Land Degradation and Rehabilitation: A Policy Framework

Geoff Edwards and Neil Byron[2]

We hear a lot about environmental pressures associated with natural resource-based production systems in Australia:

- Salinisation of land and water
- Acidification of soil
- Soil erosion and deterioration of soil structure
- Spread of weeds
- Eutrophication of streams and lakes
- Loss of biodiversity

Taken together, these are usually seen as Australia's worst environmental problem.

Australia is committing a large, and increasing, amount of public resources to the objective of improving the natural resource-based environment. For example, the Murray Darling Basin Council has adopted a program of salinity interception schemes worth $60 million over 7 years, complementing the $1.4 billion National Action Plan for Salinity and Water Quality (Truss 2001). Our focus is mainly on the agriculture-related component, a large part of the whole. The magnitude and growth of public funding in this area is sufficient reason for holding today's Symposium, notwithstanding that the spending of landholders on "environmental protection and improvement" almost certainly dwarfs public spending. Open and critical scrutiny of policy is conducive to better policy and better policymaking.

In addition to the size and the growth in public investment in the environment, there are other reasons why it is appropriate to look closely at this area. The complex and often poorly-understood biophysical relationships involved, means that it is very difficult to accurately assess the public and private benefits and costs of any actions, or of inaction. Achieving the desideratum expressed by the Prime Minister in announcing the National Action Plan for Salinity and Water Quality that targets and standards for water quality and salinity should be "based on good science and economics" (Howard 2000, p.2) therefore poses a large challenge. The implications of good and bad decisions for Australian food production, exports, employment and population distribution could be substantial in the next 30-50 years.

We have been asked to help "set the scene" for the following sessions. We attempt to open up the topic by posing a number of questions that seem important in thinking about agriculture-related environmental damage and about policy responses. We have also offered some possible answers to these questions, drawing substantially on the research of others. However, consistent with our terms of reference, we do not wish to strike a prescriptive tone, and we are conscious that there is much more to be said.

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Why has environmental deterioration occurred?

This question can be answered at different levels, depending on one's philosophy or ideology. We do not think it correct, or helpful, to lay the blame mainly on baser human motives such as greed or rapaciousness, though they have played a part.

Rather, in common with many researchers and informed commentators, we highlight three factors that can explain much of the environmental damage to Australia's natural resource-based economy without invoking the wickedness of man (and woman!).

1. Lack of knowledge. The European settlers in Australia found a land very different from what they had known. The soil was not moist and fertile, but dry and infertile. The summers were not short, cool and wet, but long, hot and dry (Barr and Cary 1992, p. 1). Although some parts of the country have now been occupied for two hundred years, that is not a long time to learn the relationships between the activities of man and the condition of the soil, water, vegetation and fauna---especially given the long lead-times that sometimes occur between human action and nature's response. And the learning was slowed by the practice for some 150 years of trying to force the landscape into submission with European farming methods, rather than adapting those methods to the unique Australian conditions.[3]

2. Presence of externalities. Even when the knowledge was available, land managers have sometimes had little financial incentive to consider the effects that their decisions have on others. This applies to decisions on water use that affect irrigation salinity, decisions on tree removal that impact on dryland salinity, decisions affecting the addition of nutrients to ground water and surface water, and decisions on control of weeds and animal pests.

3. Government policies that make it rational for private land managers to behave in ways that damage the environment. Examples from Australia's past and present are:

- Tax incentives for land clearing---contributing to salinity, erosion and loss of biodiversity
- Fertiliser subsidies---encouraging soil acidification and eutrophication in water
- The provision of water to irrigators at less than its marginal social cost
- Drought assistance---discouraging de-stocking in dry periods, and encouraging higher stocking rates at all times
- Tenure conditions that provide inadequate incentives to invest in protecting and improving the land resource, and that discourage the conservation of nature, on pastoral leases

[3] The environmental degradation needs to be kept in perspective. In a careful study of the economic sustainability of Australian agriculture, Chisholm (1992, pp. 24-5)) concludes: "From a national perspective, loss of agricultural production due to land degradation, appears to be small relative to the overall increase in productive capacity arising from technological innovation and management changes". Barr and Cary (1992, p. 283) write: "….we are optimistic rather than pessimistic about the longer term health of the rural environment. With the notable exceptions of the irrigated agriculture in the Murray-Darling Basin, Western Australia's dryland salinity and the, yet to be solved, problem of acid soils, the prognosis for rural land is better than for some of the earlier periods in Australian agriculture. Much of the current, conditioned reaction to problems of land degradation does not take adequate account of the sum of human experience in these matters. The store of science and technology has continued to grow since Europeans have come to Australia. There are many cases where land use that at one time was unsustainable has subsequently become more sustainable because of advances in science and technology".

- Price supports for dairy products, wheat and sugar---encouraging more intensive farming

A longer list of "behavioural causes" of land degradation is provided by Dumsday (1987), drawing on the contributions of several authors in Chisholm and Dumsday (1987). That list is presented in Table 1. It is of interest that it is unclear in some cases in which direction the exploitation of land departed from the economically optimal level. Four of the thirteen behavioural factors listed could result in a level of land degradation that was either less than or greater than the economically optimal level.

Table 1. Behavioural causes of land degradation direction of deviation from optimal resource usage

Behavioural factor	Under-exploitation	Over-exploitation
Discount rates or imperfect capital markets		X
Irreversibility		X
Intergenerational equity		X
Uncertainty	X	X
Lack of knowledge	X	X
Property rights		X
Freehold tenure		X
Long-term leasehold		X
Fixed-term leasehold		X
Government policies	X	X
Externalities and public goods	X	X
Perception		X
Economies of scale		X

Source: Adapted from Dumsday (1987, p.325).

Who are the decision-makers?

Responses to environmental deterioration are made at several levels.

1. Owners and managers of land make decisions about land use and management practices.

2. Governments make decisions in a variety of domains intended to influence the natural environment. These include:

- Trade controls, international treaties, taxation (Federal Government)
- Regulation of land and water use (State governments)
- Local-level land use and rating (Local Government)

3. Research organisations (involving the private sector---including rural industries---universities, and government).[4] Researchers advance our understanding of environmental issues, and of the relationships between production activities and the natural environment. They make decisions, often influenced by what they have learned from potential users of their research, on the directions to take in their search for ways to obtain better environmental and economic outcomes from land and water use.

4. Members of the community. As householders, people may make decisions about how they obtain their drinking water as local supplies become more saline. They may change their recreation and holiday behaviour in response to changes in the quality of rivers, lakes or forests. Some may make decisions on where to live partly with regard to expected environmental trends. Individuals may group together in community organisations to try to influence the decisions of land managers, governments and research organisations in ways they see as desirable on environmental grounds. The public may also choose to act through their decisions on which products to buy ("green consumerism").

What are the key desirable characteristics of policy processes for the environment?

- Recognition that decisions should advance the interests of *people*. That may seem too obvious to mention. However, some calls for substantial changes in farming on environmental grounds appear to have little regard to the consequences for people.

- A forward-looking approach, assessing the total benefits and total costs of alternative initiatives where that is feasible.[5] This approach must be capable of answering the question *Which environmental improvements should be undertaken?* A simple "efficiency" answer is "Those that result in economic benefits in excess of the economic costs" (where "economic" costs and benefits may include hard-to-value effects like cleaner water and conservation of biodiversity). Our society may decide, reasonably, that it wants to make decisions partly with regard to non-economic considerations---for example, not just on the expected overall costs and benefits, but the balance between costs and benefits in particular regions. In doing that, however, it is sensible to keep tabs on the net economic gains foregone in pursuing "non-economic" objectives. That is conducive to decisions being made with appreciation of the trade-off between non-economic objectives and economic objectives.

- Use of cost-effectiveness approaches to compare different ways of achieving environmental objectives where, as will often be the case (Stoneham 2000), targets need to be set through the political process.

[4] It should be acknowledged that some new knowledge is discovered not through the formal research undertaken by research organisations, but through the observation and creativeness of land managers.

[5] Sometimes estimates of the cost of environmental damage have been presented, often without details on how the numbers have been calculated, or on what they mean. These backward-looking biophysical assessments of environmental damage and dollar estimates of environmental costs are not what is needed by resource managers or governments to make sound decisions for the future. By way of elaboration, consider the question "How much has salinisation cost Australia?". Use of a counterfactual with zero salinity is unrealistic. Zero salinity is probably never feasible for Australian agriculture, and it is unlikely to be optimal, even with an understanding of agriculture-environment relationships much better than at present. To be realistic and helpful in a policy context, the question asked must lead to a weighing of the future costs and benefits from options for reducing salinity.

- An approach that is conducive to weighing the merits of an extra $100 million for conservation against $100 million for competing social demands---for example, health, education, transport and welfare. The conservation budget should not be quarantined from the scrutiny that applies in other areas in the process of bringing expenditures and available resources into balance. This consideration, among others, needs to be borne in mind in assessing the NFF/ACF proposal for a new environment spending program of $6.5 billion a year over ten years, funded partly by a hypothecated Medicare-type levy on income (and partly by the private sector).

What are the options for responding to environmental problems?

Four options can be identified.

1. Do nothing. This is not necessarily an admission of defeat or lethargy. It may be a rational approach in the presence of uncertainty, especially if there is reason to expect that the information available for informing a decision would be significantly improved were the decision deferred. Doing nothing may also be a rational conscious response to an assessment that, given current knowledge and technologies, the costs of taking action now are likely to be greater than the expected benefits (Pannel, 2000).

2. Address the problem. This may mean acting to reduce dryland or irrigation salinity, soil acidification, or loss of plant and animal species. Note that action in any of these areas has a positive effect if it *slows* an unfavourable trend---reversing the trend is welcome but often unrealistic in any time-span meaningful to politicians or, indeed, to most mortals.

3. Adapt to the problem. This could involve a range of approaches, including growing more salt-tolerant species, and withdrawing land and other resources from agricultural production.

4. Add to knowledge of the problem through research. New knowledge may contribute to reducing the problem, adapting to the problem, or both. The better the knowledge base, the less likely it will be that option 1---do nothing---will be optimal.

It is possible for several of these options to be pursued simultaneously. That is what is happening in Australia. *Perhaps* there are a few land managers who are doing nothing in response to environmental problems. If there are, it is because they see no options for addressing environmental problems or adapting to them that they find attractive. Around Australia, land managers, governments, community groups and researchers are devoting substantial effort to the last three options---addressing environmental problems, adapting to them, and adding to the knowledge base about the environment.

Who is responsible for change under options 2-4?

Option 2: Address the Problem.

Individual land managers could change to more environmentally-friendly land use and management practices. On the presumption that they have already taken those actions to address environmental problems that they find attractive, further actions seem most likely in response to a change in their decision-making environment. The decision-making environment could change because land managers obtain new information on

land use-environment relationships, for example, the increasing use of shelterbelts and the retention of native vegetation. Governments may have a role here through assisting the research and extension processes.

Alternatively, changes in government policies could provide carrots or sticks that induce land managers to change their land use or management practices in ways that reduce adverse environmental impacts. That is, governments could use regulations, taxes, or subsidies to induce individual land managers to change their behaviour in environment-improving ways, or they could offer to pay them directly according to the quantities of specified environmental public goods they produce. The economic rationale for government actions such as these would be strongest when the benefits of the changes in behaviour were mainly external effects.

The relevant performance measure of the success of government action to reduce environmental problems is the success with which the problems are reduced. While economists support the use of social cost-benefit analysis, or at least cost-effectiveness analysis, in assessing initiatives to improve the environment, the objective is *environmental.*

Option 3: Adapt to the Problem.

Land managers often have attractive opportunities for adjustment---that is, opportunities to increase their income over *doing nothing*---even when they have no attractive ways to address the environmental pressures. This adjustment will happen autonomously as individual land managers perceive opportunities to do so to their own benefit.

The role for government in encouraging adjustment to environmental problems, if there is one, is very different from government's role in *addressing* those problems. In addressing environmental problems, the objective is environmental. In encouraging adaptation to environmental problems, however, the focus is on helping decision-makers to adjust. The action that is most appropriate here will depend on whether government is motivated more by efficiency considerations or by equity (fairness).

If economic efficiency is the driving force, any government involvement in the adjustment process needs to be justified by evidence of "market failure". Mainstream economists would see steps to improve the *information* available to land managers on adjustment opportunities as the most likely government intervention consistent with correction of market failure (Industry Commission 1998). If, however, the aim of government is to assist farmers on equity grounds, the focus needs to be on targeting assistance to those individuals judged most deserving.

Note that, with either the efficiency- or equity-oriented approaches to adaptation, the concern is with resource allocation and income respectively, not with the environment.

Another possibility that should be noted is that governments in responding to environmental problems are concerned especially with political pay-offs. When this is so, they will have no need for "good science and economics". "The architects of Landcare", in an assessment of their creation, write: "…and there is a political imperative to maximise the number of projects funded across the country so that as many voters as possible can see where their Telstra dollars have gone" (Toyne and Farley 2000, p.9).

Option 4: Research

Here we have no answers, but a list of unresolved questions. An important piece of the background is that, because of the uniqueness of Australia's natural environment, we are more dependent on our own research---as opposed to foreign research---into the environment than we are for research for manufacturing and tertiary industries. There is also a view that under grants-based funding of environmental research, "political appearances are more important than development of intellectually defensible solutions to environmental problems" (Watson 2000, p.16).

- What are the potential pay-offs from acquiring new knowledge, compared to better application of the existing (but still unapplied) knowledge?
- What is the rationale for the funding levels from the public sector and from industry? Should public funding for R&D and extension cover only public goods (on the equity grounds that profit-enhancing research for non-rural sectors is rarely subsidised.)?
- Can the appropriate mix of research on adaptation versus mitigation be determined from the expected net social benefits of each?
- What is the best balance between problem-oriented research and curiosity-driven research?
- How well are present processes for allocating research budgets between programs and projects working?
- How can efficiency in research delivery be enhanced?

Who should pay the costs of responding to environmental problems?

Answering this question requires resort to value judgements; there is no objective answer. However, we suggest that useful guidance can be obtained from the following points.

1. When the effects of actions by a landholder to address---prevent or reduce---environmental damage are confined to his/her own property, it is appropriate for the landholder to pay the costs of addressing the problem, as well as the costs of adapting to it. The case for government to pay in this situation is weak. Examples of situations of this type include some dryland salinity (Pannell, McFarlane and Ferdowsian 2001) and soil acidification.

2. When action taken on land use or management practices on one person's property has environmental effects on the properties of others, the determination of who should pay depends on who has what property rights. If it is accepted that a landowner's property rights do not extend to damaging the property of others, it is appropriate that landowners meet the costs of preventing environmental damage beyond their boundary. This guideline is consistent with the "polluter pays" principle. A different answer might be given if the view were taken that a landholder had the right to clear native vegetation, ignore weeds and animal pests, and pollute ground and surface water without regard to the costs imposed on others. It might then be held that other beneficiaries of the landholder's environmental responsibility in *not* undertaking these damaging practices---or, perhaps, the government---should contribute to the costs.

3. A third case might be where an upstream land-owner could take actions (at a cost to himself/herself) which will generate significant positive externalities downstream, over and above "normal conditions". Will the beneficiaries club together to pay the upstream farmer? Will the government pay him on their behalf? Can the government force him to

provide positive externalities, or can they only force him to stop generating negative externalities?

4. What if new discoveries about biophysical relationships reveal a previously unknown requirement for costly changes in land use or management practices on some landholdings, in order to prevent damage to land or water elsewhere? In this situation, those landholders facing additional costs may believe strongly that they should not have to bear a yoke that was absent and unanticipated in their decision-making about how much to pay for their property, the development plans for the property, and their borrowing. Perhaps this belief is not unrelated to the recollection by farmers of the Commonwealth government's objective until the 1960s of encouraging farm development and increasing production (Watson 2000). Farmers may receive support in their thinking from other groups in the community. Perhaps this situation is relevant in considering salinity in the eastern states.

In thinking about this question, it is helpful to reflect on the property rights possessed by landowners. Property rights are "….one's effective rights to do things and his effective claims to rewards (positive or negative) as a result of his actions" (McKean 1972, p. 177). In Australia, and other market-type economies, it is accepted that the property rights in land include the right to the higher profits due to good seasons, buoyant markets and research-induced technological progress. Similarly, landowners bear the lower profits due to poor seasons and depressed markets. Is it reasonable to suggest that landowners should bear the extra costs needed to avoid imposing external costs on others when the presence of those costs and the means of preventing them is demonstrated by research? Some states appear to have answered "yes" in placing restrictions on the removal of native vegetation in recent times. This restriction represents a modification of the property rights of landowners in the light of new knowledge and, perhaps, changes in social attitudes.

The discussion above suggests that the specification of property rights cannot be regarded as static (Aretino *et al* 2001). Indeed, it is widely accepted that the efficiency with which a society meets the aspirations of its citizens will in the long-run depend largely on the adaptations made to property rights in response to technological developments, newly discovered relationships and community values (for example, Demsetz 1967). Among the changes needed for efficiency will be changes in the property rights in agricultural land.

It needs to be observed that no matter who pays initially for the costs of reducing agriculture-related environmental damage, the ultimate distribution of the cost will depend on the structure of markets. If farmers pay the costs initially, part of the environmental costs will ultimately be passed on to consumers, domestic and foreign, for those commodities facing imperfectly elastic demand and supply curves. However, for major Australian agricultural commodities other than wool, the industry is considered to face approximately perfectly elastic demand---price is determined totally by overseas supply and demand---and no part of extra policy-induced environmental costs paid by producers are passed on to consumers. There is a broader dimension, however. If governments around the world are requiring farmers to incur extra costs in order to protect the environment, the upward shifts in global supply curves will cause commodity prices to rise. Indeed, with an international trend to make farmers meet more of the environmental costs they generate, it is conceivable that farmers in those countries where environmental costs are relatively low could be net winners when the market response to the multi-country environmental measures is allowed for. Cassells and Meister (2001) found that New Zealand dairy farmers would lose if they alone were made to bear the costs of effluent controls, but that they would gain if they along with

farmers in the other three leading dairy export regions (EU, Australia, and US) had those costs imposed on them.

Conclusions

Australia faces a challenge to improve its agriculture-related environment in ways that increase the welfare of Australians. The rudimentary nature of scientific knowledge of many aspects of agriculture-environment relationships should caution against too willing adoption of "bold" and expensive initiatives to improve the environment. The worthiness of the environmental cause offers no guarantee against wasteful allocation of resources to it. It appears appropriate to give high priority to improving knowledge. It also appears sensible to be careful about cutting off options that may be attractive as scientific understanding of the problems increases. Governments could re-examine remaining policies in the "no regrets" category---those that rate poorly from an efficiency view as well as from an environmental perspective (for example, water pricing).

In thinking about *Who Pays?* for agriculture-related environmental protection, property rights are important, as is the distribution of benefits from the improvement. The case for government (taxpayers) to contribute to environmental protection is weakest when the benefits accrue entirely to the landholder who changes his/her land use or practices, while the case is strongest when the benefits go entirely to others. Realistically, there are limits to the income that landholders can be expected to forego for the benefit of others, and this limit is perhaps lower when it is clear that government policies have contributed to the problems being addressed. The public's recognition of the merits of addressing---preventing and reducing---land and water conservation, and that they will be ultimate beneficiaries, strengthens the political economy case for a significant contribution from taxpayers. The case for taxpayers to assist in funding landholders' adaptation to environmental pressures is more problematic. The appropriate form of any assistance for this purpose will depend on whether it is motivated by efficiency or equity considerations. There is an important role for governments in modifying property rights and responsibilities for land and water with changes in knowledge on agriculture-environment relationships, and with changes in community preferences.

Australia's decisions on environmental policy need to be informed by the best-feasible understanding of the biophysical relationships involved and by a suitable framework for gauging the pluses and minuses of alternative responses to environmental problems. It is hard to think of an area where present and future generations of Australians stand to gain so much from the merging of, in the Prime Minister's words, "good science and economics".

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Background

Geoff Edwards has carried out research on the economics of agricultural policy, environmental economics and on the economic payoff from research, and his publications are mainly in these areas. At the end of June 2001 he finished a three year term as editor of the *Australian Journal of Agricultural and Resource Economics*.

Geoff worked as Associate Commissioner on the Industry Commission's inquiry into the sugar industry in 1991 and 1992. He is a former president of the Australian Agricultural Economics Society. Before joining La Trobe University he worked in the Bureau of Agricultural Economics, The Federal Treasury and at the University of Melbourne. He is a graduate of the University of New England. Geoff grew up on a mixed farm in North-Eastern Tasmania. All subsequent physical activity has been easy compared with picking up stones prior to planting the potato crop. Geoff is on leave from La Trobe at the Productivity Commission until early December.

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