RELATIONSHIPS BETWEEN WATERS, FENCELINES, BIOMASS AND LARGE HERBIVORES IN SOUTH-WEST QUEENSLAND

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ABSTRACT

Herbivore distribution and biomass were assessed in a south-west Queensland mulga paddock where a boredrain and semi-permanent earth tanks were used to water stock. Distance to fencelines and waters explained little of the variation in herbivore distribution or biomass. Herbivore distribution was rarely related to distance from the boredrain, although ungulate distribution was related to distance from the nearest water, which included the boredrain, but only after the boredrain was turned off. Macropod intensity increased with distance from the boredrain. Biomass was related to distance from the nearest fence and distance from semi-permanent waters. The lack of correlation between the explored variables and distance to the boredrain suggests the stocking gradient out from the boredrain was not as high as with the point waters.

INTRODUCTION

In south-west and central Qld and north central and north-west NSW, stock are watered from freely flowing bores distributed by open drains (boredrains) which flow for tens of kilometres through several paddocks and sometimes several properties. However boredrains have the problems of water wastage (85% of water is lost to evaporation or seepage), declining flow rates (Habermahl 1980), erosion, diversion of overland flow and facilitating the spread of woody weeds (Jones 1995). This unsustainable use of artesian water is being addressed by the Queensland Department of Natural Resources in a demonstration project that is controlling water flow by piping a number of bores to troughs.

Herbivore distribution in rangelands has been correlated with point waters, wind (Lange 1969, Stafford Smith 1984, Landsberg *et al.* 1992, Thrash *et al.* 1993), vegetation (Landsberg *et al.* 1992), biomass and geomorphic zone (Terpstra and Wilson 1989). This paper examines the influence of boredrains on the distribution of macropods and ungulates within a paddock where a boredrain is replaced by troughs.

The study site is 40 kilometres south-east of Cunnamulla, south-west Queensland; median annual rainfall is 345 mm and the site is situated on the Gilruth hard mulga land system (Mills and Lee 1990). The main water source of the study site was a boredrain which flowed through the northern third of the 2000 ha (4 × 5 km) paddock, together with several semi-permanent earth tanks. The boredrain was turned off and troughs were functioning in April 1995. The paddock carries between 400 and 550 merino ewes, with occasional additions of cattle depending on season. Lambing occurs May-July and lambs are removed in January.

METHODS

Herbivore distribution in the paddock was assessed using dung counts following the methodology of Stafford Smith (1984) and Landsberg *et al.* (1994). The paddock was sampled on a 250 × 500 metre grid with transect lines 500 m apart. Dung was separated into macropod, ungulate and other herbivore events. Goat dung was not differentiated from sheep dung due to the low number of goats in the area (Stuart Boyd Law, pers. comm.). Macropods present in the paddock were grey and red kangaroos and wallaroos. Biomass was estimated in 1 metre square quadrats placed along the dung transect at 25 metre intervals.

Surveys were completed twice with the boredrain flowing, in December 1994 and March 1995, and twice yearly after the drain was turned off, beginning October 1995. Biomass was assessed in 40% of dung transects in March 1995 and 100% of dung transects in October 1995. Distance to fencelines, distance to waters and biomass were assessed for their relationship to macropod and ungulate dung density by stepwise multiple regressions.

RESULTS

Table 1. R^2 of correlations between herbivore distribution and distance to water, fencelines and biomass and between biomass distribution and distance to water and fencelines. Correlations are positive except where indicated (-). * P<0.05, ** P<0.01, *** P<0.001.

	Distance to the boredrain	Distance to nearest semi-permanent water	Distance to nearest water 1994	Distance to the southern fenceline	Distance to the nearest fenceline	Biomass Oct 1995
Ungulate dung 12/94						
log $_{10}$ Ungulate dung 12/94						
Macropod dung 12/94	0.02*			0.31***		
log $_{10}$ Macropod dung 12/94				0.20***		
Ungulate dung 04/95						
log $_{10}$ Ungulate dung 04/95				0.06**(-)		
Macropod dung 04/95						
log $_{10}$ Macropod dung 04/95						
Ungulate dung 10/95			0.16***(-)			
log $_{10}$ Ungulate dung 10/95			0.09*(-)			
Macropod dung 10/95	0.05**					0.07***
log $_{10}$ Macropod dung 10/95				0.08***(-)		0.07***
Biomass 04/95		0.23***				
log $_{10}$ Biomass 04/95		0.19***				
Biomass 10/95		0.08***			0.08***	
log $_{10}$ Biomass 10/95		0.09***			0.08***	

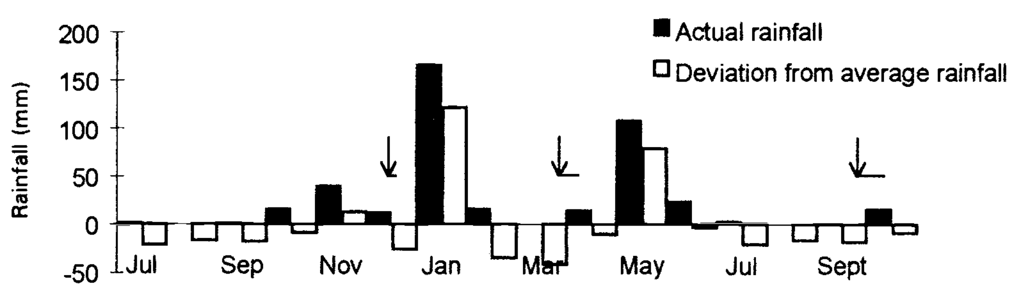

Figure 1. Rainfall at Cunnamulla and the deviation of rainfall from the monthly average. Arrows indicate time and duration of sampling periods.

Results of the regression analysis (Table 1) show linear and logarithmic correlations varied with time and between herbivores. Relationships described only a small amount of the variation in herbivore and biomass distribution, with very low R^2 values. Herbivore distribution was not related to distance from troughs six months after the boredrain was turned off. Rainfall was generally below average leading up to the December 1994 and October 1995 data collections (Figure 1). The paddock had a good perennial base of grasses which held total biomass fairly constant independent of seasonal conditions; biomass was 840 kg/ha and 760 kg/ha in April and October 1995, respectively.

DISCUSSION

The lack of correlation between herbivore distribution in December 1994 and distance to water may be for a number of reasons. Lactating ewes generally have higher water requirements, although this is dependent on seasonal conditions (SCARS 1990), so it would be expected that ungulate movements would be related to water in December 1994 and October 1995. The presence of older lambs in December 1994 may have decreased flock dependence on water (compared to October 1995) and the pushing of mulga in the southern end of the paddock in the months prior to December tended to concentrate stock in that area (unpubl. data). By March and April 1995 feed was more evenly spread. Significantly higher densities of ungulate dung closer to the southern fence in April 1995 probably reflect their tendency to graze into the wind, which is predominantly south-easterly at this time, when food is not limiting. The lack of correlation between water and ungulate distribution at this time is not surprising given the cooler season and higher than average rainfall before the data collection. The significantly higher level of ungulate activity in October 1995 (after the drain was no longer functioning) in areas closer to the location of the waters in 1994 (including the boredrain) suggests that first, sheep movements were related to the boredrain in the past and second, their change in movement patterns in response to new waters is slow.

The relatively small influence of all waters on herbivore distribution is similar to past findings in paddocks with point waters (Landsberg *et al.* 1992, Thrash *et al.* 1993). The complex patterns in herbivore distribution may partly reflect the large choice of waters available to animals, with some 4.5 kilometres of boredrain (present since 1923) and 5 semi-permanent earth tanks (present for the last 20 years). This meant that stock were never more than 2 kilometres from water when the semi-permanent earth tanks had water.

Trends in macropod distribution varied with time. Sheep and kangaroos have been observed to change their foraging strategy in relation to feed availability (Ellis *et al.* 1977) and this may partly explain varying patterns in distribution over time. Intensity of macropod grazing was generally not related to water except where negatively related to distance from the drain, which may be a response to vegetation quality closer to the drain (data yet to be analysed). The lack of correlation between macropod distribution and trough placement was similar to that reported by Gibson (1995), where, beyond 100 m from troughs, macropod dung counts at Currawinya National Park were not significantly different. Macropod grazing was significantly influenced by biomass, supporting Wilson's (1991) findings. In contrast to the findings of Arnold (1987), where sheep more frequently ate at higher biomass patches, sheep distribution did not appear to be related to biomass at this scale. Herbivores may be responding to vegetation types at a smaller scale such as the land unit (Terpstra and Wilson 1989).

The correlations between biomass and distance to the nearest semi-permanent water and the nearest fenceline indicate that there has been differentially higher grazing closer to semi-permanent waters and fencelines. If so, these vegetation patterns probably reflect past herbivore pressures, as herbivore distribution was not significantly influenced by distance to the nearest water and fence during this study.

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