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# Integration of biodiversity and agricultural production across Australian temperate grasslands

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**Abstract.** The transformation of Australian agriculture over the 20th Century saw the conversion of native pastures to improved pastures, largely through the application of artificial fertilisers. During this time biodiversity conservation was largely confined to iconic scenic reserves on public land. Today, nationally endangered temperate native grassland communities are largely confined to private land. The development of the Landcare Movement in the 1980s highlighted the role that agricultural land managers and agricultural landscapes play in maintaining biodiversity across the continent. Research into on-farm conservation was soon being funded by governments at state and commonwealth levels, as well as industry bodies. These industry bodies generally focused on research into the place of biodiversity in production systems, particularly natural pastures, and more broadly in farm businesses. We present the following: (1) An overview of the research undertaken since 1990 in Tasmania; and (2) The results from a limited survey of graziers assessing the contemporary relevance of this research. We then evaluate the influence of industry-based research on the development of incentive programs targeted at agricultural land managers.

**Keywords:** Industry-funded programs, Tasmania, conservation, profitability, natural grasslands.

## Introduction

Agricultural production is an important part of Tasmania's economy. Since European settlement, traditional use of natural grassland communities has been for livestock grazing, until conversion to improved pastures accelerated in the 1950s (Kirkpatrick and Bridle 2007). Since the 1990s, natural and sown pastures on fertile soils have been converted to cropping under irrigation. Remnants of natural grasslands and areas of derived grasslands now exist in a mosaic of intensive irrigated and dryland agriculture (sown pastures and cropping) and woody vegetation (plantation and native forests). Given the reduction in area of natural grasslands, two lowland communities are now nationally listed as threatened. Management of these grasslands is largely in the hands of private landholders.

The overlap between production and conservation initiatives can be most easily explored by focusing on research and development (R&D) programs which aimed to deliver production and or conservation outcomes for pasture-based farming systems, particularly lowland native grassy ecosystems used for extensive grazing (grasslands, natural pastures, grassy woodlands and grassy forests). Using Tasmania as a case study, we assess the role that conservation/production programs have played in maintaining natural grasslands on private land. The evaluation will cover the complex relationships between production and biodiversity outcomes practiced at farm level but with implications for the broader landscape.

## Methods

The authors review activity in key industry research and development programs focusing on production and conservation over the past 23 years. Information on programs and particularly outputs are collated, and considered in the context of recent changes in policy (*e.g.* the listing of lowland natural grassland communities in Tasmania) and in landholder interest in conservation initiatives.

A small number of landholders (n=5) who had been involved in industry programs were approached to share their thoughts on the following questions:

- How beneficial do you think it was in terms of increasing productivity on your place?
- How beneficial for other farms in the district?
- What are the take home messages for programs like Land, Water & Wool (LWW) in terms of delivering production and biodiversity outcomes into the future?
- What lessons are to be learnt for the development and delivery of future programs?

A larger research project, covering south-eastern Australian temperate grasslands, will provide a greater understanding of how farmers include biodiversity considerations in whole farm planning and in business decisions, and the implications for the development of future government and industry programs.

## Results – Tasmanian lowland natural grasslands

### Conservation programs

In the mid to late 1980s, the initial focus on natural grasslands, funded by the Office of the National Estate, was for conservation outcomes (Kirkpatrick *et al.* 1988). These low budget initiatives were supported by post-graduate student projects (*e.g.* Fensham 1989; Gilfedder and Kirkpatrick 1998) and were followed by projects funded by non-government organisations (NGO) on private land (Kirkpatrick 1991). In the 1990s, the Australian Government funded larger budget programs such as “Bushcare”, a Natural Heritage Trust (NHT) initiative (Kirkpatrick and Gilfedder 1999). In addition, a grant through the Land and Water Resources Research and Development Corporation (LWRRDC) provided further opportunities to better understand landholders’ use of natural ecosystems (Gilfedder and Kirkpatrick 1998). Concurrently, Greening Australia was undertaking restoration activities in grassy ecosystems (Zacharek and Waugh 1999). The conservation work of Kirkpatrick and Gilfedder was instrumental in developing awareness of the value of working with land holders to recognise and promote biodiversity outcomes on private land.

### Agricultural productivity programs

Industry funded programs from the agricultural sector, in collaboration with the Tasmanian Institute of Agricultural Research, delivered research and extension programs aimed at increasing productivity from pasture-based agriculture. In 1992 the International Wool Secretariat funded a pasture survey across 97 wool-producing properties in eastern Tasmania (Friend *et al.* 1997). Meat & Livestock Australia and the Australian Government co-funded the highly successful Australia-wide ‘Sustainable Grazing Program’ (SGS), from 1996-2001 (Mason *et al.* 2003). SGS provided a model of participatory research whereby farmers, researchers and extension professionals worked together to develop projects to seek production gains for grazing enterprises. While a triple bottom line approach was used, Mason *et al.* (2003) acknowledged that the integration of biodiversity and production was not a key focus. Australian Wool Innovation (AWI) initiated the 8 x 5 Wool for Profit program which commenced in 2002. This program included natural pasture monitoring sites to increase graziers’ knowledge and understanding of the impact of timing of grazing, fertiliser use and stocking rate on pasture productivity. It also provided data for a rudimentary analysis of the proportion of native vegetation on farm and production data (Reid 2003).

### Combining agriculture and conservation

The parallel programs of production and conservation for extensive grazing enterprises became explicitly aligned under LWW, which was co-funded by AWI and the Australian Government through Land and Water Australia (LWA). This national program ran from 2001 to 2006. The native vegetation and biodiversity component focused on grazing enterprises (natural grasslands, natural pastures and grassy woodlands). The program built on the SGS model, promoting bottom up research activities, working with local

land holders to research and deliver practical management outcomes for wool producers. Outputs such as Gilfedder *et al.* (2003), Mokany *et al.* (2006) and Kirkpatrick and Bridle (2007) celebrated the complementary role of fine wool production on natural pastures and biodiversity management outcomes, resulting in the development of an on farm biodiversity management plan to assist wool producers to gain a premium price for their product in the international market (Kirkpatrick and Bridle 2007).

### Evaluating outcomes

Since the 1990s a number of agencies have invested funds into increasing farmers’ grazing management skills and increasing community awareness of the importance of natural grassy vegetation and promoting the role of wool producers as managers of conservation assets. *What have these investments achieved in terms of better conservation outcomes and more profitable businesses?*

Evaluation of the SGS program (Allan *et al.* 2003) reported an increase in farmers’ awareness of the importance of grazing management to increase profitability on farm. Changing grazing management provides environmental benefits such as increased ground cover which provides production benefits through the ability to carry more livestock. Within production and conservation programs, different grazing management practices were shown to affect pasture composition, *e.g.* a reduction in weed cover in sown pastures and manipulating structure and diversity in natural pastures (Mokany *et al.* 2006).

In Tasmania, two of the three widespread lowland natural grassland communities were listed under the national Environmental Protection and Biodiversity Conservation (EPBC) Act in 2009. Modelling the distribution of natural pastures over time and mapping of the current extent revealed that less than 10% of lowland *Themeda triandra* (kangaroo grass) grasslands remain, including loss in recent years leading up to the EPBC listing. Lowland *Poa* tussock grasslands are also listed, with similar losses documented (Table 1). The greatest extent of the two listed communities is on private land. Approximately 20 % of the extent of lowland *Themeda* grassland and 35% of lowland *Poa* grassland is under a covenant or vegetation management agreement (DPIPWE unpublished data).

The observed reduction in the extent of natural grassland before regulatory listing would suggest that impending regulation can have perverse conservation outcomes. However, an increase in covenants and vegetation management agreements (DPIPWE unpublished data) is underpinned by an increasing awareness of the importance of natural grasslands from governments and private landholder perspectives. It could be argued that these policy responses, with uptake from landholders, are a result of having the conservation and production-focused programs. Some graziers are more aware of what they have on their land and its relative value as a conservation and production asset. Policy makers and researchers are more aware of the context in which graziers make production-related decisions and are more aware of the stewardship role landholders have in conserving natural grasslands. Incentive schemes have been implemented, and are

**Table 1. Extent and decline of lowland grassland in Tasmania since European settlement.**

Grassland community	Modelled pre-European area (ha)	2008 estimated area (ha) (%) remaining	2011 estimated area TASVEG (ha) (%) remaining
Lowland <i>Themeda triandra</i> grassland EPBC listed	80,000	7,600 (9.5%)	7,115 (8.9%)
Lowland <i>Poa labillardierei</i> grassland EPBC listed	50,000 (mostly valley floors)	14,000 (6,500, 13% valley floors, plus 7,500 derived grassland on slopes)	12,742 (valleys and slopes not distinguished)
Lowland grassland complex	13,000	74,000 much derived from clearing woody vegetation	71,812

currently under further development, that consider the opportunity cost of not converting natural grasslands and also consider on-going management requirements to maintain the conservation asset. Voluntary conservation agreements have resulted in over 650 conservation covenants on private land in Tasmania, including natural grasslands.

### Evaluating outcomes – what the landholders say

Landholders involved with a number of these production and conservation focused programs were asked to comment on the relative value of the programs to them. The distinction between production and conservation foci was noticeable: *'The LWW program was of benefit in terms of the grazing data collected and the access it gave to other 'natural pasture' site data, but the greatest direct benefit to my business I gained through involvement in the Sustainable Grazing Systems program. SGS gave me access to the latest thinking on grazing management and by applying the principles we increased our profitability at [farm name] considerably.'* Another suggested that LWW *'... gave us some confidence in what we were doing at the time but also some ideas on improving and using natives. It didn't increase our [productivity] alone.'*

Delivering conservation outcomes in the future is closely linked to farm profitability. *'They must link directly to business benefits. Extensive grazing areas businesses tend to be focusing on production per animal, and if this can be shown to increase by doing this or that then it will be adopted... If conservation values and grazing are complementary then profitable grazing management is possibly the best solution. It is far easier to demonstrate a gain by monitoring animal performance rather than landscape condition for example. If grazing is not compatible then, yes, certainly, other incentives are needed, then management incentives are probably the way to go.'*

When asked about long-term outcomes and future programs one person commented that having a program following on from another provided more information to graziers. This is likely to develop a culture of life-long

learning and adaptive management approaches to managing for biodiversity and production. One grazer noted *'It's a bit like controlling rabbits. It's just not the one thing that works best but a combination of tools. ...work we have been doing suggests that farm groups seem to have a wider effect getting to a larger audience... It seems the ongoing involvement of a group gets more attention.'*

### Conclusion

Our research has shown that programs that successfully combined economic evaluation of production and conservation outcomes were few. The focus on improving grazing management provides land managers with the skills to improve biodiversity outcomes on private land. Anecdotal evidence suggests that increased awareness of the relative value of conservation assets has empowered land owners to present a strong case for higher conservation payments.

Future programs need to embed conservation and production outcomes into their structure, and acknowledge that conservation assets may need to become an off-farm income source to be maintained in the long term. One last comment from a grazer about industry and government funded programs provides greater insights beyond production and environmental outcomes: *'You get out of them what you put in to them. The key is involvement. It's very hard to put a dollar return on, or production gain. Lots of additional spinoffs also occur with the inevitable networking and information sharing that occurs through participation. They also provide the over-worked farmer with the opportunity to remove themselves from their daily grind enabling refreshment, renewal and the realisation that they are not alone.'*

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