# Living with
# saline land

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In many of Australia's salt-affected regions there will be extensive areas where salinisation processes cannot be reversed. Revegetation with salt-tolerant species, for functional, aesthetic and productive purposes, will be a key component of management plans for saline discharge zones in these areas.

The species best adapted to saline environments are called halophytes. These are highly effective at avoiding salt uptake, and at dealing with salt accumulation in the leaves. Small amounts of sodium and chloride ions actually seem to stimulate their growth.

Old man saltbush (*Atriplex nummularia*) is a halophyte favoured by many farmers as a source of fodder on saline discharge areas. But saltbush is unlikely to help lower watertables because it drinks relatively slowly (1 mm/day) from only the top 20-30 cm of the soil profile. Also, it is vulnerable to waterlogging, a common characteristic of discharge zones.

Most other plant species being considered for saltland agronomy are non-halophytes. Their growth is reduced significantly at relatively low salt concentrations. Although they can limit salt uptake to some extent, death eventually occurs due to progressive ion accumulation, particularly in the low-oxygen environment of waterlogged soils.

Among the non-halophytes, however, there are some species adapted to moderately saline environments. A number of these were studied during research led by CSIRO Land and Water in South Australia's Upper South East, a region stretching from the Coorong to the towns of Keith and Naracoorte.

The Upper South East is dominated by remnant sand dunes and interdunal flats underlain by shallow saline groundwater. Some 250 000 ha of the 680 000 ha region is salt affected and 175 000 is at risk of salinisation. Amid the largely pastoral landscape is 100 000 ha of state parks, heritage areas, and wetlands of international significance.

A series of CSIRO studies between 1992 and 1995 gathered information to help the region meet various land management objectives. For example, the success of drainage and revegetation strategies relies on understanding how wetland vegetation copes with saline and waterlogged conditions, and its influence on watertable levels and salt build-up. And sustainability on the interdunal flats depends on agricultural vegetation coping with salinity and waterlogging.

The most common type of ephemeral wetland vegetation is the swamp paperbark, a tree well adapted to occasional inundation, waterlogging and salinity.

As salt accumulates near the soil surface in summer, the surface roots of the paperbark die so that water is extracted only from below the saline zone. In winter, rainfall recharges the groundwater, leaching salt from the soil profile and causing the moderately saline groundwater to rise to the soil surface. This flushing of the soil is vital to the trees' survival.

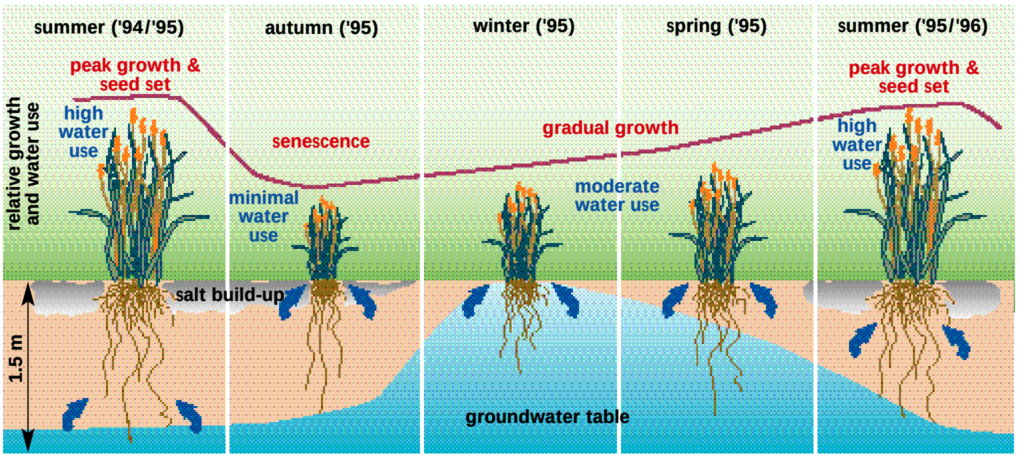
In response to the waterlogging, the roots die back to near the surface. Subsequent evapotranspiration then causes the watertable to drop quickly and the roots again grow.

**The success of salinity management strategies in the Upper South East relies on understanding relationships between wetland vegetation and saline watertables, and on the ability of agricultural plants to cope with salinity and waterlogging.**

In periods when salt accumulates in the root zone between the capillary fringe and the soil surface, the tree drops its leaf water potential, a mechanism which increases its ability to extract water from the soil. The same mechanism is used by plants to 'squeeze' water from a dry soil profile.

Other salt-tolerant plants studied in the Upper South East were tall wheatgrass and puccinellia, pasture species offering perhaps the most profitable option for grazing in the region. Puccinellia was able to grow over groundwater of most salinities, as long as rainfall and surface flows were sufficient to flush the surface soils. Tall wheatgrass also varied its growth in response to salt accumulation and water availability (see diagram).

The field research concluded that although revegetation could provide some benefits for water balance control, it would need to be combined with drainage to have maximum benefits. The implementation of drainage works in the region is likely to depend on the success of cost-sharing arrangements.




**Growth, reproduction, root structure and water use of tall wheatgrass adjusts according to seasonal fluctuations in salt and groundwater levels. During summer, when water is usually unavailable in the surface soils due to salt accumulation, deeper roots provide access to groundwater. Growth rates fall during autumn, then rise in late winter and spring in response to rehydration of the soil zone.**