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SUBMISSION TO THE INQUIRY INTO COORDINATION OF THE SCIENCE TO COMBAT THE NATION'S SALINITY PROBLEM

Working Party

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Preamble

Dryland salinity is a serious and complex issue facing much of Australia's agriculture and the broader environment. The principal controls on where, and how severely dryland salinity develops are topography, hydrogeology and land use. Understanding the relationships between these controls and how to use this understanding to best combat the problem requires a complex, interdisciplinary, and interagency approach. In addition to biophysical sciences, social sciences must be considered as an integral part of the science base. At Murdoch University we have extensive experience of involvement in salinity research and development projects over the last 20 years and now have working linkages with most of the State and Federal natural resource management agencies, and several other universities. We also train many of the key staff who are developing the science base in agencies and implementing salinity control strategies with agencies and the community. As such we are well placed to understand the nature and operation of this complex issue and to give advice on the coordination of the science to combat the nation's salinity problem. The document does not pretend to cover all possible aspects of the salinity issue but summarises a Murdoch University perspective.

Responses to terms of reference

a. Use of the salinity science base and research data (including the development of new scientific, technical and engineering knowledge) in the management, coordination and implementation of salinity programs

Training is a key to effective implementation of the science base and research data. Many of the Murdoch University's graduates from Environmental Science, Restoration Ecology and Conservation Biology degrees end up working in natural resource management where salinity is a priority issue. At Murdoch University, we ensure that our undergraduates are exposed to the current science in salinity management. In addition, honours and postgraduate students undertake research on their supervisors' funded projects on salinity. Through the entrance of graduates into the workforce, there is a close relationship between the science base and research data and implementation of salinity programmes. The nexus between science and management, coordination and implementation is further enhanced through research on salinity (funded by GRDC/LWA and ARC), and service on key policy and technical committees in the State by our staff (e.g. WA Salinity Research and Development Technical Committee, Natural Resources Management Council of WA). The continued linkage between active research by staff, undergraduate teaching and postgraduate research is critically important for the vitality of salinity programmes.

The Flowtube project is a specific example of the incorporation of the salinity science base being incorporated into the WA Salinity Strategy. Currently a user-friendly version of the Flowtube computer model is being refined (funded by NDSP) for use in the management, coordination and implementation of salinity programs. We are aware of this program now being used in WA, Victoria and SA, with prospects for its adoption in Queensland and NSW.

The salinity "science base" must also include the Social Sciences in addition to the Biological and Physical Sciences listed in the Inquiry Information document. Sustainability, a goal pursued by Australian governments and mandated through a number of international conventions to which Australia is signatory, relies on the triple bottom line. This triple bottom line is achieved by having solutions to problems or actions that are not only biologically and physically possible but are also economically feasible and socially acceptable. Each bottom line should be supported and refined by a body of scientific research. The Inquiry Information document details research to address the first of these bottom lines, but not the second and third. As such, Salinity Science must encompass economic research to help meet the second, economic bottom line and social research to help achieve the third, social bottom line.

A number of Commonwealth agencies are making efforts to research economic and social science aspects of salinity management.[1] BRS, CSIRO and LWA are notable examples, although for all three limited funding is an issue. The first two in particular are dogged by the related issues of a lack of diffusion of their research findings through to decision makers as well as lack of adoption of research findings. A number of universities around Australia, including Murdoch University, conduct social and economic research related to salinity management, with the Commonwealth having funded such work through the NDSP, LWA and other research and development corporations. NDSP has a patchy record in relation to social research although it has paid more attention over recent years.

An additional reason for including social research in the "salinity sciences" is that the findings from biological and physical science research are unlikely to be adopted unless the economic and social conditions conducive to such adoption are known and/or can be created. For example, no amount of research into new salt-tolerant agricultural crops is going to result in adoption if the economic drivers likely to support or impede such adoption are unknown and cannot be managed. And, although we all know that dramatic changes to agricultural landscapes are needed to address salinity concerns, without an understanding of the concerns, values, fears and aspirations of the people living in those landscapes, such changes remain unachievable.

Through understanding and working with these attitudes, decision makers can initiate and support the changes needed to deal with salinisation. social research can also help determine the "best" ways of organising government agencies, business and others to deliver on-ground outcomes. Such institutional research is commonplace in other countries such the United States where it is used to improve the likelihood of research being implemented by ensuring decision makers are organised in ways that support rather than impede action. Policy research can be used to evaluate policy options – What is the best policy "mix" to achieve on-the-ground outcomes? What might be a cost-neutral set of policy approaches?

A final area of social research critical to salinity management, neglected until recently, is examining "sustainable futures". LWA are to be commended, as part of their Social and Institutional Research Program (SIRP), for initiating a futures research program.

Salinity is one of a number of natural resource management issues that has biological, physical, economic and social bases. It is not sufficient, however, to study any one of these in isolation. The greatest hope for the future is being able to undertake multi-disciplinary research to provide integrated solutions to salinity as a multi-faceted problem. Achievement of sustainable futures requires such a multi-disciplinary approach. Organisations such as CSIRO and universities such as Murdoch, with multi-disciplinary departments, are well-placed to conduct such research. Such research does, however,

[1] Economic research is a form of social research but for ease and clarity of discussion has been considered separately in this submission.

require larger budgets over longer time periods than the more traditional single disciplinary approaches to research.

Two essential drivers for getting such research undertaken are having researchers with the requisite skills and having the funding to enable the research to be undertaken. Over the last few years the Australia Research Council, plus research and development corporations, have periodically supported such research.

RECOMMENDATIONS

1. Give adequate recognition and support to the role of universities in training the staff who will have carriage of management, coordination and implementation of salinity programs. Such training occurs at undergraduate level and in research higher degrees.

2. Ensure that salinity science is integrated with other land management research such as biodiversity and conservation.

3. Ensure that any consideration by the Commonwealth Government of the sciences in relation to salinity management is broadened to include the social sciences because without them the likelihood of achieving and implementing sustainable outcomes is limited.

4. Continue to support Commonwealth research organizations such as BRS, and CSIRO in their social research focus.

5. Ensure that the NDSP or its future equivalent is adequately funded to conduct economic and social research as part of their focus on salinity management.

6. Encourage the research and development corporations (e.g. RIRDC, GRDC) and CRCs with an interest is salinity to attract and support postgraduate students to undertake multidisciplinary research projects.

7. Encourage the ARC to support and preferentially fund multidisciplinary projects in the natural resource management area.

b. Linkages between those conducting research and those implementing salinity solutions, including the coordination and dissemination of research and data across jurisdictions and agencies, and to all relevant decision makers (including catchment management bodies and land holders)

Understanding of the mechanisms causing dryland salinity and the means of its amelioration is not a static thing: our understanding of both is continually evolving and improving, and probably at an ever increasing rate. For this to continue it is vital for funding to continue to be available for such research. It should be recognised that

significant regional differences exist in the salinity problem and hence solutions found to work in one region are not necessarily transferable to another. Extension of best regionally-derived science to catchment management bodies and landholders is clearly vital but in many ways this is best done with the participation of the scientists involved in such multidisciplinary research. If we were to stop research now, or slow it down, and leave it to communicators to extend what we already know it would have two serious consequences:

- Our knowledge base would become static, and when we see how much our understanding has changed and developed over the last +20 years this would have most unfortunate consequences. Much of what we now believe is in complete contradiction of what was thought 20 years ago, and our understanding is still evolving.
- The extension of even what we currently know would suffer because as scientists diverted their interests to other areas, it would become more difficult to keep the communicators and end users informed of new developments and understanding.

Apparent "quick fix" options are tempting and may appeal to people because it would look as if we were 'doing something'. An example is the highly expensive large-scale regional acquisition of airborne electromagnetic data. This is not a total solution. Not only are such data sets expensive, and therefore resource intensive, they are very difficult to interpret unambiguously, and their relevance to the battle against dryland salinity has been intensely questioned. In Western Australia, most scientists would agree that the balance between costs and benefits of such surveys does not justify their use.

To sum up, whilst data acquisition and extension are vital parts of the battle against dryland salinity, the core to success lies in a vigorous, active, well-funded multidisciplinary and multi-agency research effort. We will abandon this to our peril, as to think that our current levels of knowledge and wisdom are sufficient, will not result in the best solutions.

The following comments focus on three key groups of players in linking research and implementation – researchers and their funders, organizations such as State Government Departments and non-government organizations such as Greening Australia, and individual landholders who ultimately have responsibility for most of the on-ground management actions. Over the last 4-5 years enormous efforts have been made by Commonwealth research and development corporations to maximise the likelihood that research findings will be adopted. Funding application forms require researchers to give detailed attention to how their research findings will be diffused while CSIRO and a number of the CRCs have staff dedicated to communicating research findings to potential users. A significant element of the success of the NDSP was its appointment of communicators in each state to work closely with the scientists to continually publicise the relevant outcomes of the research. This approach has certainly enabled researchers to focus on and recognise the importance of researching with implementation in mind.

To combat this situation increased funding for multidisciplinary research is vital. Whether it be the National Dryland Salinity Research Program, or a suitable quasi-

independent successor, there needs to be such an organisation, the sole aim of which is to fund and coordinate research and development into various aspects of dryland salinity, and to facilitate its extension to land managers. Although there are currently 2 CRCs operating in the salinity arena, their foci are somewhat narrow and there is still a strong need for some mechanism of bringing different aspects of salinity research together effectively.

We view the ARC Linkage programme as a particularly effective scheme to achieve linkage but it is increasingly hampered by the fact that State Government agencies cannot find even modest amounts of cash to participate as industry partners.

In terms of the second key group, government agencies and other organizations, the adoption efforts of researchers are largely wasted if these organizations are set up and responsibilities allocated in ways that impede or prevent research reaching those on-the-ground. Research into the best ways of organising both across government and within government departments is a key focus of natural resource management research in countries such as the United States. It has not, however, received much attention in this country.

The organisational landscape of salinity management has become even more complex with the appearance and consolidation of regional natural resource management groups, charged with primary responsibility for implementing the Commonwealth's NHT and NAP programs via accredited regional strategies and investment plans. There is no explicit provision for research within these programmes, however, research findings will clearly be called upon to guide management activities undertaken by these groups over the next 4-5 years. It seems essential that these groups have access to "science brokers" who are able to access and translate science for application on-the-ground.

Implementation of the National Action Plan for Salinity and Water Quality through priority regions represents a radical departure from previous salinity funding arrangements. The devolution of decision-making about salinity investments under the NAP is a laudable programme to empower local communities to find solutions to salinity and to direct the investment of federal funds for this purpose. The Regional groups have representation from government and community stakeholders. However, there are concerns that they lack the technical knowledge of the science base and latest research required to evaluate all proposals and rank them according to soundness of the science.

They are also under pressure to spend a large body of funds in a relatively short period of time. Past experience suggests to us that large proportions of the funds can be wasted in this scenario unless there is explicit scientific peer review of spending proposals, the necessity to seek expert technical advice, and the ability to carry forward allocated funds until such time as good projects come forward.

The characteristics of the third key group of players in implementation – individual landholders – adds further complexity to salinity management. Landholders may not regard salinity management as part of their core business of farming or have the training

to be able to adopt the information scientists have for them. Both impede implementation efforts.

RECOMMENDATIONS

8. Continue the NDSP or develop an equivalent successor, with the remit of integrating salinity research.

9. Continue to support inclusion of science extension and adoption needs as part of the planning and funding of scientific research.

10. Strongly recommend the allocation of part of the NAP and NHT monies to science brokers who can translate available science for the regional natural resource management groups.

11. Ensure that adequate ongoing government support is provided for individual landholders to aid them in implementing the salinity actions identified through scientific research.

c. Adequacy of technical and scientific support in applying salinity management options

Over the last decade in WA at least, the extension services provided by the Department of Agriculture (a department with a significant role in salinity management) have gradually been withdrawn. Such withdrawal has been a response to general down-sizing in the public sector combined with the view that landholders accrue a private benefit from extension services (through improved agricultural production and hence profits) and as such these services should be provided by and purchased from the private sector.

The responsibility for extension activities associated with salinity management has largely fallen on the shoulders of community support officers (CSOs), often recent graduates employed on short-term contracts under the NHT and more recently NAP programs. There is an urgent need to enhance the skills of these officers as well as in the longer term attract experienced people to these positions (or at the very least make the conditions attractive enough to retain those already incumbent in the positions).

Further, there is a low number of trained and experienced hydrologists in regional areas which frequently slows or impedes the flow of research results to the regions and hence the ability of regional groups to develop local responses to salinity problems.

RECOMMENDATIONS

12. As a matter of high priority, provide training for CSOs to increase their skills in relation to natural resource management. In the longer term, create greater

security of employment and associated improvements in work conditions and support.

Murdoch University is contributing to a number of strategically important research activities that need continued support to develop salinity management options. These are:

Salt-tolerant plants:
At Murdoch we have developed salt tolerant hybrid trees to add to the species available for planting in saline waterlogged areas. The objective in breeding *the Eucalyptus camaldulensis x globulus* hybrids was to develop trees that will deliver a commercial return in lumber or wood chips from saline land. The selected clones will be marketed Australia –wide by Saltgrow Pty Ltd. Ashgrove Qld 4060, together with genotypes of other species and hybrids they have bred. Trees necessarily involve long term research and further assessment of growth rates and wood and pulp quality from trees on saline land is required.

Desalination:
Murdoch University's Environmental Technology Centre has expertise in desalination arising from its work in providing technology to remote Aboriginal communities. It has developed a solar powered reverse osmosis desalination, which is now manufactured by a local company (Solar Energy Systems Ltd, refer to website http://www.sesltd.com.au/html/waterpure.htm). They are teaming with CSIRO and other WA universities to apply desalination technology to provide water to WA wheatbelt towns and at the same time protect infrastructure (by removing salt from local groundwater and eliminate import of water). Early estimates are that this can be achieved in an economical way. The science that is required, is as following:
a. Understanding and managing feedstock water quality
b. Evaluating alternative energy sources
c. Downstream mineral recovery and uses for salts produced
d. Safe disposal siting and design
e. Fit-for-purpose water for associated industries

Groundwater hydrology:
Salinity is essentially a water problem. All catchment management plans depend on clear conceptual models of groundwater processes. Whilst many of the key questions of hydrogeology have been answered, at least in WA, others remain. The spatial variability of recharge and discharge rates is one such issue. The change in groundwater processes as aquifers reach a new hydrological equilibrium is another. Finally, there is a need for tools that land managers and advisers can use to predict the special distribution of salt affected land. Such tools will supplement those such as AgET (1-dimensional water balance program) and Flowtube (2- dimensional water balance program).

Remnant vegetation:
It is now accepted that resources are not sufficient to save all remnant vegetation under threat from salinity. Decision makers need better indicators and threshold values by which to judge the likely fate of the remnant vegetation (with and without drainage and

other salinity management) and the prospects of restoring damaged ecosystems. Our work for NDSP is a useful starting point for the development of such tools, but needs to be further extended into a range of other ecosystems and environments.

Deep open drains:
A significant programme to evaluate the effectiveness and impacts of deep open drains is about to commence in WA. It is still too early to judge the likely success of this programme in delivering the guidance that farmers, natural resource managers and the community alike need to assess drainage proposals. However, we anticipate that further support is needed to investigate the downstream impacts of deep open drains. And if their continued use for salinity management is sanctioned by government work on the institutional arrangements for successful management of costs and benefits will need a social sciences and policy input.