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DELETERIOUS EFFECTS OF GRAZING ON THE BIODIVERSITY OF BREAKAWAY FOOTSLOPE THICKETS

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ABSTRACT

This study compared habitat structure and species richness between grazed and ungrazed breakaway footslope thickets in the arid shrublands of Western Australia. Mobile or more transient habitat variables (ground cover, leaf litter cover and depth) were significantly less in the grazed area. Similarly, there were less frogs and lizards in the grazed sites. We interpret these results in the context of the biology of the vertebrates and conclude that reduction of leaf litter may be responsible for the patterns. Ongoing sampling within the broader study will be used to test this hypothesis.

INTRODUCTION

There has been considerable work done on examining the influence of grazing on biodiversity (e.g. Woinarski and Ash 2002, Jansen and Healey 2003). But there have been few opportunities to develop before-after-control-impact studies on these effects. One such study is being developed in the Goldfields of WA. We present preliminary results comparing vegetation structure and terrestrial vertebrates of breakaway footslopes in a grazed and ungrazed area.

Breakaway footslope thickets appear intermittently in surface water run-on areas in recesses at the base of breakaways. In contrast to the rest of the vegetation on the footslope they tend to have large trees, several layers of vegetation, deep leaf litter, and characteristically denser and more species rich vegetation.

METHODS

In July and November 2003, we sampled five replicate breakaway thickets in a grazed and an ungrazed area on Cashmere Downs pastoral station in the WA Goldfields (28°58'S; 119°34'E). The grazed and ungrazed breakaways are approximately forty kilometres apart. The grazed sites have been grazed certainly since the mid-1960's and possibly as early as the 1930s. The ungrazed areas were too distant from water to allow continued grazing, though there was the occasional dung pile and cattle track and on the breakaway a single pile of goat dung.

Leaf litter cover and depth, area of rock and area of logs were sampled in five 1 sq m quadrats placed along the longest axis of each thicket. A 2 metre wide belt transect (10 metres long) was used to sample density and number of perennial species in three strata: <1 metre, between 1 and 2 metres and >2 metres. Vertebrates were sampled from a single pitfall line (with two buckets; called an array) over 182 array nights. Invertebrates were also sampled but the results are not reported here.

RESULTS AND DISCUSSION

Grazing altered the less resilient habitat components: there was less leaf litter (both depth and cover) and vegetation at the ground layer (and consequently more bare ground) in the grazed sites. Habitat attributes such as rocks and logs, and perennial vegetation density in the mid and upper strata did not differ between treatments. The total number of plant species differed between treatments, but did not differ significantly between strata (Table 1).

Table 1: Habitat and perennial vegetation species variables from grazed and ungrazed sites. Those in bold face are significant. Means (±SE)

	Ungrazed	Grazed	Sig. Level
Area Bare ground[1]	**1.6(.22)**	**2.28(.23)**	**0.02**
Area rock[1]	0.96(.07)	1.12(.07)	0.1
Area leaf[1]	**4.72(.12)**	**4.36(.14)**	**0.03**
Area log[1]	1.24(.09)	1.28(.15)	0.74
Leaf Depth[1]	**2.28(.25)**	**1.64(.11)**	**0.04**
Total Number species[2]	**12(1.79)**	**5.4(2.1)**	**0.04**
#species < 1 metre[2]	7.8(1.39)	3.4(1.9)	0.097
# species 1-2 metres[2]	1.8(.73)	0.4(.24)	0.105
# species >2 metres[2]	1.8(0.5)	1.6(.24)	0.724
Density < 1metres[2]	**34.6(6.4)**	**9.8(6.1)**	**0.023**
Density1-2 metres[2]	2.2(0.97)	0.8(0.58)	0.251
Density >2[2]	3(1.14)	2.2(0.58)	0.55

[1] Kruskal-Wallis Test; [2] ANOVA

It rained on both sampling occasions. While this allowed frogs to be active, the summer rain bought with it a large temperature drop. This may have influenced our fauna results, but as the sites experienced similar rainfall, some patterns are evident. The ungrazed thickets had a higher number of vertebrate species than the grazed thickets (7 versus 2). Both species found in the grazed sites were also found in the ungrazed sites. The frog *Pseudophyrne occidentalis* was more common in the ungrazed area (31 vs 1) and was found in all five of the ungrazed sites but only one of the grazed sites.

Grazing is known to influence frog (Jansen and Healey 2003) and reptile (Woinarski and Ash 2002) assemblages. However, while the proximate cause (habitat alteration) is known, the ultimate reasons (specific habitat components) are difficult to determine. Changes in substrate and canopy cover may explain the reptile assemblage at a local scale (Smith 1996). In this study, changes in substrate, particularly leaf litter, may have driven our results. The skink *Lerista muelleri* (only found at the ungrazed sites) is fossorial and may require deep leaf litter for foraging its invertebrate prey. Likewise, *P. occidentalis* was found in all ungrazed sites and only a single grazed site. Congeners (e.g. *P. guentheri*) use dead leaves as diurnal habitat.

These findings are part of a larger study that will ultimately contain four treatments ((i) Never grazed and never to be grazed; (ii) released from grazing; (iii) ungrazed but soon to be grazed and (iv) grazed with continued grazing) in three vegetation communities (thickets at breakaway footslopes, chenopod and mulga communities). The results above are from treatments (iii) and (iv). Ongoing comparisons, particularly monitoring the breakaway thickets after they are grazed, should allow further understanding of the patterns found here.

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