

Salinity

CSIRO Land and Water



Australia's rivers and landscapes are under threat to rising salinity. Salinity affects regions in all parts of Australia but particularly Western Australia, South Australia and in the Murray-Darling Basin. With rising salinity, we face the loss of both aquatic and terrestrial biodiversity. On the rural front, salinity affects some of Australia's most productive land.

What is salinity?

To most people, the word salinity refers to the situation when the quantity or availability of salts in the landscape causes problems with soil and water quality, agriculture, the built and natural environment, and biodiversity.

The salt is mainly sodium chloride (NaCl) or common table salt.

There are two kinds of soil salinity: irrigated land salinity and dryland salinity.

Dryland salinity is the movement of salt to the land surface with groundwater, occurring on land that is not used for irrigation, and it causes the most widespread damage. The amount of salt in Australia is not increasing but is being brought towards the surface: before European settlement and extensive farming this salt was stored safely in the earth below the depth of plant roots.



How bad is the problem?

Salinity in soil, groundwater and river systems is now a serious problem in many parts of Australia, and the problem is increasing. Terms such as 'the white plague' and 'the salt bomb', which you might read in newspapers and magazines or hear on the news, indicate the gravity of problems associated with salinity in Australia.

Since there is often a time lag effect between the cause of a salinity outbreak and the actual effects, it is difficult to know exactly how much of Australia is affected by salinity. There are enormous, ancient stores of salts that

are released from weathering rocks, or were carried in from surrounding oceans in rainfall, and trapped in the landscape long ago. It is these deposits of stored salt that feed the majority of salinity problems.

These salt stores are distributed widely across the semi-arid and arid parts of Australia, stretching in a huge arc from the north Tropics, down south adjacent to the Great Dividing Range, broadening and sweeping across the Murray-Darling Basin to take in the Riverina and Mallee regions of New South Wales, Victoria and South Australia.

In Western Australia, salt is stored in a large arc sweeping south and east along the semi-arid and arid landscapes of the southern part of the state.

Although northern Australia has far less dryland salinity than temperate (southern) Australia, it could become a problem in catchments with high salt stores if the water balance changes and cause the groundwater to rise.

What causes salinity?

Two broad forms of salinity are primary and secondary salinity. Primary salinity is part of the Australian landscape and reflects the development of this landscape over time. Secondary salinity is the salinisation of land and water resources due to land use impacts by people.

Australia as a country is geologically old and stable, with vast reserves of stored salt beneath the land surface. Our climate is drier than many other countries: meaning that it has low rainfall compared to potential evaporation.

Australian native vegetation grows well in this harsh climate because it is perfectly adapted to the conditions. Much of our vegetation is perennial, with a deep root system that takes full advantage of any available water.

Because of this, very little water is left to escape to the deeper soil below the roots, and this water has all the remaining salts concentrated in it. Also, because the country is relatively flat, thanks to its great geological age, there is very little run-off to flush salt from the landscape back out to sea.

Over thousands of years the salts in this very small leakage has gradually built up so that there are now very large amounts stored deep in the soil.

Since European settlement, however, the landscape has changed dramatically in a very short time due to the clearing of native vegetation for grazing, cropping and other agriculture. These land use practices have substantially increased the amount of water leaking into the groundwater beneath the root system. Since there is more water going into the ground than is being removed, the watertable is rising to the surface.

Where the groundwater contains salt or intercepts the vast stores of ancient salt in the landscape, this salt seeps to the surface of the land, and into the rivers and streams. Different factors such as climate, soil permeability and vegetation affect the rate at which this problem occurs.



What does salinity do to our water and land?

When salinity has affected a landscape, warning signs appear. These include sick or dying trees and declining vegetation, the colonisation by salt-tolerant weed-like plants such as sea barley grass and spiny rush, salty bare patches where all of the vegetation has died, and saline pools in creek beds.



As salinity impacts on any remaining native vegetation and the wildlife that depends on it for survival, the loss of biodiversity escalates.

Salinity also reduces the productivity of crops and the sustainability of agriculture. It affects the health of our rivers and streams, in extreme cases the water may be too salty for animals and humans to drink.

Where there are buildings, fences, roads and other infrastructure, they can be damaged by saline soil and water. Foundations can crumble, and roads degrade, increasing the risks of accidents and causing large repair bills.

Salinity and its related problems have the potential to affect all Australians, whether they live in the country or in the city. Many people feel that salinity is the most serious environmental threat that Australia faces.

What can be done to stop the problems?

Since salinity is a problem that affects us all, we all have a part to play in coping with it!

There are a number of organisations in Australia that are dedicated to researching the causes of salinity, tracking the growth of the problem in Australia, and seeking solutions and ways to live with the problem.

Commonwealth, state and local governments, industry, farmers, land managers and community groups are all involved in the fight against salinity. In November 2000, a National Action Plan for Salinity and Water Quality was endorsed by the Prime Minister, Premiers and Chief Ministers at the Council of Australian Governments.

In June 2008, this program was replaced by the *Caring for Our Country* program. The *Caring for Our Country* program aims to integrate delivery of the Commonwealth's previous natural resource management programs, the Natural Heritage Trust, the National Action Plan for Salinity and Water Quality, the National Landcare program, the Environmental Stewardship program and the Working on Country indigenous land and environmental program.

Unfortunately, there is no simple single solution to salinity. Because of the large geological scale in which the problem exists, there is a significant time lag between the cause of salinity in a landscape, and the ongoing effects. This means that, even if we make dramatic changes right now, we will still have to live with salinity for many years to come. This is where we can all make a difference: by understanding the salinity problem and by accepting the changes that every Australian will have to make, we can assist water and land managers in coping with the problem.

Any solutions that we do put into place will have to balance a number of considerations including sustainability, economic viability, protection of biodiversity and the environment, and social, cultural and community concerns.

The most effective methods of dealing with salinity are likely to be a combination of different land uses which are suited to the local conditions. Possible solutions include:

- Development of commercial tree production systems and/or novel tree species for large areas of our current crop and pasture zones - these include trees for fruit, nuts, oils, medicines, bush foods, specialty timbers, charcoal and energy.
- Farming systems that combine the best current annual and perennial plants, the best agronomy, companion plantings, rotations and combinations.
- New types of cereals, pulses, oilseeds and forages specially bred to reduce deep drainage and nitrogen leakage.
- Ways to pinpoint the best locations for tree crops, other perennial plants and high-value annuals to meet targets for water quantity and quality.
- New tools to help land managers monitor leakage past the root zone and change their land use.
- Engineering solutions such as deep open drains, subsurface drains, siphons, windmill and solar pumping in areas that are already salinised.
- Integration of plant based and engineering solution in areas where one solution alone is insufficient.



More information

Salinity research and possible solutions:

- A Revolution in Land Use: Emerging Land Use Systems for Managing Dryland Salinity
www.clw.csiro.au/publications/general2003/revolution/
- Effectiveness of Current Farming Systems in the Control of Dryland Salinity
www.clw.csiro.au/publications/general2002/effectiveness/
- Heartlands Fact Sheet No 3: Assessing and Managing Dryland Salinity
www.clw.csiro.au/heartlands/publications/factsheets/Heartlands_FS3_Assessing_and_Managing_Dryland_Salinity.pdf
- CSIRO Land and Water research publications
www.clw.csiro.au/publications/
- Key issues in land and water management
www.clw.csiro.au/issues/



Related issues:

- Caring for Our Country program
www.nrm.gov.au/
- National Action Plan for Salinity and Water Quality
www.napswq.gov.au/
- Material for students and teachers
www.clw.csiro.au/education/
- Images from SciencelImage
www.scienceimage.csiro.au/

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