House of Representatives Standing Committee on Science and Innovation

Inquiry into coordination of the science to combat the nation's salinity problem

CSIRO Response

Contributors:
Colin Chartres
Mirko Stauffacher
Jim Cox
Glen Walker
Chris Smith
Mat Gilfedder
Nico Marcar
Willem Bouma
Brian Ryan

Contact:
Dr. Colin Chartres
Business Director
CSIRO Land and Water
Clunies Ross str.
Canberra ACT 2601
Ph: (02) 6246 5778
Email: Colin.Chartres@csiro.au

Executive summary

The last fifteen years have seen significant shifts in Natural Resource Management (NRM) triggered mainly by a better understanding of the magnitude and implications of some of the issues, notably salinity. The level of intervention needed to deal with salinity (mitigation, prevention, "living with it") is now also being understood at both Commonwealth and State level as illustrated by the National Action Plan for Salinity and Water Quality (NAPSWQ). This has resulted in:

- Increased funding for NRM and salinity, in particular;
- More importance placed on natural resource outcomes rather than inputs;
- Development of regional NRM groups and regional strategic planning.

At the same time:

- There is a towards deskilling within state agencies, and reduction in state extension services;
- Phase 2 of the National Dryland Salinity Program (salinity research coordination at national level) is nearing completion and its future is uncertain.

Additional resourcing and structural changes resulting from the NAPSWQ critically call for a re-assessment of national salinity research coordination needs, recognising the vital role the NDSP played since inception (1992) and its legacy of established networks. The additional level of complexity presented by the devolution of NRM to the regions suggests a need for a more region specific and targeted research coordination effort. This implies a partial reworking of the current NDSP model to address NAPSWQ needs and other NHT initiatives.

On a scientific front, progress in recent years has been significant. Whilst our conceptual understanding of salinisation processes is good, the translation of this understanding into effective on-ground solutions is still hampered by critical research gaps:

- 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; other areas need to be managed to minimize the adverse impacts and maintain ecological function; and some 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 (broad and small scale);
- Currently, there is a limited range of robust profitable farming/biological systems that will reduce recharge to the extent required to make a major 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.
- Engineering will be required in the short to medium term to protect some assets. There is recognition of the need for such schemes to be part of an overall catchment plan and need for 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 greater understanding is required to understand impacts on biodiversity (terrestrial, floodplain and in-stream) and to manage land and water management in a way appropriate to maintain important ecological assets and function;
- Novel policy and market instruments need to be developed to drive appropriate actions.

TOR1 response: the last 30 years of salinity research have proven very successful and provide a good platform for the development of management options. Informed use of research outcomes is essential as not to waste resources.

TOR2 response: managing and coordinating the application of best science in relation to Australia's salinity programs is absolutely critical to the success of salinity management across the nation.

TOR3 response: adequacy of technical and scientific support is highly variable across the nation and often lacks consistency. Investment in technical and scientific support must be proportionate to the overall investments and risks.

Context

Changes in the NRM environment

Over the last 15 years there has been a shift in the way Natural Resource Management (NRM) issues have been resourced, from Landcare to Natural Heritage Trust (NHT) to National Action Plan for Salinity and Water Quality (NAPSWQ). With this shift there have been a number of significant changes:

- Increased funding for NRM and salinity, in particular;
- More importance placed on natural resource outcomes rather than inputs;
- Development of regional NRM groups and regional strategic planning;
- Focus on prioritisation and protection of assets;
- Acceptance that in a number of areas there will be some environmental degradation; and
- Significant deskilling within state agencies and reduction in state extension services.

Technical documents supporting this process of change were:

- Prime Minister's Science and Engineering and Innovation Council report on Salinity;
- National Land and Water Resources Audit (NLWRA) Report on Dryland Salinity;
- Murray Darling Basin Commission (MDBC) Salinity Audit; and
- National Dryland Salinity Program (NDSP, Phases 1 and 2).

The NDSP is a partnership coordinated by Land and Water Australia (L&WA) and involves CSIRO, all states, Grains Research and Development Corporation (GRDC) and MDBC. Its principal aim is 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. Prior to NDSP, L&WA, state agencies and CSIRO often had individually funded projects on salinity but:

- Approaches were different between states;
- Science development was dependent on the strength of research providers in each state;
- Because of the piecemeal nature of the research, it was difficult to provide a national picture of the extent of the problem and a lack of coherence in learning from the research programs;
- There was a significant divide between researchers at a national level and local/regional planning groups; and
- Much of the action at a local/regional level was taking place with only minor technical input.

The future of the NDSP looks uncertain, mainly because:

- The pool of funding is relatively small to that available through the NAPSWQ;
- With the release of state and MDBC salinity strategies and NAPSWQ, there is a need to support regional implementation and hence a different approach required for national research;

Clearly, without a national coordinator, there is the potential to revert to many of the same problems prior to the NDSP.

The shift to regional NRM management has presented a number of difficulties for Commonwealth and state technical providers who continue to support NRM science:

- The sheer number of NRM groups has meant high transaction costs in communication;
- There is potential for creating confusion for the NRM groups if approached by several research providers;
- There is a need to convince NRM groups to invest in technical information;
- It is not clear who is providing the balance between emerging technologies and existing technologies and whether they have the capacity to make those decisions;
- Getting the coordination between groups to support strategic research.

Science Issues

There have been a number of lessons learnt from NDSP, the "audits" and other research over the last 30 years. In considering this, we need to note that salinity cannot be considered in isolation, but must be included with other NRM issues and economic considerations. Key lessons learnt include:

- The public and private investment required (money, technical resources, extension services, time of landholders, community representatives etc) to shift to 'sustainable' land and water management is massive, will need greater resources and will take some 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;
- Currently, there is a limited range of robust profitable farming/biological systems that will reduce recharge to the extent required to make a major 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 characterization 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 in process understanding and development of salinity management options;
- 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 get on-ground implementation we must provide information at the finer scale. This information must be locally applicable and its impact assessed against a regional target;
- There are thresholds for which 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 minimize 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;
- 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 much greater understanding is required to understand impacts on biodiversity (terrestrial, floodplain and in-stream) and to manage land and water management in a way appropriate to maintain important ecological assets and function;
- Novel policy instruments can be effective in driving appropriate actions; and
- There has been severe questioning of the extent of the salinity problem and the underlying information which has been used to justify the extent and predicted increase of salinised land in some areas.

The science required to meet these challenges can be grouped into nine key areas:
- New or modified land use systems;
- Techniques to target investment (money, technical resources, etc) to protect assets, encourage or maintain perennial systems where appropriate and for planning to avoid further salinity impacts;
- Best management practice protocols for engineering schemes;
- Better understanding of the relationship between land and water management and biodiversity (includes climate variability);
- Developing systems suited for saline land and water;
- Techniques to characterise the landscape across both broad areas and smaller areas identified for asset protection;
- Development of better policy instruments to encourage uptake of salinity measures;
- Data collection, collation and analysis that will provide evidence for actions taken; and
- Better tools to relate on-ground actions with regional natural resource outcomes.

Commonwealth's role in managing and coordinating the application of the best science in relation to Australia's salinity programs

As explained in the context, the environment for application of salinity science has changed significantly. 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 others' mistakes;
- 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 these problems has varied considerably. 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 SA 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. NSW has a state-wide Salinity Strategy operating through thirteen Catchment Management Authorities.

However, NAP is not the only science funding for NRM issues. The CNRM has therefore not limited their brokering to NAP funded NRM issues. Also, a number of the CRC's (~11) 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 science to support salinity management; and
- CRC-Catchment Hydrology is developing modelling tools relating end-of-valley targets to land use change.

CSIRO along with various state and Commonwealth agencies, and in some cases extension companies and rural water authorities, is a partner in these CRC's.

The Research and Development Corporations (RDC's) also potentially provide substantial funding for NRM research. L&WA has historically been a good provider of funding for salinity research, but over the last 5 years has had reduced funding. Many of the other RDC's have traditionally been production-oriented and have provided little, if any, support for sustainability issues. Recent changes in Commonwealth funding should have changed this somewhat, 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 L&WA and Meat & Livestock Australia (MLA). 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. Unfortunately the sustainability angle of the project has been diminished during the course of its development. Another example is the joint CSIRO/AFFA 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 MDBC. A longer-term example is the Joint Venture Agroforestry Program (JVAP). This program incorporates a partnership between Rural Industries RDC, L&WA, Forest and Wood Products RDC and the MDBC aimed at agroforestry systems for sustainable landscapes and has supported some key sustainability projects. GRDC has supported water balance work on phase farming, but up to now supported very little catchment-scale work. While the RDC's have good programs such as TOPCROP and Million Hectares for bringing research into implementation, they have not linked well, if at all, into the regional planning process.

MDBC which represents the Commonwealth and 5 state/territory governments in the Murray-Darling Basin has funded research and investigation activities through its Strategic Investigations and Extension (SI&E) 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 aims to combine biophysical modelling and on-ground research with communities and agencies to provide a robust framework for landuse change aimed at salinity mitigation and other NRM issues in the Southern MDB.

Universities have been piecemeal in their research into NRM issues. They have had difficulty in putting together multidisciplinary teams, providing incentives for staff to work on applied science, and do not have the time (or charter) to deal with the time-intensive activities needed to relate to regional groups. There is a high variability in the ability of states to support NRM science activities. Most states have some strong groups in say land resource or modelling, but deskilling and outsourcing of state agencies has meant this is not true across the breadth of salinity activities. Both universities and state agencies are seeking improved opportunities through CRC's.

CSIRO, along with other Commonwealth agencies such Bureau of Rural Sciences (BRS), Geoscience Australia (GA) and Australian Bureau of Agricultural Resource Economics (ABARE) have no such charter to coordinate research activities at a Commonwealth level. While each have been responsible for key advances in salinity science over the last 10 years, they each have specific coordination roles (e.g. CSIRO runs the Australian

Collaborative Land Evaluation Program while Geoscience Australia specialises in geophysical techniques for mapping salinity, and BRS coordinates policy research).

The Commonwealth has recently directly contracted a number of salinity science activities, the largest being the Salinity Mapping and Management Support Program (SMMSP). Others include PRISM (modelling archive), review of salinity mapping methods, dryland salinity data infrastructure project and a review of desalinisation.

The liited involvement of the above mentioned research providers in salinity and NRM issues suggests the need for a complex landscape of research and science to support salinity management. However there are a number of deficiencies apparent in the current situation:

- There is poor linkage between regional investment strategies and many of the research activities;
- There is a lack of cohesion between state and Commonwealth activities;
- The coordination of research priorities from regional plans into state or national programs is currently weak. Centres such as CNRM and CIRM are beginning to do this with respect to NAP funding;
- CRC programs do not cover all states, are often not well linked to regional bodies and often not responsive of state issues;
- RDC's have been isolated from the regional planning processes and have historically been production-oriented. Even when sustainability issues have been funded they have been poorly related to catchment-scale issues;
- The direct BRS/GA funding for NAP-related activities has been poorly coordinated with state and regional activities and lacks a strategic framework as occurred through NDSP.

TOR 1: 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

There has been some very successful salinity related research over the last 30 years. Examples of research involving CSIRO include:

- Catchment studies that provided a robust conceptual framework for salinsation processes understanding. These include the large Collie catchments (WA) study, Mallee, WA wheatbelt, as well as participation in NDSP focus catchments (Upper South East, Liverpool Plains, Loddon Campaspe, Kent River and Upper Burdekin) and NLWRA case studies.
  - http://audit.ea.gov.au/ANRA/land/docs/national/Salinity_Contents.html

- Measuring and estimating recharge across different landscapes and land uses to determine the effectiveness of current farming systems.
  - http://www.publish.csiro.au/nid/18/pid/3286.htm
  - Petheram C, Walker G, Grayson R, Thierfelder T and Zhang L (2002) Towards a framework for predicting impacts of land-use on recharge: 1. A review of recharge studies in Australia. Australian Journal of Soil Research 40(3), 397-417.
  - http://www.clw.csiro.au/publications/Dryland.pdf
  - http://www.clw.csiro.au/publications/70445.pdf

- Development and application of remote technologies, (e.g. Land Monitor in WA), and geophysical techniques.
  - http://www.landmonitor.wa.gov.au/
  - http://www.cmis.csiro.au/RSM/research/pdf/CaccettaP_lmpaper2000.pdf

- Understanding the impacts of plantations on hydrology.
  - Kyabram - http://www.rirdc.gov.au/reports/AFT/00-163.pdf
  - Deniliquin - http://www.rirdc.gov.au/reports/AFT/02-146sum.html
  - Zhang - http://www.eoc.csiro.au/aciar/book/PDF/Monograph_84_Chapter_20.pdf
  - JVAP - http://www.rirdc.gov.au/reports/AFT/01-086.pdf

- Development and understanding of saline agriculture/forestry systems
  - Marcar, N., Crawford, D., Leppert, P., Jovanovic, T., Floyd, R. & Farrow, R. 1995. Trees for saltland; a guide to selecting native species for Australia. Melbourne, Australia, CSIRO Press.
  - Marcar, N. and Crawford, D.F. 2003. Trees for Saline Landscapes. RIRDC (in press).

- Development of tools to support decision-making for farming systems (e.g. APSIM), groundwater (e.g. FLOWTUBE, HARSD, unit response function), catchment planning (e.g. Zhang curves, BC2C, SLIM, Floodplain Impact Model), climate change, and fore-casting scenarios.
  - APSIM - http://www.apsru.gov.au/apsru/Products/apsim.htm

- Improved tools for ecological understanding (fragmentation of landscapes, salinisation of floodplains)

- Improved social and economic tools (e.g. PRIME, SPAM)

- Engineering support (disposal basins, serial biological concentration, FILTER, etc.)
  - Disposal basins - http://www.catchment.crc.org.au/oldresearch/salinity_s2.htm

- Landscape characterisation (ACLEP)
  - http://www.clw.csiro.au/aclep/

CSIRO is involved in various partnerships and major programs that are delivering salinity R&D for industry and community benefit. These include the following:

- Heartlands - http://www.clw.csiro.au/heartlands/
- Ecosystem Services - http://www.ecosystemservicesproject.org/
- National Dryland Salinity Program - http://www.ndsp.gov.au
- Joint Venture Agroforestry Program - http://www.rirdc.gov.au/programs/aft.html
- CRC for Catchment Hydrology - http://www.catchment.crc.org.au
- CRC for Plant-Based Management of Dryland Salinity - http://www1.crcsalinity.com/
- CRC for Landscape Evolution and Mineral Exploration - http://leme.anu.edu.au/

Evidence of the use of the salinity base and research data for the management, coordination and implementation of salinity programs include:

- Water allocation planning in SA (SIMPACT, FIM, SPAM);
- Salt interception schemes design (FIM, Geophysics, geochemistry, modelling);
- Environmental flows for Lower Murray (FIM, FIP, WAVES);
- Regional salinity planning throughout Australia (Groundwater flow systems, FLAG, FLOWTUBE, BC2C);
- Farming systems (lucerne uptake, APSIM, Heartlands Initiative);
- Monitoring and mapping of saline land (LandMonitor);
- Catchment planning for water yield (Zhang curves, CRC-CH Toolkit, Heartlands Initiative, Rive Murray Healthy Country Flagship project);
- Market-based instruments (CLW: Mike Young, Jeff Connor)

Evidence of failure of data and information being used:

- Disposal basins – lack of an appropriate regulatory framework (Disposal basins - http://www.catchment.crc.org.au/oldresearch/salinity_s2.htm)

CSIRO is in a unique position among research providers to assemble the multidisciplinary teams needed to address complex NRM issues like salinity. The multiplicity of biophysical processes involved requires specialised knowledge in a range of different scientific areas to provide a whole system understanding. Socio-economics are also key areas when dealing with NRM management where triple bottom line outcomes are expected. CSIRO has in recent years developed extensive skill in those areas and can provide tailored advice to regions with respect to what options they could consider and their trade off.

TOR 2: 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)

Three key users of science are:

1. Policy (Commonwealth, state)
2. Regional Planning and Local Government
3. Landholders

Key providers of research knowledge are:

1. CSIRO, GA, ABARE
2. State technical providers
3. Universities
4. Consultants

Partnerships and Research Brokers include:

1. CRC's
2. NDSP
3. RDC's
4. BRS
5. Key Research Centres

Partnerships and Research Brokers set up specific programs which deliver research knowledge to key users. However, sometimes the key users bypass the partnerships and research brokers and deal directly with the key providers.

Bottom-up analyses of research needs:

Each regional investment strategy requires some research and investigation to support their regional plan. There is a need at the state and national level to provide a 'bottom-up' analysis of the research needs to support the national implementation. It should be recognised that we do not currently have all the answers. Some of the identified research needs are merely an extension or application of existing knowledge and techniques, but others will not be. Some will be regionally specific while others will have some generic

similarities with other regions. Developing programs that are adequately regionally specific yet having broad similarities across state borders will be a challenge. Programs like the Sustainable Grazing Systems for Saline Land and Commercial Environmental Forestry are providing good examples of the way forward.

Mixing up top-down with bottom-up:

Merely aggregating from the regional plans will not necessarily bring in new knowledge or techniques, nor will it necessarily satisfy national objectives. Thus in addition to the 'bottom-up' approach, there is a need for a process that canvasses new ideas or emerging technology and proceeds to phase in an appropriate implementation. There is also a need to incorporate lessons learnt from past studies and bring in a national perspective. Through such a process, it will be possible to develop up an appropriate research portfolio. It is not clear who will fill this role.

Funding:

It should be recognised that the implementation or development of any NRM program will require a strategic investment. Some of this could be used to fund local technical providers, some developed up to state programs and some for national programs. A nominal percentage needs to be allocated to each of these. The funding of research below a generic level so as to be regionally-specific requires significantly more funding. Overcoming jurisdictional constraints is obviously a problem.

Brokering:

Besides trying to broker projects between regional bodies, there is a need to link CRC programs and RDC programs and research providers with regional plans.

Data:

There is a need to broker a data exchange between regional groups, state and Commonwealth agencies.

Communication:

Continuation of vehicles for communication across state borders such as SALTLIST, FOCUS, NDSP and other web-pages (e.g. CRC's). There needs to be a greater effort into ensuring uptake of research knowledge:

- Networks fed from research programs
- Continue to support NDSP-initiated communication activities.

Apart from the Productive Use and Rehabilitation of Saline Land (PURSL) biennial conference, there are no regular national conferences dealing with salinity.

Policy level:

The links between CSIRO and other Commonwealth agencies (AFFA-EA-MDBC-RDC's-ABARE-BRS) are in place with each agency aware of its role in NRM issues. The links between CSIRO (the primary deliverer of salinity research knowledge) and state agencies vary from state to state. They are very strong in WA (e.g. CSIRO and the state agencies are currently working together to develop an engineering strategy for the wheatbelt) and also in SA (the recent NAP funded aerial geophysics program between PIRSA and CLW has been very successful). CLW is currently strengthening its links with the state of QLD by setting up a salinity team in Brisbane and appointing new staff to work in conjunction with QDNRM. The links with NSW and VIC are currently weak but CSIRO is endeavouring to work with several of the CMB's and CMA's though this has been difficult and costly for CSIRO because of their sheer number. Currently tenuous links exist between CSIRO and agencies involved in NRM in Tasmania.

TOR 3: Adequacy of technical and scientific support in applying salinity management options

The adequacy of technical and scientific support in each state is highly variable. Some areas have longer experience with salinity planning than others. There are issues in regions with haste to develop and roll out plans for salinity management without long term experience and understanding of salinity. Investment in technical and scientific support needs to be proportionate to the overall investment and risks. There is a lack of consistency in approaches, information, etc. in the regions. There is a need for the regions to differentiate quality of technical providers. There has been a decline in technical support within agencies for the last ten years and now experienced people are spread too thin.

There is a need for investment in data. It can take a long time to obtain adequate good quality data and information on which to base decisions.

SUMMARY: How to ensure that the best scientific knowledge and expertise is and continues to be used to address the problems presented by the nation's salinity challenge?

Two key words: prioritisation and coordination:

- Prioritisation of work and funding is critical so as not to waste resources allocated to salinity management. The use of regional targets for natural resources outcomes and regional investment plans provide a framework for setting priorities. The need for a triage approach to salinity management for both public and private investment can not be stated strongly enough as some critical assets (water resources, biodiversity areas of international significance, urban areas, etc.) can justify the major intervention required to protect them; other areas need to be managed to minimize the adverse impacts and maintain ecological function; and remaining areas will require management that adapts to the more saline conditions. We need to be able to provide spatially explicit information at broad and small scale levels to determine the most appropriate management responses and institutional arrangements (policy and market instruments);
- Coordination and governance of the salinity research effort. Since 1992 the National Dryland Salinity Program (NDSP) provided national guidance and coordination of salinity research, building up tremendous amount of knowledge and providing established networks and communication structures. The second phase of the NDSP is nearing completion and its future is uncertain. There is a critical need for national research coordination, especially with the added level of complexity presented by the devolution of NRM to the regions. Future coordination of research must recognise the structural adjustments born out of the NAPSWQ and respond to the needs of regional emphasis of NRM in a national context.

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