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LAND MANAGERS AND LANDSCAPE FUNCTION ANALYSIS (LFA): ENHANCING ADAPTIVE ENVIRONMENTAL MANAGEMENT WHILE MONITORING RESOURCE CONDITION IN WESTERN NSW.

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INTRODUCTION

Landscape Function Analysis (LFA) is a rigorously developed method that can be used to assess and monitor how a hill slope is functioning as a biogeochemical system and the extent to which it is self-regenerating (Tongway and Hindley 2004). It is used extensively in mine reclamation and in rangeland monitoring, particularly in Western Australia (Watson *et al.* 2006; Watson *et al.* 2007), and, if used in a time sequence and in context, can show the extent to which a landscape is retaining and using its vital resources.

LFA is a central part of a broader method, Ecosystem Function Analysis (EFA) which incorporates further assessments to more fully characterize the functional performance of plants and animals. It is based on a clearly articulated conceptual framework, involves collecting data on a gradient-oriented transect in which landscape organisation is characterised and soil surface analysis rankings using sample sites on the transect. A purpose-built software package then uses the data to generate information that characterizes the site and calculates indices for stability, water infiltration and nutrient cycling. It generates the information immediately so that interpretation of the results can begin on the day of monitoring.

LFA AND ADAPTIVE MANAGEMENT

The basis of adaptive management is 'learning by doing' with the addition of an explicit, deliberate and formal dimension to frame the problem and work out a strategy to address it, undertake experimentation and testing, critically process the results then reassess the strategy (Schreiber *et al.* 2004; Stankey *et al.* 2005).

Interactive adaptive management would involve landholders aiming towards maintaining or improving land condition using LFA as a monitoring tool. Information generated by LFA can determine the dynamic range of function of a targeted land type and show, through periodic monitoring, how land is responding to management treatments which can be active or passive in nature. Whilst individual landholders could undertake this process, incorporating it into a Landcare group strategy would generate additional benefits. A range of management strategies undertaken in a district could be monitored in parallel and over time to generate social learning. This is consistent with farming systems research advocating work at the interface between biophysical systems and social management systems (Keating and McCown 2001).

This paper describes progress of research being supported by the Rangeland and Wildlife Program of Rural Industries Research and Development (RIRDC) and Western Catchment Management Authority (WCMA) to determine how useful LFA is to land managers. We are attempting to answer questions such as: Can land managers learn how to do it? What does it mean to them? Do they find it useful? Are they interested in using it as a group monitoring tool?

METHODS

This paper documents an adaptive learning cycle incorporating the development and trialing of an on-site training package, an evaluation of its use leading to modification, its use in the modified form by new groups, then the opportunity for further modifications. The evaluation incorporates comparing the use of LFA by novices to its use by an expert and follow-up interviews with those trained. The work is taking place in the Barrier Ranges north of Broken Hill and in the Wanaaring area in Western NSW, Australia.

During 2006, a 2 day on-site LFA training package was developed. It was trialed at Fowlers Gap Arid Zone Research Station in November 2006 to a group comprising landholders from the Barrier Area Rangecare Group (BARG), WCMA personnel and representatives from the Natural Resources Commission. The training culminated in participants undertaking an LFA without assistance on 2 transects that had been previously analysed by an LFA expert. These data were then compared and the results fed back to the groups at the conclusion of the training. It became clear that the groups were using a range of approaches to classifying the landscape organisation, reflecting significant misconceptions amongst some groups. As a result some groups generated LFA indices that were different to the expert, while for other groups results were consistent with the expert.

In response to the trial, the training package was modified to place more emphasis on the landscape organisation phase of the procedure. The modified training package was then used with another group of BARG landholders, DPI research staff and a landholder from Wanaaring at Mt Woowoolahra Station in October 2007. This time participants were more consistent in describing landscape organisation, and as a consequence their data were closer to the data generated by the expert.

The collected data will be analysed using a statistical analysis on the level of agreement between measurements (Bland and Altman 1986; 1995) done by novice and expert users of LFA. This will be completed following the final training course and once all data has been collated.

After each LFA training session, feedback about the opinions and observations of participants was obtained by discussing the following topics with each group:

- the success of the training course;
- personal responses to LFA as a methodology for use by landholders; and
- whether LFA should form the basis for a community monitoring system.

A third training course took place at Wanaaring in June 2008 with local landholders as well as people from WA. The results from this course were not available at time of writing. Follow-up interviews of participants were scheduled for July and August 2008, the results of which will be known at the time of the Rangelands Conference.

PARTICIPANT FEEDBACK

Whilst the dataset at time of writing was not complete enough to analyse statistically, participant responses immediately after the training course were very encouraging. They reported enjoying the course as a practical, hands-on experience. Several described how the course opened their eyes to how landscapes function rather than just assessing condition, which is generally limited to information on pasture species.

Participants in the first course described landscape organisation as the most difficult part whereas this was not a problem in the modified course offered to the second group. There were comments about how confidence grew through the course as they were encouraged to participate rather than just watching. Several practical suggestions were made at each of the first two courses that were used to further refine the method and the course.

When asked about the relevance of LFA, participants were very positive. One described it as;

> 'better compared to some other methods (tactical grazing) as it provides a deeper and more 'whole' understanding of how soil, vegetation and landscape function.'

It was described as very relevant and several instances were described where knowledge of landscape function would be of benefit. CMA people reported the view that they were asked to largely report on condition where, following training, they could see that concentrating on function would be more useful. Two participants reported that, following training, they were already looking at their land differently, indicating that they were already making informal use of the principles behind LFA without actually doing a formal transect.

Following the second course there was strong support for setting up a multi-property monitoring system using LFA. There was unanimous support for the view that such a system would generate considerable benefits and would be self-sustaining after an initial training and set-up period.

CMA and NRC participants expressed the view that data derived through LFA is likely to be useful in assessing the impact of incentives projects and, if widely and systematically conducted could provide a very valuable addition to the existing fragmentary and crude data on resource condition.

CONCLUSIONS

Broad conclusions are that the package improved as a result of the learning cycle and that novices using the modified package-generated data very similar to the expert after a 2 day training course. In addition, landholders responded very positively to LFA, expressing a desire to incorporate it into their day-to-day management as well as work together with other land managers to develop group monitoring using LFA.

Whilst statistical analysis is still required to measure the significance of differences between novices and the expert, and follow-up interviews are still required to assess aspects of the training in and use of LFA, it is already clear that:

- Landholders are capable of learning LFA in a two-day training course.
- Landholders readily understood the concepts behind LFA and were able to integrate them into their existing knowledge and understanding of the landscape.
- Landholders perceived LFA to be useful in that it enhanced their understanding of the landscape and provided an additional tool to help inform their management.

Even if LFA is not conducted formally following training, LFA lends itself to informal appraisal by landholders once the principles are understood. Illustrated local region manuals or 'glove box guides' could be developed to maintain and reinforce the principles.

It is also conceivable that landholders themselves could become LFA data collectors for wider use of LFA by regional bodies.

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