Environmental Management Systems – new tools for plant-based solutions to salinity

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Abstract

This paper focuses on some components of an Environmental Management System (EMS) to help farmers improve their management of environmental impacts. We used a group learning approach with 12 farmers in the southern Riverina of NSW to develop and test an EMS from the 'ground up'. The major environmental problems in the area included water logging, salinity and remnant vegetation decline.

A self-assessment questionnaire, covering nine areas of farm management, allowed farmers to identify areas for improvement. Monitoring tools featured in this paper were designed to assist management of water and remnant vegetation. The water monitoring tool enabled assessment of the 'perenniality' of the farm (includes farmed and remnant areas) and calculation of the amount of perennials needed in rotation to minimise leakage on farm. Farmers could also estimate the amount and frequency of leakage on a paddock basis. Remnant vegetation tools allowed farmers to readily assess the condition and quality of existing remnants and identify management actions for improvement. Using self-assessment and understanding the basis behind the development of the monitoring tools has resulted in farmers having a deeper understanding of the impacts of their farming systems on the environment. Nine of the 12 participants reported farming practice changes during the project. These components of an EMS, and a group learning approach can provide a pathway of motivation, empowerment and inspiration for farmers to increase the perenniality of their farming systems and reduce environmental impacts.

Key Words

group learning, self-assessment, monitoring

Introduction

Society is becoming increasingly concerned about the environmental performance of agriculture and the terms 'clean and green' are frequently being used for marketing purposes. Whilst Australia has quality assurance and quarantine procedures to justify the 'clean' part, we are poorly prepared to justify our 'green' credentials. Environmental Management Systems (EMS) can be used for such justification if used appropriately (1).

An EMS is a methodical approach to organisational structure, planning activities, implementation and review of an organisation's or business's attempts to manage its impacts on the environment. The essential components of EMS comprise an environmental review, development of an environmental policy, significance assessment, 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 (1, 2). Our EMS is presented (Figure 1) as a learning cycle, where components are linked. This paper focuses on the development and testing of a pilot EMS in the southern Riverina of NSW. The emphasis is on components (self-assessment questionnaires and simple monitoring tools on water and remnant vegetation management) to help farmers improve management of dryland salinity through improving the water use and perenniality of their farming systems.

Methods

Group learning approach

We used a group learning approach with 12 family partnerships in the southern Riverina (latitude 35?S, longitude 146?E). Farm size ranged from 256 to 5,750 ha (average 1,500 ha) with 40% average area cropped. The fundamentals of the approach were to use adult learning principles of concrete experience, reflective observation, abstract conceptualisation and active experimentation in a learning cycle to understand and improve the situation of interest (3). Farmers and scientists were active co-experimenters engaged in joint learning (4).

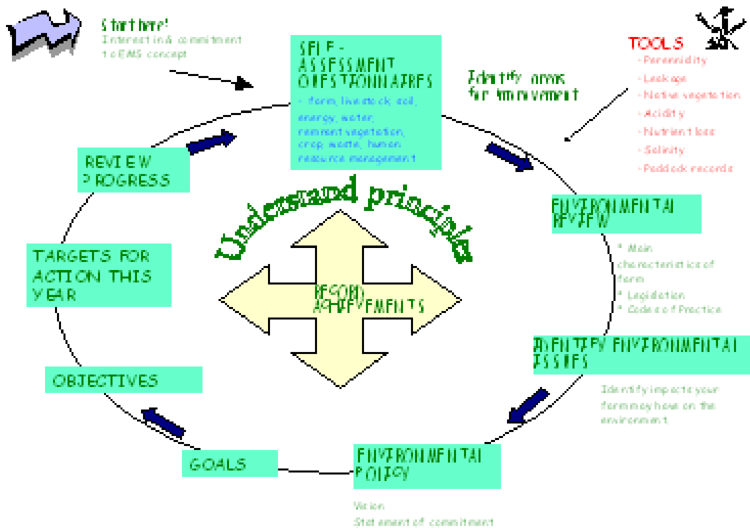

Figure 1. The first year of an EMS learning cycle.

Introduction to EMS

Farmers had not been previously exposed to EMS and thus much time was spent in explaining it, showing farmers examples of overseas and Australian work and comparing the motivations of different groups. Schemes covered included work occurring in the Australian cotton industry (5), a grains pilot in NSW (6), Tasmanian work (7), the Ontario Environmental Farm Plan (http://www.agcare.org/plans.html), Linking Environment and Farming (LEAF) in the UK (http://www.leafuk.org), Farm*A*Syst in the USA (http://www.uwex.edu/farmasyst) and Noslam in NZ (http://www.noslam.co.nz). The components of EMS which farmers were most ready to tackle first were development of self-assessment and monitoring tools (the focus of this paper). Areas which farmers considered to be ‘bureaucratic’, such as writing a review, policy and developing goals and targets were left until later (not covered in this paper).

Self-assessment questionnaires

From the above approaches, self-assessment procedures were developed to cover nine major areas of farm management as listed in Table 1. Farmers wanted a quantitative (1-5) scoring system to compare issues and also ‘benchmark’ their performance.

Development of monitoring tools from major issues identified by farmers

Farmers identified major environmental problems which included water issues (waterlogging, the future threat of salinity) and remnant vegetation decline. The principles on which monitoring tools were developed were: 1) tools should not impose large extra cost or time requirements than were incurred for production monitoring, 2) tools should be as simple as possible but based on scientific research and local knowledge, 3) tools should contain sufficient (but brief) information to give farmers an understanding of environmental issues and solutions for management. Tools were drafted and then discussed, with several iterations.

Evaluation of practice change

Practice change was surveyed asking farmers for a written response to the statement 'Make a list of any farming practices that have changed since your involvement in this project'.

Results

Farmer performance through self-assessment

Farmer ranking for self-assessment questionnaires are presented (Table 1) with rank 1 being the module scoring most highly and rank 9 the least. Performance was strongest in remnant vegetation management, with seven farmers scoring this as first or second ranking. The top remnant vegetation managers all worked actively with Greening Australia staff, had strong local knowledge and were actively managing remnants. Performance was also strong in crop, livestock, farm and soil management. For water management, only four farmers ranked their knowledge and practices in the top three. Three of the top water managers also scored highly for crop and soil management. These farmers used lucerne, were increasing (or had achieved) perenniality targets towards a long-term goal and were aware of salinity risks in their area. The top water managers also scored highly for crop management and were amongst the top soil managers.

Table 1. Farmer ranking across the nine self-assessment topic areas.

Farmer	Farm	Water	Soil	Remnant vegetation	Crop	Stock	Human Resource	Waste	Energy
					Ranking where 1= highest ranked				
1	4	5	6	1	2	3	9	7	7
2	4	5	3	ND	1	2	6	7	8
3	5	8	1	2	6	2	9	4	7
4	5	3	1	6	2	3	7	9	8
5	5	3	4	7	1	1	6	9	8
6	2	NR	3	NR	NR	1	4	6	5
7	2	3	8	1	6	5	4	8	6
8	6	5	2	8	1	4	9	3	7
9	5	8	8	1	6	4	2	3	7
10	2	8	4	1	7	8	3	6	4

11	7	9	5	1	3	2	7	3	6
12	3	4	5	1	2	7	8	5	9

ND – not done, self-assessment questionnaire not returned; NR – not relevant to the enterprise.

Monitoring tools

Each of the tools (water and remnant vegetation) was structured with a summary of why the issue is important and a suggested long-term environmental goal. Step-wise calculations to assess the issue were then given. The water tools enable farmers to estimate the ‘perenniality’ of their farm (the proportion of the farm under effective perennial vegetation) and prompted them to think about the level of perenniality needed to prevent salinity becoming a major problem. The tools also allowed the frequency and amount of leakage (deep drainage) below the root zone to be calculated. The perenniality tool used previous research about the capacity of plant types to create soil water storage ‘buffers’; perenniality is expressed relative to that of trees or lucerne (100%). Frequency and amount of leakage (deep drainage) below the root zone (paddock or farm basis) can be calculated using a simple monthly water balance (leakage in mm = seasonal winter rainfall excess – assumed plant water use – soil water storage capacity under the relevant plant type). The calculations require monthly rainfall records, an assessment of soil class (four choices), plant type and assumed water use (8).

Remnant vegetation assessment tools had a pre-amble and contact list followed by single sheet assessments covering the remnant size, width, ground-layer condition, presence of log and branches and connectedness. Each category was scored (1-5 rating) and management actions within each ‘box’ could be used as prompts to suggest management actions for improvement.

Practice changes resulting from the project

Nine of the 12 farmers changed their practices and another (farmer 11) indicated that he intended to. Farmer 6 had intensified management. Only two (farmers 2 and 3) did not indicate that change was likely. Five participants (farmers 1, 4, 9, 10 and 12) had increased their farms’ perenniality (lucerne) during the project and five (farmers 4, 5, 8, 10 and 12) were more actively managing remnant vegetation. Farmer 5, who joined the group to ‘counter the green element’ markedly changed his views and management of remnant vegetation. In contrast farmer 9 (amongst the ‘greenest’ in the group) changed his management on arable areas and no longer feared high production systems on the parts of his farm capable of sustaining such.

Group learning for development of sustainable farming systems and delivery of EMS

The principles of group learning (9) were aligned with what we thought to be ideal for EMS delivery. These were:

1. accelerated learning was aided by the support of group members,

2. development of empathy between participants allowed them to develop a collective understanding and lead to individual empowerment,

3. reflection was an important part of the process and allowed farmers to explore issues to help construct the next action or component, and

4. the individual was responsible for their own issues and concerns but was able to use the group to explore and reflect before deciding the next step.

Conclusions

Group learning was effective for increasing farmers understanding of the principles of environmental management as well as for delivering EMS. Self-assessment was useful in highlighting areas of management for improvement while the self-assessment process was a useful ‘warm-up’ introduction to EMS. The more ‘bureaucratic’ aspects of environmental review, policy and documenting action plans would have turned farmers off EMS in the initial stages. These components are likely to require one-to-one facilitation.

The development of monitoring tools using group discussion has resulted in development of practical environmental monitoring tools. Farmers have gained a deeper understanding of the impacts of agriculture on the environment through this process of development and a stronger understanding of their basis than would probably have occurred through an EMS process without such emphasis. Practice changes towards increased perenniality and remnant vegetation management for nine out of 12 partnerships indicated the success of the approach we used. Self-assessment and monitoring as part of a group learning approach can provide motivation, empowerment and inspiration for farmers to increase the perenniality of their farming systems and reduce environmental impacts.

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