Home

Full report

Natural Heritage Trust

Helping Communities
Helping Australia

DRYLAND SALINITY IN AUSTRALIA

A summary of the National Land and Water Resources Audit's Australian Dryland Salinity Assessment 2000

Extent, impacts, processes and management options

www.nlwra.gov.au/atlas

Home

Full report

NATIONAL LAND AND WATER RESOURCES AUDIT

Assessing the condition and capacity of Australia's natural resources

The National Land and Water Resources Audit (Audit) is conducting the first Australia-wide assessments of:

- water availability and quality
- dryland salinity
- vegetation
- rangelands
- agricultural productivity and sustainability
- capacity for change
- catchments, rivers and estuaries
- diversity of species and ecosystems

It is the first time that the Commonwealth, States and Territories have collaborated on such a broad program.

Australian Dryland Salinity Assessment 2000 is a wake-up call to land managers. It focuses on:

- why dryland salinity is emerging now
- impacts of dryland salinity
- how much dryland salinity exists in each State and Territory
- the risk and impacts of dryland salinity in 50 years time
- dryland salinity management options

Dryland salinity has taken a long time to develop. Solutions will be neither quick nor simple. Australian Dryland Salinity Assessment 2000 is providing information that defines dryland salinity and helps to identify possible solutions.

PROVIDING ACCESS TO INFORMATION

Australian Natural Resources Atlas

The Australian Natural Resources Atlas (Atlas) is an internet-based 'one-stop-shop' for information on Australia's natural resources. The Atlas provides summary data and information at national, State and regional scales and the full Australian Dryland Salinity Assessment 2000 report.

www.nlwra.gov.au/atlas

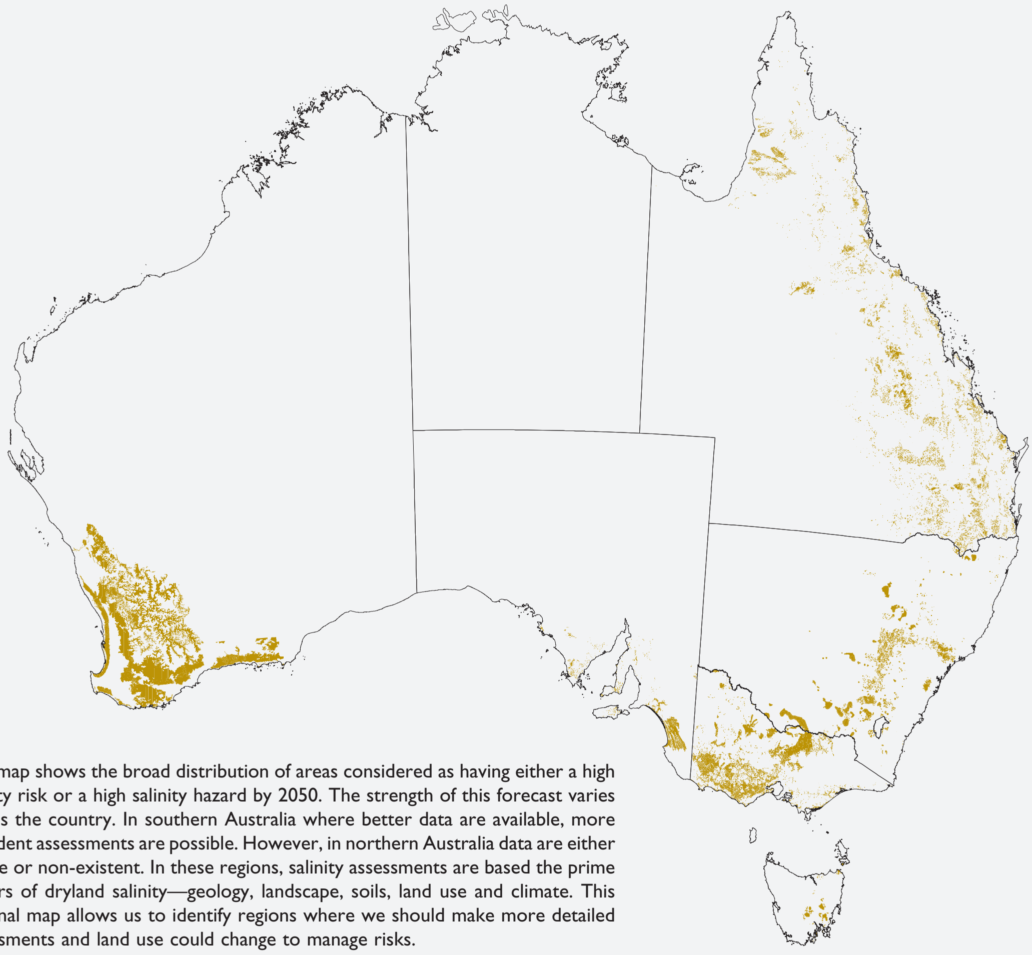
Home

Full report

DRYLAND SALINITY – A NATIONAL PROBLEM

The Audit estimates that nearly 5.7 million hectares are considered at risk or affected by dryland salinity—a figure that could triple to 17 million hectares in 50 years time. To address dryland salinity and its impacts, means first understanding how much dryland salinity we have and where it occurs.

Figure 1. Forecasted areas containing land of high hazard or risk of dryland salinity in 2050.



This map shows the broad distribution of areas considered as having either a high salinity risk or a high salinity hazard by 2050. The strength of this forecast varies across the country. In southern Australia where better data are available, more confident assessments are possible. However, in northern Australia data are either sparse or non-existent. In these regions, salinity assessments are based the prime drivers of dryland salinity—geology, landscape, soils, land use and climate. This national map allows us to identify regions where we should make more detailed assessments and land use could change to manage risks.

Most non-agricultural areas in Western Australia, South Australia and western New South Wales were considered at very low risk of salinity and were therefore not assessed.

Home

Full report

Salinity: caused by a change in water balance

WHAT CAUSES DRYLAND SALINITY?

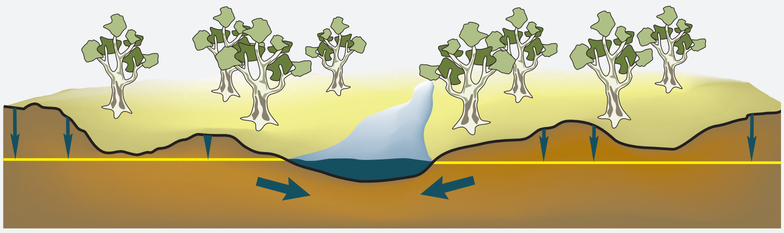
***Primary** salinity: caused by naturally occurring salt deposits*

***Secondary** salinity: caused by activities of people and a change in the water balance*

Australia is a naturally salty continent with limited capacity to drain salt and water. Some salt is released from weathering rocks (particularly those formed from marine sediments), but most is carried by rain from the surrounding oceans and deposited on the soil and in the water.

Before clearing

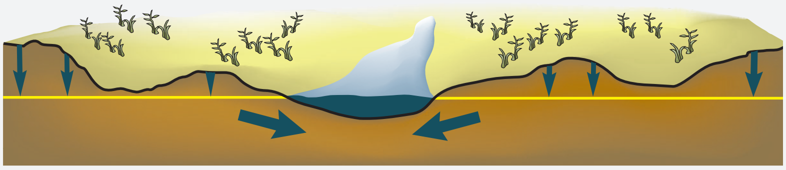
Perennial native vegetation



Australia's natural salinity has been exacerbated by changes in land use since European settlement. We have cleared the native vegetation and replaced it with crops and pastures that have shallower roots and different seasonal growth patterns.

Shortly after clearing

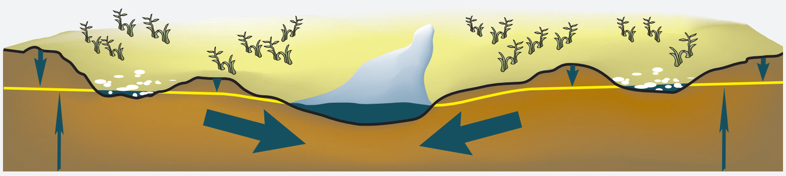
Annual crops and pastures



These plants use less water allowing more water to 'leak' from beneath the root zone into the groundwater. This extra groundwater makes the watertable rise bringing dissolved salts to the surface to contaminate the land and surface water.

Later …

Dryland salinity develops in low-lying areas



In some cases this results in white salt scars on the soil surface, particularly in low-lying areas such as rivers, streams and wetlands.

Australian Dryland Salinity Assessment 2000 assessed secondary salinity.

IMPACTS OF DRYLAND SALINITY

Dryland salinity is most widespread in agricultural areas where it dramatically reduces farm production. But it also affects other parts of the catchment: damaging infrastructure—buildings, roads, bridges and sewerage lines—and reducing the diversity of our native plants and animals. Dryland salinity is linked to other degradation issues such as soil erosion, eutrophication of streams and loss of riparian zone vegetation.

Agriculture

Dryland salinity reduces yields and retards growth of broadacre cereal crops and traditional pastures.

In Victoria, the half a million hectares of cropping and pasture land at risk of dryland salinity could increase to nearly three million hectares by 2050.

Water resources

Dryland salinity increases the amount of salt in rivers affecting water supplies for drinking and irrigation and having serious economic, social and environmental consequences for rural and urban communities

Many surface water resources in Western Australia are already too saline for domestic use and further deterioration will challenge future supplies.

Infrastructure

Salt destroys bitumen and concrete.

In south-west New South Wales about 34% of State roads and 21% of national highways are affected by dryland salinity.

Biodiversity

Dryland salinity destroys habitats, particularly around rivers and streams.

At least 1500 plant species will suffer from dryland salinity in Western Australia alone, with 450 of these subject to extinction.

Table 1. Australian agricultural, water, infrastructure and biodiversity assets at high risk from shallow watertables or with a high salinity hazard now and in 20 and 50 years time.

Asset	2000	2020	2050
Agricultural land (ha)	4 650 000	6 371 000	13 660 000
Remnant and planted perennial vegetation (ha)	631 000	777 000	2 020 000
Length of streams and lake perimeter (km)	11 800	20 000	41 300
Rail (km)	1 600	2 060	5 100
Roads (km)	19 900	26 600	67 400
Towns (number)	68	125	219
Important wetlands (number)	80	81	130

Data in this table is derived from the best available data supplied by State and Territory agencies.

Monitoring: an essential part of dryland salinity control

SALINITY ACROSS AUSTRALIA

One of the biggest issues facing land managers is lack of data. This assessment provides regional information about the extent, impacts and causes of dryland salinity. It also highlights the need for monitoring to help decision makers on the ground. At the policy level, the States and Commonwealth government have used this assessment to contribute to their respective salinity strategies. It underpins the implementation of the National Action Plan for Salinity and Water Quality.

There is a potential for dryland salinity across Australia. But the extent and impact vary from region to region.

Table 2. State areas at high risk from shallow watertables or with a high salinity hazard.

State*	1998/2000	2050
New South Wales	181 000	1 300 000
Victoria	670 000	3 110 000
Queensland	not assessed	3 100 000
South Australia	390 000	600 000
Western Australia	4 363 000	8 800 000
Tasmania	54 000	90 000
Total	**5 658 000**	**17 000 000**

* The Northern Territory and the Australian Capital Territory were not included in this assessment since dryland salinity issues were considered to be very minor in these areas.

This table is based on the best available data provided by States and Territories.

New South Wales

More than 90% of the dryland salinity in New South Wales occurs in five catchments—the Murray, Murrumbidgee, Lachlan, Macquarie and Hunter rivers.

Key issues

- Developing acceptable and achievable environmental performance targets for major catchments contributing to dryland salinity.
- Developing economically viable and socially acceptable management options.

Victoria

Between 8% and 18% of Victoria's agricultural land is predicted to be at high salinity risk, with as much as 47% at moderate risk.

Key issues

- Managing stream salinity in the Murray–Darling Basin because of potential impacts on irrigation, urban and industrial use and aquatic ecosystems.
- improving data and information for use by catchment management authorities

Tasmania

Most land at risk of dryland salinity in Tasmania is in the agricultural midlands and north.

Key issues

- Understanding (at the technical level) the hydrogeological processes that drive dryland salinity in Tasmania.
- Collecting data and information to assess the extent and range of impacts from dryland salinity.
- Dryland salinity has most impact on diversification from marginal enterprises into intensive irrigated cropping.

Waterlogging: an early sign of dryland salinity

SALINITY ACROSS AUSTRALIA

Western Australia

Western Australia has the largest area at risk of dryland salinity in Australia, now and over the next 50 years.

In the south-west region 16% of land has a high potential of developing salinity from shallow watertables—predicted to rise to 33% by 2050.

Key issues

- Determining impact of different management strategies on changes in groundwater levels at a catchment scale.
- Managing groundwater to protect rural towns and key biodiversity assets.

Northern Australia: prevention is better than cure

Dryland salinity is extremely difficult to slow, halt or reverse. Wise management now will prove more cost-effective than attempts to solve dryland salinity after it has begun.

- Northern Australia has far less dryland salinity than temperate Australia. However dryland salinity could become a problem for many catchments with high salt stores if water balance changes lead to groundwater rises. In Queensland an estimated 3.1 million hectares is considered to have a high hazard, and more rigorous assessments of the risks under current land uses are a priority.
- Northern Australia presents an opportunity to avoid the dryland salinity problems of temperate Australia. We need to recognise that broad-scale clearing in areas with significant salt stores lead to changes in water balance.

Queensland

The relatively small area of dryland salinity in Queensland is in the eastern part of the State. However, there is much greater potential for dryland salinity to develop elsewhere in the State.

Key issues

- Using preventive and protective action to maintain groundwater levels in areas where salt stores would be mobilised following clearing of native vegetation.
- Developing and implementing farming systems that minimise changes to groundwater levels.
- Improving groundwater monitoring for assessing dryland salinity and its impacts.

Northern Territory

Dryland salinity hazard for the Northern Territory is relatively low.

The greatest potential for dryland salinity is in isolated patches in inland semi-arid areas (particularly on the Sturt Plateau). Other susceptible areas are scattered mainly across the northern part of the Territory.

South Australia

Dryland salinity affects land and wetlands mainly in the upper south-east part of South Australia. This area is predicted to increase by 60% in 50 years under current land use and groundwater trends.

Key issues

- Managing salt exports from the Mallee region to the Murray River.
- Securing good quality water supplies.

Home

Full report

Local groundwater flow systems
(Kamarooka, Victoria)

UNDERSTANDING GROUNDWATER ...

Dryland salinity results from rising groundwater.

Not all groundwater is the same; some moves slowly over many centuries, some moves quickly in the matter of years. To better understand and describe these processes, Australia's groundwater has been classified into three main types of *groundwater flow system*. These have been mapped (see Figure 2).

Local groundwater flow systems

- low water storage capacity and permeability
- rapid response to increased intake of groundwater

In these systems the watertables rise rapidly and dryland salinity occurs within 30 to 50 years. These systems can respond quickly to salinity management and action can be taken at a farm scale.

Intermediate groundwater flow systems

- moderate water storage capacity and permeability
- slower response to increased intake of groundwater; take longer to 'fill' than local groundwater flow systems

Dryland salinity typically occurs in these systems within 50 to 100 years of clearing of native vegetation. The slower responsiveness of these groundwater flow systems present greater challenges in managing dryland salinity.

Regional groundwater flow systems

- high storage capacity and permeability
- very slow response to increased intake of groundwater

Regional groundwater flow systems take many years (100 to 1000) to fully develop dryland salinity. They occur on a vast scale, so farm-based catchment management options alone are unlikely to re-establish an acceptable water balance. Widespread community action and major land use change are needed to sufficiently alter the water balance.

Intermediate groundwater flow systems
(Wanilla, South Australia)

Home

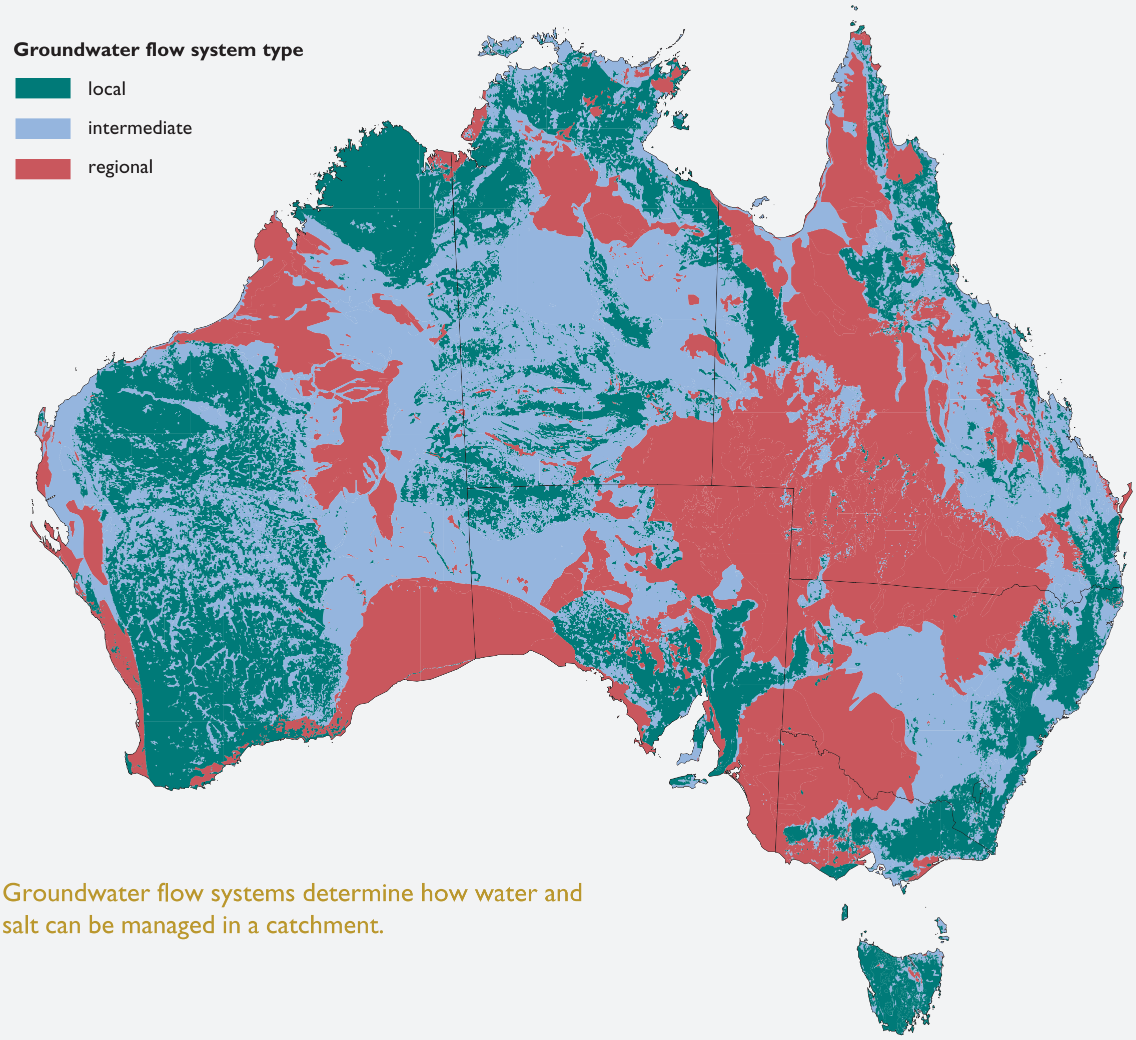
Full report

Home
Full report

Intermediate and local groundwater flow systems
(Upper Billabong Creek, New South Wales:)

… THE KEY TO TACKLING SALINITY

Figure 2. Distribution of local, intermediate and regional groundwater flow systems across Australia.



Groundwater flow systems determine how water and salt can be managed in a catchment.

Regional groundwater flow systems
(Lake Warden, Western Australia)

Home
Full report

Planting trees can help to reduce groundwater recharge

MANAGING DRYLAND SALINITY INTO THE FUTURE

We face a threefold increase in dryland salinity over coming decades and we know that groundwater takes years to respond to landscape changes. Solving dryland salinity requires a long term commitment.

It is also unlikely that any one management option will work by itself since the groundwater flow systems behave differently. This assessment has shown that we need to:

- use a mix of preventive, land use, engineering and saline resource management techniques
- learn more about soil, salt, water and vegetation, and integrate this knowledge into information about groundwater flow systems
- protect assets—infrastructure, biodiversity, soils, water—that are at risk and set realistic and feasible targets for salinity management
- consider the whole system—including people and socioeconomic factors

Which are the best options?

We need to recognise that there is no quick fix. Salinity can be managed by prevention, treating the cause, ameliorating the symptoms or a combination of these.

We need to select management strategies that are cost-effective and easy to implement.

Prevention

- Maintain natural water balance processes where possible
- Design new farming and land use systems that manage the salt and water balance

Land use change

- High water-use cropping and pasture
- Revegetation with trees or agro-forestry

Engineering options

- Simple, on-paddock surface water management measures such as banks and drains
- Larger scale measures such as deep drains, sub-surface drains, pumps, interception and diversion systems

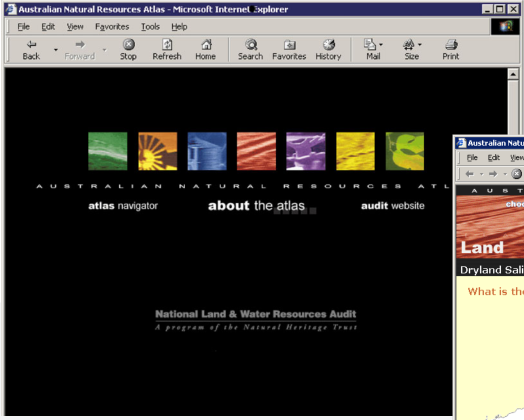
Engineering options are limited by the type of groundwater flow system.

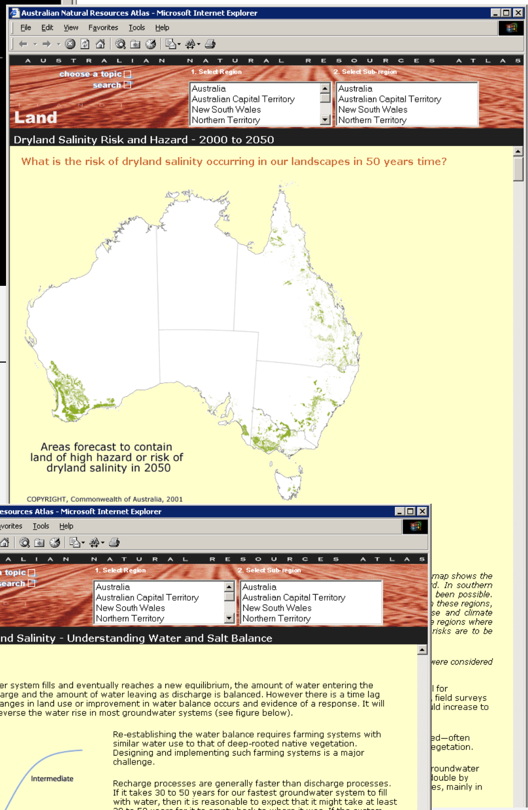
Living with and using salt

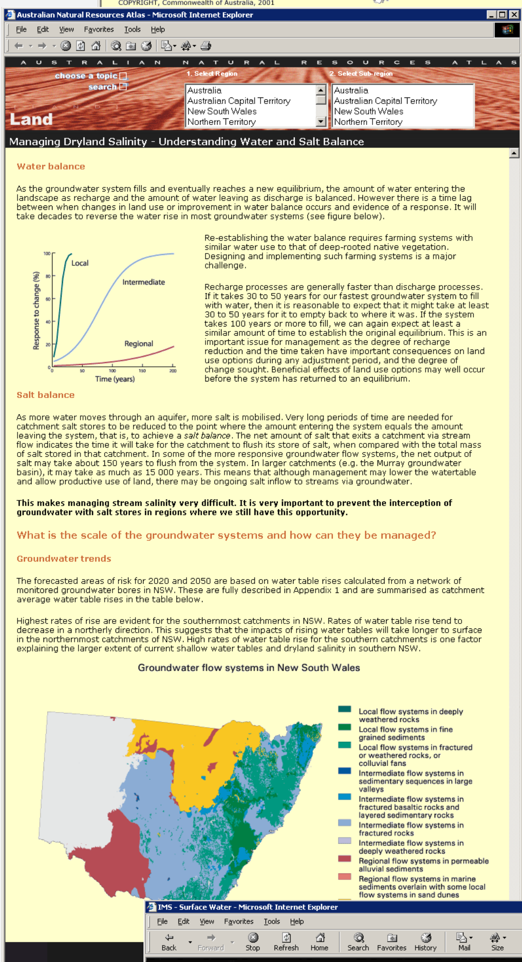
- Salt-tolerant plants for stock fodder, horticulture or agro-forestry
- Saline aquaculture
- Extraction of high grade salt

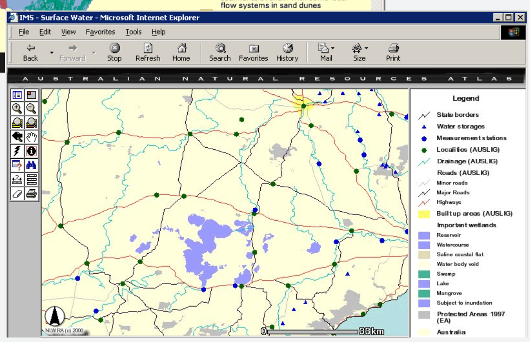
Using salt-affected land for agriculture is limited to discharge areas with reliable groundwater supplies. The demand for saltland production systems will become more widespread as the extent of salinity increases.

Community solutions will be needed for larger scale areas at risk









PROVIDING ACCESS TO INFORMATION

Access to information is fundamental to managing dryland salinity. This assessment forms part of the Australian Natural Resources Atlas (Atlas)—an internet-based 'one-stop-shop' for data, maps, information and links to related sites. The Atlas is organised by subject and geography.

Subjects include:

- coasts
- rangelands
- water
- land—includes dryland salinity
- people—Australians and the management of natural resources
- agriculture
- biodiversity

Dryland salinity topics are:

- risk and hazard
- impacts
- management
- monitoring
- groundwater flow systems
- catchment case studies

Information products are presented for the whole of Australia, by State and Territory and by sub-region.

Make your own on-line map

The dryland salinity assessment is linked to information collected as part of the other Audit assessments. These data can be combined to produce your own map.

www.nlwra.gov.au/atlas

IN PARTNERSHIP

Australian Dryland Salinity Assessment 2000 was prepared by the National Land and Water Resources Audit in partnership with:

National Dryland Salinity Program	www.ndsp.gov.au
New South Wales	
Department of Land and Water Conservation	www.dlwc.nsw.gov.au
Victoria	
Department of Natural Resources and Environment	www.nre.vic.gov.au
Queensland	
Department of Natural Resources	www.dnr.qld.gov.au
Western Australia	
Agriculture WA	www.agric.wa.gov.au
South Australia	
Primary Industries & Resources South Australia	www.pir.sa.gov.au
Tasmania	
Department of Primary Industries, Water and Environment	www.dpiwe.tas.gov.au
Northern Territory	
Department of Lands, Planning and Environment	www.lpe.nt.gov.au
Murray–Darling Basin Commission	www.mdbc.gov.au
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