

# Managing Soil Acidity

## Status of soil acidity and liming in South Australia

RURAL  
SOLUTIONS SA  
**PIRSA**

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Forward, DEWNR



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Australian Government  
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Government  
of South Australia

# Contents

- Understanding acidity
- current and future projections
- Status
- Rates of acidification
- pH change over time
- Lime sales and targets



# SOIL ACIDITY BASICS-

## Soil pH and nutrient availability



### TOO MUCH:

- aluminium
- manganese
- Iron

### NOT ENOUGH:

- magnesium
- calcium
- potassium
- phosphorous
- molybdenum

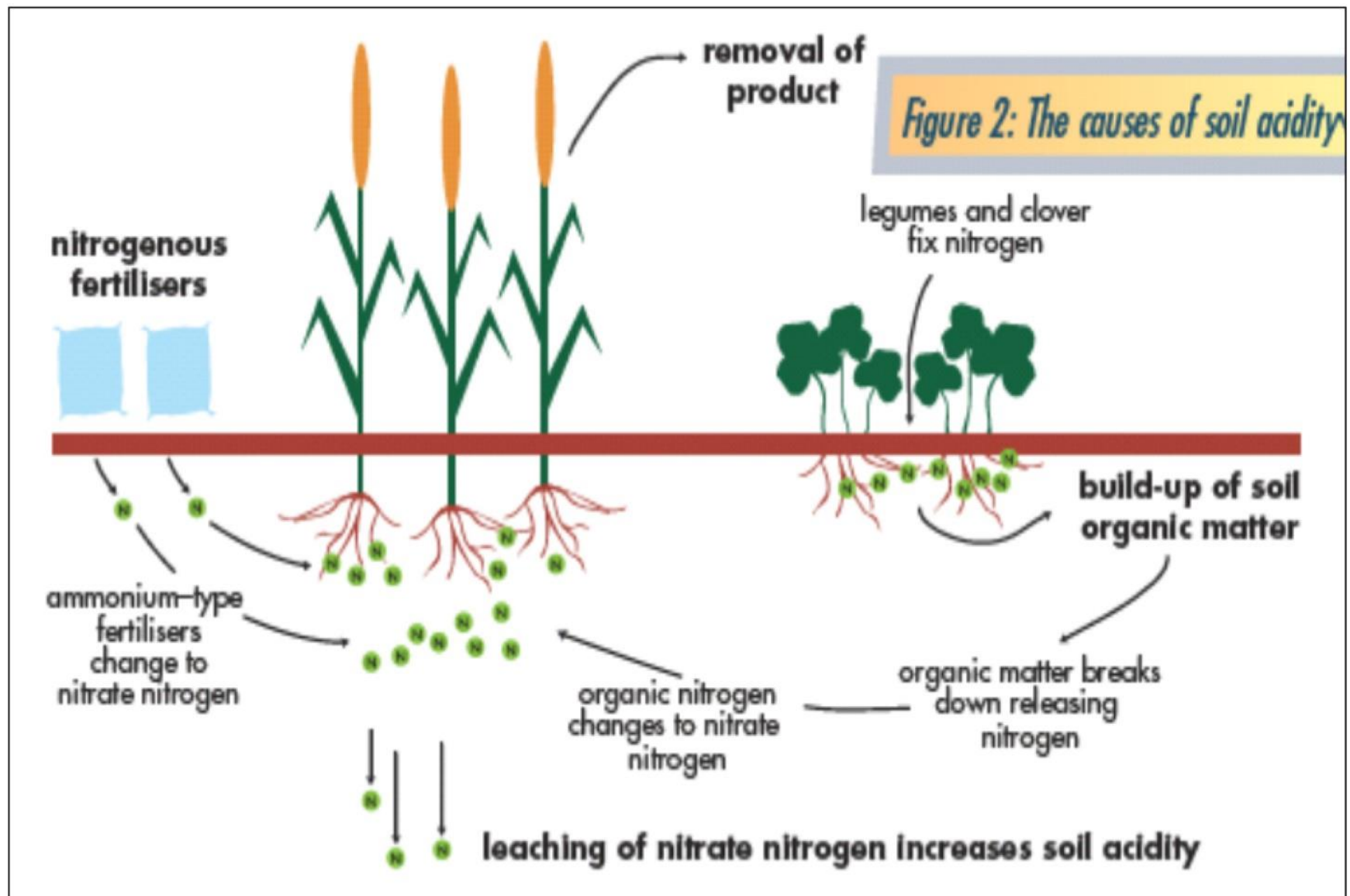
### TOO MUCH:

- sodium
- Boron

### NOT ENOUGH:

- iron
- zinc
- manganese
- copper
- phosphorous

# Causes of acidification



# Aluminium Toxicity

Increased solubility of Aluminium and Iron  
– Poor root development.  
– Complexing of phosphorus to these cations reduces fertiliser efficiency.

*Photo Credit: Stephen Carr,  
University  
of WA.*





# Aluminium Toxicity- critical levels

- | Al tolerance of Plant | Al – Ca Cl <sub>2</sub> -mg/kg | Al- KCL - mg/kg | Ex Al %- medium salinity |
|-----------------------|--------------------------------|-----------------|--------------------------|
| Highly sensitive      | 0.5-2                          | 15-30           | 2-8                      |
| Sensitive             | 2-4                            | 30-50           | 8-12                     |
| Tolerant              | 4-8                            | 50-100          | 12-21                    |
| Highly Tolerant       | 8-13.5                         | >100            | 21-30                    |

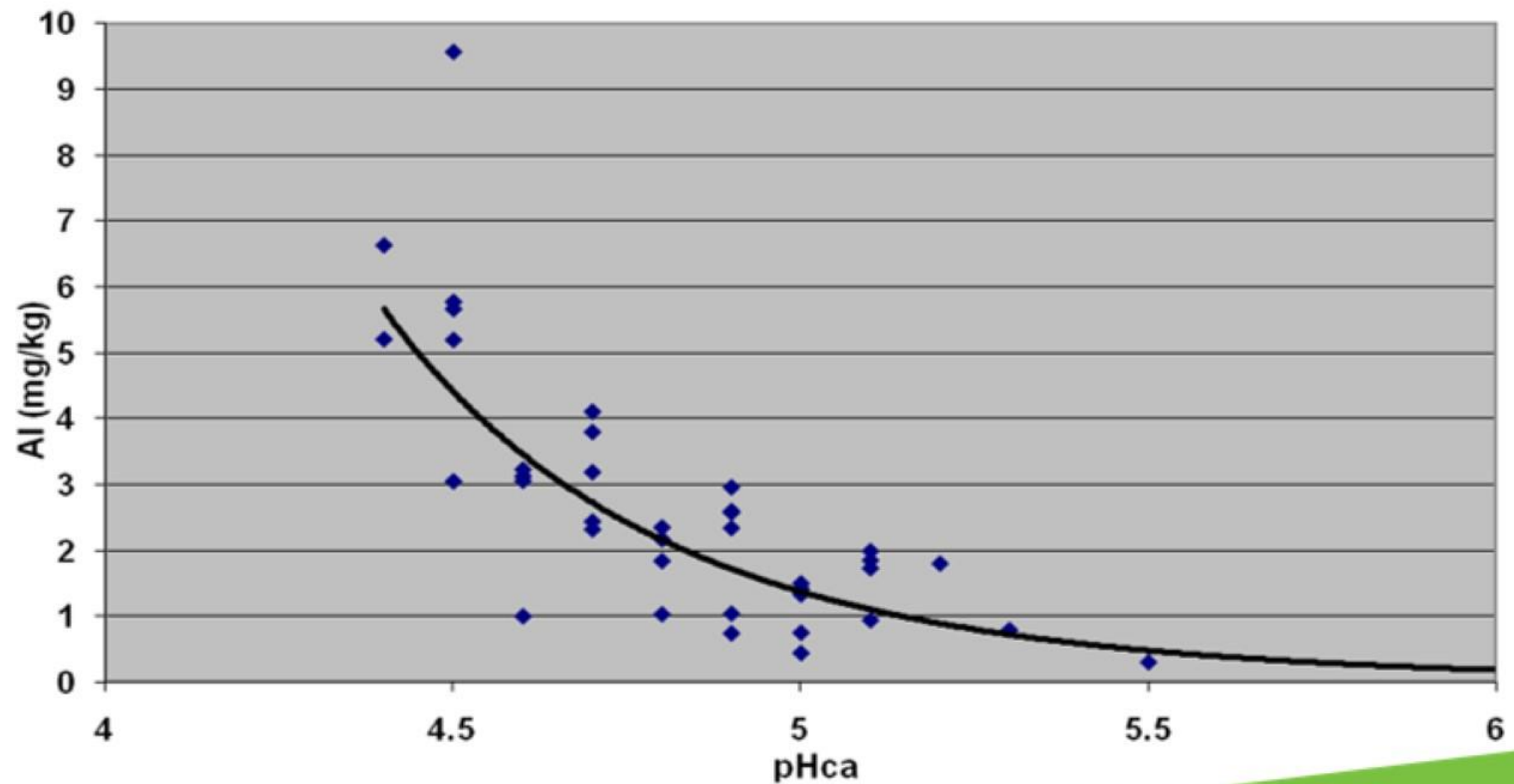
# Acidity Tolerance

Very Sensitive	Sensitive	Tolerant	Highly Tolerant
<p>Durum Wheat</p> <p>Most barley cultivars</p> <p>Faba Beans</p> <p>Lentils</p> <p>Chickpeas</p> <p>Annual Medics</p> <p>Lucerne</p> <p>Buffel Grass</p> <p>Tall wheatgrass</p>	<p>Janz wheat</p> <p>Canola</p> <p>Wallaby grass</p> <p>Phalaris</p> <p>Balansa Clover</p>	<p>Wheat*</p> <p>Subclover</p> <p>Vetch</p> <p>Cocksfoot</p> <p>Ryegrass</p> <p>Chicory</p>	<p>Oats</p> <p>Triticale</p> <p>Lupins</p> <p>Serradella</p> <p>Couch grass</p>



# Lillecrap- Loamy Sand to SL

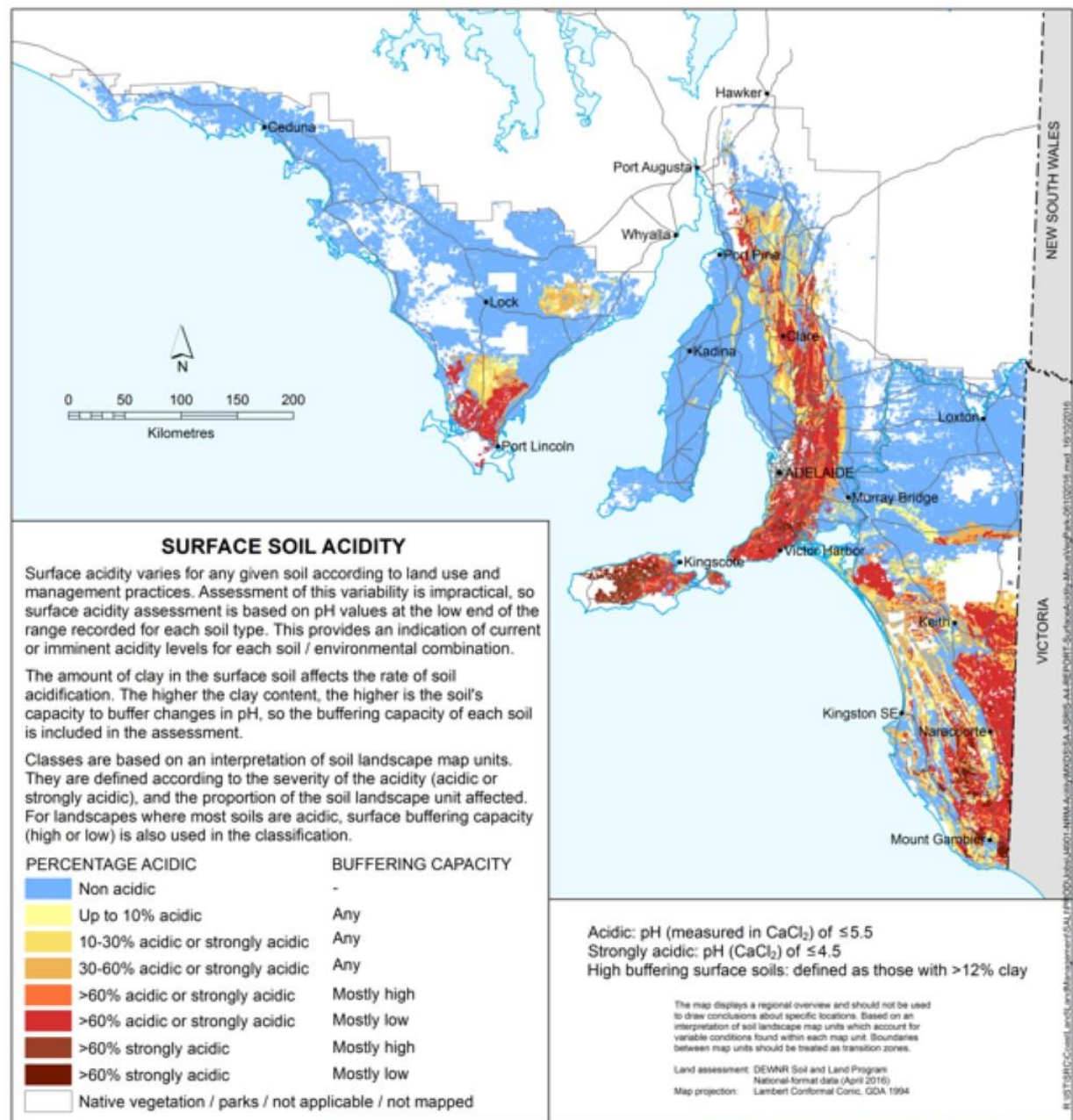
Relationship between aluminium toxicity and strong acidity- Joanna





# MAPPING SOIL ACIDITY CURRENT EXTENT

- 20% (2.0 m ha) of agricultural soils in SA affected/prone
- Extent increasing, subsurface acidity increasing



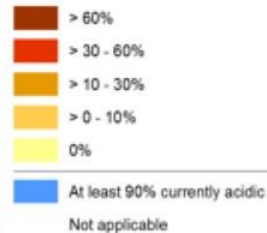
## FUTURE EXTENT

- Over the next 10-50 years
- Soils without calcareous buffering material or surface pH < 7.5

### SOUTHERN SOUTH AUSTRALIA FUTURE ACIDIFICATION POTENTIAL

Future acidification potential is a term which applies to soils which are not currently acidic (or prone to acidification in the short term), but could conceivably become acidic in future in the absence of ameliorative management practices. Future time frame is 10-50 years (from 2015). Soils which have surfaces which are calcareous or have pH (CaCl<sub>2</sub>) greater than or equal to 7.5 are considered to have no future acidification potential. Remaining soils are assessed according to current surface pH and surface clay content.

The map shows the distribution of soils with future acidification potential as a proportion of mapped soil landscape units.



#### NOTES ON USE OF THE MAP

1. This information is derived from limited field inspection, and is subject to change without notice.
2. Boundaries between mapping units should be treated as transition zones.
3. The map is intended to provide a regional overview and should not be used to draw conclusions about conditions at specific locations.
4. Under no circumstances must the scale of the map be enlarged beyond its scale of mapping.
5. Advice from Soil and Land Program should be sought prior to using this information for commercial decision making.
6. Under no circumstances may the data or information associated with this map or any accompanying report be altered in any way without the express permission of DEWNR Soil and Land Program.

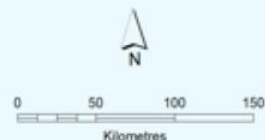
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Land assessment: DEWNR Soil and Land Program,  
(National Format date: June 2015)  
Map projection: Lambert Conformal Conic, GDA84



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NRM Region boundary  
 Main road

Southern Ocean

NEW SOUTH WALES

VICTORIA

REPRODUCED FROM THE SOUTH AUSTRALIAN GOVERNMENT'S SOIL AND LAND PROGRAM



Primary Industries and Regions SA

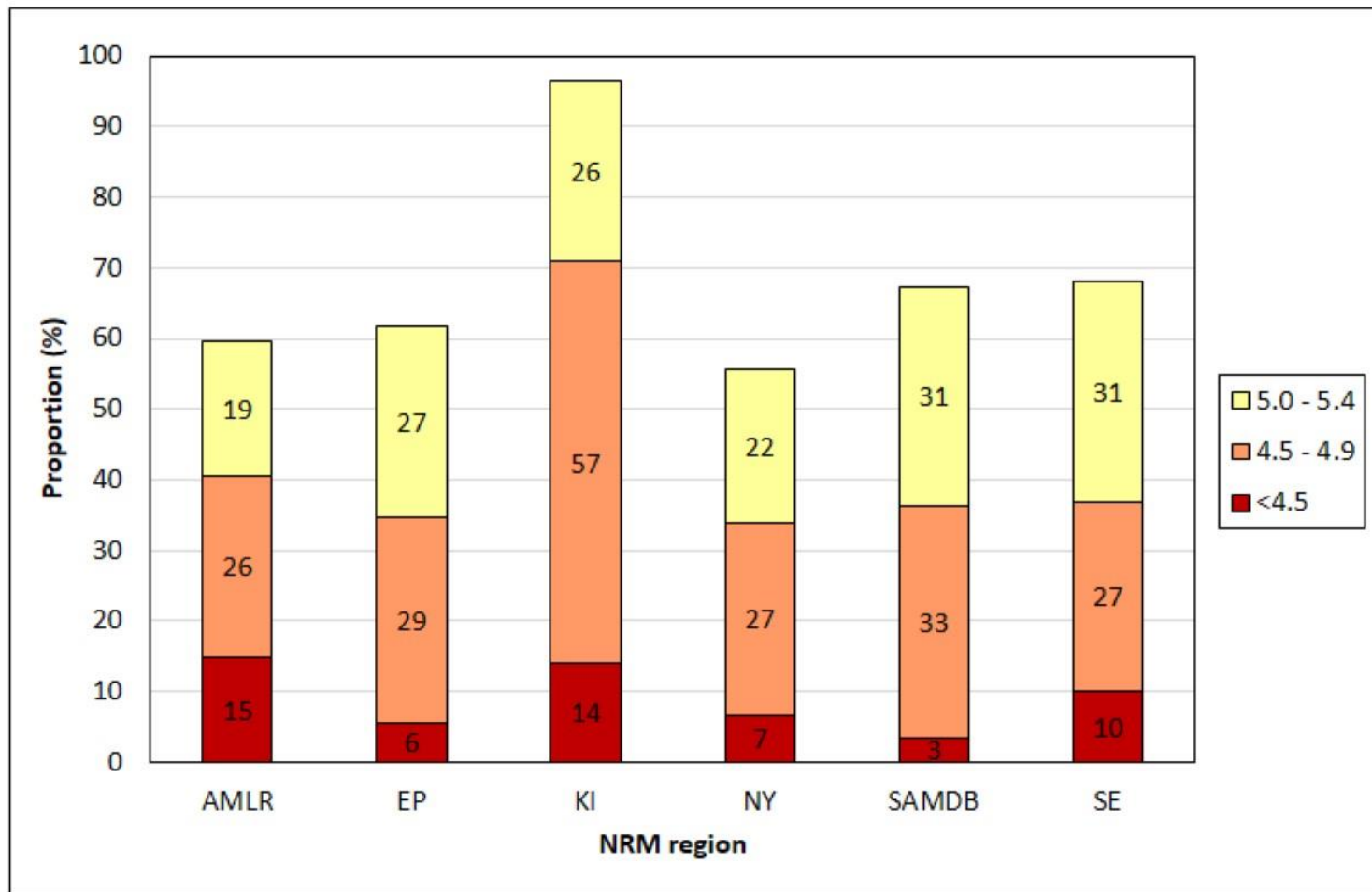


# Status- Recent Regional sampling- 07-14 assessments- in acid prone areas 400 sites

Region	Area Prone ha	Topsoil (0-10) below pHca 5.0	Subsurface (10-20cm) below 5.0
Kangaroo Is	184,000	86%	78%
South East	637,000	40%	50%
<i>Mt Lofty Ranges</i>	306,000	40%	48%
Eyre Pen	178,000	43%	19%
MDB	267,000	38%	49%
Northern	278,000	45%	28%

## Summary of surface (0-10cm) soil pH<sub>Ca</sub> results by NRM region

Combined results from DEWNR regional surveillance, monitoring, Ag Bureau sites in acid prone areas, 2008 - 2015



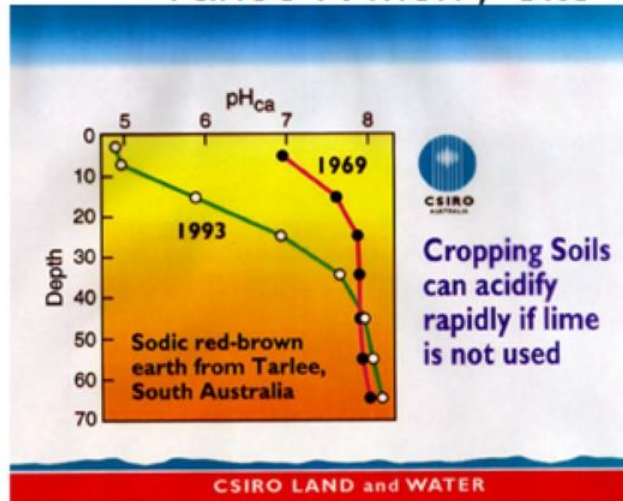
# Rates of Acidification - 70s to 90s from Merry, CSIRO

Land Use	Mean Annual Acidification Rate Kg lime/ha/yr
Low Intensity Grazing	30
Medium Intensity Grazing- some hay cuts	100
High Intensity Grazing	150
Cropping Pasture Rotation	100
Intensive Cropping- some pasture, high N inputs	200
Mostly continuous Cropping- high N inputs	250
Continuous cropping- high N, leaching years	350 ??
High N grassy pasture systems	??

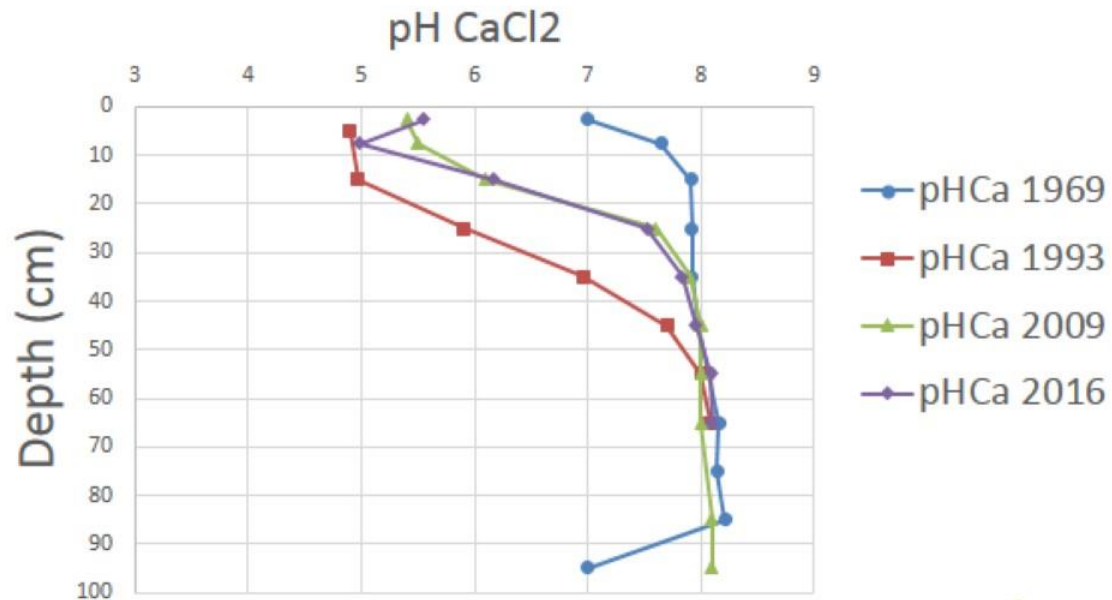


# pH decline at Tarlee- limed 3 times

## Tarlee R Merry Site

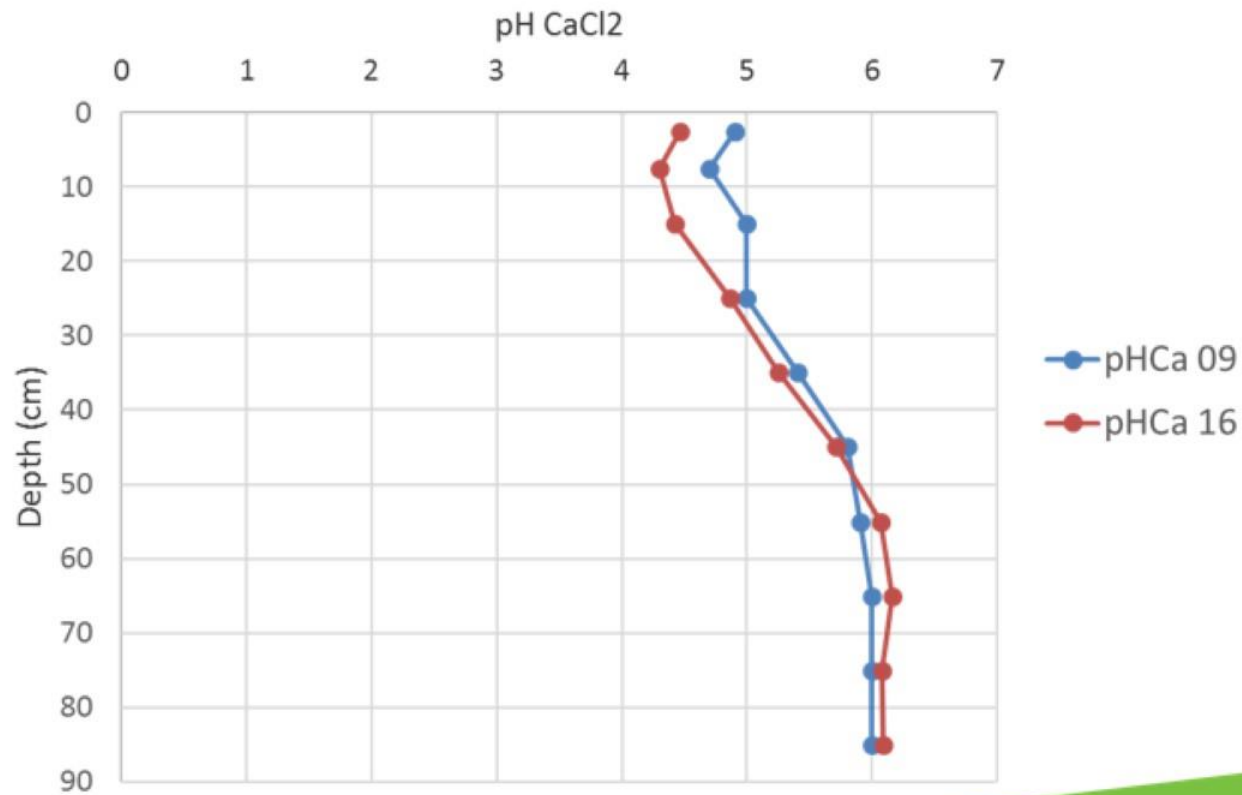


## Clarke pH CaCl<sub>2</sub>



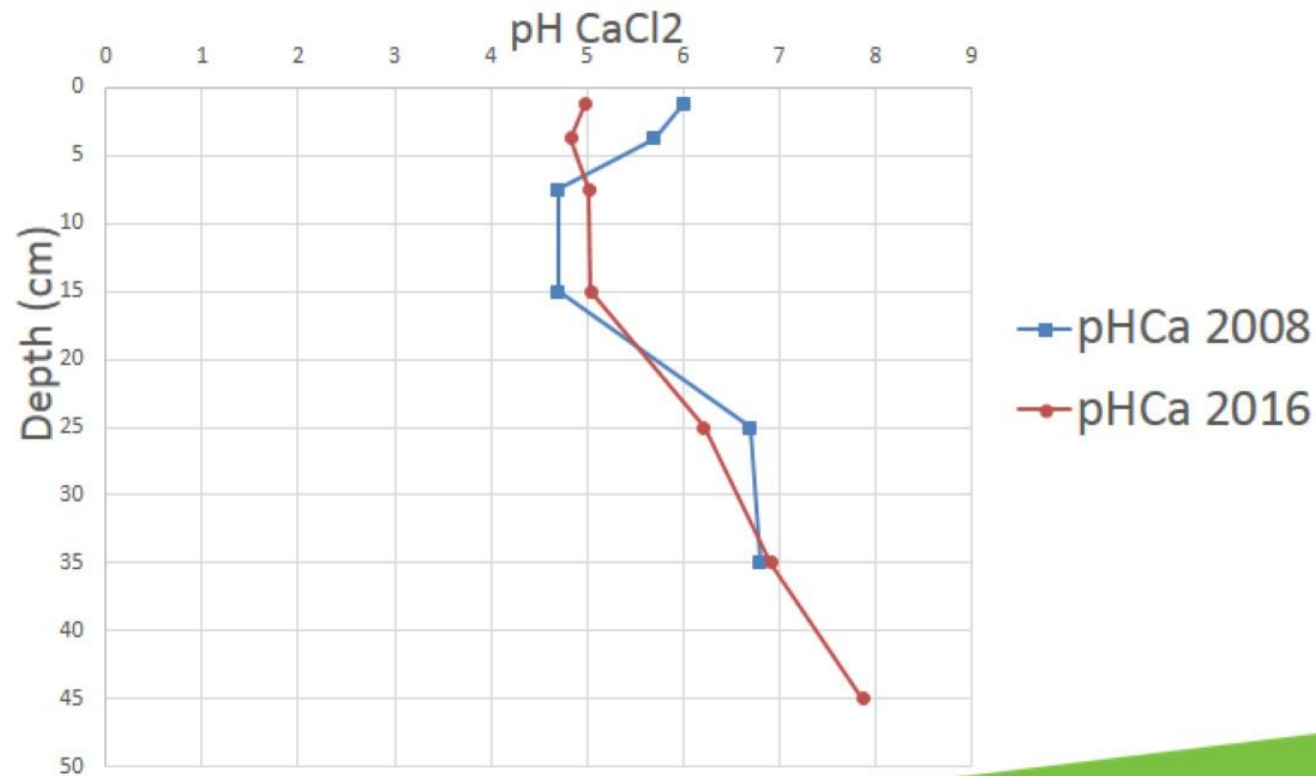
# Ironstone soil EP

Dennis pH CaCl2

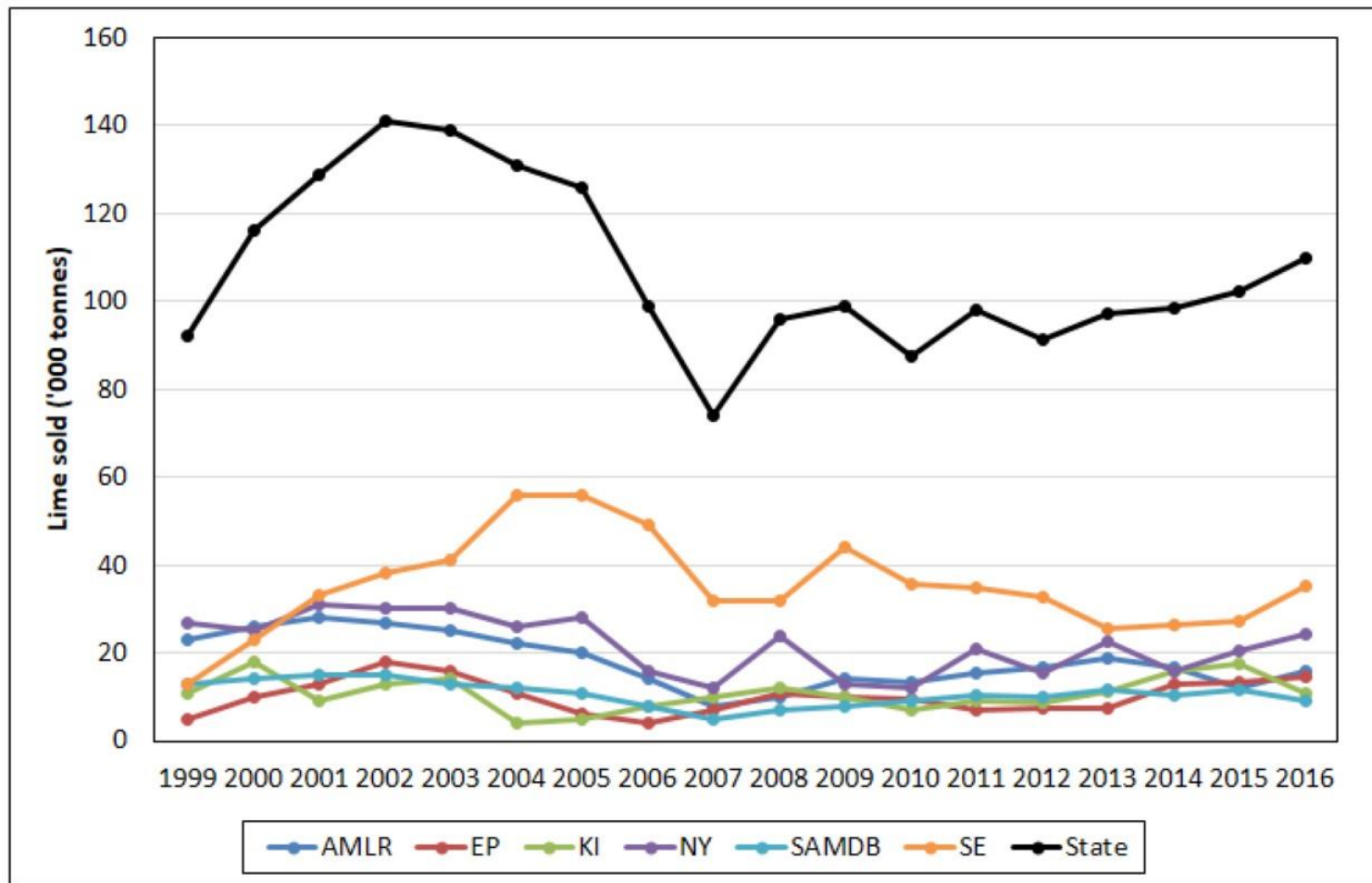


# clayed sand SE

Lutt pHCaCl



## Estimated annual lime sales ('000 tonnes) in NRM regions and SA, 1999 to 2016; data from lime sellers in SA



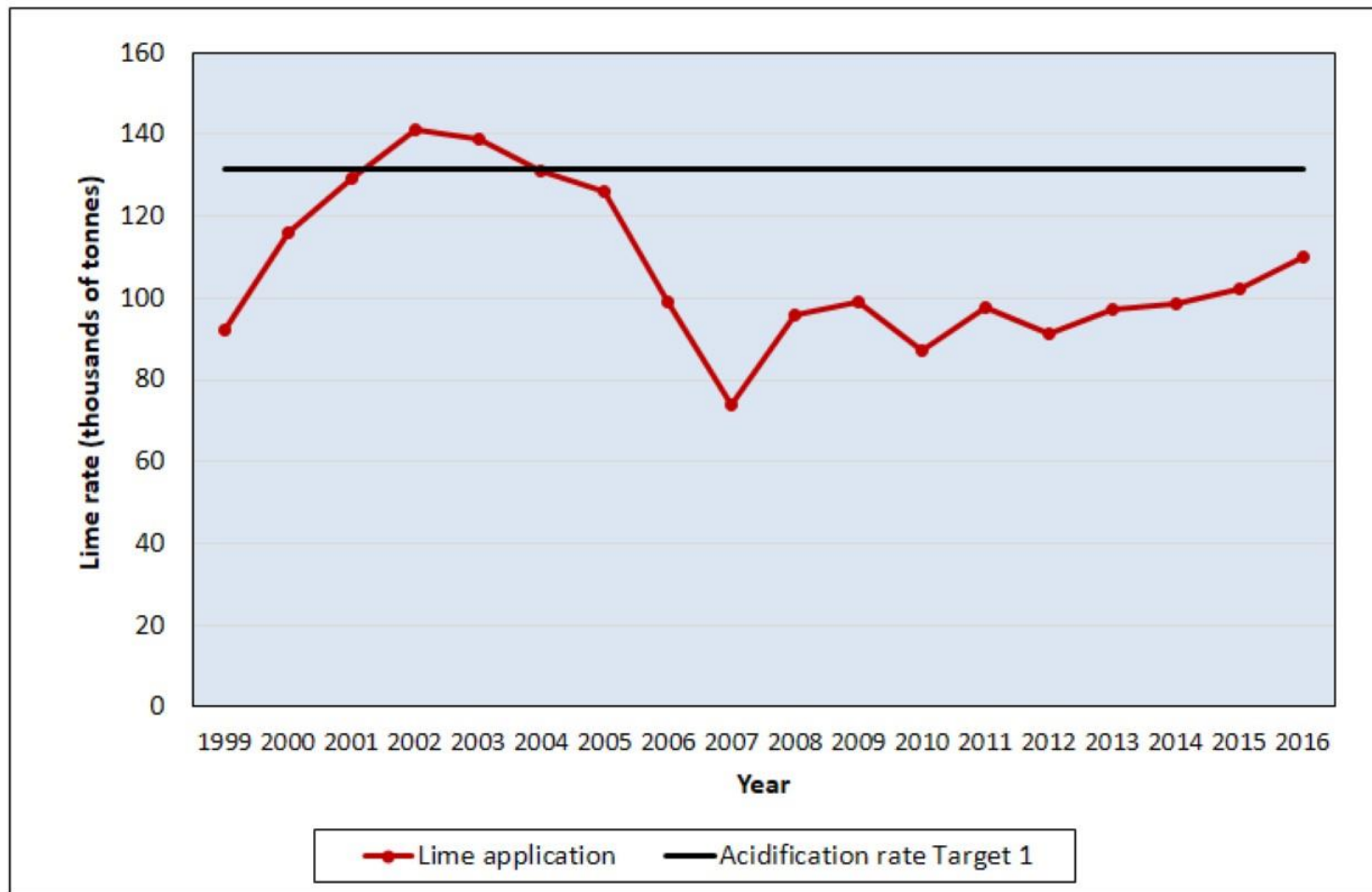
# Revised Targets for Liming SA#

- Target 1 – acidification from land use on % of acid prone land < pHCa 5.5
- Target 2- acidification from land use on all “acid prone” agricultural land
- Target 3 (catch up)- lime requirement to adjust pHCa to 5.5 in the surface and 5.0 in the subsoil on agricultural soil in SA
- # have accounted for alkaline clay and water

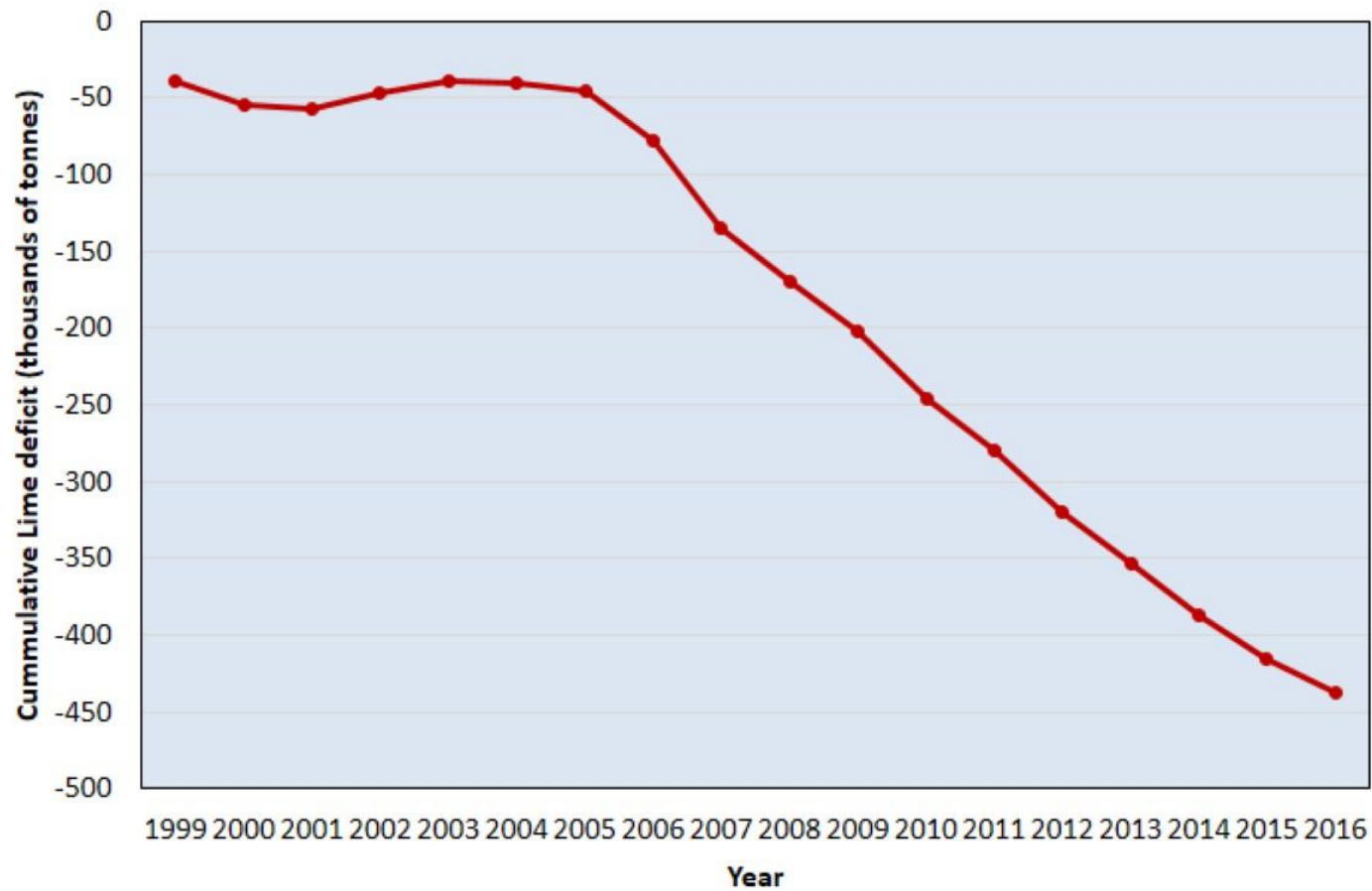




**Estimated annual lime sales ('000 tonnes) in SA and estimated lime requirement to treat surface soil acidification on soils below pH<sub>Ca</sub> 5.5- Target 1, 1999 to 2016; data from lime sellers in SA**



**Estimated cumulative lime deficit ('000 tonnes) in SA (lime use minus estimated surface soil acidification rate on soils below pH<sub>Ca</sub> 5.5) 1999 to 2016; data from lime sellers in SA.  
Based on 2016 acidification rates estimate.**



# Summary targets for Liming SA

- Target 1 –% of land < pHCa 5.5 - 131,000t/yr
- Target 2- all “acid prone” – 202,000t/yr
- Target 3 - catch up – 2.9 million t
- Actual – mean last 10 years – 95,000t/yr



# Thank You to Project Sponsors/ partners

- GRDC
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- DAFF/DA/ Landcare
- DEWNR/NRMBs
- Agricultural Bureau of SA

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