Dryland Salinity in Australia: evolution of our knowledge and efforts to manage salinisation.

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EXTENDED ABSTRACT

Whilst in principle the causal mechanism for dryland salinisation of soil, wetlands, groundwater and rivers is simple in concept it is usually difficult and complex to describe and predict its detail expression in many Australian landscapes. Understanding the salt balance, the size and spatial distribution of salt stores, their geochemistry and role in the geomorphic and pedological history of the landscape requires a large investment in site specific information and landscape evolutionary analysis. Furthermore the hydrological process that drives the mobilisation of the salt store can vary in its nature and expression across space scales from soil and regolith, to the hillslope, to catchments and to large regional river basins. This takes place within and across differing geologic and geomorphologic histories. In addition to this the hydrological driver of dryland salinisation, leakage beneath the root zone, is subject to climate shifts and variations- the sequences of droughts, and floods and periods of higher rainfall which characterise the Australian environment. Now superimpose on this, the land use, its activities and its timing with respect to the climate sequence of floods and droughts and you have the final complex expression of dryland salinity in the Australian landscape.

As a result of these complex interactions the evolution of our understanding of salinity has to be seen against the Australian history of land use and farming practice, the climate variability, our emerging understanding of geology, geomorphology, soils, and the hydrological processes

operating across these landscapes. The consequence is that our knowledge has grown in an interrupted, fragmented and regionally isolated manner and has often lacked reference and integration with unifying scientific principles. This has made difficult the communication and application of knowledge to both policy development and land management. There has been a tendency to seek simplistic and single factor solutions and force these onto what are complex and diverse hydrological and geological settings. Meanwhile whole-of-system analysis and a search for unifying scientific principles have been rare. Attempts to predict the future extent and nature of land and water salinity have yielded some very large estimates and considerable controversy. As a result knowledge evolution has suffered from weak scientific capacity, fragmentation, lack of whole-of-system analysis and very importantly a lack of site specific geological, soils and hydrological information. The inadequacy of monitoring, evaluation and reporting of salinity in soils, shallow groundwater and streams continues to constrain the scientific capacity to characterise accurately future salinisation and to predict the trends under current and future land use and examine the impacts of climate change and variability.

The research and development to underpin management of salinity has frequently lagged the policy and desire for immediate on-ground action. With fragmented and often only rudimentary knowledge and a general lack of sufficient site specific information program activities have often been poorly targeted and appear now to have delivered little benefit to salinity control. Current work with regional catchment authorities across Australia shows that creation of improved land use and farming options is a priority option for investment by natural resource management bodies. This is especially so in circumstances where the costs to farmers and landholders of existing environmentally beneficial land-use options are too great. It is now clear that whilst focussed research has made progress with some good things in the pipeline, there is a desperate lack of farming options for very large areas of the Australian landscape that are both profitable and treat the cause of the dryland salinity. One of the important insights from economic modelling is that farming options that may look attractive at a low level of adoption have, at the high levels of

adoption which are essential to impact on the dryland salinity, some very perverse economic outcomes.

As to the future: Knowledge of dryland salinity processes and their diverse expressions across climates, geomorphic settings and spatial scales on both land and water salinisation, has in recent years gathered some momentum. Will this continue as resources and the scientific capacity to address impacts of climate change will assume increasing importance? It should do so if science encompasses a whole-of-system approach and strengthens its efforts to measure and predict the distribution, transformation and movement of water, salt, nutrient and sediment within and across Australian landscapes. This knowledge capacity should not only continue to improve our understanding and management of salinity but should also provide the foundations for examining the impacts of climate change on the functioning of our landscapes and their ecosystems including the management of dryland salinity under a changing climate.

The evolution and increasing use of ecosystem service payments which combine biodiversity, carbon sequestration, water quality and salinity benefits is seen to be increasingly important and a powerful driver for changed land use to manage salinity into the future. This coupled with recent legislation in NSW and Queensland to bring a halt to broad-scale clearing of remnant native vegetation will play a key role in reducing further expansion of land and water salinity arising from dryland salinisation. The task ahead now is to give a clearer focus to the repair and protection of environmental and infrastructural assets. Learning to live in saline landscapes will unfortunately continue to be the only option for some circumstances.

In the last decade much has been learned about not only how dryland salinity works, but also about policy and implementation in our efforts to manage salinity. We now have institutional arrangements with regional bodies responsible for on ground delivery of water and land management. This is a most important step forward. We have learned within these arrangements new skills in setting priorities for investment to deliver the desired improvements to the condition of our land and water. It has been confirmed again recently that the land use change and new farming

options for salinity management are few and restricted in application. Therefore it is now more critical than ever for increasing research effort to be directed to finding new farming options. The future investments by Australian and State governments to deliver salinity, biodiversity and other natural resource benefits through regional bodies is currently under review. We now have a great opportunity to update our national and state policies, to catch up with the new science that is able to provide more reliable estimates of the distribution, extent and trends in salinity and its diverse expression across the Australian landscape. It is an opportunity to learn how our response to salinity can be better managed through the flexibility and increasing capacity of Australia's regional natural resource management bodies. We can build a much more productive and effective salinity program that will really deliver positive outcomes. But first we must invest in the science and on-farm innovation to drive the development of land use and farming options that generate regional wealth and address the cause of salinity at its roots.