Effectiveness of a demonstration program to manage dryland salinity in the central wheat belt of Western Australia

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Introduction

Community and catchment-based approaches to natural resource management have a long history in Australia. Community-based approaches to address salinity have been highly successful in raising awareness and providing education about the problem of dryland salinity, as well as encouraging participation in managing the problem. A main weakness of the approach is that community groups, in general, don't have the skills and infrastructure required to evaluate new technologies to combat salinity.

In an attempt to overcome the weaknesses of past group-based approaches, Catchment Demonstration Initiative (CDI) projects were established by the Western Australian Government in 2000 for targeted investment in large-scale catchment-based demonstrations of integrated salinity management practices. The primary goal of the CDI was to fund land use change in the wheatbelt, with each group having targets set for expected impacts. The demonstrations in the CDI projects include engineering and plant-based options for salinity management integrated in viable farming systems. Options were negotiated and designed with the participation of landholders. In one such CDI, based in the Wallatin and O'Brien catchment in the central wheatbelt of Western Australia, the close cooperation between a multi-disciplinary team of agronomists, hydrologists, economists and social scientists and the catchment group gave an opportunity to assess the effectiveness of the CDI approach in deciding and adopting salinity management methods.

This paper is based on both informal observations and documented evidence and analyses (Dawes *et al*. 2007, Measham 2008, Robertson *et al*. 2007, Robertson *et al*. 2008a,b).

The Catchment Demonstration Initiative

The CDI in Wallatin-O'Brien was conducted in two phases. Following initial planning in 2003-04, the first phase (2005-06) demonstrated a range of available salinity management options, covering engineering and plant-based methods following salinity risk assessments carried out at 15 diverse sites throughout the catchment. Landholders hosting a demonstration project contributed about 25% towards the cost of the project. In the second phase (2007-08), landholders were invited to submit applications for "rollout" funding from the CDI for on-ground works throughout the catchment, with the expectation that rollout projects would be influenced by what had been learnt in the demonstration phase. This was seen as a test of landholders' interest and confidence in investing 50% of their own funds in implementing the options. The rationale behind the two-phased approach is that it provided an opportunity for landholders to observe salinity management options being trialed and to assess their suitability for their own sites and business circumstances.

Early in the CDI a key constraint was identified. This was the uncertainty landholders expressed about dealing with salinity and being confident about "what to do where?" on their own farm. The key requirement of the CDI then evolved into developing approaches to improve locational knowledge for on-ground works. The landholders required increased certainty of benefits from their investment in salinity. Reducing this uncertainty has been a major outcome of the CDI, as landholders have increased their understanding of managing salinity on their properties (Measham 2008).

The demonstration projects

The 15 demonstration projects covered a range of landscape positions (4 on upper slopes, 3 mid-slope, 8 valley floor), a range of salinity management strategies (4 containment, 4 recovery, 3 adaptation, 2 assessment of risk and 2 a combination of strategies), and a range of salinity management options (6 engineering-based, 5 plant-based, 2 risk assessment, 2 surface water management, and 1 creek-line rehabilitation). The emphasis on engineering options came from a community concern that ,considerable on-ground works had been undertaken in the previous two decades and that there was no clear evidence that these works had significantly reduced the potential for salinity nor recovered land from salinity. Specifically, landholders in these catchments had invested heavily in tree planting on non-arable areas in the previous 15 years, in part to combat salinity. Now they believed further revegetation had little economic justification (Smith 2007).

Once the demonstration phase commenced, the design of each project was reviewed by the manager and, as required, a series of technical advisory groups (TAG) specialising in engineering options, plant-based options and/or surface water management. The TAG process provided accountability of expenditure of public money on the demonstration projects and allowed for flexibility to change projects as information become available. The expected area of impact1 of each demonstration project was assessed via on-site investigation and modelling and interpretation by the TAG (Robertson *et al*. 2007). The expected area of impact on agricultural land varied from 8 to 350 ha. There were also expected impacts on roads in two projects (0.2 and 1 km) and a creek-line (4 km).

The process of designing, reviewing and implementing the demonstration projects highlighted the complex technical demands around engineering works, such as deep open drains and groundwater pumping, and the valuable role that technical input can play (Robertson *et al.* 2007). The technical requirements for design and implementation varied across the set of demonstration projects from engineering-based projects that required geophysics, drilling/excavation, test pumping, hydrological modelling, and engineering design to plant-based projects that required some geophysics, drilling and agronomic advice. Consequently the technical costs of investigation varied from $25 to $50 per ha ofexpected impact. Expenditure was greater than what would be expected for implementation by farmers, or with mature technologies; and highlighted the need for a set of cost-effective technical investigations for landholders (Robertson *et al*. 2007). When calculated along cost-effective lines the technical costs of investigation would have reduced from $25-50 per ha to $14 to $30 per ha of expected impact.

As a result of the higher costs of investigations and lower agricultural production some of the demonstrations had a lower than expected benefit than expected in the initial CDI plan. Most produced negative net present values, even with optimistic assumptions. This finding confirms that farmers' current decisions to invest only modestly in salinity mitigation is justified on economic grounds. The most favourable projects were those that improved agricultural productivity cheaply on formerly unproductive land (e.g. saltbush on saline land), or protected valuable infrastructure such asfarm buildings. There were two projects where there was a clear benefit through the use of brackish groundwater for stock watering.

The rollout phase

In late 2006, landholders were invited to submit applications for rollout funding from the CDI for onground works. Each landholder was supplied with application templates that prompted the applicants for technical information on the proposed project, critical information required to design the project, a map of the site, an indicative budget, and any regulatory requirements (e.g. notice of intent to drain).

Funding applications were received for a range of on-ground works, despite recent poor seasons and low disposable incomes. The applications were overwhelmingly plant-based. The plant-based projects 1 The effect of any intervention can take many years to be fully expressed so the only method available to assess impact was expert opinions and predictive modeling. Only long term monitoring will show whether these estimates are accurate were proposed to be sown on areas of between 1 and 97 ha and estimated area of impact ranged from 1 to 33 ha. Most projects were based on "hotspots" discussed during interactive property assessments held prior to the rollout phase, where a hydrologist, agronomist, other technical experts and the CDI manager visited each farm and analysed and reviewed options. Some applicants changed their mind as a result of the technical review visit indicating the review influenced their decision making. Also, a number of landholders referred to demonstration projects when assessing the suitability of an option for their "hotspot", reflecting the importance of these projects.

Public vs. private benefits

A striking finding was that the expected area of impact for most of the demonstration projects (and indeed the rollout projects) was equivalent to 1-2 typical sized paddocks and hence well within the boundaries of the farm hosting the project. Only in the case of two projects (surface water management and deep drains) did the benefit extend beyond the boundaries of one farm, and this is because the works went across the boundaries. The area of impact is consistent with the localised and isolated nature of salinity outbreaks and the highly compartmentalised nature of the groundwater flow systems in the area (Dawes *et al*. 2007, Robertson *et al*. 2008b) and reinforces the view that there are many situations in Western Australia in which salinity is a localised problem due to the nature of the groundwater system and increasing size of farms (Pannell *et al*. 2001). Localised groundwater systems can allow an individual landholder to reap the benefits and costs from their own land management decisions rather than relying on the actions of others in the catchment (Kingwell *et al*. 2003). By implication, maintaining a focus on group action in the CDI as a means for capturing synergies in hydrological benefit is misguided. Instead the CDI must emphasise the opportunities for beneficial action by individuals as a means of managing the salinity problem. Benefits of group-based action accrue via other means, mostly through group learning, social support and managing issues such as disposal of groundwater, surface water management, and connecting bush remnants via corridors (Measham 2008).

Due to the use of public funding in the CDI, a concerted attempt was made in the planning stage of the demonstration phase to build in as much public benefit as possible into each project. By early 2006, when each project had been re-reviewed, re-negotiated with landholders and the expected area of impact revised, public benefits were expected in five projects only – the recovery of saline-affected land in a large nature reserve, a reduction in the cost of public road maintenance and the protection of threatened flora in roadside reserves. Most of the anticipated private benefits were improved production from agricultural land, although in two projects the protection of farm buildings under threat from salinity was also listed as a priority. The downwards revision in public benefits expected from the demonstration projects was a reflection of the reduced hydrological impact of projects once reviewed, but also a lack of engagement from public agencies such as the local government, which has the responsibility for the upkeep of rural roads and small reserves.

There is also a public benefit of better knowledge in the catchments, and the permeation through the wider local community. Better knowledge may not just lead to better on-ground actions, but also avoiding investments in actions that will not be cost effective.

Conclusions

On the positive side, we conclude that CDI-type approaches can overcome knowledge constraints in managing salinity by fostering social learning, offer a structured process of trialling options so that the costs and benefits can be clearly and transparently quantified, and avoid the costly mistakes and "learning failures" of the past. On the negative side we argue that such approaches impose demands on the time of landholders, are expensive on the basis of dollars per hectare impacted and it can be difficult to garner ownership from all involved if good process for engagement is not followed. There is the additional problem that few community groups have the capacity to run such programs and disseminate the new knowledge so that the CDI has impact outside the focus catchment. In common to many publicly-funded approaches to salinity, we found that public benefits are smaller than hoped for and that results from monitoring and evaluation are out of step with the time frames for decisions about on-ground works.

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