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OPTIONS FOR IMPROVING GRAZING DISTRIBUTION IN SAVANNA RANGELANDS

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ABSTRACT

Cattle distribution data from GPS collars, and spatial patterns of defoliation and pasture productivity are being used to compare the effectiveness of reducing paddock size to that of installing additional water points in large paddocks, to spread grazing pressure more evenly across the landscape. Uneven grazing distribution is a common problem in extensive savanna rangelands, causing poor overall forage utilisation, localised areas of very heavy use, and rendering many grazing management practices ineffective. Achieving more even landscape use is seen as an integral part of sustainably increasing livestock production. Early results indicate that smaller paddocks are more effective in achieving greater use of the landscape as a whole. However, within smaller paddocks, preferred areas remain the focus of much grazing activity, highlighting the need for additional ways of minimising these grazing impacts.

INTRODUCTION

Uneven grazing of the landscape by cattle is a familiar problem in the tropical savannas of northern Australia. This patchy use results in poor overall forage utilisation and the development of localised areas of very heavy use. Cattle consume only an estimated 10% of annual forage production on many properties (S. Petty, unpublished data), with this mostly being obtained from limited areas that are heavily grazed. Since utilisation rates of between 20 and 30% are considered sustainable (McIvor and Gardener 1995) many pastoralists view this ineffective use of forage resources as a loss to the grazing enterprise. In those areas that are heavily used, palatable perennial grasses are lost and the area of bare soil and rate of soil erosion increase. Uneven grazing also reduces the effectiveness of the grazing management practices commonly considered necessary for achieving ecological and economic sustainability such as conservative stocking rates and grazing systems that involve periods of rest, because they are subject to localised overuse by livestock within large paddocks in many rangeland systems (e.g. Hunt 2001).

Improving the evenness of grazing across the landscape is regarded as a key element of pastoral intensification in northern Australia and potentially offers two main benefits. Firstly, it is expected to produce more effective use of pasture resources, and is thus seen as a key option for attaining greater productivity. Secondly, minimising the area within paddocks subject to heavy use is regarded as an important element of ecologically sustainable grazing management.

Cattle use the landscape unevenly in part because of the extensive and relatively undeveloped nature (in terms of subdivisional fencing and water-points) of cattle enterprises in northern Australia. Because cattle need to return to water regularly their grazing range is limited, and their preference for particular landscape elements such as areas with preferred plant species means they will not necessarily use all areas within large paddocks. Reducing paddock size or, alternatively, installing additional water points in large paddocks are two potential options available to pastoralists for managing grazing distribution. However, many biotic and abiotic factors influence the way cattle use landscapes (Stuth 1991) and may limit the effectiveness of these two approaches.

This paper presents preliminary results from a project that is investigating the effectiveness of these two approaches for achieving more even grazing, and whether there are benefits to livestock production and ecological sustainability from more even use. This work is being conducted as part of the Pigeon Hole Project, a major grazing study on Pigeon Hole Station in the Victoria River Downs district of the Northern Territory. The study began in mid 2003.

METHODS

Pigeon Hole Station is located towards the southern drier (approx. 600 mm p.a.) limit of the tropical tall-grass savannas. The study area is part of the Wave Hill land-system, comprised of gently undulating deep cracking black clay soil intersected by occasional creek lines (usually dry), and is only sparsely wooded. The ground layer vegetation is a mix of perennial grasses (e.g. *Astrebla*, *Chrysopogon* and *Aristida* spp.), annual grasses (e.g. *Iseilema* spp.) and perennial and annual forbs.

Three paddocks are included in this part of the study, and these represent substantially different configurations to usual industry practice. The largest paddock is approximately 57 sq. km with five water points. This is about half the size with roughly twice the number of waters of most commercial paddocks in the region. Another study paddock is 34 sq. km with two waters, and the smallest paddock is 9 sq. km with a single central water point. This paddock and water point configuration was established just prior to the study commencing, although the land was within larger paddocks subject to grazing before the study.

Use of the landscape within these paddocks by cattle (breeding cows) is being monitored using cattle collars fitted with global position systems (GPS), and on-ground assessment of pasture defoliation. Impacts on pasture composition, patchiness and productivity and livestock production are also being assessed. At this early stage no consistent differences are apparent in pasture or livestock productivity variables between the paddocks so these data are not presented. Data from the GPS collars are the basis of the results presented here. Since the results are preliminary, and the study is ongoing, some points are illustrated with single examples, but these are more broadly representative of the results to date.

GPS collars were fitted to 2-4 cattle per paddock for periods of six months (i.e. for each dry and wet season) over the last 2 years. The collars store a GPS fix every hour and record lateral and vertical head movements to enable discernment of grazing, travelling and resting activities at each fix (although the results presented include all activities). At each biannual muster the data is downloaded and the collars are redeployed on different cows. Cows are selected randomly within the limits of the station manager's preferred pregnancy status and body condition score for cows for that time of year. Cows are returned to the same paddocks from which they came.

RESULTS

We compared the home range of collared cows with the area nominally available to them within a paddock (i.e. paddock size) to provide a coarse measure of the effectiveness of their use of the landscape. Home range is the area used by an animal as it goes about its usual activities of grazing, watering, resting and so on. We estimated home range for each collared cow for each period using the 95% minimum convex polygon method.

Cattle home ranges more closely matched paddock size in smaller paddocks than in larger ones with relatively even water distribution (Fig. 1), suggesting that smaller paddocks are more likely to improve the effectiveness of landscape use as a whole. However in larger paddocks, because some cattle use different areas to others, landscape use is more effective than the individual home ranges suggest. Nevertheless, small paddocks appear to be more effective in increasing livestock access to pasture resources because cattle are forced to use more of the landscape.

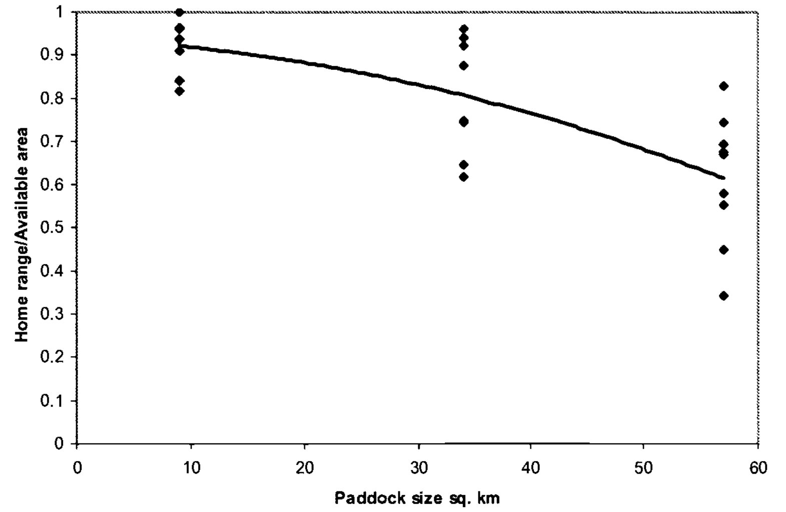

Figure 1: The effectiveness of landscape use by cattle for three paddock size/water point configurations

Effectiveness is determined as the ratio of individual home range to paddock area. See text for paddock details. Each point represents one cow for a six-month period.

However an inspection of the GPS data for individual cattle reveals that, while there is a good general spread of activity within small paddocks, areas of concentrated use do occur (see Figure 2 for an example). Not surprisingly, water points are a focus for cattle in our study, but of greater importance is the tendency for cattle to show preference for other areas, such as riparian zones and areas of red and intermediate soil within the broader matrix of black soil. As a result, the objective of reducing the incidence of concentrations of grazing use by reducing paddock size is not achieved as effectively as anticipated. It should be noted that use of riparian areas and intermediate soils has decreased, and for other areas it has increased, as the study has progressed. Work is continuing to better understand these observations.

DISCUSSION

These preliminary results suggest that, while more even and therefore more effective use of the landscape as a whole can result from subdivision of the landscape compared with installing additional waters in large paddocks, uneven use can still occur within smaller paddocks. This might result in adverse impacts on those areas that experience higher grazing pressures. Additional management action appears necessary to minimise these impacts.

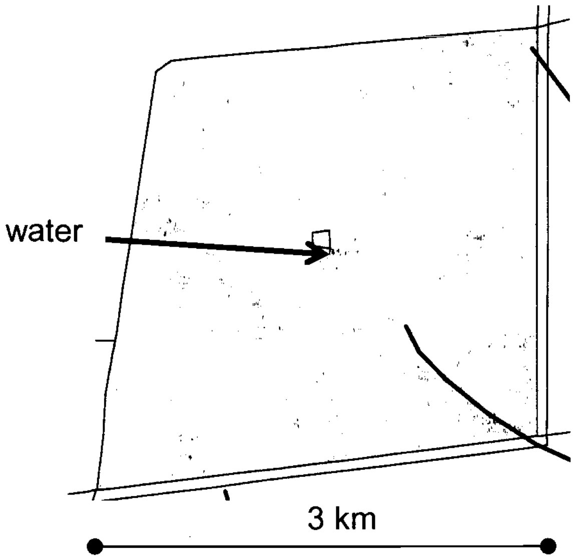

Figure 2: An example of use of the smallest paddock by one cow over six months

Each dot represents an hourly GPS fix. Riparian areas are indicated by heavy lines. Activity is concentrated in a riparian area in the south east and on red and intermediate soils elsewhere.

Other management options for improving grazing distribution within smaller paddocks could include the use of fire to remove preferred patches or attract cattle to less preferred areas (Andrew 1986), or perhaps using behavioural principles to alter cattle behaviour. Regular monitoring of grazing impacts and appropriate management responses are also crucial.

Whether land condition and livestock production benefit from smaller paddocks and more waters remains unclear. One question of interest is whether larger paddocks that have good water distribution offer production advantages over smaller paddocks because cattle can select a higher quality diet. Furthermore, we will need to establish whether any improvement in production and associated financial returns outweigh the costs of the additional infrastructure required. Answers to these questions should become clearer as the study progresses.

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