PROCEEDINGS OF THE AUSTRALIAN RANGELAND SOCIETY BIENNIAL CONFERENCE

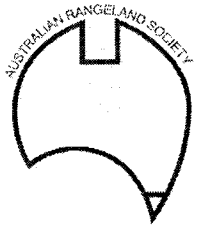
Official publication of The Australian Rangeland Society

Form of Reference

The reference for this article should be in this general form;
Author family name, initials (year). Title. *In*: Proceedings of the nth Australian Rangeland Society Biennial Conference. Pages. (Australian Rangeland Society: Australia).
For example:
Anderson, L., van Klinken, R. D., and Shepherd, D. (2008). Aerially surveying Mesquite *(Prosopis* spp.) in the Pilbara. *In*: 'A Climate of Change in the Rangelands. Proceedings of the 15th Australian Rangeland Society Biennial Conference'. (Ed. D. Orr) 4 pages. (Australian Rangeland Society: Australia).

Disclaimer

The Australian Rangeland Society and Editors cannot be held responsible for errors or any consequences arising from the use of information obtained in this article or in the Proceedings of the Australian Rangeland Society Biennial Conferences. The views and opinions expressed do not necessarily reflect those of the Australian Rangeland Society and Editors, neither does the publication of advertisements constitute any endorsement by the Australian Rangeland Society and Editors of the products advertised.



The Australian Rangeland Society

MAINTAINING BIODIVERSITY VALUES UNDER PASTORAL INTENSIFICATION IN THE AUSTRALIAN TROPICAL SAVANNAS

A. Fisher[1,6], J. Low Choy[1], D. Milne[1], A. Ash[2], R. Cowley[3], L. Hunt[4], N. MacDonald[3] and S. Petty[5]

[1]Tropical Savannas CRC & Department of Natural Resources, Environment and the Arts, PO Box 496, Palmerston NT 0831
[2]CSIRO Sustainable Ecosystems, 306 Carmody Rd, St Lucia Qld 4067
[3]Department of Primary Industry, Fisheries and Mines, PO Box 1346, Katherine NT 0851
[4]CSIRO Sustainable Ecosystems, PMB 44, Winnellie NT 0822
[5]Heytesbury Beef, Unit 6/90 Ross Smith Avenue, Fannie Bay NT 0820
[6]Corresponding author: alaric.fisher@nt.gov.au

ABSTRACT

Various methods of pastoral intensification are being explored by producers in the northern Australian rangelands in order to increase production and improve economic performance. However, increased evenness of use and homogenisation of the landscape may have negative impacts on biodiversity. One component of a commercial-scale grazing trial in north-western Australia - the Pigeon Hole Project - is exploring the impacts on biodiversity of various grazing management strategies, and will develop recommendations for protecting biodiversity values under more intensive pastoral use. Sampling of plants, ants and vertebrates at 100 biodiversity monitoring sites commenced in 2003 and has provided a comprehensive baseline against which treatment effects can be assessed. No effects of the grazing treatments on the sampled biota have emerged after 2 years.

INTRODUCTION

The vast pastoral estate in Australian tropical savannas is very important for conservation of our rangeland biodiversity. Ecologically sustainable grazing systems, based on retaining native pasture in good condition, can help ensure the preservation of most native species and ecosystems, many of which are not, or only poorly, represented in the conservation reserve system (Woinarski & Fisher 2003).

Pastoral producers in the northern Australian rangelands are increasingly exploring methods to increase production and improve economic performance (Ash *et al.*, this volume), which typically involve infrastructure development aimed at better management of grazing and increased evenness of use. However, spatial and temporal heterogeneity in landscapes is likely to be important in maximising native species diversity. Additionally, areas that are water-remote or lightly grazed may be important habitat for components of the flora and fauna that are most grazing-sensitive (eg. Landsberg *et al.* 1997, Biograze 2000). Intensification, therefore, may have negative impacts on biodiversity at a property and, ultimately, regional scale, even if it is sustainable from the perspective of land and pasture condition.

The development of the Pigeon Hole Project, a commercial-scale grazing trial in the Victoria River District of the Northern Territory, provides an opportunity to test the ecological sustainability of pastoral intensification. One component of this project aims to explore the impacts on biodiversity of various grazing management systems, and consequently develop recommendations for maintaining biodiversity values under more intensive pastoral use. In this paper we present some preliminary results from the first two years of the project.

METHODS

Pigeon Hole Station is located in the Victoria River District (17°S 131°E), one of the most productive rangeland areas in north-western Australia. The Pigeon Hole Project, which commenced in mid 2003, is a major grazing study that occupies c. 400km^2 of the property, with a number of experimental grazing systems (see other papers in this session). The trial area is on the Wave Hill landsystem, with black cracking clay soils supporting a very sparse tree layer and a ground layer of mixed perennial grasses (eg. *Chrysopogon*, *Aristida*, *Dicanthium* and *Astrebla* spp.), annual grasses (eg. *Sarga timorense*, *Iseilema* spp.) and forbs.

100 permanent biodiversity monitoring sites have been established within the trial area, sampling most of the grazing treatments. This includes paddocks of c. 20 km^2 with five levels of pasture utilisation (15%, 20%, 25%, 30%, 40%); paddocks of three grazing radii (1km, 2km, 3km); a wet-season spelling system with 3 sub-paddocks, and a cell-grazing system. Additionally, 16 ungrazed exclosures of 4 sizes (0.4, 4, 40, 400ha) have been established within the utilisation paddocks to test the potential value for maintaining biodiversity of on-property "conservation areas". Multiple sites within each paddock were located both close to, and distant from, newly established waterpoints, and a small number of sites were located in narrow riparian zones. Sites were also established in similar vegetation on the adjacent Gregory National Park, where cattle grazing has been excluded for 15 years (although there are still significant numbers of feral herbivores).

A range of biota including vascular plants, birds, reptiles, small mammals and ants, as well as vegetation structure, ground layer cover and grazing pressure, are assessed annually at each site. Sampling commenced at 62 sites in 2003 and all sites have been sampled from early 2004. Only a snapshot of selected results to date can be presented here; we concentrate on the utilisation treatment and "conservation areas", and mostly use plants as an example group.

RESULTS

A total of 215 plant, 75 bird, 20 reptile, 4 small mammal and 54 ant species have been recorded from the biodiversity sampling sites (Table 1). For all taxa there is substantial variation between sites in local richness; the highest richness values for plants and birds are associated with riparian sites. The vertebrate and ant fauna are relatively species-poor at site and study-area scale (compared to eucalypt woodlands on other soil types). Within each major taxonomic group there is a substantial component of species restricted to, or with a strong preference for, black-soil grassland habitats. A number of rare or poorly recorded species of plants, ants and reptiles have been found.

Two factors complicate the elucidation of trends attributable to the grazing treatments. There is substantial inter-annual variation in both the vegetation and fauna (Table 1, Fig. 1). While this presumably relates to seasonal conditions, particularly the amount and timing of rainfall and subsequent response of vegetation, patterns are not necessarily consistent between taxa. There are also some pre-treatment differences between the new paddocks. Ordination and ANOSIM analysis demonstrated a significant compositional difference between paddocks for all taxa, with these differences smallest for birds and largest for ants (which mesh with the expected relative levels of species turnover across geographic space).

Preliminary analyses show no evidence of effects on biodiversity of any grazing treatment to date. For the utilisation treatment, ANOSIM analysis showed that differences between the 5 paddocks in plant and bird composition actually decreased from 2003 to 2005. Although site richness varied across years (eg. Fig. 1), there was no significant difference between

utilisation levels in the direction or size of the trend, for either plants or birds. Examination of Fig. 1 suggests that a decline in plant species richness may be emerging in the 25% and 30% utilisation treatments. This is not evident at the highest utilisation level, although a fire that burnt some of these sites in late 2004 has complicated the vegetation response.

Species composition (of plants or birds) in the exclosures has not diverged from that in the surrounding grazed paddocks (Fig. 2). Interestingly, composition in the (longer-ungrazed) Gregory National Park is generally similar to that of sites within Pigeon Hole station. Trends over years in species richness are also not significantly different between exclosures and grazed sites. To date, there has also been no differential response in composition or richness between exclosures of differing size.

Table 1: Total richness and mean site richness of flora and fauna at biodiversity monitoring sites

Note that 100 sites were sampled in 2004-05, but only 62 in 2003. Ants are sampled biannually; data from 2005 is not yet available.

	2003	2004	2005
Total species (within sites)			
Plants	171	197	178
Ants	54	-	
Birds	62	63	71
Small mammals	3	3	2
Reptiles	19	17	18
Mean species per site (range)			
Plants	41.6 (21-74)	41.8 (19-85)	35.9 (17-69)
Ants	12.9 (5-21)	-	
Birds	7.2 (1-18)	8.4 (2-18)	12.7 (2-24)
Small mammals	0.6 (0-2)	0.6 (0-1)	0.3 (0-1)
Reptiles	2.4 (0-6)	2.4 (0-8)	2.2 (0-6)

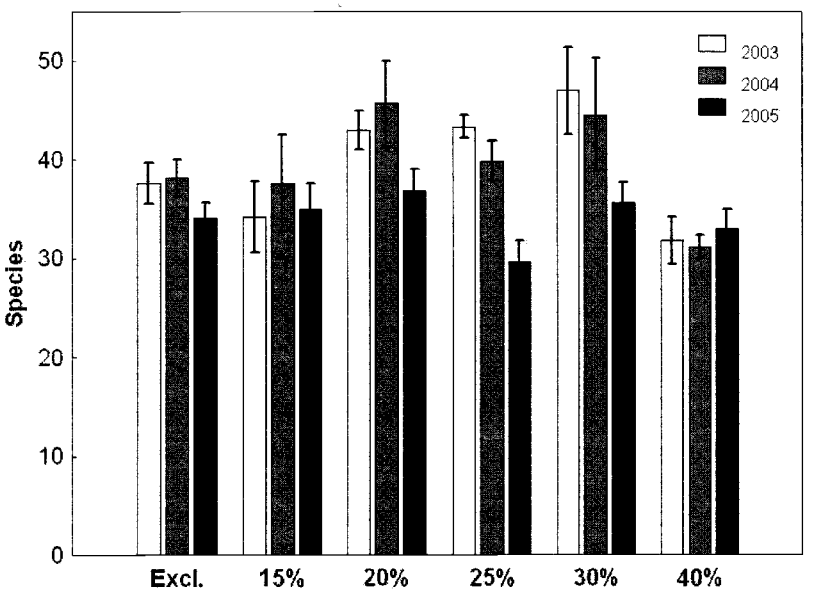


Figure 1: Mean species richness of plants in exclosures and five utilisation paddocks, for three years since the trial started (2003-2005)

Riparian sites are excluded; whiskers are one SE.

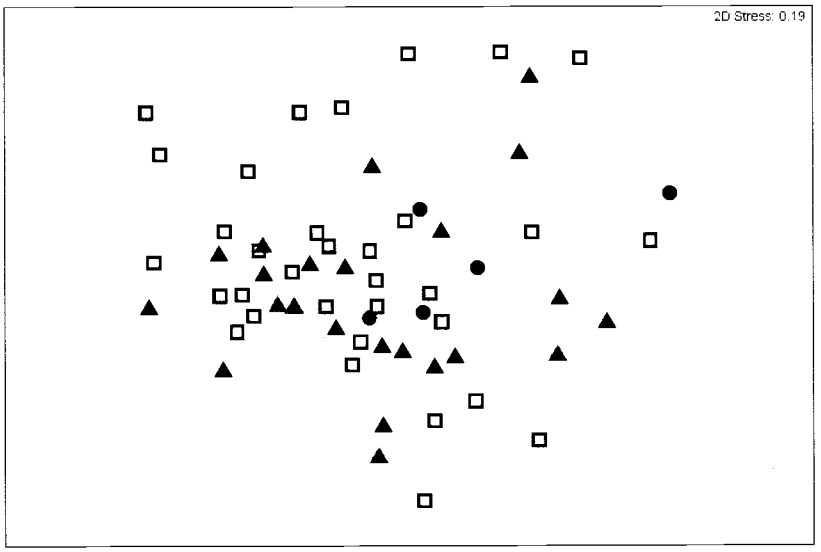


Figure 2: Ordination of sites by plant species composition in 2005
Grazed sites in the utilisation paddocks, open squares; ungrazed "conservation areas", closed triangles; Gregory National Park, closed circles.

DISCUSSION

Biodiversity sampling in the early stages of the Pigeon Hole Project has established a good baseline against which potential grazing treatment effects can be assessed. Although this system is relatively species-poor, the diversity of native plants and animals has been both surprising and of great interest to local pastoralists.

There is no evidence of substantial impact on the biota two years after the grazing treatments were imposed. This is unsurprising in this short period, particularly given that these black-soil systems are considered to be relatively resilient, and that grazing effects must emerge from a background of previous grazing patterns and substantial inter-annual variation. It is therefore important that the ecological sustainability of the new grazing systems are tested over meaningful timeframes (5-10 years). Simple measures such as species richness may also not reflect significant changes in composition, and it will also be important to track the response of individual species.

ACKNOWLEDGEMENTS

Financial support was provided by Meat & Livestock Australia, Tropical Savannas CRC and Victoria River District Conservation Association. We thank Russell and Sonya Teece (managers of Pigeon Hole Stn), the many staff and volunteers that assisted with fieldwork, and Tony Hertog and Alan Andersen (CSIRO Sustainable Ecosystems) for identifying ants.

REFERENCES

Biograze (2000). 'Biograze: Waterpoints and wildlife.' CSIRO, Alice Springs.

Landsberg, J., James, C.D., Morton, S.R., Hobbs, T., Stol, .J, Drew, A. and Tongway, H. (1997). 'The effects of artificial sources of water on rangeland biodiversity.' Environment Australia and CSIRO, Canberra.

Woinarski, J.C.Z. and Fisher, A. (2003). Conservation and the maintenance of biodiversity in the rangelands. *Rangeland Journal* 25: 157-171.