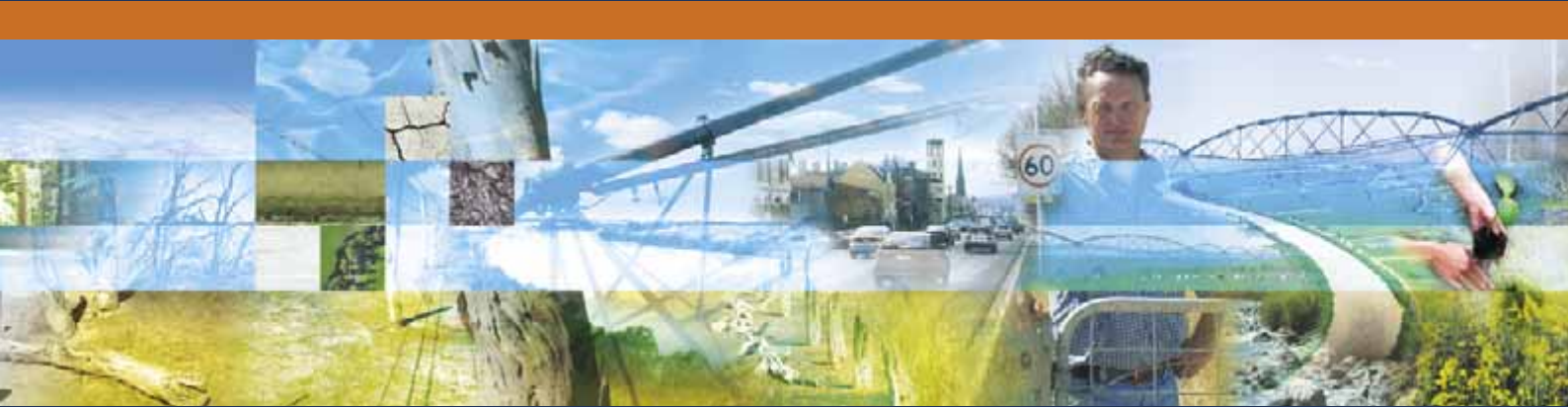


Breaking Ground – Key Findings and Research Outcomes from 10 Years of Australia's National Dryland Salinity Program

An Overview



National
**DRYLAND
SALINITY**
Program

*Know-how
to tackle salinity*

Breaking Ground – Key Findings and Research Outcomes from 10 years of Australia's National Dryland Salinity Program – An Overview

INTRODUCTION

Over the last decade, Australians have gained a much greater awareness of dryland salinity – its extent, the damage it has caused and the risks it poses – and a much better understanding of the causes of salinity and what we might do to manage or prevent it. Between 1993–2003 Australia's National Dryland Salinity Program (NDSP) has been a leader in both this awareness raising and knowledge generation.

The great strength of this national program has been its capacity to bring together many of Australia's leading hydrogeologists, soil scientists, agronomists, economists, social scientists and policy advisers – all contributing to our greater understanding of salinity and its implications for-the nation. It has done this by forging a collaborative partnership between Australian and State Government agencies, CSIRO, the Murray–Darling Basin Commission and industry Research-and Development Corporations. Alongside this research effort, the NDSP has implemented an effective communication and knowledge brokering strategy, informing and engaging stakeholders, and culminating with the three synthesis documents developed here.

The NDSP ran over two five-year phases, commissioning, coordinating and managing around 50 major research projects with an investment value of almost \$25 million. In that time, it harnessed the skills and experience of nearly 300 researchers, technical assistants, consultants and policy-advisers.

BRINGING IT ALL TOGETHER...

An NDSP forum in 2003 provided an opportunity for all the research teams to report on their achievements during the second phase of the program. This forum conveyed an unmistakable message that the NDSP really had dramatically advanced our knowledge and understanding of dryland salinity. Not only had it challenged and overturned many of the assumptions of a decade ago, it had unlocked doors to understanding the processes and managing the outcomes, and had put into perspective the relative impacts that salinity has on different aspects of the economy, the environment and society.

Perhaps the most significant conclusion to be drawn from the 2003 forum was that the NDSP has been far more than 50 research projects. The outcomes of these projects are interrelated and add value to each other. They also add great value and derive further value from research done outside of the NDSP. In this context, overall outcome of the research conducted by the NDSP is much more than just the sum of its parts.

Recognising the value of its research, the NDSP Management Board proposed that a further year should be dedicated to harvesting this new knowledge and making it readily available to the diverse range of stakeholders who stand to benefit from it – the policy makers, the strategic planners particularly at the regional and catchment level, those organisations and individuals who advise farmers and other land managers and indeed the farmers and land managers themselves.



...AND MAKING IT ACCESSIBLE

There were two major challenges inherent in this communications proposal. First, like other natural resource issues, dryland salinity is a function of many interacting biophysical and biochemical processes, and our response to salinity is influenced by social, economic, cultural and policy factors. How do we bring all this together in a coherent 'story' that is useful to the reader? Second, much of the research that has been conducted over the past decade is already 'out there'. There is a great deal of information available about salinity, much (but not all) of it reliable and useful. The problem is that it is seldom accessible – how do we find the information that is relevant to our situation, at the level appropriate to our needs, and how do we even know where to begin in our search for the right-information for our particular circumstances?

The NDSP confronted these basic questions by establishing **three teams** to draw together all significant available information on:

- The key findings that have emerged from 10 years of the NDSP;
- Dryland salinity and catchment management; and
- On-farm decisions and catchment outcomes.

A fourth team was set up to road test these materials with salinity management networks nationally and regionally and advise on any changes that would improve the accuracy, comprehensiveness, relevance and accessibility of the material.

These teams brought together the technical skills of specialist technical writers, the NDSP Operations Committee along with communications skills from the NDSP Communications Coordinators. Their brief was to gather all the available research into a one-stop-shop, but being aware that a document that looked like a doorstop would probably be used as one.

Each team has distilled the information from the relevant NDSP research and integrated this with known research from other sources. The result is three documents designed specifically to assist busy people who need to access the right information quickly.

The first of these documents, *Breaking Ground*, summarises the six key messages that emerge from this decade of research. These messages provide a broad sweep across the evolution of our understanding in that time, the options available to and the limitations imposed upon salinity managers, and the important remaining gaps in our-knowledge.

The other two documents are resource directories – they are not 'how to' manuals and they are not designed to be read from cover to cover. Rather, they have been designed to allow us to dip in and out, accessing just what we need at the level we need it.

The power of the *Catchment Management* and the *On-Farm Decisions* directories comes from the summary of information extensive referencing that brings users to the level of detail they need. These references range from brief *TechNotes* for readers who, at least initially, want little more than a project summary, through to medium length workshop papers and finally to comprehensive



Breaking Ground – Key Findings and Research Outcomes from 10 years of Australia's National Dryland Salinity Program – An Overview

It is one thing to have a reference cited, it is another to have that reference material provided. This is the great strength of the CD-ROM that features all three documents, covered by a search engine, with links to the vast majority of the cited material as downloadable reports or as relevant web-sites. The length to which the NDSP Communications Team has gone to obtain digital versions of this reference material has highlighted just how important this contribution will be.

Both the *Catchment Management* and the *On-Farm Decisions* directories carry a comprehensive 'help' section (with web-links to the web-site of each 'helpful' product, agency or organisation) and a glossary.

All three documents and the CD-ROM have been thoroughly reviewed by focus groups in six States—and redrafted or edited in response to this feedback. Gathering and incorporating informed comment from almost 150 stakeholders from State government agencies, local government, catchment management authorities, researchers, industry, Landcare groups, farmers and farmer groups across all States has been a huge undertaking for the NDSP, but has built further confidence into the final products.

Importantly, research into salinity continues after the NDSP. The CRC for Plant-based Management of Dryland Salinity has a significant portfolio of research projects and will continue to maintain several of the NDSP's successful communications tools: the national newsletter *Focus on Salt*; the landholder case studies, *SALT Magazine*; and the e-mail listserv, *Saltlist*.

KEY FINDINGS

In its second phase, the NDSP invested in research across seven themes:

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

Breaking Ground – Key Findings from 10 years of Australia's National Dryland Salinity Program (NDSP) reveals that the more you know about salinity the more you realise you don't know.

A-decade of NDSP research has provided many answers, but also demonstrates that there is still-much to be done if we are to confidently identify the best management strategies for salinity in diverse situations. Tension still exists between farm and catchment-scale outcomes given conflicting national cost/benefit decisions made in respect to the options available at the respective scales.

Over the period of this research the focus has shifted from salinity as largely an issue for agriculture, to an increasing awareness of the impact on infrastructure. While the research has given us valuable insights into the causes and the impacts, practical and economic solutions are still elusive and their effects may not be felt for decades. This highlights the importance of integrating salinity management with other natural resource management strategies, but also points to the likelihood that in some cases we will have to live with salinity and we need to find ways to make that practical and acceptable.





In the light of this research, added to that of the first phase, **six key messages** emerge to guide our future response to salinity:

1. Salinity costs are significant and rising, hence responses 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 ratio of revegetating catchments requires careful analysis.
6. Lack of capacity is an important, but secondary constraint to managing salinity.

Many R&D priorities are identified in the Breaking Ground report, but the three highest priorities are:

1. **Developing the means to value environmental benefits:** so that decisions based on alternative salinity management options takes into account the full range of value at stake in decisions;
2. **Developing profitable industry solutions:** so that economically, environmentally and socially feasible options are in the hands of those managing the vast majority of Australian landscapes;
3. **Reconciling farm and catchment decision tradeoffs:** so that the potential conflicts in rational decisions at one scale with rationale decisions at another are minimised in the meantime (awaiting the outcomes of priority 2).

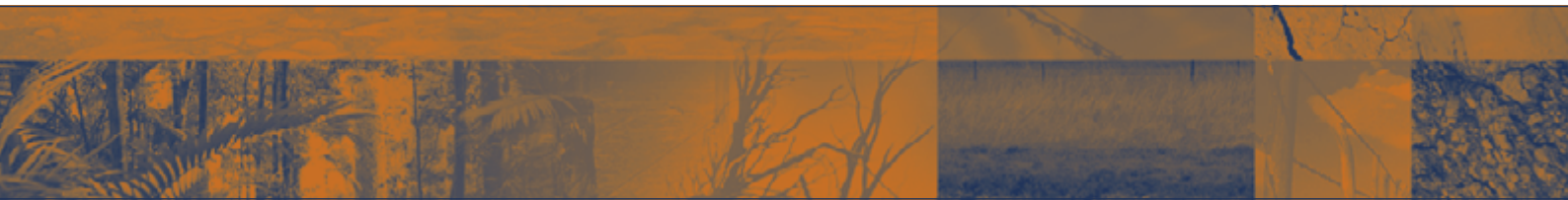
DRYLAND SALINITY AND CATCHMENT MANAGEMENT

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

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.





This directory 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?*

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*¹, together with *Understanding dryland salinity*², which summarised 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, suggesting a way to proceed.

Each Action uses three indicative codes on ‘Cost’, ‘Time’ and ‘Confidence’ to further inform the regional decision-making processes. The ‘Cost’ code refers in very general terms 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 we implement the action – if the confidence is low, it is generally a consequence of limited examples of implementation or of mixed results.

While the review of information has been extensive, some examples of local and regional research will be missing and we 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. We will see that the answers to these five major questions are inevitably 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 us to institutions and programs that are major players in furthering research in the area.

A checklist of the ‘Actions’ and ‘R&D Tips’ highlighted throughout Questions 1 to 5 is then followed by a chapter on ‘Where to get help’, which compiles contacts, information, products and services. The contacts go beyond a list of references to helping us find the specific services we 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 version accessible on-line via-the NDSP web-site (www.ndsp.gov.au). The CD-ROM provides electronic links to all key reports, including summary reports, technical reports and NDSP *TechNotes*. These links plus a ‘search’ facility enable us to readily find the level of detail required. Maps, posters and a glossary of terms also feature on the CD-ROM.

ACTION #4.3

Refer to the table on ‘Suitability of options for managing dryland salinity’ in the ‘Tools Regional Information Package’ for your region (or as a model to develop your own) to identify broad management options and ratings for each groundwater flow system-type.



R & D TIP #4.1

Consider the ‘National Evaluation Framework’ project as a foundation from which to build benchmarking, monitoring and evaluation mechanisms at all scales of salinity management, using consistent and transferable approaches, and drawing on adequate and reliable data.

DRYLAND SALINITY: ON-FARM DECISIONS AND CATCHMENT OUTCOMES

Dryland Salinity – On-Farm Decisions and Catchment Outcomes – a Guide for Leading Producers and Advisors is intended as a reference document for proactive producers who lead (for example) regional Landcare networks and large-scale (possibly State-wide) conservation farming and grazing groups. These producers influence development of salinity management options, industry research and development programs, and community/government salinity management initiatives.

It will also be useful to experienced extension advisors who facilitate liaison between the above groups and between the groups and State agencies and regional catchment management organisations. These advisors influence agricultural extension and natural resource management programs and community/government salinity management initiatives.

This report adds significant value to other salinity management guides by reviewing actual case studies that indicate the amount or level of farm to catchment-scale outcomes that can be expected from applying different combinations of options in different situations.

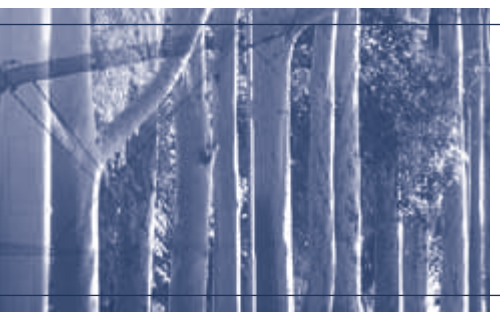
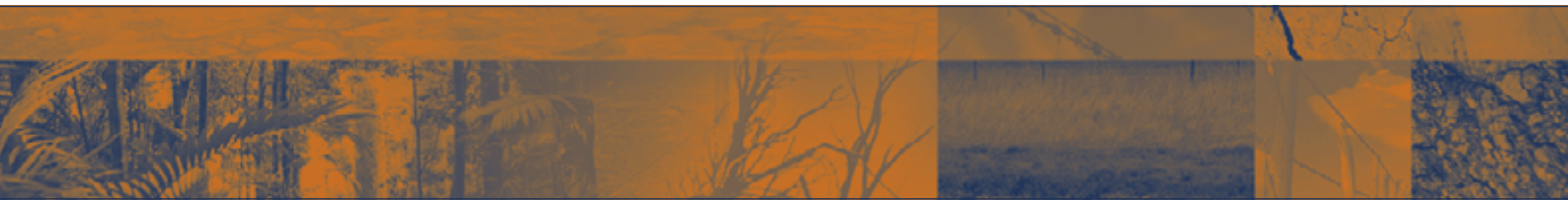


Important points

1. This report is not intended for the broad producer community. Most NDSP and associated research from 1993 to 2003 has been regional to national in scale, and was aimed primarily at providing the science to underpin government and industry-wide responses to salinity.
2. State agencies and catchment management organisations are collating results of on-farm demonstrations and field experiments addressing salinity in their local area, interpreting them in the light of regional to national scale research, and developing salinity management information for the broad producer community.
3. Producers requiring basic information about salinity should:
 - Talk with their local advisors, including extension staff in State agencies, catchment management organisations, agribusiness companies, non-government organisations, and private consulting firms; and
 - Read some of the comprehensive publications concerning salinity including, for example the book *Assessing the causes, impacts, costs and management of salinity*, the *Salinity Management Handbook* and the *TOOLS Salinity Information Package*.

Within the limitations of regional to national scale studies undertaken by the NDSP and associated research, this report makes as much progress as possible in providing answers to key farm-scale questions:

- Is salinity likely to be severe enough to justify action?
- If action is justified, is there sufficient knowledge about salinity processes, impacts, and management options to decide on the best approach and preferred management options?



- In assisting producers and advisors to obtain answers to these questions, this report guides them through the following decision-making sequence:
 - Assessing salinity risk (and the nature of the salinity problem);
 - Short-listing possible approaches to managing it;
 - Reviewing tactics and management options;
 - Considering possible farm to catchment-scale outcomes from implementing the options;
 - Deciding on the best approach or approaches; and
 - Confirming preferred tactics and options.

A salinity management matrix, based on information from actual case studies, shows how the various factors in decision-making can fit together and the possible outcomes of those decisions. The matrix summarises, for different groundwater flow systems in different catchments and-regions:

- The nature of the salinity problem being addressed (i.e. land or stream salinisation).
- Approaches to salinity management being adopted or considered.
- Tactics being employed or researched.
- Management options being implemented or researched.
- Level or amount of change expected from implementing the options.

5. CONSIDERING POSSIBLE FARM TO CATCHMENT-SCALE OUTCOMES

5.2 SALINITY MANAGEMENT MATRIX, BASED ON MAJOR CASE STUDIES

| ISSUES/CONSTRAINTS/STAKEHOLDER CONCERNS | DESCRIPTION | NATURE OF CATCHMENT | NATURE OF THE SALINITY PROBLEM | APPROACHES | TACTICS | OPTIONS | POSSIBLE FARM TO CATCHMENT-SCALE OUTCOMES |
|---|--|---------------------------|--------------------------------|---|--|---|---|
| Soil | High salt content in soils, especially in the (sub)surface | Wetlands, low-lying areas | Land salinisation | Policy development, farm-level action, soil reclamation | Soil reclamation, soil reclamation, soil reclamation | Reclamation of saline soils, reclamation of saline soils, reclamation of saline soils | Salinity reduction is difficult to achieve, but soil reclamation is possible. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. See case study 11 |
| Water | High salt content in groundwater, especially in the (sub)surface | Wetlands, low-lying areas | Land salinisation | Policy development, farm-level action, soil reclamation | Soil reclamation, soil reclamation, soil reclamation | Reclamation of saline soils, reclamation of saline soils, reclamation of saline soils | Salinity reduction is difficult to achieve, but soil reclamation is possible. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. See case study 11 |
| Soil and groundwater | High salt content in soils and groundwater, especially in the (sub)surface | Wetlands, low-lying areas | Land salinisation | Policy development, farm-level action, soil reclamation | Soil reclamation, soil reclamation, soil reclamation | Reclamation of saline soils, reclamation of saline soils, reclamation of saline soils | Salinity reduction is difficult to achieve, but soil reclamation is possible. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. See case study 11 |
| Soil and groundwater | High salt content in soils and groundwater, especially in the (sub)surface | Wetlands, low-lying areas | Land salinisation | Policy development, farm-level action, soil reclamation | Soil reclamation, soil reclamation, soil reclamation | Reclamation of saline soils, reclamation of saline soils, reclamation of saline soils | Salinity reduction is difficult to achieve, but soil reclamation is possible. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. See case study 11 |
| Soil and groundwater | High salt content in soils and groundwater, especially in the (sub)surface | Wetlands, low-lying areas | Land salinisation | Policy development, farm-level action, soil reclamation | Soil reclamation, soil reclamation, soil reclamation | Reclamation of saline soils, reclamation of saline soils, reclamation of saline soils | Salinity reduction is difficult to achieve, but soil reclamation is possible. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. See case study 11 |
| Soil and groundwater | High salt content in soils and groundwater, especially in the (sub)surface | Wetlands, low-lying areas | Land salinisation | Policy development, farm-level action, soil reclamation | Soil reclamation, soil reclamation, soil reclamation | Reclamation of saline soils, reclamation of saline soils, reclamation of saline soils | Salinity reduction is difficult to achieve, but soil reclamation is possible. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. See case study 11 |
| Soil and groundwater | High salt content in soils and groundwater, especially in the (sub)surface | Wetlands, low-lying areas | Land salinisation | Policy development, farm-level action, soil reclamation | Soil reclamation, soil reclamation, soil reclamation | Reclamation of saline soils, reclamation of saline soils, reclamation of saline soils | Salinity reduction is difficult to achieve, but soil reclamation is possible. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. See case study 11 |
| Soil and groundwater | High salt content in soils and groundwater, especially in the (sub)surface | Wetlands, low-lying areas | Land salinisation | Policy development, farm-level action, soil reclamation | Soil reclamation, soil reclamation, soil reclamation | Reclamation of saline soils, reclamation of saline soils, reclamation of saline soils | Salinity reduction is difficult to achieve, but soil reclamation is possible. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. See case study 11 |
| Soil and groundwater | High salt content in soils and groundwater, especially in the (sub)surface | Wetlands, low-lying areas | Land salinisation | Policy development, farm-level action, soil reclamation | Soil reclamation, soil reclamation, soil reclamation | Reclamation of saline soils, reclamation of saline soils, reclamation of saline soils | Salinity reduction is difficult to achieve, but soil reclamation is possible. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. Soil reclamation is possible in some areas, but not in others. See case study 11 |



An appendix provides additional information about impacts, priority areas for action, and recommended management options for producers and advisors who may not be covered by the case studies. A further appendix contains a brief summary of the findings of recent reviews of the effectiveness and possible outcomes of engineering options.

Like the Catchments directory, this directory is available in hard copy and CD-ROM, with a summary version accessible on-line via the NDSP web-site (www.ndsp.gov.au). The CD-ROM provides electronic links to all key reports, including summary reports, 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.



FURTHER INFORMATION

The National Dryland Salinity Program ended 30 June 2004. This summary document provides an overview of the key findings and management actions featured in the larger synthesis reports prepared as a part of the Program's final year. These resources will provide ongoing access to the knowledge generated by the NDSP and ensure a continuing legacy for the Program's significant body of research.

The complete findings outlined in this summary, together with supporting resources are available on the CD-ROM *Managing Dryland Salinity in Australia – Key Findings, Research Directory and Action Manual from Australia's National Dryland Salinity Program* (EC030652).

Catchment Managers, Farm Advisors and Producers who (for example) lead regional Landcare networks or conservation farming and grazing groups may also find it useful to obtain hard copies of the following:

- Dryland Salinity and Catchment Management – A resource directory and action manual for Catchment Managers (PX040649)
- Dryland Salinity: On-Farm Decisions and Catchment Outcomes – A guide for leading producers and advisors (PX040651)

Please note: both of these publications are also included on the CD-ROM.

To order a copy of these and other Land & Water Australia resources you can:

- complete and fax or post the order form at the back of this summary
- order online from the Land & Water Australia online catalogue www.lwa.gov.au/catalogue
- telephone Canprint Communications, Freecall 1800 776616 and quote the product number (in brackets after each title)

Despite the completion of the National Dryland Salinity Program, research on the critical natural resource issue of dryland salinity will be continued by research organisations throughout Australia, including the CRC for Plant-Based Management for Dryland Salinity.

The CRC will also continue to publish two journals initiated by the NDSP:

- SALT Magazine – to communicate productive, profitable solutions for dryland salinity, and
- Focus on Salt – updates of the CRC's R&D and other investments, dryland salinity initiatives, management options, events and activities and news from your region

For more information about the CRC and to subscribe visit <http://www1.crcsalinity.com.au/index.asp>

Land & Water Australia will ensure that the findings from the more than ten years of research completed by the NDSP will remain available to the public by:

- continuing to host the NDSP website www.ndsp.gov.au, and
- distributing NDSP products and other research outputs, *mostly free* of charge.

Published by: Land & Water Australia
Postal Address: GPO Box 2182
CANBERRA ACT 2601
Office Location: Level 1, Phoenix Building
86 Northbourne Ave
BRADDON ACT
Telephone: 02 6263 6000
Facsimile: 02 6263 6099
Email: Land&WaterAustralia@lwa.gov.au
Internet: <http://www.lwa.gov.au>

© Land & Water Australia 2005

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

Disclaimer:

The information contained in this publication is intended for general use, to assist public knowledge 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, and Australia's National Dryland Salinity Program and its partners do not assume liability of any kind whatsoever resulting from any person's use or reliance on the content of this document.

Publication data:

Breaking Ground – Key Findings and Research Outcomes from 10 years of Australia's National Dryland Salinity Program: An Overview (second edition)
Product code: PK050997
Designed and Typeset by ZOO
Printed by Paragon Printers
October 2005

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



National Land & Water Resources Audit
An Initiative of the Natural Heritage Trust



State Governments of South Australia, New South Wales, Queensland, Western Australia, Victoria and Tasmania.

National
**DRYLAND
SALINITY**
Program

*Know-how
to tackle salinity*