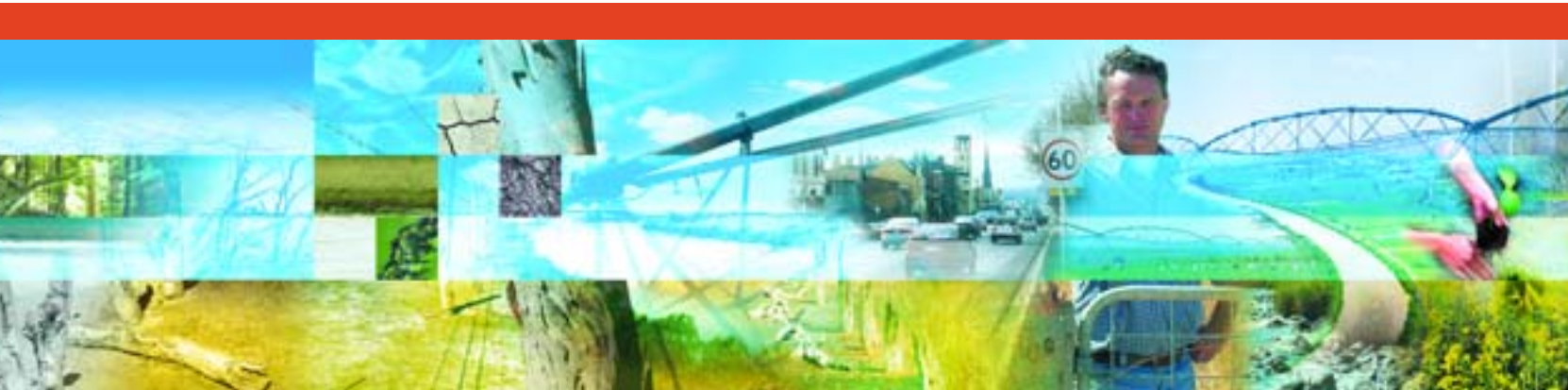


Dryland Salinity and Catchment Management

A Resource Directory and Action Manual for Catchment Managers



National
**DRYLAND
SALINITY**
Program

Know-how
to tackle salinity

Dryland Salinity and Catchment Management

A Resource Directory and Action Manual for Catchment Managers



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Australia's National Dryland Salinity Program is a collaborative research and development effort that is investigating the causes of, and solutions to, the national problem of dryland salinity. It was initiated by Land & Water Australia (formerly LWRRDC) in 1993 and has involved a wide range of funding partners and research organisations. It has been managed by Land & Water Australia since its inception.

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Finally, Dr Richard Price managed the National Dryland Salinity Program for 11 years from its inception to the production of these synthesis reports. For the first 10 years Richard worked as a program manager within Land & Water Australia and in this final year as a consultant to Land & Water Australia. Throughout this period, Richard's enthusiasm, drive, keen insights, extensive network and excellent program management skills have been fundamental to the success and impact of the NDSP. This has been an important contribution to salinity research in Australia, and to the wider understanding within the Australian community of the salinity challenge we face and how to manage it.

The National Dryland Salinity Program is jointly supported by the following organisations



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CRC FOR
PLANT-BASED
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OF DRYLAND
SALINITY



Grains
Research &
Development
Corporation



National Land & Water Resources Audit
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State Governments of South Australia, New South Wales, Queensland, Western Australia, Victoria and Tasmania.

DISCLAIMER: The information contained in this publication is intended for general use, to assist public knowledge and discussion and to help improve the sustainable management of land, water and vegetation. The information should not be relied upon for the purpose of a particular matter. Legal advice should be obtained before any action or decision is taken on the basis of any material in this document. The Commonwealth of Australia, Land & Water Australia, the authors or contributors, and the National Dryland Salinity Program and its partners do not assume liability of any kind whatsoever resulting from any person's use or reliance upon the content of this document.

FOREWORD

This report represents in part the culmination of an extraordinary adventure.

The National Dryland Salinity Program (NDSP) was established in 1993 by Land & Water Australia, the National Landcare Program, the Murray Darling Basin Commission and the State governments of New South Wales, Queensland, Victoria, South Australia and Western Australia, in recognition of the need for a coordinated approach to dryland salinity research in Australia. The NDSP has invested over \$40 million into new knowledge and understanding, technologies, decision-support systems and information products that are helping people across Australia to manage dryland salinity.

This investment has led a national shift in salinity research and policy, responding flexibly to the changing political environment and on-ground demands over this time. It played a major role in the report to the Prime Minister's Science, Engineering and Innovation Council, that provided a compelling case for establishment of the National Action Plan for Salinity and Water Quality (NAP). The NDSP had already brought the States and industry together under a national approach to salinity research and management. An independent review of the NDSP in 2003 confirmed the pre-eminent contribution it has made to developing solutions applicable at catchment and farm scales.

Over this past year, the 11th year of the program, the NDSP has invested a full year in harvesting and synthesising the efforts of over 300 researchers who investigated the causes, costs, consequences, solutions and management of dryland salinity in Australia over the past 10 years of the program.

This great portfolio of scientific and practical knowledge has been synthesised into three landmark reports, of which this is one. The three synthesis reports are designed to help people to make better decisions at farm scale, at catchment scale, and in developing policy respectively, based on the best available knowledge in Australia about salinity.

The foundation for these reports, and their companion resources, is solid science. This ground breaking research has brought together the contributions of hydrologists, economists, soil and plant specialists, ecologists, sociologists, biologists, agronomists, geologists, mathematicians, engineers, professional communicators and many others.

The synthesis process has been based on collaborative learning and analysis, spiced with vigorous discussion, debate and argument in public meetings and among partners. Drafts of the reports were road-tested in workshops in every State, involving catchment managers, farmers and their advisors.

The NDSP has been about more than just science. Indeed, it has been about professional communication developing solutions for farmers, catchment managers and others, backed by good science. This ambitious attempt to pull together a vast amount of scientific knowledge, and to package it to make it more useful for its end users, was made possible through funding from Land & Water Australia, the Department of Agriculture, Fisheries and Forestry (under the NAP), the Murray-Darling Basin Commission, Meat & Livestock Australia, the Rural Industries R&D Corporation, the Grains R&D Corporation, the Department of Natural Resources & Mines (Qld), the Department of Agriculture (WA) and the Department of Water, Land and Biodiversity Conservation (SA).

On behalf of the Governing Board and the NDSP partners that invested so much in this program, I commend these reports to you.

Kevin Goss, Chairman
National Dryland Salinity Program

HOW WAS THIS DOCUMENT PRODUCED?

This report was written and compiled by Lisa Robins (Robins Environmental Consulting), as Program Leader of the Catchment Team for the National Dryland Salinity Program (NDSP) Enhanced Communication Year 2003–04. The chapter on 'where to get help' was written and compiled by Dr Bruce Munday (Clear Connections). Report editing was by Georgina Wilson (NDSP Communication Coordinator, WA) and production coordination by Kim Mitchell (Currie Communications). Resource referencing was coordinated by Jo Curkpatrick (NDSP Communication Coordinator, Victoria) and Lisa Gray (NDSP Communication Coordinator, New South Wales).

The report was comprehensively reviewed by about 90 participants at focus groups in Queensland, New South Wales, South Australia, Tasmania, Victoria and Western Australia in February to April 2004. Dr Bruce Munday facilitated these events.

Development of the report was overseen by the NDSP Catchment Team, comprising:

- Peter Barker (Department of Infrastructure, Planning & Natural Resources, New South Wales)
- Dr Michael Crawford (Department of Primary Industries, Victoria)
- Dr Richard Cresswell and Peter Baker (Bureau of Rural Sciences)
- Jo Curkpatrick (NDSP Communication Coordinator, Victoria)
- Dr Sharon Davis, Dr Michele Akeroyd and Marie Waschka (Murray–Darling Basin Commission)
- Dr Richard George (Department of Agriculture, Western Australia)
- Lisa Gray (NDSP Communication Coordinator, NSW)
- Mike Grundy (Department of Natural Resources, Queensland)
- Dr Russell Haines (Rural Industries Research & Development Corporation)
- Alana Innes (National Land & Water Resources Audit)
- Daryl Richardson (CRC for Plant-based Management of Dryland Salinity)
- Dr Mirko Stauffacher (CSIRO Land & Water)
- Simon Veitch (Department of Agriculture, Fisheries & Forestry).

Input was provided by Dr Richard Price (Kiri-ganai, NDSP National Manager), John Powell (Optimal ICM), Dr Bruce Munday, and Melanie King (Land & Water Australia). Contributions were also made by NDSP Operations Committee member Cameron Allan (Meat & Livestock Australia) and NDSP Communication Coordinators (Mark Warnick, NDSP Communication Coordinator, Qld and Georgina Wilson, NDSP Communication Coordinator, WA).

The report was further provided to the following three committees of the Murray–Darling Basin Commission:

- Groundwater Technical Reference Group
- Basin Salinity Management Strategy Implementation Working Group
- Project Steering Committee of the 'Catchment Classification' project.

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Executive summary

Dryland Salinity and Catchment Management – A Resource Directory and Action Manual for Catchment Managers was prepared to assist strategic level planning and management about dryland salinity, with particular consideration to integrated natural resource management.

This directory consolidates the breadth of ground-breaking research commissioned by the National Dryland Salinity Program (NDSP) with significant research findings and resources on dryland salinity developed throughout Australia over the past 10 years. It captures research undertaken at the national, State and regional levels, and interprets the findings for the catchment manager.

It is framed around five vital questions for catchment managers, and each chapter starts by addressing why the particular question is important.

- Question 1 – *What is the current extent of dryland salinity and its risk of spread?*
- Question 2 – *What are the causes and processes of dryland salinity?*
- Question 3 – *What are the current and predicted impacts and costs of dryland salinity?*
- Question 4 – *What can we do and how do we measure progress?*
- Question 5 – *How do we integrate with other natural resource management issues?*

Advice from more than 150 people involved in salinity research or management was sought in developing the structure and content of this report.

Foremost, the directory is designed so that information to support decision-making can be readily accessed. A roadmap at the start of each chapter guides the reader to the information sought. Actions are highlighted in 'break-out' boxes, suggesting a way forward and interpreting the research and resources at the catchment level. Each action is rated on cost (high or low), time scale (long or short-term), and an indication of the level of confidence in success.

A comprehensive contact list and references are also provided.

The companion CD-ROM puts a library of research and resources within reach of the great variety of catchment managers seeking answers on dryland salinity management. While the directory itself will provide answers to many questions, the reports embodied in the CD-ROM, supported by a search facility, enable the user to access a wealth of information at the desired level of detail. It provides the first genuine repository of information on dryland salinity that transcends institutional and program boundaries.

All catchment managers throughout Australia will find something in this directory and its companion CD-ROM to improve regional planning and management. It is an essential reference for combining with regional and local sources.



Introduction

WHO IS THIS INFORMATION FOR?

This directory was prepared to assist strategic level planning and management about dryland salinity, with particular consideration to integrated natural resource management. It is designed to help you, as a busy catchment manager, to access information quickly that is relevant to you and your team following more than a decade of research. It is structured so that you can dip in and out rather than read from front to back. It is a resource directory, not a sequential 'how to' manual on developing a dryland salinity strategy. Suggested 'actions' are highlighted throughout, as well as summarised as a checklist at the end of the report.

This directory presents resources and research findings related to catchment-level decision-making on dryland salinity. It draws on research undertaken through the National Dryland Salinity Program (NDSP) and any other pertinent resources, research and investigations at the national, state and regional level.

It is structured around five major questions of interest to catchment managers. These questions are discussed under 'How do I use this document?'

The directory builds on and adds to the publication *Assessing the causes, impacts, costs and management of dryland salinity*,¹ which summarised the findings of NDSP Phase I (1993–98) and provided a general review of knowledge to that time. An outline of contents is provided in each chapter of this publication, as it remains a relevant reference for dryland salinity planning and management. You should consider it a companion text to this report.

Three general references on dryland salinity management are also recommended. The *Salinity Management Handbook*² comprises three parts (understanding salinity, investigating salinity and managing salinity) and provides a comprehensive and practical introduction to salinity. *Trees, Water and Salt*³ is a guideline on how to use trees in the Australian context to achieve healthy catchments and productive farms. The *Salinity Information Package*⁴ is a series of 40 technical information sheets (www.ndsp.gov.au) written in plain English for catchment managers on planning and managing dryland salinity addressing the following:

- Understanding dryland salinity
- Recognising dryland salinity
- Assessing dryland salinity risk
- Classifying biophysical and landscape processes
- Catchment planning and management options
- Implementing salinity management strategies
- Monitoring the effectiveness of salinity management strategies
- Assessing progress and reviewing plans.

Research outcomes relevant to leading producers and experienced advisors are available in the companion to this report: *Dryland salinity: on-farm decisions and catchment outcomes – a guide for leading producers and advisors*.⁵

Who is a catchment manager?

- Catchment and regional organisations
- Community-based NRM coordinators and facilitators
- Private service providers
- Governments (Local, State, Federal)
- Research purchasers and providers
- Non-government organisations
- Indigenous groups
- Industry and infrastructure managers
- Statutory authorities.

WHAT IS THE NDSP?

The National Dryland Salinity Program (NDSP) was established in 1993 and its first five-year phase focused on understanding causes of dryland salinity and establishing a national collaborative research and development effort. A larger second phase, completed in June 2003, involved new funding partners. Research projects were grouped into seven themes that aimed to address remaining gaps in understanding salinity and develop practical, profitable and sustainable solutions.

The seven themes related to understanding and managing salinity were:

- Audit and Monitoring
- Policy and Operating Environment
- Industry Solutions
- Productive Use of Saline Resources
- Environmental Protection and Rehabilitation
- Infrastructure Management
- Regional and Community Initiatives.

Ten years of research through the NDSP tells us:

- There is still much to be done
- The focus has shifted to include impacts on infrastructure – roads, bridges, buildings and other engineered structures
- Practical and economic solutions are not easy to find and their impact may not be felt for decades
- Salinity management should be integrated with other natural resource management strategies
- In some cases we will have to live with salinity and must find the institutional and practical means to make that possible.

In summary, the key messages described in the companion report *Breaking Ground – Key findings from 10 years of Australia's National Dryland Salinity Program*⁶ are:

1. Salinity costs are significant and rising: Protection must be strategic.
2. Profitable options for reversing the trend are lacking (but under development).
3. There is no one salinity problem: It challenges us to look beyond traditional policy instruments.
4. Integrated catchment management must be seen as only one approach to deal with dryland salinity.
5. Vegetation management remains the key to managing water resources, although the benefit-cost of revegetating catchments requires careful analysis.
6. Lack of capacity is an important, but secondary constraint, to managing salinity.

HOW DO I USE THIS DOCUMENT?

This directory is framed around the five vital questions for catchment managers, and each chapter starts by addressing why the particular question is important.

- Question 1 – What is the current extent of dryland salinity and its risk of spread?
- Question 2 – What are the causes and processes of dryland salinity?
- Question 3 – What are the current and predicted impacts and costs of dryland salinity?
- Question 4 – What can we do and how do we measure progress?
- Question 5 – How do we integrate with other natural resource management issues?

Each question provides an outline of what we knew in 1998 at the end of NDSP Phase I. This is drawn from the information presented in the report *Assessing the causes, impacts, costs and management of dryland salinity*, together with *Understanding dryland salinity*,⁷ which summarises the outcomes of some 27 projects, most within the Murray–Darling Basin Commission's Dryland Program for the same period.

The lessons from NDSP Phase II and other significant research and investigations at the national, State and regional scales that contribute significantly to answering the questions are then captured. 'Actions' are highlighted in break-out boxes, providing you with a suggested way to proceed.

Each action uses three codes on 'Cost', 'Time' and 'Confidence' to further inform your regional decision-making processes. The 'Cost' code refers to the cost of implementing the action. The 'Time' code refers to the time to undertake the action, not the time to achieve a result. The 'Confidence' code refers to the degree of confidence in achieving the anticipated result should you implement the action – if the confidence is low, it is generally a consequence of limited examples of implementation or of mixed results. The codes are only indicative and should be interpreted for your regional circumstances. While the coding system provides a useful function, it is not always possible to accurately reflect all catchments across Australia in this simplified manner.



While the review of information has been extensive, some local and regional research will be missing and you should be careful not to overlook these by consulting local experts and resource libraries. Examples are provided where possible to demonstrate advances in thinking and technology applied at a catchment level.

You will see that the answers to these five major questions are incomplete, and that there are gaps in our understanding to inform regional decision-making. The research findings are therefore used to look forward and ask 'Where to from here?' The ideas and directions provided here are intended to inform planning and management decision-making at the regional level. 'R&D Tips' are provided to direct you to institutions and programs that are major players in furthering research in the area.


What are 'the Audit' and 'the Atlas'?

The National Land & Water Resources Audit ('the Audit') conducted the first Australia-wide assessment of our natural resources from 1997 to 2002. The dryland salinity assessment focused 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.

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

Its strategic plan covering 2002 to 2007 is available on the Audit web-page.



A checklist of the 'Actions' and 'R&D Tips' highlighted throughout Questions 1 to 5 is then provided, followed by a chapter on 'Where to get help', which compiles contacts, information, products and services. The contacts go beyond a list of institutions to helping you find the specific services you need to support catchment planning and management in addition to the 'R&D Tips'. A full list of references is provided in the concluding chapter.

This directory is available in hard copy and CD-ROM, with a summary brochure accessible on-line via the NDSP web-site (www.ndsp.gov.au). The CD-ROM provides electronic links to reports, including summary booklets, technical reports and NDSP *TechNotes*. These links plus a 'search' facility enable you to readily find the level of detail required. Maps, posters and a glossary of terms also feature on the CD-ROM.

WHY HAS THIS INFORMATION BEEN PROVIDED?

The NDSP has existed for 10 years, and has made a significant contribution to understanding dryland salinity across Australia. The States and the Australian Government have worked together in a coordinated way to address the problem, together with financial support from some rural industry groups. Research and development has been undertaken that would be beyond the scope of a single State or organisation, and we have moved from a state of little knowledge to having a more comprehensive understanding of the problems, the knowledge gaps and the actions needed to move forward.

There is far more activity in progress now to tackle dryland salinity than in 1993 at the genesis of NDSP. Regional models emphasising community engagement in priority-setting and resource allocation have developed across Australia. Regional planning needs to ensure that it continues to draw on the most up-to-date thinking, and this directory is pivotal in encapsulating the learnings from and beyond the NDSP at the catchment scale to-date.

Dryland salinity and its linkages to water quality and quantity and other natural resource management issues are very complex. We do not have the resources to investigate and develop a detailed understanding of these linkages and potential solutions in all areas where salinity occurs in Australia. We will always need to take the lessons from detailed studies in one part and apply them as best we can elsewhere. We will need to make 'best bet' judgements, and learn from both our achievements and mistakes.

We have relatively few experts to share across a vast landscape, so we need to be smart about allocating their time and our resources. Increasingly, investigations on dryland salinity are being initiated at the regional level to inform the implementation of catchment management plans. It will be important for regions to share information and think beyond the boundaries of their catchments if we are to succeed in managing dryland salinity and protecting our natural resources and other important assets at the continental scale.

The information provided here for catchment managers showcases the wealth of information available and encourages its application. It points out the gaps and where future investigations would yield significant benefits. Importantly, it also highlights the inter-dependencies between natural resource issues and between regions in tackling dryland salinity, and the benefits of on-going collaboration and cooperative research and information sharing.

WHERE IS THE INFORMATION APPLICABLE?

The information provided in this directory can apply across Australia to catchments with potential for dryland salinity, and has particular relevance to regional natural resource management groups. Dryland salinity, water quality, water yield and biodiversity issues rank highly in the on-going process of catchment planning and investment. This directory aims to support these regional planning and investment processes by pointing catchment managers to appropriate and cost-effective solutions.

The directory gives particular emphasis to the concept of a *Groundwater Flow Systems Framework*⁸ in transferring information and understanding between parts of Australia, as well as providing an integrating mechanism for better understanding the connections between natural resource management issues.

HOW CONFIDENT ARE WE IN THE INFORMATION?

The information presented in this directory is drawn from research and resources of varying detail, and therefore varies in how confident we can be in using it. Specific comments are provided throughout on issues of confidence, especially with respect to data and modelling outputs.

The issue of scale is important to highlight – while we can be confident about using certain information at one scale, it does not necessarily mean that it can be applied with the same level of confidence at a different scale. The *Groundwater Flow Systems Framework* is a typical example, where maps at various scales (1:5,000,000, 1:1,000,000, 1:250,000 and 1:100,000) are designed for different decision-making processes.

Our confidence in data, information and understanding varies significantly between regions. While most research investments at a regional level are based on the premise of being able to transfer the results elsewhere, this is often difficult in practice as the Australian landscape is so variable. This is why the *Groundwater Flow Systems Framework* offers great promise, as it provides a tool to extrapolate between well and poorly studied landscapes and improves our confidence in making management decisions. At the broad scale, it also informs the first cut process of prioritisation.

WHEN SHOULD THE INFORMATION BE USED?

While many catchments have finalised plans and investment strategies for managing dryland salinity, water yield, biodiversity and other natural resource issues based on the best available information, it will be important to keep abreast of new information and manage dryland salinity adaptively in this light.

The setting of salinity targets isn't the endpoint, but rather one measure of progress to inform the on-going process of decision-making. Information and understanding about dryland salinity and its relationship to other natural resource management issues will continue to grow and evolve, and you will need to embrace and adapt to new knowledge and technology along the way.

The planning cycle for catchment management is on-going – it's never too late for new information to inform your decision-making processes.

