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

Submission from the Centre for Salinity Assessment and Management
University of Sydney

1. THE CENTRE FOR SALINITY ASSESSMENT AND MANAGEMENT

The Centre for Salinity Assessment and Management (CSAM) was established in the University of Sydney to provide leadership in addressing one of the greatest problems facing this nation - deterioration of the Australian environment through declining land and water quality associated with salinity. CSAM brings together researchers and teachers with knowledge about soil, water, salt, vegetation, groundwater flow systems (the "hard science"), as well as biophysical and socio-economic impacts of changes in land and water use and their management. The mains aims of CSAM are:

(i) To research and extend methods of salinity assessment at various scales;

(ii) To research underlying sources of salt and extend viable solutions to manage salinity;

(iii) To develop teaching modules for primary, secondary and tertiary students;

(iv) To train undergraduate and postgraduate students for professional careers in research and with industry groups;

(v) To promote collaboration with national and international research agencies and centres involved in salinity assessment and management;

(vi) To inspire scientists from a variety of backgrounds to explore new and innovative ways of managing salinity;

(vii) To develop interactive programs with community groups;

(viii) To organise symposia involving government agencies, community groups and research scientists to promote salinity education, research and management.

CSAM is based jointly in the Faculty of Agriculture, Food and Natural Resources and the Faculty of Science, both of which contribute to teaching in relevant degrees in Land and Water Science, Environmental Science, Resource Economics, Agricultural Science. Information on CSAM and its recent activities is available at http://www.agric.usyd.edu.au/csam/index.html .

2. COMMENTS ADDRESSING THE TERMS OF REFERENCE OF THE INQUIRY

i. Use of the salinity science base and research data in the management, coordination and implementation of salinity programs

Key scientific questions that need to be answered to address salinity problems are:

- Where in the landscape are salts stored?
- What are the processes that mobilise stored salts into the root zone of plants, to streams and rivers, and to locations where damage is caused to built infrastructure?
- How can affected areas be most effectively rehabilitated?

In the past, salinity research programs have tended to evolve on an *ad hoc* basis, especially those aimed at providing baseline estimates of salinity at the catchment to national levels. Estimates of the extent and the severity of the salinity problem have mostly referred to existing resource maps (national and state), which were not designed for this purpose. This has resulted in the accuracy of some of our current salinity hazard maps being questioned. Therefore, there needs to be a concerted and collaborative effort involving Commonwealth and State research organisations and agencies, and universities to measure, map and model salt stores and water flows in the landscape to provide scientifically sound and properly referenced baseline estimates of the extent, severity and the potential risk of salinisation of our land and water resources.

With more accurate estimates of the current situation regarding salinity, we would be able to more effectively model the processes that mobilise stored salts into the landscape, to identify management

options, develop decision support systems for management purposes, and put in place appropriate networks to monitor the implementation of management decisions. Since the key to salinisation is water movement, salinity modelling needs to be linked to research on water resources. No doubt, much has been achieved at the local level in some regions, but this needs to be supported by more rigorous and coordinated programs at the national, state and regional levels.

These questions apply not only to rural environments, but also to urban ecosystems. Significant urban salinity problems are already evident in some communities, and there is considerable potential for these problems to be increased by development. Hence, there is a clear need to direct efforts to measuring, mapping and modelling salt stores and water flows in urban landscapes. Technical knowledge gained in answering these questions needs to be supported by sound economic analyses and social impact assessments to identify options for addressing salinity problems in a sustainable way. It seems clear that the best outcomes will necessarily involve multidisciplinary teams.

ii. Linkages between those conducting research and those implementing salinity solutions, including the coordination and dissemination of research data across jurisdictions and agencies, and to all relevant decision makers

There is much high quality research currently being conducted in Australia on many aspects of salinity, but this effort would benefit from greater integration and more coordinated and strategic leadership. Developing a national inventory of salinity research, to help funding agencies establish priorities and identify gaps would add value to current research; some efforts have been made in this direction but these are limited. The application of mathematical methods for modelling salinity is constrained by a lack of good data.

A culture of greater salinity awareness needs to be created in the community. Educational programs on salinity should include teaching modules developed for primary and secondary students. There is a demand for well-trained scientists and resource economists knowledgeable about salinity in a broader context of landscape and natural resource management to work collaboratively towards solutions, and to extend knowledge through interactive programs with community groups. Attracting high quality postgraduate students to train the next generation of leaders, researchers and policy makers in natural resource management is one of the biggest challenges, in large part because of the high employability of basic graduates. Initiatives to increase the capabilities of natural resource managers working in salinity programs for using and interpreting agricultural, geoscientific, economic and social data within Geographic Information Systems (GIS), would enhance engagement between research providers and users, and the transfer of research outputs to the community. A regular forum in which relevant questions could be directed to researchers, and where researchers could learn about issues of community importance as well as gain more global perspectives, would be of benefit.

There is a need to make databases more available between research organizations particularly for modelling purposes. Intellectual property issues may need to be resolved for this to occur. Some of the basic landscape data, such as topography (elevation), cadastre and river network systems, should be made available to researchers free of charge, as occurs in the USA. The high cost of access to some of these data is a constraint on research, especially in earth sciences. At the very least, public good research programs should have free access to these data.

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

Access to, and use of, modern technology to measure salinity and monitor implementation of management decisions is fundamental to addressing the long-term management of salinity. Without access to this new technology, the national capability to address the issues will be constrained, leading to significantly increased losses of production and increased remediation and management costs.

In summary, the key points are that there needs to be

- better integration of efforts by Commonwealth and State research organisations and agencies, and universities, to measure, map and model salt stores and water flows in rural and urban landscapes to

provide properly referenced estimates of the extent, severity and the potential risks of salinisation of our land and water resources;

- more effective modelling of processes that mobilise stored salts into the landscape, to identify management options, develop decision support systems for management purposes, and put in place appropriate networks to monitor the implementation of management decisions;
- greater availability of databases between research organizations;
- emphasis on training the next generation of research leaders and policy makers in a culture of greater salinity awareness in the whole community;
- extensive collaboration in research and implementation of management options between landholders, regional planners, scientists, industry, community, and government.

GENERAL COMMENTS

Major changes have taken place in the Australian landscape since European settlement. Great agricultural and mineral wealth has been achieved, but at a price of large-scale soil and water degradation from major changes to natural water flows and nutrient cycles in ecosystems. Salinity is one of the most visible, pervasive and destructive symptoms of this degradation, and is one of the greatest challenges facing the nation today.

The causes of salinity in Australia are now reasonably well understood at a general level, and there is recognition of the pivotal role that water plays in salinisation. Water contains dissolved salts which move with water but are left behind when water evaporates or is used by plants. Ultimately, salinity is a symptom of land and water uses that are not well matched to the natural cycles in the Australian landscape. The essence of the problem is addressing critical issues of water and land degradation and maintaining security of food supply as Australian faces unprecedented pressures on its natural resources in the next half century. Salinity is a problem that appears a long time after land use changes have occurred: typically 30 to 50 years at a local level and more than 100 years at the regional scale. Reversing the process will require the implementation of long term measures that may not be acceptable to contemporary stakeholders.

Universities should play significant roles in research and education on salinity in Australia. They can take a strategic approach and provide long-term continuity of effort in research and training, while at the same time working closely with more mission-oriented programs (eg, National Action Plan) and organizations (eg, CRCs), which have a specific focus. The universities are ideally positioned to provide leadership in research and teaching in addressing this complex problem, where both knowledge and education are critical, and where landholders, regional planners, scientists, industry, community, and government need to work together.

History gives us lessons on the consequences of not addressing problems of salinity. Salinisation of the soil was a major contributor to the downfall of ancient civilizations in Mesopotamia in 4000 BC and again in 500 AD. Salt from sedimentary rocks was deposited in the Tigris-Euphrates Delta by flooding and irrigation. As salinity increased, soil fertility diminished, as did the ability of agricultural systems to respond to natural environmental disturbances. Crop production shifted to more salt-tolerant crops (eg, wheat to barley) and control of water rights became a cause of conflict. We will travel down the same path unless scientists from a variety of backgrounds are encouraged to explore new and innovative ways of managing our land and water resources to control salinity.

Professor Les Copeland

Director, CSAM and
Dean, Faculty of Agriculture, Food and Natural Resources
University of Sydney

16 October 2003