The economics of sustainability

The challenge of agricultural and resource economics in the 21st Century

Mr Roger Beale, AM*

Key words: natural resource management, alternative economics.

Abstract:

Achieving ecologically sustainable natural resource management is one of Australia's most significant environmental and economic challenges for the 21st century. Successful tackling our most pressing problems – salinity, water management, biodiversity conservation and climate change – is going to require an increasing integration of biophysical, legal, social and economic strategies. This is beginning to test the limits of the traditional neo-classical approach to environmental and natural resource management analysis and policy development. It is useful to examine what economics may learn from and add to analyses from other disciplines. Continuing to develop integrated interdisciplinary and multi-disciplinary approaches to natural resource management will ensure that economics will remain an important part of environmental and resource policy making.

*Mr Roger Beale AM, Secretary, Commonwealth Department of Environment and Heritage, GPO Box 787, Canberra 2601.

This paper was prepared with assistance from Hannah Parris, Taron Brearley and Michelle Scoccimarro from the Environmental Economics Unit of Environment Australia.

State of the environment

Thank you for inviting me to present today at the Opening Plenary Session. I would like to acknowledge the traditional owners of the ACT, the Ngunnawal people.

I have been fortunate enough to be the Secretary of Environment Australia at a time when environmental and natural resource issues have become a "mainstream" part of Government policy making.

The recent formation of the Sustainable Environment Committee of Cabinet is clear evidence that the Commonwealth ranks the environment and natural resource management as having equal importance as other key policy issues of national security, government finances and employment.

In parallel to this, debates about our most pressing environmental issues – biodiversity conservation, salinity, water management and climate change – are no longer just about ethical or moral issues. Increasingly, they will go to the heart of how our economy generates wealth and prosperity and how we may sustain ourselves on this vast, dry and ancient continent.

I want to put to you two simple propositions about the future of our discipline. First, that environmental sustainability will become a key issue for every agricultural and resource economist and economics will become a key discipline for those seeking to build sustainability. Second, to be most effective, economists will have to be increasingly syncretic in our approach to problems and absorb the insights from other disciplines.

State of the environment

Our rural prosperity has come at a price:

- The area of agricultural land considered to be at risk from salinity - resulting in reduced yields and retardation of growth of broad acre crops and other traditional pastures – is set to grow from its current level of 4.7 million hectares, to 6.3 million hectares in 2020 and 13.7 million hectares in 2050 *(Commonwealth of Australia 2001a).*
- Since European settlement, almost 70 per cent of all native vegetation has been removed or significantly modified *(Commonwealth of Australia 1996)*. Current estimates place land clearing at approximately 470,000 hectares per annum in 1999 *(AGO 2001).*
- 26% of Australia's surface water and 30% of ground water management areas are either close to or are overused when compared with ecologically sustainable flow regimes *(Commonwealth of Australia 2001b)*.
- Temperature in Australia has risen approximately 0.7^{o}C over the past 50 years. Agriculture is expected to be particularly vulnerable to further climatic change in Australia, with substantial differences in regional impacts. Some expected impacts include: lower levels of rainfall in some areas, leading to increase moisture stress for wheat production, warmer winters, and less winter chilling, for stone fruit production and rising temperatures leading to lower milk yields *(CSIRO 2001)*.
- And we are increasingly aware of the likely impact of climate change on biodiversity, particularly in our alpine region where the unique flora and fauna have insufficient capacity, or capability, to adapt to climate change. For example, in the period to 2030, a time span too short to allow for evolutionary adaptation, the CSIRO has estimated that the area experiencing snow cover greater than 30 days will be reduced by 66% *(CSIRO 2001b)*.

Economists respond

Economists have been aware of the importance of natural resources to economic growth at least since the time of Adam Smith's publication of the *Wealth of Nations* in 1776. However, it wasn't until the publication of Pigou's work in 1932, that economics formally recognised the existence and impact of externalities on human welfare. Since then, economists have developed a rigorous and impressive set of analytical tools, which we regularly draw upon to analyse environmental problems.

Using this tool kit, economists have helped society illuminate the consequences of our choices about the way our natural resources are used.

In this way economists have participated in public policy debates, and gradually over time, have demonstrated the value of using economic instruments to achieve efficient and effective outcomes.

Over the past decade and more, the use of economic instruments has led to some successes in environmental management, when compared to the alternatives.

Examples include SO_2 markets in the United States, the development of water trading regimes in some catchments in the Murray-Darling Basin, the development of carbon trading frameworks by the Australian Greenhouse Office and the Bush Tender Trial, a pilot biodiversity auction in Victoria. The SO_2 market has delivered substantial emissions reductions at only a fraction of the management costs that would be incurred if a regulatory, command and control, program was put in place.

On the whole, agricultural and resource economists have responded well to natural resource management issues. We are good at:

- operating at the nexus of economic theory and biophysical landscape management;
- communicating between the scientific, economic and policy making communities; and
- more recently, recognising the limits to economics.

Economics and natural resource management

Natural resource management is quintessentially a multi-disciplinary art - it should bring together good science, good economics and good politics.

Economics has served policy makers well. However, as issues of greater complexity are brought into the policy area – issues like salinity, biodiversity conservation, water quality and climate change – we are beginning to test the limits of what the neo-classical framework can comfortably address – and not simply because of data deficiencies.

More specifically, many of the central characteristics of natural resource management are not well handled by the neo-classical framework. These include:

- high level of uncertainty, irreversibility and very long run effects. (In the long run we may all be dead, but the environment will still be around!!);
- "irrational" behaviour by economic agents, and how we manage changes of preferences over time;
- value systems and ethical issues in natural resource management;

And

- economics continues to use the "homo economicus" model as the basis for analysis – even though it is widely recognised as being an over simplification of human behaviour.

A good example of how rational economic agents can create unsustainable natural resource management outcomes is to consider the position of a farmer back in the 1930s. At the time, even if you considered the long run effects on the land, or salinity, as a result of modern farming practices the remoteness of the effects and the time preference of income could have led to a perfectly (economically) rational but ecologically unsustainable decision to "mine" the soil. But of course fewer farmers then were informed about the actual biophysical risks of their practices. Even today, some farmers who are aware of the risks, consciously make the decision that using their land as a non-renewable resource makes better sense economically, than investing in activities that promote sustainable production and biodiversity conservation.

Economics has tended to focus on static efficiency – describing the new desirable equilibrium state – in it's rush to promote the benefits of an efficient outcome. But it has tended not to examine the adjustment path. This can give economics a bad name and suggests that we need to learn more from other disciplines about the adjustment path and spend more time describing how to get where we want to go.

Improving on success

There is much we can do to improve on our record of success and many things we can learn from other disciplines that would help us over come the shortcomings of the neo-classical framework. I would like to focus on three things:

- The influence of networks, social interactions and culture on economic decision making;
- The key differences between "homo economicus" and real human beings; and
- The importance of multidiscipinary approaches.

Influence of social networks on economic decision making

Applied psychology and behavioural economics has done considerable work on perceptions of justice and how these impact on allocation decisions. This suggests that people:

- tend to allocate resources on the basis of *changes* in endowments, rather than total endowments, and so tend to divide resources either evenly or to provide even benefits, with little regard to the initial position of the recipients;
- are strongly influenced by perceived motivations as well as by actual actions; and
- prefer more egalitarian societies and outcomes, even where they personally stand to be disadvantaged by the mechanisms required to produce these outcomes.

For example, recent results published in the *Scientific American* using the experimental economic model, the Ultimatum Game, have suggested that people are driven, not solely by the profit motive but to acting in a way that is considered "fair" and will reject "unfair" behaviour (*Sigmund et al 2002).*

"Homo economicus" and real human beings

Experimental economics has provided many fascinating insights into human behaviour. It has suggested that real world people seem much more prone to error and a lack of self-control than the rational actors that inhabit economic models. For example, real world people:

- infer too much from limited data;
- remember (and weight) the last event;
- tend to assume data confirms their existing hypothesis;
- persistently misjudge the satisfaction or dissatisfaction associated with an event;
- procrastinate or rush in prematurely;
- take out insurance when they shouldn't, and fail to insure when they should; and
- value a dollar lost more highly than a dollar gained.

The notion that economists – schooled in the mathematically rigorous neo-classical tradition – should incorporate these psychological and sociological based ideas into their analysis is a radical proposition.

But economics, and economists, ignore these ideas at their peril. After years of micro-economic reform, politicians became increasingly hesitant to heed the advice given to them by the economists, including myself. It was good economic advice, but what it didn't do was take sufficient account of the political economy and human dimension of the reform process.

Communities are not opposed to change, they resist change where they feel like they have not been meaningfully involved in the process of reform. They become outraged at a lack of control.

We have seen this happening in Australia – with the emergence of fringe political parties who oppose economic reform – and in New Zealand, where more than a decade of economic upheaval ended in a political backlash at the ballot box.

The importance of a multidiscipinary approach

This underscores the importance of taking a multi-disciplinary approach in our work. Economic policy making is most effective when it incorporates not only the lesson learnt from other disciplines, but also the insights gained from analyses from other fields. This is particularly important in the natural resource management area, where we are very much beholden to the parameters set by biophysical landscapes within which we work and also by the political relationships between stakeholder groups.

For example, advances in the area of complexity theory have allowed the development of new metaphors for framing and analysing problems, and has also opened up the possibility of developing new computational models with the capacity for incorporating concepts such as irreversibility, uncertainty, randomness - all qualities which are inherent to natural resource management problems.

NHT analysis – a cautionary tale

The drawbacks of adopting a single disciplinary approach to policy analysis was recently (and inadvertently) highlighted by the work of David Denemark, a political scientist from the University of Western Australia, on the distribution of funding under the Natural Heritage Trust (NHT).

Many of you may be aware that the Trust has attracted some criticism through the suggestion that distribution of funds were politically biased.

Denemark's paper, "Pork Barrel Politics" (*Denemark, 1998),* attempts to compare funding decisions of the Trust with that of controversy surrounding the 1993 Local Community Sports Grants (the "Sport's Rorts" affair) using a political framework and political variables in his analysis. Denemark could find no relationship between the marginality of the seats and funding decision in the case of the NHT. He hypothesises instead that funding focussed on rural seats as a trade off for National Party support for National Competition Policy. This analysis was used to support Denemark's assertion that the structure of the Australian parliamentary system, which revolves around party government and promotes party orientated voting patterns, provides powerful incentives to the Ministerial elite to "pork barrel" public funds to maximise their own party's electoral advantage *(ibid).*

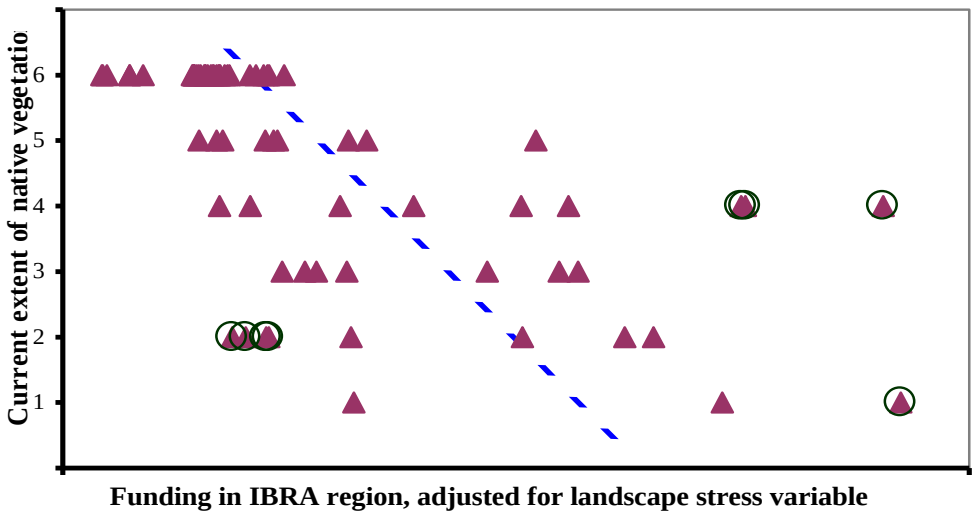
By using only politics as the filter through which data is analysed, it is not surprising that Denemark comes up with a political explanation of the distribution of funding.

What Denemark did not do was examine any variables relating to program design or to Australia's pressing land and water degradation problems - issues that the NHT is designed to address - or to program processes. The Auditor-General reviewed the Trust process and concluded there was no basis for suggesting bias in fund allocations.

Ideally, in looking at outcomes, we should want to investigate correlations between the distribution of grants and all plausible explanators of funding allocations. Initial analysis carried out by Environment Australia on this issue has used regression techniques to estimate the relationship between expenditure in each Interim Biogeographical Regionalisation of Australia (IBRA)[1] region and two environmental factors - the extent of native vegetation remaining in each bioregion and dummy variables for bioregions assessed as having high levels of overall landscape stress. We have found that we can explain 60% of funding based on these two environmental factors.

We expect that further regression analysis based on variables such as other environmental indicators, the level of community environmental activity (which is associated with grant application rates), economic productivity of the area and so on would serve to improve the explanatory power of the model.

Figure 1: relationship between vegetation focussed funding and remanent vegetation



The estimated relationship between funding in each IBRA region and one of these variables, the extent of remnant vegetation, is shown in Figure 1.

The triangles represent data points and the line is the expected level of funding based on the regression. The higher the triangle on the vertical access, the greater the current extent of native vegetation remaining in the region, as assessed by the National Land and Water Resources Audit *(Commonwealth of Australia 2000)*.

[1] The Interim Biogeographic Regionalisation for Australia (IBRA) is a framework for conservation planning and sustainable resource management within a bioregional context. IBRA regions represent a landscape based approach to

IBRA regions that received considerably more funding than expected, based on the indicators used, include Sydney Basin, Riverina, South Eastern Highlands (inland SE NSW and Victoria in the highlands and sub-alpine region) and the Avon (WA) Wheat Belt. These regions are highlight by circles surrounding their representative data points.

These departures from expected levels of funding are likely to be explained by other factors such as varying returns to investment (all are highly productive areas where concerted action can be expected to pay off in terms of environmental and production outcomes), important examples of fragile ecosystems, salinity and water quality, and capacity (both skill and structures) to apply for and win grants.

But my main point here is illustrative. Denemark searched high and low for political theories and data to explain the distribution when he could have readily explained the bulk of the expenditure by looking at just two variables actually related to the biophysical realities underpinning the Trust.

There is a valuable lesson here for economists. By looking at a problem through one framework only – political science – Denemark was only able to come up with political answers. Similarly, if economists look at problems solely through our neoclassical framework, we are denying ourselves the rich and valuable insights that could be obtained if we broadened our work to include other disciplines.

Using economics to address natural resource management problems

How may we apply these lessons to natural resource management? I'd like to spend the remainder of my speech briefly considering some of the big challenges facing the profession and facing natural resource management policy making.

Salinity and biodiversity conservation

Recent growing interest in the use of market and economic based tools to improve salinity management and promote biodiversity conservation has highlighted the importance of the biological and physical sciences to our branch of economics.

There is little point in designing an efficient market for the trading of salinity or biodiversity credits - theoretically perfect in every way – if it does not respect the biophysical realities that underpins the problem at hand.

Incorporation of characteristics such as non-substitutability, "hot-spots", irreversibility and scientific uncertainty requires an honest appraisal of whether a "market solution" will be effective and appropriate.

classifying the land surface from a range of continental data on environmental attributes. More information about IBRA may be found at http://www.ea.gov.au/parks/nrs/ibraimcr/index.html

Complex market systems which result in high transactions costs and high data costs are unlikely to achieve environmental goals. The challenges to building market structures that avoid these drawbacks are interesting and go to the heart of market design. They include:

- measurement and division of salinity and biodiversity into units capable of being traded;
- attribution of activities to individual landholders which contribute or detract from achieving salinity and biodiversity outcomes; and
- designing trading rules which do not violate the biophysical limits of the problem but which result in viable markets.

I am not saying that market solutions don't have a role, but we need to be realistic about their efficacy.

Water management

The development of property rights and associated emergence of markets in the eastern states has demonstrated the practicality of using this economic tool to more efficiently manage what is essentially a commons resource.

Markets have increased the economic efficiency of the water cap in the NSW Murray Darling Basin by an estimated $65m annually with the benefit of extending trading across the entire Basin likely to exceed $100m per year. *(Murray-Darling Basin Commission 2000)*

The challenge to expanding trading is to put the economic principles of trading into practice and develop property rights regimes to these commons resources in a way that promotes efficient use, deals with externalities, addresses the needs of the environment and is acceptable to the community.

Creating clearly defined property rights, with a market value, also makes trade-offs between consumptive uses and environmental needs more explicit.

Our next big challenge is to explore how economics may assist in the management of non-point source water pollution. While we have been able to introduce effective economic solutions to point source problems (eg load based licensing) the challenges of large geographical areas, large numbers of individuals and limited scientific knowledge make the lessons and models harder to implement.

Conclusion

I have underlined the importance of being multi-disciplinary in our approach to environmental and natural resource management issues and of incorporating elements of real human societies and behaviour into economic analysis. This

does not undermine the importance of economics within environmental policy making, rather it highlights that economics is very important – too important to leave just to the economists.

REFERENCES

Australian Greenhouse Office 2001, *National Greenhouse Gas Inventory: Land Use Change and Forestry Sector 1990 - 1999,* Australian Greenhouse Office, Canberra.

Commonwealth of Australia 1996, *State of the Environment 1996,* State of the Environment Advisory Council, Canberra.

Commonwealth of Australia 2000, *Landscape Health in Australia. A rapid assessment of the relative condition of Australia's bioregions and sub-regions.* National Land and Water Resource Audit, Canberra.

Commonwealth of Australia 2001a, *Australian Dryland Salinity Assessment 2000. Extent, impacts, processes, monitoring and management options*, Land and Water Australia, Canberra, January.

Commonwealth of Australia 2001b, *Australian Water Resources Assessment 2000. Surface water and groundwater - availability and quality*, Land and Water Australia, Canberra, February.

CSIRO 2001a, *Climate Change: projections for Australia,* CSIRO Impacts and Adaptation Working Group, Canberra.

CSIRO 2001b, *Climate Change: impacts for Australia,* CSIRO Impacts and Adaptation Working Group, Canberra.

Denemark, D., 1998 "Pork Barrel Politics" in *Australian Quarterly,* November-December 1998, pp 3-7

Murray-Darling Basin Commission 2000, *Review of the Operation of the Cap – draft overview report of the Cap Project Board,* Murray-Darling Basin Commission, Canberra, March.

Sigmund, K., Fehr, E., Nowak, M.A., 2002 'The Economics of Fair Play' in *Scientific American,* February 2002, pp 83-87.