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# BIODIVERSITY AT THE “TOORAK” GRAZING TRIAL, NORTHWESTERN QLD

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## INTRODUCTION

There is increasing impetus for the maintenance of biodiversity values throughout Australia's rangelands. This necessitates an improved understanding of the effects of grazing management on biodiversity, invoking the question of whether there is a threshold of grazing intensity above which ecological sustainability is compromised. A substantial impediment to addressing this question is the shortage, in many rangeland regions, of comparable areas having a broad range of precisely-known grazing levels consistently applied over long periods. In this paper we describe a preliminary biodiversity assessment within a long-term grazing trial in the Mitchell grasslands of northwestern Queensland, a region where much of the biota is still poorly known.

## METHODS

The study was at Toorak Research Station (21.0°S 141.8°E), where an unreplicated grazing study was established in 1984. The paddocks (ranging in size from 7 to 57 ha) have since been grazed by sheep at five levels of pasture utilisation (10, 20, 30, 50 and 80%) and there is also a 1 ha enclosure (Fig. 1). Stock is watered from a bore drain and there is patchy grazing even within these small paddocks (Phelps and Orr 2002). Vegetation is grassland dominated by *Astrelba* spp., on cracking-clay soils.

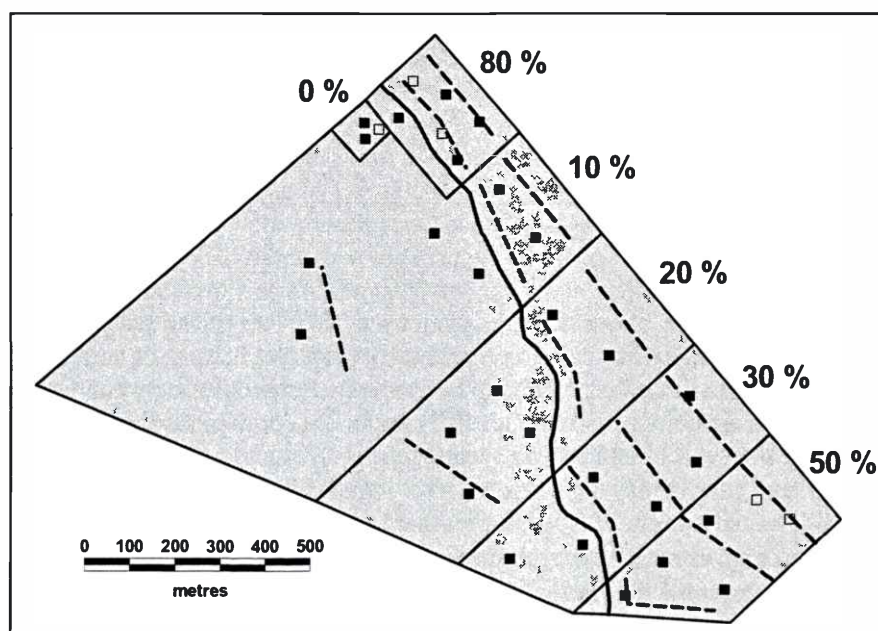


Figure 1. Layout of the Toorak grazing trial, showing the boredrain (solid line), sample sites (solid squares, all taxa; open squares, plants and habitat data only) and bird transects (dashed lines).

Biodiversity sampling was carried out in May 2003. Mammals, reptiles, ants, plants, vegetation structure, stock use and other habitat attributes were sampled at two to six 20x20 m sites within each paddock, with sites chosen to incorporate variation in utilisation within each treatment (Fig 1.). Birds were counted along two or three 250m x 50m transects within each paddock (plus instantaneous counts within the enclosure), each transect being walked a total of 11 times over three days.

## RESULTS

A total of 93 plant, 21 ant, 16 bird, 8 reptile and 3 small mammal species were recorded within the grazing trial. A poor wet season prior to sampling probably contributed to low richness and abundance of most animal taxa, as well as low plant cover. A brief summary of some results is given in Table 1. There was considerable within-treatment variation in many habitat attributes and most did not differ significantly between treatments. Plant and litter cover generally decreased with utilisation, while perennial grass basal area was greatest at intermediate grazing levels (notably, most perennial grasses had died in the 0% enclosure). Plant and ant richness differed between treatments, but there was not a simple linear relationship with utilisation. Bird and reptile richness were independent of utilisation, while the higher mammal richness at high utilisation levels was due to the presence of the dasyurid *Planigale ingrami*. Plant composition differed significantly with utilisation level, as did (but less clearly) ant composition. Many plant species showed decrease or increase responses to utilisation level, with a few species most or least frequent at intermediate grazing levels. Similar response patterns were also evident for smaller numbers of ant, mammal, reptile and bird species.

Table 1. Summary data for utilisation treatments. Treatment means were compared with Kruskal-Wallis tests (H). Composition was compared using ANOSIM (R); the table shows which other treatments are not significantly dissimilar. (ns,  $P>0.1$ ; \*,  $P<0.1$ , \*\*,  $P<0.01$ ; \*\*\*,  $P<0.001$ ).

	0%	10%	20%	30%	50%	80%	H
Understorey cover %	19.7	13.6	18.8	14.8	12.7	7.6	3.9 ns
Litter cover %	23.9	9.3	8.6	4.0	3.1	1.8	25.6 ***
Perennial grass BA %	1.2	5.7	7.5	7.3	5.5	5.3	8.9 ns
<u>Richness:</u> Plant	27.3	29.7	19.0	24.8	24.8	29.5	15.0 **
Ant	6.5	2.5	6.0	3.5	4.8	3.3	14.9 **
Bird	1.0	3.3	2.7	2.7	1.7	6.0	6.1 ns
Reptile	1.0	0.8	0.8	0.5	0.0	1.5	8.1 ns
Mammal	0.0	0.3	0.0	0.3	0.8	0.8	9.5 *
<u>Composition:</u> Plant	none	none	none	50	30	none	0.52 ***
Ant	all	none	30	0,20,30,50,80	0,30,80	0,30,50	0.16 *
Bird	all	all	all	all	all	all	0.09 ns
Reptile & mammal	all	all	0,10,80	0,10,50,80	0,10,30,80	all	0.29 **

## DISCUSSION

This study supports the findings of recent investigations in a variety of rangeland ecosystems, that the effects of grazing on biodiversity are expressed primarily through changes in composition, rather than in species richness, and that the nature of the effect varies substantially between taxa. This suggests that maintenance of heterogeneity of grazing levels is important for maintaining biodiversity values. A challenge for ecological research, and for land managers, is to elucidate the 'optimal configuration' of such heterogeneity, and how it may be achieved in a logistically and economically feasible manner. The preliminary biodiversity study at Toorak presented tantalising (rather than clear-cut) results and further intensive sampling, in more favourable seasonal conditions, is desirable. Future analyses will also consider the importance of small-scale (within-paddock) variation in grazing intensity.

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