

Experiences with Alternative Land, Water and Biodiversity Policy Approaches in Australia

David Pannell

> Introduction

Socially and economically, Australia has much in common with Canada. However, there are some considerable differences between the two countries in terms of their approach to environmental and natural resource issues. This chapter provides an overview of recent trends in natural resource policy in Australia, focusing on policies for land, water, and biodiversity conservation. The purpose of the chapter is to share the lessons from Australia's experiences in these areas, and to highlight some aspects of government behaviour that could be relevant to many Western countries. An overview of a range of recent policy programs in Australia reveals that there are few clear success stories. Successive programs have failed to fix clearly identified problems, due to politics, community expectations, and impatience. This chapter identifies ways to improve the cost-effectiveness of these programs including having a stronger focus on achieving outcomes, rather than just supporting activities; more rigorously targeting expenditures to high-payoff situations; relying more on scientific and economic information in that targeting; and using a broader range of policy tools, selected to suit the relevant bio-physical and socio-economic circumstances.

> Society and government

Most Australians live in coastal cities. The population density in agricultural areas is, on average, very low by global standards. Most agricultural land is not irrigated, and is used for cereal cropping, canola, legume crops, sheep, and cattle. Irrigated and higher rainfall areas support many different industries including horticulture, vineyards, dairy, and plantation forestry.

Australia has separate governments for each of its six states and two territories, as well as a national government. Consistent with the experience of Canada, relations between state and national governments over this area of policy have sometimes been strained. In Australia, responsibility for environmental and natural resource issues rests primarily with state governments, but in the past two decades, Australia's national government has played an increasingly influential role. This influence has been created through the provision of programs that provide large financial resources to states, but with strings attached; in many cases, state governments must provide matching funds. In this way, the national government has strongly influenced the agenda and largely determined the approach to policy, to the chagrin of some state governments. Most of the programs listed below were initiated by the national government.

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 9

Chapter 10

Chapter 11

Chapter 12

Chapter 13

Chapter 14

Acknowledgments

Publishing Information

About the Fraser Institute

> The environment and natural resources

Key environmental and natural resource problems in rural areas of Australia include land degradation (especially salinization and acidification), loss of biodiversity, and issues with water quality and quantity.

Land degradation

In most countries where land salinization is a problem, the cause of that salinity is irrigation. Although Australia does have a significant problem with irrigation salinity, the largest area of salt-affected land is in non-irrigated regions. In these areas, the sub-soils are naturally high in salt. Australia's native vegetation is well adapted to use all available rainfall (Pannell, 2001a). However, in large areas the natural vegetation has been replaced by European-style agriculture based on annual plants such as wheat, which allows some water to move past the root zone. This causes groundwaters to rise and, in places, bring salts to the surface (National Land and Water Resources Audit, 2001a). Around two million hectares of land are already salt-affected (Australian Bureau of Statistics, 2002), and another four million hectares are at risk. One of the key strategies to contain salinity is to reestablish perennial plants (trees, shrubs, and pastures) in order to prevent the rise of saline groundwaters (Pannell and Ewing, 2006).

Between 12 and 24 million hectares of agricultural land in Australia have strongly acidic soils (National Land and Water Resources Audit, 2001b), and agricultural activities such as the application of nitrogen fertilizer make them more so. Plants on acidic soils often

suffer from aluminium toxicity, and these crops suffer yield losses (Cregan and Scott, 1998). Farmers have increasingly applied lime to counter soil acidity.

In the past, wind erosion was a serious problem for Australian agriculture. A very high level of adoption of minimum tillage systems has resulted in a dramatic reduction in this problem. For example, by 2004/2005, an estimated 70 percent of the nation's crop farmers had adopted both direct drilling and minimum tillage practices (Hodges and Goesch, 2006), and in the main crop-producing state, Western Australia, 86 percent of crop farmers were using zero-tillage systems in 2003 (D'Emden and Llewellyn, 2004).

Biodiversity

In 2000, *Nature* published an assessment of the world's 25 most important biodiversity hot spots, which were defined as areas with an "exceptional concentration of endemic species undergoing exceptional loss of habitat" (Myers et al., 2000). The agricultural region of southwestern Australia was included in the list. It is the only such hot spot in Australia, one of only four in developed countries, and one of only five outside the tropics. Protection of biodiversity in this region is of international significance. Biology in that region, and in Australia in general, is highly diverse because of the continent's great age, and because it has had a relatively stable climate for a very long period of time. For example, the glaciation that affected Canada in recent ice ages did not affect Australia.

Having especially rich flora and fauna means that there is potentially a lot to lose. Furthermore, because of the long undisturbed evolutionary processes, many

A breath of fresh Air

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 9

Chapter 10

Chapter 11

Chapter 12

Chapter 13

Chapter 14

Acknowledgments

Publishing Information

About the Fraser Institute

species are endemic to small areas, and so potentially susceptible to extinction. Recent biological surveys have found that there are at least 450 plant species and 700 arthropod species in southwestern Australia that exist only in those parts of the landscape that are at risk of salinization (Keighery et al., 2004). Another area of concern has been the clearing of native vegetation to increase the area available for agriculture. This directly removes native plants and reduces habitat for native animals.

Water

In common with most countries, Australia faces challenges with nutrients and sediment entering waterways and water bodies. In addition, salinization of water resources is a major concern in Australia's major river systems. There has been increasing concern about the allocation of available water among competing uses: irrigation, domestic use, industry, and the environment. Irrigation is by far the largest water user. In some waterways, the amount of water allocated to irrigators exceeds average annual flows—a problem that policy makers have been addressing in recent years (see discussion of the National Water Initiative below).

> Experiences with different policy programs and approaches

Landcare (1989)

The National Landcare Program (NLP) was launched by the national government in 1989 from the foundation of

the National Soil Conservation Program. The NLP was based on the premise that land degradation in agriculture could be solved by awareness-raising, education, and catchment planning processes for groups of farmers (Curtis and De Lacy, 1997; Vanclay, 1997). A stewardship ethic was to be cultivated among farmers.

The primary instruments used within the Landcare program were the provision of paid facilitators and organizers to local farmer groups, the development of catchment plans, and subsidies for the partial funding of relatively small-scale on-ground works. Often the facilitators lacked strong agricultural or technical backgrounds, but had skills in organization and communication.

For over a decade, this paradigm was the dominant force shaping resource management policies for agriculture. The NLP approach was very successful at raising awareness of resource conservation issues among farmers, and, in some cases, this awareness led to changes in farming practices. However, the contributors to Lockie and Vanclay (1997) identified a range of problems with the objectives and underlying assumptions of the NLP, including:

- ⌘ differences between the professed ideology of the program, and the way it actually operated;
- ⌘ a failure of the program designers to appreciate the complexity and difficulty of the issues the program was intended to address; and
- ⌘ unrealistic expectations regarding how much voluntary change in land management could be prompted through education, training, communication, and awareness raising.

A breath of fresh Air

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 9

Chapter 10

Chapter 11

Chapter 12

Chapter 13

Chapter 14

Acknowledgments

Publishing Information

About the Fraser Institute

Reinforcing the latter point, Barr notes the inadequacy of relying on voluntarism and a stewardship ethic: “There is a significant body of research that demonstrates that links between environmental beliefs and environmental behaviour are tenuous” (1999: 134).

To the above-noted problems, I would add:

- ⌘ a lack of targeted funds to priority areas where intervention could make a major difference;
- ⌘ a neglect of technical, scientific, and economic issues; and
- ⌘ a focus on a particular subset of policy tools, rather than an assessment of which tools would be best suited for particular problems in particular locations.

After a decade of efforts under the Landcare banner, many farmers became jaded with the Landcare approach, and dismissive of the unrealistic expectations embodied in the program. Overall, the achievements of Landcare were disappointing relative to the hopes initially had for it. Although “empowerment” and “participation” (Landcare buzzwords) are important elements of good extension¹ practice, they are not sufficient weapons against the more intractable environmental problems, such as salinity and vegetation loss (see Pannell et al., 2006). Regarding salinity, for example, Ridley and Pannell (2005) recognize the need for more attention to technology development;

¹ Extension is a commonly used term in agriculture, used to encompass education, communication, persuasion, awareness raising, training, and similar activities.

regulation; direct funding of major engineering works; carefully targeted grants to support changes in land use; and serious consideration of “no action” as the most appropriate response in many cases.

Natural Heritage Trust (1997)

The Natural Heritage Trust (NHT) was intended to address a range of land, water, and biodiversity conservation issues. It was a much larger program than the NLP, perhaps reflecting a growing public concern for environmental issues.

The National Landcare Program was untargeted; almost any change to land-management practices that were perceived as being more “sustainable” could be encouraged and supported. The NHT was meant to be more discerning and targeted in its support for activities. In practice, however, the degree of rigour used to evaluate proposals for funding was often low. An inquiry by the Australian National Audit Office in 2001 expressed concern that there was insufficient knowledge about what environmental benefits were being generated by the program. Nevertheless, the identified weaknesses of the program did not seem to be of great concern to the national government, which perhaps felt that the political benefits of having a high profile environmental program were sufficient to justify its existence. A second phase of the program was announced in 2001, and concluded in 2008.

National Action Plan for Salinity and Water Quality (2001)

This program was aimed at a subset of issues concerning salinity and water quality. In response to criticisms

A breath of fresh Air

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 9

Chapter 10

Chapter 11

Chapter 12

Chapter 13

Chapter 14

Acknowledgments

Publishing Information

About the Fraser Institute

regarding the lack of suitable targeting of funds in the NHT, the program was another attempt at more targeted funding. As with previous programs, it failed to deliver. One reason why it failed was that the main targeting was done at too large a scale: the region. Within targeted regions, it was still possible to spend program resources unproductively, and this has happened often. Contributing to this was an ongoing neglect of scientific and economic considerations in the planning and accreditation of plans, and the use of inappropriate policy tools.

The document released to announce the program, *Our Vital Resources – National Action Plan for Salinity and Water Quality*, emphasized “Integrated Catchment/Region Management Plans” which were to be developed “by the community” (NAPSWQ, 2000). In practice, funds have been used mainly to fund extension, or to offer small, temporary incentive payments (grants) to landholders. Novel elements of the national action plan included the setting of targets for salinity, with funding to achieve these targets being given to community-based groups in the regions.

Setting targets for a catchment or region raises a number of issues (Pannell, 2001a). If they are not based on detailed empirical analyses which account for the physical and economic realities of the catchment, targets can easily define outcomes which are inferior to a business as usual approach. If they are based on scientifically credible analyses, targets for the available budget will sometimes be very modest, and may threaten the political viability of the program. For example, in the case of salinity in Australia, the current national program involves an expenditure of AU\$1.4 billion over eight years; a prominent estimate of the cost of

addressing salinity in a relatively comprehensive way is AU\$65 billion over 10 years (Watson, 2001)—and even that is likely a substantial underestimate, in my view. Unwilling to face these hard realities, governments have allowed the available public funds to be spread thinly across many small projects, with the hope of achieving broader impacts. Instead, this has caused the funds to become diluted and relatively ineffectual.

Regional delivery

Australia’s national action plan and the second phase of the Natural Heritage Trust were delivered through a set of 56 regional bodies. It was reasoned that these bodies would have (or would be able to obtain) better knowledge of local conditions and problems than governments could access. These bodies vary widely in their expertise and their size (e.g., in terms of number of staff, they range from approximately 20 to 80).

The quality of the analysis conducted to support funding allocation decisions varied widely among the regional bodies. Consistent with the government’s expectations, they consulted widely within their communities, but they did not sufficiently consider sound evidence and modeling to ensure that planned interventions would actually achieve outcomes. Government funding conditions did not require them to do so.

National Water Initiative

The Economist (2003, July 19: 13) has described Australia as “the country that takes top prize for sensible water management.” This is based primarily on Australia’s establishment of markets for irrigation water, in

A breath of fresh Air

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 9

Chapter 10

Chapter 11

Chapter 12

Chapter 13

Chapter 14

Acknowledgments

Publishing Information

About the Fraser Institute

which rights can be freely traded amongst irrigators. Nevertheless, considerable challenges remain. There has been great pressure to reallocate water away from irrigators and towards environmental flows and urban water users. A number of Australian cities are suffering serious shortfalls of water due to growing demand and, in recent years, below-average supply.

There has been political resistance to making use of markets to undertake this reallocation, largely because of concerns about any relocation taking place, rather than concerns about using markets for this purpose. On the other hand, resistance to making use of markets has been evident in the debate about water allocation among urban users (e.g., Crase and Dollery, 2006).

The National Water Initiative (NWI) is Australia's current document laying out the agenda for further water reform. According to the National Water Commission's web site, the official objective of the NWI is "to achieve a nationally compatible market, regulatory and planning based system of managing surface and groundwater resources for rural and urban use that optimizes economic, social and environmental outcomes" (Australia, National Water Commission, no date). It covers eight areas: water access entitlements and planning framework; water markets and trading; water pricing; integrated management of water for environmental and other public-benefit outcomes; water-resource accounting; urban water reform; knowledge and capacity building; and community partnerships and adjustment.

The early performance of the initiative has been mixed, due to the political resistance noted above. However, given Australia's good progress in this area in the past, and the imperative to deal with current pressures, one can remain hopeful about medium-term prospects for reform.

Controls on clearing of native vegetation

In rural areas of Australia, there are many remnants of the original native vegetation, a portion of which are of high biodiversity value. State governments have increasingly sought to protect remnants on private land from clearing by farmers who wish to expand their productive farm area. More stringent regulatory restrictions on further clearing have been introduced, and in most states it is now difficult for most farmers to undertake any clearing. Two states, Queensland and New South Wales, have the largest areas of uncleared native vegetation, and the political pressure to allow further clearing is more intense in those states. Nevertheless, even there, pressure from environmental interests has been increasingly influential.

This area of policy is different from the main national programs mentioned above in terms of its reliance on regulatory restrictions to influence landholder behaviour. As a consequence, it has been a highly contentious area of policy, prompting, for example, a recent national review of costs to landholders resulting from restrictions on the management of native vegetation (Productivity Commission, 2004). The report concluded that existing regulatory approaches are not as effective as they could be in promoting objectives to retain and rehabilitate native vegetation on private land, and that they impose significant costs.

Economic policy instruments ("market-based instruments")

Apart from the creation of water markets, there has also been growing interest in the use of economic policy instruments, such as conservation tenders (see, for

A breath of fresh Air

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 9

Chapter 10

Chapter 11

Chapter 12

Chapter 13

Chapter 14

Acknowledgments

Publishing Information

About the Fraser Institute

example, Stoneham et al., 2003), tradable pollution permits, and offset schemes. A pilot program of “market-based instruments” was initiated in 2001, and extended in 2005. The program has supported a significant number of small but innovative trials of these instruments.

The experience so far has been encouraging, but it has also revealed some limitations. In a review of the outcomes of the first phase of the program, Grafton (2005) concluded that cost savings are possible, relative to traditional mechanisms. He argued that the mechanism with the greatest potential for widespread application is conservation tenders, which involve landholders submitting bids to undertake works in an auction-like setting. Environmental managers select the bids that offer the best value for money. Grafton pointed out that, to effectively implement these instruments, there needs to be good bio-physical modeling at the farm or paddock level, and adequate monitoring and enforcement of landholders’ actions.

Pannell (2001b) has argued that there appears to be excessive enthusiasm for market-based instruments in some policy quarters, and that there needs to be care to ensure that they are applied in situations where there is market failure. “Market failure” describes a situation where a change in the way resources are managed would increase efficiency. Government intervention may be warranted to achieve that change if it does not arise spontaneously in the market. Although economic policy instruments may be useful tools to overcome market failure, in situations where resource degradation is not a sign of market failure (e.g., where it is actually more efficient to allow the degradation to occur because the cost of the degradation is less than the cost of preventing it), economic instruments usually cannot alter the equation

to make resource protection economically desirable, especially in the short-term. There may be exceptions to this in the medium- to long-term if the presence of the economic instrument provides sufficient incentive for landholders to innovate and develop less expensive ways to reduce degradation.

> Lessons from Australia

The experiences related here reveal that it is difficult to design and implement a policy program for environmental and natural resource management that delivers real outcomes. Despite long-term efforts using a variety of approaches for many different issues, there are few clear success stories. Each new program has had further experience to build on, but some of the lessons seem to have been hard to learn. For example, the need to target natural resource management investments to likely high-payoff situations has been apparent and reinforced through several policy programs, but has yet to be fully acted on.

It appears that various factors get in the way of hard-nosed targeting based on likely outcomes, including politics, community expectations about how funds should be spent, and an impatience to undertake on-ground works without waiting for the analysis that is necessary for effective targeting.

When targeting funds, policy makers should consider who will benefit and who will bear the cost of abatement. Of the degradation issues discussed earlier, some are fully within the sphere of the affected landholders who bear all the costs and receive all the benefits (e.g., soil acidity, wind erosion, sometimes salinity). In these cases, economists would argue that the case for government intervention is

A breath of fresh Air

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 9

Chapter 10

Chapter 11

Chapter 12

Chapter 13

Chapter 14

Acknowledgments

Publishing Information

About the Fraser Institute

weak, except perhaps for information or education programs to counter information failures. If they have access to good information, farmers themselves are best placed to judge whether degradation problems that affect only them warrant the costs of abatement. Other degradation problems have substantial off-site impacts, termed “externalities” by economists (e.g., salinity affecting waterways, roads, or biodiversity), or have strong public-good characteristics (e.g., biodiversity). These examples constitute much stronger cases for government intervention. As in Canada, policy programs in Australia have often neglected this important distinction.

There has been a tendency for policy programs to follow what might be called “fashions,” as different policy approaches rise and fall in esteem. We have seen a reliance on voluntarism and peer pressure in the National Landcare Program, a reliance on markets for water, and a great interest in market-based instruments for environmental programs. Overall, there seems to have been a reliance on one or a small number of policy mechanisms within each program.

Ridley and Pannell (2005) have demonstrated that a fuller range of policy mechanisms needs to be used to effectively address major environmental problems across the full range of circumstances that arise. They integrated biological, physical, economic, and social research regarding the management of salinity to develop recommendations regarding a range of policy responses: grants and other economic instruments, command-and-control regulation, communication or education, engineering works, technology development, other research, and no action. Their recommended response depends on local bio-physical and socioeconomic factors that drive the benefits and costs of taking action to manage salinity.

Successful policy programs need to be built on an approach that is more patient than is often the case. Patience is needed to conduct and learn from research and analysis in order to support the design phase of policy programs, the planning and prioritization of specific investments, and the implementation of plans. For some problems, there is a need to develop improved technologies (e.g., improved farming options), rather than persist with existing technologies, and this also requires patience. More often, programs have tended to rush into the implementation of poorly conceived plans, based on inadequate technologies.

Most of the programs discussed above have embodied unrealistic expectations regarding the financial and other sacrifices that farmers must be willing to make on behalf of the broader community, or they have overlooked these costs and their consequences for farmer participation. The farm-level economics of the proposed changes in land management are crucial, but this seems to be under-recognized by policy makers.

Of course, these lessons can be difficult to apply in situations where degradation issues have become highly politicized. The sort of catastrophic forecasts that typify this situation make it extremely difficult for advocates of the public interest to make themselves heard in their calls for a balanced policy approach.

Policy recommendations

In light of the preceding discussion, I have a number of recommendations for policy makers with respect to the way in which policy should be designed and implemented.

A breath of fresh Air

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 9

Chapter 10

Chapter 11

Chapter 12

Chapter 13

Chapter 14

Acknowledgments

Publishing Information

About the Fraser Institute

A breath of fresh Air

- ⌘ Focus on the delivery of outcomes, not activity. Ensure that the funded activities are the right activities in the right areas to achieve target outcomes.
- ⌘ Recognize that different policy tools are appropriate for different circumstances—even if the environmental problem is the same.
- ⌘ Conduct detailed analysis and modeling. Consultation with the community is not enough to develop effective investment plans and targets.
- ⌘ Be prepared to target a smaller number of threatened assets if the analysis shows that this is more cost-effective than spreading resources thinly over many assets.
- ⌘ Pay attention to the large body of existing research on what drives landholder behaviour (e.g., Pannell et al., 2006; Knowler and Bradshaw, 2006), and form realistic expectations with respect to how landholders will respond to policy (i.e., not as well as you might wish).
- ⌘ Be patient. Do not rush to spend program dollars quickly, before analysis showing where funds could have the greatest impact has been done.
- ⌘ If devolving decision-making powers over public funds to community-based bodies, ensure that there is rigorous accreditation of proposed investments and scrutiny of planning processes to ensure accountability.

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 9

Chapter 10

Chapter 11

Chapter 12

Chapter 13

Chapter 14

Acknowledgments

Publishing Information

About the Fraser Institute

References

Australia, National Action Plan for Salinity and Water Quality [NAPSWQ] (2000). *Our Vital Resources: A National Action Plan for Salinity & Water Quality*.

Australian Government. <<http://www.napswq.gov.au/publications/policies/pubs/vital-resources.pdf>>, as of July 21, 2008.

Australia, National Water Commission (no date). *National Water Initiative*. <<http://www.nwc.gov.au/NWI/index.cfm>>.

Australian Bureau of Statistics (2002). *Salinity on Australian Farms*. Report 4615.0. Australian Bureau of Statistics.

Barr, N. (1999). Social Aspects of Rural Natural Resource Management. In *Outlook 99: Proceedings of the National Agricultural and Resources Outlook Conference, Canberra, March 17-18* (Vol. 1) (Australian Bureau of Agricultural and Resource Economics): 133–40.

Cruse, L., and B. Dollery (2006). Water Rights: A Comparison of the Impacts of Urban and Irrigation Reforms in Australia. *Australian Journal of Agricultural and Resource Economics* 50, 3 (September): 451–62.

Cregan, P., and B. Scott (1998). Soil Acidification – An Agricultural and Environmental Problem. In J. Pratley and A. Robertson (eds.), *Agriculture and the Environmental Imperative* (CSIRO): 98–128.

Curtis, A., and T. De Lacy (1997). Examining the Assumptions Underlying Landcare. In S. Lockie and F. Vanclay (eds.), *Critical Landcare* (Centre for Rural Social Research, Charles Sturt University): 185–99.

D’Emden, F.H., and R.S. Llewellyn (2004). *No-till Adoption and Cropping Issues for Australian Grain Growers*. The Regional Institute. <http://www.cropscience.org.au/icsc2004/symposia/6/4/928_emenfh.htm>, as of December 21, 2006.

The Economist (2003, July 19). Survey: Liquid Assets. *The Economist*: 13–15.

Grafton, R. Quentin (2005). *Evaluation of Round One of the Market Based Instrument Pilot Program*. Australian Government, Department of Agriculture, Fisheries and Forestry.

Hodges, Andrew, and Tim Goesch (2006). *Australian Farms: Natural Resource Management in 2004-05*. ABARE Research Report 06.12. Prepared for the Australian Government, Department of Agriculture, Fisheries and Forestry. <http://www.abareconomics.com/publications_html/crops/crops_06/nrm_ausfarms.pdf>, as of December 21, 2006.

Keighery, G.J., S.A. Halse, M.S. Harvey, and N.L. McKenzie (eds.) (2004). *A Biodiversity Survey of the Western Australian Agricultural Zone*. Western Australian Museum.

Knowler, D., and B. Bradshaw (2006). Farmers’ Adoption of Conservation Agriculture: A Review

A breath of fresh Air

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 9

Chapter 10

Chapter 11

Chapter 12

Chapter 13

Chapter 14

Acknowledgments

Publishing Information

About the Fraser Institute

and Synthesis of Recent Research. *Food Policy* 32, 1 (February): 25–48.

Lockie, S., and F. Vanclay (eds.) (1997). *Critical Landcare*. Key Papers Series No. 5. Centre for Rural Social Research, Charles Sturt University.

Myers, N., R.A. Mittermier, C.G. Mittermier, G.A.B. da Fonseca, and J. Kent (2000). Biodiversity Hotspots for Conservation Priorities. *Nature* 403: 853–58.

National Land and Water Resources Audit (2001a). *Australian Dryland Salinity Assessment 2000*. National Land and Water Resources Audit.

National Land and Water Resources Audit (2001b). *Australian Agricultural Assessment 2001*. National Land and Water Resources Audit.

Pannell, D.J. (2001a). Dryland Salinity: Economic, Scientific, Social and Policy Dimensions. *Australian Journal of Agricultural and Resource Economics* 45, 4: 517–46.

Pannell, D.J. (2001b). Harry Potter and the Pendulums of Perpetual Motion: Economic Policy Instruments for Environmental Management. *Connections: Farm, Food and Resource Issues* 1 (Summer): 3–8.

Pannell, D.J., and Ewing, M.A. (2006). Managing Secondary Dryland Salinity: Options and Challenges. *Agricultural Water Management* 80, 1/2/3: 41–56.

Pannell, D.J., G.R. Marshall, N. Barr, A. Curtis, F. Vanclay, and R. Wilkinson (2006). Understanding and Promoting Adoption of Conservation Practices by Rural Landholders. *Australian Journal of Experimental Agriculture* 46, 11: 1407–24.

Productivity Commission (2004). *Impacts of Native Vegetation and Biodiversity Regulations*. Productivity Commission Inquiry Report No. 29. Productivity Commission.

Ridley, A., and Pannell, D.J. (2005). The Role of Plants and Plant-based R&D in Managing Dryland Salinity in Australia. *Australian Journal of Experimental Agriculture* 45, 11: 1341–55.

Stoneham, G., V. Chaudhri, A. Ha, and L. Strappazzon (2003). Auctions for Conservation Contracts: An Empirical Examination of Victoria's BushTender Trial. *Australian Journal of Agricultural and Resource Economics* 47, 4 (December): 477–500.

Vanclay, F. (1997). The Social Basis of Environmental Management in Agriculture: A Background for Understanding Landcare. In S. Lockie and F. Vanclay (eds.), *Critical Landcare* (Centre for Rural Social Research, Charles Sturt University): 9–27.

Watson, A. (2001). Dear Taxpayer, Send Money. *Connections: Farm, Food and Resource Issues* 1 (Summer). <http://www.agrifood.info/connections/summer_2001/Watson.html>, as of December 21, 2006.

A breath of fresh Air

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 9

Chapter 10

Chapter 11

Chapter 12

Chapter 13

Chapter 14

Acknowledgments

Publishing Information

About the Fraser Institute

A breath of fresh Air



David Pannell

David Pannell is a Professor in the School of Agricultural and Resource Economics at the University of Western Australia, an Australian Research Council Federation Fellow, and the author of 130 journal articles and book chapters. His research includes the economics of land and water conservation; farmer adoption of land conservation practices; risk management; policy evaluation; and the economics of farming systems.

He was president of the Australian Agricultural and Resource Economics Society in 2000, and a director on the Board of Land and Water Australia from 2002 to 2005. Professor Pannell's research has won awards in the United States, Australia, Canada, and the United Kingdom.

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 9

Chapter 10

Chapter 11

Chapter 12

Chapter 13

Chapter 14

Acknowledgments

Publishing Information

About the Fraser Institute