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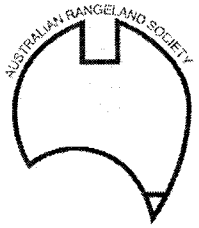

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IS THERE POTENTIAL FOR IMPROVED PRODUCTION IN SAVANNA RANGELANDS: LESSONS FROM A FOURTEEN YEAR GRAZING TRIAL AT MT SANFORD, VICTORIA RIVER DISTRICT

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ABSTRACT

A grazing trial begun in the Victoria River District (VRD) in 1993 aimed to determine sustainable management strategies and stocking rates that were optimal in terms of both ecology and economics. Stocking rates between 5-15 breeders/km^2 (average pasture utilisation rates of 6-20%) were chosen based on best knowledge of sustainable rates. Results from the first eight years suggested that even the highest stocking rates tested were sustainable. In 2001 the trial was modified to test set utilisation/variable stocking rates and included even higher utilisation rates than the first trial, with rates tested ranging from 12-45%. Results since 2001 suggest that utilisation rates up to 24% are sustainable with smaller, more evenly watered (and hence grazed) paddocks. This has major implications for the number of cattle that can potentially be carried in northern Australia and may have profound effects on regional development.

INTRODUCTION

A 1997 survey in the VRD of 134 paddocks found paddock stocking rates averaged 11 AE/km^2 ranging from 5-35 AE/km^2 (Dyer et al. 2003). 40% of paddocks were stocked less than 10 AE/km^2. Based on modelled pasture growth, 11AE/km^2 is equivalent to 25% utilisation on red and 15% utilisation on black soils in a median rainfall year (Dyer et al. 2003). At the time of the survey however, this represented utilisation rates of just 13% on black soil or 21% utilisation on red soil (Dyer at al. 2003).

However, while average utilisation rates were low to moderate, paddock sizes are large and 40% of the VRD is greater than 4km from water (Fisher 2001), resulting in areas close to water being overgrazed, while far from water utilisation is very low. Cattle producers in the region recognise the potential for further development and in a recent survey of cattle producers in the Katherine region (Oxley 2006), producers estimated that carrying capacity could be increased by 25% in the next five years and 42% in the next 10 years with current development plans, with 80% of producers having immediate plans to develop further water points and subdivide paddocks.

This paper presents results from a long term grazing trial at Mt Sanford. Prior to this study there was little local information on sustainable carrying capacity of the region. This study will provide objective estimates of sustainable utilisation, and facilitate infrastructure development based on realistic production capacity estimates, which will hopefully avoid the over-development of the rangeland that has occurred in the eastern savannas (Stokes 2004).

METHODS

The trial was at Mt. Sanford Station, approximately 500km south west of Katherine, in an open savanna dominated by (in order of yield) *Astrebla spp.* (19%), *Aristida latifolia* (18%), *Iseilema spp.* (12%), *Chrysopogon fallax* (11%) and *Dichanthium spp.* (11%) on basalt derived black cracking clay soils. The paddocks ranged in size from 4-8km^2 and were roughly square or rectangular in shape.

May 1993 - May 2000

Six paddocks were set stocked with 54 cows, 10-13 steers, 2 bulls and associated calves. Stocking rates varied from 5-15 head/km^2 depending on paddock size. Utilisation rates varied seasonally with pasture growth and averaged 7-20%.

October 2000 – October 2005

Following the first eight years of the trial, treatments were changed to set utilisation and variable stocking. Animal numbers were adjusted each May to achieve a constant utilisation rate (the proportion of the pasture that grows each year that is consumed by cattle). The lowest utilisation treatments (average of 6-7%) were abandoned and higher utilisation rates (35 and 45%) added. Planned (and actual average adjusted utilisation rates) were 12(13)%, 16(19)%, 22(24)%, 28(31)%, 35(41)% and 45(49)%. A late wet in 2002/2003 meant that actual utilisation was much higher than aimed for, which increased the average utilisation over the trial.

Pasture was assessed for percent bare ground, total standing dry matter and percent composition of the top four species contributing to yield at the end of the wet season in April/early May and the end of dry season in October each year, except where access was not possible due to rain, with 12 datasets from 1994 to 2000 and 11 datasets from 2001-2006.

Statistical analysis

Each utilisation treatment was usually represented by a single paddock. Hence variables could vary significantly between paddocks as a result of inherent paddock differences. For this reason, it is the effect of utilisation treatment on change through time that was often of interest as a way of differentiating utilisation effects. This was detected through repeated measures ANOVA, time x utilisation interactions of April/May datasets.

RESULTS

From 1994 – 2000, only one year had below average rainfall (1997/98) with four years in the top 20%, and one year in the top 30%. Rainfall was median to above average from 2001-2006, although the 2002/2003 growing season was very short and hence poor, with no substantial rainfall until the second half of the wet season.

Most variables varied significantly through time, following seasonal fluctuations (Table 1). From 1994 to 2000 utilisation had no discernable negative effect on land condition. From 2001 to 2006 there was beginning to be some indication that utilisation levels above 30% are leading to reduced land condition.

Percent bare ground was higher with higher utilisation from 1994 through to 2006. From 1994 to 2000, average % bare ground at the end of the wet season ranged from 16-23%, and 28-43% at the end of the dry season (at 7 and 20% utilisation respectively). From 2001-2006, the proportion of bare ground in May and October increased up to 31% utilisation (at 26% and 56% bare ground respectively), but did not increase with higher utilisation.

Table 1: Effect of utilisation treatment and time on land condition indices and plant composition in May from 1994 to 2006 at Mt Sanford. Repeated Measures ANOVA. P< .05, **P<.01, *** P<.001. * ln (x+1) transformation applied to the dependent variable

Variable	Utilisation (7-20%)	Time 1994-2000	Time * utilisation interaction	Utilisation (13-49%)	Time 2001-2006	Time * utilisation interaction
% Bare ground	*	***	**	*	***	***
Total standing dry matter		***	***		***	***
Aristida latifolia yield	**	***	***		***	***
Astrebla spp. yield	**	***	**	**	***	***
Brachyachne convergens yield*		***	***	**	***	***
Chrysopogon fallax yield		***	***		***	
Iseilema spp. yield *	***	***	***	***	***	***
*Panicum decompositum**		***			***	**

Total standing dry matter did not significantly vary between utilisation levels from May 1994-2006. However, it was significantly negatively correlated with utilisation in May 2002, 2003, 2004 and 2006 (Spearman's correlation -.43***, -.30*, -.39** and -.27* respectively), but this represented recent grazing as growth estimates were not influenced by utilisation rate.

From 1994 to 2000 *Astrebla spp.* yield was significantly higher at the highest utilisation level of 20%, increasing more through time, while in the two lowest utilisation treatments *Astrebla spp.* started out highest, but decreased through time. From 2001-2006, *Astrebla spp.* yield through time varied with utilisation treatment; increasing at 13%, highest and fluctuating at 24 & 31% and relatively low and flat at 19, 41 and 49%. *Panicum decompositum* yield decreased more through time in 41 and 49% utilisation from 2001-2006. Other palatable dominants at the site, *Dichanthium* species showed no response to utilisation level.

Chrysopogon fallax yield increased through time at 20% from 1994-2000, while fluctuating at lower utilisation levels and its trend through time did not vary between utilisation treatments from 2001-2006.

From 1994-2000 *Aristida latifolia* yield was significantly higher through time at the 16% utilisation level than at 20%, which varied little through time. From 2001-2006, there was no utilisation treatment effects on *Aristida latifolia*. Time utilisation interactions were not indicative of *Aristida* increasing more at higher utilisation levels.

Iseilema spp. yield was highest and varied more inter-annually at 12% utilisation from 1994-2000, and 13% utilisation from 2001-2006 (both in the same paddock). *Brachyachne convergens* yield decreased most through time from 1994-2000 at 12% utilisation and was lowest and fluctuated least from 2000-2006 in 13% utilisation (the same paddock).

DISCUSSION

There was no evidence of declining land condition under utilisation levels ranging from 7-20% from 1994 to 2000. In contrast to this, the palatable *Astrebla spp.* yield *increased*

through time at 20% utilisation, when they are known decreasers under heavy grazing (Fisher 2001). Additionally cover levels at 20% utilisation were within current recommended levels of more than 50% ground cover (Chilcott *et al.* 2004). This is perhaps not surprising given that 30% utilisation of Mitchell grass vegetation types in Queensland is considered 'moderate' grazing pressure (Fisher 2001).

From 2001-2006, there was some evidence that the highest utilisation levels of utilisation may not be sustainable, with negative impacts on the palatable *Panicum decompositum* at 41-49% utilisation. The higher levels of the decreaser *Astrebla spp.* at intermediate utilisation rates of 24-31% suggests these are sustainable levels. However at 31-49% utilisation cover levels leading into the wet season were less than 50%, which is below that recommended for sustainable land use (Chilcott et al. 2004). The higher incidence of palatable *Iseilema spp.* combined with a lower incidence of increaser *Brachyachne convergens* in the lowest utilisation treatment, are typical grazing responses found elsewhere (eg. Fisher 2001).

CONCLUSIONS

Fourteen years of grazing across a variety of seasons have demonstrated that land condition can be maintained at levels of utilisation around 24%, and potentially up to 31% utilisation which is considerably higher than the industry average of 20% and is consistent with producer plans to increase production by 25% in the region in the next five years. However, this higher utilisation rate may not be applicable to red soils. It is also contingent upon appropriate infrastructure development and more intensive management systems to manage the increased risk associated with more closely following seasonal potential.

ACKNOWLEDGEMENTS

Thanks to Heytesbury Beef for their ongoing support and collaboration in this research. This Research has been funded by the Natural Heritage Trust, Meat and Livestock Australia, The Northern Territory Government and Heytesbury Beef. Thanks to the many staff of DPIFM who have contributed to this project.

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