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FACTORS INFLUENCING PIOSPHERE DEVELOPMENT IN SMALL *ASTREBLA* GRASSLAND PADDOCKS IN THE VICTORIA RIVER DISTRICT, NT

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ABSTRACT
Paddocks in a stocking rate trial at Mt Sanford, in the Victoria River District of the Northern Territory, were examined for factors that influenced the development of piospheres (zones of attenuating stocking pressure radiating out from waters). Paddocks had the same number of stock per paddock and per water, but varied in size and % utilisation. There was considerable variation in the development of piosphere patterns between the six paddocks. Of all the paddock characteristics investigated, only mineral supplementation had an effect on piosphere development, with supplemented paddocks being far more likely to develop piosphere patterns. Interestingly, average paddock utilsation had no effect on piosphere development. The findings provide useful insight into optimal paddock design and grazing management options to increase uniformity of grazing.

INTRODUCTION
The development of piospheres is a well documented phenomenon in extensive rangeland systems (reviewed in Andrew 1988). Uneven grazing in large paddocks can lead to some areas of the range being under-utilised while other areas are badly overgrazed, leading to reduced cover and infiltration, soil loss, and consequent loss of pasture productivity. Understanding the factors influencing uneven grazing may help to develop strategies to promote more even grazing. For this reason, factors governing piosphere development in small stocking rate trial paddocks were investigated.

Methods
The six paddocks varied in size (431-1233 ha), shape (square – rectangular), maximum distance to water (1-2.2 km), average utilisation (6-20%), mineral supplementation (with and without) and land unit uniformity (83-100% *Astrebla spp.* grassland). A squareness index was calculated as ABS(1-(breadth/length)). Paddocks were all stocked with 54 cows, 13 steers, 2 bulls and associated calves. Hence utilisation was proportional to paddock size, and the number of head per water point was constant.

To test for the effect of water placement, vegetation variables were correlated with distance to water using Spearman's rank correlation coefficient. This output was then analysed further. The number of instances in each paddock where variables were correlated with distance to water was analysed in relation to paddock attributes. Additionally the strength of the correlation (r_s) was compared in relation to paddock characteristics.

Results
The six paddocks varied in the development of piospheres. Paddock shape, size, land system uniformity, time paddock had been stocked, and maximum distance to water did not influence whether piospheres developed in a paddock. However, supplemented paddocks were much more likely to develop piospheres than non-supplemented paddocks. This was evident in that 1) the number of vegetation variables that were significantly correlated with distance to water, varied substantially between supplemented and non-supplemented paddocks; and 2) the strength of the correlation with distance to water and % bare, yield and perennial yield was influenced by whether the paddock was supplemented (Table 1).

When the unsupplemented paddocks were removed from the dataset, there was still no effect of time paddock had been stocked, paddock size and shape, maximum distance to water and utilisation rate on the development of piosphere patterns.

Table 1: Effect of supplementation on the development of piosphere trends.

Variable	Supplemented		No supplementation	
	N=4		N=2	
	Mean	SE	Mean	SE
Number of variables per paddock significantly correlated with DTW (October)	10.75	1.65	1	1
r_s % Bare (average all years) vs DTW	-0.63	0.06	-0.01	0.02
r_s % Bare (October) vs DTW	-0.61	0.09	-0.08	0.13
r_s Yield (average all years) vs DTW	0.43	0.13	-0.28	0.08
r_s Perennial Yield (average all years) vs DTW	0.30	0.17	-0.53	0.05

Discussion

Piosphere development in small paddocks, would generally be expected to be less pronounced where the maximum distance to water (2.2km) is still well within the range of cattle. The trend to reduce paddock size and increase utilisation levels, is partly to overcome uneven grazing patterns. But even in these small paddocks, where supplement is placed close to waters, piosphere patterns may develop.

Supplement placement has previously been identified as a factor influencing piosphere patterns (reviewed in Bailey *et al.* 1998). Various factors may be influencing the heavier use of areas surrounding waters in supplemented paddocks, apart from the time spent at the supplement near waters. Overall utilisation levels will be higher in supplemented paddocks because intake per beast will be higher (McDonald *et al.* 1995). Additionally the higher intake of dry feed in supplemented paddocks, will require more water (SCA 1990). Conversely in nonsupplemented paddocks, animals will be more nutritionally stressed and may spend more time away from waters, to find higher quality diets (i.e. where high quality components have not already been selectively grazed out of the pasture). It would be interesting to compare water medication as a form of supplementation on the impact of piosphere development.

Number of head per water is thought to largely influence piosphere development (Cowley 2001). Usually however, the number of stock per water is correlated with total utilisation, and it is difficult to separate the effects of stock per water and overall paddock utilisation. However this study was unique in comparing different overall paddock utilisations with the number of head per water point staying constant. The fact that utilisation did not influence piosphere development indicates that (at least at these moderate to low stocking rates) it is the number of head per waterpoint that influences piosphere development rather than the overall paddock utilisation.

REFERENCES

Andrew, M.M. (1988). Grazing impact in relation to livestock watering points. *Trends in Ecology and Evolution* 3: 336-339.

Bailey, D.W., Dumont, B. and Wallis De Vries, M.F. (1998). Utilization of heterogeneous grasslands by domestic herbivores: theory to management. *Annales de Zootechnie* 47: 321-333.

Cowley, R.A. (2001) The effect of changing water distribution from linear to point source on vegetation and soil following piping of an artesian bore in a semi-arid mulga paddock. PhD Thesis, The University of Queensland, Australia.

McDonald, P., Edwards, R.A., Greenhalgh, J.F.D. and Morgan, C.A. (1995) Animal Nutrition. Longman, Essex.

Standing Committee on Agriculture (1990) Feeding standards for Australian livestock. Ruminants Subcomittee. CSIRO, Australia.