Inquiry into the extent and economic impact of salinity

Senate Environment, Communications, Information Technology and the Arts Committee

CSIRO submission

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Acronyms used

CIRM	Centre for Integrated Research Management
CMA	Catchment Management Authority
CNRM	Centre for Natural Resource Management
CRC	Co-operative Research Centres
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture, Fisheries and Forestry
GRDC	Grains Research and Development Corporation
JVAP	Joint Venture Agroforestry Program
LWA	Land and Water Australia
MDBC	Murray Darling Basin Commission
MLA	Meat and Livestock Australia
NAP/NHT	National Action Plan/Natural Heritage Trust
NDSP	National Dryland Salinity Program
NRM	Natural Resources Management
RDC	Research and Development Corporation
WfHC	Water for a Healthy Country

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Executive Summary

National coordination and science brokering

- Natural resources systems are complex and effective catchment management planning will need to integrate the results and findings from a wide range of different but connected disciplines from biophysical, economic and social sciences.
- The flow of quality scientific and technical information, albeit greatly enhanced by NAP/NHT, still needs to be considerably improved, potentially through a focused body comprised of key scientists and major stakeholders that interfaces closely with Catchment Management Authorities, State Agencies and the Commonwealth.
- The benefits of a coordinating research and implementation structure across Australia are undeniable and with the demise of the NDSP and no obvious succession strategy, there is a pressing need for a similar initiative.
- There is a strong need for national salinity research coordination and a science brokering process that facilitates access to biophysical, social and economic research. Regional planners need to be able to have *access to and input in* quality science to underpin their management plans.
- While there is often detailed knowledge of specific research subjects and sites, and knowledge of broad scale processes, there are significant challenges in integrating current knowledge across the range of scales needed to apply it to landscapes, regional and paddock scales.
- There is a need for an information brokering structure accessible by NRM planners that provides up-to-date information and assistance. Such a structure should also provide a forum for planners, decision makers and scientists to exchange ideas to identify research gaps and signpost new research avenues.
- A governing structure that acts as an overarching coordinating entity to guide investment, planning and extension is needed.

Regional coordination

- Regional groups are operating at vastly different levels in terms of their ability to be informed purchasers of science, to integrate science into their plans and to manage that information over the long term.
- The level of difficulty presented by the devolution of NRM responsibility to the regions highlights the need for more region-specific and targeted coordination efforts that enable proper assessment of the issues (triple bottom line) and the development of plans consistent with local needs, but providing a regional impact.
- The use of regional targets for natural resource outcomes and regional investment plans provides a framework for setting priorities.
- The CSIRO Water for Healthy Country Flagship Program is a good example of an emerging country-wide NRM-focused partnership initiative.

Research gaps

- Significant progress had been made in salinity research, but there are still some critical gaps in our understanding that need to be addressed to assist NRM planners:
- Broad-scale salinisation process understanding is now being used operationally for prioritization purposes (groundwater flow systems), but when it comes to implementation and enterprise scale, there are data and knowledge gaps that impede both effective on-ground action and monitoring for management plans effectiveness.
- Climate change and variability are key drivers in salinity and future water resources management. Better understanding of their implication for NRM planning is essential.
- There are too few sustainable and financially attractive solutions for salinity. Additional research is needed in the development and design of combined biophysical and engineering solutions for salinity that NRM planners can chose from.

Introduction

The implementation of the National Action Plan/Natural Heritage Trust (NAP/NHT) has led to significant progress in the understanding at community level of the key processes that cause a deterioration in salinity and water quality as well as in the development of strategies and management practices to combat the land and water degradation resulting from them. It has also fostered a greater regional and community engagement in Natural Resources Management and considerable progress has been achieved in establishing processes to facilitate the uptake of science and technology in catchment management planning procedures.

In our view, it is less certain whether the NAP/NHT have established sufficient mechanisms to efficiently transfer new scientific information and understanding from research and development agencies such as CSIRO and the CRCs to catchment management authorities. We do of course recognise that this criticism also potentially reflects on the former organisations. What is certain, however, is that natural resources systems are complex and that effective catchment management planning will need to integrate the results and findings from a wide range of different but connected disciplines from biophysical, economic and social sciences.

Have goals of national programs to address salinity been attained, including those stated in the National Action Plan for Salinity and Water Quality, National Heritage Trust and National Landcare programs?

Research access

The success of Federal Programs hinges to a large extent on the level of knowledge and expertise of the agencies and individuals charged with the development and implementation of catchment management strategies and plans. Currently, the level of expertise across catchment management authorities and agencies varies considerably across Australia and there is no consistent way of assessing the validity and relevance of management strategies and plans against NRM objectives and targets.

A review of current management plans suggests that relevant science and technology has been captured but that it is often not being applied appropriately to the problems being addressed. The complex nature of NRM is largely at the core of that issue, and a better shared understanding of targets and strategies and better interactions between R&D agencies and regional groups are needed.

The flow of quality scientific and technical information, albeit greatly enhanced by NAP/NHT, still needs to be considerably improved, potentially through a focused body comprised of key scientists and major stakeholders that interfaces closely with Catchment Management Authorities, State Agencies and the Commonwealth.

Research coordination

In recent years, the environment for application of salinity science has changed significantly as the awareness of salinity grew to make it a nation-wide NRM priority. Unfortunately, 2004 witnessed the demise of the National Dryland Salinity Program (NDSP), the only salinity research funding and coordinating entity operating across Australia. Its principal aim was to initiate and coordinate relevant research at a national level and to play a major role in developing communication networks between researchers, regional groups and policy.

The benefits of a coordinating research and implementation structure across Australia are undeniable and with the demise of the NDSP and no obvious succession strategy, there is a pressing need for a similar initiative.

Without any coordination at either State or Commonwealth level, there is a real risk of:

- disconnection between science providers and NRM implementation;
- lack of investment in strategic research required to overcome knowledge gaps underpinning regional plans;
- lack of uptake of new technology;
- lack of coherence between different regional plans and monitoring;
- failure to learn from mistakes made by others;
- lack of acceptance of lessons coming from science;
- greater influence of local interest groups; and

- lack of a regulatory framework to ensure best management practice for engineering schemes.

The way in which each State has responded to addressing this issue has varied considerably.

For example, South Australia has formed a Centre for Natural Resource Management (CNRM) which aims to broker research on NRM issues. CNRM is a partnership between state government, CSIRO and the South Australian universities. With respect to NAP, the CNRM has reviewed all current regional plans, held workshops with regional groups to discuss their knowledge gaps, prioritised research needs to underpin the regional investment and identified appropriate research providers. In Queensland, the Centre for Integrated Research Management (CIRM) has existed for a number of years, but its role has changed recently to be similar to the CNRM. In Victoria, state-wide (non-regional) programs have been formed to transcend regional investigation priorities. New South Wales has a state-wide Salinity Strategy operating through Catchment Management Authorities.

From a research point of view, a number of research providers and funding bodies are operating in the realm of salinity. Several CRC's have NRM issues, in particular salinity, identified as part of their business plan, but a smaller number have salinity as a major component:

- CRC-Plant Based Management of Salinity is primarily focussed on developing biological/farming systems to reduce recharge or adapt to saline conditions;
- CRC-Landscape Evolution and Mineral Exploration, as part of its second round, is developing regolith[1] science to support salinity management; and
- CRC-Catchment Hydrology is developing modelling tools relating end-of-valley targets from CMAs to land-use change.

The Research and Development Corporations (RDCs) also provide substantial funding for NRM research. Land and Water Australia (LWA) has historically been a good provider of funding for salinity research, but over the last five years has had reduced funding. Many of the other RDCs have traditionally been production-oriented and have provided little, if any, support for sustainability issues. The recent changes in Commonwealth funding towards regions through the NAP should have addressed this issue, but it is still too early to see whether this has actually occurred.

A recent example of a well-coordinated program is the Sustainable Grazing Systems on Saline Land, jointly funded by LWA and Meat & Livestock Australia. An interstate research program has been developed towards sustainable productive saline systems, together with a producer network and demonstration sites. This system provides a good model for relating research with end-users. Another example is the joint CSIRO/DAFF Commercial Environmental Forestry project which seeks to quantify the key elements of the investment framework required for strategic tree planting in low rainfall environments for reducing river salinity in the Murray Darling basin.

A longer-term example is the Joint Venture Agroforestry Program (JVAP). This program incorporates a partnership between Rural Industries RDCs, LWA, Forest and Wood Products RDC and the Murray Darling Basin Commission (MDBC) aimed at agroforestry systems for sustainable landscapes and has supported some key sustainability projects.

The Grains Research and Development Corporation (GRDC) has supported water balance work on phase farming, but up to now supported very little catchment-scale work. While the RDCs have good programs for bringing research into implementation, they have not linked well, if at all, into the recent regional planning process.

The MDBC, representing the Commonwealth and five state/territory governments in the Murray-Darling Basin, has funded research and investigation activities through its Strategic Investigations and Extension Program. This program is aimed at overcoming knowledge gaps related to implementation of its programs and associated policy development and occurs through the agreement of the respective governments.

Another example is the CSIRO-led "Heartlands Initiative" which, over a five-year period, has been able to combine biophysical modelling and on-

1 Regolith is the surficial mantle of weathered rock, sediments, soils and biotic complexes that are formed by the natural processes of weathering erosion and transportation.

ground research and implementation with communities and agencies to provide a robust framework for land-use change aimed at salinity mitigation and other NRM issues in the Southern MDB.

As illustrated above, research ability and good will are certainly not lacking, but there is a need for cohesion and coordination with regards to salinity funding and research across the county. CSIRO does not have a charter to coordinate research activities at Commonwealth level, but recognising the need for integrated triple bottom line research in NRM, it established the Water for a Healthy Country (WfHC) Flagship Program, a science partnership that will provide information and management opportunities to regions to improve the benefits Australia gains from its water resources. The Flagship Program will also deliver the science required to underpin the implementation of various Federal, State and regional water resource management strategies (quality, quantity, sustainability).

What is the role that regional catchment management authorities are required to play in management of salinity-affected areas, and what are the legislative and financial support available to assist them in achieving national goals?

Access to scientific expertise

The NRM challenge faced by regional CMAs is immense. NRM requires integration and interpretation of scientific theory and knowledge across specific scientific disciplines that have often operated in relative isolation from one another.

While there is often detailed knowledge of specific research subjects and sites, and knowledge of broad scale processes, there are significant challenges in integrating current knowledge across the range of scales needed to apply it to landscapes, regional and paddock scales. It is not surprising that both practitioners and users of science are having difficulty coming to grips with the complexities of managing both natural and developed ecosystems.

Regional groups are operating at vastly different levels in terms of their ability to be informed purchasers of science, to integrate science into their plans and to manage that information over the long term.

There is a need for an information brokering structure accessible by NRM planners that provides up-to-date information and assistance. Such a structure should also provide a forum for planners, decision makers and scientists to exchange ideas to identify research gaps and signpost new research avenues.

Scientific and institutional challenges

There have been a number of lessons learnt from the NDSP, the National Land and Water Resources Audit 2000 (NLWRA), other “audits” and research outcomes over the last 30 years. In considering this, it is obvious that salinity cannot be considered in isolation, but must be included with other NRM issues and socio-economic considerations. The key lessons learnt include:

- The public and private investment required (money, technical resources, extension services, landholder time commitment, community representatives etc) to shift to sustainable land and water management is massive, will need greater resources and will take decades to achieve. The use of regional targets for natural resource outcomes and regional investment plans provides a framework for setting priorities. This allows instant action to mitigate some problems while allowing planning now for the issues, which will take a longer time to achieve a positive change.
- There are thresholds for the degree of intervention required to reverse trends on individual ground water systems. Hence there is a need for a triage approach to salinity management for both public and private investment – some major assets (water resources, biodiversity areas of international significance, urban areas, etc.) can justify the major intervention required to protect them while other areas need to be managed to minimise the adverse impacts and maintain ecological function. Any remaining areas will require management that adapts to the more saline conditions. We need to be able to provide spatially explicit information to determine most appropriate responses. Without a robust investment prioritisation framework, there is a risk of widespread inappropriate intervention (method and scale).

- Currently, there is a limited range of robust profitable farming/biological systems that will reduce recharge to the extent required to make a significant difference to the salinity problem. It is imperative that more innovative systems be developed and current systems modified to be appropriate for the Australian landscape. For example, developing tree-based systems that can also provide carbon sequestration, biodiversity and other benefits as well as salinity mitigation. We need to recognise that there may be significant time delays in developing these new systems, understanding where in the landscape they would be appropriate, having them adopted and for the new systems to reverse salinity trends. There are some existing systems that can improve the 'perenniality' of the system. These systems should be encouraged where it is sensible to do so.
- Our conceptual understanding of salinity processes is generally good. However to manage salinity we need to be able to understand the spatial variability of these processes. Given the complexity of the landscape and the large areas associated with salinity, there is a need to broadly categorise large areas quickly in order to focus areas of effort and techniques for detailed characterisation of the landscape in these identified areas.
- Climate variability is a major factor that governs (and brings a large uncertainty) to Australian water resources. This ranges over rainfall, evaporation, water storages, streamflow and groundwater recharge. All these factors are significant to salinity control strategies (dilution flows, recharge control). Increased national capability in using understanding of the climate system is making seasonal and multi-seasonal climate forecasts on a regional scale a reality that has not been available before. This capability should be integrated with water resource management and strategies to counter salinity. Climate change (due to anthropogenic contributions to the greenhouse effect; i.e. global warming) is going to be a major future factor in the management of Australian water and natural resources. It will affect rainfall, temperature, and evaporation. Climate change has to be factored into process understanding and development of salinity management options. There is a need for a Systems Approach that integrates biophysical social and economic aspects of management to maximise adoption through novel policy and market instruments. These systems have to include key drivers such as climate variability and change as their understanding will play a fundamental role in future water resources management. Such systems are currently under development under the banner of the CSIRO Water for Healthy Country Flagship initiative.
- There is a need for investment in research to develop tools that allow the assessment of the effect of paddock-scale management changes on end-of-valley salinity targets. It will be essential to understand the effect of year to year variability on the response so that changes in any one year are in context with longer term trends.
- Local information for monitoring land and water degradation is often deficient, abstract and catchment-based rather than based on local information applicable at the farm scale. To reduce uncertainty in decision making, real time monitoring, data warehousing and processing capabilities should be developed across the country involving partnerships between the States, Commonwealth agencies, private industry and the community. Similar systems are already in use in other countries and some early scoping and development of a related framework for Australia (the Water Resources Observation Network) is being undertaken by CSIRO.
- Nationally there is still scope for avoiding the outbreak of further salinity through maintenance of perennial cover and through planning regulations with respect to new developments.
- Engineering will be required in the short to medium term to protect some assets. There has been a long experience with such schemes (groundwater pumping, surface and sub-surface drainage, desalinisation etc). However there is recognition of the need for such schemes to be part of an overall catchment plan which incorporates best management practice with respect to siting, design,

maintenance, disposal of saline water, water re-use, institutional arrangements, environmental impacts and management and communication with stakeholders.

- A better understanding of salinity impacts on biodiversity (terrestrial, floodplain and in-stream) is needed in order to manage key ecological assets and functions. Research in the area is currently under way within the WFHC flagship in the Ecological Opportunities project.
- Novel policy instruments can be effective in driving appropriate implementation.

NRM planners and Catchment Management Authorities need to have access to and input in the most up-to-date research initiatives. The examples above are research gaps that will need to be addressed to maximise our collective investment in NRM.

What action has been taken as a result of recommendations made by the House of Representatives' Science and Innovation Committee's inquiry into salinity?

One of the overarching issues identified by the House of Representatives' inquiry was the lack of coordination of salinity research across the country following the demise of the National Dryland Salinity Program. This was highlighted by the fact that 11 out of 24 of their recommendations relied on the existence of an overarching coordinating entity to guide investment, planning and extension. Such a governing structure has yet to be developed as only part of the science coordination and brokering issues are addressed by the recent Executive Steering Committee for Australian Salinity Information (ESCASI) initiative but it provides a starting point.