IMPROVING THE ENVIRONMENT IN AUSTRALIAN AGRICULTURE: THE EXPERIENCE OF GOVERNMENT POLICY INITIATIVES WITH REFERENCE TO ENVIRONMENTAL MANAGEMENT SYSTEMS

John CARY [a)] and Anna ROBERTS [b)]

[a)] Institute for Sustainability and Innovation, Victoria University, PO Box 14428 Melbourne Vic 8001, Australia, Ph.D.
[b)] Department of Primary Industries, Rutherglen Centre, RMB 1145 Rutherglen, Victoria 3685, Australia, Ph.D.

ABSTRACT

This paper broadly examines the efficacy of government-supported programs, including encouraging the use of market-based instruments, to encourage improved management of land and water systems associated with agricultural land in Australia. Evidence is presented from a specific case assessment of a program to promote adoption of environmental management systems (EMSs) to improve biodiversity and ecosystems in agriculture. Data are presented on reported EMS activity and the perceptions and experience of selected groups of broad-acre farmers in central Victoria and dairy and beef farmers in Gippsland. The farmers were participants in a project designed to encourage more sustainable catchments through actions on individual farms. The pro-environmental behaviours of farmers were mediated through encouraging the voluntary adoption of government and industry sponsored EMSs, often with the provision of financial incentives and other support. This program was developed within a policy framework favouring market-based instruments. There were three significant findings from the study. First, voluntary adoption of EMS practices with sufficient public benefits to justify government investment was unlikely at sufficient scale for significant catchment impact. Second, more targeted investment is required to protect the highest value ecosystem assets. Third, there were different comparative advantages for EMSs for different agricultural industries. There are implications for government intervention where the complementarities for ecosystem improvement and private benefit are not clearly understood.

Key words: environmental management systems / market-based instruments / behaviour change

INTRODUCTION

All over the world, there is a long history of using natural resources in a manner that is ecologically unsustainable (Ludwig et al. 2001). Australia, which has had only recent agricultural development (often less than 200 years), has experienced extensive land degradation and declines in biodiversity, water quality and water availability, as well as increases in dry-land salinity and soil erosion (Barr and Cary, 1992). Australia, with its small population (less than 3 people/km^2 compared with 116 people/km^2 in the European Union) and large distance from markets, is heavily reliant on exporting agricultural produce (ABS, 2008; Eurostat, 2009). An inevitable consequence of this is that Australian agriculture is much less subsidised than in Europe (ABARE, 2006). The economic drivers for improved environmental practices are usually weak. If they were strong, there would not be a problem of environmental and land degradation. These problems have been recognised by Australian governments, commonly by making grants available to attempt to ameliorate the problems. Government programs to increase the awareness of sustainable practices, on their own, usually will not improve the effectiveness of the existing drivers of change. Government subsidies are often necessary in encouraging local projects; but they are unlikely to ensure on-going improved resource management after the subsidies are

withdrawn. It is unrealistic to assume small subsidies and incentives with limited duration will have on-going effects where there is little on-going private economic incentive to encourage appropriate management.

Since 1990 the Australian Government has made substantial grant investments to landholders to halt and reverse land and water problems. Between 1996 and 2007 the Australian Government invested $AUD 1.5 billion in the Natural Heritage Trust (NHT) program and a further $AUD 1.0 billion in the NHT and the National Action Plan for Salinity and Water Quality, with State and Territory governments matching this latter funding with cash or in-kind contributions (Auditor General, 2008). These programs for on-ground natural resource management were administered by grants to regional bodies and directly to landholders. However, the the Australian National Audit Office found little evidence that this investment had achieved stated natural resource management targets or achieved value for money (Auditor General, 2008). Pannell and Roberts (2009) in a retrospective assessment also found, with few exceptions, projects delivered under the National Action Plan for Salinity and Water Quality generated few worthwhile salinity mitigation benefits and were likely to have little enduring benefit.

The use of market-based instruments (MBIs) to tackle natural resource degradation has received growing attention in Australia over the last decade. MBIs address the market failure of negative environmental externalities typically by incorporating the external cost of production or consumption activities through taxes or charges on processes or products, or by creating property rights and facilitating the establishment of proxy markets. MBIs can be price-based, rights-based or designed to reduce market friction by improving the workings of existing markets (Whitten, van Bueren and Collins, 2003). MBIs can consist of a range of mechanism to promote more sustainable pro-environmental behaviour, including eco-taxes, tradable permits, eco-labelling and certification, as well as quasi-market instruments such as auctions for the provision of eco-services (Table 1).

Table 1: Market-based instruments by type (Source: Whitten, van Bueren and Collins, 2003)

Price-based	**Rights-based**	**Market friction**
• Emission charges • User charges • Product charges • Performance bonds • Non-compliance fees • Subsidies (materials and financial) • Removal of perverse subsidies/taxes • Deposit-refund systems	• Tradeable permits, rights or quotas • Offset schemes	• Reducing market barriers • Extension / education programs • Research programs designed to facilitate market exchanges • Labelling • Information disclosure

Australian and State government have encouraged the use of pilot programs to explore the use of MBIs. Examples of these programs can be seen in Australian Government (2003) and Whitten and Young (2003). It is too early to assess many of these programs, although it can be observed that the transaction costs involved in implementing these programs is often high (Australian Government, 2004) and some natural resource problems are unlikely to be amenable to MBI solutions on a wide scale.

Between 2003 and 2007 the Australian government provided targeted subsidies to stimulate the voluntary adoption of industry-based EMSs at the farm level. EMSs provide a basis to support the environmental claims embraced in eco-labelling and certification for agricultural and food products. In April 2003 the Australian Government launched an $AUD 8.5 million EMS

National Pilot Program involving 15 pilot projects. These projects represented a diverse range of industries, regions, partnerships and natural resource management issues and were designed to achieve complementary environmental and commercial benefits (EMS Implementation Working Group, 2003). More generally, the program reflected multiple policy elements of a command and control approach, a market response model intended to lead to autonomous decisions by farmers; and a process and network approach facilitating learning networks and interaction between farmers and government agents (Elzen and Wieczorek, 2005). The government policy supporting EMSs embraced elements of an MBI by potentially encouraging market differentiation via eco-labelling and certification and reducing market friction. However the program tended to focus on farm production aspects without insistance on programs being linked to markets and specifically eco-labelled products.

EMSs are process tools to ameliorate environmental risk associated with production, business and marketing activity. Australian farm operations are covered by fewer legislative and regulatory requirements than other forms of industry, and relatively few approvals must be gained before farming operations occur. Where legislation exists, its application to farming enterprises is often unspecific and farmers are not provided with clear indications of what an allowable practice might be. Thus, there have been few clear regulatory drivers for EMS adoption within agriculture (Carruthers, 2005).

We will examine some cases to assess the efficacy of, and the response of farmers to, government-sponsored programs to encourage adoption of voluntary EMSs in agriculture. These government-supported programs were developed to improve biodiversity and the sustainability of ecosystems in Australian agriculture within the context of a policy framework favouring market-based instruments. The adoption of EMSs was expected to lead to more sustainable catchments and ecosystems in agriculture and to improve biodiversity while providing private and public benefits at the catchment level.

AIMS

The aim of the study was to assess the effectiveness of EMS in achieving desirable environmental outcomes, specifically:

- To assess the practices undertaken by farmer groups who have participated in EMS and the likely public and private benefits.
- To assess whether EMS was likely to be widely adopted and the implications for environmental outcomes.
- To consider the appropriateness of government policies encourging EMS adoption.

METHODS

Resource improvement practices adopted as part of EMS were studied in three farming industries. The farm industries were broad-acre cropping in central Victoria, and dairy and beef farming in Gippsland, Victoria. Four groups of case study farmers were selected for investigation – the Enviromeat group in Gippsland, the Natte Yallock cropping group, and 2 dairy groups (Poowong and Glen Alvie). Each group participated in a focus group and was asked the same questions. A schedule of questions to guide the focus group discussion was developed based on a review of EMS literature (see Cary et al., 2009). The focus group discussions identified the determinants of farmers' willingness to implement EMS activity and the barriers to increased adoption of EMS. Responses were recorded and transcribed. The public and private benefits of management practices associated with EMS were assessed after conducting the focus groups, and were checked by the group's usual facilitator, who had knowledge of local practices.

The Enviromeat group represented specialist beef production in Gippsland implementing an ISO 14001 accredited EMS and an environmentally branded product – Enviromeat. The program was a Department of Agriculture Fisheries and Forestry funded EMS pilot project. Its early members had been supplying a quality-assured, branded beef product through Gippsland Natural Pty Ltd. Initially, sixty farm businesses participated in federal government-supported training workshops. Subsequently, 27 farms participated in external audits and formed the Gippsland EMS Cluster with 21 farms meeting the additional requirements to become accredited suppliers of Enviromeat. The group had strong leadership and a strong extension facilitator. A focus group of nine members of the Enviromeat group, conducted in September 2007.

Members of the Natte Yallock Landcare Group, located in north central Victoria, participated in a trial of a Stage 3 EMS (ISO 14001 EMS, without a third party audit) based on the Australian EMS Manual and Workbook. The pilot project was developed in a partnership between the Australian Landcare Management System (ALMS). Members of the group operated mixed cropping and grazing properties. A focus group comprised 12 members of the Natte Yallock group was conducted in March 2007. All participants in the focus group had implemented significant components of the ALMS ISO 14001 compliant EMS during the program. Few participants had completed a peer audit and none sought full EMS ISO 14001 certification.

Two groups of dairy farmers in Gippsland were investigated. Two focus groups, one representing the Poowong Dairy Discussion Group and a group representing the Glen Alvie Discussion Group, comprised nine members and five members, respectively. These focus groups were conducted in March 2008. The principal interest was the place and use of DairySAT, a structured program which focuses on-farm environmental management activities relevant to dairy farming. DairySAT was used for self assessment, planning and modifying environmental management.

RESULTS AND DISCUSSION

Consideration of public and private benefits

A consideration of EMS needs to assess private and public benefits and costs. Private benefits are benefits accruing from an activity which are captured or, if costs, incurred by an individual or business. Public benefits or costs are those which accrue to a wider group of individuals or to society. An assessment of the public and private benefits associated with the common resource management practices linked to EMS participation for the industry cases considered is presented in Table 2.

There were three main groups of practices being undertaken as major activities associated with EMS:

- Practices where there can be reasonable private benefits (chemical use, planting of perennial pastures and trees for production, and direct drilling of crops).
- Practices where there are commonly negative private benefits (enhancing biodiversity, riparian management, and gully control).
- Practices underpinned by regulation (chemical use and disposal, effluent management, and silage wrap).

For practices with sufficient private benefit, extension or no action are appropriate government responses, depending upon the public benefits (see Pannell, 2008). Such practices would be adopted (or not adopted) regardless of whether an EMS was part of the extension program. Similarly, practices with a regulatory requirement, such as chemical use and disposal, effluent management and disposal or silage wrap should be implemented regardless of EMS, although undertaking EMS may well help make farmers more aware of their legal obligations. Regardless of whether EMS are undertaken in conjunction with regulatory obligations, better

compliance and enforcement would seem to be sensible to improve the public benefits. Regulation can take the form of either polluter pays (such as regulatory requirement and enforcement) or beneficiary pays. Pannell (2008) does not make recommendations about the most appropriate regulatory tool. For the practices listed in Table 2, a polluter pays mechanism is used. It is noteworthy that for all chemical and waste disposal issues, particularly dairy effluent, there are numerous issues of non-compliance. Stronger government enforcement would seem to be sensible to gain most public benefit.

Practices for which there are negative private benefits and sufficient positive public benefits (eg riparian management, remnant protection, seeding or planting for biodiversity) were the practices which had most chance of generating benefits at the catchment scale. These are the practices which ideally would be most strongly encouraged as part of an EMS. With the possible exception of the Enviromeat group, it appeared that adoption of these practices occurred more as a result of available incentive funding than as part of EMS participation.

Also shown in Table 2 is the most appropriate policy tool (Pannell 2008) which would be required for the practice to be sufficiently attractive for farmers to adopt. For many of the management practices undertaken as part of the EMS activity and listed in Table 2 some form of government support seemed necessary to ensure adoption. Whilst this appears to be sound for practices which do not have an underpinning regulatory requirement (such as riparian management and remnant protection), it appears to be perverse to provide incentives to ensure compliance in matters such as dairy effluent management, for which there is a regulatory requirement.

Table 2. Public and private benefits and regulatory requirements associated with EMS management practices by beef, cropping, and dairy farmers

Practice	Private benefits	Public benefits	Existing Regulatory requirement [b]	Implied policy tool
Riparian management (B, D)[a]	Small to medium negative	Small to large positive	No	Positive incentives
Protecting remnants (B)	Small positive to small negative	Small to large positive	No, except for clearing	Positive incentives, extension or no action
Direct seeding or tree planting (biodiversity) (B, C, D)	Small positive to medium negative	Small to medium positive	No	Positive incentives, extension, or no action if public benefit is small
Tree planting (mainly shelter) (B,C,D) [a]	Small positive to medium negative	Small positive	No	No action or extension
Improved chemical use (B, C, D)	Medium to high positive	Small to medium positive	Yes	No action or extension
Chemical disposal issues (B, C, D)	Nil to small negative	Small to medium positive	Yes	Positive incentives or no action
Fencing off gullies (C)	Small to large negative	Small to large positive	No	Positive Incentives
Planting perennial pastures (C)	Medium negative to large positive	Small negative to small positive	No	Extension only in carefully targeted, specific situations. More commonly no action
Direct drilling crops (C)	Zero to large positive	Small to medium positive	No	Extension or no action
Appropriate Effluent disposal (D)	Zero to medium negative	Small to large positive benefits	Yes	No action or extension, needs underpinning regulation – benefits from compliance
Appropriate disposal of silage wrap (D)	Small positive to small negative	Small to medium positive	Yes	No action, needs underpinning regulation – benefits from compliance

[a] B refers to the beef group (Enviromeat in Gippsland); C is the cropping group (Natte Yallock); D refers to the dairy groups (Poowong and Glen Alvie).

[b] Pest and weed control is a requirement on all land.

Overall there were a range of practices conducted as part of an EMS. Those of most public benefit need either regulation enforcement or provision of positive incentives, both of which could occur without the need for EMS, although being undertaken as part of an EMS would add a useful educational component.

Influencing adoption and market signals

There are four factors which drive the adoption of standards and certification for agriculture industries RMCG (2007):

- compliance;
- market access;
- business/production efficiency; and
- stewardship and community relationships.

A summary of the relevance of each of these factors for each of the 3 industries in the case studies is shown in Table 3.

Table 3: Major drivers for EMS in the beef (Enviromeat), cropping and dairy industries

Farming group	Compliance	Market access	Business , production efficiency	Stewardship, community relationships
Beef Enviromeat		√		√
Cropping – Natte Yallock				√
Dairy Poowong and Glen Alvie	√			√

Direct market access was present only in the case of Enviromeat (Gippsland beef) group. Compliance issues were a major driver in the dairy industry but, unlike the Australian cotton industry where pesticide use is acknowledged as having had a major impact on the environment (Bowmer, 1996), market access issues appear insufficient to drive EMS adoption. Groups provided varying and mixed reactions regarding the presence of business and production efficiency improvements but overall there were few drivers of improved business efficiency in any group. Stewardship and community relationships were generally an important catalyst for involvement in EMS pilot programs and for continuing in the programs, but not for the full implementation of programs.

We also assessed the drivers and barriers to adoption of EMS. Overcoming the private costs faced by individuals was a barrier in all groups (Table 4). For governments to rationally provide significant financial investment or funding of EMS there would need to be an emphasis on farmers undertaking environmental asset protection above that which would be undertaken where there is only net private benefit (Cary et al., 2009).

For the Enviromeat group the net private benefits of the environmental activities undertaken were sufficient to ensure on-going adoption of EMS, with the group continuing to operate after cessation of support funding. Product branding and the strong environmental values held by the group were important drivers. For the cropping farmers, there were no market drivers and the net private benefits were insufficient to bring about widespread EMS adoption. Dairy farmers were unlikely to continue autonomous participation in DairySAT EMS program without external facilitation and co-ordination or the threat of increased regulation and enforcement.

Table 4. Drivers and barriers for EMS adoption for participating beef, cropping and dairy farmers

Farming group	Drivers	Barriers
Beef – Enviromeat	Product branding – Enviromeat. Higher product price from a niche market	Paperwork
	Environmental values	Private costs of implementation and marketing
Cropping – Natte Yallock	Involved in incentive programs with Catchment Management Authority	Lack of market signal – undifferentiated product
	Interest in environment	Paperwork
	Extension	Private costs of implementation
Dairy – Poowong and Glen Alvie	Participation in DairySAT (approach made through Landcare, not autonomous self-start) with extension support	Lack of market signals
	Availability of effluent and/or riparian incentives	Paperwork
	Fear of increased regulation – especially for effluent disposal	Private costs of implementation

In an earlier study of the Enviromenat EMS Pilot Project (Higgins et al 2006a; Higgins et al 2006b) group members identified the following benefits of EMS participation:

- responding to public opinion about the environment;
- pre-empting government regulation;
- avoiding private regulation and preventing loss of market access;
- financial benefits (positive and negative);
- providing increased consumer confidence in farming practices;
- learning about good farming practice;
- making new contacts / social aspects;
- consistent with existing philosophy and farming values; and
- fits with existing plans (Higgins *et al.* 2006b)

Participants also identified the following limitations of participating in EMSs:

- lack of consumer demand;
- do not wish to pursue full ISO 14001 certification;
- (for many producers) in the absence of significant consumer demand at the time of the interviews – there was little financial incentive to pursue or maintain third party EMS certification;
- increased paper work; and
- cost of auditing and compliance(Higgins *et al.*, 2006b).

Farmers are more likely to adopt a practice, either an individual land management practice or a process such as EMS, when it has fairly immediate positive outcomes, when it can be trialled on a small scale, it is not too risky; and when it is simple rather than complex (Cary et al., 2002). EMS provides adoption challenges with respect to some of the above attributes. For example early positive outcomes exist only if a market premium exists (usually only in niche markets). EMS can be trialled on a small scale, if a staged approach is used such as initial self assessment, with subsequent progression to more complex auditable systems such as ISO 14001 if there are sufficient benefits. EMS is not risky to adopt, requiring only time and persistence. It is however complex if done to an auditable standard, requiring good record keeping, paperwork, understanding and compliance with legal obligations, and other factors. For a business which

already has strong record keeping, paperwork and understanding of legal compliance issues, EMS would not be onerous.

Some of the practices conducted as part of EMS may have small private benefits to landholders but significant benefits for the catchment – for example, extensive stream enhancement or extensive conservation of biodiversity. Self-interested perception of private benefit is rarely sufficient to produce optimal adoption of such practices from the perspective of environmental outcomes. In these cases there will be a need for external incentives, regulation or other appropriate policy instrument involving public investment to assure participation. Pannell (2008) has suggested four policy mechanisms: positive or negative incentives (using financial or regulatory instruments), extension, or technology development. The most appropriate policy tool which would be required for the practice to be sufficiently attractive for farmers to adopt is shown in Table 2. In the cases reported here some form of government support, more often than not, seemed necessary to ensure adoption of many of the practices undertaken as part of the EMS activity.The choice of appropriate mechanisms for encouraging environmentally beneficial change should depend on the relative levels of private net benefits and public net benefits. Pannell's (2008) framework is based on public environment managers requiring a benefit-cost ratio of at least 1.0. and preferably greater, to publicly invest in incentives or extension.

The experience of the case study groups in attempting to implement EMS was mixed. The Enviromeat group was able to establish and develop markets for the Enviromeat product which provided positive feedback to encourage implementation of EMS activities. However, some industry and government subsidies were necessary for the initial establishment of Enviromeat. As a consequence, the group was able to develop the Enviromeat product as a differentiated fresh food provided to a niche market by a collaborative and tight supply chain. This is unlikely to be able to be repeated for the Australian beef industry as a whole (Pahl, 2007).

For the Natte Yallock group cropping farmers, as has been found been suggested previously (Ridley, 2007), the lack of market drivers for implementation of EMSs for products such as commodity grains provided negative feedback, discouraging continuation of EMS. The promotion of EMS in the broad-acre sector is constrained by supply chain arrangements where it is difficult to link market-place signals for differentiated products to individual properties. Thus, support for implementation of EMS type programs will depend on identifying net public benefits which will frequently be dispersed and low and, thus, unlikely to warrant significant public investment.

For the majority of dairy farmers in the Poowong and Glen Alvie groups on-going participation was likely to require on-going extension and industry support or government subsidy for activity for which there was insufficient privately-captured benefit. There was no concrete link between DairySAT participation and consumers or markets for dairy products. The discipline required for more formal credentialing and auditing did not appear to be attractive to participating dairy farmers.

CONCLUSIONS

The majority of these EMS pilot projects have been government and industry initiated and therefore have sought to increase awareness and adoption of management systems that will lead to public good outcomes, address community expectations or future market access requirements or, often, to demonstrate the environmental commitment of farmers to the broader community. Few of these projects have attempted to set production-oriented environmental standards in order to meet specific consumer demands, create a market niche and assist with product labelling.

A criticism of government subsidised encouragement of voluntary EMSs is that the focus has been on the production side, and its link to ecosystems, with inadequate attention to the

consumer side – inherent to the MBI approach. Studies of marketing chains and at the retail level indicated that Australian consumers have lacked an understanding of, and appeared to have little expressed utility for, sustainably-produced or environmentally friendly food products. Consumers were generally unwilling to pay a premium for food certified to be sustainably-produced. Consumers have a clearer understanding of, and preference for, organically produced food which was particularly linked to improved consumer health (Bhaskaran *et al*., 2006).

From a policy perspective to achieve the best overall environmental outcomes, and for government investment to be warranted to support adoption of EMS, there needs to be sufficiently large public benefits. Voluntary adoption of EMS practices with sufficient public benefits to justify government investment was unlikely at sufficient scale to have significant catchment-level impact. As a consequence, much more targeted investment to protect the highest value ecosystem assets (such as waterways and threatened ecological communities) is required, and this will require MBI policy tools other than widespread encouragement of EMS.

In contrast to broad-acre farm industries, industries such as horticulture (Hopkins et al., 2007) and intensive animal production have stronger external incentives to adopt EMS, particularly for practices associated with off-site impacts such as nutrient and chemical pollution. Intensive farm industries typically have shorter marketing chains linking producers and consumers and are thus more able to credibly link environmental improvement to discrete, and specifically-sourced, food products. Horticulture and intensive animal production are also likely to have stronger regulatory drivers to adopt EMS, particularly to redress off-site impacts.

The most important elements encouraging or mitigating pro-environmental behaviour change were individual farmers' anticipated outcomes of any change in behaviour (reflecting the 'external' conditions facilitating or discouraging pro-environmental behaviour). Most farmers considered voluntary adoption of EMS and certification to ISO 14001 standard too onerous and too costly relative to benefits derived. While many of the management practices adopted by farmers had public benefits such as improving stream water quality or enhancing biodiversity, with some notable exceptions farmers were willing only to adopt environmental practices which had sufficient private benefit to their farm businesses. This private benefit reflected monetary or other factors which were of benefit, such as ease of management or improved landscape aesthetics.

In contrast to broad-acre industries, the dairy industry has stronger regulatory drivers to adopt EMS, particularly for waste disposal, especially dairy effluent, which has the most potential to force increased environmental scrutiny. Pollution issues have motivated other intensive industries such as horticulture, cotton and intensive animal production. However, despite the stronger drivers in the dairy industry, social pressure alone is unlikely to lead to adoption of acceptable environmental practices such as waste management (effluent, chemicals, silage wrap) at sufficient scale without strong regulatory enforcement.

There were industry differences in the comparative advantage of adoption of EMS. The low or negative net private benefits for many practices were insufficient to bring about substantive and on-going adoption of EMS especially in broad-acre agricultural industries. Voluntary adoption of practices (with or without EMS) with sufficient public benefits to justify government investment was unlikely to occur at sufficient scale to have significant catchment-level impact. Understandably farmers were most willing to adopt management practices which had sufficient private benefit to their farm businesses, reflecting monetary and other factors such as ease of management or improved landscape aesthetics. Many of the environmental management practices also had public benefits, such as improving stream water quality or enhancing biodiversity. Thus, while voluntary-based NRM approaches are attractive for government, in contrast to use of regulatory based approaches, the low or negative net private benefits (and any available government support) for EMS activities were generally insufficient to bring about substantive and on-going adoption, especially in broad-acre agricultural industries. Government

investment in EMS and precursor schemes appears to be unjustified on the basis of sufficient public benefits. EMS is more likely to deliver public benefits if it is aimed at protecting assets of sufficiently high value and under high threat from agriculture, such as waterways and threatened ecological communities. This requires farmers to have access to spatial information to help assess the location of these sites and associated management recommendations. Remediation of these sites is not likely to provide sufficient private benefits to farmers for voluntary adoption.

ACKNOWLEDGEMENTS

We thank Emily Tee for conducting the interviews associated with this work.

REFERENCES

ABARE. Agricultural economies of Australia and New Zealand. Canberra, Australian Bureau of Agricultural and Resource Economics, 2006. http://www.abareconomics.com/interactive/ausNZ_ag/htm/au_overview.htm (accessed 13.05.09)

ABS. *Australia at a Glance*. Canberra, Australian Bureau of Statistics, Publication 1309.0, 2008.

Auditor General. Regional delivery model for the Natural Heritage Trust and the National Action Plan for Salinity and Water Quality, Report No. 21 2007–08, Performance Audit. Canberra, Australian National Audit Office, 2008.

Australian Government. National market-based instruments programme projects - Round 1. 2003. http://www.napswq.gov.au/mbi/mbi-round1.html (accessed 13.05.09).

Australian Government. The use of market based instruments for environmental outcomes. Submission to the Productivity Commission review of national competition arrangements. Department of the Environment and Heritage, 2004. http://www.pc.gov.au/__data/assets/file/0003/47325/sub097.rtf (accessed 13.05.09).

Barr, N.F./ Cary, J.W. *Greening a Brown Land: The Australian Search for Sustainable Land Use*. Melbourne, Macmillan, 1992, 344 p.

Bhaskaran, S./ Polonsky, M./ Cary, J./ Fernandez, S. Environmentally sustainable food production and marketing: Opportunity or hype? *British Food Journal*, 108 (2006), 677-690.

Bowmer, K.H. Biological impact of cotton pesticides. Canberra, Land and Water Resources Research and Development Corporation, 1996, 107p.

Carruthers, G. Adoption of environmental management systems in agriculture. Part 2: An Analysis of 40 Case Studies. Canberra, Rural Industries Research and Development Corporation, 2005.

Cary, J./ Roberts, A./ Tee, E. Differential adoption of EMS in Victoria. Department of Primary Industries, Victoria, 2009, (forthcoming).

Cary, J.W./ Webb, T./ Barr, N.F. Understanding landholders' capacity to change to sustainable practices. Canberra, Bureau of Rural Sciences, 2002.

Chang H., and Kristiansen P. Selling Australia as 'clean and green'. *The Australian Journal of Agricultural and Resource Economics*, 50 (2006), 103-113.

Elzen, B./ Wieczorek, A. Transitions towards sustainability through system innovation. *Technological Forecasting and Social Change*, 72 (2005), 651-661.

Environmental management systems implementation working group. The national environmental management systems implementation plan. The Natural Resource Management Ministerial Council. Canberra, Australian Department of Agriculture, Fisheries and Forestry, 2003.

Eurostat. Selected Statistics. 2009. http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&language=en&pcode=tps00001&tableSelection=1&footnotes=yes&labeling=labels&plugin=1 (accessed 13.05.09).

Higgins, V./ Dibden, J./ Cocklin, C. Market-oriented initiatives for agri-environmental governance: environmental management systems in Australia. In D. Maye, L. Holloway & M. Kneafsey (eds), *Constructing 'Alternative' Food Geographies: Representation and Practice*. Elsevier, 2006a.

Higgins, V./ Dibden, J./ Cocklin, C. Governing alternative food supply chains: the role of private agri-environmental standards. Presented at RC-40 session: Bar coding the food of the future: the social and political implications of agri-food supply chain re-governance. World Congress of Sociology, Durban, 2006b.

Hopkins, W.E./ Ashcroft, W.J./ Boland A.-M. Improving environmental management in Australian horticulture: critical factors for the implementation of EMS. *Australian Journal of Experimental Agriculture*, 47 (2007), 325-322.

Ludwig, D./ Mangel, M./ Haddell, B. Ecology, conservation and public policy. *Annual Review of Ecology and Systematics*, 32 (2001), 481-517.

Pahl, L. Adoption of environmental assurance in pastoral industry supply chains – market failure and beyond. *Australian Journal of Experimental Agriculture*, 47 (2007), 233-244.

Pannell, D.J. Public benefits, private benefits, and policy mechanism choice for land-use change for environmental benefits. *Land Economics*, 84 (2008), 225-240.

Pannell, D.J./ Roberts, A.M. The Australian National Action Plan for Salinity and Water Quality: a retrospective assessment. *Australian Journal of Agricultural Resource Economics*, 2009, (submitted).

Ridley, A.M. Preparing Australian broadacre agriculture for environmental scrutiny using Environmental Management Systems: implications for extension services. *Australian Journal of Experimental Agriculture*, 47 (2007), 367-377.

RMCG. Streamlined property management systems (Component 3.1) Exploring the role of certification and standards: Understanding the views and position of Victoria's agricultural industries – expectations, usefulness and motivation for future use. Final Report to Department of Primary Industries, 2007.

Whitten, S./ van Bueren, M./ Collins, D. An overview of market-based instruments and environmental policy in Australia. 6th Annual National AARES Symposium, Canberra, 2003. http://www.ecosystemservicesproject.org/html/publications/docs/MBIs_overview.pdf (accessed 18.05.09).

Whitten, S./ Young, M. Market-based tools for environmental management: where do they fit and where to next? 6th Annual National AARES Symposium, Canberra, 2003 http://www.ecosystemservicesproject.org/html/publications/docs/MBIs_conclusion.pdf