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LONG TERM RESPONSES OF *Astrebla* spp. (MITCHELL GRASS) TUSSOCKS TO RAINFALL IN NORTH-WESTERN QUEENSLAND

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INTRODUCTION

Drought is an ever-present problem for sustainable grazing enterprises in the semi-arid and arid zones of Australia. Little is known of the long-term responses of pastures to drought although some studies, such as that in *Astrebla* spp. (Mitchell grass) grasslands (Everest 1935), have documented a poor short-term response by perennial grasses to severe drought. Despite this, *Astrebla* grasslands are considered to be resilient to moderate grazing during “average” to above average rainfall (Orr 1998). This paper presents data on changes in plant size and survival of *Astrebla* spp. for both the original plants and for three selected cohorts in relation to rainfall between 1984 and 2003 in a grazing study in north-western Queensland. In particular, we report the impacts of the 1987-89 and 2001-03 droughts.

METHODS

An unreplicated grazing study incorporating six levels of annual utilization (0, 10, 20, 30, 50 and 80% of end of summer forage) by sheep commenced in *Astrebla* grassland at “Toorak” Research Station, northwest Queensland in 1984 and remains current in 2004 (Orr and Phelps 2003). Population dynamics of *Astrebla* spp. are monitored annually by charting the position and diameter of the initial tussocks and newly recruited seedlings in permanent quadrats, each 1 x 1 metre, in the 10, 30, 50 and 80% utilisation paddocks.

Individual plant size is determined as the area covered by each plant and is calculated by dividing the basal area per quadrat by the number of individual plants (incorporating the number of segments of these plants) of the different age plants in that quadrat. We demonstrate the impact of the 1987-89 and 2001-03 droughts by presenting data for the initial, mixed age (1984) plants and for plants recruited during the 1986-87, 1988-89 and 1993-94 summers. For the purpose of this paper, we have pooled data for each cohort across the four utilisation treatments.

RESULTS

The mean size of the original *Astrebla* spp. plants at the start of this study in 1984 was 350 sq cm but had declined substantially to be <10 sq cm by 1990 (Figure 1a) due to the 1987-89 drought. This reduction in plant size was associated with a similar reduction in tussock survival (Figure 1c) and there was a clear trend for this decline in tussock survival to be greatest at 80% utilisation (data not presented). After 1990, surviving original tussocks increased in size to be 100 sq cm in 2000 however, the 2001-03 drought again caused a substantial decrease to an overall size of <10 sq cm in 2003. There was evidence of a further small decline in tussock survival between 2001 and 2003.

Seedling recruitment of 1.5, 32.0 and 0.6 seedlings/sq m were recorded in 1987, 1989 and 1994 respectively. Tussocks arising from each of these recruitment events continued to increase in size with increasing age until the severe 2001-03 drought caused a substantial decline in tussock size irrespective of age (Figure 1b). Despite this substantial decline in tussock size, there was some decline in survival for the 1994 cohort but not for either the 1987 or 1989 cohorts (Figure 1d).

DISCUSSION

Our results clearly indicate that drought has impacted on *Astrebla* spp. by substantially reducing plant size for all ages. Despite this, some plants from each cohort persisted throughout the drought. This

ability to persist through drought is consistent with documented long life spans of 23 years for individual *Astrebla* spp. plants (Williams and Roe 1975).

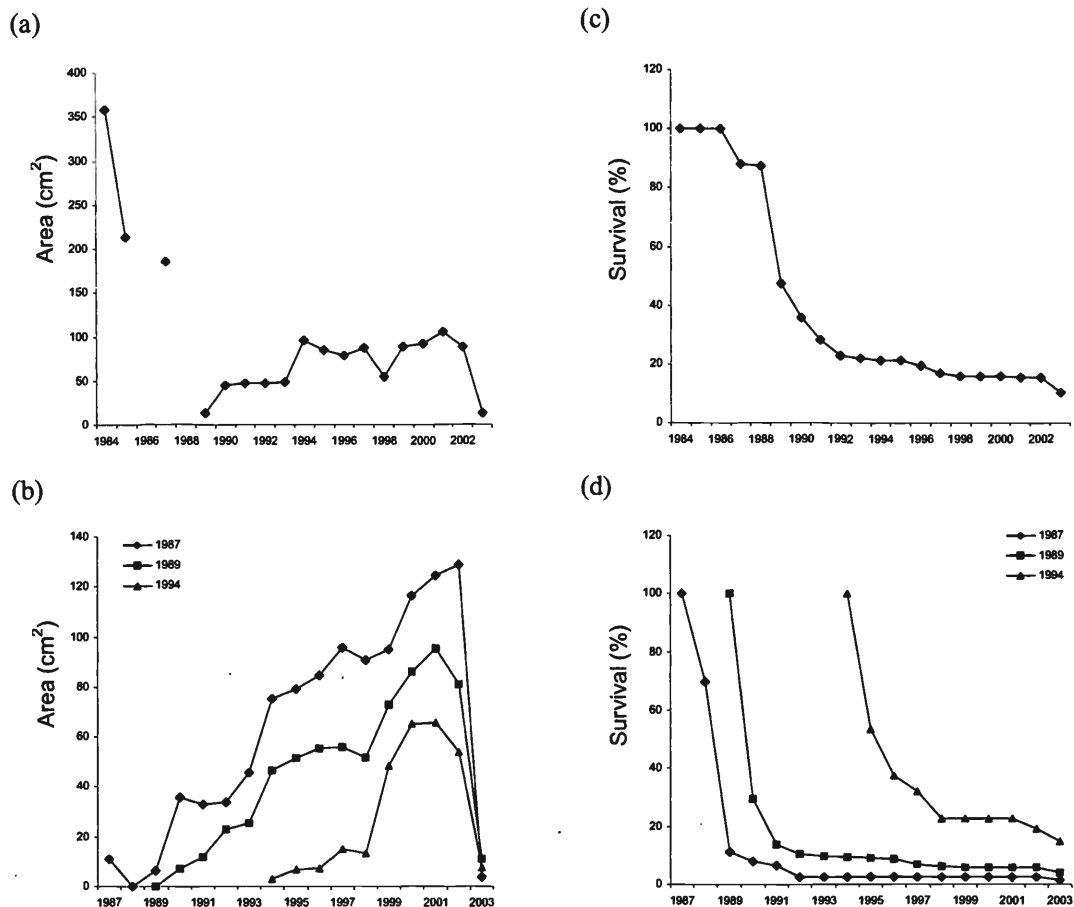


Figure 1. Changes in the size (sq cm) of *Astrebla* spp. tussocks of (a) Original plants, (b) 1987, 1989 and 1994 cohorts and of plant survival (%) of (c) Original plants and (d) 1987, 1989 and 1994 cohorts.

Our results indicate that only small reductions in the survival of *Astrebla* spp. during the 2001-03 drought at Julia Creek conflict with reports of extensive death of *Astrebla* spp. in central western Queensland (J. Milson, *pers. comm.*). These differences possibly reflect a greater severity of drought in the central west compared with our northern site and this may be manifest in higher plant death.

The Toorak grazing study will continue to measure the impact of rainfall and grazing pressure. The continuation of this grazing study will be achieved through new financial support provided by BHP Billiton through their Cannington Mine at nearby McKinlay.

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