

Soil acidity and lime use in South Australia

Summary of data (June 2023)



Ref: DEW-D0021796

Key points

How much land in South Australia is acidic?

- Approximately 3.9 million hectares (44%) of agricultural land in South Australia (SA) are considered at risk of acidity. Of this, about 2.5 million hectares (28%) are already close to or at pH levels that are too acidic and reducing the yield of crops and pastures (Figure 1).

What is the cost of production losses due to soil acidity?

- In South Australia the cost of lost crop and pasture production due to soil acidity is estimated at about \$89 million per year.

How much lime is applied annually?

- Approximately 309,000 tonnes of lime was used on acidic agricultural land in SA in 2022, and lime use has tripled since 2016.

How much lime is needed on an annual basis?

- In 2022, the estimated amount of lime needed to balance annual soil acidification (lime requirement) was 200,000 tonnes.
- The annual lime requirement is projected to increase to 293,000 tonnes by 2050. This is due to increasing agricultural production, particularly more intensive cropping systems and higher nitrogen use.
- This estimate is for the surface soil layer (0-10cm) only and does not include the lime required to balance sub-surface soil acidification.

How does this compare with the amount of lime used annually?

- Since 1999 a shortfall (deficit) of 418,000 tonnes of lime has accumulated, because overall, lime use has been below the estimated lime requirement. This means soil acidity has been increasing, and the area affected is increasing.
- Annual lime use has been greater than the lime requirement since 2018, and this is reducing the accumulated deficit.

How much lime is required to catch up?

- Over and above the annual lime needed to balance acidification, an estimated 2.65 million tonnes of lime would need to be applied to raise the pH of all currently acidic soils to pH_{CaCl} 5.5 (called the 'catch-up' lime requirement).
- Most of the catch-up lime requirement is to balance acidification that would have occurred before 1999.

How much lime will be required in the future to amend acidic soils?

- To fully amend acidic soils on the broad scale, it will require application of the catch-up lime requirement as well as the lime requirement to balance annual acidification.

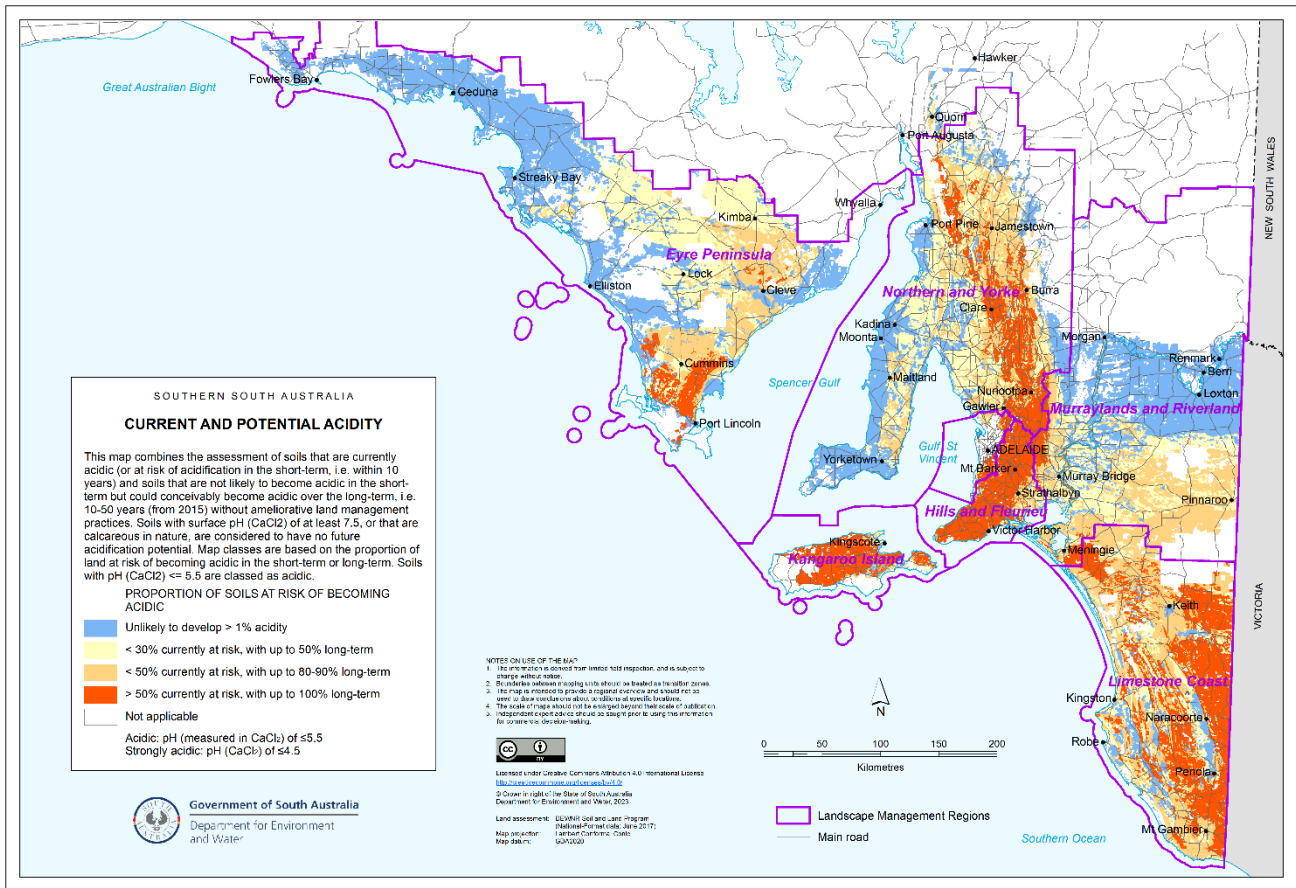


Figure 1. Areas with current and potential acidity on agricultural land in South Australia

Summary of data

Lime use

In 2022, 309,000 tonnes of lime was used on agricultural land in SA.

Annual lime use has increased by about 200,000 tonnes (has tripled) since 2016 (Figure 2).

From 1999 to 2016, lime use was within the range of about 75,000 to 140,000 tonnes (Figure 2).

Lime use within landscape regions is estimated from lime tonnage data from individual sellers.

Since 2016 there have been large increases in the estimated lime used in most landscape regions, particularly Eyre Peninsula, Northern and Yorke, Limestone Coast and Kangaroo Island (Figure 3).

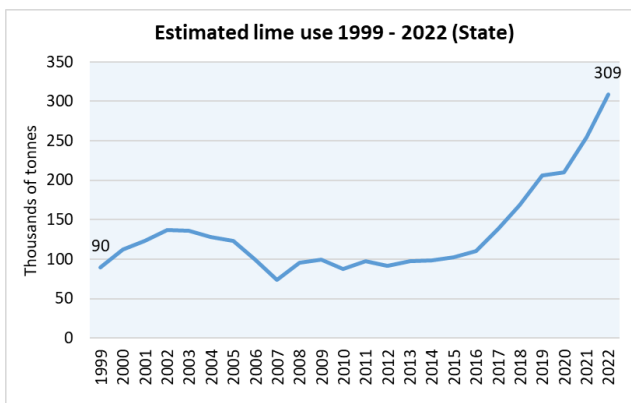


Figure 2

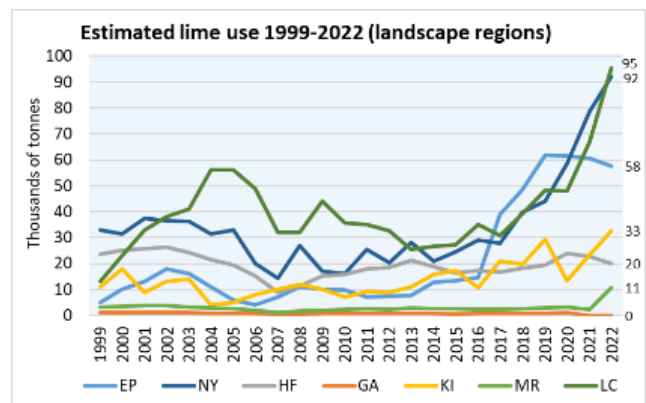


Figure 3

Lime requirement for annual acidification

Annual soil acidification rates are estimated using mapped soil type data, land use types and production intensity.

The lime requirement (amount of lime needed to balance the estimated annual acidification) on acid soils has increased from 123,000 tonnes in 1999 to 200,000 tonnes in 2022 (Figure 4).

This is projected to increase to 293,000 tonnes by around 2050 (Figure 4).

This estimate is for the surface soil layer (0-10cm) only and does not include the lime required to balance sub-surface soil acidification (has not been estimated).

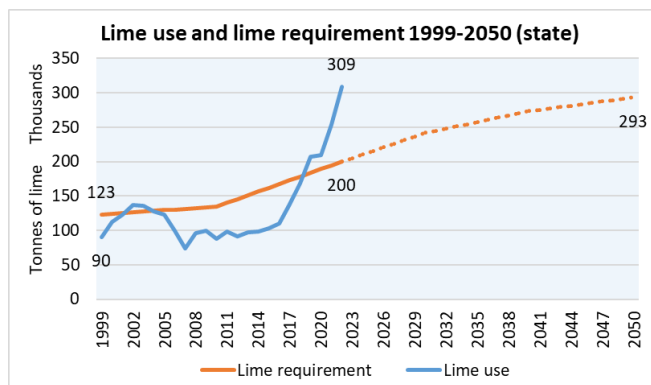


Figure 4

The lime requirement is estimated to increase over time based on:

- Increasing cropping intensity, nitrogen fertilizer inputs and production levels since around 1980 which are increasing soil acidification rates.
- The extent of soils with pH_{CaCl} levels falling below 5.5 is predicted to expand, particularly on non-calcareous soil types with lower buffering capacity (sandier texture). This is being confirmed by soil pH testing, which is showing acidifying soils in agricultural districts occurring well beyond the traditionally recognised acid soil areas.

Since 2018, lime use has been above the lime requirement, but this is actually helping to make up the accumulated shortfall of lime use prior to 2018.

Lime use balance

In SA the cumulative lime balance (annual lime use minus lime requirement) since 1998 is estimated to be minus 418,000 tonnes (i.e. a deficit) (Figure 5).

This accumulating deficit of lime means that soil acidity has continued to worsen overall.

The increasing lime use since 2018 is starting to reduce this deficit.

There is no data for years before 1999, but a lime deficit was probably accumulating for many years.

In 2022 the cumulative lime balance was estimated to be in deficit in the Northern and Yorke, Eyre Peninsula, and Murraylands and Riverland Landscape Regions (Figure 6).

Lime use needs to continue to increase in these areas to make up the lime deficit.

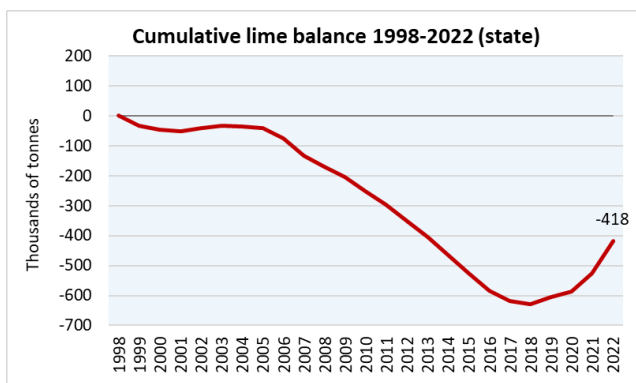


Figure 5

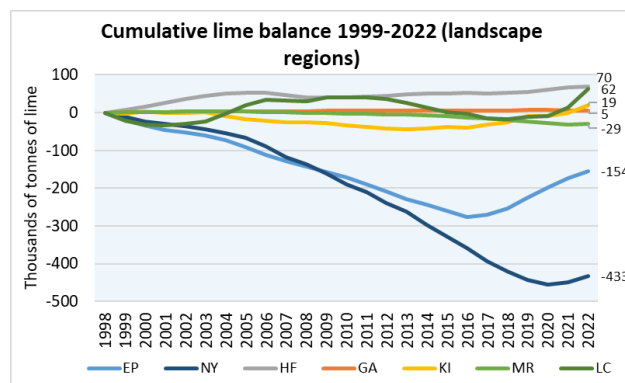


Figure 6

Catch-up lime needed for acidic soils

In addition to the lime required to balance annual acidification, extra lime would need to be applied to ameliorate soils that are already acidic (below pH_{CaCl} 5.5). This is referred to as the 'catch-up' lime requirement.

It is estimated that the catch-up lime requirement for SA's acid soils is 2.65 million tonnes of lime (Figure 7).

This is the amount of lime needed to raise the pH of acidic soils 0-10cm layer to 5.5 and 10-20cm acidic layer to pH 5.0.

The majority of this lime is needed to treat soils in the Limestone Coast region and higher rainfall agricultural areas (particularly Mt Lofty Ranges, Kangaroo Island) which have more extensive naturally acid soils (Figure 7).

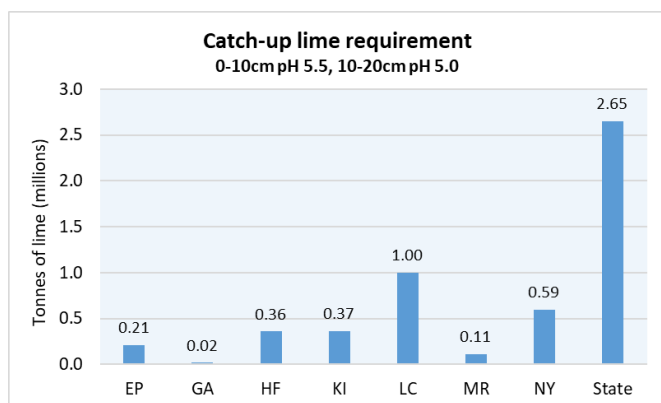


Figure 7

To fully amend acidic soils on the broad scale, it will require applying the catch-up lime requirement as well as the lime requirement to balance annual acidification.

At the property scale, in areas that are potentially acidifying, regular paddock soil pH testing and liming is needed to ensure optimum crop and pasture production, and stop increasing sub-surface acidification.

Spatial paddock pH mapping and variable rate lime application can give the most cost-efficient treatment and management of soil acidity. Nearly 470,000 hectares of cropping land has been pH mapped over about the past 10 years in SA.

Data estimates in this report have been derived from:

- Analysis of the DEW State Soil and Land Information Database
- SA ALUM Land Use Survey 2008, production intensity and documented acidification rates
- Targeted soil pH testing including paddock pH mapping
- PIRSA SA crop production estimates, value of production and lime trial results
- Local knowledge of soils specialists in PIRSA-SARDI and DEW

Preferred way to cite this information sheet

Department for Environment and Water (2023). Soil acidity and lime use in South Australia – May 2023

<https://data.environment.sa.gov.au/Land/Land-Resources/> (insert date web page accessed)



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