Using environmental management systems for maintaining native vegetation and biodiversity in rural landscapes

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Abstract

Australian farmers are keen to market products as 'clean and green', but so far with little justification of the 'green' component. Environmental management systems (EMS) offer a structured approach that can help farmers assess and improve their environmental performance. This paper reports progress towards developing an EMS that will help farmers build systems to meet the dual goals of native vegetation and viable farming. The practical implications of linking EMS at the catchment level is explored, as well as the potential role of EMS to deliver minimum standards for biodiversity conservation.

An action learning approach using a farmer group, with access to locally relevant technical expertise, is essential for developing a deeper understanding of the impacts of agriculture on the environment. Cultural change requires long-term commitment and investment in learning. We found that action learning can provide motivation, empowerment and inspiration for changing the farming system to one of increased perenniality, where biodiversity is restored and enhanced, and an EMS provides a useful structure in which to do this. Concentrating on the EMS process, rather than understanding environmental impacts, may not be enough to guarantee an acceptable environmental outcome. Using farmer 'champions' would assist cultural change and promotion of EMS. Components of EMS can be linked to the catchment scale through the use of minimum standards for biodiversity. How this is to be achieved on a voluntary level is a challenge.

Keywords

biodiversity conservation, catchment management, environmental management systems, environmental standards

Introduction

Society is becoming increasingly concerned about the environmental performance of agriculture. In Australia we are often quick to use the terms 'clean and green' to describe agricultural produce, and while we can justify the 'clean' part, we are poorly prepared to justify the 'green' part. Environmental management systems (EMSs) can be used to help justify our 'green' credentials.

An EMS is a management process approach for a business — in this case a farm — to deal with environmental management aspects (Carruthers and Murray 1999), so that it can assess and improve environmental performance. The essential components of EMS are: an environmental review, development of an environmental policy, a significance assessment of the environmental issues, setting of goals and targets, development of appropriate management practices and procedures, action plans, appropriate monitoring and documentation, and finally a review or audit process. Important underlying principles for the development of EMSs in Australian agriculture are that they should be voluntary, industry-led, adaptable, allow for continuous improvement, and be able to support natural resource management objectives (EMS Working Group 2001).

The ISO 14000 series of standards was developed in 1996 as the internationally recognised certification system for environmental management systems (Morelli 1999). Many of the current pilot EMSs in Australian agriculture are consistent with this framework, but a farm can be audited at a number of levels, including self-auditng, auditing by a second party, and auditing to ISO 14001 (an external audit by a third party). As has been pointed out by Anderson et al. (2001), the ISO 14000 series defines a process and does not set minimum standards; but minimum standards have been argued as necessary for issues of irreversibility such as biodiversity (Stoneham et al. 2002, Anderson et al. 2001).

The ‘irreversibility’ feature of biodiversity loss sets it apart from other issues dealt with in EMS (Anderson *et al.* 2001). Because biodiversity decline cannot be reversed easily, if at all, minimum standards need to be set by government to put in place a legal requirement to protect on-ground biodiversity performance. Continuous improvement alone is not enough to ensure the conservation of biodiversity. Stoneham et al. (2002) concluded that minimum standards for biodiversity are vital to ensure that any given stock of natural capital is passed on to future generations.

A number of industries, including grains, beef, horticulture, viticulture and cotton, have invested in EMS pilots. The framework for delivery of these pilots has occurred on a number of different levels ranging from self-assessment of environmental impacts and monitoring through to auditing. However, the number of farms progressing to full ISO 14000 is very low; for example, there are only two in the grains industry. Biodiversity has not been a major focus of most pilot EMSs; three exceptions are the Barwon Basin and Riverina EMS groups and GippsBeef.

An EMS can be used as a tool for ensuring continuous improvement of a farming system, giving good environmental outcomes as well as production benefits. Some of the fundamentals of environmentally acceptable farming systems are minimal leakage of water and nutrients, negligible erosion, no persistent toxicities, control of pests, diseases and weeds, and no loss of biodiversity in surrounding areas (Ridley 2001). These attributes have been the focus of an EMS pilot project in the southern Riverina of New South Wales. EMS components developed in this project address important natural resource management issues such as water and nutrient leakage and perenniality, and can help farmers identify which parts of the farm contribute to environmental degradation. This information is important for farmers’ management decisions on land use change — such as the change to protecting and enhancing biodiversity.

EMS also has a potential role at the catchment management level. Governments are increasingly focusing attention at the catchment scale to achieve environmental targets. Targets set at a catchment scale need to translate to targets for improving management at a property scale. The Murray–Darling Basin Ministerial Council has highlighted the need to evaluate the links between targets at different scales (MDBC 2000). For example, the National Action Plan for Salinity and Water Quality is based on setting goals and targets for local catchments, including regional targets for vegetation management (EMS Working Group 2001). The proposed National EMS Framework also seeks to link EMS with catchment targets.

This paper explores the work to date in developing EMS with a group of cropping farmers in the southern Riverina of New South Wales, particularly in relation to the incorporation of biodiversity into EMS. The potential use of EMS for meeting natural resource management outcomes for government, and its potential as a tool for governments in delivering minimum standards for biodiversity, will also be explored. This paper also outlines the limitations and opportunities for EMS to be expanded from the farm scale to the catchment scale.

Methods

The Riverina EMS group: participants and the region

A group of 12 farming families from the southern Riverina area of New South Wales (Murray catchment) have participated in a pilot for developing a grains EMS over the last three years. The area was chosen because the environmental problems are representative of many cropping areas of southern Australia but are not yet at the point of severe degradation. The major environmental issues identified by farmers include the threat of dryland salinity, soil acidification, other soil degradation issues, remnant vegetation decline, weed control and herbicide resistance. The area has less than 10% native vegetation left, and its ecosystems are among the most threatened in southern Australia (Benson 1999).

Farmers wanted to be involved in the project in order to better understand the environmental impacts of their farming system on the environment, not specifically to develop an EMS, as most had little idea of what this entailed. Participating farmers believed that they should have a 'caretaker' role for the land, both for future generations and for wildlife, and that they should leave the land in as good or better condition. There was an understanding that longer time scales were needed for environmental issues compared with economic ones (Ridley et al. 2002).

EMS approach

Action learning approach using a group

An action learning approach was used to develop components of an EMS from the ground up. Action learning was identified as the best approach to use because of the complex nature of EMS and the need for group support to develop, act and reflect on the components of the project. We found that the principles of action learning (Kemmis and Taggart 1988) were well aligned with what we believed to be the ideal mechanism for EMS delivery, namely that action learning allows for:

- accelerated learning aided by the support of other members of the group
- empathy between participants to develop a collective understanding
- individual empowerment
- voluntary participation (members can join or leave as they like)
- time for reflection: exploring current issues in order to help construct the next action or component of an EMS
- individual responsibility for issues or concerns and use of the group situation to explore through reflection to decide the next step.

The action learning approach thus enables farmers to meet other farmers in a group specifically to discuss land management issues. New ideas such as EMS are more likely to gain acceptance with farmers using this approach, as found by Vanclay (1992) for the value of Landcare groups.

The first step in this approach was for the group to identify their mutual concerns and agree to work together to improve their own situation, in terms of better production *and* improved environmental outcomes. The group identified remnant vegetation decline as a very high priority.

EMS as a learning cycle

We have applied the essential components of an EMS to an action learning framework. Our interpretation of EMS can be illustrated as a learning cycle in which all components of EMS are linked (Figure 1).

Development of self-assessment questionnaires

Once the group had a clearer understanding of the EMS concept and had identified major environmental issues, they decided that the best approach was to first develop a self-assessment questionnaire covering all aspects of farm management (water, soil, remnant vegetation, crop, livestock, human resources and waste). The scientific staff initially designed the questions and format, which were presented and discussed with farmers. Farmers had strong views on areas for improvement, areas of weakness or irrelevance, and the format they preferred to follow. This ensured that the self-assessment questionnaires were practical. Successive iterations ultimately resulted in the final questionnaire. Because the group lacked expertise in relation to a number of issues, outside help was sought. One such area was remnant vegetation, for which we sought the help of Greening Australia.

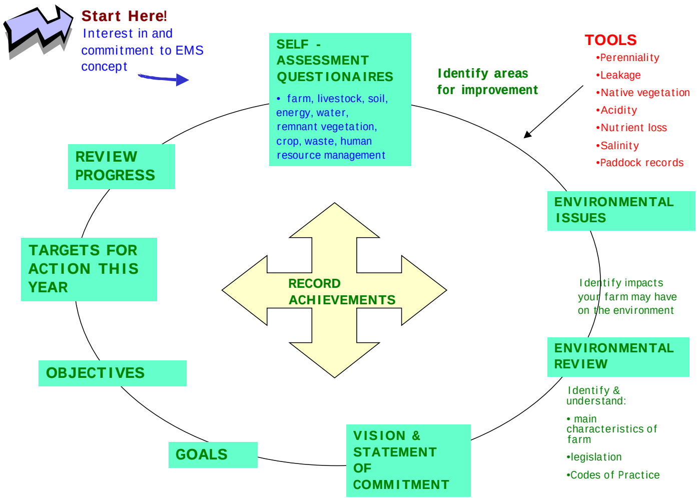

Figure 1 The first year of the EMS learning cycle. Within this learning cycle biodiversity can be addressed at each stage of the EMS, and within each component of the EMS.

The remnant vegetation management self-assessment questionnaire was based on questions relating to both the protection of existing remnants and the enhancement of remnants. For 'protection of existing remnants' the farmers were asked to rate themselves in areas such as surveying remnants for biodiversity value, measures in place to protect and enhance remnants, remnant area management in terms of grazing and weed control, and their understanding of the legislation regarding the protection of native vegetation on private land. The participants also had to rate themselves for 'enhancing remnants', such as having remnant vegetation targets, planning of remnant enhancement in conjunction with adjacent landholders, and using species of local origin. An example of the remnant vegetation management self-assessment questionnaire is included in Appendix 1.

Farmer performance in self-assessment

Farmers assessed their performance against each of the self-assessment questionnaires and added up their scores for each module. The research team then collated all results and presented farmers with their own score, expressed as a percentage of total possible for each module and a group average. Results were also calculated for each farmer in terms of ranking, 1 being the module where the best score was obtained and 9 the module where scores were lowest. At the end of each self-assessment questionnaire farmers were prompted to write down three areas for improvement. These were linked later in the EMS process to developing priorities for action (Figure 1).

Development of monitoring tools

Once the group had developed self-assessment procedures, the next focus was to develop simple monitoring tools. This phase commenced approximately 12 months into the project. From this point, in addition to time being spent at meetings developing and refining self-assessment, a major topic for monitoring was discussed. Major environmental issues for which the group wanted monitoring tools included water leakage, remnant vegetation, soil acidification and monitoring of groundwater salinity. We have focused on the remnant vegetation tool in this paper.

The development of a monitoring tool for remnant vegetation started with the group expressing the desire to be able to identify the most valuable patches of remnants and learn how to protect and enhance them. A number of participants were well informed about vegetation management and valued vegetation highly. The goal set for on-farm management of remnant vegetation, which was readily agreed to by participants, was that all remnants should be ranked, then protected and managed according to time and money constraints.

The challenge for biodiversity monitoring has been to develop simple methods that farmers can use to monitor their biodiversity performance on farms. Our approach for developing a remnant vegetation monitoring tool was to make the tool simple, while providing good information about why biodiversity is important and how to assess the quality of remnants.

We reviewed existing literature, used farmer knowledge, and sought Greening Australia's expertise because that organisation is highly regarded and works closely with the community in this region. The major issues were discussed with the group at one meeting, and then we went into a paddock with Greening Australia staff and learnt about the major elements we should assess for vegetation quality. From this a monitoring tool was drafted, based on farmer knowledge, advice from Greening Australia and other work (MCMC 1998, Platt and Thomas 1996, Richards and Edwards 2000). The tool was then modified at subsequent meetings as more remnants were assessed. Elements from the monitoring tool excluded the identification of native species, as this is a technical skill that was not considered essential by farmers at that stage. The group had a good discussion about the role of isolated trees in paddocks, but farmers decided that as such trees had little hope of being retained in a healthy state, so to monitor their demise was not a good use of limited time.

The remnant vegetation monitoring tool provided farmers with information about the key things to look for in assessing remnants on their farm and factors associated with the condition of remnant vegetation. Two assessment sheets were provided for farmers to use to assess the value of their remnants. An example of one is given in Appendix 2.

Development of an Environmental Review, Policy and Action Plan

The development of the self-assessment and monitoring tools gave the group the opportunity to adjust to the idea of an EMS, and to be ready for the more challenging parts of the process. Farmers were neither ready nor receptive for these more formal written parts of the EMS early on in the project. As a basis for development the Environmental Review and Policy, the team used the NSW Agriculture approach as a starting point (Tinning and Carruthers 2002). Steps were modified for simplification, and clear guidelines were given.

Using EMS to meet catchment targets: is this possible?

The Riverina EMS project was approached by the Murray Catchment Management Board (NSW) to identify how an EMS might be applied at the catchment scale. In other words, could an EMS be used as a vehicle to measure progress towards the catchment targets set out in the Catchment Management Blueprint? To do this we assessed the major components of the Murray Catchment Blueprint (DLWC 2001) and our EMS framework for potential compatibility and complementarity. A table was developed to demonstrate the most feasible links between our EMS framework and the Murray Catchment Blueprint framework. This table was then presented to the Board for consideration.

Results

The Riverina EMS group: participants and the region

Farm size ranged from 400 to 5000 ha and had a typical cropping intensity of 40 to 60%. The major enterprises are mostly mixed cropping with either beef or sheep. The proportion of farms covered by remnant vegetation (including woodlands, native pastures and wetlands) ranged from 3.5 to 57% (average of 14%). Table 1 illustrates the key features of the 12 farms, showing farm size and the extent of remnant vegetation on the farms.

Table 1 Key features of the 12 participants' farms.

Farmer	Farm size (ha)	Average annual crop (% of total farm area)	Remnant vegetation (% of total farm area)	
1	1950	40	Woodlands Wetlands	3 2

2	2300	50	Woodlands and creeks	10
3	780	60	Woodlands	5
4	1033	62	Woodlands Native pasture	1.5 2
5	871	50	Woodlands Wetlands	9 11
6	256	0	None	0
7	1040	40	Woodlands	20
8	430	65	Woodlands	10
9	5750	20	Wetlands Woodlands Native pasture	20 12 25
10	2000	42	Woodlands Swamp	1.5 2.5
11	830	50	Woodlands	7
12	1820	33	Woodlands	12
Average	**1709**	**47**		**13**

Farmer performance in self-assessment questionnaires

The range of farmer performance for each self-assessment module is presented in Table 2. We have presented individual self-assessment scores, although due to variability in farmers scoring themselves, comparisons across modules for particular individuals is more valid than between farmers. For example, from what we know of farmer 3's practices, he scored himself harshly compared with others. As a group, performance was strongest in management of remnant vegetation, with 7 farmers scoring management of remnant vegetation either as first or second ranking (Table 2).

Table 2 Farmer performance across the nine self-assessment questionnaires.

Management areas and % of total possible score									
Farmer	**Farm**	**Water**	**Soil**	**Remnant veg'n**	**Crop**	**Stock**	**Human resource**	**Waste**	**Energy**
1	66	65	63	84	73	67	48	54	54
2	81	58	85	ND	88	87	49	46	36
3	64	54	69	66	61	66	49	65	59
4	82	88	95	73	90	88	68	65	67
5	71	75	72	65	91	91	66	53	48
6	89	NR	88	NR	NR	100	83	71	75
7	83	73	66	67	67	68	70	66	67
8	73	75	79	92	92	76	59	77	67
9	65	55	55	62	62	73	76	75	60
10	73	59	65	62	62	59	71	63	65
11	63	53	69	77	77	80	63	77	66
12	75	68	67	80	80	64	62	67	52
13	66	64	63	78	78	ND	55	47	49
Average	**73**	**66**	**72**	**77**	**77**	**76**	**64**	**64**	**59**

ND – not done, self-assessment questionnaire not returned

NR – not relevant, many issues not relevant to enterprise, difficult to score meaningfully

Development of the remnant vegetation monitoring tool

The main table in the remnant vegetation tool is presented as Appendix 2. At Riverina EMS group meetings the host farmer would choose a particular remnant for the group to assess. Each group member would fill out the assessment sheet, and the individual scores and differences of opinion would then be discussed.

Future management of the remnant under study was always discussed, and this helped to test and refine the monitoring tool. It also gave the host farmer some practical ideas for management. Such group discussions meant that the views of farmers with strong skills in remnant vegetation management could be shared and the management solutions could be discussed by all. Most participants felt they learned something new and useful from each remnant assessment.

Environmental review and policy and action plan

Environmental Review

The steps involved in the Environmental Review were:

1. *Describe the major characteristics of the farm.* Participants were asked to describe physical aspects of the farm (size, location, percentage of farm under remnant vegetation, crop, perennial pastures). They were asked to describe any remnant vegetation (species, size of remnant, condition of remnant and if there were any DLWC property agreements applying). They were also asked to describe cropping rotations.
2. *List major environmental impacts.* Participants were asked to look at their farm plan or map and list the major environmental impacts the farm might have on the environment.
3. *List targets for action.* By referring to the three ‘areas for improvement’ listed at the end of each self-assessment questionnaire, participants were asked to compile a list of specific targets for action. For example, if they had identified an improvement was to fence off remnant vegetation areas in the self-assessment questionnaire, they may have a target for action to fence off 5 ha per year for the next five years.
4. *Legal requirements.* As a basic requirement of an EMS, farmers were asked to read through the relevant legislation applying to their environmental responsibilities, for example the NSW *Native Vegetation Conservation Act 1997*. Summarised Acts and Regulations were given for farmers to read, as well as relevant website addresses. They were then asked to write down the practices they need to change, with respect to the legislation.
5. *Codes of Practice.* Farmers were directed to relevant Codes of Practice and then asked to write down any actions needed to meet these requirements.

Environmental Policy and Action Plan

This involved the farmers in another five steps:

1. *Vision.* Farmers are asked to write a farm vision (‘big picture’ statement) of what they wanted to ultimately achieve on their farms.
2. *Statement of commitment.* Farmers needed to write a statement of commitment if EMS is to be compatible with ISO 14001. The statement required the words ‘committed’ to be included and a statement that they were prepared to accept legal responsibilities and codes of practice.
2. *Setting of goals.* Goals were set for what they want to achieve in terms of environmental protection on their farm.
4. *Setting objectives.* Objectives were then identified to address how each goal would be met (what, why, when and where details). The goal was broken down into achievable parts.
5. *Action plan.* An action plan was formulated for the short term (12 months) and the long term (over 5 to 10 years). The objectives were listed, along with the person responsible, the cost, the materials required and a space to tick-off the action when it is completed.

Environmental Policy and Action Plan examples

For the purposes of illustrating how farmers have integrated biodiversity into this component of an EMS, some examples from the Environmental Review of two farmers in the group are provided in Table 3.

Table 3 Environmental policy and action plan examples (biodiversity examples).

EMS component	Farmer example
Vision	**Farmer 9** 'As custodians, we aim to maximise agricultural production within the capabilities of our land, while nurturing and enhancing the natural environment'. **Farmer 11** 'Make money, have a lot of fun making it. Vastly enhance the natural biodiversity of the property and leave it as a blueprint for a profitable, healthy and sustainable management system'.
Statement of commitment	**Farmer 9 '**We are committed to managing key environmental issues with particular emphasis on protecting and enhancing remnant vegetation and maintaining environmental standards that are consistent with industry codes of practice and all relevant legislation'. **Farmer 11** 'We are committed to the principles of ecologically sustainable farm management based on the understanding we are caretakers of the land responsible for passing it on to future generations undamaged. The laws and codes of practice that govern our management are designed to protect our employees, the environment, animals and future for all. Although we occasionally grumble about paperwork, we accept our legal responsibilities that come with such a privilege'.
Goal	**Farmer 9 '**To have a net gain in remnant vegetation and biodiversity'. **Farmer 11** 'Leave the farm in much better condition than when we came Double natural biodiversity'.
Objectives	**Farmer 9** 'Protect and enhance remaining unprotected areas of remnant vegetation by a further 10% of the farm over the next 50 years Create strategically placed biodiversity blocks'. **Farmer 11** 'Enhance remnant vegetation sites by fencing off and replace as many of the missing 'original' species as possible. Use DLWC property agreement funds and Greening Australia'. 'Increase area to native trees from 7% to 10% by 2005 and to 15% by 2010'.
Action plan	**Farmer 9:** 'Fence gully area and direct seed Front Hills by October 2002'. **Farmer 11:** 'Erect fox-proof fence to protect nesting curlews by October 2001 Plant 1000 trees by September 2001'.

Llinking EMSs to catchment targets

The Murray Catchment Management Plan (DLWC 2001) has set primary objectives and catchment targets which are time-bound and measurable. Within each target there are more specifically measurable management objectives with priority actions for each of the 10 geographic management units. The targets were set to be achieved over a period of 10 years. We concluded that the catchment targets most related to EMS were those for salinity, acidity and biodiversity. The catchment biodiversity targets are used to demonstrate the potential links for EMS in Table 4.

Table 4 Complementarity of the structure of the Murray Catchment Management Plan with on-farm EMS.

Murray Catchment Management Plan (MCMP)	On-farm EMS framework
Primary objective Native biodiversity is maintained or enhanced at the landscape level	**Vision** Farm vision should be broad and include economic, environmental and social outcomes. *Farmer example:* 'Enhance the natural biodiversity of the property and leave it as a blueprint for a profitable, healthy and sustainable management system.'
Catchment target No net loss of all broad vegetation types and by 2012 restore 52 000 ha of under-represented broad vegetation types with the goal of achieving a minimum of 30% of their original extent and composition by 2052	**Goals** Could link MCMP targets if biodiversity targets were included in EMS goals. *Farmer example:* 'To have a net gain in remnant vegetation and biodiversity.'
Management target (by 2012) Actively manage areas of existing native vegetation by 2032 (40% of each broad vegetation type actively managed by 2012).	**Objectives** (time bound) EMS objectives are usually over at least a 10 year time frame. *Farmer example:* 'Increase area to native trees from 7% to 10% by 2005 and to 15% by 2010.'
Management priority actions (2012) Management units are listed in priority for action for biodiversity: 1. West Corurgan 2. Central Riverina 3. South West Slopes	**Action plan** (annual and continuing) EMS action plans need to be documented and achievements recorded. They could be used to show what on-ground actions towards the catchment target have been achieved annually. *Farmer example (from central Riverina):* 'Fence gully area and direct seed Front Hills by October 2002.'

Discussion

Incorporating biodiversity into the EMS process: practical implications from the Riverina EMS project

The implications of biodiversity loss in terms of how private land has been managed is well documented (Lowe et al. 2001). As 29% of Victoria's population of threatened species are on private land, which is mostly used for agriculture (Lowe et al. 2000), it is vital that biodiversity is incorporated into EMS.

The ISO 14001 series of standards for EMSs are based on the ISO 9000 series for quality management. These standards relate to a process, not on-ground environmental outcomes, and do not necessarily set minimum standards for biodiversity. But it is clear that farmers are not ready to embark on the ISO 14001 step-wise approach (Ridley et al. 2002). We need to be mindful of incorporating biodiversity into EMSs in a practical and meaningful way that farmers can use and without 'putting them off'.

While in this paper we have focused on remnant vegetation, the Riverina EMS project has shown EMS to provide a framework for linking both environment and production issues, which therefore may appeal to farmers more than focussing only on 'green' issues. The success of the project, with 12 farmers remaining committed for the full three years, has also shown that the emphasis needs to be on education and not the EMS process itself. Increasing farmers' understanding of the importance of biodiversity on the farm, how to assess its quality, and how to manage it, is an education process. The EMS components that were developed enabled us to deliver this biodiversity 'education' and led to changed attitudes and knowledge of remnant vegetation within the group. An example of this change is demonstrated by farmers 5 and 9. Farmer 5 joined the group to 'counteract the supposedly green element'. He says that participation has fundamentally changed the way he views things and his attitude to his own farm. His approach to remnant vegetation has changed dramatically. Farmer 9 was among the 'greenest' in the group and has recently won the Prime Minister's award as Environmentalist of the Year. As a result of group learning and EMS he has markedly changed his attitude and practices in managing the arable parts of the farm.

The development of the self-assessment questionnaires and monitoring tools in the Riverina project has provided a valuable link between the environmental and production aspects of the farm. It is important that these components have local relevance in order to appeal to farmers, such as local information on native biodiversity. Farmers need to know what species they are likely to find on their farms, how to assess the quality of the remnants, how they should go about managing these areas, and how to monitor these areas in the long term to gauge their performance. These views are consistent with the findings of Lowe et al. (2001) concerning the challenges of incorporating biodiversity into EMSs.

The potential for governments to use EMSs for addressing public good issues such as biodiversity

<u>The potential role of government in EMSs</u>

EMSs have traditionally been used by industry to address the 'brown' issues of pollution, waste management and energy efficiency. Private industry is likely to invest in improving these issues when there are market benefits for them to do so. The more 'green' issues such as biodiversity have values for society (public good), and the private sector does not usually invested in them. This failure of the market to address issues such as biodiversity is where the role of government is crucial.

Investment in the conservation of biodiversity is a clear role of government because it meets the criteria for government involvement as set out by Cole and Harris (2001), that:

- the proposed activity produces a **public good** such as the development of environmental policy, research into environmental issues, public provision of information and education, and
- the proposed activity corrects an **externality** (e.g. that an EMS should deliver positive environmental outcomes to the wider community).

There may be a number of ways that government can address biodiversity conservation, not necessarily through EMSs. Cole and Harris (2001) suggested a number of tools for improved natural resource management outcomes, including legislation, market-based mechanisms (taxes, subsidies, tradable permit schemes, auctions), and education and information (including EMSs). All of these have the potential to influence change in farming practices to preserve native biodiversity. Whether EMSs are necessarily the most cost-effective way to achieve these outcomes is beyond the scope of this paper. However, we suggest that their educational role is a very important consideration.

<u>Potential for government to use EMS as a tool to deliver minimum standards for biodiversity</u>

The use of EMSs to implement minimum performance standards for agricultural land has potential benefits for helping deliver biodiversity outcomes and targets such as those set out in Victoria's Biodiversity Strategy (Government of Victoria 1997). The work of Anderson et al. (2001) in developing a framework for incorporating biodiversity into EMSs sets minimum performance standards which are based on the principle of *no net loss* of biodiversity. The minimum standards developed in this framework are currently voluntary, are based on avoiding further biodiversity impacts, and also include biodiversity restoration (refer to Anderson et al. 2001, Table 1, page 37 for on-farm minimum standards for biodiversity).

One of the basic principles of an EMS is that it is voluntary (EMS Working Group 2001). Because the setting of minimum performance standards is important because of the ‘irreversibility’ issue, the voluntary nature of EMS is challenged. The standards for ‘biodiversity maintenance’ could be used as policy and be covered by legislation, and the second component (restoration) requires trade-offs at the expense of agriculture and would therefore involve the development of some sort of cost-sharing agreement as a driver (Anderson et al. 2001). While these standards could become policy, which would be reflected in catchment targets, they are not yet covered by specific legislation that farmers have to abide by. A landholder only has to show continuous improvement towards achieving a legislative standard (J. McQueenie, pers. comm.). If standards became mandatory in legislation, this could cause conflict when EMS is seen as voluntary.

The biodiversity framework developed by Anderson et al. (2001) was the first step towards incorporating native biodiversity standards into EMS in Victoria. The practical implications of this framework are being tested in two field-based projects: *Best Agricultural Practice for Biodiversity Conservation in Grazing Industries* and *Environmental ‘Best Practice’ for Sustainable Grain Production in the South West of Victoria* (McQueenie 2002).

The involvement of government in issues such as biodiversity means that partnerships between farmers and government are likely to be very fruitful, but trust needs to be established before the partnership can work to its fullest potential.

Linking EMSs to catchment targets

EMSs have the potential to link with catchment targets because they operate at a farm level and provide a structured approach for assessing, monitoring and improving farmers’ environmental performance. An EMS would be a useful tool for transparent accounting of what is happening on the ground.

<u>Linking an EMS framework with the Murray Catchment Blueprint: opportunities and challenges</u>

The level of complementarity of our EMS framework with the Murray Catchment Blueprint has demonstrated that EMSs could be used for catchment management ‘accounting’. However, in the absence of clear drivers or incentives, such as farmer training and direct financial incentives, links will be difficult to establish. An EMS would, however, enable catchment management boards to determine whether priority actions have occurred at the farm level, as farmers would need to keep good records to prove they have taken the actions as part of their EMS.

One of the advantages that an EMS has at the catchment scale is that it can result in a greater understanding of the off-site impacts of agriculture, and therefore start farmers thinking beyond the farm to the catchment. An EMS also has the advantage that it can be implemented at a number of levels, from increasing awareness from self-assessment questionnaires through to the full development of an environmental review and action plan.

There are several challenges for using EMSs at the catchment scale, which have been highlighted to the Murray Catchment Board and would also apply to Victorian CMAs:

- The Catchment Board needs to consider whether an EMS is the most cost-effective way to achieve catchment targets, as management actions to achieve them could be undertaken on farms without an EMS.
- EMS requires a high level of farm management; not all farmers are ready for it.
- Our EMS was developed for the Riverina and would need some modification to be applied to other bioregions.
- EMS is not suitable for all catchment actions. While it is well suited to salinity and acidity targets, it would only be partially suitable for biodiversity targets. At present EMSs are not well suited to meaningfully assess threatened species, and would need local mapping and scientific input for the restoration of under-represented vegetation types.

After discussing the potential linkages, opportunities and challenges for EMSs at the catchment scale, the Murray Catchment Board has since incorporated EMS approaches into their catchment strategy. It is highly likely that EMS will be incorporated into some Victorian regional catchment strategies as they are reviewed this year.

Conclusion

Action learning using a group format to deliver EMS to Riverina farmers has been very successful in introducing practical self-assessment and monitoring tools for farmers to use for remnant vegetation. EMS shows promise for improving biodiversity management, as well as other environmental outcomes, at the on-farm level. It provides a useful framework to link production and environmental issues, and therefore may appeal to farmers more than discussions about 'green issues' in a group. Learning gained from the Riverina pilot has shown that the emphasis should be on education, not the EMS process.

While EMS may not necessarily be essential for achieving natural resource management outcomes, it has the potential to enable governments to deliver minimum performance standards for biodiversity and to provide a link to catchment targets. Linking EMS to the catchment scale helps transparent accounting of on-ground progress towards targets set out in regional catchment strategies and local plans.

Our recommendations for how EMS could be useful for bringing about land use change, specifically the management of native biodiversity are as follows:

1. Use farmer 'champions' to assist in cultural change and promotion of EMS

New and complex concepts such as EMS (and within this, biodiversity management), requires cultural change before they are accepted as part of everyday farming. Achieving cultural change requires a long-term investment (Rudy 2002). Using farmer 'champions' for 'success stories' about how biodiversity can be managed as part of a farming system would greatly assist the acceptance of EMS throughout the farming community, because farmer peers are often more credible to farmers themselves than are government scientists.

2. Base EMS delivery on group learning, use it as an educational tool

Group learning is a powerful tool for EMS delivery and achieving biodiversity outcomes. Biodiversity education requires local content, the development of simple ways for farmers to assess habitat quality, advice for farmers on how best to manage biodiversity. Understanding how farming practices affect biodiversity also needs some development, as highlighted by Lowe et. al (2001).

3. Develop incentives to link farm and catchment through an EMS framework

EMS shows promise as a way to link on-farm actions and the measurement of progress towards catchment targets.

However, financial incentives for rewarding farmers who improve their environmental performance and use monitoring for the purpose of catchment 'accountability' are needed. Financial incentives are essential if better biodiversity outcomes are to be achieved over large areas.

Acknowledgments

We have been privileged to work with a visionary group of farmers committed to developing profitable and environmentally acceptable farming systems. Thanks to Malcolm Ferguson, Bill and Jaquetta Sloane, Tony Piggin, Glen Martin, Julie and Ken Taylor, Jan and Geoff Davis, Graham Clifton, Alistair Robb, Simon Withers, Charles Cay, David Bird, and Kent and Sue Jaques. We wish to acknowledge the Grains Research and Development Corporation for providing funding, and thank Ian Davidson of Greening Australia for his input in developing the remnant vegetation components of the project. We would also like to thank Anne Cole and Jane Harris for their guidance into understanding the role of government in EMS, and Jane McQueenie (Parks, Flora & Fauna Division, DSE).

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Appendix 1

Example of the 'protecting existing remnant vegetation' section of the native vegetation self-assessment questionnaire.

Practice	Rating					Cross if does not apply
	1	2	3	4	5	
Major remnants on my farm have been surveyed for their biodiversity value and habitat quality.						
My farm plan includes measures to protect and enhance remnants.						
Remnants are only grazed strategically to encourage regeneration or control of annual pasture grasses.						
Remnants are managed to minimise fertiliser application, chemical drifts and to minimise stock camping.						
Remnants are fenced off to control stock access.						
I retain dead trees and fallen branches in remnants (I do not 'tidy them up').						
I seek advice from experts regarding management of remnants when I have to deal with issues I do not have adequate knowledge about (e.g. Greening Australia).						
I have management agreements (e.g. with the Department of Land and Water Conservation) or covenants on significant remnant areas.						
I have a good understanding of current legislation regarding protection of native vegetation on private land.						
I have a pest, animal and environmental weed program for my bushlands and wetlands.						
Sub–total :						

Appendix 2

Remnant vegetation assessment monitoring tool table (accompanied by instructions indicating the need to tick the appropriate box, then add up the total score for each remnant and identify each remnant on the property).

QUALITY	LOW (1)	MEDIUM – LOW (2)	MEDIUM (3)	MEDIUM – HIGH (4)	HIGH (5)	**RATING**
SIZE	1 ha or less	1-5 ha	5-10 ha	10-20 ha	>20 ha (list size)	
WIDTH	Thin strip 20 m or less wide		Site 20-50 m wide	50-200 m wide	> 200 m wide	
GROUND LAYER CONDITION	Ground layer dominated. by annual pasture grasses and/or other weeds. Scattered trees.	Mostly annual pasture grasses with some native grasses. Scattered trees	Mostly native grasses. Some tree regrowth present 2-4 m.	Mostly native grasses, Various tree sizes. Few shrubs.	Mixed size tree layer. Shrubs common. Native grasses dominant. Native ground cover like lilies, orchids, and herbaceous wildflowers.	
LOGS AND BRANCHES	Remnant is very 'tidy' – no fallen timber remains		Some fallen timber and dead trees, but quite a lot of big timber removed. May only be small hollows for fauna.		Most dead trees and fallen timber remain in the remnant. Hollows for fauna common.	
PROTECTION	Remnant is not fenced off from livestock at all. Grazing for long periods in the paddock occurs every year. Spray drifts and numerous stock camps.	Remnant is not fully fenced from stock but is in a location where stock rarely stay for long periods.	Remnant is fenced from stock, but good grazing management practice is either not known or not used.	Remnant is fenced from stock and some strategic grazing management is used.	Remnant is fenced from stock, fire management maintains large hollows and grazing is either unnecessary or used strategically to control weed invasion and promote regeneration of native species.	
CONNECTEDNESS	No other remnant within 1 km.	No other remnant or corridor within several hundred metres.	Adjacent remnants within several hundred metres.	Adjacent remnants within several hundred metres and have good connection via a corridor.	Remnant is well connected – either with a large remnant nearby or wide corridor to a large remnant eg creek line or wide roadside (Note adjacent remnants do not need to be on your farm).	
BIODIVERSITY	Visit your remnant site at different times. Sit quietly for 20 minutes or so and observe/note the different animal and plant species you see. Seek expert advice from Greening Australia, Bushcare, DLWC or other conservation groups.					
TOTAL :						