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MANAGING GRASSY WOODLANDS: BALANCING PRODUCTION AND CONSERVATION OF RESOURCES

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Abstract

Eastern Australian eucalypt woodlands are important agricultural areas that have been widely modified during two centuries of European-style use. Despite this they contain important natural resources including significant biodiversity. Long term sustainability of production depends on maintaining resources and management must be for both production and conservation. A research program on four properties in south east Queensland showed the properties were in generally good condition although all had some problems, and has highlighted a number of significant costs and barriers to adopting a more balanced approach to production and conservation.

Keywords: land use, tree clearing, biodiversity, costs and returns, riparian land

Introduction

Woodlands with a tree layer of *Eucalyptus* species and a herbaceous layer dominated by perennial tussock grasses are widespread in eastern Australia. They are important for agriculture and have been widely modified in the past two centuries by tree clearing, sowing introduced pasture species, adding fertiliser, altering fire regimes, and increasing grazing

pressure. Most have been altered to some degree with greatest change in the southern temperate areas and less in the northern sub-tropical and tropical areas which are the focus of this paper. These woodlands are complex vegetation mosaics and pose problems for management not present in more intensive systems. For example, they have a variable tree layer which has been cleared to different levels; the pastures are a mix of native pastures, oversown pastures and fully developed pastures; paddocks are typically large and include several landscape elements (hilltops, slopes, riparian zones); grazing is variable over the areas and many pastures contain patches which have been utilised to widely varying degrees.

These woodlands have significant conservation status and biodiversity. However, because they are prime grazing lands and amongst the first regions settled for pastoralism, only limited areas have been retained in formal reserves (Sattler and Williams 1999) so conservation of biodiversity will need to include private grazing lands.

These woodlands have been used for 150 years for European style agriculture, particularly for beef production. Although producers and managers have been aware of resource issues, traditionally most emphasis has been placed on managing for production to ensure financial viability. Whilst this aspect will continue to be vitally important, there are increasing social and environmental demands on management. Some of these come via market forces where buyers demand products conform to certain environmental standards, whilst others are legislative requirements, such as limits on tree clearing. There is also growing recognition that a number of resource issues have become increasingly severe problems – sodic and acid soils, salinity, loss of native vegetation/biodiversity (SCARM 1998).

An exclusive emphasis on production will no longer be possible but managing for multiple objectives to balance production and conservation of resources is not easy, especially with a variable and changing climate, and continuing adverse terms of trade for livestock

production. Some trade-offs will be required to meet these objectives e.g. increased short term costs or reduced production to ensure resource conservation. However the long term sustainability of the production systems depends on maintaining resources even if they can be over-utilised in the short term. This paper describes research that aims to increase ecological sustainability of woodlands used for beef production in south-east Queensland.

Material and Methods - Case studies

A project combining biology and socio-economics has been conducted for the past three years to assess trade-offs between production and conservation objectives and barriers to change in grazing management of grassy woodlands.

A set of inter-linking principles, indicators and thresholds for the ecologically sustainable management of eucalypt woodlands for livestock production was developed using a modified Delphi approach (McIntyre *et al.* 2000). These cover soils, pastures, trees, watercourses and wildlife habitat. The principles are arranged hierarchically with the top or broadest level principles shown in Table 1. The lower level principles provide greater detail. For example, under “Manage pastures for production and to maintain the variety of plants and animals” next level principles include “Graze conservatively to maintain dominance of tall and medium tussock grasses over 60-70% of the native pastures”.

Four commercial beef-producing properties in south-east Queensland were selected as case studies. On each property the soils were described and mapped, and detailed field surveys measured environmental and management impacts on soil condition, herbaceous species diversity, tree density and health, and wildlife habitat. The level of tree clearing in relation to soil fertility is shown in Table 2. The inventory and condition of current resources, and existing management and production systems, were described for the four properties (MacLeod and McIvor 1998). Proposed scenarios applying the management principles were

then developed for each property and the production and financial implications of the changes assessed using a mix of qualitative and quantitative modelling of pasture production, livestock responses and financial performance. Impacts on pasture production were estimated using the pasture model GRASP (McKeon *et al.* 1990); an example of the impacts is given in Table 2.

Panels of experienced property managers have been used to examine opportunities for, and barriers to, change. These can be grouped under three headings. Firstly, financial which includes the actual cost of changes (e.g. additional fencing to exclude grazing from a sensitive area, provision of off-stream water points, etc) and reduced returns due to lower animal production. Secondly, operational aspects where the management of the property is affected (e.g. new fences interfere with the existing movement of stock, fire and weed hazards). And thirdly, social aspects such as family situations (age, household needs, etc) and congruency with existing management styles and attitudes towards biodiversity conservation.

Results and Discussion

Most of the properties met the high level principles, but not the more detailed lower level principles and thresholds under existing management systems. For example, while most properties would meet the 30% woodland threshold, the woodland is not distributed equally across the vegetation types – it is generally concentrated on the poorer soils with the medium and high fertility soils and riparian areas the first to be cleared for more intensive production (Table 2). This emphasis on clearing the more fertile and accessible areas, which typically incorporate riparian lands, will always be a problem for the conservation of native vegetation and critical wildlife habitat in these areas and may be a universal problem.

The project has highlighted the importance of landscape level management issues and whole property management. e.g. riparian areas are often in poor condition – narrow or non-

existent tree buffers with poor health of any trees present, streambank erosion. However regeneration of these may be ineffective in the long term if upland areas are ignored and salinity destroys the lower landscape.

The stream buffers have many roles (e.g. trapping soil and nutrients before they enter the streams, stream bank stability, wildlife habitat) and the importance of these roles will vary with stream size. Many small streams have no or few trees but well grassed channels – these will be stable with little erosion but provide poor wildlife habitat. Therefore, appropriate management will require a sensible balance based on clearly-stated objectives.

As mentioned earlier there are both direct costs to applying the principles and opportunity costs of foregone production. For the latter, preliminary financial analyses of the reduced carrying capacity as trees regenerate suggest these costs are within the range of 5-20% (Table 2). However, these immediate costs may avert much larger future costs or the loss of land from grazing due to such resource losses as saline and acidic soils. Poor financial returns for livestock products and the often labour-intensive tasks involved with restoration will limit the capacity of producers to take positive action on a broad scale. However there have been positive developments with the increase in Landcare groups over the past decade and a wider level of community involvement in land management issues, including funding from the Natural Heritage Trust. Despite these changes, progress will not be rapid and efforts will need to be concentrated where maximum benefits can be obtained for the expense and effort e.g. restoration of riparian buffers can protect stream banks, improve water quality, conserve threatened vegetation and provide wildlife habitat.

Land use is changing and there is a need to conserve biodiversity resources for alternative (and at this stage possibly unidentified) uses. This is particularly apparent in coastal and sub-coastal areas where increasing population pressures are placing competing demands on the land – residential, rural retreats, water supply, new industries (e.g.

horticulture). The research described can play a significant role in the process of resolving many of these land use issues.

Acknowledgments

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References

McIntyre, S., McIvor J.G. and MacLeod N.D. (2000). Principles for sustainable grazing in eucalypt woodlands: landscape-scale indicators and the search for thresholds. Pages 92-100 in P. Hale, A. Petrie, D. Moloney and P. Sattler, eds Management for Sustainable Ecosystems. Centre for Conservation Biology, University of Queensland, Brisbane.

McKeon, G.M., Day K.A., Howden S.M., Mott J.J., Orr D.M., Scattini W.J. and Weston E.J. (1990). Northern Australian savannas: management for pastoral production. Journal of Biogeography **17:** 355-372.

MacLeod, N.D. and McIvor J.G. (1998). Managing grazed landscapes: Production and conservation tradeoffs in sub-tropical woodlands. Proceedings of the Bioeconomic Modelling Workshop (Post-Australian Agricultural and Resource Economics Society Conference, Armidale) (Ed. J. Gooday). ABARE, Canberra, pp. 51-63.

Sattler, P. and Williams R. (Eds) (1999). The Conservation Status of Queensland's Bioregional Ecosystems. Environmental Protection Agency, Brisbane.

SCARM (1998). Sustainable Agriculture: Assessing Australia's Recent Performance. Standing Committee on Agriculture and Resource Management Technical Report No. 70. CSIRO, Canberra.

Table 1 - General principles for the ecologically sustainable management of grazed woodlands (from McIntyre *et al*. 2000).

1. Property planning and management should include a long-term vision which considers the whole of the property and its place in the catchment
2. Manage soils to prevent erosion and to maintain productive capacity and water quality
3. Manage pastures for production and to maintain the variety of plants and animals
4. Maintain local native trees for the long-term ecological health of the property and catchment
5. Manage at least 10% of the property for wildlife values
6. Watercourses are particularly important to the ecosystem and grazing enterprise, and require special management

Table 2 - Woodland status of four properties in south-east Queensland.

	Property 1	Property 2	Property 3	Property 4
(a) Soil fertility				
Low	52	58	36	79
Medium	48	8	7	30
High	17	38	11	10
Whole property	48	34	10	28
(b) Herbage production				
Current herbage production	960	2130	1870	14580
% reduction with 30% woodland	7	17	17	11

(a) Distribution of woodland in relation to soil fertility. The values are the proportions (%) of the area of the property with that soil fertility which are currently woodland.
(b) Estimated herbage production (tonnes/property) with current woodland cover, and percentage reduction in herbage production due to competition from trees if all soil-vegetation units had at least 30% woodland cover.