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).

The Australian Rangeland Society

RANGELAND ASSESSMENT WITH SATELLITE-BASED GRAZING GRADIENT METHODS

Gary Bastin, Vanessa Chewings and Geoff Pickup,

CSIRO, P.O. Box 2111, Alice Springs NT 0871

INTRODUCTION

The arid zone is characterised by episodic rainfall events which produce infrequent vegetation growth pulses (Pickup, 1989). This vegetation then senesces and decays, or is consumed by herbivores. The magnitude and composition of the vegetation pulse is controlled by position in the landscape (soil fertility, additional run-on) and is also affected by grazing history. However, the effect of past grazing is often very difficult to determine in spatially complex landscapes receiving seasonally variable rainfall.

Ground-based monitoring systems are now well established in most states. Methods used generally recognize the importance of quantitative data and multivariate analysis techniques. However, the problem remains that point-based assessments are labour intensive and widely spaced. They often have difficulty in separating human-induced change from background natural processes (Pickup, 1989).

A satellite-based approach to land assessment utilises the advantages of repetitive and complete data coverage for areas of interest. Procedures are now available for the rapid processing of digital data to provide an index of vegetation cover (Pickup et al. 1992). The results of spatial and temporal analyses that have allowed grazing impact to be determined from Landsat MSS data over large areas are described in this poster.

GRAZING GRADIENTS

Grazing pressure is focused on the watering point in most arid zone paddocks. Vegetation cover typically increases away from water as trampling and grazing effects decrease producing a 'grazing gradient' (Pickup 1989). Cattle also display a preference for communities with palatable species and the different vegetation types within a paddock can have markedly different cover levels with distance from water. Vegetation cover increases after rain and the extent to which the grazing gradient disappears across an entire vegetation type after very good rains provides an assessment of land degradation (Pickup and Chewings, 1992).

METHODS

65000 sq km of the southern Alice Springs district located under Landsat path 102 were examined using the grazing gradient method. Data were acquired for a dry period (February 1988) and following good rains (June 1988 and May 1989) of up to 350 mm. These data were radiometrically standardised and geometrically rectified before being used to compute seasonal indices of vegetation cover. Spatial information including land system boundaries and the locations of 3500 km of fencing and 420 waters were digitised and merged with the multitemporal vegetation indices in a geographic information system. Average dry and wet period vegetation cover at increasing distance from water was then calculated for 25 of the more extensive land systems within 220 'paddocks' across the region. This required approximately 1000 separate analyses. Paddocks ranged in area from <10 sq km to >3000 sq km.

RESULTS

The contrasting behaviour of highly preferred and 'desert' type country is summarised below. Alluvial plains adjacent to the Todd River and other major creeks in the northern part of the analysis region have a distinct dry-period cover gradient (**Fig.** 1a). On average, insignificant vegetation recovery occurred across the 700 sq km of Todd land system following approximately 200 mm of rain in March 1988. Cover levels diminish at the watered extremity of the land system due to the more open nature of small, and isolated, clumps of this country. In contrast, spinifex sandplains are generally avoided by cattle and there is minimal grazing impact across the 2800 sq km of Singleton land system (**Fig. 1b**).

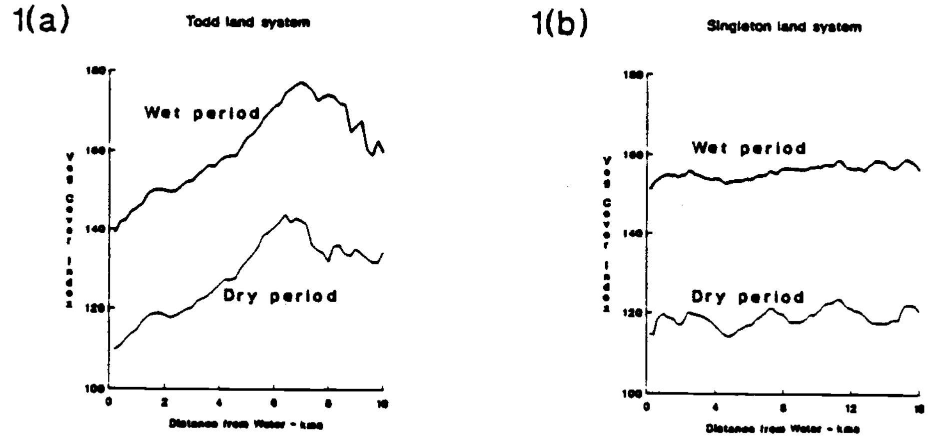

Figure 1. Average wet- and dry-period cover levels for Todd l.s. (1a) and Singleton l.s. (1b) at increasing distance from water. February 1988 MSS data was used to estimate dry-period cover while wet-period cover is derived from June 1998 MSS data.

Reduced perennial grass cover, increased run-off and past soil erosion contribute to the lack of cover response following rain on Todd l.s. The sandy soils of Singleton l.s. retain good infiltration and the generally unpalatable grass and forb species grow well after rain.

The presence of grazing gradients in satellite data is verified by ground truthing. Intensive sampling with the wheel point apparatus at one bore on Todd l.s. has revealed a distinct gradient of increasing herbage and litter cover with distance from water. Highly significant correlations (R^2>0.65) exist between this data and the contemporary satellite-derived vegetation cover index.

DISCUSSION

The grazing gradient method has allowed us to characterise past grazing effects over the entire analysis region in a rapid (<2 years), objective and consistent manner. The results show that those land systems which are highly preferred by cattle have the most persistent wet-period grazing gradients. This indicates that vegetation recovery is retarded by past grazing practices. Future analyses can be rapidly conducted in an identical manner by updating the multitemporal satellite data base.

REFERENCES

Pickup, G. 1989. New land degradation survey techniques for arid Australia - problems and prospects. *Aust. Rangel. J.* 11:74-82.

Pickup, G., Chewings, V.H. and Nelson, D.J. 1992. Estimating changes in vegetation cover over time in arid rangelands using MSS data. Submitted to Remote Sensing of Environment.

Pickup, G. and Chewings, V.H. 1992. A grazing gradient approach to land degradation assessment in arid areas from remotely sensed data. Submitted to *Int. J. Remote Sensing.*