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The influence of grazing management and total grazing pressure fencing on ground cover and floristic diversity in the semi-arid rangelands

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Abstract

The contribution of non-domestic grazing pressure to pastoral areas of western NSW has been reported to increase grazing intensity by at least 50%. Any control of these external grazing pressures will increase the capacity for landholders to manage and restore pastoral areas. The use of total grazing pressure (TGP) fencing to enhance ground cover is assumed but as yet unproven. This paper describes the preliminary results of a study that is assessing the impact of TGP fencing in combination with alternative grazing management on ground cover and floristic diversity in western NSW. Two management systems - 'TGP fencing with rotational grazing' and 'non-TGP fencing with set stocking'- were contrasted using a series of paired sites in similar landscapes. Non-TGP fencing with set stocking resulted in less than half the floristic diversity and almost twice the proportion of bare ground compared with TGP fencing and rotational grazing. These preliminary results suggest that both catchment targets of maintaining 40% ground cover and increased biodiversity can be achieved by combining rotational grazing with control of total grazing pressure.

Introduction

Total grazing pressure (TGP) is the combined grazing pressure exerted by all herbivores (domestic, native and feral) on vegetation, soils and water and has been identified as a major issue across Australian rangelands (Fischer *et al*. 2004). In south-eastern Australia, feral goat and kangaroo populations can each contribute 30-50% of the TGP (Thompson *et al*. 2002). TGP can essentially be double the contribution of domestic livestock alone and directly impacts on the feed-base and pastoral productivity. However, the problem is difficult as goats are also seen as a 'cash crop' in western NSW (Khairo and Hacker 2011) making landholders reluctant to control goat populations. Added to this, spelling paddocks from domestic stock is often seen as futile as kangaroos may simply over utilise rested pastures (Fischer *et al.* 2004). The result is that typically paddocks are maintained on the basis of set or continuous stocking. The perceived difficulty of incorporating periods of rest or destocking within a grazing system represents a major impediment to sustainable rangeland management and restoration.

The Western CMA provides considerable incentive funding to encourage landholders to utilise TGP fencing as a mechanism for restoring both productivity and the natural resource base. However, there is a lack of empirical data to quantify the impact of TGP fencing, and grazing management within the TGP fenced area, on ground cover and biodiversity. We report the preliminary results of an on-going study examining the combined impacts of TGP fencing under alternative grazing managements on ground cover and floristic diversity at Cobar, in the Western Division of NSW.

Materials and Methods

Treatments

Two management systems were compared using two paddocks located in close proximity (<2 km). One paddock was located at “Gilgunnia” 38 km NE of Cobar and the second paddock on a neighbouring property. Both paddocks shared common site and vegetation characteristics - broad drainage flats with yarran (*Acacia homalophylla*), turpentine (*Eremophila sturtii*) and scattered bimble box (*Eucalyptus populnea*) - and comparable levels of shrub cover (<20%). The management systems were:

(i) Rotational grazing of Boer goats and sheep within a 155ha TGP fenced paddock (TGP, rotational grazing)
(ii) Set stocked feral goats within a 1600 ha paddock (Non-TGP, set stocking).

Data collection
Data were collected between May and July 2012. Contrasts were made using three (TGP, rotational grazing) and two (non-TGP, set stocking) 0.5 ha sites. Site layout followed Hacker *et al* (2010), using a modification of a step point method (Fig. 1.). Seven ground cover components (litter, cryptogam, plant base, wood, rock, dung and bare ground) were assessed at 2m intervals along each of 10 parallel, 100m transects, generating 500 points/site. At each step point the total number of floristic species and fresh dung (sheep/goats or kangaroo) within a semi-circular quadrat (0.5m radius) was counted giving a total of 500 quadrats recorded for each site. Unknown seedlings or species were recorded as separate entities where possible. Standing dry matter (SDM) was recorded for each site using the photographic standards of Campbell and Hacker (2000).

Data analysis
Data was analysed using the following mixed linear models. For all analyses, transects (within sites) were used as replicates.

For each ground cover type (bare ground, litter, cryptogam, plant base, wood, rock and dung) the proportion of quadrats with cover type:

Proportion of quadrats ~ Management system + random (Site)

Overall ground cover (combined litter, cryptogam, plant base, wood, rock and dung):

*Proportion of quadrats ~ Management system*Cover type + random (Site)*

Level of significance was determined by applying the logit transformation, $Y=\log(P/(1-P))$, to the proportion of quadrats (P) prior to analysis.

The mean number of plant species and fresh dung (sheep/goats and kangaroo)

Mean number /quadrat ~ Management system + random (Site)
*Total dung count per transect ~ Management system + random (Site)**

* Level of significance was determined by applying square root transformation prior to analysis.

Results
There were significant differences in the number of species between the two management systems ($p<0.001$) with ‘TGP, rotational grazing’ sites having more than twice the number of species of ‘non-TGP, set stocking’ sites (Fig.2.). Despite these large differences the positive effects of TGP fencing in combination with rotational grazing are perhaps understated as

species within the 'non-TGP, set stocked' sites were grazed to a height of around 1 cm whereas utilisation of species within 'TGP, rotational grazing' sites was estimated to be less than 5%. This is reflected by differences in SDM where 'non-TGP, set stocking' and 'TGP, rotational grazing' sites had an average of 125 and 800kgDM/ha respectively.

Details of paddock stocking histories have not been provided. However, an indication of difference in past grazing pressure between the two management systems is provided by the relative abundance of old dung (from the step point data) and fresh dung from the semi-circular quadrats. Non-TGP, set stocking sites had significantly more ($P<0.001$) fresh dung than TGP, rotationally grazed sites (Fig.3.). There was also some indication that historic grazing pressure within TGP, rotationally grazed sites was higher than those for the Non-TGP, set stocking sites (Fig.4.).

Proportions of ground cover varied significantly among ground cover components ($p<0.001$, Fig.4.) and the interaction between ground cover type and management system was also significant ($p<0.001$). For example, the proportion of bare ground at 'non-TGP, set stocking' sites was more than double that of 'TGP, rotational grazing' sites (> 60% compared with <30%, Fig.4).

Conclusion

The results reported here suggest that the combination of TGP fencing and rotational grazing can result in ground cover levels that are aligned to catchment targets of maintaining ground cover above 40%. However, we have illustrated these effects using the two opposite ends of the grazing spectrum. Ongoing studies, evaluating the impacts of TGP fencing with set stocking and alternative enterprises, and measures of grazing intensity will provide additional information on the utility value of TGP fencing.

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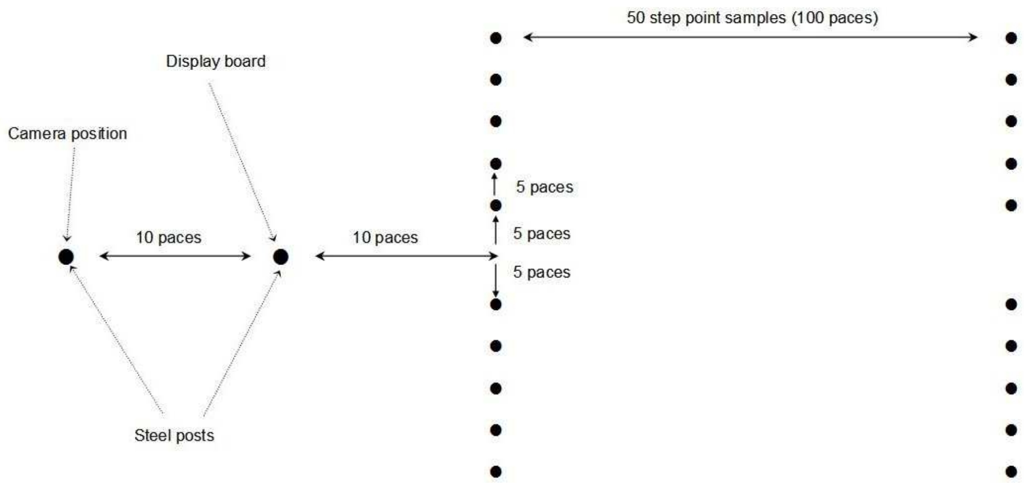

Fig. 1. Layout of 0.5 ha plots sampled for ground cover and floristic diversity (After Hacker *et al.* 2010).

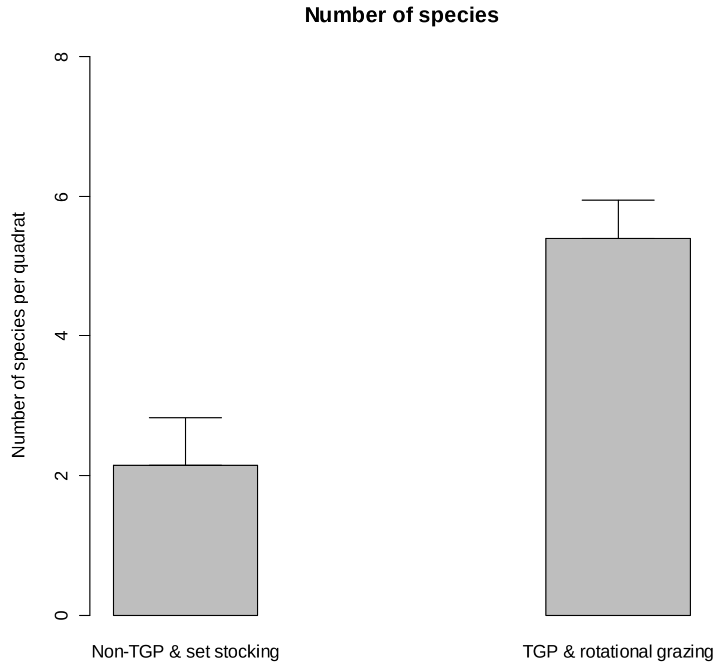

Fig.2. Total number of species within a semi-circular quadrat (0.5m radius) for 'non-TGP, set stocking' and 'TGP, rotational grazing' systems (bars represent one standard error).

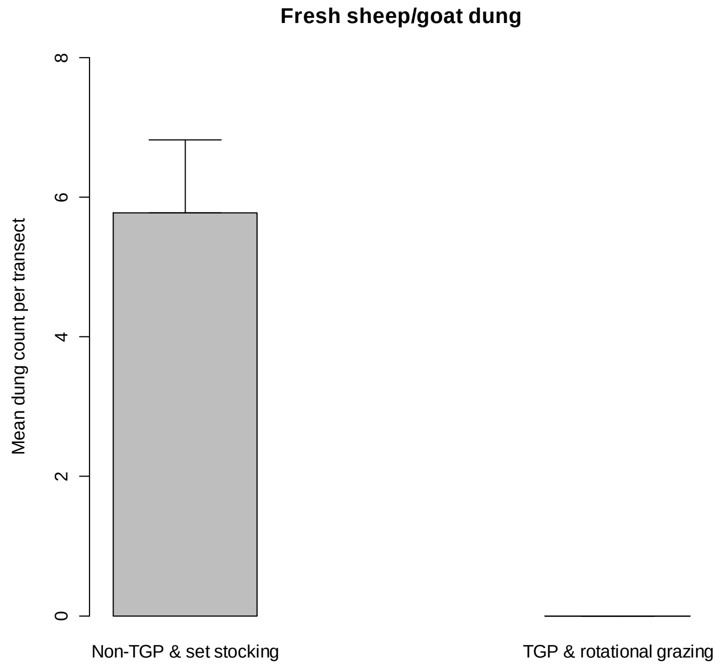

Fig.3. Mean fresh dung counts (sheep or goats) per transect, each containing 50 semi-circular quadrats (0.5m radius), for 'non-TGP, set stocking' and 'TGP, rotational grazing' systems (bars represent one standard error).

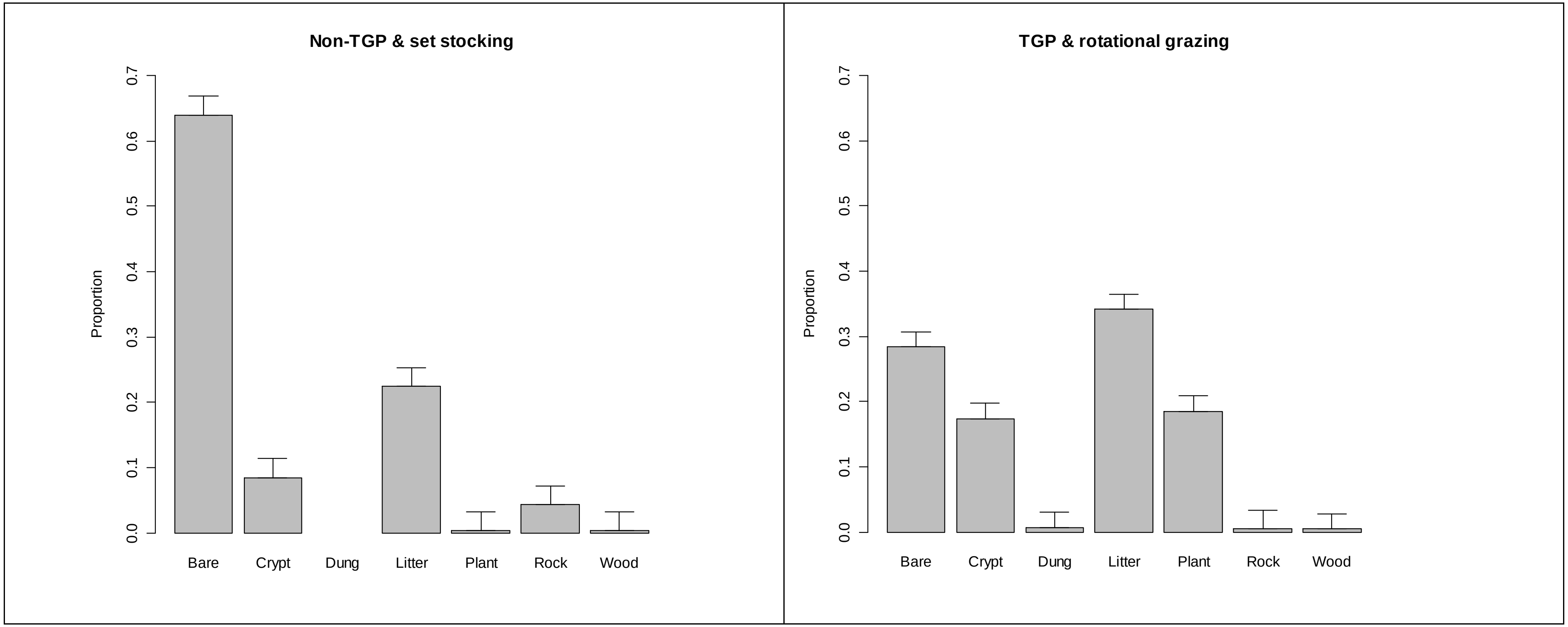

Fig.4. Contrasts in ground cover type between 'non-TGP, set stocking' and 'TGP, rotational grazing' systems (bars represent one standard error).

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