
The Parliament of the Commonwealth of Australia

Science Overcoming Salinity:

Coordinating and extending the science to address the nation's salinity problem

House of Representatives
Standing Committee on Science and Innovation

May 2004
Canberra

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ISBN 0 642 78468 X

Cover photograph: Salt crystals build up on the remnants of tree trunks at Quairading, in Western Australia's Wheat Belt.

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Foreword

There is a public perception that salinity is overwhelmingly the result of poor agricultural practices over many decades. While some of those practices have clearly caused and/or added to the problem in some instances, the occurrence of salt in our landscape is both natural and historical. Captain Charles Sturt finding the Darling River too salty to drink in 1829 is a good demonstration.

The House of Representatives Standing Committee on Science and Innovation, in conducting this Inquiry, did not focus on the causes of salinity as such, other than to outline some of the history of salinity. The Committee's main goal was to determine whether the best and most up-to-date science was being applied to individual problems, and whether effective coordination was in place so that the science made it 'down to the ground'.

Governments at both the national and state level are and will continue to invest substantial amounts of money in addressing salinity throughout many parts of Australia. It is crucial for that investment not to be wasted. However, if there are not strong and easily followed links between the science and those working at the catchment or farm level, that investment may be ill directed.

In the report that follows, the Committee makes twenty-four recommendations designed to ensure the science base remains current and relevant and that processes give land managers confidence that their work will have maximum impact on salinity problems.

The Inquiry was greatly assisted by the quality of the submissions, the wonderful cooperation during inspections and the excellent witnesses. The input came from government, academe and the private sector and the Committee is grateful to everyone who contributed.

My thanks go to my colleagues on the Committee who participated with enthusiasm throughout the Inquiry. Thanks also go to the dedicated staff of the Secretariat for their diligence and support.

Gary Nairn MP
Chair



Membership of the Committee

Chair Mr Gary Nairn MP

Deputy Chair Ms Ann Corcoran MP

Members Mr Martyn Evans MP

 Mr John Forrest MP

 Ms Sharon Grierson MP

 Mr Michael Hatton MP

 Mr Peter Lindsay MP

 Mr Tony Smith MP

 Mr Ken Ticehurst MP

 Dr Mal Washer MP

Committee Secretariat

Secretary Ms Catherine Cornish

Inquiry Secretary Mr Jerome Brown

Research Officer Ms Zoë Smith

Administrative Officer Ms Suzy Domitrovic



Terms of reference

On 18 August 2003, the Minister for Science, the Hon Peter McGauran MP, asked the House of Representatives Standing Committee on Science and Innovation to inquire into and report on the Commonwealth's role in managing and coordinating the application of the best science in relation to Australia's salinity programs.

In conducting its inquiry, the Committee was asked to give particular consideration to the:

- a) use of the salinity science base and research data (including the development of new scientific, technical and engineering knowledge) in the management, coordination and implementation of salinity programs;
- b) linkages between those conducting research and those implementing salinity solutions, including the coordination and dissemination of research and data across jurisdictions and agencies, and to all relevant decision makers (including catchment management bodies and land holders); and
- c) adequacy of technical and scientific support in applying salinity management options.

List of abbreviations and glossary of terms¹

AAS

Australian Academy of Science

ABS

Australian Bureau of Statistics

Accreditation

A formal process for assessing the appropriateness of a strategy or plan for implementation

ACF

Australian Conservation Foundation

AEM

airborne electromagnetic (induction techniques for salinity mapping)

Agroforestry

A collective name for land-use systems in which woody perennials (trees,

1 The glossary has been compiled from the following sources: Murray-Darling Basin Commission, *Annual Report 2001 – 2002*, MDBC, Canberra, 2002, pp. 144-48; Murray-Darling Basin Commission, *Integrated Catchment Management in the Murray-Darling Basin 2001 – 2010*, MDB Ministerial Council, Canberra, 2001, pp. 26-29; Parliamentary Research Service, *Murray-Darling Basin: Ecologically Sustainable Irrigation?*, Research Paper No. 30 1994/95, Canberra, Department of the Parliamentary Library, 1995, pp. 3-4; Industry Commission, *A Full Repairing Lease*, IC, Report No. 60, Canberra, 1998, pp. xix-xx; M. Sexton, *Silent Flood: Australia's Salinity Crisis*, ABC Books, Sydney, 2003, pp. 195-8; F. Ghassemi et. al., *Salinisation of Land and Water Resources*, UNSW Press, Sydney, 1995, pp. 513-17; A. Young, 'The potential of agroforestry as a practical means of sustaining soil fertility', in R. T. Prinsley and M. J. Swift (eds), *Amelioration of soils by trees*, Commonwealth Science Council, London, 1986. ANZLIC – The Spatial Information Council, *Policy Statement on Spatial Data Management*, 1999, viewed 8 June 2004, <www.anzlic.org.au/publications.html>. Government program titles are italicised.

shrubs) are grown in association with herbaceous plants (crops, pastures) and/or livestock in a spatial arrangement, a rotation, or both, and in which there are ecological and economic interactions between the tree and the non-tree components of the system

Aquifer

A porous soil or rock formation, below the surface of the ground, that holds water and through which water can move to reach bores and springs

ASAN

Australian Salinity Action Network

ANZLIC

Australia New Zealand Land Information Council. The peak council for the coordination of spatial data management in Australia and New Zealand.

ASDD

The Australian Spatial Data Directory. A key component of the ASDI which provides information about the availability, characteristics and quality of spatial data held by governments and the private sector and how that information may be obtained.

ASDI

The Australian Spatial Data Infrastructure. A network of fundamental spatial databases maintained by custodians and linked through the adoption of consistent standards, policies and administrative arrangements.

Biodiversity

The variety of life forms, plants, animals and micro-organisms, the genes they contain, the ecosystems they form, and ecosystem processes

BRS

Bureau of Rural Sciences

Catchment

An area of land supplying water to a watercourse bounded by hills or ridges that direct the flow of water

CMO

Catchment management organisation. A generic name for organisations

comprising members of the catchment community, government and other interested parties established by state governments for the specific purpose of overseeing the management of a catchment's natural resources.

CCRC

Cotton Cooperative Research Centre

CMA

catchment management authority

CMB

catchment management board

COAG

Council of Australian Governments

CRC

Cooperative Research Centre

CRC LEME

Cooperative Research Centre for Landscape Environments and Mineral Exploration

CRC PBMDS

Cooperative Research Centre for Plant-based Management of Dryland Salinity

CRDC

Cotton Research and Development Corporation

CSIRO

Commonwealth Scientific and Industrial Research Organisation

Cyclic salt

The salt derived from oceanic spray transported inland by winds and deposited by rain

DAFF

(Australian Government) Department of Agriculture, Fisheries and Forestry

DEST

(Australian Government) Department of Education, Science and Training

Discharge

Groundwater that escapes into a stream bed, lake or ocean, or through the land surface

Discharge zone

Areas of catchments where groundwater emerges at low points in the landscape

DRDC

Dairy Research and Development Corporation

Dryland salinity

Saline seepages or salt scalds occurring in rain-fed (non-irrigated) areas caused by changes in land use that affect the groundwater balance throughout the landscapes. A typical situation occurs following the tree clearing from hillslopes, which reduces transpiration and allows an increase in rainfall intake beyond the root zone and a rise in watertables lower down the slope. Increased subsurface seepage dissolves salts in the soil and, with lateral flow through the landscape, moves from hillslopes to valley floors. Salty water then surfaces in patches depending on the geomorphology and topography of the site. The salt becomes concentrated by evaporation at these locations and the normal vegetation is killed.

DEH

(Australian Government) Department of the Environment and Heritage

EC units

The electrical conductivity (EC) of water provides a measure of the amount of salt dissolved in the water—the higher the EC value, the more saline the water. One EC equals one micro-Siemen per centimetre measured at 25 degrees Celsius, or approximately 0.6 milligrams of salt per litre. 800 EC units is the World Health Organization recommended desirable upper limit for salinity in drinking water.

End-of-valley target

A target for the quality and quantity of water at the point where a river leaves a catchment

EMS

environmental management systems

Evapotranspiration

Water returned to the atmosphere by evaporation (by the sun) and by plants emitting water vapour from their leaves

FWPRDC

Forest and Wood Products Research and Development Corporation

GRDC

Grains Research and Development Corporation

Groundwater

The water in the saturated pores of soil or rock below the watertable

ICM

Integrated catchment management. The integration of water and land management activities and the government agencies involved in these activities within a catchment.

Irrigation salinity

A form of salinity that is caused by the increasing build-up of salts in soils used for irrigation. It results from raised watertable levels that bring soil salts into the upper levels of the soil profile, as well as the repeated use of saline river water for irrigation.

Landcare

Landcare is a community-based approach to fixing environmental problems and protecting the future of our natural resources. There are now more than 4250 Landcare groups across Australia. About one in every three rural landholders is a member of a Landcare Group.

Land holders

Those who own or lease land

Land managers

Those who manage land, including farmers, graziers, irrigators, cultural and environmental land holders, councils and government agencies

LWA

Land and Water Australia. LWA is an Australian Government research and development corporation within the Agriculture, Fisheries and Forestry portfolio. Established in 1990 as the Land and Water Resources Research and Development Corporation under the *Primary Industries and Energy Research and Development Act 1989*, LWA invests in research and development for the productive and sustainable management of Australia's land, water and vegetation resources.

Market mechanisms

Mechanisms that change the market forces for particular commodities to help achieve the desired natural resource management outcome

MDBC

Murray-Darling Basin Commission

NAP

National Action Plan for Salinity and Water Quality

Established by the Australian, state and territory governments in November 2000, the objectives of the NAP are to enable regional communities and landholders to use coordinated and targeted action to prevent, stabilise and reverse trends in dryland salinity, and to improve water quality. Under the NAP, the Commonwealth funds communities to implement accredited integrated catchment/region management plans through block funding, on a matching basis with the States and Territories. Twenty-one priority regions have been identified under the Plan. Governments have jointly committed a total of \$1.4 billion for the NAP over seven years to 2007-08.

NDSP

National Dryland Salinity Program

The NDSP was established in 1993 to address the lack of opportunity for the research community to cooperate across disciplines, organisational boundaries and state borders to address the management of dryland salinity. The Program's goal is to research, develop and extend practical approaches to effectively manage dryland salinity. The Program, which completed a second phase in 2003, is managed by Land and Water Australia on behalf of a consortium of organisations. In 2003-04 the NDSP will focus on four key areas: policy, production, catchments and networks as part of an accelerated communication and regional consultation process.

NHT

Natural Heritage Trust

The Australian Government established the NHT in May 1997 to fund environmental protection, sustainable agriculture and natural resource management. Trust funding totalling \$1.4 billion supported some 12 000 projects and related programs over the six years to 2001-02. More than 400 000 Australians were involved in these projects. In the May 2001 Budget, the NHT was extended with the allocation of an additional \$1 billion for a further five years to 2006-07. Trust funds are delivered at three levels: national investments, regional investments and a local component to directly fund some community groups. Under the *NHT Extension*, states and territories have agreed to provide matching funding for investments at the regional level. Funding for projects is delivered under four Trust programs: Landcare, Bushcare, Rivercare and Coastcare. The 2004 Budget provided an additional \$300 million for the NHT to 2007-08, bringing total investment in the Trust to \$3.0 billion.

NLP

National Landcare Program

The objective of the NLP is to increase the engagement of industry and resource users in Landcare and NRM activities. The NLP has a focus on sustainable farming and sustainable land management. NLP investments currently consist of a community support and a national component. There are currently some 4 000 Landcare groups, involving some 40 per cent of the nation's farmers. In 2003, the NLP received an additional \$122 million in funding for the three years to 2005-06. The 2004 Budget extended the Program by providing an additional \$80 million (\$40 million in both 2006-07 and 2007-08).

NLWRA

National Land and Water Resources Audit

Established in 1997, the NLWRA is a \$30 million research program funded under the NHT, the objective of which is to facilitate improved decision making on land and water resource management issues, particularly by the Australian and state governments. Now in its second phase, June 2002–June 2007, the Audit will provide data, information and assessments of Australia's land, water and biological resources to support sustainable development. A core function will be to collate natural resource information to support the monitoring and evaluation of the NAP and the NHT. Two key audit information products are the Australian Natural Resources Atlas and the Australian Natural Resources Data Library. One of

the Audit's principal pieces of research has been the Australian Dryland Salinity Assessment 2000.

NRM

natural resource management

NRMMC

Natural Resource Management Ministerial Council. The NRMMC consists of Australian, state and territory government ministers responsible for primary industries, natural resources, environment and water policy. The Council is the peak government forum for consultation, coordination and, where appropriate, integration of action by governments on natural resource management issues. Among its other roles, the Council oversees the development and implementation of national natural resource management programs, including the *National Action Plan for Salinity and Water Quality* and the *Natural Heritage Trust*. The Council is supported by one permanent standing committee, the Natural Resource Management Standing Committee, membership of which comprises departmental heads of relevant government agencies.

Public good

A benefit accruing to the community as a whole

Private good

A benefit accruing to an individual or individual organisations

PUR\$L

Productive Use and Rehabilitation of Saline Land

RDC

Research and Development Corporation

Recharge

Water that has drained below the root zone of any local vegetation and which is then able to drain downward to add to the underlying layer of saturated soil, or groundwater

Recharge area

An area where water enters the soil and contributes to the groundwater store. Upper slopes and areas with shallow soils are common recharge areas. Recharge is maximised where soils overlie fractured rocks, where

soils are highly permeable, where vegetation is shallow-rooted or absent, and when rainfall exceeds evapotranspiration.

Regolith

A general term for the entire layer of fragmental and loose, incoherent or unconsolidated rock material of whatever origin (residual or transported) and of very varied character, that nearly everywhere forms the surface of the land and overlies or covers the bedrock

Riparian

Of, inhabiting, or situated on the bank and floodplain of a river

RIRDC

Rural Industries Research and Development Corporation

River salinity

River salinity is caused by saline discharges from dryland, irrigation and urban salinity, and aquifers into creeks and rivers

Salinisation

Degradation of the soil or water through the accumulation of salts. Land salinisation occurs following the accumulation of soluble salts (usually sodium chloride) at or near the soil surface, to a level that causes degradation. This usually occurs through the evaporation of groundwater that discharges through the soil surface. Water salinisation usually results from increasing salinity of run-off and groundwater.

Salinity

The concentration of dissolved salts in groundwater or river water, usually expressed in EC units

Salt scald

An area where salt crystals accumulate on the soil surface, suppressing plant growth and often leading to surface soil erosion which can expose saline subsoils

Surface water

Water on the surface of the land, for example, rivers, creeks, lakes, dams and overland flows

Urban salinity

Salinity that occurs as a result of urban activities

Waterlogging

Saturation of soil with water, resulting from over irrigation, seepage or inadequate drainage

Watertable

The upper surface of a layer of soil or rock material that is saturated with water



List of recommendations

2 The nation's programs to combat salinity

Recommendation 1

The Committee recommends that mechanisms be developed to ensure that validated salinity research findings are considered in regional planning processes, and specifically that Australian Government agencies in cooperation with state and territory governments:

- (a) develop systems to ensure that the best science is made available to state government agencies, catchment management organisations (CMOs) and land managers on an on-going basis;
- (b) provide CMOs and land managers with adequate support and resources to use and incorporate science into their regional plans, investment strategies and on-ground works; and
- (c) provide guidelines for CMOs and land managers, making them aware of pertinent salinity research findings, detailing their implications for the broad types of investments that may be undertaken, and enforcing the guidelines through the accreditation process for regional plans.

For implementation, this recommendation should be read in conjunction with recommendations 3 and 15.

4 The salinity science base

Recommendation 2

- (a) The Committee recommends that the Australian Government, in cooperation with state agencies, conduct an audit of the totality of salinity research and development activities

undertaken by all agencies and programs in which the Australian Government invests, including:

- (i) national programs that address salinity, such as the *National Action Plan for Salinity and Water Quality* and *Natural Heritage Trust*;
 - (ii) programs such as the *National Dryland Salinity Program* and National Land and Water Resources Audit;
 - (iii) agencies within Australian Government departments, including the Bureau of Rural Sciences;
 - (iv) Cooperative Research Centres;
 - (v) Research and Development Corporations;
 - (vi) national science agencies, including the Commonwealth Scientific and Industrial Research Organisation;
 - (vii) universities; and
 - (viii) where possible, the private sector.
- (b) The Committee further recommends that the audit:
- (i) map the state of salinity research findings and the tools currently available for salinity management;
 - (ii) identify all critical research gaps;
 - (iii) suggest directions for future salinity research and development activities; and
 - (iv) identify steps that might be taken to bring greater coherence to salinity research efforts across all Australian Government funded agencies and programs, and to improve coordination with state and regional research activities.

5 The coordination of salinity research

Recommendation 3

The Committee recommends that the Australian Government ensure the continuation of the *National Dryland Salinity Program* (NDSP) as a matter of urgency, and that:

-
- (a) the role of the NDSP be expanded to address irrigation and urban salinity, with the Program renamed the *National Salinity Program* (NSP) or similar;
 - (b) the NSP be managed within Land and Water Australia (LWA);
 - (c) the NSP adopt research, coordination and communication strategies that assist the regional delivery of natural resource management programs and the requirements of the *National Action Plan for Salinity and Water Quality* specifically;
 - (d) the functions of the NSP have regard for those identified in this report;
 - (e) the NSP/LWA be adequately resourced to perform its functions by the Australian and state governments;
 - (f) relevant Research and Development Corporations, Cooperative Research Centres, national science agencies, universities, state agencies and the private sector be strongly encouraged to partner the NSP; and
 - (g) there be a continuing role for an Operations Committee, or equivalent, in providing independent scientific advice with that advice coming from a broad cross-section of scientific personnel from both the government and non-government sectors.

This recommendation should be read in conjunction with recommendations 1 and 15.

6 The adequacy of the science base, research needs and funding

Recommendation 4

The Committee recommends that the Australian Government give greater emphasis through its investments in salinity science to develop new, economically viable land and water use systems.

Recommendation 5

The Committee recommends that the Australian Government encourage catchment management organisations to introduce industry development planning into their natural resource management planning and funding prioritisation process.

Recommendation 6

The Committee recommends that the Australian Government emphasise, through its investments in salinity science, the development of technologies to address urban salinity, including:

- (a) salinity assessment and risk evaluation methods; and
- (b) options for treatment and management.

Recommendation 7

The Committee recommends that the Australian Government:

- (a) foster greater cooperation amongst scientists addressing salinity and, specifically, sponsor an annual multidisciplinary salinity conference, research showcase or science roundtable; and
- (b) examine ways to foster interdisciplinary research in natural resource management more generally.

Recommendation 8

- (a) The Committee recommends that the Australian and state governments make provision within the *National Action Plan for Salinity and Water Quality* for the establishment of a salinity research and development fund, to finance research that:
 - (i) is of national or statewide significance, and beyond the scope of individual catchment management organisations (CMOs);
 - (ii) pertains to the development of new technologies and industries for salinity management; and
 - (iii) is otherwise of a long-term, strategic or generic nature.
- (b) The Committee further recommends that the allocation of the pooled research funds:
 - (i) be as agreed between the Australian and state governments, but that CMOs be consulted for research needs; and
 - (ii) have regard for the research priorities identified in this report.

Recommendation 9

The Committee recommends that the Australian Government encourage Research and Development Corporations to:

- (a) invest more substantially in research for sustainable land use systems and in the development of new salinity technologies; and
- (b) conduct projects that forge links across commodities in farming systems.

Recommendation 10

The Committee recommends that, in cooperation with the states, the Australian Government:

- (a) identify and remove impediments for catchment management organisations (CMOs) to undertake or commission research, and encourage CMOs to support research activity as part of their investment strategies;
- (b) provide incentives for greater collaboration between CMOs to support research of cross-catchment benefit; and
- (c) provide an appropriate degree of support to evaluate tenders and contracts let at the regional level.

Recommendation 11

The Committee recommends that the Australian Government examine ways to encourage private sector investment in research and development for commercial measures to arrest salinity and other forms of natural resource degradation.

Recommendation 12

The Committee recommends that the Australian Government, in cooperation with state governments, encourage development of industry capacity in salinity research and development, by adopting measures that include:

- (a) ensuring tender specifications provide genuine opportunities for industry to compete for public research funds, particularly for small to medium sized enterprises at the regional level; and
- (b) ensuring tendering processes are transparent, so that industry can compete effectively against publicly funded organisations.

7 Data management and mapping technologies

Recommendation 13

The Committee recommends that the Australian and state government agencies holding natural resource management datasets, accelerate the development of data collection, management and retrieval systems that are standardised, integrated and accessible.

Recommendation 14

The Committee recommends that ANZLIC – the Spatial Information Council, in collaboration with the National Land and Water Resources Audit, be resourced to support managers of regional projects to develop and implement best practice data management policies. Emphasis should be placed on developing:

- (a) consistent data collection, management and retrieval systems;
- (b) mechanisms to encourage data sharing between catchment management organisations, research institutions, industry bodies and government agencies; and
- (c) quality assurance processes to ensure standards are attained.

8 Support for implementers: extending the science

Recommendation 15

The Committee recommends that the Australian Government in cooperation with the states and territories build on existing initiatives to establish a database of interpretive material, scientific research and data, related to salinity and its management. The three levels of the database should be:

- (a) a ready reference salinity component, containing concise, integrated, accurate, and easy to understand information to assist land managers, particular farmers, catchment management organisation staff and natural resource management extension officers;
- (b) links to salinity related research papers, endorsed by the *National Dryland Salinity Program* or its successor body;
- (c) a meta-data component identifying the location of available salinity data and, where possible, the capacity for a storage and retrieval system for salinity related data particularly that

collected for the *National Action Plan for Salinity and Water Quality*.

For implementation, this recommendation should be read in conjunction with recommendations 1 and 3.

Recommendation 16

The Committee urges relevant Australian, state and territory government agencies and industry groups to enhance their support for face-to-face extension services by ensuring that there are adequate numbers of qualified extension staff available to assist land managers, particularly farmers.

Recommendation 17

The Committee recommends that the Australian Government, in partnership with the relevant state agencies, compile and publish a state by state manual of viable salinity management options, to assist extension staff and land managers. This manual should be updated regularly, and survey current best practice approaches to salinity management. It should also be available free of charge in both hard copy and on the internet to extension staff and land managers dealing with salinity problems.

Recommendation 18

The Committee recommends that the relevant Australian Government agencies in consultation with state and territory governments review the issue of diminishing state extension services, with a particular focus on:

- (a) the employment conditions of extension staff;
- (b) the potential career pathways of extension staff; and
- (c) the adequacy of the training provided for extension staff to ensure their knowledge of technical, scientific and policy issues, relating to natural resource management and in particular salinity, is both current and comprehensive.

Recommendation 19

The Committee recommends that the Australian Government, in cooperation with the states, undertake an audit of the national, state and regional extension services available for salinity management, and natural resource management more generally.

Recommendation 20

The Committee recommends that the Australian Government review the effectiveness of the *National Landcare Program's* state and regional natural resource management facilitators, with a particular focus on ensuring that:

- (a) their roles and responsibilities are delineated clearly to avoid duplication with other extension services and are consistent with other national programs designed to address salinity issues; and
- (b) they receive the training and access to current information, necessary to perform their duties.

Recommendation 21

The Committee recommends that the extension services provided by the Australian Government, and participating states and territories, through the *National Action Plan for Salinity and Water Quality* and the *Natural Heritage Trust* be reviewed in due course, with a particular focus on:

- (a) the employment conditions of extension staff;
- (b) the potential career pathways of extension staff; and
- (c) the adequacy of the training provided for extension staff to ensure their knowledge of technical, scientific and policy issues, relating to natural resource management and in particular salinity, is both current and comprehensive.

Recommendation 22

The Committee recommends that the Australian, state and territory governments increase their support of catchment management organisations by:

- (a) undertaking a review to assess the effectiveness of providing groups of mobile knowledge brokers, directed to advise on national natural resource management policies and provide integrated, current and relevant scientific and technical support on salinity issues to individuals and organisations managing salinity;
- (b) providing funding for the operations of any such groups as are recommended to be formed;

- (c) enabling the secondment of such knowledge brokers from relevant research agencies, such as the *National Dryland Salinity Program*, the Cooperative Research Centre for Plant-Based Management of Dryland Salinity and the Commonwealth Scientific and Industrial Research Organisation's Land and Water Division.

Recommendation 23

The Committee recommends that the Australian Government support the establishment of a national annual forum on salinity policy, research and management, associated with the *National Action Plan for Salinity and Water Quality*, for government agency staff, catchment management organisations, private consultants, farmers, and other land managers.

Recommendation 24

The Committee recommends the Australian Government:

- (a) examine and remove any impediments to the further development of an industry in technical and support services for environmental management; and
- (b) establish and coordinate, with the cooperation of the states and territories, a national accreditation process for private sector salinity advisors to ensure that salinity advice and implementation services meet best practice standards.



Executive summary

Introduction

The terms of reference for the inquiry were to examine and report on the Commonwealth's role in managing and coordinating the application of the best science in relation to Australia's salinity programs. The Committee was asked to give particular consideration to: the use of the salinity science base and research data in salinity programs; linkages between researchers and those implementing solutions, including the coordination and dissemination of research; and the adequacy of technical and scientific support in applying management options.

These matters are addressed in the Committee's report, which consists of eight chapters. The contents, findings and recommendations of each chapter are summarised as follows.

Chapter one Introduction

The chapter outlines the referral of the inquiry to the Committee, the conduct of the inquiry, and the structure of the report and its principal findings.

Chapter two The nation's programs to address salinity

The chapter discusses the major national natural resource management (NRM) programs that address salinity, strategies to address salinity in the Murray-Darling Basin and the states, and local government initiatives. The Committee notes the role of regional planning and delivery of NRM programs (particularly *A National Action Plan for Salinity and Water Quality* (NAP) and the *Natural Heritage Trust*) through catchment management organisations (CMOs), and the evidence in response to the national programs.

The responses to the NRM programs relate to the implications for salinity research, research coordination and extension of research findings that emerge from:

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- the architecture of the NAP;
 - the alleged failure to incorporate key research findings into salinity programs and the mistaken presumption that economically viable solutions are available for widespread adoption;
 - the claim that the Australian Government's science investments neglect research into new salinity management methods and technologies; and
 - the implications of region-based planning and delivery of NRM programs.

Several of these matters are further developed in subsequent chapters.

The Committee welcomes the commitment by the Australian and state governments to address salinity. The NAP involves a funding commitment of \$1.4 billion over seven years, which represents a significant increase in aggregate funding for works to address salinity.

Primary responsibility for NRM rests with the states and several state governments have developed salinity strategies which incorporate research findings. Efforts to address salinity in the Murray-Darling Basin commenced in 1988 with the adoption of the *Basin Salinity and Drainage Strategy*. Over the ten years to 1999, the Murray-Darling Basin Commission invested some \$70 million in on-ground works, which were successful in achieving salinity reduction targets. The Commission has now developed a new *Basin Salinity Management Strategy* for the period to 2015.

The Committee concludes that the NAP-related research activities of national agencies should be better coordinated with state and regional activities.

The Committee supports the NAP's focus on immediate on-ground actions to address salinity, noting evidence suggesting there is sufficient knowledge to support some positive landscape change. However, the Committee is also persuaded that a sufficient number of economically viable management options to address salinity are not yet available. Consequently, the Committee concludes there is a need to support further research and development (R&D) if salinity is to be addressed at the scales required.

The establishment of CMOs has assisted the integrated management of natural resource degradation issues, ensuring that salinity is not addressed in isolation. The Committee is also aware that many CMOs are currently being established or have not been operating long. However, arrangements for CMOs (for example, their organisational structure and legislative basis) vary considerably across the states. The Committee concludes that, to facilitate delivery of NRM programs, there may be value in establishing all CMOs on a consistent basis, perhaps through the Council of Australian Governments.

The Committee notes the risks attendant upon the devolution of NRM to regional bodies, particularly for the adequate use of science in regional plans, coordinated research activity and the extension of salinity science.

While the Committee supports regional-level investment, it notes that there is likely to be a focus on funding immediate on-ground works and a tendency to give investment in longer-term and generic research (that transcend regional boundaries) a low priority. Generic research may be beyond the resources, charter and scale of individual CMOs. Consequently, the Committee is concerned that the regional delivery focus under NRM programs not detract from coordinated research of a type that will benefit multiple regions, and that should properly be conducted at the state or national levels.

Evidence pointed to considerable variation across CMOs in the uptake of science. The Committee urges that regional planning, investment strategies and on-ground works be informed by the best available science and recommends that CMOs and land managers be adequately supported to use and incorporate science into their planning and investment activities [**Recommendation 1**].

The Committee also urges that adequate scientific and technical support be given to those non-NAP regions that are also threatened by salinity. The matters of regional capacity and support for the implementation of salinity programs are addressed further in chapter eight.

Chapter three The nature of the salinity problem

The chapter presents the dominant explanation of the salinity problem and provides an overview of salinisation processes, types of salinity, management options, and the extent, impacts and costs of salinisation. Alternative scientific perspectives for the sources of salt in the landscape, salinity processes, the extent of the salinity problem, and the veracity of some public sector research and audit findings are considered.

A consensus explanation of the salinity problem has developed which explains secondary, or human-induced, salinity as having resulted from changes to the hydrology of the Australian landscape caused by changed land use following European settlement. However, this explanation has been criticised and alternative models proposed. Although the Committee does not wish to definitively adjudicate on these debates, it urges that all contributors to the scientific understanding of salinity have adequate opportunity for their perspectives to be presented and examined.

The Committee is profoundly concerned that while the precise extent of salinisation is unclear, 5.7 million hectares of agricultural and pastoral land are currently estimated to have a high potential for developing salinity. It is estimated

that two million hectares of agricultural land are currently showing signs of salinity. More than 70 per cent of the nation's salinity problem occurs in one state—Western Australia. The Committee observed first-hand the impacts of salinity during its inspections in New South Wales, Victoria and Western Australia. Vast tracts of farming land have succumbed to salinity. The effect of salinity in urban areas was just as striking.

The current and predicted impact of salinity on infrastructure, water quality, productive land, bio-diversity, remnant vegetation and conservation reserves is significant. The costs imposed on landholders, governments and residents of rural towns are considerable. The loss in profits for the agricultural sector in Western Australia has been estimated at between \$80 and \$260 million per year, while in the Murray-Darling Basin, the cost of dryland salinity in eight tributary valleys of the Basin is approximately \$247 million per year. The cost of salinity to consumptive users of River Murray water totals \$47 million per year. In Wagga Wagga, the Council reported that the damage to infrastructure in the town would amount to \$180 million over 30 years, with some residents already spending up to \$20 000 to repair their homes.

Chapter four The salinity science base

The chapter reviews the agencies and programs whose research efforts constitute the 'science base and research data' to address salinity at the national level. The chapter summarises key research findings and products of these agencies and programs. The chapter also summarises the salinity science and technologies developed by private sector contributors to the inquiry, and notes the significant 'applied science' contribution of many individual landholders.

A wealth of salinity research has been undertaken by a range of Australian Government funded agencies and programs, including: national science agencies, Cooperative Research Centres, Research and Development Corporations (RDCs), the *National Dryland Salinity Program* (NDSP), the National Land and Water Resources Audit, and universities. An array of research products and management tools have been developed.

The Committee concludes that a comprehensive audit of the Australian Government investment in salinity research may help to: map the salinity science base and management tools currently available; identify critical research gaps; and assist in bringing greater coherence to the range of science investments for salinity and, potentially, improve their effectiveness [**Recommendation 2**]. The audit may also assist in improving coordination with state and regional research efforts.

Chapter five The coordination of salinity research

The chapter describes the coordination of salinity research at national and state levels, the challenges for research coordination in the new NRM environment and institutional proposals for improved coordination.

A strong case is made in the evidence for salinity R&D to be nationally coordinated. The reasons for this include:

- the structural changes ushered in with the NAP, notably the devolution of NRM responsibilities to regions and the fragmentation of efforts at the national level;
- the perhaps unavoidable complexity of salinity research efforts across a large number of agencies and programs, which need to be effectively coordinated—now more than ever;
- to link research providers and their products with CMOs, land managers and others undertaking on-ground works;
- to identify the R&D issues of national significance, ensure they are adequately addressed and avoid duplication;
- to maintain the momentum developed through the NDSP in R&D and extension; and
- to better coordinate research programs with state and territory salinity strategies, so as to avoid overlap between governments at different levels.

Strong support was expressed for the NDSP, which has effectively brokered R&D priorities at the national level since its establishment in 1993. The Committee believes that the NDSP ought to be continued and its functions expanded to address irrigation and urban salinity. The Program could be renamed the *National Salinity Program*, or similar [**Recommendation 3**]. With the imminent closure of the NDSP, the Committee recommends that the Australian and state governments, as a matter of urgency, provide funding for the Program's continuation and expansion.

Salinity ought to be addressed within the context of integrated responses to natural resource degradation issues. Institutional structures for salinity science should be integrated with other NRM science programs. In this way, the single issue focus will not undermine the development of integrated responses to the range of NRM issues required by CMOs and land managers. For this reason, continuing to locate a national research coordination function within Land and Water Australia (LWA) seems appropriate.

Chapter six The adequacy of the science base, research needs and funding

The chapter addresses the adequacy of the Australian Government's investments in salinity science, and the need for further research. The chapter canvasses an array of research needs proposed in the evidence and makes proposals for funding research to address knowledge gaps.

Despite the knowledge and management tools developed to date, the Committee is persuaded that governments need to provide on-going support for salinity R&D.

Evidence suggested there is an imbalance in the Australian Government's salinity science investments towards mapping, at the expense of developing new land and water use systems, including engineering systems and new industries for saline resources.

There were strongly divergent views in the evidence: between national NRM agencies, which argued for the efficacy of highly targeted interventions (at least in eastern Australia) aided by mapping technologies, versus a range of submitters who argued that research findings point to the need for large scale land use change and, hence, the need for profitable land use options that can be widely adopted by landholders.

The Committee notes that differences in geology and landscape characteristics between the east and west of the continent may have contributed to diverging perspectives on appropriate management interventions and R&D priorities. Nonetheless, the national NRM agencies conceded that, while the prospects for targeted interventions in eastern Australia may be positive, the situation in Western Australia is characterised by much larger, homogenous systems and landscape salt.

The Committee welcomes the potential for targeted salinity management in some locations assisted by mapping technologies, but notes that 70 per cent of the nation's salinity problem occurs in Western Australia. Calls from this state, and a range of other submitters, are for new land and water use systems and strategic interventions to protect high value assets. Consequently, the Committee recommends that the Australian Government give greater emphasis through its science investments to the development of new, economically viable land and water use systems [**Recommendation 4**].

Although the Committee's inquiry was concerned with national salinity science coordination and the terms of reference did not seek comment on research priorities, approximately 70 submitters identified specific research needs.

Prioritising research needs for future R&D investment is properly the responsibility of CMOs and technical committees at state and national levels. However, the Committee recommends that, in addition to new land and water use systems, greater research emphasis be given to address urban salinity **[Recommendation 6]**. CMOs should also be encouraged to introduce industry development planning into their NRM planning and funding prioritisation process **[Recommendation 5]**.

The Committee also urges that multidisciplinary research be encouraged **[Recommendation 7]**.

The new NRM context has altered the research supply-demand relationship, with CMOs now having greater power to determine research priorities. While this situation is welcomed, the Committee urges that a 'bottom-up' approach to the identification of research priorities be effectively combined with a 'top-down' analysis to ensure that national perspectives and new scientific knowledge or techniques are incorporated into regional management practice.

Notwithstanding the overall increase in salinity funding, the Committee is concerned that the NAP does not have a charter to fund salinity R&D, at least not beyond that required for regional level implementation. The Committee is persuaded that adequate funding should be available to support salinity R&D, particularly into generic issues that are of national relevance or for research that is beyond the scope of individual CMOs. The Committee recommends that provision be made within the NAP for the establishment of a salinity R&D fund to finance research of this nature **[Recommendation 8]**.

In view of the significance of their research investments and their relationship with primary producers, the role of RDCs is of particular importance. The Committee supports calls for RDCs to invest more substantially in researching sustainable land use systems, and in the development of new salinity technologies **[Recommendation 9]**.

Although the Committee identifies the need for generic research activities to be supported at state and national levels, the Committee believes that individual CMOs ought to be encouraged to undertake or commission salinity R&D, where this is relevant **[Recommendation 10]**. CMOs should also be provided with an appropriate degree of support, particularly in regard to evaluation of tenders and contracts let at the regional level.

The Committee wishes to encourage greater opportunity for small to medium sized enterprises to tender for research work, particularly at the regional level, and to encourage private sector investment in salinity research activities **[Recommendations 11 and 12]**.

The Committee notes the need for long-term funding for data collection to monitor the effects of salinity management actions at the regional level. The Committee urges government agencies to provide this on-going support.

Chapter seven Data management and mapping technologies

The chapter reviews the evidence relating to the Australian Government's data collection, management and retrieval arrangements, canvasses options for improving coordination to address submitters' concerns and describes the Australian Government's initiatives to reduce problems associated with data management. The chapter then continues the discussion, from chapter six, of the place of mapping technologies in the NAP, and outlines the views of submitters' in relation to the appropriate use of these technologies.

A range of Federal and state government initiatives is in place to facilitate best practice data collection, management and retrieval practices. However, the Committee is concerned that problems in this area persist and recommends that governments expedite the development of data management systems that are standardised, integrated and accessible [**Recommendation 13**]. With the increased involvement of CMOs in data collection, the Committee recommends that the Australian Government increase efforts to equip managers of regional projects with the requisite skills for data management [**Recommendations 14**].

The Committee notes the importance accorded to mapping technologies, particularly airborne geophysical techniques, in the NAP. The Committee contends that mapping technologies may perform an important role in salinity management, for example: surveying large areas of land (greater than 50 000 hectares); in prioritising on-ground works; and in protecting high value assets (such as towns).

The Committee notes a range of concerns about the use of airborne geophysical techniques, specifically the observation that airborne electromagnetics (AEM) may have been 'over sold' by relevant Australian Government agencies. The Committee believes that the Australian Government should take note of the concerns raised by submitters. Following the discussion in chapter six, the Committee concludes that while AEM is a useful enabling technology, the utilisation of the technology should not detract from efforts to develop new land and water use systems that can be adopted on-ground by land managers, particularly in Western Australia.

The Committee was disappointed to hear that some companies felt they were being discouraged from participating in salinity mapping surveys. The Committee believes that the private sector has an important role in developing innovative

technologies, and providing on-ground services to land managers, which is an issue explored further in chapter eight.

Chapter eight Support for implementers: extending the science

The final chapter of the report addresses the adequacy of technical and scientific support for land managers and CMOs in applying salinity management options.

In the absence of economically viable management options, better means of information transfer will not solve the problem of salinity. Evidence suggests that for land managers to adopt research products, they require management options that are as profitable as current systems, complimentary to efforts to address other natural resource degradation issues, are low risk and simple to implement.

The Committee concludes that the Australian and state governments should publish, and regularly update, a manual of viable salinity management options. This should be available both in hard copy and on the internet [**Recommendation 17**]. The Committee notes calls from a number of submitters for the establishment of a national salinity database or 'one-stop-shop' of salinity information. The Committee recommends that the Australian Government build on the efforts of the NDSP in developing a database of interpretive material and scientific research, including raw data, related to salinity and its management [**Recommendation 15**].

Information is delivered to implementers in a variety of forms and through a range of delivery methods, of which traditional face-to-face extension by state agencies remains widely preferred. The Committee recognises that land managers and CMOs consult a range of sources for advice and support and that these various means ought to be supported in their diversity.

The Committee observed the excellent work of services that continue to be provided by some states. However, the Committee is concerned at the decline in the numbers of state extension officers and evidence of depletion in the skill base among extension personnel. The Committee urges the Australian and state governments to increase their face-to-face extension services and to review the employment conditions, career pathways and training for extension personnel [**Recommendations 16 and 18**].

Funding provided under the NAP and NHT will significantly boost extension services nationally. However, there is a lack of clarity about the extent of extension services funded by the Australian Government and the Committee believes that an audit ought to be conducted to assess the adequacy of the Government's efforts in this regard [**Recommendation 19**]. While insufficient time has elapsed to review progress, the Committee recommends that, in due course, a review of the training and employment conditions be conducted for the Australian Government-funded NRM facilitators [**Recommendations 20 and 21**].

Under the regional delivery arrangements of the NAP, CMOs will increasingly provide support services. However, there is considerable variation in the capacity of CMOs to access, comprehend and extend salinity science findings. A range of options to increase the capacity of CMOs was proposed. The Committee recommends that the Australian Government consider establishing groups of mobile knowledge brokers to advise on NRM policy and provide integrated scientific and technical support to land managers and CMOs [**Recommendation 22**]. Furthermore, the Committee acknowledges the key role of the NDSP as a communicator of research findings on dryland salinity, particularly through its Communications Team.

Accompanying the decline in traditional state extension, services have increasingly been provided by others organisations and individuals, including: science agencies, industry bodies, individual scientists, agribusinesses, landholder groups and local governments. A private consulting industry has now also emerged. The Committee considers the support for landholders provided through these various means.

While encouraging direct interaction between scientists and land managers, and supporting the co-location of researchers and implementers, the direct extension of research by individual scientist may not be the most efficient means of extending research findings. The Committee recommends the establishment of a national annual forum on salinity policy, research and management, to bring together government agency staff, CMOs, land managers, scientists and private consultants [**Recommendation 23**].

While wishing to encourage private sector provision of technical and support services, the Committee recognises that there are limits to their role, especially when dealing with an issue like salinity that crosses farm and state boundaries and has a strong public good dimension. Nonetheless, the Committee recommends that impediments to the future development of this industry be removed [**Recommendation 24**]. To ensure that CMOs and landholders are given appropriate and credible advice by private consultants, the Committee further recommends an accreditation process be developed to ensure salinity advice meets best practice standards.

