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TRANSITIONS BETWEEN VEGETATION STATES IN TROPICAL TALLGRASS: FALLING OVER CLIFFS AND SLOWLY CLIMBING BACK

A.J. Ash[1], *J.R. Brown*[1] *and D.C. Cowan*[2]

[1]CSIRO, Division of Tropical Crops and Pastures, PMB, Aitkenvale Qld 4814
[2]QDPI, PO Box 183, Charters Towers Qld 4820

ABSTRACT

Two states of herbaceous vegetation, one dominated by palatable perennial grasses (SI) and the second by less palatable perennial grasses and annual species (SII), were subjected to different levels of utilisation by cattle at two sites in the tallgrass region of northern Queensland. Trends in basal area and percentage of perennial grasses were not linear: SI pastures were initially resistant to change in response to high levels of utilisation while SII pastures started to recover quickly once utilisation was relaxed or removed. A non-linear model of perennial grass change is described.

INTRODUCTION

The tropical tallgrass rangelands occur across northern Australia from the Kimberley region of Western Australia to the central coast of Queensland. The vegetation is an open eucalypt woodland with an herbaceous understorey of perennial tussock grasses. Increasing grazing pressure, particularly in the last three decades, has resulted in a significant loss of perennial grasses, especially in the north-east (Tothill and Gillies 1992). Changes in vegetation composition have been described using state and transition models (Ash *et al.* 1994) and the Meat Research Corporation has adopted this model as a conceptual and working framework for its sustainability projects in northern Australia. This paper describes one of these projects which aims to quantify the management actions necessary to shift botanical composition from undesirable vegetation states to desirable ones and *vice versa*.

MATERIALS AND METHODS

Grazing sites have been established on three important land types in the Charters Towers region of north-east Queensland; low fertility earth soils, moderate fertility neutral red duplexes, and high fertility euchrozems. Two of the sites (Hillgrove/Eumara Springs and Cardigan) were established in 1992 and the Lakeview/Allan Hills site was established in 1994. At each site fence-line contrasts were chosen where land on one side was dominated by palatable perennial grasses (SI) while across the fence-line higher historical grazing pressure had resulted in the dominance of less palatable perennial and annual grasses (SII). On each vegetation state different rates of utilisation, ranging from 25 to 75% of annual net primary productivity, have been implemented to form a suite of treatment plots.

RESULTS AND DISCUSSION

Rainfall in each of the years from 1992 to 1995 was between 50 and 60% of long-term average rainfall at all three sites. Basal area and the percentage of perennial grasses for the Hillgrove and Cardigan sites at the end of the 1995 growing season, three years after grazing commenced, is shown in Table 1. Under high levels of utilisation (75%) basal area and perennial grass percentage declined significantly in State I, but the majority of this decrease occurred in the third year. Thus there was some resistance to change in the pasture. Zero or light (25%) utilisation in SII resulted in a significant recovery in basal area (initial basal areas in SII were 25-30% of those in SI) and the percentage of perennial grasses. In contrast, high levels of utilisation in SII surprisingly did not cause a rapid loss of the remaining perennial grasses, but only a gradual decline.

Figure 1 shows a conceptual model that might best describe these changes in perennial grass composition under grazing. In pasture with a high basal area of perennial grasses there is an initial *resistant* stage (A) where little change occurs, even with high levels of utilisation. Land managed to be in this condition will tolerate one or two drought years where utilisation is likely to be high without having its capacity for post-drought recovery significantly impaired. The next stage (B) is *responsive*, where continued heavy grazing pressure will result in a rapid decline in perennial grasses. Alternatively, perennial grasses can recover quite quickly if utilisation is light. This stage is the most critical for management because of the speed of change. The third stage (C) is *ruination*, where high levels of utilisation, which are easier to achieve as the pasture is much less productive with a low basal area (McIvor *et al.* 1995), will deplete the perennial grasses further. The decline is not as rapid as in the responsive stage, possibly because the remaining perennial grasses are in resource rich areas and are more resilient, and/or as the perennial grasses decline to very low levels selectivity for them by animals may decrease as the cost/benefit ratio of searching and harvesting them rises. While the loss of the remaining perennial grasses maybe a relatively slow process it is likely that recovery will be equally slow, or even slower, if soil surface condition has declined to such a level that recolonisation by perennials is difficult. The last stage (D) is *rehabilitation/repossession*, where the perennial grasses become locally extinct and the risk of severe soil degradation is high. Economic returns will be low and highly variable, placing the enterprise at financial risk. Further studies are required to validate this model and to better quantify the shape of the relationship under different conditions.

Table 1. Influence of utilisation rate (UR) on basal area (BA) and percentage composition of perennial grasses (PG) after 3 years of grazing.

UR	Cardigan		Hillgrove	
	BA (%)	PG (%)	BA(%)	PG(%)
State I				
25%	1.4	95	0.7	89
50%	1.0	92	0.8	91
75%	0.7	48	0.4	79
State II				
0%	0.8	81	0.4	70
25%	0.7	70	0.3	47
50%	0.4	37	0.2	30
75%	0.4	28	0.2	27

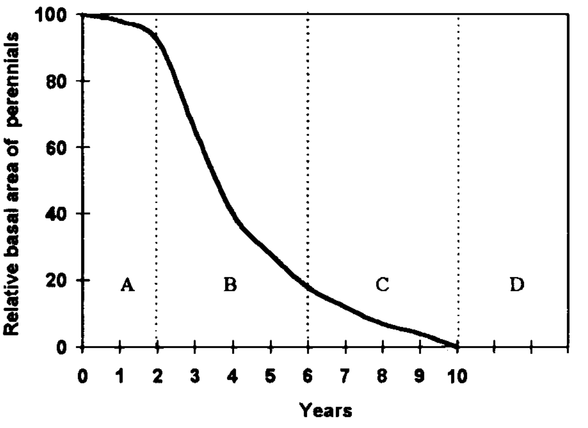

Figure 1. Conceptual model of perennial grass change in tropical tallgrass rangelands.

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