AGRICULTURE AND THE SUSTAINABLE DEVELOPMENT DEBATE

Gary Stoneham and Andrew Arch
Department of Agriculture, Victoria

Australian Agricultural Economic Society
35th Annual Conference
University of New England, Armidale NSW

1. INTRODUCTION

In recent years the discussion about the most appropriate way of managing natural resources and protecting the environment has intensified. This debate has now emerged under the banner of sustainable development. Although the term sustainable development is applied to many different problems embracing both resource availability and environmental issues, its common theme is in relation to concern for the well being of future generations and the implicit value of the natural environment.

The idea of sustainable development first seemed to come to the fore with the release of the World Conservation Strategy (IUCN, 1980) and the Australian response to that strategy (Cwlth Aust, 1984) which was subtitled *Living Resource Conservation for Sustainable Development.* More recently the World Commission on Environment and Development's report, "Our Common Future", (the *Brundtland Report*) along with a number of other reports and conferences on the subject have tended to popularise the topic[1].

Brundtland suggests that sustainable development seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future. Concerns are raised within the report that current economic activity may threaten future prospects. However, the conclusion is not drawn that economic and ecological concerns are necessarily in opposition.

In its broadest sense, sustainable development highlights the linkage between economic activity and the environment. While this linkage has been recognised for a long time it has often been possible to disassociate economic activity from its environmental consequences because time and space often extend beyond the practical limits of a utilitarian approach to resource allocation.

In this paper various approaches to the use of natural resources are examined. These are then considered in the context of land degradation, considered to be the major environmental problem facing agriculture in Australia

[1] for example, Turner (1989), Edens et al (1985), Davis and Schirmer (1987), and of course Commonwealth of Australia (1990).

2. APPROACHES TO RESOURCE MANAGEMENT

The current dominant paradigm applied to natural resource management and use in the Western world is a utilitarian approach relying on the theories of neo-classical economics. However, as indicated above, a 'sustainable' approach to the management of natural resources is now increasingly being called for. In this section we will examine the utilitarian approach and some of the alternative "schools" within the sustainable development umbrella.

2.1 A Utilitarian Approach to Resource Use

Resource allocation within the utilitarian approach relies on the response of decision makers to price signals. As such this approach is more concerned with the process by which resources are allocated than on the final outcome of the decision making process.

A utilitarian approach suggests that the optimal profile of resource use is that which maximises the difference between the benefits of using the resource and the costs of harvesting, or extracting and using, the resource. Because resource use decisions generally involve flows of benefits and costs which occur through time future benefits and costs are discounted to present value terms.

This approach relies on many assumptions including full information, a complete set of risk markets and full accounting of all of the benefits and costs of alternatives. It concedes decision making to present generations and relies on them to make resource allocation choices which are optimal for both current and future generations.

Redclift (1987) suggests that one of the biggest hurdles in accounting for the environment in economic analyses is the assumptions of the two disciplines. Neo-classical economics assumes that resources are divisible and can be owned; market mechanisms fail to allocate environmental goods and services efficiently "precisely because they are not divisible, frequently do not reach equilibrium positions, and incur changes which are not reversible." (p.40)

Batie (1989), drawing on Barbier (1989), also suggests that much of natural resource economics treats natural resources as distinct, independent, divisible inputs by focussing on their optimal rate of exploitation and paying little attention to the trade-offs between economic activity and natural resource quality. No account is taken in the neo-classical paradigm of inter-relationships in the natural or social environment. Batie and others point out that neo-classical analysis often neglects to account for environmental concerns which are outside the usual confines of the production process.

More recently economists have attempted to address some of these shortcomings of the conventional paradigm by adopting a pluralistic approach that emphasises the linkages between economics and ecology (Redclift, 1987; Turner, 1988a). Much of this effort has been directed towards developing methods of valuing environmental resources (eg Mitchell and Carson, 1989; Rose, 1990; Sappideen, 1991), broadening the net of cost benefit analysis (DCFL, 1989) and looking at the issues of intergenerational equity (Page 1977; Pearce, 1987) and discounting (Kula, 1986). Methods of incorporating the environment and natural resources into the National Accounts are also being developed (Anon, 1990; Pearce *et al*, 1989; Repetto, 1986) although the concept of natural resource accounting is very slow to be adopted.

2.2 Approaches Taken to the Issue of Sustainability

There is a consensus among sustainable development advocates that sustainable development is a concept based on intergenerational equity - that is, the current generation must not compromise the ability of future generations to meet their 'material needs' and enjoy a healthy environment. Within this general consensual framework, there are different interpretations.

These interpretations vary from sustainable economic growth through to sustainable ecological diversity where the impact on economic growth is not considered. Douglas (1984a,b) provides a breakdown of the approaches to agricultural sustainability into three schools:

- "food sufficiency" or "productivity" - when agriculture is primarily an instrument for supplying the worlds demand for food;
- "stewardship" - when agricultural production is not measured by total output or output per unit of scarce resource over a limited time period, but by the average level of output that can be sustained indefinitely; and
- "community" - when the effects of agricultural production systems on the social fabric of a community are accounted for. This group is usually economically minded also but places primary emphasis on promoting coherent rural cultures that are self-sufficient.

These "schools" of Douglas' place the emphasis of sustainability respectively on economic efficiency, ecological soundness, and social justice. Trying to achieve all three goals, and most people would probably see some value in all of them, leads to the question of trade-offs, an area where the economics discipline obviously has a role to play.

2.2.1 Maintenance of productive services

Some groups of sustainable development advocates see sustainability as maintaining the food bowl of the world so that we don't condemn millions to starvation. Defenders of our conventional farming systems often use this to justify their choice of agricultural production techniques. This approach has a certain appeal.

As long as farmers can adopt new levels of technology to produce more food more efficiently, and science and technology can overcome any degradation or pollution problems caused by the production processes, then this approach will continue to be seen as credible. However, Douglas (1984) claims that the most disturbing feature of this widely held approach is the relative lack of concern about the possibility of environmental costs escalating.

While technological determinants do not usually rule out completely the environmental costs of their externalities, Douglas suggests that they tend to take a short term view of the potential environmental hazards or question the evidence that the resource is being depleted.

2.2.2 Ecological limits

A growing number of sustainable development advocates look for biological or physical limits the development process and argue that "well being" is not the same as "well having" and that nature is to be respected and not "exploited" (Sachs, 1989). This approach is exemplified in the extreme by the 'deep ecology' school - an extreme preservationist position dominated by the intuitive (as opposed to instrumental) value in nature and rights for non-human species (O'Riodan and Turner, 1983).

The deep ecology position is reflected in agriculture by groups such as "animal rightists" (Batie 1989). Pearce (1987) suggests that an extended theory of justice (see section 2.2.3) may even be aligned with deep ecology as it might see humans as stewards for other species out of a rational consideration of the similarities and differences between humans and non-humans.

Table 1 compares the current dominant social paradigm, closely aligned with utilitarianism, with that of deep ecology.

Table 1. Typical Components of Growth/Environment Paradigms

Dominant social paradigm	***Deep ecology paradigm***
Dominance over nature	Harmo nature
Natural environment as a resource	Values in nature, Biosphere impartiality
Material goals, Economic growth	Non-material goals, Ecological sustainability
Ample reserves, Perfect substitutes	Finite natural reserves
High technology, Science solutions	Appropriate technology solutions
Consumerism	Basic needs, Recycling
Centralised, Large scale	Decentralised, Small scale
Authoritarian, Coercive structures	Participatory, Democratic structures
Shallow	*Deep*

Source: Redclift (1987, p44)

Redclift (1987) suggests that 'deep ecology' has a small following partly because of some of its tenets. 'Biospheric egalitarianism' can easily be dismissed as eccentric or untenable; it is not obvious the something has value to humans simply because it is alive. Deep ecologists have a deep seated mistrust of the ability of science and technology to continue to increase the environments carrying capacity and productive capabilities. This translates into an extreme aversion to environmental risks. While there are some areas of environmental concern which technology is unlikely to solve there are others where it is making much headway, for example with the development of more species specific pesticides.

2.2.3 A justice approach to resource use

Another approach to the issue of resource use is 'justice as fairness'. This was expounded by Rawls (1971) who contends that the benefits from resource use should be shared equally among all. While Rawls originally considered the intra-temporal problem of the current generation, Page (1977) has extended the concept to apply to intergenerational choices.

The theory goes something like this: all citizens are to assume a 'veil of ignorance' about their final status in the world, ie they don't know whether they will be rich or poor, advantaged or disadvantaged, and the rules for distributing 'primary goods' will result in a 'fair' distribution of all goods. Pearce (1987) likens the results of Rawls' argument with the results of the 'maximin' principle in which each individual secures the greatest possible protection against being the poorest member of society. Page argues that it will dictate a requirement of 'permanent livability', which he interprets as a requirement to keep the resource base intact.

Applied to cases of non-renewable resources, for example, this implies that an optimal rate of resource depletion is one that maximises the benefits from resource use for those generations which would otherwise receive the smallest benefits.

Clearly there is an identification problem in the application of this principle in that the least advantaged generation will change with each resource use policy change. This approach suggests that a two stage selection process would be in order if the Rawlsian approach were to be followed. In the first place, the least advantaged group associated with each resource use policy would need to be identified, followed by the selection of a policy which treats the least advantaged group most favourably.

Turner (1988b) raises a major flaw with the 'justice as fairness' approach when it is applied to the problem of intergenerational equity. If all generations were represented in the 'original position ' then the actual representatives could work out how many generations there would be and share the resources accordingly (p.356). Batie (1989) suggests that the critical question of "What is the minimum set of resources that should be available to all generations?" is not precisely addressed and is made more difficult because the carrying capacity of the environment is expanding due to advances being made in science and technology (p.1086).

The justice, or equity, approach seems unruly because of differing perspective on the meaning of equity, because each resource use profile will generate a new group of least advantaged individuals, and because of the uncertainty regarding future developments in terms of our ability to use resources.

3. LAND DEGRADATION AND SUSTAINABLE DEVELOPMENT

In this section land degradation is examined in relation to sustainable resource use. This is addressed under two headings - the private or productivity aspects and the social or global aspects. These two facets of land degradation are not unrelated in reality although it is beneficial for the moment to consider the productivity aspects of the sustainability question in isolation from the broader aspects of land use.

3.1 Land Degradation and Farm Productivity

Land is one of the natural resources which make up the capital base of farms. Farmers, as resource managers, make explicit or implicit decisions about the way this resource is to be used. For example, the method of cultivation used or the type of crop grown can determine the rate of soil degradation. The connection between land use and land degradation is well documented in the scientific literature. It is farmers then that make land use decisions which ultimately influence the level of land degradation. Farmers can choose land use practices which degrade the soil resource in the short term with some consequent effect on the future productive capacity of the farm. This scenario may produce relatively high income levels in the short term but lead to a reduced capacity to earn income in the future. At the other extreme, farmers may conserve the soil resource so that productive capacity is retained through time. There are many points between these two extremes.

This suggests that there are both benefits and costs associated with land degradation and the balance between benefits and costs is likely to change according to various technical and economic factors. Farmers benefit from soil degradation when they can produce agricultural products at lower cost than production systems that conserve soil. On the other hand, there are costs associated with degrading the soil resource base which arise when soil degradation leads to a reduction in farm productivity in the future.

In formal terms, the land degradation problem is an optimal control problem where the objective is to determine that pattern of resource use which maximises the difference between the benefits of land degradation and the costs of land degradation. While this problem is tractable in theory there are many practical factors to consider. The ability of farmers to make sensible decisions about the land resource requires a detailed knowledge about the relationship between the resource stock/quality and subsequent productivity, an efficient land market - ie a market which values land according to its productive potential and inputs are valued on a social rather than private basis.

Given this framework, it is useful to examine what has happened to the land resource over time. On one hand it has been argued that there has been a decline in the ability of the agricultural land base to produce crop and livestock products. Under the "deep" ecological definition this suggests the current patterns of land use are not sustainable and that current use is mortgaged against future generations' income - the current approach to agricultural production is un-sustainable. Eckersley (1989) for example estimates that each year around $600m of production is forgone due to damage done to the agricultural land through degradation.

This argument is not, however, consistent with recent studies which document the rate of improvement in farm productivity over time. For example, Lewis *et al* (1988) indicate that the ratio of outputs from agriculture to inputs used (productivity) has increased by an average of 2.8 per cent per year. Moreover, this suggests that productivity of our agricultural resource base has increased at a faster rate than other sectors of the economy which have recorded less than half the rate of productivity growth in agriculture. By the "shallow" definition then, the agricultural sector has improved rather than diminished its ability to generate outputs even though some parts of the resource base have been degraded in the process. Under this definition it could be concluded that the resource base has been managed in a sustainable way.

The measures that show that productivity is increasing, and can continue to increase, over time can be misleading.

There are two main reasons for this:

i) the measures of productivity are usually selective in the outputs and inputs they account for. eg soil, salt and chemical effects on health.

ii) prices paid for inputs or received for outputs might not be reflecting the real value of those inputs and outputs, thus distorting the production decisions. eg prices of water and energy, equalised product prices, and the finite stocks of commonly used inputs such as fertilisers.

This leads us to an alternative perspective of the agricultural production process; one which takes account of that fact that agriculture operates within a broader environmental, economic and social regime.

3.2 Land Degradation and Global Issues

While most of the land degradation problems in Australian agriculture are regarded as on-site (Cwlth of Australia, 1989) there still might be too much resource degradation from an individuals perspective due to a lack of information about the results of their actions, what to do about the problem even if they are aware of it, or even a lack of information within the land and capital markets of the implications of a degraded resource base.

Additionally, external effects are a serious problem for some agricultural areas. eg off-site effects of salinity and chemical spray drift.

These informational and externality problems usually can be addressed through the usual arsenal of policy instruments discussed ad-infinitum in the literature:

- taxes and charges
- subsidies
- regulation
- property rights
- research
- education
- moral suasion (now being given more credence as demonstrated by the formation of LandCare Groups and the Victorian community based salinity management plans)

These instruments all have their uses in different situations. Property rights are of fundamental importance to the efficiency of a market approach and Anderson (1990) and others highlight the advantages of market based solutions.

There remain, however, a range of environmental and natural resource problems that cannot be handled by these conventional approaches for a number of reasons. Problems such as siltation of the great barrier reef, acid rain destroying crops and forests, agriculture and forestry activities in developing countries contributing to the 'greenhouse' effect and depletion of fish stocks in the Pacific Ocean exist because of, or impinge on, agriculture and primary production.

Some of the reasons for these problems include:

- internationalisation of the environment - the problem of a 'global commons';
- severe information deficiencies;
- high levels of uncertainty of the results of a particular course of action;
- possibility of a catastrophic consequence of a course of action;
- irreversibility of a course of action; and
- developing countries' desire to 'catch up' to the developed countries.

These lead many advocates of the utilitarian approach to consider a "maximise subject to constraint" (Batie, 1989) or "ecologically bounded economics" (Pearce, 1987) approach in which ecological or biophysical constraints need to be considered as boundaries to otherwise normal economic maximisation activity.

Batie (1989) outlines two stages to this approach:

i) the establishment of some contractual arrangement, incorporating ecological principles and environmental ethics, to establish the rules; and
ii) within those rules, the economic maximisation of the utilitarian approach can be adopted.

This is akin to Turner's (1988a,b) 'pluralistic' approach in which he advocates a cooperation between economists and environmental scientists.

4. CONCLUSION

Although there are many different approaches to resource management it is possible to define a universal objective which broadly aims to manage resources in a way that maximises utility. Differences in the patterns of resource use arise according to the ability or inclination of decision makers to consider all of the benefits and costs associated with resource use and according to the difficulties of valuing factors which impinge on alternative uses of resources.

In the narrowest sense it can be shown that, over time, the agricultural sector has been able to sustain and even improve it's ability to generate goods and services from a combination of natural and artificial inputs. It is less clear whether the inclusion of a more extensive range of costs (non-point costs, costs on environmental diversity etc.) associated with agricultural production would change this conclusion.

The non-point aspects of resource use present a more challenging problem to resource managers than that of productivity. There are a range of measures which can be used to move closer to the universal objective noted above. These measurers are generally applied in a process of maximisation-subject to constraints. In general, it can be concluded that the constraints applied to limit economic activity should be in proportion to the level of information about the resource base. Where little information exists about the consequences of change, or where the consequences of change tend toward catastrophe, the constraints applied should be conservative.

A second observation of the process of maximisation-subject to constrain process is the general reluctance to use strict market based approaches to maximisation. For example, land degradation problems in Australia have often been addressed by attempting to find ways of accommodating

degradation of the resource base through modified production systems eg finding salt tolerant species. What has been largely ignored is the potential benefits associated with better definition of property rights and the use of pricing mechanisms to reflect the real costs of all the inputs. Developing and applying remote and point sensing techniques which reduce the cost of measuring key variables such as water quality change, soil loss etc on a site by site basis could be expected to yield significant economic benefits. Likewise there are likely to be significant benefits associated with more robust methods of valuing environmental resources.

Even if property rights can be extended to internalise more of the non-point aspects of resource use, there remain formidable problems where elements of irreversibility or catastrophe exist, or where property rights cannot be defined because of the global nature of externalities.

5. REFERENCES

Anon (1990), 'Natural Resource and Environmental Accounting in the National Accounts', **Australian National Accounts, National Income and Expenditure - March Quarter 1990**, pp 64-71.

Anderson, T. and Leal, D. (1990), **Free Market Environmentalism**, Political Economy Research Center, Bozeman, Montana (forthcoming).

Barbier, E.B. (1989), **Economics, Natural Resource Scarcity and Development: Conventional and Alternative Views**, Erthscan Publications, London.

Batie, S.S. (1989), 'Sustanable Development: Challenges to the Profession of Agricultural Economics', Am J Agric Econ, 71(5):1083-1101.

Commonwealth of Australia (1984), **National Conservation Strategy for Australia**, Australian Government Publishing Service, Canberra.

Commonwealth of Australia (1989), **The Effectiveness of Land Degradation Policies and Programs**, Australian Government Publishing Service, Canberra

Commonwealth of Australia (1990), **Ecologically Sustainable Development**, Australian Government Government Publishing Service, Canberra

DCFL (1989), **Project Evaluation Manual**, Department of Concervation, Forests and Lands, Esat Melbourne.

Davis, T.J. and Schirmer, I.A. (Eds) (1987), **Sustainability Issues in Agricultural Development**, Proceedings of the Seventh Agriculture Sector Symposium, The World Bank, Washington, D.C.

Douglas, G.K. (1984a), 'The Meanings of Agricultural Sustainability', in Douglas, G.K. (Ed), **Agricultural Sustainability in a Changing World Order**, Westview Press, Boulder, Colorado.

Douglas, G.K. (1984b), 'When is Agriculture Sustainable', in Edens, T.C., Fridgen, C. and Battenfield, S.L. (Eds), **Sustainable Agriculture and Integrated Farming Systems**, 1984 Conference Proceedings, Michigan State University Press, East Lansing.

Eckersley, R. (1989) **Regreening Australia: The Environmental, Economics and Social Benefits of Reforestation**, Occaisional Paper No. 3, CSIRO, Canberra.

Edens, T.C., Fridgen, C. and Battenfield, S.L. (Eds) (1984), **Sustainable Agriculture and Integrated Farming Systems**, 1984 Conference Proceedings, Michigan State University Press, East Lansing.

IUCN (International Union for the Conservation of Nature) (1980), **World Conservation Strategy**, IUCN-UNEP-WWF, Gland, Switzerland

Kula, E. (1986), The Developing Framework for the Economic Evaluation of Forestry in the United Kingdom, **Journal of Agricultural Economics**, 37:365-376.

Lewis, P., Martin, W. and Savage, C. (1988), 'Capital and investment in the Agricultural Economy', **Quarterly Review of Rural Economics**, 10(1):48-53.

Mitchell, R.C. and Carson, R.T. (1989), **Using Surveys to Value Public Goods: The Contingent Valuation Method**, Resources for the Future, Washington, D.C.

O'Riodan, T.J. and Turner, R.J. (1983) **An Annotated Reader in Environmental Planning and Management**, Pergamon Press

Page, T. (1977), **Conservation and Economic Efficiency: an approach to materials policy**, Resources for the Future/John Hopkins University Press, Baltimore MD, 266 pp.

Pearce, D. (1987), Foundations of an ecological economics, **Ecological Modelling**, 38:9-18

Pearce D., Markandya, A. and Barbier, E.B. (1989), **Blueprint for a Green Economy**, Earthscan Publications, London.

Rawls, J (1971), A Theory of Justice, Oxford University Press, Oxford, 607 pp.

Redclift, M. (1987), **Sustainable Development - Exploring the Contr tictions**, Methuen, London.

Repetto, R. (1986), **Natural Resource Accounting for Countries with Natural Resource-Based Economies**, World Resources Institute, Washington, D.C.

Rose, R. (1990), 'Valuing Environmental Services', **Agriculture and Resources Quarterly**, 2(3):300-306.

Sachs, W. (1989), 'A Critique of Ecology: The Virtue of Enoughness', **New Perspectives Quarterly**, 6:6-19.

Sappideen, B. (1991), 'Environmental Shadow Pricing: Some Issues Related to Salinity Management', **35th Annual Conference of the Australian Agricltural Economics Society**, Armidale

Turner R.K. (1988a), 'Sustainability, Resource Conservation and Pollution Control: An Overview' in Turner, R.K. (Ed), **Sustainable Environmental Management**, Westview Press, Boulder, Colorado.

Turner, R.K. (1989b), 'Pluralism in Environmental Economics: A Survey of the Sustainable Economic Development Debate', **J Agric Econ**, 39(3):352-359.