Coorong Dryland Salinity Description and Impacts

This section is adapted from;
Natural Resources of the Tatiara – A plan for action. 2013-2018
Recharge Reduction – Reaping the Rewards. March 1997
Coorong District Local Action Plan – Sustainability, Agriculture, Environment. 2012
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Coorong Tatiara Local Action Plan - Coorong & Tatiara District Councils

Dryland Salinity and the Coorong Landscape

A huge amount of salt is stored in the subsurface soils underlying parts of the Coorong. Historically this salt was accumulated when the area was originally covered with seawater. In the Mallee highland zone the salt is held at depth while on the Coastal plains it is much closer to the surface.

A dryland salinity problem emerges when a rising watertable mobilises salts and carries them upwards close to the ground surface where they are further concentrated by evaporation.

The topography of the region formed by the ancient coastlines has resulted in a landscape of salty flats and range country. Where the summer – autumn watertable is within two metres of the soil surface the effects of dryland salinity are likely to be most severe. Groundwater is drawn up through the soil profile by capillary action, eventually evaporating as it reaches the surface, leaving the salts at or near the topsoil root zone.

Natural expressions of this can be seen at Waltowa Wetlands, Elephant Lake, and the extension of Blink Creek extending inland from Lake Alexandrina though to Cooke Plains.

Historically, the higher elevation areas of the Coorong District have been somewhat immune to the water balance and salinity issues affecting the lower lying areas of the district.

The section above is adapted from 'Natural Resources of the Tatiara – A plan for action. 2013-2018'.

Recharge and Discharge Defined

Recharge – is the unused rainfall that percolates down past the root zone of plants and eventually reaches the water table.

Originally the deep rooted native vegetation cover kept the watertables at depth by providing a balance between rainfall recharge and evapotranspiration. However with clearance of scrublands and their replacement with shallow rooted annual crops and pastures, this balance was disrupted and more rainfall reached the watertable causing a general rise bringing the dissolved salts closer to the surface. The widespread sowing of lucerne when the land was first cleared assisted in keeping watertables in check, however the pasture aphid invasions of the late 1970's and the dramatic loss of susceptible lucerne stands at that time led to a general watertable rise and a rapid spread of dryland salinity in adjacent low lying areas.

Over the 2000's the spread of dryland salinity appeared to stabilise. However from around 2015 onward increases in the area of affected as covered in Sections 2 and 3 have occurred.

Low lying areas where the groundwater is removed by evaporation are known as **discharge** areas. These can be associated with very high levels of soil salinity.

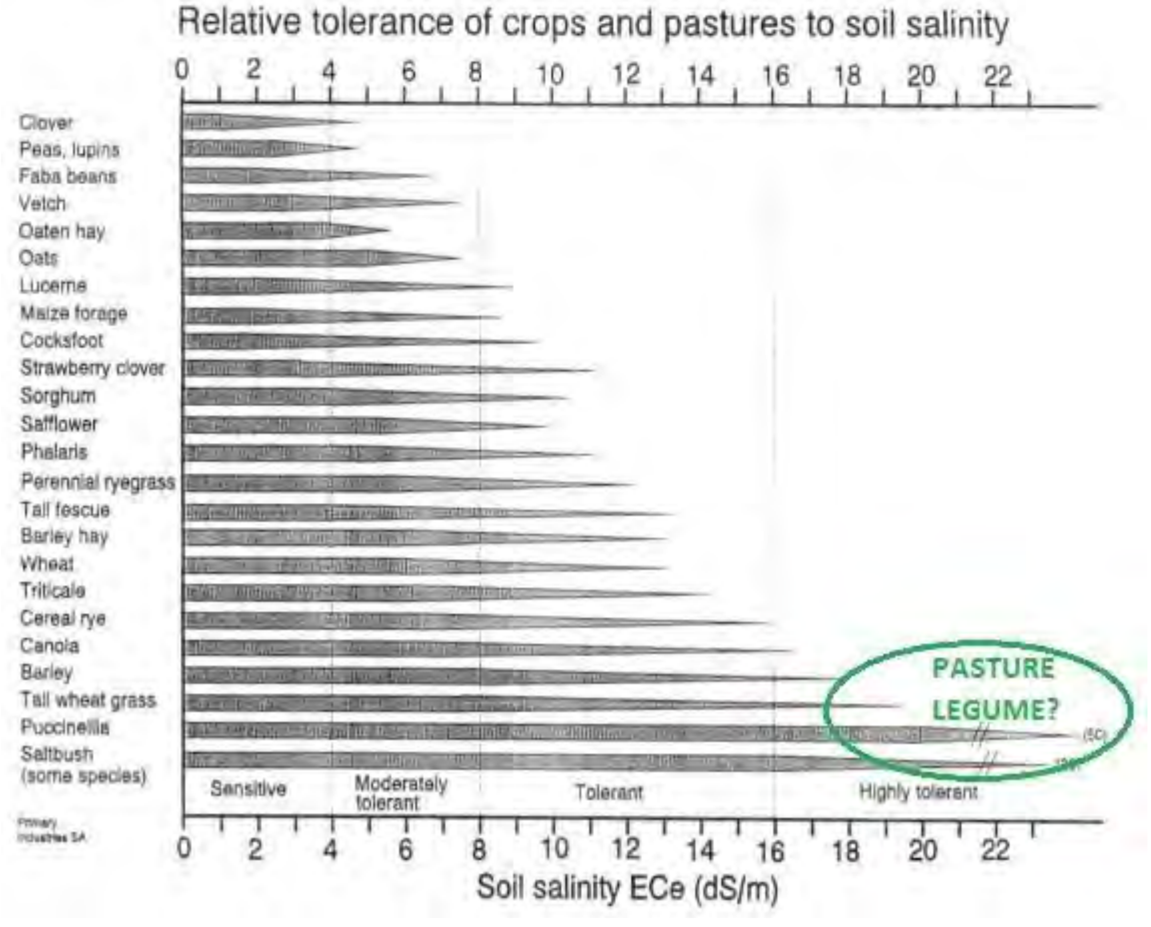
As the water table rises, dissolved salts from the soil are carried with it. When the water table rises to within one or two metres of the soil surface, evaporation and use of the water by plants removes the groundwater but leaves the salt behind, which raises the salinity of the remaining groundwater.

In low lying areas where the water table is close to the soil surface, the salt is concentrated at the surface, resulting in dryland salinity which causes; the death of plants that are not salt tolerant, adversely affect soil structure, and reduce the quality of water supplies.

Agriculture & Enterprise Mix Impact

The impact of dryland salinity and agriculture and farm business can include;

- The range of production possible on saline areas is significantly reduced. See Figure 5 below,
- Potential reduction in property values,
- More rapid deterioration of farm improvements such as sheds, fences, roads, vehicles and equipment due to operating in a wet and salty environment,
- Potential drop in farm equity, affecting the ability of farm businesses to access finance,
- The need to restrict livestock access to wet saline areas seasonally,
- Salinisation of farm water supplies sourced from the unconfined aquifer, leading to increased reliance on SA Water mains and an increased cost to the farm business,
- Increased pressure on non saline land. In an attempt to offset the losses from salt affected area, non salinised land may be put under increased pressure,
- Aesthetic impact.



Relative tolerance of crops and pastures to soil salinity. *Source: PIRSA Fact Sheet – Tim Herrmann.*

Where discharge are not hyper saline these areas can be appropriate for a range of salt tolerant pastures. Where successful and well managed this can provide good quality feed for sheep and cattle.

Bare salinised land can be at risk of wind erosion. Establishment of ground cover is a high priority to both prevent erosion, but also to reduce the evapo-concentration of salts at the soil surface.

The reduction in ground cover, and health of crops and pastures growing in these low lying areas can further compound the cycle of reduced plant water use, and increased recharge to groundwater.

Salinity affected paddock Cooke Plains

Environmental Impact

Increases in the level of the saline unconfined aquifer also has environmental impacts, on low lying native vegetation, mature trees, and wetlands. Groundwater dependant wetlands can also be adversely affected by higher salinity levels.

Impacts include;
- Decline in native vegetation and mature trees,
- Loss of nesting sites and decline in bird populations,
- Loss of food sources for wildlife populations,
- Increased soil and wind erosion,
- Loss of wetland habitat,
- Loss of aesthetic value,
- Reduced species diversity.
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The reduction in the health of native vegetation in these low lying areas can further compound the cycle of reduced plant water use, and increased recharge to groundwater.

Dryland Salinity affected native vegetation

Impact on the Built Environment

Some township areas in the Coorong District are located in low lying areas.

Where groundwater levels beneath the soil surface the built environment dryland salinity can impact on;
- Structural damage to houses, sheds, and other buildings,
- Reduced life of water pipes and electrical equipment,
- Decline of quality in unconfined groundwater bores for use on sporting grounds, gardens and domestic uses,
- Damage to pumping and water reticulation equipment,
- Roads, footpaths, pipelines, culverts, septic systems, underground communication cables, and the footings of powerlines and electrical transmission towers

Salinity affected road and building foundation. Photo credit: NSW Government
Repairs as a result of rising salt damp at Tintinara CWA Building

Social Impact

The main social impacts occur at the farm and local community level. Reduced farm incomes, potentially decreased land values, have a direct flow on impact to the local economy.

Property sizes are likely to increase, leading to flow population decreases impacting local business, schools, volunteer dependant services like CFS and Ambulance, and sporting clubs.

Dryland salinity has a real social impact;

- The stress caused by the expansion and production impact of dryland salinity to land owners and farm businesses,
- Social impact on rural communities due to reduced economic activity,
- Reduction in tourism and recreational activities due to the unattractive damage caused by salt as well as a reduced capacity of resources to support aesthetic, tourism, and recreational based activities.

Dryland Salinity and Climate Variability

Both dryland salinity and climate change have the potential to reduce the agricultural production options available where they have an impact. The reduction in the production options increases business vulnerability in response to commodity market fluctuations and seasonal variability.

The relationship between dryland salinity and climate variability also needs to be considered as an additional risk factor looking forward in the Coorong District.

Climate Variability in the Coorong

There is empirical evidence that the climate within the Coorong District is not the same as it was fifty or more years ago. Analysis of local rainfall data suggests that annual rainfall has been steadily decreasing since the 1950s, resulting in annual rainfall of up to 60mm less than they were in the earlier part of the 20th century. These trends are supported by long-term, high quality data from the Bureau of Meteorology.

Looking at local daily data, the autumnal break appears to be arriving later and with less regularity. The spring months appear drier and the total number of months without rain appears to be increasing.

There is limited long-term temperature data for the Coorong District, however long term (50-120 year) temperature data from Robe, Nhill, Lameroo and Murray Bridge suggest that there has be an increase in extremely hot days (>40° C), a decrease in frost events and an increase in average night-time temperatures. This is supported by shorter term (20-50 yr) temperature data from the Coorong District.

A range of government agencies (CSIRO, Australian Bureau of Meteorology, South Australian Research & Development Institute) have looked at these long term trends in climate. The tables below show the results of their more sophisticated extrapolation of climate data, done for four other towns within or near the Coorong District.

Projected changes from current (<2000) conditions by 2030 (CSIRO, 2009)

Town	Temperature increase (°C)	Rainfall reduction (%)	Rainfall reduction (mm)	Evaporation increase (mm)
Lameroo	0.74 – 0.98	2.1 – 12.6	8 - 49	33.2 – 48.6
Tailem Bend	0.72 – 0.91	2.5 – 12.0	12 - 56	32.9 – 47.6
Meningie	0.69 – 0.86	2.7 – 11.5	10 - 43	39.4 – 50.8

Number of days likely to experience high or low temperatures (CSIRO, 2009)

Site	Minimum below 0°C			Maximum above 35°C			Maximum above 40°C		
	Present	2030	2070	Present	2030	2070	Present	2030	2070
Tailem Bend	3	1-2	0-1	25	25-31	28-55	5	5-9	7-22
Keith	4	1-3	0-2	23	24-30	26-53	4	5-7	6-19

Reference: Coorong District Local Action Plan – Sustainability, Agriculture, Environment. 2012

The relationship between dryland salinity and climate

As discussed further in Sections 5 – 9 groundwater and dryland salinity trends are influenced by climatic and seasonal factors in the following ways;

- Intense rainfall events can cause a spike in levels of recharge,
- Intense rainfall events can cause a spike in groundwater levels,
- Evapotranspiration causes 'wicking up' from the shallow saline groundwater leaving the salt behind,
- Long hot and dry conditions further concentrate salt at the soils surface,
- Rainfall is essential at the start of the growing season to ensure salts are flushed from the top soil to allow seedlings to successfully establish.

Long dry periods such as the millennium drought, 2015-16 drought, and 2018-19 drought would have significantly impaired the health, vigour, density and water use potential of perennial pastures on both saline and non saline land. In particular the summer active perennial pasture base that prevails in this region of dryland lucerne, perennial veldt grass and primrose. When rainfall did return after these dry periods, these pastures would have not been in optimum condition to 'use the rain where it fell', and hence reduce recharge to groundwater.

In the Watertable Trends and Graphs link, it is shown that the watertable rose by up to 1 m following high rainfall episodic events in 2010/11, 2013 and 2016.

Saltland areas could still expand into the future, due to increased evapotranspiration causing 'wicking up' from the shallow saline groundwater leaving the salt behind, and lower rainfall leading to less leaching of salts down through the soil profile.

Improved awareness of the interactions between climatic variations and groundwater trends could inform farm management decisions that respond to episodic rainfall events.