Long-term profitability and sustainability of grazing strategies in a tropical savanna in north Queensland

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Abstract

Rainfall variability is a major challenge to sustainable management on rangelands. We present data from a grazing trial in north Queensland on the relative performance of moderate (MSR), heavy (HSR), two variable (VAR and SOI) stocking rates and a rotational spelling (R/Spell) strategy, over a 12-year period. VAR strategy involved adjusting stocking rate according to pasture mass at the end of the wet season and SOI adjustment based on the Southern Oscillation Index and pasture mass. The density of palatable, productive and perennial grasses after 12 years was markedly higher in the MSR and R/Spell than in the VAR and SOI but was by far the lowest in the HSR. Accumulated cash surplus at the end of the 12 years was far lower in the HSR relative to the other strategies. These results directly challenge the assumption that sustainably and profitability are incompatible in rangelands.

Introduction

Rainfall and pasture growth in northern Australia can vary sharply between years, making grazing management difficult. Strategies such as moderate or variable stocking are recommended to manage for this variability (Danckwerts *et al.* 1993) but there is a lack of data on their performance relative to conventional management. In particular, there is a perception that recommended strategies are not profitable and managers need to stock relatively heavily to remain financially viable (Stockwell *et al.* 1991).

The Wambiana trial was initiated in 1997 to objectively compare the performance of different grazing strategies and generate empirical evidence on which to base management decisions. Here we report briefly on the performance of these strategies over the 12-year period between 1998 and 2009.

Methods

The trial is located in *Eucalyptus-Acacia* savanna on 'Wambiana', near Charters Towers, Queensland (O'Reagain *et al.* 2009). Mean annual rainfall is 650 mm (C.V. = 40%), largely concentrated between December and April. Grazing strategies were: (i) *Heavy stocking rate* (HSR) at 4 ha/animal equivalent (AE= 450 kg steer), (ii) *Moderate stocking rate* (MSR) at 8 ha/AE, (iii) *Rotational wet-season spelling* (R/Spell) in a 3-paddock system at 6 ha/AE, (iv) *Variable stocking* (VAR) – stocking rates adjusted according to pasture mass at the end of the wet season (range: 4-12 ha/AE) and (iv) a *Southern Oscillation Index (SOI*) - *Variable strategy,* stocking rates adjusted in November based on the SOI and pasture mass (range: 4-12 ha/AE). Treatments are replicated twice and paddocks are about 100 ha in size (O'Reagain *et al* 2008).

Paddocks are stocked with Brahman-cross steers; these arrived at 18 months of age and stayed on the trail for two years (see O'Reagain *et al.* 2009). Animals were weighed at the start and end of the grazing year (May/June). Steers were supplemented with wet-season P and dry season urea. Molasses and urea drought feeding was provided to the HSR in some drier years due to extremely low pasture mass (<300 kg/ha). Accumulated cash surplus (ACS) was calculated from the annual value of beef produced minus variable and interest (7.5%) costs. 3-P grass (palatable, productive and perennial) densities were measured annually (2006-2009) in the late wet season on permanent monitoring sites.

Results and Discussion

Rainfall and stocking rate

The first four years of the trial were relatively wet but these were followed by six years of poorly distributed, below average rainfall (Fig. 1a). Rainfall in the last 2 years was however, very good and well above average. Stocking rates in the VAR and SOI were initially high but were reduced sharply after 2001 as rainfall declined. In the R/Spell, stocking rates had to be reduced in 2003 due to an ill-timed fire and drought. HSR stocking rates had to be cut by 30 % in May 2005 due to reduced carrying capacity in these paddocks. In contrast, MSR stocking rates remained relatively constant throughout the trial period.

Animal production

Average live weight gain (LWG) per animal over 12 years was highest in the MSR (113 kg) followed by the VAR (106 kg), R/Spell (104 kg) and SOI (103 kg), but was by far the lowest in the HSR (86 kg). Moderately stocked steers generally finished heavier, in better condition and received a price premium ($0.10 - 0.20/kg) at the meatworks, particularly in drier years. Exceptions to this occurred in 2007/08 and 2008/09: here very good seasons and a reduced stocking rate in the HSR gave similar or marginally higher LWGs than in the MSR.
Average LWG per unit area (LWG/ha) was greatest in the HSR (21 kg/ha) but this strategy was subsidised by drought feeding in four of the 12 years. LWG/ha was lowest in the MSR (14 kg/ha), followed by the R/Spell (16 kg/ha), SOI (17 kg/ha) and VAR (18 kg/ha).

Economic performance

Accumulated cash surplus (ACS) in the HSR increased rapidly in the initial, wet years (Fig. 1a) but declined steadily in drier years due to drought feeding costs, interest on livestock capital and lower product value. In the MSR in contrast, ACS increased consistently across all years due to low costs and a high product value.

ACS also increased rapidly in the heavily stocked VAR and SOI strategies in the early wet years but these initial gains were eroded by losses from reduced LWG and the forced sale of poor condition cattle in the change to dry years in 2001/02. Nevertheless, in contrast to the HSR, this sharp cut in stocking rates allowed ACS to recover in subsequent years.

After 12 years, accumulated cash surplus (ACS) was highest in the VAR and MSR followed by the R/Spell and SOI strategies. ACS was by far the lowest in the HSR. Averaged over all years this difference is between \$6 and \$9 per ha/year. Scaling up to an average north Queensland property of 20 000 ha, this equates to a gross income advantage of the other strategies over the HSR of about \$2 million over 12 years.

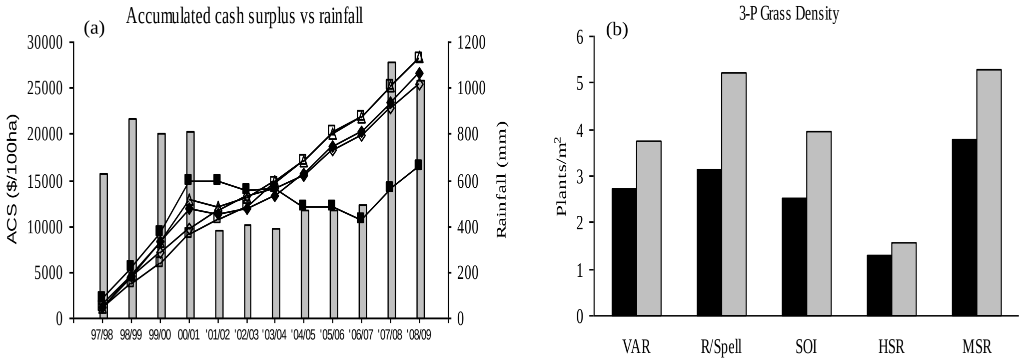

Fig. 1. (a) Annual rainfall (bars) and accumulated cash surplus (ACS) over 12 years for the VAR (△), (R/Spell (◇), SOI(◆), HSR (■) and MSR (□) strategies. (b) 3-P grass density in different strategies in 2006 and 2009

3-P tussock density

After 12 years, the density of 3-P grasses such as *Bothriochloa ewartiana, Dicanthium sericeum* and *Heteropogon contortus* were markedly higher in the MSR and R/Spell than in the VAR and SOI (Fig. 1b). Tussock densities were by far the lowest in the HSR. The slightly lower 3-P densities in the VAR and SOI reflect the earlier impact of high pasture utilisation rates in these strategies leading into the 2002/03 drought (O'Reagain *et al.* 2009).

The change in 3-P densities from 2006 to 2009 is also noteworthy. With good rainfall, 3-P densities increased from 2006 to 2009 in all treatments, except the HSR. This is despite the reduced stocking rate in the HSR since May 2005. The relatively poor response in the HSR indicates that the increased pasture cover and mass observed in this strategy in recent, wet years is largely cosmetic and is unlikely to be sustained in drier years.

Conclusions

Our results give clear evidence of the profitability and relative sustainability of recommended strategies such as moderate relative to heavy stocking. The results need to be extrapolated to the breeder and enterprise level and across a range of rainfall scenarios but provide key evidence to challenge the perception that recommended strategies are unprofitable. Based on these results and general learnings from the Wambiana trial we suggest a combination of 'constrained' flexible stocking within limits set by long-term carrying capacity as well as wet season spelling for sustainable and profitable management. This strategy and others will be tested in the next phase of the Wambiana project starting in late 2010.

Acknowledgements

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