

'Farming Acid Soils Champions on Eyre Peninsula 2018-2023'

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Soil Acidity on Eyre Peninsula

Eyre Peninsula (EP) has an expanding area affected by soil acidity. In 2020 DEW estimated around 297,000 ha of agricultural land to be acid prone with around 223,000 ha already at pH levels where acidity is currently considered an issue. The areas affected are expected to increase to 487,000 ha by 2050 if the acidification within farming systems continue.

Recent projects on the EP suggest that the rate of soil acidification is occurring faster on average than historical estimates (Masters 2015 to 2020). The areas currently affected and with the potential for acidity to develop are shown in Figure 1 below.

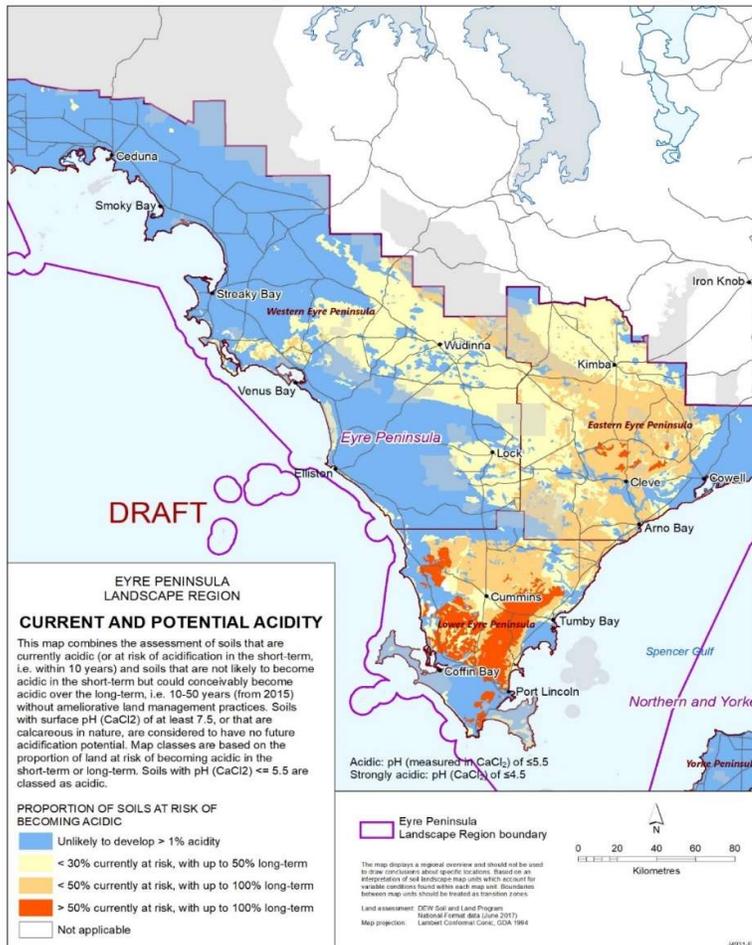


Figure 1- A map of the current and potential areas of soil acidity, Eyre Peninsula of South Australia (DEW 2022)

At this stage, soil acidity is common on the Lower EP and the Cleve Hills and is starting to appear in the Arno Bay to Lock area. However, soil acidity is currently very uncommon within the Kimba to Wudinna areas.

Average lime use since 1999 to remediate soils is about 77% of the estimated topsoil acidification rate (35,000 tonnes for all acid prone soils), so a lime deficit has accumulated (Forward and Hughes 2019). However, increased lime sales in the region with estimated sales of more than 50,000 t per year since 2019 has started to reduce this deficit (Forward and Hughes 2019, Masters 2020, and Masters 2021 unpublished).

Another method of reducing acidification is the addition of alkaline clay to soil and this has been used for some sandy soils, particular around Wharminda, Lock and the northern Cleve Hills.

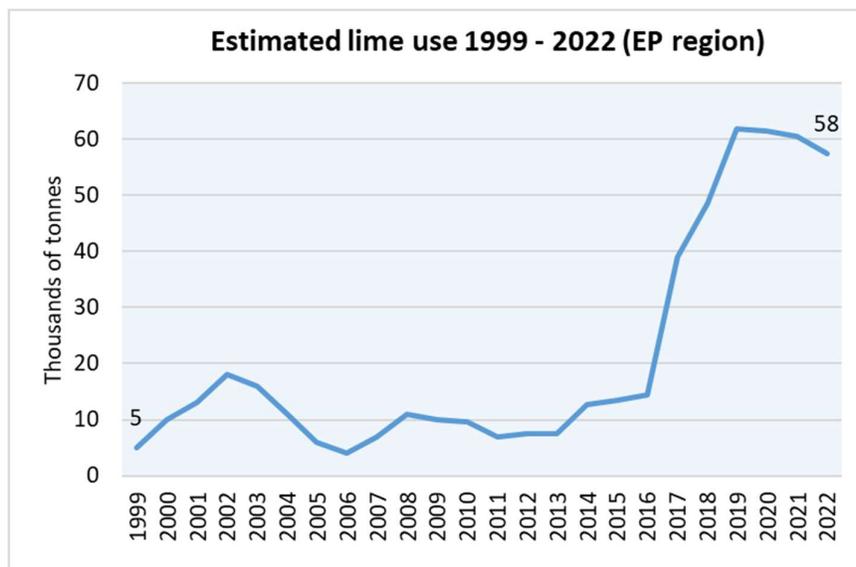


Figure 2- Estimated lime use (tonnes) over time from years 1999 to 2022 for the whole Eyre Peninsula region showing the current level of use at 58 tonnes of lime (DEW, 2023)

Overview and summary of ‘Farming acid soils champions on Eyre Peninsula’.

Background

In 2015/2016 and 2016/2018, in partnership with local farmer groups and with funding from the Department for Environment and Water (DEW), the Eyre Peninsula Landscape Board (formerly Eyre Peninsula Natural Resource Management Board) supported PIRSA soil consultants to develop and deliver an extension program called ‘*Farming Acid Soils Champions*’ (FASC) which had the objective of developing the knowledge and skills of farmers on Lower Eyre Peninsula to champion the cause of managing acidic soils in the region (Masters 2016, Masters 2018).

Current Project

Using a similar method to the early workshops a new project particularly targeting new regional areas was developed for the 2018/23 period.

This report details the 2018/23 activities and results from the ‘*Farming Acid Soils Champions*’ project, a Regenerative Agriculture Project jointly delivered by Agricultural Innovation and Research Eyre Peninsula (AIR EP) and the Department of Primary Industries and Regions (PIRSA) and supported by the Eyre Peninsula Landscape

Board (the Board) with funding from the Australian Government's National Landcare Program (NLP). The first year was undertaken as part of the Board's 'Restoring pH balance project in areas with existing soil acidity' project, supported by the Regenerative Agriculture Program and funded by the Australian Government's National Landcare Program. Other components of this project are reported on the technical report on the monitoring sites. In 2019/20 to 2022/23 this project was varied to be about the acid soils champions and encouragement of pH mapping. Independent reports in each year's activities are available so this report provided an overview only.

The project milestones were:

- Year 1 - 2018/19- Preparation and delivery of 2 workshops each at two locations, submission of workshop report (other components reported in pH monitoring report)
- Year 2 - 2019/20 - Preparation and delivery of 2 workshops, submission of workshop report
- Year 3 - 2020/21- Preparation and delivery of 2 workshops, submission of workshop report
- Year 4 - 2021/22 - Preparation and delivery of 2 workshops, submission of workshop report
- Year 5 - 2022/23 - Preparation and delivery of 2 workshops, submission of workshop report and submission of final report.

Note the agreement was varied in April 2022 due to issues in the north- east workshops after the area was severally flood affected in January 2022.

The two main components of the workshops included:

1. To deliver the 'Farming Acid Soils Champions' program to new farmer groups (one each on Lower EP and Eastern EP/ year).
2. Soil pH mapping – To provide participants with the knowledge and equipment to undertake pH mapping on their properties using aerial photos and pH field kits, and to offer them the opportunity to have a paddock mapped using a VERIS pH mapping machine.

2018/19 workshops

Two sessions were held at Cummins (28 February - 4 participants and follow up June 13 June, 2019) and two workshops held at Cleve (1 March- 15 participants and 13 June, 2019). Veris pH mapping was demonstrated after the initial workshop with the two groups as well as several farmers using pH kits to understand pH variability in paddocks. The second workshop focussed on what landholder had learnt about their paddock variability and how they had treated the paddock.

Overall, workshop program provided participants with a good overview of the causes, monitoring and impacts of soil acidity, and demonstrated novel strategies for planning to treat the issue through pH mapping activities and demonstration of excel based soil acidity management tools/models.

All participants who submitted feedback found the workshops interesting and relevant to their business, and found all components of the program had at least some value to them. All participants also stated that they would make changes to the management of their property as a result of the program including;

- Increase pH testing and liming to bring pH above the target surface value of 5.5 CaCl₂.
- Apply variable rates of lime to different areas for increased effectiveness of the liming operation, and
- Increase paddock scale pH mapping, with Veris machines and field pH kits for increase cost effectiveness of liming.

More detailed reporting is presented in **Masters, B. (2019)** '*Restoring Soil pH balance in areas with existing soil acidity 2018-2019*'. Final Project Report, PIRSA. June 2019.

2019/20 workshops

Two groups were established in 2019/20 (one each in Eastern EP and Lower EP). Workshop 1 of the program was held at Cummins on Tuesday 25 February 2020 (15 participants from 13 farm businesses plus 3 local agronomists) and at Cleve the following day (8 participants from 6 farm businesses). Brett Masters (PIRSA) presented an overview of the causes of soil acidity and the impact of soil type and farming systems on acidification rates.

As part of this workshop participants were supplied with an aerial photograph of one of their paddocks and a field pH kit. Board employee Mary Crawford led an exercise to show participants how they could use these to undertake 'low tech' soil pH mapping on their property to identify zones of varying soil pH within a paddock.

The second workshop in the program (held at Cleve on Tuesday 16 June 2020 and the following day at Cummins) gave landholders an opportunity to discuss their observations, what they had learnt about managing soil acidity, pH mapping results and what treatments they had implemented since the February workshop.

Brett Masters (PIRSA) delivered a series of presentations including discussion of the field mapping exercise results, case studies demonstrating the cost effectiveness of liming from pH mapping, summary of the surveillance sampling results, pH stratification under no-till and lime movement through the soil profile. PIRSA's excel based soil acidity management tools including the 'Lime Maintenance Rate Model', 'Lime Comparison' and 'Cost of soil acidity' tools were also demonstrated at this workshop.

Participants in the program found it interesting and relevant to their business and found the information presented valuable for understanding the causes, and monitoring the impacts, of soil acidity. Participants also gained skills to effectively treat soil acidity on their properties. Most participants responded that they would make changes to the management practices on their property as a result of the program including;

- Increased regular pH testing/paddock scale pH mapping;
- Apply variable rates of lime to target areas;
- Incorporation of lime into the subsurface by deep ripping or spading;
- Utilise excel based tools/models for management of acidity.

2020/21 workshops

Initial workshops were held in at Cummins on Lower EP on 24 February 2021 and in Cleve on the following day. Brett Masters (PIRSA) presented an overview of the causes of soil acidity and participants shared their experience of managing soil acidity.

Josh Telfer (Sustainable Agriculture Project Officer, AIR EP) led an exercise to show participants how they could use an aerial photograph and field pH kit to undertake 'low tech' soil pH mapping and identify zones of varying soil pH within a paddock.

Follow up workshops were held on 24 June at Cummins and 28 June at Cleve where participants were given the opportunity to discuss their observations, what they had learnt about managing soil acidity, pH mapping results and what treatments they had implemented since the February workshop.

Additional, information was presented on;

- Case studies demonstrating the cost effectiveness of liming from pH mapping,
- Summary of the 2020 surveillance sampling results
- pH stratification under no-till and lime movement through the soil profile
- Demonstration of PIRSA's excel based soil acidity management tools including the 'Lime Maintenance Rate Model', 'Lime Comparison' and 'Cost of soil acidity' tools.

Participant feedback from participants expressed that the program was interesting and valuable; and that it had improved their understanding of soil acidity and acidification rates. Most participants responded that they would make changes to the management practices on their property because of the program, with intended changes including;

- Increased regular pH testing/paddock scale pH mapping,
- Increased applications of lime,
- Incorporation of lime into the subsurface by deep ripping or spading,
- Utilising excel based tools/models for management of acidity.

2021/22

Initially workshops were proposed at with the Buckleboo farmers group near Kimba but due to major flooding issues workshops were deferred.

2022/23

At Buckleboo/Kimba proposed landholder participants felt the acidity workshop would not be suitable because acidity still not really a widespread issue in the district and they were still overcoming floods in the district. For these reasons a decision was made to run workshops at Tuckey and organise a webinar in partnership with AIREP as a replacement and leave the Kimba workshops until a later date. In addition, acidity forums were run at Cleve and Yallunda Flat as part of the 2022/23 project in partnership with AIREP.

Deliverables in 2022/23

- Soil pit acidity session with Tuckey Ag Bureau. Acidity was the main theme but looked at other limitations as well. Two acid soil pits were examined. Acidity knowledge was poor of this group before the soil pit day.

The soil pit field day was held on 24 March 2023, 50 participants including 15 Cleve Area School students attended.

Feedback from participants included:

- “That was spot on. Hit the nail on the head with identifying soils constraints information”,
 - “The soil pit session was good, and I learnt a lot”,
 - “Soil acidification is definitely becoming more of an issue and I’m glad the school students were here as it’s an issue they’ll have to deal with down the track”,
 - “We never thought we’d have a problem with soil acidity in the past but can see why current farming practices are increasing this issue”.
- Delivered two acid soils forums in partnership with AIREP at Cleve and Yallunda Flat. AIR EP feedback indicated with 39 farm business representatives participating. Discussion across all the content was wide-ranging with all farmers showing interest. The farmers were interested in data which was specific to the long-term monitoring sites and major contributors to the development of acidic soils in their district. There was high interest in the emerging technological aspects. Overall interest was high as practical applications and real-life local results were discussed in detail.
Feedback included:
 - Learning to trial ways to get lime to depth while dealing with high pH topsoil.
 - Good insights into liming and effects on various depths of soil.
 - Learned that the best time to start liming is now not later.
 - Will continue to test more manually with a pH kit top and at 20cm.
 - Learned that too much lime on subsurface affects it going into the subsoil.
 - Great conclusions and take-home messages.
 - Justified what they have done with ideas for ongoing management.
 - Keep an eye on subsurface pH.
 - Excellent information - local data and new cutting-edge research.
 - Webinar still to come- this is proposed on 20 June 2023 and will involve Ruby Hume (PhD student, University of Adelaide, linked to GRDC project and recently presented at soil acidity workshops on EP) and Josh Telfer as presenters and will follow a similar outline to the forums at Cleve and Yallunda Flat.

Future Directions for soil acidity on Eyre Peninsula

Eyre Peninsula landholders can roughly be grouped into three in terms of soil acidity. These include:

1. Aware and treating – most common on Lower EP and the Cleve Hills. Key issues going forward link to initial liming, re-liming, subsurface stratification, other treatments options and links to acid tolerance and other land management issues.
2. Emerging Areas- areas where some acidity now present, further expansion will occur over the next decade or two. Key issues include awareness, soil pH mapping, local lime sources, monitoring and at identification of at risk landscapes and other treatment options. Landholder education needs to be maintained.

3. Yet to emerge area- key issue include selected soil pH mapping, monitoring sites on at risk soils and understanding of causes. Some landholder awareness required. As acidity begins to emerge the issues above will become more prevalent.

In any future program the stage of acidity development and landholders' knowledge and understanding needs to be taken into account when planning extension projects and activities. The monitoring program is discussed in Masters et al (2023) which highlights the emphasis for future sampling needs to be emerging and yet to emerge areas of acid soils.

The acidity link with other agricultural practices needs consideration as acidity often develops first on the most productive soils on the district.

Issues such as sandy soils treatments, expansion of acid sensitive plants such as lentils needs to be considered in future programs.

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Abbreviations

DEW	Department for Environment and Water.
EP	Eyre Peninsula
EEP	Eastern Eyre Peninsula.
EPNRM	Eyre Peninsula Natural Resources Management Board
FASC	Farming Acid Soils Champions
ha	hectares
LEP	Lower Eyre Peninsula
NLP	National Landcare Program
NREP	Natural Resources Eyre Peninsula
pH	Potential hydrogen; a measure of soil acidity and alkalinity
pH (CaCl₂)	pH in calcium chloride solution
PIRSA	Primary Industries and Regions SA
t	tonnes
t/ha	tonnes per hectare