



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

ECONOMICS, ECOLOGY AND THE ENVIRONMENT

Working Paper No. 139

**Economic Change and Environmental Issues:
Policy Reforms and Concerns
in Australian Agriculture**

by

Clem Tisdell

April 2007



THE UNIVERSITY OF QUEENSLAND

ISSN 1327-8231
**WORKING PAPERS ON
ECONOMICS, ECOLOGY AND THE ENVIRONMENT**

Working Paper No. 139

**Economic Change and Environmental Issues:
Policy Reforms and Concerns
in Australian Agriculture**

by

Clem Tisdell*

* School of Economics, The University of Queensland, Brisbane 4072 QLD, Australia. Email:
c.tisdell@economics.uq.edu.au

Note: A slightly modified paper which was presented for the Green Week Scientific Conference 2007, held 17-18 January, 2007 in Berlin on “Managing Economic, Social and Biological Transformations”. It was in the Marie Curie series on Modern Agriculture in Central Europe and Eastern Europe: Tools for Analysis and Management of Rural Change (MACE).

WORKING PAPERS IN THE SERIES, *Economics, Ecology and the Environment* are published by the School of Economics, University of Queensland, 4072, Australia, as follow up to the Australian Centre for International Agricultural Research Project 40 of which Professor Clem Tisdell was the Project Leader. Views expressed in these working papers are those of their authors and not necessarily of any of the organisations associated with the Project. They should not be reproduced in whole or in part without the written permission of the Project Leader. It is planned to publish contributions to this series over the next few years.

Research for ACIAR project 40, *Economic Impact and Rural Adjustments to Nature Conservation (Biodiversity) Programmes: A Case Study of Xishuangbanna Dai Autonomous Prefecture, Yunnan, China* was sponsored by the Australian Centre for International Agricultural Research (ACIAR), GPO Box 1571, Canberra, ACT, 2601, Australia.

The research for ACIAR project 40 has led in part, to the research being carried out in this current series.

For more information write to Emeritus Professor Clem Tisdell, School of Economics, University of Queensland, Brisbane 4072, Australia. E-mail c.tisdell@economics.uq.edu.au

Economic Change and Environmental Issues: Policy Reforms and Concerns in Australian Agriculture

Abstract

Since the closing years of the 1980s, Australia has adopted structural adjustment policies designed to foster economic liberalism based on the market system. Today, there is little economic protection for Australian agriculture and Australia is a persistent advocate of free international agricultural trade. The natural Australian environment is not very favourable for agriculture because of low and erratic levels of rainfall and poor soils. Scarcity of water in Australia is growing and its use has become a major natural resource issue. Water availability and use of water by Australian agriculture is discussed, its environmental impacts are considered and the scope for using market systems to allocate water effectively are discussed. Other environmental topics considered are water pollution and the use of chemicals in Australian agriculture, land clearing for agriculture and the environmental impact of pastoralism, soil degradation and reliance on genetically modified crops. Landcare Australia, an institutional initiative commenced in 1989 with the aim of promoting land conservation, is also examined. This program involves co-management between government and community groups (mostly of farmers) and community co-operation as a way to promote land conservation. It is not a market-based system. The view is expressed that market mechanisms are inadequate on their own for dealing with many environmental issues raised by agricultural development. Policy-makers need to consider a range of mechanisms, none of which are likely to be perfect.

Economic Change and Environmental Issues: Policy Reforms and Concerns in Australian Agriculture

1. Introduction

Geographically, Australia is quite different to most of Europe, particularly Central and Eastern Europe. Its settlement by Europeans did not commence until after the independence of the USA; the first European settlement started in 1788 when a British colony was established. Although state enterprises and state interventionist policies grew in importance after World War II, the economic system remained a mixed one but was never a communist one. Since the closing years of the 1980s, Australia has followed policies intended to foster greater reliance on market systems. These policies have included less restriction on trade (domestic and international), the privatisation of public enterprises, and measures to reduce the size of the public sector (Tisdell, 2005).

These policies have affected Australian agriculture which has become subject to a greater extent to market forces. In general, the Australian Government does not try to prop up declining agricultural industries but provides assistance to affected farmers or those involved in rural industries to exit the industry and find jobs elsewhere. The competitive paradigm has become the basis of Australian agricultural policy. In the case of agriculture, subsidies are often provided for consolidation of farms in such circumstances. In fishing, boat licenses and boats may be purchased by the government as well as fishing rights. The main emphasis of the Australian Government appears of late to have been one of promoting economic efficiency rather than, for example, sustaining rural communities by means of subsidies.

The numbers employed in Australian agriculture are declining. In 2006, Australian agriculture employed 288,900 persons full-time (311,800 persons with part-timers), a small proportion (about 3 per cent) of the Australian workforce (see Table 1). In general, the relative economic importance of agriculture in Australia has shown a long-term downward trend and now accounts for only about 3 per cent of Australia's GDP. Nevertheless, such economic indicators are not an entirely satisfactory guide to the economic significance of agriculture. For example, in many non-metropolitan

regions of Australia, agriculture is a major source of employment, it provides commodities that are essential for human life and it generates considerable indirect employment.

Table 1: Structure of employment in the Australian Economy by Sectors, August 2006, based on number of persons employed

Industry	Full-time 000	% of Total F/T	Persons 000	% of Total persons
Agriculture	238.9	3.3	311.8	3.1
Services to Agriculture; hunting and trapping	18.1	0.3	21.0	0.2
Forestry and Logging	11.8	0.2	12.0	0.1
Commercial Fishing	8.0	0.1	9.5	0.1
Total :Agriculture, forestry and Fishing	275.0	3.8	355.3	3.5
Mining	126.6	1.8	132.6	1.3
Manufacturing	924.5	12.8	1056.2	10.4
Tertiary	5889.6	81.6	8627.9	84.8
Total	7215.7	100.0	10172.0	100.0

Note: The total number of persons includes those employed part-time

Source: Based on Australian Bureau of Statistics Table 2.2, “Australian Labour Statistics”, Oct. 2006

Australia is a highly urbanised country and almost two-thirds of its population lives in its capital cities. Most of its population (over 80 per cent) is engaged in tertiary industry. Its arid and semi-arid regions are very sparsely populated as can be seen from Figure 1.

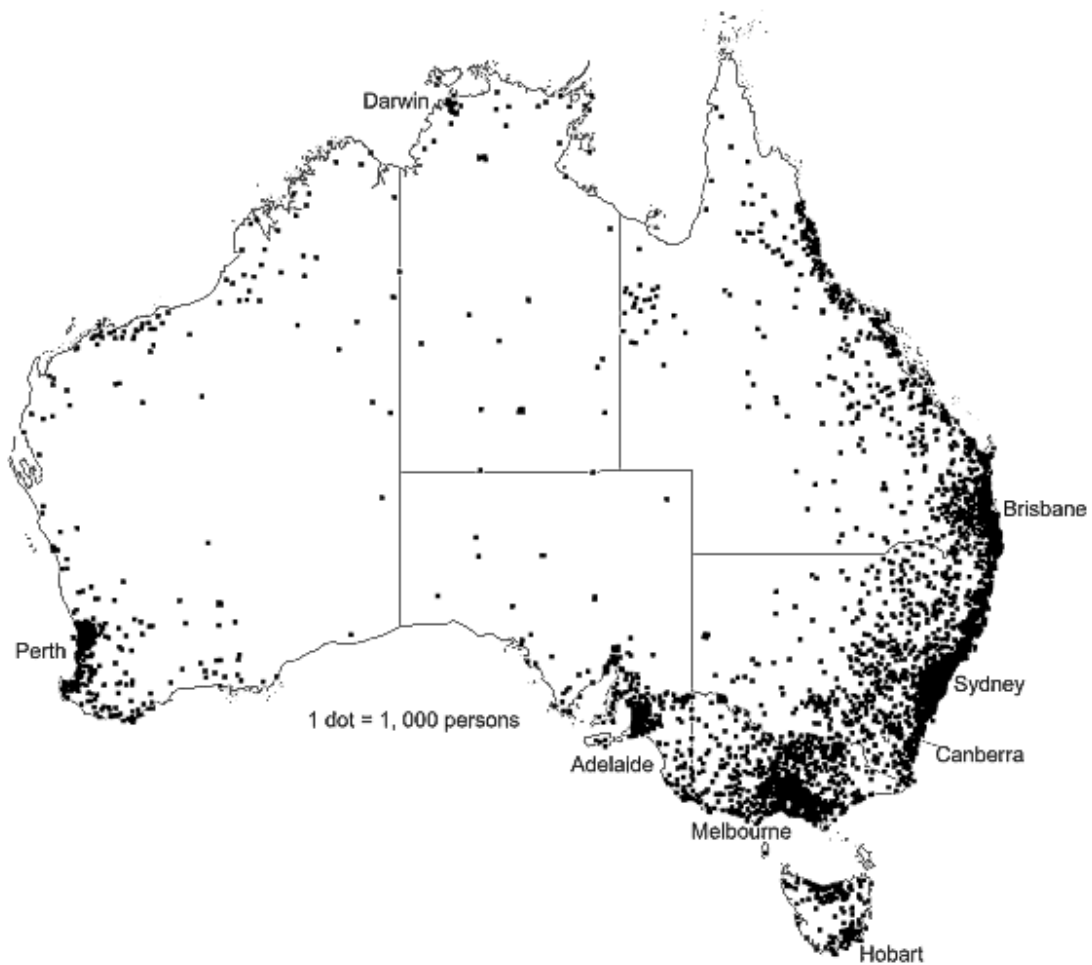


Figure 1: Population distribution of Australia as at 30 June, 2004

Source: Australian Bureau of Statistics, *Year Book Australia, 2006*

A downward trend in agriculture relative to other industries is a common feature as countries develop. This trend is likely to occur eventually in Central and Eastern Europe. In Australia, this process has been associated with increases in the scale of agricultural operations (size of farms), growing capital intensification of agriculture, rising levels of labour productivity and growing environmental problems. At the same time, the market power of intermediate domestic purchasers of agricultural products such as large supermarket chains and processors, has increased causing concerns amongst some farmers, for example dairy farmers and vegetable growers, that they are being exploited. Moreover, agriculture in Australia is under severe environmental pressure due to growing water shortages and community concerns about its environmental impacts.

Australia is not a very favourable country for agriculture. With the exception of Antarctica, it is the world's driest continent. A third of it is arid (receives less than 250 mm or rain on average annually) and another third is semi-arid (has an average annual rainfall of 240-500 mm per year). Furthermore, evaporation rates can be high and the amount of rainfall variable and uncertain.

To make matters worse, Australia does not have very fertile soils. *The Year Book Australia, 2005* reports:

“Most [Australian soils] are ancient, strongly weathered and infertile by world standards, with deficiencies in phosphorus and nitrogen. Those on floodplains are younger and more fertile. Very few are considered good quality soils for agriculture. To offset nutrient deficiencies, superphosphate and nitrogenous fertilisers are widely used particularly on pasture and cereal crops. Fragile soil structure and a susceptibility to waterlogging are other common features of Australian soils, while large areas are naturally affected by salt or acidity. These soil characteristics restrict particular agricultural activities, sometimes ruling out agricultural activity altogether.”

(Australian Bureau of Statistics, 2006a p.1)

Despite Australia's difficult natural environment for agriculture, agriculture accounts for the major portion of its land use. In 2003, it accounted for 57 per cent of Australian land use. About three-quarters of this land was used for extensive grazing of livestock. Of the 439.5 million hectares of land used for agriculture in Australia, only about 23.5 million hectares was used for crops and this constituted about 3 per cent of the total land use. Only 10 per cent of this area was irrigated. Nevertheless, agriculture accounted for 67 per cent of water consumption in Australia.

The largest number of farming establishments in Australia as at 30 July 2003 were engaged in beef cattle farming (36,208) followed by horticulture and fruit growing (21,213), then mixed grain, sheep and beef farming (17,104), sheep farming (13,250), grain growing (11,960), dairy farming (11,003) and sugar cane growing (4,762) (Australian Bureau of Statistics, 2006b). With some yearly variation, the gross value of Australian crop production and livestock production are about equal. In 2004-05,

meat and meat products combined was the largest export item of the Australian farm sector (A\$ 6944m) followed by cereals (A\$5157m), wool (A\$2,838m) and sugar (A\$1645m). Asia was an important export market for Australian agricultural exports. Trade barriers made it difficult for Australia to export to the EU.

With this background in mind, let us consider a number of environmental issues that have been raised by the development of Australian agriculture and some of the policies that have been adopted to address these. Water availability, water pollution, land clearing, degradation of soils, the use of genetically modified organisms, the Landcare initiative and other conservation measures designed to influence agriculture will be considered.

2. Water Availability

Lack of water has become a serious environmental problem in Australia, highlighted by a current prolonged drought on much of the continent. As a result of this drought, levels of reservoirs are very low and water-use restrictions have been tightened in most capital cities and elsewhere. It is speculated that Australia's prolonged drought conditions could be a result of climate change being brought about by global warming. Australia's production from irrigated agricultural land can be expected to be reduced severely if the dry conditions which Australia is experiencing persist for much longer.

Data is limited on water use by agriculture. It is estimated* that in 2000-01 Australian agriculture used 72,431 gigalitres (GL) of water, 57 per cent of that used in Australia. In 2002-03, 10,404 GL of water was used by agriculture for irrigation. The main purposes for which it was used are in descending order: pasture for grazing purposes (2,827 GL), cotton growing (1,526 GL) and sugar cane cultivation (1,293 GL). Vegetable growing for human consumption only used 8.4 GL. The largest use per hectare was for rice growing (14.1 million litres) followed by cotton production.

There have been and are doubts about whether Australia's irrigation water is being used in the most economic manner. Considerable attention is, therefore being given to the extension and improvement of schemes to market rights to water use, tradeable

* All statistics in this paper are derived from figures available from the Australian Bureau of Statistics (unless otherwise stated) and most are in relevant issues of *Year Book Australia*.

permit systems. Such systems, however, will not lead to water use that is socially efficient unless greater attention is given to the environmental externalities or spillovers generated by different types of agriculture. For example, both cotton production and sugar cane production are reported to have serious adverse effects on water quality. For instance, sugar cane production is believed to have increased nutrient levels in the Great Barrier Reef Region which could lead to deterioration in coral reefs in this region. These reefs are a major tourist attraction and a significant recreational resource.

No user-pay schemes operate in Australia designed to bring the private marginal costs of agricultural production into line with social marginal costs. This also appears to be the case in most parts of the world. Water markets may not work efficiently if farms are not required to take into account their environmental spillovers in their economic decision-making. Nevertheless, even if not perfect, water markets may be better than no markets at all for water.

Agricultural users of water compete with non-agricultural users of water. Should non-agricultural users also be part of a market-dominated trading system for water?

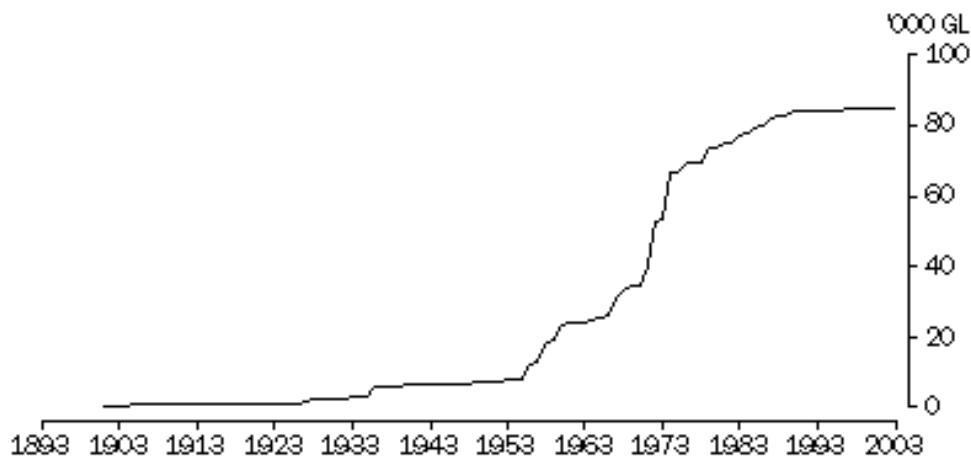
Another problem is how much water should be reserved for nature. If total quotas for water use for human consumption are high relative to supply, river flows and the levels of natural water bodies are likely to be reduced with adverse consequences for wildlife. Should nature conservation bodies be provided with water quotas? Should they be permitted to trade in water markets?

The only major inland waterway of Australia is the Murray-Darling River System. It is heavily utilised for irrigation purposes and the management of its water resources is complicated by the fact that it is located in four Australian states. Consequently, political transboundary issues occur which complicate the management of its water resources. Upstream states are inclined to 'hog' their available water. Whether or not interstate marketing of water rights can help to resolve this problem has yet to be decided. Nevertheless, it is clear that water is becoming scarcer in Australia and that user-pay principles are being increasingly applied to water use.

However, water markets do not solve all environmental problems. A decision is still required about how much water to draw from the natural environment for human use and how much to leave for nature. This is not just an Australian problem but a global issue. In the Murray-Darling River system, irrigation has not only reduced water flows but the building of dams and river locks has reduced the variability of water flows. This has adversely affected the reproduction of some species of water fowl and types of gum trees. In another part of the world, China, the building of the Three Gorges Dam is believed likely to have adverse consequences for some species of wildlife in the Yangtze River system, such as a species of freshwater porpoise.

In the most settled areas of Australia, little potential seems to remain for building further large dams to enhance water storage capacity. Furthermore, since about the early 1980s, there has been increasing opposition by conservation groups to further construction of large dams. Roughly, total water storage capacity of large dams in Australia has followed a logistic curve. As can be seen from Figure 2, there was rapid expansion in the building of such dams in the 1950s, 60s and 70s with little expansion since then.

24.14 TOTAL WATER STORAGE CAPACITY OF LARGE DAMS



Source: *Water Account, Australia, 2000-01* (46i0.0).

Figure 2: Total water storage capacity of large dams in Australia in thousands of gegalitres, 1901-2003

Source: Australian Bureau of Statistics, *Year Book Australia 2006*

It may also be noted that many measures have been implemented in recent times to economise on water uses outside of agriculture, and policies for this are being developed further. Measures include the introduction of water meters and marginal cost pricing for household water use, subsidies for the installation of some technologies that reduce water use, and for the installation of rainwater tanks. In addition, restrictions have been imposed on water use in most capital cities. These include limiting use of water for home gardens. Recycling of water for household use and other urban uses is expected to develop in the near future.

3. Water Pollution, Use of Chemicals and Agriculture

Australian soils are very deficient in nitrogen and phosphorus. Therefore, chemical fertilisers are widely applied on more productive agricultural areas to boost yields. For example, between 1990 and 2000, the use of nitrogen fertiliser more than tripled and the use of phosphorus more than doubled in Australia (see Figure 3). Nutrient rich water run-off associated with use of such fertilisers increases risks of algal blooms and eutrophication of water bodies. In addition, use of herbicides, fungicides and insecticides in Australian agriculture grew significantly in this period. Particularly in the case of cotton, there were increasing fears of water contamination from the use of insecticides.

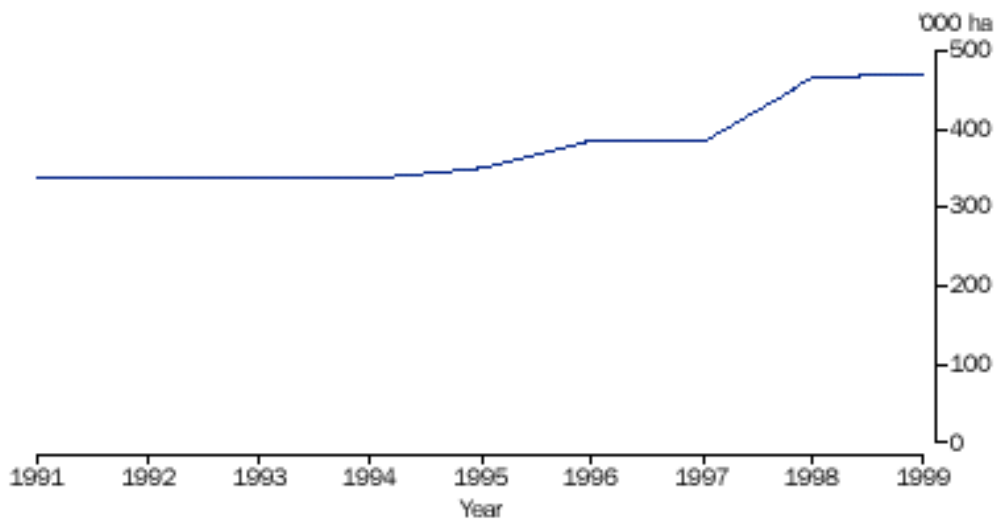


Figure 3: Fertiliser consumption (phosphorus and nitrogen in Australia, 1989-90 to 1999-00)

4. Land Clearing and the Environmental Impact of Pastoralism

A considerable amount of clearing of natural vegetation to make way for agriculture has occurred in Australia. It is estimated that in the eastern temperate zone of Australia, about 90 per cent of natural vegetation has been removed since European settlement. In Australia as a whole, more than 20 per cent of woodland and forest cover have been removed. The most intensive clearing is for cropping and improved pastures. However, vegetation is also removed to improve the availability of grass for livestock, particularly cattle.

During the 1990s, the rate of land clearing in Australia actually increased (see Figure 4), mostly in Queensland. However, Queensland has recently placed additional restrictions on land clearing. Therefore, the rate of clearing may slow down in this decade.



Source: National Greenhouse Gas Inventory, Australian Greenhouse Office 2001.

Figure 4: Annual area in thousands of hectares of land cleared in Australia, 1991-1999

Source: Australian Bureau of Statistics, "Measuring Australia's Progress, 2002"

Land clearing reduces the biodiversity of wildlife and has other significant environmental consequences. Nevertheless, agriculture is virtually impossible without a change to natural environments. The economic benefits of agriculture have to be compared with its environmental costs. This has been highlighted by the Australian Bureau of Statistics (2002a, p.4) as follows:

“The vast majority of Australian land has been cleared for use in economic production, in particular agriculture, which has generated income and employment. But land clearance has economic impacts too. It can, for instance, lead to costs associated with reduced flood control, the provision of potable water or increased salinity and soil erosion.

Land clearance is a key pressure on biodiversity, and an estimated 1,000 to 2,000 birds permanently lose their habitat for every 100 ha of woodland cleared. About 14% of Australia’s total greenhouse emissions are estimated to arise from land clearance (greenhouse gases are released from the burning and decay of vegetation and from the disturbance of soil which releases carbon). Clearing vegetation plays an important role in the spread of invasive species, land degradation and declining water quality (which are important to the environment and can impose costs upon the economy).”

Until recent decades, Australian governments subsidised land clearing. Land acquisition for the Crown (government) was often conditional on the land being cleared and tax concessions were given for land clearing. Land clearing was considered a sign of economic development. However, in recent decades tax incentives have been withdrawn and Australian governments have attempted to restrict land clearing.

It is also the case that livestock grazing without land clearing usually changes species composition and can result in extinction of the species, even though it may benefit a few.

5. Soil Degradation

Salinity, sodicity and acidity affect many Australian soils. These conditions occur naturally in Australia but can be aggravated by agricultural practices. For example, tree clearing can increase the incidence of dryland salinity and cause water courses to become very saline. Where previously cereals and similar crops could be grown, this becomes no longer possible if salinity develops. Soil may become bare in patches as

a result of increasing salinity. Wildlife may be adversely affected by the increased salting of water bodies. It has been estimated that the annual cost to Australian agriculture of these soil conditions exceeds AUD\$2.5 billion. There are also doubts about whether Australian farmers return sufficient organic matter to their soil. Few Australian farmers engage in green manuring and many graze or burn their stubble from crops rather than return it to the soil. Thus soils tend to lose humus and their structure may deteriorate.

6. Genetically Modified Crops

Australia has few genetically modified crops. The main one is cotton which has been genetically modified for insect resistance or modified to be resistant to the herbicide glyphosphate. There has been no significant use of genetically modified crops for food production in Australia, unlike in the Americas.

7. Landcare Australia

An interesting initiative in Australia designed to address land conservation problems have been the Landcare Program. This began in 1989 as a result of the partnership between the National Farmers' Federation (NFF), a peak farmers' pressure group and the Australian Conservation Foundation (ACF), a major conservation NGO in Australia. Their organizations were able to convince the Australian Government to support the Landcare Program. The government provided over \$1 billion of funding for this purpose in the 1990s and its continuing financial support for the program is ensured until mid-2008. The emphasis of the program is on encouraging "landholders to undertake Landcare and related conservation works by supporting collective action by communities." It also aims to encourage farmers to adopt sustainable management practices.

Today there are about 4000 community Landcare groups in Australia. By the end of the 1990s, almost 40 per cent of broadacre and dairy properties had Landcare membership. Activities included tree planting, especially along water courses, removal of exotic weeds, fencing of remnant vegetation and so on.

The Landcare Program also makes information available to farmers to assist them to engage in sustainable farming. Online information is available for example on

environmental best practices, weed control, minimum tillage, erosion control and salinity. A Government sponsored NGO (or Quasi-NGO, 'Quango'), Landcare Australia Ltd., promotes and sponsors the Australian Landcare movement and targets corporate sponsorship. Nevertheless, most of the available funds for Landcare are directly controlled by the Australian Government through its Department of Agriculture, Fisheries and Forestry. It is possible, therefore, that the transaction costs involved in funding are high. Moreover, it is unclear how many farmers have adopted conservation farming practices as a result of the activities of government agencies and land management groups. Some evidence suggests that it is few (Australian Bureau of Statistics, 2002b, p. 5).

The National Landcare Program involves elements of co-operation and indirectly, co-management. It would be interesting to compare its performance and character with schemes implemented in the EU to motivate farms to voluntarily produce agro-environmental goods (see Falconer, 2002). It is, however, not possible to do this here. Note that the Australian Government has developed additional initiatives in recent years to encourage sustainable agriculture and to conserve natural resources. These initiatives include support from the Natural Heritage Trust and the National Action Plan for Salinity and Water Quality. Once again it is possible that a substantial amount of the funds are absorbed by the Australian public service itself.

8. Concluding Comments

In recent decades, the Australian Government has become committed to economic liberalism based on the market system. Economic policy reforms have been made in the agricultural sector and other sectors to foster greater market competition and to harness the operation of market focus. In international fora, Australia has argued strongly in favour of free international trade, particularly in relation to agriculture, and continues to press for reduced protection of agriculture in regions such as the EU. The Australian Prime Minister sees free trade as efficient and also believes that greater liberalisation of international trade will have positive environmental benefits. However, negative environmental impacts are also probable, as is discussed in Tisdell (2001).

It is clear that within Australia, market reforms have not satisfactorily addressed several environmental and natural resource problems stemming from the development of agriculture. These include water use, land clearing, soil degradation, and water pollution as well as loss of biodiversity. Australia is moving towards the extension of water markets as a means to deal with its water scarcity problem. While these markets could result in more efficient use of water, they will be far from ideal if the externalities generated by water use are not allowed for. A particular problem is how much water to reserve for the functioning of natural ecosystems and where. Who should decide this and how?

Many of the environment problems associated with Australian agriculture, such as land clearing, continue to be addressed by administrative means, or are not effectively addressed at all, such as nutrient enrichment of run-off water in some localities. Also co-management and co-operation have been 'triallyed' for over a decade as a way to deal with soil degradation problems through the Australian Landcare Program. This suggests that it is impractical and unwise to rely on price mechanisms alone to manage environmental problems associated with the development of agriculture. Price mechanisms, like most mechanisms for social organization of resource allocation, have their limitations. This makes policy choices difficult because it is necessary to choose between less than perfect policy mechanisms.

In conclusion, it might be noted that while in Europe and Japan the multifunctionality of agriculture (Van Huylenbroeck and Durand, 2003) and its positive environmental spillovers are stressed as a reason for income transfers to agricultural markets (Van Huylenbroeck et al., 2004; Hagedorn, 2002; Van Huylenbroeck and Whitby, 1999), this is less so in Australia and the United States (Tisdell, 2003). In general, Australia has in recent times adopted market-led policies in relation to its agricultural industries and has concentrated on providing structural adjustment assistance to farmers to cope with market change, for example, grants to farmers to exit sugar cane production and dairying given recent low returns and to assist with the consolidation of farms in these industries. In particular, virtually no stress has been put on landscape amenities as a reason for agricultural or rural support in Australia, unlike in Europe (Vanslembrouck and Van Huylenbroeck, 2005). However, in some areas, agricultured landscapes clearly do have amenity value in Australia. For instance, loss of sugar cane fields and

their possible conversion to other uses, such as housing estates, was in the last few years controversial in the Sunshine Coast area north of Brisbane. The loss was a result of the closing of a local sugar cane mill. Many residents and tourists valued the verdant landscapes containing sugar cane.

Nevertheless, it has been claimed recently that Australian Government drought relief for farmers is artificially propping up Australian agriculture (McGauran, 2006). It is claimed to be encouraging farmers to stay on marginal land and to be assisting inefficient farmers to continue farming. Substantial amounts of financial drought relief have been provided to Australian farmers since 2001, and funding will continue for drought relief until 2008 resulting in total assistance of 1.9 billion Australian dollars. There is uncertainty about whether the current drought conditions are normal or exceptional or whether they are partly a consequence of changing weather patterns as a result of rises in the levels of greenhouse gases in the atmosphere. If there is climate change, farmers need to adjust to it.

The level of income support for European agriculture is well in excess of that for Australian farmers. The OECD (2006) estimated the level of farm income support (from taxpayers and consumers) to be in 2004, 32 per cent of farm income in the EU (25) and 5 per cent of farm income in Australia. However, with the expansion of the number of countries in the EU, political pressures are likely to be generated which will eventually lead to reduced income support for European farmers. There may be growing emphasis on market competitiveness as a pillar of agricultural policy in the EU, both as a result of internal political pressures and external ones, such as those articulated in the WTO. Secondly, there are likely to be growing concerns about the level of transaction costs involved in interventionist agricultural policies, namely the costs imposed on farmers in gaining income support and the costs of the public administration of such schemes. These concerns may further erode support for the EU's existing agricultural policies. Thus in the long term, the EU's agricultural policies may converge closer to those of Australia. However, the speed of change in the EU's agricultural policy will be constrained by the difficult and considerable rural adjustments that are required in the EU's new member states from Central and Eastern Europe. There is considerable disparity in the stages of agricultural development in the states of the EU.

9. Acknowledgements

I wish to thank Glynn Edwards for research assistance.

10. References

- Australian Bureau of Statistics (2006a) *Year Book of Australia, 2005* Agriculture. The agricultural environment. <http://www.abs.gov.au> (updated 24/1/2006) Accessed 8/11/2006.
- Australian Bureau of Statistics (2006b) *Year Book of Australia, 2005*. Agriculture. Characteristics of Australian farms. <http://www.abs.gov.au> (updated 24/1/2006) Accessed 8/11/2006.
- Australian Bureau of Statistics (2002a) *Measuring Australia's Progress, 2002*. The headline indicators have clearance. <http://222.abs.gov.au>. Accessed 8/11/2006.
- Australian Bureau of Statistics (2002b) *Year Book of Australia, 2002*. Environment. Australian land resources – an overview. <http://www.abs.gov.au>. Accessed 19/11/2006.
- Falconer, K. (2002) “Developing co-operative approaches to agri-environmental policy: a transactions cost perspective on farmer participation in voluntary schemes”. Pp. 239-259 in K. Hagedorn (ed.) *Environmental Co-operation and Institutional Change: Themes and Policies for European Agriculture*. Edward Elgar, Cheltenham, UK.
- Hagedorn, K. (2002) *Environmental Co-operation and Institutional Change: Theories and Policies for European Agriculture*. Edward Elgar, Cheltenham, UK and Northampton, MA, USA.
- OECD (2006) *Agricultural Policies in OECD Countries: Monitoring and Evaluation*. OECD, Paris.
- McGauron, P. (2006) “Drought package encourages farmers to stay on the land”. ABC transcript from AM program. <http://www.abc.net.au/am/content/2006/51766690.htm> [Accessed 13/12/2006].
- Tisdell, C.A. (2004) “The WTO, labour and environmental standards: globalisation with reference to India”. Pp 87-105 in C. Tisdell and R.K. Sen (eds.) *Economic Globalisation: Social Conflicts, Labour and Environmental Issues*. Edward Elgar, Cheltenham, UK and Northampton, MA, USA.

- Tisdell, C.A. (2001) "Globalisation and sustainability: environmental Kuznets curve and the WTO". *Ecological Economics* 39, 185-196.
- Tisdell, C.A. (2005) "Australia's economic policies in an era of globalisation". Pp. 151-166 in C. Tisdell (ed.) *Globalisation and World Economic Policies*. Serials Publications, New Delhi.
- Van Huylenbroeck, G. and Durand, G. (2003) *Multifunctional Agriculture: A New Paradigm for European Agricultural and Rural Development*. Ashgate, Aldershot, England and Burlington, USA.
- Van Huylenbroeck, G., Verbecke, W., and Lewers, L. (2004) *Role of Institutions in Rural Policies and Agricultural Markets*. Elsevier, Amsterdam.
- Van Huylenbroeck, G. and Whitby, M. (1999). *Countryside Stewardship: Farmers Policies and Markets*. Pergamon Press, Amsterdam.
- Vanslebrouck, I. and Van Huylenbroeck, G. (2005) *Landscape Amenities: Economic Assessment of Agricultural Landscapes*. Springer, Dordrecht, The Netherlands

PREVIOUS WORKING PAPERS IN THE SERIES ECONOMICS, ECOLOGY AND ENVIRONMENT

For a list of working papers 1-100 in this series, visit the following website:
http://www.uq.edu.au/economics/PDF/Clem_Tisdell_WorkingPapers.pdf or see lists in papers 101-140

101. Knowledge and Willingness to Pay for the Conservation of Wildlife Species: Experimental Results Evaluating Australian Tropical Species, by Clem Tisdell and Clevo Wilson, May 2004.
102. Antarctic Tourists, Wildlife and the Environment: Attractions and Reactions to Antarctica, by Clem Tisdell, May 2004.
103. Birds in an Australian Rainforest: Their Attraction for Visitors and Visitors' Ecological Impacts, by Clem Tisdell and Clevo Wilson, May 2004.
104. Nature-Based Tourism and the Valuation of its Environmental Resources: Economic and Other Aspects by Clem Tisdell, May 2004.
105. Glow Worms as a Tourist Attraction in Springbrook National Park: Visitor Attitudes and Economic Issues, by Clem Tisdell, Clevo Wilson and David Merritt, July 2004.
106. Australian Tropical Reptile Species: Ecological Status, Public Valuation and Attitudes to their Conservation and Commercial Use, by Clem Tisdell, Clevo Wilson and Hemanath Swarna Nantha, August 2004.
107. Information and Wildlife Valuation: Experiments and Policy, by Clem Tisdell and Clevo Wilson, August 2004.
108. What are the Economic Prospects of Developing Aquaculture in Queensland to Supply the Low Price White Fillet Market? Lessons from the US Channel Catfish Industry, by Thorbjorn Lyster and Clem Tisdell, October 2004.
109. Comparative Public Support for Conserving Reptile Species is High: Australian Evidence and its Implications, by Clem Tisdell, Clevo Wilson and Hemanath Swarna Nantha, October 2004.
110. Dependence of public support for survival of wildlife species on their likeability by Clem Tisdell, Clevo Wilson and Hemanath Swarna Nantha, October 2004.
111. Dynamic Processes in Contingent Valuation: A Case Study Involving the Mahogany Glider by Clem Tisdell, Clevo Wilson and Hemanath Swarna Nantha, November 2004.
112. Economics, Wildlife Tourism and Conservation: Three Case Studies by Clem Tisdell and Clevo Wilson, November 2004.
113. What Role Does Knowledge of Wildlife Play in Providing Support for Species' Conservation by Clevo Wilson and Clem Tisdell, December 2004.
114. Public Support for Sustainable Commercial Harvesting of Wildlife: An Australian Case Study by Clem Tisdell, Clevo Wilson and Hemanath Swarna Nantha, December 2004.
115. Endangerment and Likeability of Wildlife Species: How Important are they for Proposed Payments for Conservation by Clem Tisdell, Hemanath Swarna Nantha and Clevo Wilson, December 2004.
116. How Knowledge Affects Payment to Conserve and Endangered Bird by Clevo Wilson and Clem Tisdell, February 2005.
117. Public Choice of Species for the Ark: Phylogenetic Similarity and Preferred Wildlife Species for Survival by Clem Tisdell, Clevo Wilson and Hemanath Swarna Nantha, March 2005.
118. Economic Incentives for Global Conservation of Wildlife: New International Policy Directions by Clem Tisdell, March 2005.
119. Resource Entitlements of Indigenous Minorities, Their Poverty and Conservation of Nature: Status of Australian Aborigines, Comparisons with India's Tribals, Theory and Changing Policies Globally by Clem Tisdell, March 2005.

120. Elephants and Polity in Ancient India as Exemplified by Kautilya's *Arthashastra* (Science of Polity) by Clem Tisdell, March 2005.
121. Sustainable Agriculture by Clem Tisdell, April 2005.
122. Dynamic Processes in the Contingent Valuation of an Endangered Mammal Species by Clem Tisdell, Clevo Wilson and Hemanath Swarna Nantha, April 2005.
123. Knowledge about a Species' Conservation Status and Funding for its Preservation: Analysis by Clem Tisdell, June 2005.
124. Public Valuation of and Attitudes towards the Conservation and Use of the Hawksbill Turtle: An Australian Case Study by Clem Tisdell, Hemanath Swarna Nantha and Clevo Wilson, June 2005.
125. Comparison of Funding and Demand for the Conservation of the Charismatic Koala with those for the Critically Endangered Wombat *Lasiorhinus krefftii* by Clem Tisdell and Hemanath Swarna Nantha, June 2005.
126. Management, Conservation and Farming of Saltwater Crocodiles: An Australian Case Study of Sustainable Commercial Use by Clem Tisdell and Hemanath Swarna Nantha, August 2005.
127. Public Attitudes to the Use of Wildlife by Aboriginal Australians: Marketing of Wildlife and its Conservation by Clem Tisdell and Hemanath Swarna Nantha, August 2005.
128. Linking Policies for Biodiversity Conservation with Advances in Behavioral Economics by Clem Tisdell, August 2005.
129. Knowledge about a Species' Conservation Status and Funding for its Preservation: Analysis by Clem Tisdell, August 2005.
130. A Report on the Management of Saltwater Crocodiles (*Crocodylus porosus*) in the Northern Territory: Results of a Survey of Pastoralists by Clem Tisdell, Clevo Wilson and Hemanath Swarna Nantha, September 2005.
131. Crocodile Farms and Management of Saltwater Crocodiles in Northern Territory: Results of a Survey of NT Crocodile Farmers Plus Analysis of Secondary Information by Clem Tisdell, September 2005.
132. The Environment and the Selection of Aquaculture Species and Systems: An Economic Analysis by Clem Tisdell, October 2005.
133. The History and Value of the Elephant in Sri Lankan Society by Ranjith Bandara and Clem Tisdell, November 2005.
134. Economics of Controlling Livestock Diseases: Basic Theory by Clem Tisdell, November 2006.
135. Poverty, Political Failure and the Use of Open Access Resources in Developing Countries by Clem Tisdell, November 2006.
136. Global Property Rights in Genetic Resources: An Economic Assessment by Clem Tisdell, November 2006.
137. Notes on the Economics of Fish Biodiversity: Linkages between Aquaculture and Fisheries by Clem Tisdell, November 2006.
138. Conservation of the Proboscis Monkey and the Orangutan in Borneo: Comparative Issues and Economic Considerations by Clem Tisdell and Hemanath Swarna Nantha, March 2007.