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Australia's National Action Plan for Salinity and Water Quality: a retrospective assessment*

David J. Pannell and Anna M. Roberts†

Perceptions of a salinity 'crisis' in Australia around 2000 resulted in the establishment of a major national program that aimed to prevent, stabilize, and reverse trends in salinity. The National Action Plan for Salinity and Water Quality allocated A$1.4 billion of public funds to 1700 projects over 7 years. Here, we assess the performance of the program in relation to 12 features that we propose as being essential for programs that aim to address complex environmental problems. The features include use of technical information to guide investment prioritization, use of socio-economic information, effective integration of information for prioritization, selection of appropriate targets, choice of appropriate policy mechanisms, and provision of incentives and support to environmental managers to pursue environmental outcomes cost effectively. Our assessment reinforces findings from a number of public reviews that found serious weaknesses in the program. Overall, with a few exceptions, projects under the National Action Plan generated few worthwhile salinity mitigation benefits and will have little enduring benefit. This was readily foreseeable given attention to the scientific and economic knowledge of salinity available at the time the program was developed.

Key words: environment, institutions, integrated catchment management, mechanism choice, natural resource management, policy.

1. Introduction

Since the 1980s, a number of government policies and programs have attempted to reduce the magnitudes of actual and threatened impacts of salinity in Australia. Key national programs have included the National Landcare Program (commenced 1989); the National Dryland Salinity Program (1993); the Natural Heritage Trust (1997); and the National Action Plan for Salinity and Water Quality (NAP) (2000). The latter two programs were delivered through 56 natural resource management bodies (Catchment Management Organisations, or CMOs), which are regionally based to enhance links to local communities and reflect local problems and priorities.

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† David Pannell (email: david.pannell@uwa.edu.au) is Professor and ARC Federation Fellow in the Centre for Environmental Economics and Policy, School of Agricultural and Resource Economics, University of Western Australia, Crawley, Western Australia, Australia. Anna Roberts (email: anna.roberts@dpi.vic.gov.au) is Senior Research Scientist at the Department of Primary Industries, Rutherglen, Victoria, Australia.

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There have also been a number of state-level salinity strategies and action plans, for Western Australia (State Salinity Council 2000), South Australia (Primary Industries and Resources South Australia 2000), New South Wales (New South Wales Government 2000), and Victoria (Anonymous 1988). These national and state programs have involved a variety of different policy tools, institutional arrangements, and levels of funding.

The program with by far the largest expenditure specifically on salinity was the NAP, which included a budget of A$1.4 billion of public funds (half Commonwealth, half state funding) over 7 years. This program tended to dominate state strategies, in part because it required matching state funds in order for national funds to flow to each state. Writing at the time of the program's announcement, Pannell (2001a) was concerned about a number of aspects of the policy. For example:

> If they are not based on detailed empirical analyses which account for the hydrological and economic realities of the catchment, targets might easily define outcomes which are inferior to a business as usual approach (p. 539).

> The regional groups to which funds are to be channeled will find it very difficult not to spread much of the money thinly and non-strategically amongst farmers (p. 539).

The NAP concluded on June 30, 2008, so it is timely to assess its performance over its 7-year life. Our questions are as follows: (i) did the program generate worthwhile benefits in a cost-effective way? and (ii) how could it have been improved? In addressing these questions, it is intended that the study can contribute to improving the design and implementation of future policies for natural resource management.

The next section provides a brief overview of the program. Section 3 describes the evidence on which our assessment is based. In Section 4, we propose 12 features that are required in a natural resource policy program if it is to be effective and discuss the performance of the NAP in relation to each of them. We also provide an overall assessment considering all 12 features. Section 5 discusses the current status of salinity in national policy, while Section 6 considers the implications for future programs, including Caring for our Country.

2. Outline of the program

Two reports contributed to an escalation of the political profile of dryland salinity leading up to the new millennium: the Salinity Audit of the Murray-Darling Basin (Murray Darling Basin Ministerial Council, 1999) and a report on the impacts of dryland salinity by the Prime Minister's Science, Engineering and Innovation Council (1999). These took the discussion of

agriculturally induced salinity into Federal cabinet and directly engaged the Prime Minister. Media attention to salinity increased dramatically, and the urban community began to be instilled with the sense of a 'crisis', affecting agriculture, infrastructure, biodiversity, and water resources (Pannell 2005).

The policy outcome was the NAP, announced by then Prime Minister John Howard in October 2000. The document released to announce the program (Anonymous, 2000) emphasized 'Integrated Catchment/Region Management Plans' to be developed 'by the community'. The community was to be supported in this by an existing network of rurally based facilitators and coordinators, by skills development programs, by extension of technical information, and by a major public communication program 'to promote behaviour change and community support'.

Funding to achieve NAP targets was directed to 21 of the 56 CMOs, those assessed as being most affected by, or at the greatest risk from, salinity. To secure the Commonwealth funds, state governments were required to provide new funds, additional to previously existing plans, on a dollar-for-dollar basis. What unfolded was a protracted political struggle. Negotiations about the NAP between the Commonwealth and state governments dragged on and in some cases descended into acrimony. States slowly signed on: South Australia in June 2001, Victoria in October 2001, Tasmania in February 2002, Queensland in March 2002, New South Wales in May 2002, the Northern Territory in February 2003, and Western Australia (the state with by far the most severe salinity problem) in October 2003, 3 years into the 7-year program. The CMOs who were charged with developing integrated catchment plans were understandably frustrated at the delays. A range of factors contributed to the delays, including disagreements about conditions for counting state funds as 'new' funding, disagreement about the almost complete reliance on CMOs to choose funding priorities, concerns by states about funds being directed away from state priorities, and tight state budgets. Once the program commenced operation in each state, it was overseen by a Joint Steering Committee, with national and state representatives. To a substantial extent, operation of the program was integrated with another major national environmental program, the Natural Heritage Trust.

Project priorities and project designs were mainly determined by CMOs, subject to approval by their relevant Joint Steering Committee. The processes used by CMOs generally did not involve comprehensive systematic analysis of investment options or project design options.

The stated goal of the program was 'to motivate and enable regional communities to use coordinated and targeted action to:

- prevent, stabilise and reverse trends in dryland salinity affecting the sustainability of production, the conservation of biological diversity and the viability of our infrastructure

- improve water quality and secure reliable allocations for human uses, industry and the environment' (Anonymous 2000, p. 5).

In 2008, following completion of the program, the Australian Government provided the authors with a database containing information about the 1728 projects that it funded. We used this database to estimate the allocation of funds within the program to the following categories: on-ground works, which includes direct actions by governments and payments to farmers to undertake works; extension and capacity building, which includes information provision, technology transfer, environmental management systems, training, awareness raising, farm planning, and demonstrations; information generating actions, such as R&D; monitoring and evaluation; planning; and overhead costs for regional NRM bodies, including administration and actions to build organizational capacity. Each project was assigned primarily to one of these categories on the basis of reading the project title and in most cases a summary project description. In 618 cases, a secondary category was also assigned because of the breadth of the project. If a secondary category was assigned, then funds were notionally allocated according to this rule: 67 per cent to the primary category and 33 per cent to the secondary category. Tables 1 and 2 show the results.

The largest investment overall was in the extension category, which took 41 per cent of the total budget, followed by on-ground works, at 34 per cent. The other four categories each constituted only 5–7 per cent of the overall budget.

A substantial part of the on-ground works category consisted of small temporary grants (so-called incentive payments) to landholders to encourage them to trial new salinity management practices in the hope that they would adopt them permanently. In many ways, this component of the investment is really a form of extension, in that it is encouraging trials of technologies, rather than undertaking works directly. If this component is defined as

Table 1 Allocation of Australian Government funds under the National Action Plan for Salinity and Water quality ($ million)

	State								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Total
On-ground works	1.1	60.0	0.0	9.8	50.5	0.0	27.3	72.5	221.3
Extension, capacity building	1.0	99.6	0.4	34.9	13.8	1.9	68.9	41.3	261.8
Information, R&D	0.1	8.3	0.5	7.4	9.0	0.6	14.7	4.0	44.5
Monitoring and evaluation	0.2	6.5	0.7	6.7	5.8	1.6	11.6	12.4	45.5
Planning	0.1	9.0	0.4	8.4	4.8	0.9	10.0	6.8	40.5
Administration, CMO capacity	0.0	2.5	0.1	8.0	6.4	0.3	8.5	3.5	29.2
Total	2.4	185.7	2.1	75.4	90.4	5.3	141.1	140.5	642.8

ACT, Australian Capital Territory; NSW, New South Wales; NT, Northern Territory; Qld, Queensland; SA, South Australia; Tas, Tasmania; Vic, Victoria; WA, Western Australia.
Source: database of projects provided by the Australian Government.

Table 2 Allocation of Australian Government funds under the National Action Plan for Salinity and Water quality (% by state)

	State								
	ACT (%)	NSW (%)	NT (%)	Qld (%)	SA (%)	Tas (%)	Vic (%)	WA (%)	Total (%)
On-ground works	46	32	0	13	56	1	19	52	34
Extension, capacity building	41	54	18	46	15	35	49	29	41
Information, R&D	4	4	26	10	10	11	10	3	7
Monitoring and evaluation	7	4	33	9	6	31	8	9	7
Planning	3	5	19	11	5	18	7	5	6
Administration, CMO capacity	0	1	4	11	7	5	6	2	5

ACT, Australian Capital Territory; NSW, New South Wales; NT, Northern Territory; Qld, Queensland; SA, South Australia; Tas, Tasmania; Vic, Victoria; WA, Western Australia.
Source: database of projects provided by the Australian Government.

extension rather than on-ground works, then the overall allocation is 51 per cent extension and 25 per cent on-ground works. (This was calculated by re-allocating all projects that relied on incentive payments to the extension category.) This will be relevant in Section 4.2 when we discuss the appropriateness of policy mechanisms used in projects supported by the program.

There were substantial differences between the states in the levels of funding provided (Table 1), with the largest funding provided to New South Wales, Victoria, Western Australia, South Australia, and Queensland, in that order. This order does not reflect the ranking of salinity severity in the states: Western Australia is by far the most severely affected, followed by either Victoria or South Australia.

There were also large differences in the relative emphasis of investment between states (Table 2). Queensland, Victoria, and New South Wales strongly emphasized investment in extension, whereas South Australia and Western Australia leaned toward on-ground works. Even if incentive payments are redefined as extension, on-ground works remain the largest investment in those two states (not shown).

There were a small number of very large projects. The five largest projects, all from Western Australia and South Australia, had a combined budget of $86 million. The other 1723 projects were mostly much smaller, with 80% of them having budgets $< \$433\,000$, on the order of $100 000 per year. (Although the program ran for 7 years, most projects ran for a shorter period, typically three to 4 years.) See Section 4.1 for discussion of the appropriate scale of salinity projects.

3. Basis of the assessment

We will discuss the performance of the program in relation to its stated goal (‘prevent, stabilize and reverse trends in dryland salinity … improve water

quality'). The discussion, in the next section, is broken down into 12 areas that are highly relevant to cost-effective achievement of outcomes in government programs for natural resource management.

There were four government reviews of the program conducted during its life, and in addition the government commissioned two consulting reports evaluating aspects of the program. Two of the reviews were conducted by the Australian National Audit Office (Auditor General 2004, 2008). These tended to focus on administrative aspects of the program but also addressed the likelihood of achieving the program's targets and the quality of those targets. There was a review by the House of Representatives Standing Committee on Science and Innovation (Parliament of the Commonwealth of Australia 2004), which addressed the use of science by the program. The Senate References Committee on Environment, Communications, Information Technology, and the Arts looked at 'whether goals of national programs to address salinity have been attained' (The Senate 2006, p. ix) and followed up the earlier review by the House of Representatives Standing Committee. And finally, there were commissioned reviews by independent consulting firms, one evaluating governance arrangements of CMOs (Walter Turnbull 2005) and the other evaluating the salinity outcomes of NAP funding delivered through CMOs (Sinclair Knight Merz (SKM) 2006). Our assessment of the program will draw on each of these reviews.

In addition, this assessment is informed by scrutiny of numerous other program documents at the program web site (http://www.napswq.gov.au), discussions and meetings with national and state government policy officers, focus group discussions with CMO staff and stakeholders (Marsh *et al*. 2008), surveys of CMOs (Seymour *et al*. 2008), interviews with landholders (Pannell and Wilkinson 2009), research on the economics of salinity management strategies (e.g., Bathgate and Pannell 2002; Kingwell *et al*. 2003; Nordblom *et al*. 2006), research into adoption of those strategies (Pannell 2001c; Pannell *et al*. 2006), insights into the development of decision frameworks that are relevant to salinity (Ridley and Pannell 2005; Pannell 2008) and experience in applying those frameworks in close partnership with CMOs (Roberts and Pannell 2009). The above government-commissioned reports focused on particular aspects of the program. This assessment draws together their findings and integrates that information with our own experiences and research to provide the first comprehensive assessment of the program.

4. Assessment of the program

In this section, we propose 12 features important to an effective policy program for natural resource management and use them to assess the NAP. The 12 features are derived from (i) previous reviews and reports examining the program, (ii) our engagement with the program through extensive interactions with government agencies and CMOs, and (iii) our own published research on salinity economics, management, and policy.

The set of features is also relevant to the new Caring for our Country program.

A common theme through the following 12 sections is that the NAP largely failed to deliver on-ground results, because the CMOs often made poor decisions about investment targets and methods. We attribute this to the failure of the program to put in place adequate institutional mechanisms to provide incentives and support to CMOs to undertake their task.

4.1 Appropriate prioritization of potential projects

There is a strong tendency for environmental programs to attempt to achieve too much, allocating too few resources to too many projects, and the NAP fell into this usual pattern. In common with many environmental programs, the total budget for the NAP ($1.4 billion over 7 years) was very small relative to the level that would be required to manage environmental degradation comprehensively. For example, one prominent analysis indicated the need for a budget of $65 billion over 10 years (Virtual Consulting Group and Griffin NRM 2000).

Scientific and economic research (see Sections 4.3 and 4.4) indicates that salinity mitigation is unusually expensive even relative to other environmental issues. For example, Beverly *et al.* (2008) estimated that to be technically effective, a modest-scale salinity project in northern Victoria would require a budget of between $7 million and $26 million. As noted earlier, 80% of NAP projects had total budgets of A$433 000 or less. We judge that most of the small projects funded by the program would not have generated worthwhile outcomes – their costs would have exceeded their benefits (e.g., Roberts and Pannell 2009).

Given these considerations, there is clearly an imperative to target salinity funds to high-priority projects. The highest priority environmental investments should have at least these four characteristics: they should relate to (i) particularly valuable environmental assets, (ii) facing high threat or high current degradation, (iii) with high feasibility of reducing that threat or degradation at reasonable cost, (iv) with the required works being reasonably attractive to relevant land or water managers. If even one of these elements is neglected by environmental managers, there is a high risk of selecting poor investments.

In the NAP and NHT, no consistent framework for planning and prioritization was provided to CMOs. Each developed its own approach and, not surprisingly, there was wide variation between regions in the approaches used (Alexander *et al.* 2010). As far as we are aware, none developed an approach that considered all four of the aforementioned characteristics. (We are aware of one analysis for a single environmental asset that did so.) This deficiency was recognized in official inquiries but not redressed. It was recognized that investment decisions should be 'outcome focused' and 'subject to a cost-benefit analysis' (The Senate, 2006, p. 221). 'Close attention must be paid to …

actively encouraging regions to put in place measures that are well targeted' (Auditor General, 2004, p. 15).

Good prioritization requires good information and good analysis, which takes time. Programs need to be run with the patience to allow this to happen. In the NAP, CMOs were placed under severe time pressure to complete their planning processes and commence spending the money, irrespective of the quality of those plans. Given the delays in establishing the program, many CMOs were faced with the need to spend large budgets in a very compressed time frame, which further eroded their motivation to prioritize investments carefully.

Ridley and Pannell (2005) developed an investment framework for salinity (called SIF3), which explicitly addresses all four characteristics. The Senate (2006) recommended that governments should 'keep a watching brief' on our framework, 'with a view to potentially implementing it (or a modified version of it) across the country' (The Senate, 2006, pp. 229–230).

4.2 Use of appropriate policy mechanisms

Even if investors make good decisions about which natural resources are to be targets for investment, it is still possible for investments to fail to deliver outcomes because of poor selection of policy mechanisms (e.g., extension, financial payments, market-based instruments, regulation, technology development, research). Pannell (2008) shows that the best choice of policy mechanism depends on the levels of public and private net benefits from proposed changes. Therefore, policy mechanism choice needs to be sensitive to local conditions, as well as to the general characteristics of a problem. In the NAP, around half of all funds were spent on extension and small temporary grants. These were often used in circumstances where they could not deliver environmental or natural resource outcomes, often because they were used to promote practices that were not adoptable on the required scale (Pannell 2001c) (see Section 4.4). Investors should have either used different policy mechanisms or prioritized different projects.

4.3 Use of technical information

Salinity and water quality are complex issues. Economically sound decisions about project priorities and policy mechanisms require considerable technical information, such as information about the likely level of impact of salinity in the absence of enhanced management, the timing of salinity onset, the likely reductions in salinity impacts through various forms of action, and lags in those reductions following management changes.

The NAP did not require CMOs to make good use of scientific information when formulating their investment priorities and plans. In general, CMOs did account reasonably well for threat or damage, but with very few exceptions, they did not use adequate information about the link between

proposed actions and environmental outcomes. They were provided with only limited technical support to do so, and they were not required to demonstrate that they had done so in the course of plans being accredited by government. Concerns about lack of science in the programs were identified repeatedly in the various inquiries and reviews commissioned by government. For example, it was highlighted that decisions should be 'based in sound, up-to-date science' (The Senate, 2006, p. 221), that in dryland areas, 'Links between actions and resource condition change … are often not confidently quantified' (SKM 2006, p. 1), and that 'NAP/NHT have only been partly successful in enabling the flow of scientific and technical information into the catchment management planning process' (Chartres *et al.* 2004, p. 4). Furthermore, CMOs were highly constrained by the program in their investment in research to collect missing information required for sound decision making. Funding was expected to be spent mainly on extension and on-ground works. Very little of the funding for research in Tables 1 and 2 was identified or commissioned by CMOs. Rather, it was done mainly by government agencies, independent of CMOs. Sinclair Knight Merz (SKM) (2006) noted that the evidence base for salinity processes related to irrigated agriculture is stronger than for nonirrigated agriculture, but from our observation of the investment plans of CMOs, this stronger evidence base was often not well used.

CMOs generally lacked capacity to make good judgments about their requirements for information and science (Seymour *et al.* 2008). 'A number of catchment management agencies interviewed had rather vague wish lists for information and tools. This indicates some lack of understanding about the potential application of existing science and technology' (Chartres *et al.* 2004, p. 4).

The need for the program to actively support CMOs in the area of science was emphasized in Recommendation 1 of the Parliament of the Commonwealth of Australia (2004, p. 57).

1. Develop systems to ensure that the best science is made available to state government agencies, catchment management organizations …;
2. Provide CMOs and land managers with adequate support and resources to use and incorporate science into their regional plans, investment strategies, and on-ground works; and
3. Provide guidelines for CMOs and land managers, making them aware of pertinent salinity research findings.

The inquiries and reports on the program recognized that 'it is important that the NAP/NHT foster the underpinning science required for its ultimate success' (Chartres *et al.* 2004, p. 4). There was some investment in R&D, particularly in Victoria (Table 1), but the connection between this work and CMO decision making was weak. In the absence of adequate scientific knowledge, it was not possible to prioritize program funds to the most beneficial projects, even if CMOs had had the skills and resources to do so.

4.4 Use of socio-economic information

If the works or changed practices needed to protect an environmental asset require changes in behavior by private land or water managers, investment managers need to consider whether those works will be attractive or unattractive to the people who would have to adopt them. There are many well-understood reasons why conservation practices can be unattractive to land and water managers (Pannell *et al*. 2006). If the practices are highly unattractive in a particular case, it will be expensive and difficult to get them adopted, and the viability of investing in that environmental asset will be reduced. Even if the works are relatively attractive when implemented at small scale, they may be highly unattractive at large scale (Bathgate and Pannell 2002).

Seymour *et al*. (2008) found that CMOs have little capacity in the use of social or economic information relating to landholder behavior. For example, they found that regional plans made little or no use of information about the farm-level economics of proposed changes in land management. This was reinforced by (Chartres *et al*. 2004, p. 3): 'Additional attention needs to be directed to issues associated with farm economics and profitability in natural resource planning'. Of the 18 regions (13 NAP regions and five non-NAP) surveyed by Seymour *et al*. (2008), a small number commissioned research into the demographic and economic character of their region ('social profiling'), but none undertook work on the adoptability of proposed works.

In general, the likely response of landholders to interventions was not considered in any depth, if at all. At national, state, and regional levels, it was generally naively assumed that, with sufficient effort and skill on the part of extension agents, landholders would respond on an adequate scale to extension and the payment of small, temporary grants. The fact that they often did not do so could readily have been foreseen. Pannell (2001b) highlighted that in many regions, there was a lack of sustainable land management practices that were highly adoptable by farmers. Pannell *et al*. (2006) argued that 'If such innovations cannot be identified or developed, there is no point in falling back onto communication. Promoting inferior practices will only lead to frustration for all parties.' (p. 1421). Such frustration did occur very commonly.

Appropriate use of social and economic information by CMOs was not encouraged by the NAP. Funding was provided despite the lack of explicit consideration of these issues in the plans that were put forward. The program was not proactive in supporting or training CMOs in this area.

4.5 Balance of investment between current works and knowledge or technology

Given the reality of a fixed budget in most environmental programs, managers face a trade-off between investing in works that will have an immediate effect and investing in actions that may have a bigger effect in the long term. Included in the latter category would be research to develop new technologies and research to provide information to allow improved decision making in

later years. Technology development would be relatively attractive in cases where the current environmental practices are not sufficiently effective, or not sufficiently adoptable, and where development of improved technologies is judged to be feasible (Pannell 2009). Research to provide information is relatively attractive where there are currently substantial gaps in information needed to drive decisions.

Technologies available for salinity management include the following:

- perennial plants (herbaceous perennial pastures, shrubs, or trees) that use more water than annual plants, including annual crops such as wheat, barley, and canola and annual pastures such as annual clover, medic, and ryegrass. If planted over a sufficiently large area, perennial plants can prevent the rise of saline groundwater to the ground surface.
- salt-tolerant plants for productive use of areas that are already affected by salinity.
- engineering works, including drainage, siphons, relief wells, and pumps (Pannell and Ewing 2006).

Although a range of technologies exist, the need for technology development for improved salinity management was recognized in several of the government reviews. For example, the Auditor General (2004, p. 14) noted that the 'limited availability of commercially attractive treatment options for regions' is a 'key risk that require(s) careful management'. The House of Representative review recommended 'that the Australian Government give greater emphasis through its investments in salinity science to develop new, economically viable land and water use systems' (Parliament of the Commonwealth of Australia, 2004, p. 167). The NAP made almost no investments in this area – only a few small projects.

The program did include some investments in the generation of information that should have been useful for planning and prioritization (Table 1), but a strong theme in the government reviews was the need to strengthen this aspect as well. 'The Committee recommends that discrete funding be allocated … for regional bodies to partner in regional scale research to deliver R&D outcomes that are more relevant to their regional priorities and needs.' (The Senate, 2006, p. 224). In most of the states, CMOs were strongly discouraged from allocating funds to research, even when a clear need was identified. The House of Representatives Review recommended that the Australian Government 'identify and remove impediments for catchment management organizations to undertake or commission research' (Parliament of the Commonwealth of Australia, 2004, p. 193), but this did not happen.

4.6 Balance of investment between mitigation and adaptation

Where mitigation is not justified on benefit-cost grounds, there may be net benefits in investing in adaptation to a degraded environment. This becomes particularly important in problems like dryland salinity where much degrada-

tion is physically impossible to avoid, or not economically efficient to prevent. Other relevant considerations include the scale of program resources relative to the scale that would be needed to prevent or repair damage, the adoptability of practices that landholders would need to take up to prevent or repair damage, and the potential to make productive use of degraded resources.

On each of these criteria, the situation favored adaptation ahead of mitigation in most areas facing serious salinity threats, particularly where the damaged or threatened asset was agricultural land. The technical feasibility of preventing or reversing is usually low in the sense that very large changes in land management are required (National Land and Water Resources Audit 2001; Dawes *et al*. 2002), the level of program resources was low relative to the scale of the problem, the adoptability of salinity mitigation methods was often poor (Pannell 2001c; Kingwell *et al*. 2003), and there existed good opportunities to make productive use of degraded resources, at least from an economic perspective (e.g., O'Connell *et al*. 2006).

However, the NAP had a clear focus on mitigation; the stated objective was to 'prevent, stabilise and reverse trends in dryland salinity' (Anonymous, 2000). The concept of adaptation was not even mentioned in the program documents. In practice, some CMOs did support a small number of projects that aimed to make productive use of salt-affected land, but the balance of emphasis of the program was clearly inefficient in this respect.

4.7 Avoidance of adverse side effects

In some circumstances, works undertaken to improve one natural resource problem can have negative consequences for another. For example, many trees were planted with the intention of reducing saline discharge into rivers in circumstances where they had a more important negative impact on the yield of fresh surface water into the same rivers (e.g., Nordblom *et al*. 2006). These plantings started prior to the NAP and continued during it, some with NAP funding support. Because the NAP did not deal adequately with the science of cause and effect, the adverse side effects were largely unrecognized by CMOs, who provided payments to *encourage* some actions that should have been *discouraged*.

4.8 Monitoring and enforcement of compliance

In circumstances where the preferred conservation practices are sufficiently attractive to landholders, environmental managers do not need to use incentive-based mechanisms to encourage adoption, and consequently, they do not need any enforcement mechanism. However, where an incentive mechanism is used to compensate for the negative private net benefits of a conservation practice or to prevent adoption of an environmentally damaging practice that is attractive to landholders, monitoring and enforcement need to be part of the program. The NAP had little monitoring and, as far as we are aware, no

mechanism for enforcing agreed changes in land management, other than refusing to extend payments to a second phase. In practice, even this option was not always used.

4.9 Setting appropriate targets

Selecting meaningful targets for environmental programs requires high-quality analysis of the investment options. Targets should be consistent with the known biophysical information about the asset's response to management, the known behavioral responses of land and water managers to policy interventions, and the resources available under the program. In the NAP, CMOs were required to specify targets, but those targets were not required to be realistic. Indeed, in some ways, realism was discouraged within the guidelines imposed, such as the need to provide 'aspirational' long-term targets. Not surprisingly, '80 out of the 163 resource condition targets identified in the plans (of eight regions examined) did not meet the identified criteria in terms of being measurable or having a specific timeframe' (Auditor General, 2008, p. 19).

4.10 Monitoring and evaluation linked to management

Good evaluation is closely related to good planning. If the analysis has been performed to select investments and establish high-quality targets, monitoring and evaluation is relatively straightforward, and results can feed into ongoing management decisions.

Many CMOs did not understand how to undertake monitoring and evaluation so that they provided sound and useful data for evaluation and ongoing management (SKM 2006). The program did not require them to do so. Monitoring in the NAP focused on accountability for funds spent but neglected the achievement of environmental outcomes. This focus sent a message to CMOs that the government was not really concerned about the achievement of outcomes, only with spending the money. Weakness of monitoring was also observed at the program level: 'At the present time it is not possible to report meaningfully on the extent to which these outputs contribute to the outcomes sought by government' (Auditor General, 2008, p. 16).

4.11 Supporting and creating appropriate incentives for environmental managers

In a program where decisions about actual investments are devolved to individuals or groups separate from the funding body (as occurred with CMOs in this case), it is important for the funding arrangements to be set up in a way that provides incentives for environmental managers to seek environmental outcomes cost effectively. Programs should also provide support to address

important knowledge and skill gaps that the relevant decision makers may have.

As we have noted earlier, the NAP provided inadequate support: 'enhancing guidance to the regions must be given a higher priority' (Auditor General, 2004, p. 15). It also provided almost no incentives for CMOs to pursue environmental outcomes. Targets were not required to be realistic, and accreditation of plans was very weak, particularly in relation to their use of science and socio-economic information. The Senate (2006) recommended that government should 'strengthen the accreditation process for regional bodies' and 'ensure that funding is conditional on rigorous investment planning' (The Senate, 2006, p. 221). This did not occur.

A rare bright spot in the published program reviews was the review by Walter Turnbull (2005, p.9), which found 'corporate governance performance to be satisfactory in the bodies reviewed'. However, we wonder about the suitability of corporate governance arrangements that could allow the other weaknesses identified here to persist.

4.12 Consistency with an appropriate role for government

Broadly speaking, Government policy may seek to: (i) increase aggregate social welfare through reducing market failure; (ii) protect or enhance publicly managed resources; (iii) address areas of inequity, inequality, or disadvantage; or (iv) pursue political objectives to generate benefits to the government. In evaluating any program, we assume that item (iv) is to be judged inappropriate. For the NAP, specifically, we believe that item (iii) should be of minimal relevance. The key issues here, then, are the extent to which the program was targeted to addressing market failures, and its success in reducing them, and its contribution to protection or enhancement of publicly managed assets.

The main market failures relevant to salinity are public-good problems (nonrivalry and nonprice excludability) associated with externalities or associated with information failures. For example, land management on one farm can cause negative externalities because of salinity affecting water resources, environmental assets, public infrastructure, or agricultural land on another farm. Information failures may arise, for example, if farmers are unaware of or have misperceptions about land management practices that would be in their interest to adopt.

Ostensibly, the NAP could be seen as targeting these market failures, through the payment of grants to farmers to internalize externalities and the use of extension officers to promote changes in farming practices. However, a deeper assessment reveals problems in both areas.

For an action to be judged as efficiently managing a negative externality, its overall benefits must exceed its costs. Pannell *et al*. (2001) argued that salinity-related externalities were very much smaller than widely believed in Western Australia, the state with by far the largest salinity problem (around

80 per cent of the total national area of salt-affected land). Some of the reasons for this would apply in parts of other states as well. Smaller externalities mean that the potential benefits from reducing externalities are lower as well. On the other hand, a range of evidence shows that the costs of reducing externalities from salinity are often large, requiring very substantial changes in land management (e.g., Dawes *et al*. 2002; National Land and Water Resources Audit, 2001), and the recommended changes often have high opportunity costs (e.g., Kingwell *et al*. 2003) especially when applied at large scale (Bathgate and Pannell 2002). Overall, the net benefits of acting to reduce salinity externalities would very often be negative. Identifying cases where they would be positive requires a detailed and sophisticated analysis. However, it is clear that the program did not include or support such analysis.

As noted earlier, most of the advocated salinity mitigation practices in most regions are unattractive to landholders for economic (Kingwell *et al*. 2003) or other (Pannell 2001c; Pannell 1999) reasons. This means that farmers' nonadoption of these practices does not constitute an information failure, and so use of extension to promote these practices is not justified on a market-failure basis.

On the other hand, some investments in direct action by government, such as pumping saline groundwater to prevent discharge into the Murray River (Murray Darling Basin Commission 2006) or into rural towns in WA (Department of Agriculture and Food Western Australia 2006), seem much more likely to be justified on a benefit-cost basis. Unfortunately, investments of this type were the exception within the NAP. An assumption built into the program, presumably for political reasons, was that most funds should mostly be directed to supporting land management change on farms.

4.13 Overall assessment

Did investments under the NAP generate worthwhile salinity abatement benefits in a cost-effective way? In our judgment, based on the evidence in Sections 4.1–4.12, the net benefits of the majority of investments under the program were negative, and in some cases, the gross benefits were negative. Funds were often poorly targeted, or effectively untargeted, and the choice of policy mechanisms was very poor, particularly in the excessive reliance on extension. This was easily foreseeable and avoidable (Pannell 2001a,b). The NAP could have been improved by better addressing the issues raised in Sections 4.1–4.12, including the use of technical and socio-economic information, better prioritization and targeting, use of appropriate policy mechanisms, and providing incentives and support to CMOs to pursue outcomes in a cost-effective way.

In some regions, there was a decrease in the incidence of dryland salinity during the life of the program, but in almost all cases this was because of below-average rainfall, rather than interventions funded by the program

(SKM 2006, p. 5). Projects that we judge likely to be cost effective include major projects dealing with salinity in the Upper South East of South Australia, the Collie River in Western Australia, and engineering works to 'intercept' (i.e., pump) saline ground water in South Australia.

The NAP has not resulted in large-scale land-use change in dryland landscapes. 'NAP investment by itself was always unlikely to do so, due to the lack of suitable landscape 'best practice' options, the scale of investment and the time required to implement landscape change and achieve a landscape response. … Performance is much stronger in irrigation regions, where salinity interventions are often more affordable and demonstrably effective' (SKM 2006, p. 8).

The Auditor General's 2008 report was particularly damning:

> There is little evidence as yet that the programs are adequately achieving the anticipated national outcomes (Auditor General, 2008, p. 16).
>
> Where the impact (of NAP investment) on resource condition is identified by regional bodies, the expected results were often low (frequently <1 per cent of the longer-term resource condition target) (Auditor General, 2008, p. 19–20).
>
> There was little information forthcoming that suggested that targets, even if met, would be sufficiently robust to arrest or reverse the decline in catchment condition in many areas (Auditor General, 2008, pp. 18–19).

It is notable that many of the issues raised in Sections 4.1–4.12 were also raised in one or more of the major reviews conducted during the life of the program, and yet these reviews had no discernible effect on the operation of the program. The Auditor General (2008) seemed frustrated that the responses to its previous reports had not been adequate: 'Performance measurement has been an ongoing issue covered by three previous (Australian National Audit Office) ANAO audits since 1996–97' (Auditor General, 2008, p. 17). Even with the understatement and cautious expression that characterizes these review reports, they are very negative in their assessments of the program. The general response of government departments was to state that 'The Departments … agree with the recommendations' (Auditor General, 2004, p.100) and that they were committed to addressing each recommendation or had already done so. However, the fundamental design and operation of the program remained unaltered.

Unlike the other reports referred to here, the Auditor General (2008) report has been taken relatively seriously. Probable causes of this include that it coincided with the transition from one program to another, that there was a change of government just before its release, and that it was especially critical.

5. The current status of salinity in national policy

In March 2008, the newly elected Australian Government announced Caring for our Country, the program that has replaced several national programs, including the NAP. The new program has a budget of $2.25 billion to deal with a wide range of environmental issues. Program documentation as of December 2008 includes a statement of intended outcomes from the program (Anonymous 2008a) and 1-year business plans (Anonymous 2008b, 2009).

Salinity is not a priority for investment in Caring for our Country. Indeed, it is barely mentioned in the program documentation. In 2000, salinity was viewed politically as a national crisis (Pannell 2005), warranting a dedicated program of $1.4 billion, but documentation for the new program includes not even a single project focused on the issue. Factors contributing to this remarkable fall in priority probably include that:

- salinity was never actually a crisis, and this becomes clearer to people over time. The experience with salinity highlights the dangers of promoting environmental problems as crises for political purposes;
- in large areas of eastern Australia, there has been below-average rainfall for several years, so that water tables have fallen, and the apparent threat from salinity has abated, as least temporarily;
- the great difficulty of mitigating salinity threats, which was known to salinity scientists in 2000, is now better known by the policy agencies. In many cases, it is a highly intractable problem;
- the very strong criticisms of the program by the Australian National Audit Office (2008) reduced the motivation of the Australian Government to continue to prioritize salinity; and
- the newly elected government may have wished to distinguish itself from the previous government, which initiated the NAP.

CMOs may still choose to invest in salinity management in the new program to a limited degree, but overall the level of such investment will be dramatically reduced.

6. Implications for future programs

The history and experience of the NAP has an important implications for future programs, including Caring for our Country. If they are to perform better than the NAP, future programs need to be designed and implemented in a way that will address the issues identified in Section 4 of this article. Key requirements include the following: using the best available technical and socio-economic information, prioritizing investments well, choosing appropriate policy mechanisms, setting realistic targets, providing incentives and support to environmental managers, and investing in ways that will deliver long-term outcomes, not just short-term activity. Crucially, program

designers need to pay particular attention to the incentives that they provide to environmental managers and project proponents, such that those who demonstrably focus on achieving important natural resource outcomes in a cost-effective way are rewarded, while those who have different priorities are not funded. Sufficient time needs to be allowed for high-quality prioritization and project design to occur, rather than rushing to meet political deadlines.

On the web site for the Caring for our Country program, the rhetoric appears promising, with an emphasis on 'a business approach to investment, clearly articulated outcomes and priorities and improved accountability.' On the other hand, program development was extremely rushed, as the Departments attempted to meet an unrealistic timeline imposed by their ministers. Further, 'clearly articulated outcomes' may be no better than unarticulated outcomes if they are not based on sound and comprehensive analysis considering asset value, levels and timing of environmental damage, the technical and socio-economic feasibility of reducing damage and costs. This has not occurred. It would have required agencies to commence their analysis well before the end of the previous program. However, such foresight has not been employed in Australian natural resource programs to date. Overall, a number of the key issues identified here have not yet been adequately addressed in the new program.

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