Aluminium toxicity

Aluminium is present in many soils but its availability and toxicity to plants depends on soil pH

Aluminium toxicity occurs in soils which contain aluminium and are strongly acidic. Aluminium availability also increases at high pH, so toxicity is theoretically possible in strongly alkaline soils as well. Aluminium is present in many soils, but its availability to plant roots is pH dependent. Aluminium is typically present in ironstone rich soils and those in which the dominant clay mineral is kaolinite. Sands contain little aluminium, so even strongly acidic sands are rarely toxic. Many plants are sensitive to aluminium even at small concentrations. As a general rule, correction of soil acidity will alleviate aluminium toxicity symptoms.

Land assessment in southern South Australia

Soil extractable aluminium levels (0.01 M calcium chloride) were measured at selected soil characterisation sites, and results were extrapolated over similar environments. Plants vary in their susceptibility to aluminium toxicity, so the three attribute classes used in the assessment of aluminium toxicity (refer to table below) are based on critical levels for aluminium sensitive plants such as lucerne.

Soil properties can vary across the landscape in a subtle or dramatic fashion. Mapping at a regional scale is not able to display this level of variability, however proportions of each *Aluminium toxicity* class (e.g. TAL1, TAL2, etc.) have been estimated for each map unit.

Further information can be found in Assessing Agricultural Land (Maschmedt 2002).

Two soil profiles from high rainfall zones with strong acidity and high (toxic) levels of aluminium in the rootzone. The soil on the left is an acidic loam over red clay on kaolinized rock from the Fleurieu Peninsula. The soil on the right is a thick bleached sand over mottled brown clay from the South East.

Area statistics

Aluminium toxicity potential	Approximate extractable aluminium (0.01 M CaCl$_2$)	Area	Cleared land	Class*
Low	Less than 2 mg/kg	93.88%	93.08%	TAL1
Moderate	2–4 mg/kg	4.20%	4.63%	TAL2
High	More than 4 mg/kg	0.50%	0.60%	TAL3
Not applicable		1.42%	1.70%	TALX
TOTAL HECTARES		15,765,460	10,439,300	

* The letters 'TAL' denotes classes that are specific to *Aluminium toxicity*

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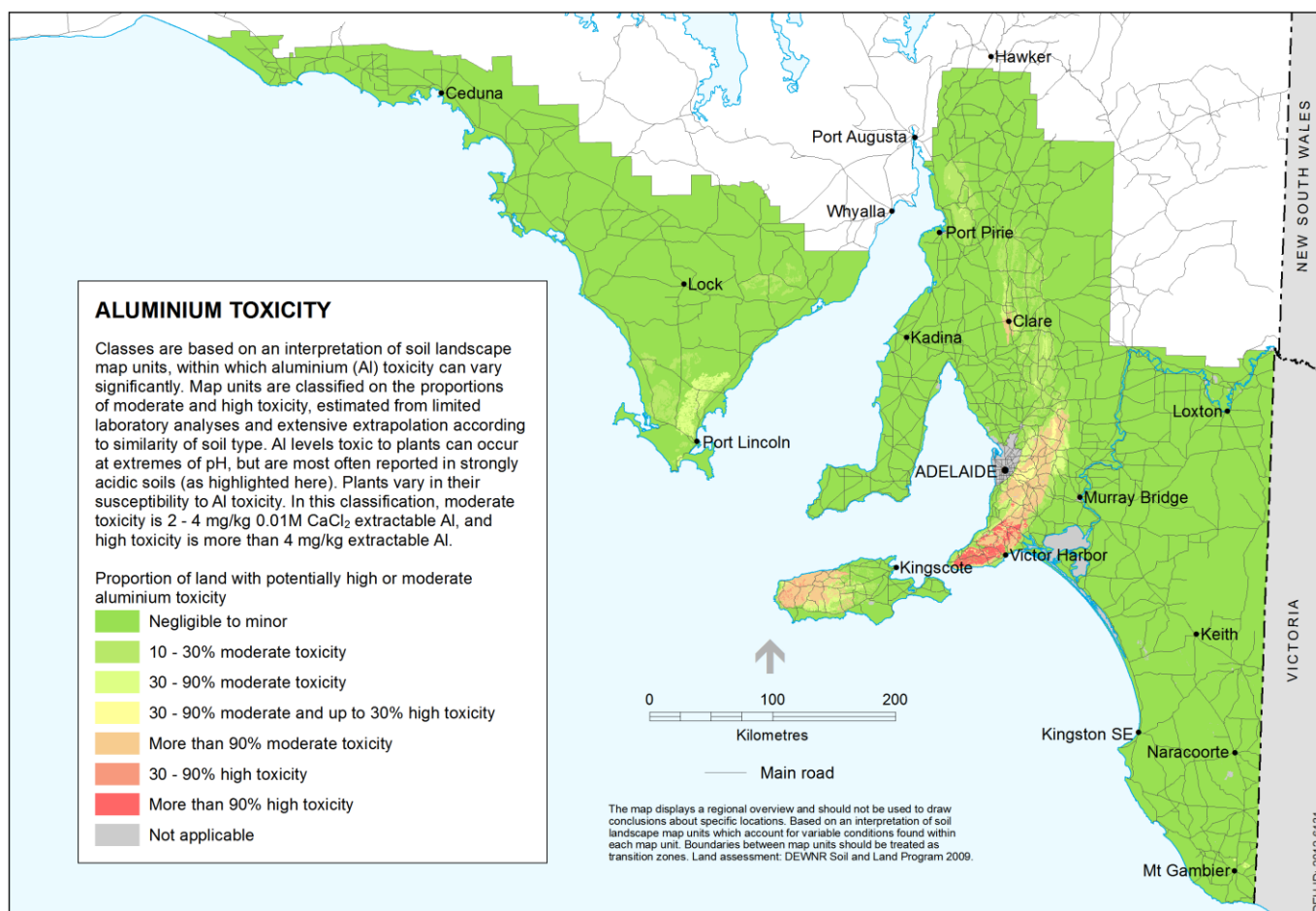Department of Environment, Water and Natural Resources

Displaying data in soil maps

Soil and land attribute maps display a simplified version of the underlying data. Mapping classes are based on an interpretation of soil landscape map units, within which aluminium (Al) toxicity can vary significantly. Map units are classified on the proportions of moderate and high toxicity, estimated from limited laboratory analyses and extensive extrapolation according to similarity of soil type. Because aluminium toxicity is highly pH dependent, and pH in turn is highly management dependent, the mapped legend categories are very generalised.

Plant sensitivity	Tolerant species	Level above which yield declines*
Very sensitive	Lucerne and canola	<2 mg/kg
Sensitive	Barley, sensitive wheat, phalaris	2-4 mg/kg
Tolerant	Sub. clover, cocksfoot, perennial rye, tolerant wheat, phalaris	4-8 mg/kg
Very tolerant	Lupins, oats, triticale	>8 mg/kg

* Interpretation of soil extractable aluminium levels (0.01 M calcium chloride extractable aluminium)

ALUMINIUM TOXICITY

Classes are based on an interpretation of soil landscape map units, within which aluminium (Al) toxicity can vary significantly. Map units are classified on the proportions of moderate and high toxicity, estimated from limited laboratory analyses and extensive extrapolation according to similarity of soil type. Al levels toxic to plants can occur at extremes of pH, but are most often reported in strongly acidic soils (as highlighted here). Plants vary in their susceptibility to Al toxicity. In this classification, moderate toxicity is 2 - 4 mg/kg 0.01M CaCl$_2$ extractable Al, and high toxicity is more than 4 mg/kg extractable Al.

Proportion of land with potentially high or moderate aluminium toxicity

- Negligible to minor
- 10 - 30% moderate toxicity
- 30 - 90% moderate toxicity
- 30 - 90% moderate and up to 30% high toxicity
- More than 90% moderate toxicity
- 30 - 90% high toxicity
- More than 90% high toxicity
- Not applicable

— Main road

The map displays a regional overview and should not be used to draw conclusions about specific locations. Based on an interpretation of soil landscape map units which account for variable conditions found within each map unit. Boundaries between map units should be treated as transition zones. Land assessment: DEWNR Soil and Land Program 2009.

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Further information

- View data on NatureMaps (→ Soils)
- Read the metadata for this layer
- Read more about soil attribute mapping
- Contact Mapland

Download from Enviro Data SA:

- Statewide map and spatial dataset
- Assessing Agricultural Lands (Maschmedt 2002)
- Soils of Southern SA book Part 1 and Part 2

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