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Environmental motivation and monitoring by landholders in north-east Victoria: fact, fantasy and future implications for catchment management

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Abstract. This paper reports on the social and business profiles of 39 landholders (in three groups) in north-east Victoria, participating in an Environmental Management Systems (EMS) project, and their motivations for participating in EMS. The level and type of record keeping, formal monitoring, use of electronic technology, and interest or capacity to monitor their environmental performance were also assessed because this is a crucial part of the EMS process and one that research has not reported on to date. Landholder participation in EMS was mostly for reasons of wanting to better account for sustainability issues in farm management. Most participants recorded rainfall, soil test results, production measures and chemical use (in total 69–97%); however, 31% kept no chemical records. Few kept records of remnant native vegetation, pasture management, weeds, pest animals or native fauna. Electronic record keeping systems were used by 26% of participants. Almost all owned a computer and over 70% used the internet and email. To assess interest and capacity to monitor environmental performance, participants were introduced to a water balance calculation tool (this being a locally relevant issue) and asked to calculate their own values. Most participants needed two to three visits to gain confidence to perform the calculations and most did not view the tools as being of much relevance. This was in strong contrast to previous work carried out in the southern Riverina of New South Wales. We conclude that environmental monitoring is more important for catchment management authorities (CMAs) and state agencies than for landholders. If CMAs are to assess how on-farm actions lead to improved environmental performance, there is a need to collect information remotely, invest in monitoring or provide incentives for farmers. There appears to be insufficient record keeping and monitoring by landholders to trace chemical residue problems. This, in addition to a lack of environmental monitoring, means that farmers in north-east Victoria cannot substantiate either 'clean' or 'green' claims. Future work should focus on awareness and education in natural resource management, as well as improved record keeping and monitoring. Some form of recognition will be needed if the majority of farmers are to participate in environmental programs. Introductory EMS training provides a means of improving business outcomes, documentation and improving environmental management.

Introduction

Maintaining documented procedures to regularly monitor and measure the key characteristics of operations and activities that can have a significant impact on the environment is an essential part of ISO 14001 EMS (Anon. 1996). Despite this, few landholders involved in EMS currently have well-developed monitoring programs (Ridley *et al*. 2007). Some monitor for production purposes (Howard *et al*. 2004; Ridley *et al*. 2007), but there is little evidence to indicate that many monitor to assess improvement in environmental management. Without this type of monitoring it will be difficult for farmers to substantiate environmental improvements.

The EMS project, referred to here, was conducted in the North East Catchment in Victoria. It was a component of one of 15 Commonwealth-funded EMS pilot projects undertaken in Australia. Many Catchment Management Authorities (CMAs) are interested in trialling EMS to see whether it has potential (in terms of being voluntary, low cost, accountable and educational) to achieve progress towards meeting the catchment targets defined in their regional catchment strategies. As most management activity is conducted at the paddock or farm level, CMAs are interested in assessing how well EMS can link farm-based activities with monitoring and reporting in relation to catchment outcomes. The monitoring and recording component of EMS allows landholders to assess their progress towards individual on-farm environmental targets, as well as to provide documented evidence to substantiate environmental improvement. It also provides CMAs with the opportunity to use some information to assist with monitoring of progress towards regional targets.

With this background, the aims of this paper were: (i) to ascertain the social and business profile of farmers and reasons for participating in the North East CMA EMS pilot project; (ii) to determine the level and type of monitoring being undertaken by landholders; (iii) to determine landholders' use of electronic technology as a tool to aid with information capture within the EMS and monitoring process; and (iv) to assess the

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interest and/or capacity for landholders to monitor their environmental performance within EMS, based on a previously tested water monitoring tool.

Methods

Selection and location of landholder participants

The project involved 39 landholder families in three geographical areas of the North East Catchment of Victoria. Three groups were located around the areas of Corryong, Tallangatta and Springhurst. The mean average annual rainfall in these areas is 775 mm at Corryong, 839 mm at Tallangatta and 609 mm at Springhurst (www.bom.com.au, verified 18 January 2007).

Landholder groups were formed by sending letters to people who had previously participated in CMA activities, through coverage on ABC radio, public notices, editorial comment in the local newspapers and public information meetings. The public meetings had a variety of speakers, ranging from scientists with extensive EMS experience through to farmer 'champions' who had been involved in a previous EMS pilot in southern NSW.

Surveys conducted

Participating landholders in the three groups were surveyed (written responses). Four surveys, involving quite different questions, were carried out over a period of 8 months from October 2003 to May 2004. Surveys were given to farmers at group EMS meetings. The first three surveys were quite extensive (not all questions reported here) and were taken home by farmers to complete. The 4th survey was a 'tick the box' survey that farmers filled in during one of the workshops. With the exception of a question on property size, all questions were multiple choice, and required a 'tick the box' response or selection of a rank. Tables shown in the results reflect the choices or scoring procedures given. Most results are presented as percentages of landholder numbers.

Surveys 1 and 2 – social and business profiles

Two initial surveys were carried out to determine background information about the participants (business and social profiles). Surveys were conducted over October and November 2003. Landholders were asked their property size and enterprise type(s), farm management structure (e.g. family owned or corporate), age, length of time farming, proportion of income earned off the farm, and whether they had a whole farm plan, current business plan and participated in quality assurance schemes. The participants' motivations for farming were also assessed; they were presented with four choices, based on value orientations developed by Gasson (1973). The wording of the choices is given in the results. Farmers were asked to give each statement a ranking of 1–4, with 4 corresponding to the main reason for farming and 1 indicating the reason they least identified with. Scores were then aggregated over the 39 participants.

Survey 3 – motivations and natural resource management knowledge

This survey was conducted in February 2004 and established the motivations for participating within the EMS pilot, knowledge of natural resource management and perceived current natural resource management performance. Forty-six participants, some being couples, completed this survey.

Survey 4 – current monitoring and use of electronic technology

This survey was conducted over April–May 2004 to gain an understanding of the aspects of farming systems that landholders currently monitor. The survey considered landholders' monitoring of rainfall, production (e.g. cattle weights, wool clip), soil, fertiliser use, chemical use, pasture management, weeds, pest animals and native fauna. The survey determined whether farmers kept records and, if so, what form of record keeping they used (from keeping notes in a diary or paddock record keeping book, through to keeping records in electronic forms). Questions were also asked about whether and what types of electronic technology were used within the family. Thirty-nine landholders completed and returned the written surveys.

Use of water monitoring tools to assess interest and capacity for landholders to monitor environmental performance

A previously developed monitoring tool (Ridley *et al*. 2003*a*) was used to assess the interest and capacity of landholders to monitor their environmental performance as part of their EMS. The tool guides farmers through some instructions to calculate 'perenniality' (a measure of the ability of plants on the farm to use water) and water loss (termed leakage). This particular tool was chosen as water use, losses and environmental flows are an extremely topical environmental issue in the region and the tool had previously been tested with farmers in southern NSW.

The concept of monitoring was introduced at the second meeting of each group. The calculations involved to assess perenniality and water loss (leakage) from farms were outlined during a presentation and discussion of the concepts. Paper copies of the tool, that included stepwise instructions, were given to landholders to take home and complete.

Results

Business profiles of participants (surveys 1 and 2)

Mean property size of participants was 471 ha (median size 400 ha), ranging from 388 ha at Springhurst to 591 ha at Corryong. The dominant enterprise across all groups was beef cattle. At Corryong, 71% of participants ran mostly beef cattle with the remainder having both sheep and cattle or crops and livestock. At Tallangatta, 67% had mostly beef, with several also dairying. The Springhurst group was slightly more diverse, with less than 50% being beef dominant and the others having sheep dominant or livestock/cropping enterprises (Table 1).

All farms were family owned and all, except one at Corryong, were family managed. At Corryong and Tallangatta, ~20% of farms earned no off-farm income, compared with only 7% (one farm) at Springhurst. A further 50% of farms at Corryong earned less than 10% of their income off-farm. At Tallangatta, 67% of farms earned 10–30% of their income off-farm. At Springhurst, which is closer to large centres of employment, 40% of farms earned 10–30% of their income off-farm and 53% earned more than 30% away from the farm (Table 1).

Only 40% of farms in Springhurst had completed both a business plan and a whole farm plan. At Tallangatta, 67% had completed business plans and 87% had whole farm plans, whereas at Corryong the respective values were 65% and 64% (Table 1).

Social profiles of participants (surveys 1 and 2)

Seventy-eight percent of landholders at Corryong, 87% at Tallangatta and 60% at Springhurst were aged between 36 and 55 years of age (Table 2). Springhurst had an older demographic profile than Corryong or Tallangatta. The majority (93%, 80% and 60% at Corryong, Tallangatta and Springhurst respectively) of farmers had more than 21 years experience as landholders and property managers.

Membership of Landcare groups was very high at 91% over all groups, ranging from 79% at Corryong to 100% at Springhurst. Sixty percent of Tallangatta participants were also in production (e.g. Beefcheque) groups (Howard *et al*. 2004), compared with only 7% at Corryong and 40% at Springhurst. Close to two-thirds of participants in Corryong and Tallangatta had participated in quality assurance schemes (e.g. Cattlecare, www.dpi.vic.gov.au, verified 19 January 2007), compared with only 40% at Springhurst. Awareness of the catchment management strategy ranged from 87% of participants at Tallangatta to 57% of participants at Corryong. Averaged over all groups, 70% of landholders were aware of the regional catchment strategy (Table 2).

The reasons for farming amongst the participants were diverse (Table 2). Within the Corryong group, the strongest motivations were for reasons of meeting a challenge, farming being worthwhile and or feeling pride in farming (termed 'expressive' motivations by Gasson 1973). These were followed closely by farming to obtain income and security ('instrumental'). In Tallangatta, the dominant motivation for farming was for reasons of independence, freedom from supervision, preference of lifestyle and/or valuing the work (termed 'intrinsic'), followed by instrumental motivations. The Springhurst group, where the proportion of off-farm income was highest, was the only one not to rank farming for income and security in the top two reasons. For all groups, the least important reasons for farming were for tradition and belonging to the community (termed as 'social' motivation by Gasson 1973).

Social profiles of participants (survey 3)

The motivations of landholders to participate in EMS were mostly because they recognised that farming businesses must take into account issues of sustainability (56% in Corryong, 84% in Tallangatta and 94% for Springhurst). Few were doing EMS to prepare themselves for future market access issues or for the sake of having an EMS (Table 3).

Only two (6%) landholders believed that they had extremely high current knowledge of natural resource management. A high proportion of Corryong participants

Table 1. Business profiles of landholders in north-east Victoria who participated in the EMS pilot project
Values are the results from surveys 1 and 2, expressed as percentage of landholders (*n* = number of landholders)

	Corryong (*n* = 14)	Tallangatta (*n* = 13)	Springhurst (*n* = 12)	Combined (*n* = 39)
Property size (ha)				
Mean property size	591	442	388	471
Median property size	407	400	284	400
Enterprise type				
Mostly grazing beef	71	67	47	61
Sheep and cattle	14	7	0	7
Cropping and livestock	7	0	13	7
Mostly grazing sheep	0	0	13	5
Dairying or dairy/beef	0	13	0	5
Dairying and beef	0	7	0	5
Other (dairy sheep or pigs)	0	0	7	5
Farm business structure				
Family owned and managed	93	100	100	98
Privately owned, employs a manager	7	0	0	2
Corporately owned and managed	0	0	0	0
Proportion of income earned off-farm				
None	21	20	7	16
1–10%	50	27	20	29
11–30%	21	40	20	27
>31%	7	13	53	25
Status of current business plan for the farm				
Completed	65	67	40	57
Not completed	21	33	47	34
In progress	14	0	13	9
Status of whole farm plan				
Completed	64	87	40	64
Not completed	21	13	60	32
In progress	14	0	0	5

believed they have low knowledge (81% scoring themselves as 1 or 2 out of a 0–5 score range). In comparison, 77% of participants in Tallangatta and 70% in Springhurst believed they had moderately high (scores 3 and 4) knowledge. Current knowledge scores were reflected in the participants' perceived performance in managing their natural resources (Table 4).

Current monitoring (survey 4)

The current level of monitoring conducted is shown in Table 5.

Rainfall

Rainfall was measured to varying degrees across the three groups. In Springhurst, 84% of participants measured and recorded rainfall, compared with 50% and 68% in Corryong and Tallangatta.

Production

Production records, such as cattle weights and wool clip, were usually (77% across the groups) kept in some written form, ranging from a high of 84% among the Tallangatta group to a low of 72% among the Corryong participants.

Soil

Soil testing was carried out on a regular basis (every 2 years) by 58% of the Tallangatta group, whilst only 31% and 36% of the Springhurst and Corryong groups, respectively, regularly tested their soil respectively. Over the three groups, only 3% did not test their soil at all.

Fertiliser use

The recording of fertiliser usage was high among all the groups; on average only 10% across the groups kept no records. The entire Springhurst group kept written records, but 17% of Tallangatta and 14% of Corryong participants kept no records.

Chemical use

Chemical record keeping was poor; across the three groups 31% kept no records with 42% of the Tallangatta participants not keeping records.

Pasture management

Pasture management was usually not recorded, with only 23% of participants keeping written records. The Corryong group had 22% who made diary records, while the other two groups only had 8% who kept written records.

Table 2. Social profiles of landholders in north-east Victoria who participated in the EMS pilot project

Values are the results from surveys 1 and 2. Values are expressed as percentage of landholders (*n* = number of landholders), except for the data regarding most important reasons for farming which are expressed on a 1–4 rating scale, where 1 is least important and 4 is most important

	Corryong (*n* = 14)	Tallangatta (*n* = 13)	Springhurst (*n* = 12)	Combined (*n* = 39)
Age of participants (years)				
31–35	7	0	7	5
36–45	57	14	20	29
46–55	21	73	40	45
55–65	14	13	26	18
>65	0	0	7	2
Length of time in farming (years)				
0–10	0	13	26	14
11–20	7	7	13	9
>21	93	80	60	77
Landcare or other catchment/environmental group membership				
Landcare	79	93	100	91
Catchment or other environmental group	7	7	53	23
Production group membership (e.g. Beefcheque, local producer group)				
Yes	7	60	40	36
No	93	40	60	64
Participation in quality assurance schemes (Flockcare, Cattlecare)				
Yes	64	67	40	57
No	36	33	60	43
Awareness of catchment management strategy				
Yes	57	87	67	70
No	43	13	33	30
Most important reasons for farming				
The farm is a means of obtaining income and security	3.7	3.4	2.9	3.3
I farm to meet a challenge, because it is a worthwhile job and/or because I feel pride in owning a farm	3.9	3.2	3.2	3.4
I enjoy farming for reasons of independence, freedom from supervision, preference for a lifestyle and/or valuing the work	3.3	3.8	3.1	3.4
My farm is important to continue a tradition, belong to a community and for recognition	3.0	2.1	2.3	2.5

Table 3. Motivation for landholders' participation in the EMS pilot project in north-east Victoria
Values are the results from survey 3, expressed as percentage of landholders (*n* = number of landholders)

	Corryong (*n* = 14)	Tallangatta (*n* = 13)	Springhurst (*n* = 12)	Combined (*n* = 39)
To gain greater insight into natural resource management	19	0	0	7
To develop EMS for my business	13	15	6	11
To improve market access in the future	13	0	0	4
Because the business of farming must take into account issues of sustainability, the environment and biodiversity	56	84	94	78

Weeds

Weed monitoring was generally a mental note (59% across the groups). Some written weed records were kept; in Tallangatta 42% kept diary notes while only 22% kept records in the Corryong group.

Pest animals

Most of the pest animal monitoring was by mental note (69% over the three groups). Of the Tallangatta group, 25% kept diary notes while none of the Corryong group kept records.

Native fauna

The monitoring of native birds and mammals was almost non-existent. Only 10% across the groups kept any form of written record; this ranged from a high of 17% among the Tallangatta group to none of the Corryong group.

Use of electronic technology

Results on computer ownership, the prime user of the computer, the types of paddock recording systems used and communication technologies used by landholders are presented in Table 6.

Paddock records

Most participants used some form of paddock records. This varied from those using an electronic system (26%) to diary notes (38%). Only 13% kept no paddock records. The group with the least use of paddock records was Corryong, with only 21%.

Computer ownership and usage

Computer ownership was high, with all except one of the participants owning a computer. The majority of the computer work was done by the senior female in the household (41% across the three groups). Among the Corryong group only 38% of males used the computer, while 84% of the males in the Tallangatta group either shared the computer work or were the sole user. In Springhurst, computer use was spread fairly equally between males and females (Table 6).

Use of communication technology

Most of the participants used email as a form of communication; on average 77% across the groups, ranging from 92% at Springhurst to 67% at Tallangatta (Table 6). Both Tallangatta and Corryong groups indicated that email use was often difficult due to the unreliability of the system coupled with being too slow and often out of order. Internet usage was lowest in Tallangatta (58%) and higher in both Springhurst (77%) and Corryong (86%). Mobile phone use ranged from 58% at Tallangatta to 69% at Springhurst.

Interest and/or capacity for landholders to monitor environmental performance

When use of monitoring tools was discussed and demonstrated at a group meeting, most landholders indicated they didn't think they could use them without one-on-one help. Following this, an extension officer visited each participant to work through the calculations. Most required up to three visits before they developed the skills and confidence to use the tool unassisted.

Table 4. Participants' ratings of their own current knowledge and performance in natural resource management
Values are the results from survey 4, expressed as a percentage of landholders (*n* = number of landholders). Scores range from 0 (none) to 5 (highest)

	Score					
	0	1	2	3	4	5
Knowledge of natural resource management						
Corryong (*n* = 16)	0	19	62	19	0	0
Tallangatta (*n* = 13)	0	0	0	54	23	0
Springhurst (*n* = 17)	0	24	0	35	35	6
Combined (*n* = 46)	0	15	28	35	20	2
Performance in natural resource management						
Corryong (*n* = 16)	0	19	44	31	6	0
Tallangatta (*n* = 13)	0	0	8	77	15	0
Springhurst (*n* = 17)	0	12	17	24	47	0
Combined (*n* = 46)	0	11	24	41	24	0

Perenniality and leakage results are given in Table 7. Perenniality was much higher among the two Upper Murray groups (49% Corryong and 45% Tallangatta) than at Springhurst, due to the higher percentage of remnant vegetation in these higher rainfall areas. In Springhurst, perenniality was calculated to be 34% of which only 8% was remnant vegetation. The perenniality results were highly variable; among the Corryong participants perenniality ranged from a low of 17% through to a high of 71% with the Springhurst group showing a spread of perenniality from 13% to 64%.

As a result of the variations to perenniality and rainfall, water leakage also varied. Among the Corryong group, leakage ranged from 48–244 mm/ha (average 135), whereas amongst the Springhurst participants the range was 37–445 mm/ha (average 112). When water leakage results were calculated to megalitres lost per farm, the numbers were very high, ranging from 435 ML/farm at Springhurst to 798 ML/farm at Corryong.

Discussion

Social landscapes and motivations of landholders for farming and participation in EMS

Recent work (Barr *et al*. 2005) suggests that Victoria can be characterised into five social landscapes, with two of these (named ‘rural amenity’ and ‘rural transitional’) characterising north-east Victoria. Both landscape types are characterised by

Table 5. Types of record keeping and monitoring currently conducted by participating landholder
Values are the results from survey 4, expressed as percentage of landholders (*n* = number of landholders)

Group location	Corryong (*n* = 14)	Tallangatta (*n* = 13)	Springhurst (*n* = 12)	Combined (*n* = 39)
Rainfall				
Measure rain and keep written records	50	68	84	67
Measure rain but don’t keep records	21	17	8	15
Don’t measure the rain	29	17	8	18
Production				
Keep formal records in an electronic or hardcopy system	29	50	46	41
Diary notes	43	34	31	36
Mental notes	14	8	8	10
Don’t keep any production records	14	8	15	13
Soil				
Carry out soil tests every 1–2 years	36	58	31	41
Carry out soil tests occasionally	57	42	69	56
Don’t carry out soil tests	7	Nil	Nil	3
Pasture management				
Notes in the paddock record system	Nil	25	8	10
Diary records	22	8	8	13
Mental note	64	42	76	62
Don’t keep any vegetation records	14	25	8	15
Fertiliser use				
Notes in the paddock record system	7	58	46	36
Diary records	43	17	46	36
Special fertiliser record book	36	8	8	18
Don’t keep any fertiliser records	14	17	Nil	10
Chemical use				
Notes in the paddock record system	14	17	23	18
Diary records	21	17	31	23
Special chemical record book	36	24	23	28
Don’t keep any chemical records	29	42	23	31
Weeds				
Keep formal records in an electronic or hardcopy system	Nil	17	Nil	5
Diary notes	22	42	31	31
Mental notes	71	33	69	59
Don’t keep any weeds records	7	8	Nil	5
Pest animals				
Keep formal records in an electronic or hardcopy system	Nil	Nil	8	3
Diary notes	Nil	25	15	13
Mental notes	86	58	62	69
Don’t keep any pest animal records	14	17	15	15
Native fauna				
Keep formal records in an electronic or hardcopy system	Nil	Nil	8	3
Diary notes	Nil	17	8	7
Mental notes	64	33	76	59
No records kept	36	50	8	31

Table 6. Participating landholders' computer usage and communication technologies
Values are the results from survey 4, expressed as percentage of landholders (*n* = number of landholders)

	Corryong (*n* = 14)	Tallangatta (*n* = 13)	Springhurst (*n* = 12)	Combined (*n* = 39)
Paddock record system				
Use an electronic computer system	14	33	31	26
Use a paddock record book	29	26	15	23
Keep diary notes	36	33	46	38
Don't keep paddock records	21	8	8	13
Computer ownership				
Own a computer	100	92	100	97
Do not own a computer	Nil	8	Nil	3
Person responsible for computer work				
Senior male in the household	22	50	8	25
Senior female in the household	64	8	46	41
Both	14	34	46	31
No-one	Nil	8	Nil	3
Types of communication technologies used				
Email	71	67	92	77
Fax	86	92	69	82
Mobile phone	64	58	69	64
Internet	86	58	77	74

small farms, high value of agricultural land in relation to production capacity, increasing purchase of land by non-locals and relatively stable or increasing populations.

The enterprise types of participants in this study were representative for north-east Victoria (Anon. 2004). Landholders were mostly experienced livestock producers. The age profiles of the Springhurst and Tallangatta groups (most being in the 46–55 year age group) were representative of those from census data (Barr *et al*. 2000), with the Corryong group being slightly younger than census data indicated. Most participants had previous contact with the CMA and were more likely to be more environmentally aware and motivated than the general landholder population. As Australia becomes increasingly urbanised and agriculture has declining political importance, the general community concern for the environment has increased and this trend will continue, as is also reflected in international trends (Barr and Wilkinson 2005). Peer, social and cultural attitudes are key factors in influencing willingness to embrace more sustainable practices (Cary *et al*. 2002).

With the exception of some of the Springhurst group, most other landholders were dominantly reliant on the farm as a source of income. The survey result that showed 65% or more of the Corryong and Tallangatta groups had a current business plan for the farm also suggests that these landholders were serious about staying in agriculture.

Within Gasson's (1973) classification of motivations for farming participants to farm, participants' motivations were dominantly 'expressive' and 'intrinsic', with 'instrumental' (the farm being a means of obtaining income and security) reasons also being important, although behind the other two. This supports work of Ridley (2004) and Vanclay (2004), who contend that profit is not the most important motivation for farming and that environmental management decision making is complex. Landholders' motivations for farming in the North East Catchment, combined with reasons for participating in

Table 7. Perenniality and water leakage results from participants' properties

	Corryong (*n* = 14)	Tallangatta (*n* = 13)	Springhurst (*n* = 12)	Combined (*n* = 39)
Calculated perenniality (% of the farm)				
Annual pasture	23	30	43	31
Exotic perennial pasture	30	29	25	29
Native perennial pasture	26	21	21	22
Lucerne and other (assumed as for lucerne)	0.5	0.2	3	1
Remnant vegetation	21	20	8	17
Total calculated perenniality	49	45	34	44
Calculated leakage				
Annual rainfall (mm)	775	839	609	741
Water leakage (mm/ha)	135	168	112	139
Farm size (ha)	591	442	388	471
Leakage/farm (ML)	798	743	435	659

EMS and a generally negative experience with quality assurance, suggest that future extension should focus on raising awareness and education about natural resource management issues of local relevance.

Current record keeping and monitoring

The monitoring survey results showed differences between the groups, with the Corryong group generally monitoring less than others. As would be expected, production monitoring was most common (77% across the groups kept formal records or at least diary notes). The most alarming finding was the overall low level of record keeping. The keeping of records is integral to the running of a business, yet overall 13% of the participants kept no production records. This is inadequate for successful business management. Most disturbing from a legal and quality assurance perspective was the finding that 31% of landholders maintained no chemical usage records. On these farms, there is no capacity to trace chemical residue problems, which renders the whole livestock industry vulnerable in terms of substantiating a 'clean' image of production.

As has been found in other EMS pilot projects, monitoring for environmental issues was very low. This supports the conclusion that there is very limited potential for CMAs to capture farmer-recorded information to assess progress towards catchment outcomes (Ridley *et al*. 2007). This is not to say EMS is not worthwhile. With education and support, it is likely to be very useful to help farmers make informed decisions about environmental management, and to highlight the need for good record keeping and monitoring to substantiate 'clean and green' claims.

The low level of environmental monitoring as part of the EMS process means that it will be difficult for landholders to substantiate a 'green' image of production. A markedly improved monitoring and recording culture is needed to substantiate claims of any kind. Monitoring needs to be made simple and relevant for landholders to achieve a perceived gain of some kind. In the first instance, it will be better for landholders to monitor one or two things well, to gain confidence and commitment. The high computer ownership and increasing use of electronic computer recording systems will also facilitate improved record keeping and monitoring, although currently there is generally a fairly low level of computer confidence and competence.

Interest and/or capacity for landholders to monitor environmental performance

Given the low level of monitoring conducted, it was not surprising that most landholders were unprepared for the calculation-based water monitoring tools for perenniality and leakage. The participants' capacity to embrace the tools varied considerably, with one designing his own computer-based recording system to calculate leakage and perenniality (he already uses computer software for paddock recording). In most cases, it required at least two sessions before people had confidence to do calculations themselves. Part of the reason was probably that landholders were not used to the abstract nature of calculation-based tools and they do not have a culture of monitoring.

Many landholders saw the monitoring tools as interesting but largely irrelevant to their business, with few making the connection between water leakage and production. Failing to keep rainfall records (34% in Tallangatta and 50% in Corryong) suggests that farmers have not viewed water as a serious limitation to production. Participants realised the importance of perenniality, but considered the cost of implementing a program of perennial pasture establishment as too expensive. This is likely to be true, except if high input pastures and stocking rates are used (Trapnell *et al*. 2006). There was a common theme of 'this is telling us is what we already know and we don't need this extra work'. However, one of the landholders in the Upper Murray immediately grasped the importance of the tool and now uses it as one of a suite of tools to aid in the long-term planning on the property.

Perenniality (44% across all groups) and leakage (139 mm) values were higher for the groups in this study (average annual rainfall 741 mm/year) than they were for an EMS group in the southern Riverina. Twelve participants in the Riverina group had 36% perenniality; rainfall ranged from ~450 to ~600 mm/year. Leakage was 8 mm/year where annual rainfall was 450 mm, compared with 60 mm/year where annual rainfall was 600 mm (Ridley *et al*. 2003*b*). In contrast to the north-east Victorian groups, farmers in both the Riverina grains groups (Ridley *et al*. 2003*b*) and North Central Victorian lamb EMS groups (Huhn *et al*. 2007) found the learning about environmental principles, through use of the water monitoring tools, to be one of the most useful parts of the EMS process. The reasons why this difference may have occurred are: (i) water monitoring being seen as of less direct relevance in north-east Victoria, given the higher rainfall environment and the limited capacity to grow agricultural plants that use most of the water (e.g. lucerne); (ii) inadequate delivery, experience or technical knowledge in delivery of monitoring tools; (iii) that monitoring tools were presented too early in the EMS process, given that there was a lack of recording and monitoring culture; and (iv) that the types of farmers in the regions were different. Most of the Riverina farmers and many of the north-central Victorian farmers were prepared to pay for private extension advice ('A' clients or innovative farmers operating in a globally focussed environment, as outlined by Stone 2005). This was in contrast to landholders in north-east Victoria who could mostly be classified using Stone's (2005) work as 'B' clients, these being traditional farmers not accustomed to paying for advice, having trouble accessing information and using Landcare and government services because the advice is free.

The high leakage values from Corryong and Tallangatta are unlikely to be a significant problem; in fact, they could be of benefit to the environment. With a few exceptions, these higher rainfall zones are not in high-risk salinity areas and thus the more water lost from farms (provided it is not rich in nutrients or sediment), the more water will reach rivers. This region produces a large proportion of the fresh water within the Murray–Darling Basin (Anon. 2004).

Springhurst is, however, within a high-risk salinity zone within the North East Catchment and thus leakage has negative environmental consequences. Springhurst also has low fertility and acid granitic soils, making establishment and management of perennials more difficult than in other areas. This is likely to

be a major problem, as Springhurst landholders may have less time to manage perennial pastures, a large proportion deriving substantial off-farm income. Management of salinity in transitional and amenity landscapes poses different challenges for the CMA than where farmers spend most of their time on the farm. Land retirement, allowing regeneration, may be a more realistic option for increasing perenniality than providing incentives for sowing pastures (Ridley and Pannell 2005).

Challenges for implementing EMS, record keeping and monitoring

EMS, even at fairly low-level approaches such as those outlined by Seymour *et al*. (2007), will pose significant challenges for broad-scale implementation. The landholders in north-east Victoria are unlikely to be ready for ISO 14001; the Stages 1 and 2 EMS proposed by Seymour *et al*. (2007) are most realistic.

EMS is a new concept and dual-purpose production and environmental management is more complex than the way landholders have been operating. Vanclay (2004) has proposed 26 principles to assist agricultural extension services promote the uptake of natural resource management. Many of these are strong positives in terms of using introductory EMS (low level) to enable farmers to make better decisions about environmental management. However, several (such as the issue of marginal farms, lack of profitability and complexity) will limit the success of EMS. The dual purpose production and environmental goals of EMS and the need for landholders to have increased skills in documentation and environmental awareness mean that EMS, although somewhat complex, is likely to be a useful tool to help CMAs achieve better environmental management on farms. If CMAs and state agencies support EMS, there is a strong need for highly trained extension staff (state agencies, Landcare, catchment management staff) with skills in production, environmental management and facilitation; this is not a trivial task in an environment of declining public resources in extension services. The opportunity for EMS to revitalise Landcare was raised at several farmer and community workshops across Victoria (Seymour 2007).

Conclusions

Environmental monitoring is more important for CMAs and state agencies than for landholders. If CMAs are to assess how on-farm actions lead to improved environmental performance, there is a need to collect information using remote sensing or for the state to invest in more monitoring. Coupled with this, in north-east Victoria there is likely to be insufficient record keeping and monitoring being conducted by landholders for successful business management, to trace chemical use and to substantiate either product quality or environmental performance. This suggests that the livestock industry in the region (predominantly beef) is unprepared for substantiating future 'clean' or 'green' claims.

Landholders' motivations to participate in EMS were to develop a better understanding of the issues of sustainability within the farming business. This, combined with their negative experience with quality assurance and poor record keeping, suggests that future work in the region should focus on awareness and education in natural resource management as well as improved record keeping and monitoring. Some form of recognition, such as financial assistance or incentives, will be needed if the majority of farmers are to participate in environmental programs. Introductory EMS training provides a means of both improving documentation as well as improving environmental management.

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