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Saline Solutions

Dryland salinity has been the focus of resource management announcements by Commonwealth and State governments in recent months. A number of draft salinity plans have been released, all of which foreshadow catchment targets, planning processes and potential regulations to control the problem.

Unfortunately, the plans released so far seem to have skirted the key problem, which is how to bring about changes in landuse in one area to benefit landholders and communities many years later in another area. Unless this dilemma is recognised and tackled, achieving effective and lasting solutions to dryland salinity is unlikely.

The problem of soil salinity has been around since biblical times, with the fate of Lot's wife probably being an early reference. Throughout history, entire civilisations have apparently collapsed as agricultural practices resulted in the soil becoming progressively poisoned by salt. In the case of Mesopotamia, irrigation-induced salinity destroyed what was a flourishing agricultural civilisation by 1800BC. In more modern times, it is claimed that irrigation in California's San Joaquin valley is currently producing the same result.

In both cases, the application of irrigation water to the land resulted in a rising underground water table in some areas, which carried dissolved salts with it. When the water table rose up to within a metre or so of the surface, capilliary action and evaporation resulted in salt deposits being left on the soil surface. Gradually, salt built up to the point where the surface soil became sterilised and unable to sustain plant growth.

Irrigation-induced salinity emerged in Australia's earlier developed irrigation areas, however better landuse planning and irrigation technology is now overcoming this problem.

A more significant problem to emerge in some areas of Australia is the phenomena known as dryland salinity. This occurs not due to the application of irrigation water, but because changes on the surface result in less of the water that soaks into the soil being removed by vegetation. In some areas, this increased "leakage" of surface water into the soil profiles results in a rising underground water-table, which brings salts to the surface where they are deposited when water evaporates. The surface changes that induce this problem include the removal of deep-rooted perennial plant species for agriculture, or the construction of roads, towns and cities.

The impacts of salinity are diverse. A more saline soil surface results in progressive vegetation changes on-site, but also produces off-site impacts such as more saline watercourses, biodiversity impacts, and damage to civil infrastructure and buildings.

While irrigation-induced salinity is usually localised, with an obvious linkage between cause and effect, the same situation does not apply to dryland salinity. Current knowledge suggests that landuse changes that have occurred many kilometres away and more than fifty years previously may be the source of an emerging salinity problem in a particular area.

Table 1: Area of Australia affected and at-risk from dryland salinity.

State	Affected area (ha)	Area at risk (ha)
Queensland	10,000	74,000
New South Wales	174,000	5,000,000
Victoria	148,000	1,000,000
South Australia	402,000	600,000
Northern Territory	Minor	Unknown
Western Australia*	1,804,000	6,109,000
Tasmaina	20,000	Unknown
Australia	>2,558,000	>12,783,000

*Much of the area in WA was marginally saline before clearing.
Source: Murray-Darling Basin Commission

There have been a number of recent reports examining dryland salinity which have provided estimates of its extent. A report prepared for The Prime Minister's Science, Engineering and Innovation Council states that about 2.5 million hectares of land is already affected, and this has the potential to increase to between 12 and 15 million hectares.[1] This is similar to estimates produced by the CSIRO and the Murray Darling Basin Commission, all of which utilised common data sources.

[1] PMSEIC (1998) Dryland Salinity and its Impacts on Rural Industries and the Landscape. Report prepared for meeting, 4 Dec., 1998.

The areas affected are predominantly productive agricultural land on the 'wetter' sides of the cropping belt, although the problem is more widespread in Western Australia, which is a naturally saline landscape. To put the problem in some perspective, the 2.5 million hectares currently affected represents about 4.5% of presently cultivated land, and if the 12 million hectare estimate were realised, it would represent around 23% of cultivated land.

In dollar terms, the PMSIEC estimated that the annual costs of salinity in Australia total $270 million, with $130 million of this being agricultural costs, $100 million being infrastructure costs, and $40 million being environmental costs such as loss of biodiversity and increased salt in creeks and rivers. A more recent study by the National Dryland Salinity Program over eight catchments in the Murray-Darling basin put the annual cost at $250 million for these catchments, suggesting the national total annual cost is much greater, and potentially as high as $1 billion.[2]

Planning Salinity Solutions

Dryland salinity has been the focus of a number of Commonwealth and State-based initiatives throughout the past two decades, with the main focus of these activities being research and planning, rather than implementation of broadscale programs. The National Dryland Salinity Program was established in 1992, and do industry Research and Development Corporations, the Commonwealth and State Governments jointly fund a research and development program. At a State level, Western Australia, South Australia, Victoria and NSW all have implemented various programs to begin to address dryland salinity, with these programs predominantly focussing on research, and support for locally-based salinity and landcare groups.

During 2000, the Murray-Darling Basin Commission (MDBC) released a draft integrated catchment management plan for the Murray-Darling Basin, which deals with a range of environmental issues, including dryland salinity.

In August, the NSW State Government released the NSW Salinity Strategy, the result of a salinity summit held at Dubbo earlier in the year.[3] In October, the Commonwealth released its "National Action plan for Salinity and Water Quality in Australia" which was to be the subject of a Council of Australian Governments meeting between the State Premiers and the Prime Minister in early November.[4]

Each of these strategies has a slightly different focus, and the overall goal of each varies. The Commonwealth plan has as its goal "to prevent, stabilise and reverse trends in dryland salinity affecting the sustainability of production … biological diversity … and infrastructure, …. and to improve water quality." The NSW salinity strategy has as its objective "to slow down the rate of increase in salinity" during the period from 2000 to 2010, perhaps recognising that reversal of the problem is a much longer-term objective.

The MDBC strategy is more general in its objectives, aiming to achieve healthy rivers, healthy ecosystems and catchments, innovative and competitive industries, and healthy regional communities.

Natural ResourceTargets

There are a number of elements that are common to each of these strategies. The first is the proposal to establish targets, be they for salinity, water quality or stream and terrestial biodiversity. The recently released Commonwealth plan states that "Agreed targets and standards will need to be set between the Commonwealth and the States and Territories, either bilaterally or multilaterally as appropriate, in consultation with the relevant community to ensure effective use of funding." The NSW Salinity Strategy states that "Communities and the NSW Government will jointly develop targets for salinity at the end of river valleys. .. They will reflect the salinity levels we are prepared to live with and can afford." The MDBC draft strategy also discusses targets in detail, specifying that targets will need to be set both at the end of valleys, and at critical points along them.

Significantly, the Commonwealth strategy incorporates targets for a range of natural resource issues, and is not restricted to salinity per se. This signals an increased role for the Commonwealth in natural resource management issues, a matter that is discussed in more detail later.

Integrated Catchment Planning

A second component that is common to each of the strategies is a proposal to establish integrated catchment or regional management plans, which aim to achieve the valley or catchment salinity targets, but also incorporating other natural resource components. In each of the strategies, mention is made of the significant role of the community in developing the plans, however the Commonwealth strategy is also quite clear in stating that "the Commonwealth and States/Territories will jointly accredit individual plans in order to be confident that they will deliver the agreed outcomes."

Research and Information

The third component that is common to both the NSW and Commonwealth plan is what is broadly termed 'capacity building' or investment in research and information services. The NSW strategy proposes the establishment of salinity action teams consisting of extension officers, plus the development of information systems that can provide site-specific data on where salt is stored and mobilised in the landscape. It also proposed a NSW Salinity Research and Development Coordinating Committee. The Commonwealth strategy envisages a facilitator and coordinator network, programs to develop management skills of landowners, and the establishment of appropriate catchment or regional delivery bodies, where they do not already exist.

The Commonwealth strategy also proposes the use of "ultrasound" salinity mapping, salt interception and

2 NDSP (2000) Determining the full cost of Dryland Salinity across the Murray-Darling Basin. www.ndsp.gov.au

3 NSW Government (2000). Taking on the Challenge. NSW Salinity Strategy.

4 Commonwealth of Australia (2000) Our Vital Resources. A national action plan for salinity and water quality in Australia. October 2000.

engineering schemes, and the development of production systems, such as new enterprises and salt-tolerant species, more suitable to salinity risk areas.

Some Emerging Issues

Moves by the Commonwealth and the States to begin an integrated program to address dryland salinity are a positive step, however they also bring to the fore a number of basic issues that require resolution in order for the initiatives to be successful. In many ways, these issues highlight that classic landuse regulatory approaches will not be appropriate in this situation.

The extent of the problem

An appropriate understanding of the extent of the problem is critical. Over-estimating its scale, and adopting ill-considered responses is just as likely to lead to failure as under-estimating its scale is. The tendency to overstate the problem is already evident in numerous articles and publications pointing to dryland salinity as proof that current landuse practices are unsustainable Australia-wide, and that the only hope is to replant most of the landscape to trees.

This is not correct, and maps identifying areas where salinity has emerged show that it predominantly arises in the higher rainfall areas of the cropping belt, and that there are a range of factors including geology, geography and soil type that contribute to its emergence. This does not mean that landuse practices and agriculture nation-wide are unsustainable– in fact far from being in decline, the annual volume of agricultural output from Australia continues to increase, the value of agricultural production is increasing, and the area sown to crops is also on an upward trend.[5]

There is a large proportion of Australian agriculture that is not affected by dryland salinity, and which current knowledge suggests is unlikely to ever be affected in the future. Placing restrictions or regulations over landuse in these areas is likely to impose considerable costs on the community, and reduce what flexibility landholders may have available in their production systems. Worse, it is likely that this will have no impact in those areas where strategic vegetation re-establishment may be useful to ameliorate the problem.

Simplistic solutions

Almost universally, strategies developed to combat dryland salinity acknowledge that there is no single or simple solution that will overcome the problem.

"Blanket recipes on how to deal with dryland salinity are likely to be inappropriate." "Salinity is a complex issue, and there are no remedial actions that can be universally applied across the country. Region based analysis is needed to clarify the degrading processes in particular areas."[6] "The costs and benefits of salinity management will vary between catchments … because of differing climate, geomorphology, soil characteristics, land cover and economic returns to land use options.

As a result, the best available policy instrument and the optimal level of intervention are likely to vary .."[7] "There are no easy answers and no quick fixes. All must understand we are in this together for the long haul."[8] These are just a few of the many comments that have been made acknowledging both the complexity of the problem, and the variability of the potential solutions.

Despite these cautions, there have been numerous calls for new regulations on landuse such as demands for a blanket ban on native vegetation clearing. The likely failure of this policy to ameliorate salinity should be obvious given that most of the areas where salinity is emerging as a problem have been cleared for almost 100 years. Additionally, soil water tables in the regions where significant clearing is still possible are up to hundreds of feet below the surface, and highly unlikely to ever represent an area of potential salinity. Further highlighting the shortcoming of this approach is CSIRO research revealing that "for some soil types, appropriate cropping and pasture systems in the Liverpool Plains climate appear capable of maintaining (soil water) leakage rates approximating those of native vegetation." This research also revealed that in low rainfall regions, the soil water table impacts of replacing native vegetation with a deep rooted perennial species such as lucerne may be minimal, as the 'leakage' of surface water into the soil is the same under both types of vegetation.[9]

The flexibility needed in any policy intervention to ameliorate salinity presents a particular challenge for Government agencies charged with administration of this issue. Typically, Government agencies prefer compliance with prescriptive processes as a mechanism to report on, and to justify public funding. However, there will need to be a great deal of process flexibility, and a much stronger reliance on outcomes as a means of justifying public expenditure. Given that these outcomes, expressed in terms of salt mobilisation rates, may only respond over timeframes in excess of decades there will be a dramatically different administrative approach needed.

Addressing market failure

One aspect of dryland salinity that is frequently commented on by those involved in policy development is the challenge created by the spatial and temporal separation of cause and effect. Clearing of land for agriculture in a particular location many years ago may now be resulting in salinity problems in another location many kilometres away, or in a watercourse thousands of kilometres away.

Classic public policy approaches that try to ensure the full costs are borne by those who create the problem cannot operate when cause and effect are separated by several generations, and are widely dispersed. Even if salinity science was developed to the stage where an area could be identified as the cause of a problem, a landholder located there is unlikely to implement any change in landuse unless a direct personal benefit is generated.

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5 ABS. (1999, 2000) Various agricultural statistics, Australian Bureau of Statistics.

6 PMSEIC (1998) op. cit.

7 Bell et. al. (2000) Salinity Management. Some public policy issues in the Murray Darling Basin. Outlook 2000.

8 Carr (2000) The NSW Salinity Strategy, Foreword from the Premier.

9 Walker et. al. (1999) Effectiveness of current farming systems in the control of dryland salinity. CSIRO Land and Water.

Imposing changed landuse on the source area via regulation would be highly inequitable, as the cost would be borne directly by the regulated landholders and the benefits eventually enjoyed by the broader community. Unfortunately, this has been the normal approach by most Governments up to the present time, despite the obvious inequity in attaining public-good outcomes such as biodiversity or threatened species preservation through regulating individual landholders.

However, dryland salinity will require landuse change in some areas to ameliorate problems in others, even though no problem is evident or likely in the area where the landuse change is required. This change will not be possible via regulation, so any successful intervention will need to be fully commercial.

The community will need to 'purchase' salinity amelioration services from specific landholders by way of incentives that match or exceed the income that could be achieved by the landholder from other farm enterprises.

Not only will Governments need to adopt this completely new approach to landuse management policy, but also to be successful it will need to be maintained for decades, irrespective of electoral or budgetary cycles. This requirement represents a major challenge for Governments that normally only work in three or four year policy horizons. This challenge has been referred to in the recent Commonwealth strategy, which states "Governments will need to evaluate the social impacts of … reforms on regional communities, and recognise that compensation and adjustment assistance may be required. Without adjustment assistance, reforms may be divisive, not supported by affected communities and possibly unachievable."

Respective roles of Government

This leads directly to a further issue, which is the need to define appropriate roles for Commonwealth and State governments.

Dryland salinity has no respect for lines drawn on maps, meaning that some form of national coordination is essential. There is little point South Australia taking decisive action, if the cause of the problem is in NSW. The involvement of the Commonwealth also appears essential, given that the power to raise the taxation revenue that may be necessary to tackle this problem now resides almost exclusively with the Commonwealth.

However, the involvement of the Commonwealth also brings with it technical and operational difficulties. Commonwealth agencies do not have the experience or the infrastructure to deliver natural resource programs. These are constitutionally the responsibility of State Governments, who already have delivery networks in place. It is also unclear which Commonwealth agency would have a lead role in delivering these proposals, although there is no doubt that private landholders would prefer to see any programs managed by Agriculture, rather than by Environment.

In the past, such Commonwealth/State arrangements have left landholders in limbo, with the State and Commonwealth Governments alternatively blaming each other for failing to act, or to provide adequate resources. A repeat of that experience would quickly erode public confidence in any dryland salinity program. This would be disastrous, as the response to it will need to extend over decades, and maintaining public confidence will be a critical element in ensuring that occurs.

A New Approach Needed

At the core of each of these issues is the need to develop a mechanism that provides incentives for appropriate changes in landuse by private landholders, but which at the same time does not become a honeypot which landholders dip into to fund any activity that could conceivably be classified as salinity-ameliorating. The methodology utilised in the Conservation Reserve Program in the USA perhaps provides a model that could be adopted. Under that program, conservation proposals from landholders are scored using an environmental index system. The Government is then able to compare the environmental returns with the projected cost bid by the landholder, and only selects proposals for funding that are cost efficient in achieving environmental benefits. A similar model could be employed in response to dryland salinity, and would do a great deal to allay landholder suspicions that they will once again bear the full cost of the communities environmental expectations.

COMMENTS CONTAINED IN THIS DOCUMENT ARE BASED ON INFORMATION AVAILABLE AT TIME OF PUBLICATION.

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