



## African Lovegrass and endangered grassy ecosystems on private land – trends and risks<sup>+</sup>

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**Abstract:** There is a trade-off between maintenance of grassland diversity and increasing agricultural production. Yet traditional livestock production systems face on-going declining terms of trade which place increasing pressure on farmers to intensify production. Alternative approaches focus on the value of native grasslands as low input systems, and concentrate on lowering costs of production and lifting profitability rather than increasing production. In these low-input systems, diverse native grasslands can be an important asset – it may be the very diversity of the grasslands that provides the benefits essential to lowering costs of production. However, invasion by unpalatable perennial grass weeds, in particular African Lovegrass, presents a significant risk both to the conservation values of a grassland and the potential for the grassland to contribute as a profitable low input component of a livestock enterprise.

Information from interviews, field research and economic analyses is combined to examine patterns of invasion, management response, and impacts of African Lovegrass on native grassy ecosystems and farm profitability. Results suggest that although good quality grassy ecosystems are more resilient to invasion, the economic benefits of control in these situations are lower than elsewhere and so producers are less likely to control Lovegrass in these situations. Invasion in these circumstances is, however, devastating to plant diversity and leads to significant reductions in potential livestock carrying capacity. The benefits of native grasslands as low-input production systems is effectively negated by the massive impact of African Lovegrass invasion, and many potential methods of control require higher inputs that can further threaten grassland diversity. Options for management of native grasslands in the face of perennial grass weed invasion are discussed.

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The talk I am going to present today differs quite bit from the abstract above. When I started to put the talk together, I realised there were a few broader things I wanted to talk about, so I am going to cover a few broad issues that are on my mind first and then start talking about African Lovegrass. I hope this talk will complement the paper just presented by Shaun McKiernan (see McKiernan & Gill submitted; not this proceedings).

This painting (right) by Robert Hoddle (c. 1823) called *Gunninginderry Plains, New South Wales* I find captivating because it hints at the dynamic nature of grasslands. We often think about the year to year or seasonal variation in plant community dynamics – we note that certain weeds come up this year, and certain things flower that year. But for me the dynamics hinted at in this painting occur at a broader scale: these grasslands are sitting in a very large landscape and in a very dynamic landscape.



You can see there are areas that are open grasslands; there is also some quite closed woodland; there are scattered trees; and what looks like regenerating trees around an isolated, individual tree out there. The spatial patterns of these grasslands and woodlands are not necessarily consistent across that landscape – rather it suggests a 'shifting mosaic' (as ecologists call it); the grasslands and the woodlands are not static, sitting there fixed in the



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landscape; it suggests a landscape that is not rigid but rather one that is moving, and constantly changing.

The other thing I love about this landscape is that it is very clear that this is a cultural landscape, a spiritual landscape. It is not just a landscape that has been formed by environmental variables. People are a key part of this landscape. I think recognising that is one of our big challenges today. In their presentations at this forum, Jasmine Foxlee and Shaun McKiernan have really highlighted the fact that grasslands are cultural landscapes. We need to take that into account if we want to succeed at all in managing these and their dynamic nature.

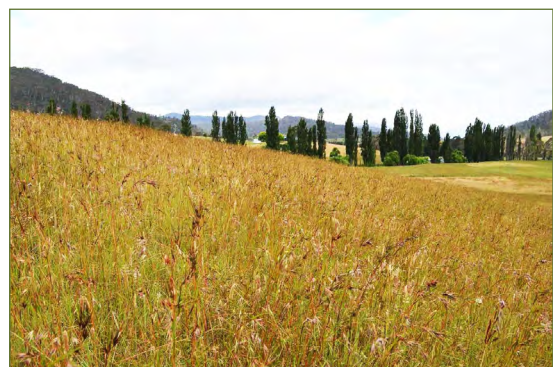
One factor affecting the long-term and broad dynamic nature of our grassy landscapes is climate and therefore CO<sub>2</sub>. We know CO<sub>2</sub> levels are going up, and have been up and down for a millennium; that during the last glacial period CO<sub>2</sub> levels were half what they are now and that tree growth and hence rates of tree invasion into grasslands were much reduced. William Bond, in Africa (Bond & Midgley 2012), has been investigating the role of CO<sub>2</sub> in *Acacia karoo* trees invading savannas (photo at right). Under glacial-period CO<sub>2</sub> levels, rates of growth were substantially reduced (see roots at the lefthand side of the inset photo), while at 450 parts per million the root growth would be like those on the righthand side of the inset. I think it is important to imagine how changing CO<sub>2</sub> has affected rates of tree invasion into grasslands, and how continuing and future CO<sub>2</sub> and climate change will be important factors to consider when we are dealing with a dynamic landscape.



Turning now to south-eastern NSW (map, right) and the Towamba Valley, a small valley just adjacent to the Bega Valley. Our traditional understanding of these coastal valleys is that they were cleared soon after European settlement. Down to the south-east there was a major port (Eden), and in this valley there was dairy, beef and sheep production. To the West is the Monaro Tablelands and the Valley was a major transport route for goods out of the Monaro. The more we know about this landscape the more it becomes clear that rather than being cleared following European settlement, this valley was actually a culturally managed grassland and had been a major pathway for people for thousands of years. A lovely sketch by Oswald Brierly (1842) *An Exploring Breakfast* (see McKenna 2002, p. iv), sketched on a journey up the Towamba Valley while working with Ben Boyd, illustrates that this pathway was not through wet forest, which is what you might imagine in this coastal hinterland. Rather this was a landscape that had open grassland among woodland and forests. There were Fig trees on the sides of the hills, but also Banksias and, importantly, lots of open grasslands scattered amongst it.



The photo at right shows that same landscape today, and now we have this other cultural overlay comprising European settlement and European management, and that is another important overlay





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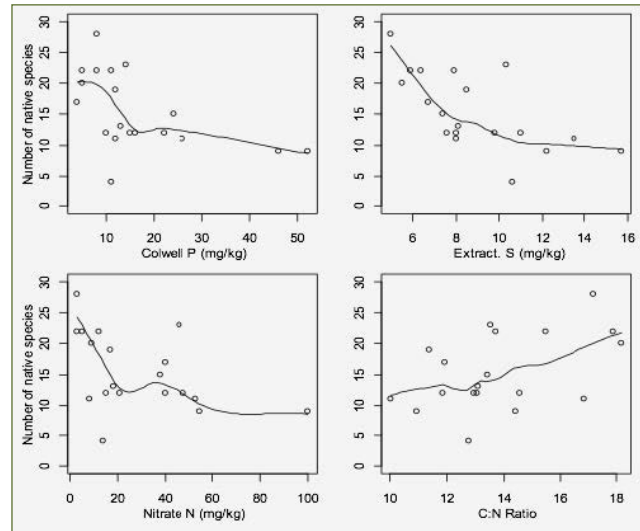
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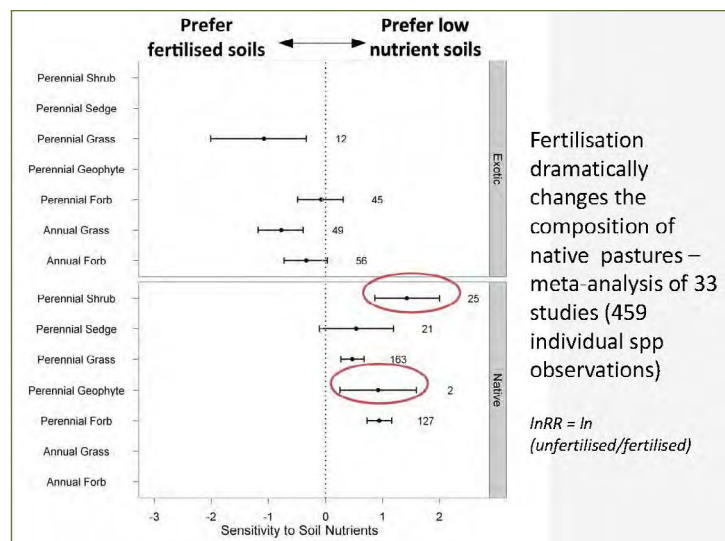
on top of the grasslands that co-exist in here. We have a diversity of land tenures, many exotic European plant species, and they are all part of the landscape and the grassland mosaic. To me it seems one of our biggest challenges in managing grasslands in the future is coming to terms with the past, and working out how to move forward while being aware of the important roles people play but also that these landscapes and the grasslands within them are highly dynamic.

Many grasslands occur in landscapes like this, where they occur as a mosaic within a primarily agricultural setting. One really significant challenge is that there is a very strong trade-off between agricultural production and maintaining diversity in these landscapes.

The graphs at right, from the Towamba Valley, show the number of native species in relation to concentrations of soil phosphate (top left), soil sulphur (top right) and soil nitrate (bottom left) and the ratio of carbon to nitrogen (bottom right). Data from all over southern Australia give similar and often much more dramatic results. Consistently, we see that the highest diversity of grassland plant species occurs where the nutrient levels are lowest in those landscapes.



Nutrients enable landholders to lift their agricultural production. Fertilised pastures can carry more livestock, but adding fertilisers changes the pasture composition, to the detriment of native grassland plant species. As an example, look at the diagram at right, from work of Dr Sue McIntyre and I, summarising a large number of studies in south-eastern Australia (Dorrough *et al.* unpublished). Native plant species are more likely to persist in low nutrient or unfertilised soils, and exotic species are more abundant in nutrient enriched pastures. It is a pretty clear picture. You intensify production through fertilisers and you lose most of the diversity in these grasslands.



Landholders are operating in a very dynamic context – there is uncertainty about the continued availability of phosphorus and other fertilisers, climatic uncertainty, as well as declining terms of trade. Alternative approaches are being tried. Charlie Massy (this proceedings) has outlined an alternative approach that focuses on trying to reduce costs of production and to lift profitability, rather than increasing production itself.

These types of approaches place far more value in native pastures, in particular the importance of plant diversity from a production, animal health and livestock husbandry perspective. A common theme among many low input producers however is that it is not important whether this diversity is of native or exotic species – it is about the importance of species diversity *per se* (see example quotes, next page). This something that we, as conservation managers and ecologists, probably have to come to terms with: these grasslands





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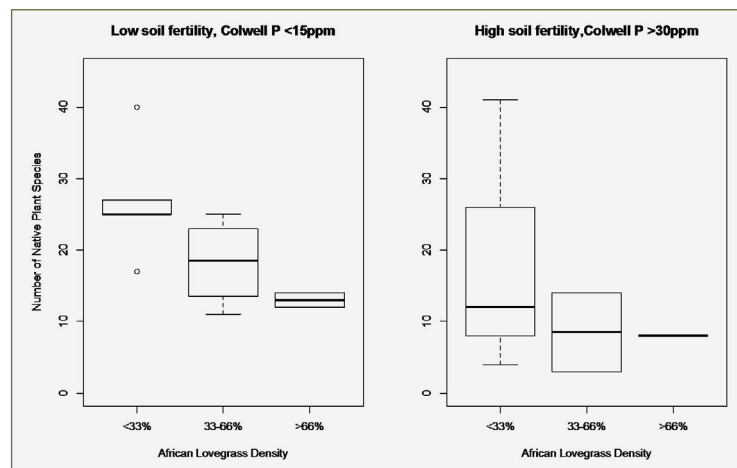
are dynamic and new species are coming in all the time and we are just going to have to accept that exotic species are now part of these ecosystems.

However, there are some invading species that have disproportionate impacts on the ecosystem and can reduce biodiversity values and disrupt production as well. One such species in south-east NSW is African Lovegrass (*Eragrostis curvula*). This grass can prevent landholders achieving low-input production systems based on high plant diversity in their pastures. African Lovegrass strongly affects the land's carrying capacity for livestock but the impact from a production perspective is not just about the number of livestock a landholder can carry. African Lovegrass also restricts the movement of sheep and cattle through pastures; it increases wear and tear on machinery; hides hazards and increases fire risk; and simply increases the time taken for many simple jobs such as mustering livestock and fencing.

The impact of Lovegrass on plant biodiversity is also significant. In low fertility soils native pasture plant diversity is highest but only when there is least African Lovegrass. There is a strong drop in number of native plant species as Lovegrass density increases. These graphs (right) show the number of native plant species across a 900 m<sup>2</sup> (30 m x 30 m) plot. At small scale, say a plot about 1 m x 1 m, which might normally have 15 species without Lovegrass, diversity can decline to one or two species co-occurring in dense Lovegrass. So the impact on plant diversity is significant, as it is on production.

We interviewed 15 landholders who have been managing Lovegrass for anywhere from 20 to 50 years. One of the consistent observations across these interviews was that pastures that have Kikuyu grass (*Cenchrus clandestinus*) tend to resist invasion by Lovegrass. But Kikuyu pastures need fairly high soil fertility and once you get to the fertility levels necessary for Kikuyu to dominate you have lost most of your native plant diversity. People interviewed by Shaun McKiernan (see McKiernan & Gill submitted) spoke of uncertainty in managing Kikuyu in a variable uncertain climate. In our work, we have interviewed a number of landholders who have said that Kikuyu is not an ideal pasture – the feed production during drought and winter is poor – but it is better than African Lovegrass, and while neither is ideal they will live with Kikuyu.

While the desire to move to a Kikuyu-based pasture is quite strong amongst most landholders, there are other low input approaches for restricting Lovegrass. Landholders we interviewed mentioned tree canopies and Kangaroo Grass (*Themeda triandra*), among other factors they associate with little Lovegrass or a slower rate of invasion by Lovegrass (Table 1, next page). Managing Kangaroo Grass and Lovegrass pastures is challenging, however, because the Lovegrass is extremely unpalatable and the Kangaroo Grass is





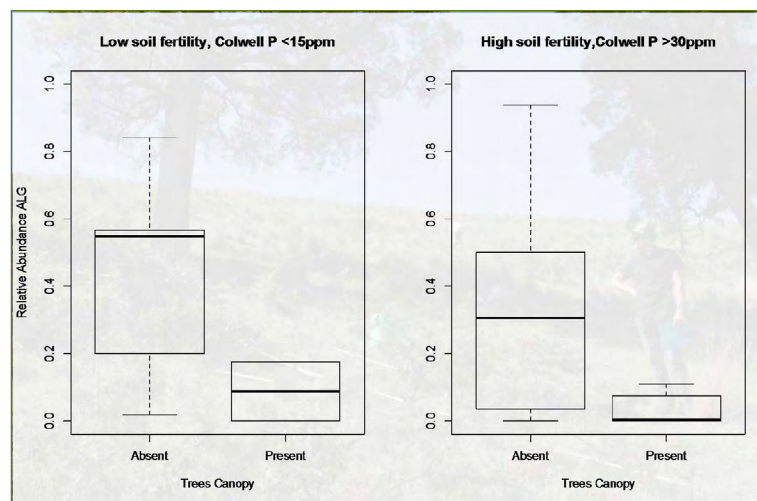
selectively grazed, providing African Lovegrass with a competitive advantage. It is a considerable challenge to get the grazing management right to give the Kangaroo Grass a greater competitive advantage. Also while the rate of invasion by Lovegrass is slower in Kangaroo Grass pastures, the native pasture has only a low carrying-capacity (relative to a Kikuyu paddock for instance) and the profitability of a paddock is questionable once Lovegrass starts to invade.

Under tree canopies, as our ecological work has shown, there is a much lower likelihood of Lovegrass being present (box plots, below right). One solution might be to put many of the less profitable native pastures under forest.

However, in the Bega Valley the open, grassy woodland has been listed as an Endangered Ecological Community and so while we tend to get more native plant species under tree canopies, planting sufficient trees across that landscape to manage African Lovegrass would have huge impacts on the landscape and would change the landscape character. How would people feel about this change? This may still be a debate we need to have for this landscape.

Table 1. Factors mentioned by producers in interviews as being often associated with zero ALG or a slower rate of ALG invasion

Locations	number
kikuyu	10
trees	6
drainage lines/swamps	5
kangaroo grass	4
fertilizer	3
cattle camps	3
irrigation	2
other	blackberries, steep southerly slopes



## In summary

The problem of Lovegrass invasion encapsulates several of the challenges of managing grasslands.

First, grasslands are dynamic and occur in a landscape that is always changing. In grasslands we often focus on the beauty of the small; small is beautiful, but when we focus on those small elements we can lose the beauty of the whole landscape and particularly that sense of timelessness in grasslands and the understanding that they are dynamic.

Second, where is the spiritual in grassland management? This is something that really seems to be lacking. I felt that Jasmine Foxlee's presentation (this proceedings) started to highlight some of that – the connection that people have to land, earth and water – which is verging on the spiritual.

Third, yes we have massive challenges in landscape management, but it is important to embrace that complexity and that diversity in the landscape.

We are fortunate to have a diversity of managers working on the ground: a diversity of both people and ideas. But when we take a particular approach to management that is focused on conservation, we have potential to lose a lot of that diversity and complexity of the landscape. In my opinion it would be terrible to lose that.

I really feel that grasslands – most of almost all ecosystems in Australia – are crying out for a different approach: something that is not about conservation. Conservation was our focus in the 20th century. Let us move past being conservationists, trying to keep things as they were in 1788 and earlier. We have a new landscape now. It is a dynamic landscape and it has



massive challenges. I think we need a new ethic, a new idea, a new philosophy that embraces complexity and that thinks about landscapes in a much more dynamic and cultural way.

Today I have presented part of my personal journey: learning that we have to embrace the past to deal with it. I think grasslands in south-eastern Australia demand reconciliation and until we have reconciliation we cannot reach the spiritual aspects of grasslands. For 40,000 years humans have had spiritual connection with this landscape and I do not see how nowadays we can avoid going back to the past to move forward with the management challenges of today.

## References

- Bond W.J. & Midgley G.F. (2012) Carbon dioxide and the uneasy interactions of trees and savannah grasses. *Philosophical Transactions of the Royal Society B* 367: 601–612.
- Brierly, Oswald (1842) *An Exploring Breakfast*. Picture. A535, Mitchell Library, State Library of NSW. In: McKenna 2002, p.iv (see below).
- Dorrough J., McIntyre S. & Duncan, D. (unpublished).
- Foxlee J. (2015) Celebrating 25 years of ParkCare and Landcare in the ACT: reflections and a vision for the future. In: *Grass half full or grass half empty? Valuing native grassy landscapes*. Proceedings of the Friends of Grasslands 20th anniversary forum, 30 October – 1 November 2014, Canberra, Australia. Eds: A. Milligan & H. Horton. Friends of Grasslands Inc.
- Hodde, Robert, 1794–1881 *Ginninginderry* [i.e. Ginninderra] *Plains, New South Wales* [picture] [between 1832 and 1835] 1 painting : watercolour ; 18 x 41.7 cm. <http://nla.gov.au/nla.pic-vn3423118> (Permission to publish: NLAref95485)
- Massy C. (2015) A glass three-quarters full: regenerating native grassland landscapes with holistic grazing management. In: *Grass half full or grass half empty? Valuing native grassy landscapes*. Proceedings of the Friends of Grasslands 20th anniversary forum, 30 October – 1 November 2014, Canberra, Australia. Eds: A. Milligan & H. Horton. Friends of Grasslands Inc.
- McKenna M. (2002) *Looking for Blackfellas' Point: An Australian History of Place*. UNSW Press Ltd, Sydney. ISBN 0 86840 644 9
- McKiernan S. & Gill N. (submitted) Watching grass grow: multispecies capacity building for invasive plant management. Submitted to *Society and Natural Resources*.

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+ This record of the talk given at the forum has been checked by the presenter, but not peer-reviewed. To find out more, contact the presenter, via their institution or by email to: [info@fog.org.au](mailto:info@fog.org.au).