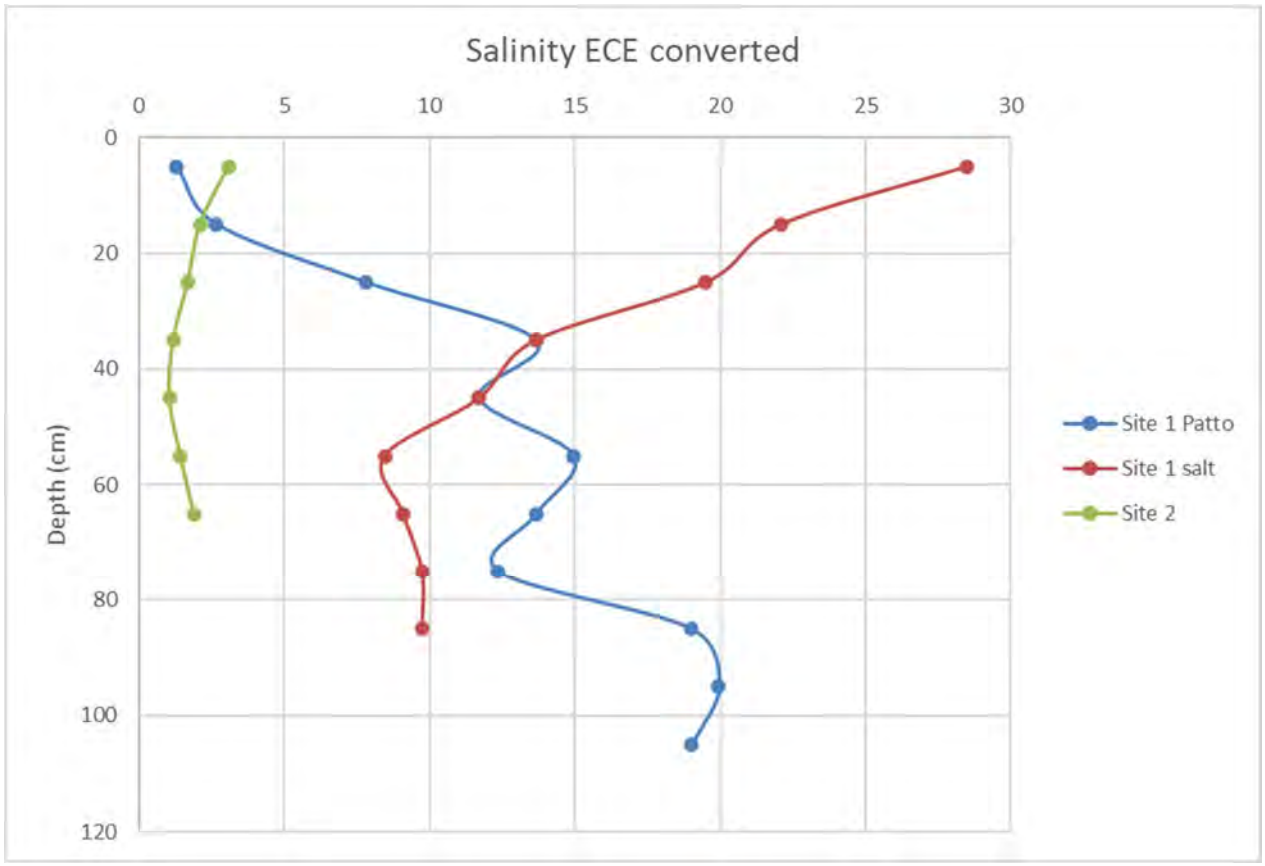
Depth (cm)	pH H_2O	pH $CaCl_2$	NO3 mg/kg	EC 1:5 dS/m	ECe	OC %	PBI	Colwell		Boron mg/kg	SO_4-S mg/kg	Trace Elements mg/kg (DPTA)			
								Avail. P mg/kg	Avail. K mg/kg			Cu	Zn	Fe	Mn
0-12	8.08	7.48	7.7	0.21	3	1.16	18	21	200	0.81	8.9	0.36	3.4	18	1.7
12-30	8.01	7.52	2.4	0.14	2	0.6	22	17	160	0.59	5.7	0.2	0.94	12	0.8
30-60	8.51	7.93	1.2	0.13	2	0.21	21	8	150	0.78	6.8	0.09	0.19	7.4	0.5
60-110	8.59	8.01	3.2	0.36	3	0.25	99	<5	320	2.6	19	0.13	0.11	21	<0.3
110-120	8.69	8.14	1.4	0.68	4	0.34	155	<5	340	3.2	38	0.27	0.15	15	0.4
Critical / Ideal values	6-8	5-7	-	<0.7	<4	S: 0.5-1.0 SL: 0.7-1.4 L: 0.9-1.8 CL/C: 1.2-2.0	20-120	25-30	100	<15	>6-8	0.3	0.5		1

Depth (cm)	Cl mg/k	Sum cations cmol (+)/kg	Exchangeable cations cmol (+)/kg				ESP	Dispersion		Calcium carbonate Equiv %
			Ca	Mg	Na	K		2 hrs	20 hrs	
0-12	57	7.3	6.35	0.68	0.00	0.30	0	0	0	1
12-30	24	6.8	5.84	0.66	0.00	0.28	0	0	0	0.5
30-60	42	5.0	4.09	0.65	0.00	0.26	0	2	2	0.4
60-110	250	16.8	12.3	3.26	0.40	0.85	2	2	2	4.6
110-120	600	20.4	14.6	4.07	0.64	1.04	3	0	0	34
Critical / Ideal values	S: <120 L: <200 C: <300	15	75% of CEC	20% of CEC	<6% of CEC	5% of CEC	<6			

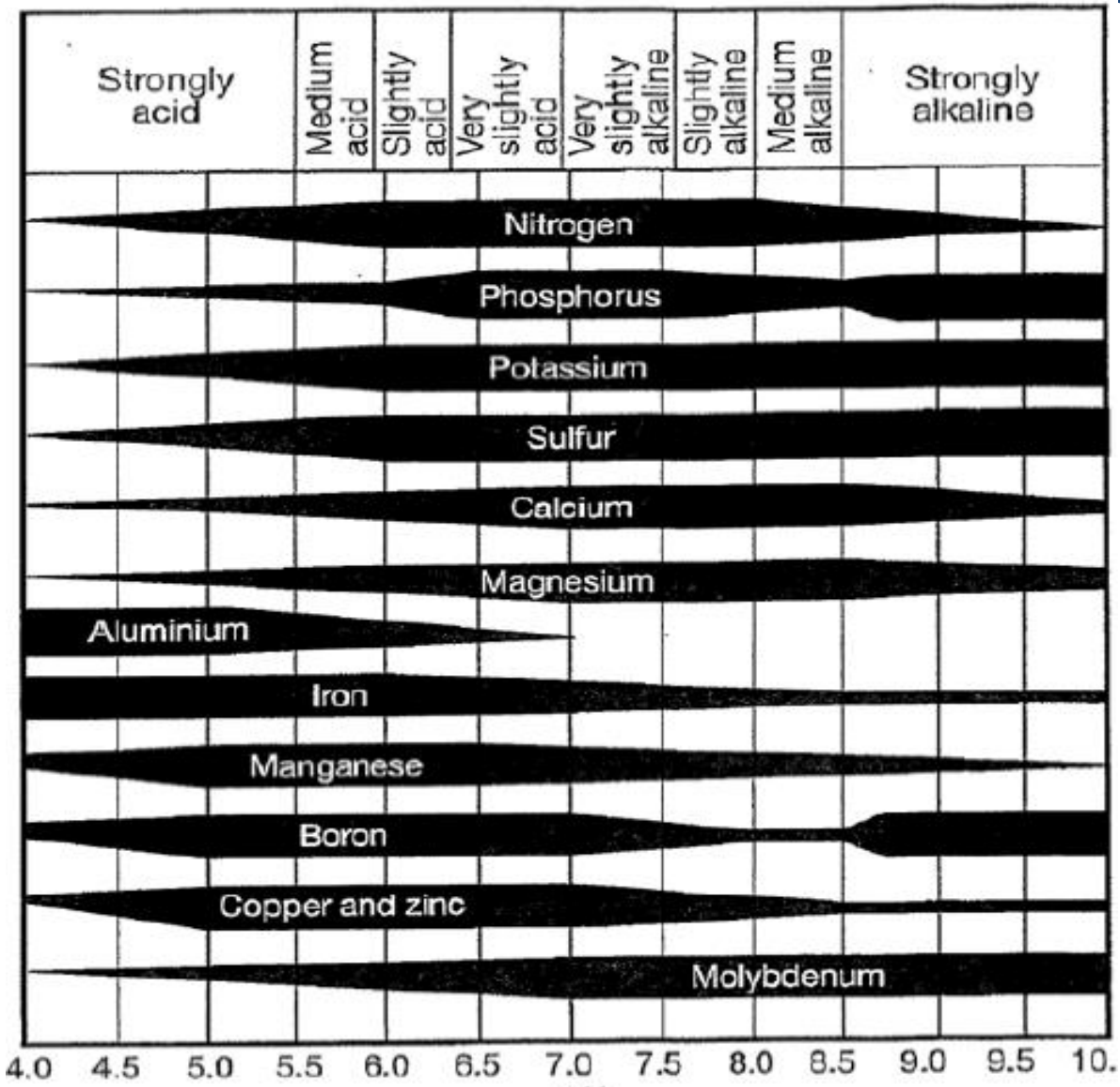
10cm increment salinity profiles EC 1:5

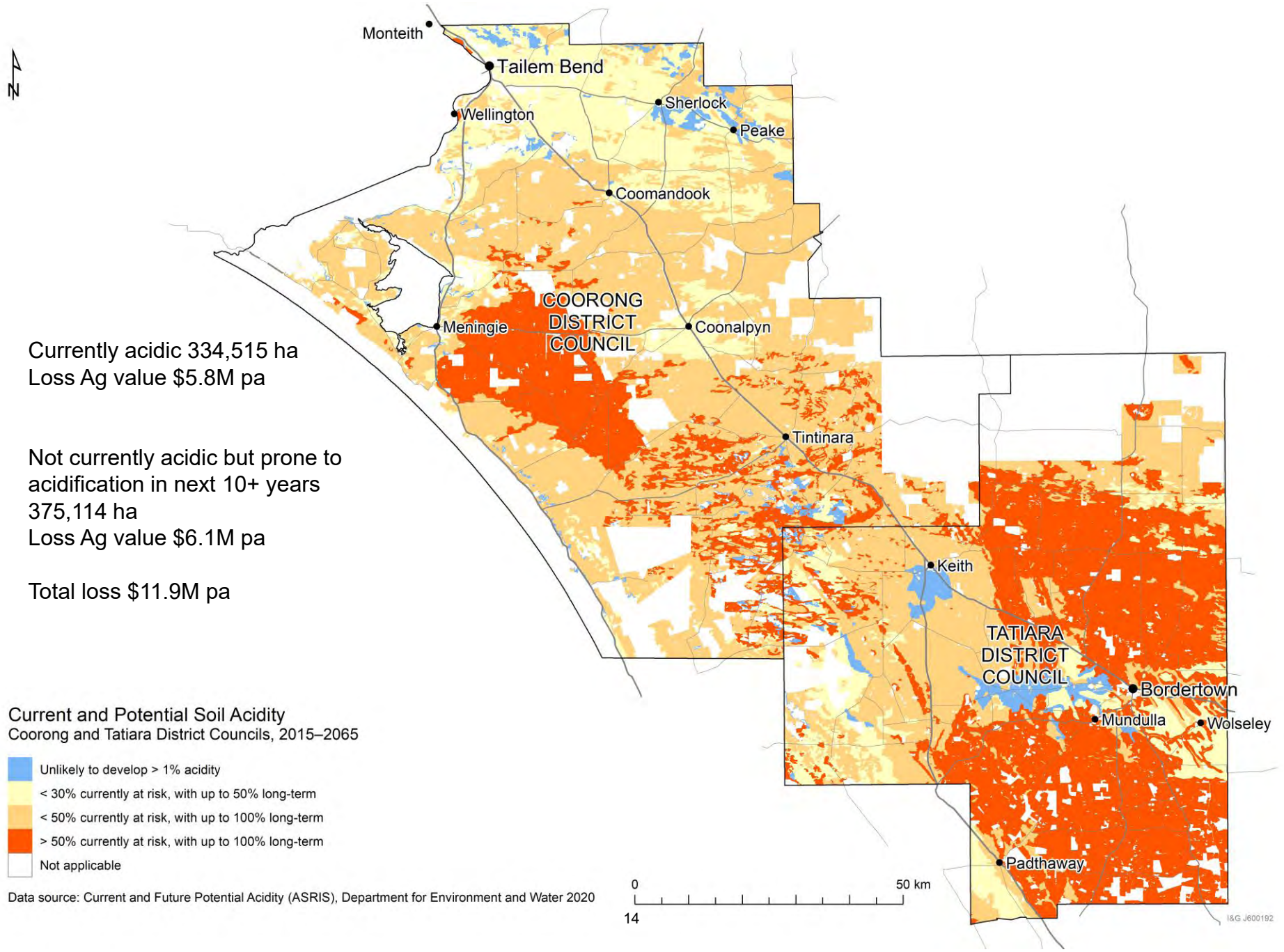


10cm increment salinity profiles ECe converted



Soil pH and nutrient availability




Monteith
Tailem Bend
Sherlock
Wellington
Peake
Coomandook
COORONG
DISTRICT
COUNCIL
Meningie
Coonalpyn
Tintinara
Keith
TATIARA
DISTRICT
COUNCIL
Bordertown
Mundulla
Wolseley
Padthaway
N
Currently acidic 334,515 ha
Loss Ag value $5.8M pa
Not currently acidic but prone to acidification in next 10+ years
375,114 ha
Loss Ag value $6.1M pa
Total loss $11.9M pa
Current and Potential Soil Acidity
Coorong and Tatiara District Councils, 2015–2065
Unlikely to develop > 1% acidity
< 30% currently at risk, with up to 50% long-term
< 50% currently at risk, with up to 100% long-term
> 50% currently at risk, with up to 100% long-term
Not applicable
Data source: Current and Future Potential Acidity (ASRIS), Department for Environment and Water 2020
0
50 km
14
I&G J600192

Estimated yield penalty

Crop Type	Production losses (t/ha)		
	Soil pH ($CaCl_2$) 5.5-5.0	4.9-4.5	≤4.5
Wheat (tolerant)	0	0.2	0.4
Barley	0.2	0.6	1.0
Peas	0.2	0.4	1.0
Lupins	0	0.2	0.4
Beans	0.2	0.6	1.2
Lentils	0.2	0.6	1.2
Hay	0.2	0.4	0.8
Canola	0.2	0.6	1.0
Oats /Triticale	0	0.2	0.4

Estimated yield penalty

Pasture	Production losses (t/ha)		
Soil pH (CaCl2)	**5.5-5.0**	**4.9-4.5**	**≤4.5**
Acid sensitive (medics)	0.2	0.6	1.0 – 1.2
Acid tolerant (sub-clovers)	0	0.2	0.4

Estimated economic impact

	Coorong District		Tatiara District		Total	
	Area impacted (ha)	Total production loss $m pa	Area impacted (ha)	Total production loss $m pa	Area impacted (ha)	Total production loss
Area currently affected by acidity	117,825	$1.9	216,690	$3.9	334,515	$5.8
Area affected over next few decades	255,448	$3.9	119,666	$2.2	375,114	$6.1
Total	**373,273**	**$5.8**	**336,356**	**$6.1**	**709,629**	**$11.9**

Treatments and pay back periods

Treatment	Approximate cost ($/ha)	Pay back period (years)	Est Time treatment may last (years)
Lime	125 - 180	1.1 – 1.4	10
Deep ripping	60 - 100	0.6 – 1.0	2-10
Spading	130	1.2	3-10
Delving	300 - 450	1.9 – 2.3	10+
Clay spreading	500 - 800	2.5 – 4.0	Up to 20+

Deep ripping, spading, delving and clay spreading are options provided that the underlying clay is alkaline.

Based on a W, B, Beans, W, B, Pasture rotation

If more sensitive crops are grown in the rotation then the pay back will be shorter.

Clay rates 150 to 250 t/ha

Soil Carbon in SA Agricultural Soils

AMANDA SCHAPEL - PIRSA

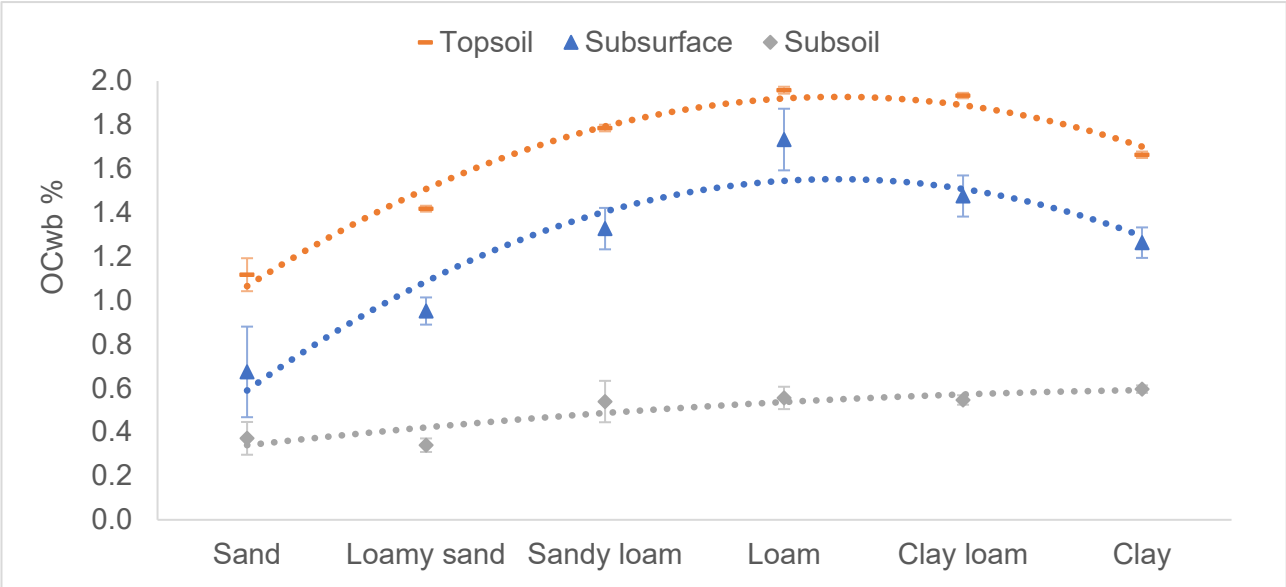
Role of carbon in the soil

Physical	Chemical	Biological
better structural stability (aggregation) lower bulk density rapid infiltration of water better drainage better root growth less erosion improved water holding capacity	improved cation exchange source of nutrients continual release of nutrients sorption and deactivation of contaminants	increased biological activity increased diversity improved suppression of soil borne pathogens

Soil Carbon Tests

Carbon type	Method	Measures	Pros / Cons
Total C	High temperature combustion (Leco or Dumas)	Organic and inorganic C	In soils with carbonate can be difficult to measure change in organic C
Organic C	Wet oxidation (Walkley Black method)	Organic C	Incomplete test – measures only 55-80% of total OC
Inorganic C	Calcium carbonate equivalent	Inorganic C	Can be an inexact test.
Total Organic C	Wet oxidation (Heanes method)	Organic C	Complete test
Total Organic C	Pretreatment then High temperature combustion (Leco or Dumas)	Organic C	Need to ensure that have complete removal of inorganic C before combustion or results will be incorrect

Average Organic Carbon Concentration of South Australia Agricultural Zone



Soil Organic Carbon Benchmarks for the Upper South East Agricultural District

Extracted from 'Soil Carbon in South Australia: Volume 4 – Benchmarks and Data analysis for the Agricultural Zone 1990-2007'. Schapel A, Herrmann T, Sweeney S and Liddicoat C (2021).

Benchmark topsoil OC (%) values for texture and land use displaying the mean and percentile values for the Upper South East compared to the mean for the Agricultural Zone.

	Ag Zone	Ag District Benchmarks						
Texture	***Mean***	**Count**	**Mean**	**25%**	**40%**	**50%**	**60%**	**75%**
Sand	*1.12*	23	1.08	0.90	1.05	1.12	1.19	1.31
Loamy sand	*1.42*	933	1.21	0.85	1.01	1.10	1.24	1.51
Sandy loam	*1.79*	636	1.43	0.96	1.20	1.35	1.50	1.80
Loam	*1.96*	437	1.66	1.20	1.40	1.50	1.70	1.97
Clay loam	*1.93*	308	1.81	1.40	1.59	1.74	1.87	2.13
Clay	*1.66*	288	1.63	1.00	1.26	1.40	1.60	1.92
Weighted Mean (all texture)	*1.77*	2625	1.45	1.02	1.22	1.33	1.49	1.77

	Benchmark OC Concentration					District Prop (%)
Land use	**Count**	**Mean**	**25%**	**50%**	**75%**	
Orchard / Vineyard	235	0.98	0.58	0.87	1.30	12
Cropping	1084	1.50	1.06	1.43	1.86	54
Irrigated Pasture	20	1.54	1.10	1.41	1.86	1
Pasture	620	1.55	1.00	1.36	1.91	31
Vegetable	37	1.67	1.10	1.51	2.24	2

CARBON ON YOUR FARM – SOIL HEALTH AND SALINITY UPDATE

COOMANDOOK 6/4/22 – PRE-EVALUATION

Name:

Role:

Landholder	Adviser/Agronomist	Industry	Other

1= Low 5=Average 10=High

SALINE SOILS

How would you rate your current knowledge around saline soils in the Coomandook region

1	2	3	4	5	6	7	8	9	10

How would you rate your current knowledge around the processes that contribute to saline soils in the Coomandook region

1	2	3	4	5	6	7	8	9	10

CARBON

How would you rate your current knowledge around carbon emissions and sequestration?

1	2	3	4	5	6	7	8	9	10

How well do you understand the factors that contribute to your farms carbon footprint?

1	2	3	4	5	6	7	8	9	10

How would you rate your current knowledge around soil carbon?

1	2	3	4	5	6	7	8	9	10

How well do you understand soil carbon stocks are and how they are calculated?

1	2	3	4	5	6	7	8	9	10

POST-EVENT EVALUATION

How would you rate todays session (1- poor, 10-excellent)

1	2	3	4	5	6	7	8	9	10

Has todays event increased your knowledge in the following areas (Y or N);

- Saline Soils
- Saline systems
- Carbon on-farm
- Soil carbon
- Climate forecasting

As a result of todays events are you likely to follow up on any of the matters covered or make any business / on-ground changes on your farm?

Saline soils

No	Unlikely	Maybe	Likely	Definitely

Saline systems

No	Unlikely	Maybe	Likely	Definitely

Carbon on-farm

No	Unlikely	Maybe	Likely	Definitely

Soil carbon

No	Unlikely	Maybe	Likely	Definitely

Climate

No	Unlikely	Maybe	Likely	Definitely