Conservation of plant diversity in native pastures on the North-West Slopes of New South Wales

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Abstract: *Vegetation surveys were used to assess how grazed native pastures conserve ground storey plant diversity compared with remnant Grassy Box Woodlands. Pastures had greater alpha diversity (species richness) than the woodlands, though the woodlands had much greater beta diversity across the study region. Despite higher diversity at the site scale, native pastures were homogenous in composition and did not conserve a large proportion of the regional ground storey species pool. The study highlighted the importance of observing plant diversity at multiple spatial scales.*

Introduction

The North-West Slopes of New South Wales (NSW) have been extensively cleared for grazing and cropping. Vegetation communities that occur on the most agriculturally productive land, such as the endangered Grassy Box Woodlands, are poorly represented in the region's reserve system. The conservation of this community – and the suite of plant species that comprise it – is reliant on farm conservation efforts. Native pastures share some floristic affinities with the diverse ground storey of Grassy Box Woodlands, and can contain many native grass and forb species of conservation value. It has been proposed that grazing native pastures for dual production/conservation outcomes may be an effective means of conserving the region's ground storey plant diversity (Dorrough *et al.* 2004), though few studies have tested this proposal.

Alpha diversity (or species richness) is the diversity of species at individual sites, and is the most commonly applied measure of biodiversity in grazing and grassland research. However, species richness alone does not reveal anything about which species are being conserved, or the differences in composition among sites. Beta diversity is the variation in species composition among sites in a geographic region, and is a key concept for biodiversity conservation (Legendre *et al.* 2005). Beta diversity is rarely considered in Australian studies of grazing effects on grasslands.

In this paper we address the questions: (1) compared with the remnant woodlands, how well do native pastures conserve the region's ground storey plant biodiversity, and (2) what can beta diversity indicate about plant conservation across the two contrasting land use types?

Methods

Floristic surveys (400 m^2, all vascular plant taxa identified) were conducted in 39 native pastures across the North-West Slopes of NSW. These surveys were paired for comparison with 39 surveys conducted in Grassy Box Woodlands dominated by White Box (*Eucalyptus albens*), selected from a large metadata set. Pairing of sites was based on proximity, landscape position and soil type. Paired sites were an average of 1.5 km apart and had similar aspect and slope. All sites were on red-brown earths. The comparison was between ground storey species only (trees and tall shrubs removed). The two sets of surveys were used to compare patterns of plant diversity in the two land use types (pastures and woodlands) at a regional scale. A SIMPER analysis was performed using PRIMER (v.6.1.8, PRIMER-E LTD, UK) to find the average similarity in composition of surveys in each data set.

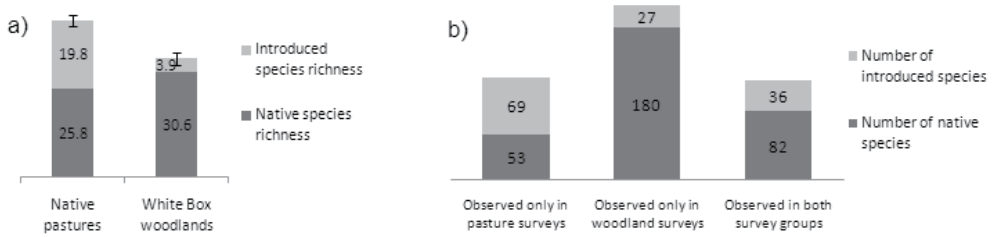

Figure 1. a) mean alpha diversity (site species richness) of each land use type, and b) land uses in which native and introduced plant species were observed.

Results and discussion

Alpha diversity in the native pastures (45.6 ± 1.7) was markedly higher than in the woodlands (34.5 ± 1.9), however much of this richness was comprised of introduced species (19.8 ± 0.7, compared with. 3.9 ± 0.6 for introduced species in the woodlands, see Fig. 1*a*). Despite higher alpha diversity in the pastures, 325 species were observed across the 39 woodland surveys compared with only 240 species in the pasture surveys, indicating greater beta diversity in the woodlands. This was confirmed by a SIMPER analysis, with the average similarity in plant composition of surveys in each dataset being 41% for the pastures and 21% for the woodlands. Fig. 1b shows the land uses in which the native and introduced species were documented. A total of 180 native species occurred only in woodland surveys compared with 53 native species occurring only in pastures. Many of the native species occurring in pastures only were very common (e.g. *Cynodon dactylon*).

Beta diversity revealed more about plant conservation in native pastures than alpha diversity. Native pastures were more homogenous in composition than the Grassy Box Woodlands. A large proportion of the regional native species pool was not persisting in the native pastures. Hence the protection and restoration of woodland communities on farms is likely to be the most effective means of maintaining plant diversity in this landscape.

One limitation of this study was that the woodland surveys had greater temporal separation than the pasture surveys, which would be overcome by conducting our own woodland surveys rather than using the metadata set. Another limitation was that grazing regimes for native pastures other than those used on the survey properties were not considered. Paddock management data for a larger set of paddock surveys (covering a greater spectrum of grazing regimes) is continuing to be collected to quantitatively assess the effect of grazing on the conservation value of pastures and grazed woodlands.

Conclusions

These preliminary data indicate that (1) the relationship between biodiversity conservation and production is antagonistic, and (2) plant conservation initiatives on farms may be better focussed on the protection and restoration of woodland remnants rather than grazed native pastures. The study highlights the importance of observing plant diversity at multiple spatial scales when assessing conservation value.

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