Managing for Biodiversity Conservation in Native Grasslands on Farms

Josh Dorrough[1], Vivienne Turner[1], Alan Yen[1], Steve Clark[2], Jim Crosthwaite[3], and Jeff Hirth[4]

[1]Arthur Rylah Institute for Environmental Research, Department of Natural Resources and Environment, PO Box 137, Heidelberg, VIC 3084; [2]Pastoral and Veterinary Institute, Department of Natural Resources and Environment, Private Bag 105, Hamilton, VIC 3300; [3]Parks, Flora and Fauna Division, Department of Natural Resources and Environment, Nicholson St, PO Box 500, East Melbourne, VIC 3002; [4]Rutherglen Research Institute, Department of Natural Resources and Environment, RMB 1145, Rutherglen, VIC 3685.
vivienne.turner@nre.vic.gov.au

Summary

Native temperate grassland and grassy woodlands have been subject to considerable modification by livestock grazing and clearance for exotic pastures and crops. In Victoria, very little high-quality grassy vegetation persists. Consequently, native grasslands and grassy woodlands are considered endangered ecological communities and therefore are a very high priority for nature conservation.

Most of the highest-quality grassland remnants occur in small, isolated areas on public land. The long-term persistence and resilience of these scattered remnants is uncertain. Although typical remnants on private land are of low quality, their large size means that they have the potential to play an important role in the conservation of grassy ecosystems. One of the major challenges of the future is determining how to enhance the quality of these remnants on private land while ensuring productivity for farmers.

This paper describes the initial results of a joint project between Agriculture Division and Parks, Flora and Fauna Division within Victoria's Department of Natural Resources and Environment. This project involves collaborative work between scientists, farmers, extension officers and policy makers to develop best management practices so that native grasslands on farms are grazed in a sustainable manner.

A detailed review of grazing management strategies in native grasslands was undertaken. As well, market research was carried out to identify the attitudes of farmers and extension officers towards grazing in native grasslands. This work identified a lack of knowledge about appropriate grazing management strategies as the major impediment to conserving grasslands within productive grazing enterprises. Four high-priority research areas were identified, as follows:

- assessment of different grazing management regimes (e.g., timing, set stocking versus cell grazing) for biodiversity enhancement or loss;
- determination of maximum productivity gains in grasslands (e.g., fertiliser rates, livestock density) beyond which there is biodiversity loss;
- cost-effective broadscale re-establishment and enhancement of native grassland; and
- identification of productivity benefits of conserving biodiversity in natural grassland ecosystems.

Introduction

The conflicts between biodiversity conservation and the need for viable agricultural production have been most apparent in temperate native grasslands and grassy woodlands. Due to low tree cover and arable soils, these ecosystems were among the first to be intensively grazed and cropped following European settlement. Pastoral activities in southern Australia have resulted in a dramatic loss of biodiversity. It is estimated that, in the Northern Plains bioregion of Victoria, grassland vegetation occupies between 0.25% and 4% of its pre-European area (McDougall and Kirkpatrick 1994, Foreman 1997). In the Western Basalt Plains, as little as 0.1% of the pre-European grasslands remain (McDougall and Kirkpatrick 1994). These declines have been the result of vegetation clearance and modification of vegetation composition by livestock grazing and associated agricultural practices. These activities have also led to changes in soils and ecosystem function, impacting on the long-term sustainability and productivity of the pastoral industries.

Within the Western Basalt Plains and Northern Plains bioregions, native grassland and grassy woodland vegetation is restricted to small, isolated remnants surrounded by a matrix of low-diversity, exotic-dominated vegetation. Although many of the highest-quality remnants occur in narrow railway verges (Stuwe and Parsons 1977) and roadsides (Stuwe 1986), in both bioregions the majority of remnant vegetation occurs on private land (Stuwe 1986; Diez and Foreman 1997; Diez *et al.* 2000). The long-term maintenance of native grassy

ecosystems in these regions will require the development of appropriate grazing management strategies within remnants and the enhancement of native vegetation in surrounding areas. This will require an understanding of biodiversity responses to a range of grazing regimes; knowledge of best practice management for enhancing and restoring grassy ecosystems; and, most importantly, a willingness to implement these strategies.

The Ecologically Sustainable Agriculture Initiative (ESAI) Grazing for Biodiversity and Profit project is a joint initiative between two divisions within the Victorian Department of Natural Resources and Environment: Agriculture Victoria and Parks, Flora and Fauna. It aims to achieve a more socially and environmentally acceptable balance between biodiversity conservation and agricultural productivity in native grasslands and grassy woodlands that remain on Victorian farms. In this paper, we describe the results of the initial stages of the project, which include a detailed review of grazing management strategies (Dorrough *et al.* in prep.) and market research undertaken to identify farmer and extension officer attitudes towards grazing and conserving native grasslands (Watson and Pryor 2002). On the basis of these results, we suggest priority areas for future research.

Methods

Review of Grazing Strategies

A review of published literature relating to grazing management strategies for biodiversity and production was undertaken, supplemented with information obtained through discussions with farmers, extension officers and other scientists (Dorrough *et al.* in prep.). The review assessed the applicability of grazing strategies for conserving biodiversity within productive farming systems and identified current gaps in knowledge. The role of biodiversity for long-term agricultural productivity was also assessed.

Market Research

The market research, undertaken by Down to Earth Research (Watson and Pryor 2002) aimed to provide a comprehensive insight into the attitude and behaviour of Victorian graziers in relation to grazing of native grasslands and grassy woodlands. A secondary aim was to examine the attitudes of extension officers working with graziers. The research was undertaken via group discussions with graziers in Benalla (Riverina), Mitiamo (Riverina), Lismore (Basalt Plains) and Dunkeld (Basalt Plains) and through twenty in-depth interviews of extension officers and native grass graziers (Table 1).

Table 1. In-depth interviews with grazier extension officers and native grass graziers showing distribution of interviews among seven stakeholder segments.

Stakeholder segment	Interviews achieved
Grazing expert	6
Biodiversity expert	5
Agribusiness adviser	1
Soil expert	1
CMA representative	2
Farm management consultant	1
Graziers	4

Results

Review of Grazing Strategies

Production values of diverse native grasslands: In general, native pastures are considered to have low productivity (Donald 1970). However, the review identified that, in certain landscapes, particularly those with low fertility and acid soils, or at certain times of the year, native pastures can be as or more productive than sown exotic species (Jones 1996; Simpson and Langford 1996). Other benefits of native pastures were identified, particularly their role in plant and animal pest management. However, with the exception of research on a few perennial grass species, few studies have examined the direct production benefits of diverse native grassland. The perennial non-graminoid herb component of grasslands, such as daisies and legumes, are known to contribute significantly to livestock diet and possibly health (Leigh and Holgate 1978; Wimbush and Costin 1979). However, many of these inter-tussock forbs are sensitive to grazing pressure. Often, rare and threatened plants of these grassy ecosystems are forbs. Grazing strategies that maintain a high cover of forb species are very likely to have benefits for both production and biodiversity

Grazing management strategies for biodiversity and production: The review identified that, although there is a growing body of research examining the effects of grazing strategies on a few perennial grasses and legumes, research on other components of biodiversity is generally lacking (e.g., other vascular plants, non-vascular plants, invertebrates). Despite the negative impacts of pastoral grazing systems on Australian biodiversity, ecological theory indicates that grazing or at least some form of biomass removal is essential for the maintenance of biodiversity in most grasslands (Lunt 1991; Fensham 1998). In the absence of grazing, there is a decline in short-lived species dependent on seed establishment and also in small, shade-intolerant species, leading to overall loss of plant richness (Tremont 1994).

Recent research suggests that active grazing strategies involving short-duration grazing at high densities followed by long periods of rest (e.g., cell grazing) may increase perennial grass cover and long-term sustainability of grazed grasslands (Earl and Jones 1996; Kemp *et al.* 2000). Observations of high native-plant-species diversity in intermittently grazed stock reserves (McIntyre and Lavorel 1994; Dorrough 2001) also support the hypothesis that cell grazing strategies might be more beneficial for biodiversity than modified set stocking (Barlow 1998). However, cell grazing can reduce spatial heterogeneity in vegetation structure (Bruce 1998), and this may have negative consequences for fauna habitat.

Although cell grazing strategies may prove to be more beneficial for biodiversity than continuous grazing, no research has yet been undertaken in diverse temperate native grasslands or grassy woodlands. We also have little understanding of the extent to which pastoral productivity can be increased before there are negative consequences for biodiversity.

Market Research

The majority of farmers participating in the group discussions were keen to preserve native grasslands, both for posterity of these ecosystems and also for the benefits of including native pastures in their grazing systems (e.g., worm control, summer feed value, low input requirements). However, there were some perceived disadvantages of native grasslands, such as low carrying capacity, possible lost income and peer pressure to establish exotic pastures. Farmers who focused on short-term gains tended to have less interest in preserving native grasslands and were more likely to desire compensation for doing so. Information on how to effectively manage native grasslands, including how to increase livestock production without significantly impacting on conservation values, was raised as an important requirement by farmers. Similar information needs were identified through in-depth interviews with extension officers. Private agricultural consultants were also eager for information, particularly conclusive scientific results demonstrating links between biodiversity, productivity and profitability.

Discussion

Long-term persistence of native grassland and grassy woodland ecosystems in temperate regions of Victoria requires active management of all remnants on both the public and private estate. This will require detailed knowledge of ecological processes and the commitment and willingness of land managers to implement appropriate grazing strategies. However, a review of management strategies and market research of graziers identified that insufficient information exists to recommend best management strategies. The market research also highlighted that some grazier segments and agricultural consultants require evidence of positive productivity benefits arising from biodiversity conservation in grazing systems. Although some ecological research does indicate that biodiverse systems may be more resilient and productive, this may not be perceived as relevant in the regions under study. In addition, the productivity benefits of biodiversity conservation will most likely be long term, and many farmers are seeking short-term productivity gains.

The future work of this ESAI project will focus on a field research program and the communication of appropriate management strategies to landholders. On the basis of the review and market research, four main research areas were identified as having high priority:

- assessment of the impact of different grazing management regimes (e.g., timing, set stocking versus cell grazing) for biodiversity;
- determination of maximum productivity gains in native grasslands and grassy woodlands (e.g., fertiliser rates, livestock density) beyond which there is biodiversity loss;
- cost-effective broadscale re-establishment and enhancement of native grassland and grassy woodland; and
- identification of productivity benefits of conserving biodiversity in natural grassy ecosystems.

References

Barlow, T. (1998). "Grassy guidelines: how to manage native grasslands and grassy woodlands on your property". Trust for Nature, Melbourne.

Bruce, S. (1998). Honours thesis. Australian National University.

Diez, S. and Foreman, P. (1997). "Remnant vegetation survey and botanical inventory of the Loddon Shire (part 2) (former shires of East Loddon, Korong and the former city of Marong)". Loddon Shire Council and Natural Resources and Environment.

Diez, S., O'Brien, E. and Alexander, J. (2000). "Remnant vegetation survey and botanical inventory of the shire of Campaspe". Shire of Campaspe Council and Natural Resources and Environment.

Donald, C. M. (1970). In "Australian grasslands", ed. R. M. Moore, pp. 303–320. Australian National University Press, Canberra.

Dorrough, J. (2001). PhD thesis. Australian National University.

Dorrough, J., Yen, A. L. and Turner, V. (in prep.). "Towards compatibility: sustainable production and biodiversity conservation in grazed grassy landscapes".

Earl, J. M. and Jones, C. E. (1996). *Rangl. J.* **18:** 327–350.

Fensham, R. J. (1998). *Biol. Cons.* **84:** 301–310.

Foreman, P. (1997). "Northern Plains Grassland community". Department of Natural Resources and Environment.

Jones, C. E. (1996). *N. Z. J. Ag. Res.* **39:** 449–456.

Kemp, D. R., Michalk, D. L. and Virgona, J. M. (2000). *Aust. J. of Exp. Ag.* **40:** 343–356.

Leigh, J. H. and Holgate, M. D. (1978). *Aust. J. Exp. Ag.* **18:** 381–390.

Lunt, I. (1991). *Vic. Nat.* **108:** 56–66.

McDougall, K. and Kirkpatrick, J. B. (1994). "Conservation of lowland native grasslands in south-eastern Australia". World Wildlife Fund, Sydney.

McIntyre, S. and Lavorel, S. (1994). *Cons. Biol.* **8:** 521–531.

Simpson, P. and Langford, C. (1996). *N. Z. J. Ag. Res.* **39:** 601–609.

Stuwe, J. (1986). "An assessment of the conservation status of native grasslands on the Western Plains, Victoria and sites of botanical significance." Department of Conservation, Forests and Lands, Arthur Rylah Institute for Environmental Research.

Stuwe, J. and Parsons, R. F. (1977). *Aust. J. Ecol.* **2:** 467–476.

Tremont, R. M. (1994). *Aust. J. Bot.* **42:** 511–530.

Watson, P. and Pryor, R. (2002). "Grazing for biodiversity and profit: farmer segmentation study & evaluation of research and extension worker attitudes." Down to Earth Research.

Wimbush, D. J. and Costin, A. B. (1979). *Aust. J. Bot.* **27**:, 741–787.