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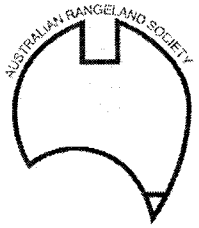

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DEFOLIATION SETS THE DEATH-TRAP FOR GRASSES AND DROUGHT SPRINGS THE TRAP

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Introduction

At pastoral settlement, the semi-arid woodlands appear to have been continuously or near continuously covered with perennial grasses beneath scattered trees and shrubs (Anon 1901). Chance fires and deliberate burning by aboriginal people presumably kept the shrub:grass ratio low. Grazing by itinerant kangaroos is unlikely to have killed grasses. It was attractive grazing land.

There has been unwelcomed loss of perennial grasses from much of these lands as a result of pastoralism. It is well known that repeated, severe defoliation kills most grasses so palatable plants are the most vulnerable (Vallentine 1990). Various grazing systems involving regular rest periods are being promoted as alternatives to continuous grazing. These systems have been developed from theories on how livestock might graze, and are expected to reduce regrazing and promote more uniform defoliation of plant communities.

Norton (1998) critically reviewed knowledge about rotational grazing systems and concluded that there is potential for significantly higher livestock production and sustainability of rangeland plant communities with their implementation. He argued from knowledge about plant responses to grazing that resting from grazing would improve survival of grasses during drought. Agistment of livestock off-property early in droughts is another way of avoiding grass loss and computer simulation (Hodgkinson 1998) of a theoretical Cobar property indicated this was more profitable than continuous grazing if practiced over the last 30 years.

In late 1986, a long-term study of the dynamics of perennial grasses under grazing began at the CSIRO *Lake Mere* research site. The study examined whether there was a drought by grazing interaction and whether survival of grasses could be predicted from rainfall and grazing pressure.

Methods

The *Lake Mere* research site (30^0 16'S, 144^0 54'E) is 204 ha fenced to form 13 paddocks of varying size. In seven of the paddocks stocked with sheep, permanent 1 m^2 quadrats were randomly located in each of 5 landscape zones. Additionally, 35 exclosures, 1 in each zone of each paddock, were set up as ungrazed controls. In each zone of each paddock, 20-25 plants of bandicoot grass (*Thyridolepis mitchelliana*) and other dominant species were sampled. At 2- to 4-monthly intervals the status of each established grass plant, within each of the grazed and ungrazed plots, was assessed by measuring foliage height and survival. Further experimental details are given in Hodgkinson (1994). Analysis of factors important in death loss of grasses was accomplished using logit analysis.

Results and Discussion

The *Lake Mere* data provide a long-term view of plant survival associated with variability in both precipitation and severity of grazing. During periods of adequate soil moisture, as in 1997 to late 1990, death losses were minimal, regardless of the severity of defoliation experienced by individual plants. During drought, which commenced at the end of 1990, death losses increased dramatically, especially for heavily grazed plants. There was a grazed height threshold at about 10 cm, below which mortality rises in a drought. Independent measurements conducted in NSW and Queensland confirmed the relationships.

The data provides a strong argument against the use of continuous or season-long grazing in these wooded rangelands. There are "death-traps", set by grazing and sprung by drought, and these need to be recognised and grazing pressure adjusted downwards early in droughts. Such a strategy may require reductions at these critical times, not only in livestock, but also in large native and feral herbivores. Recruitment of grasses when germinating rains occur should also be improved by resting from grazing (Anderson *et al.* 1996).

The relationships can best be explained by decline in supply of photosynthate to roots by grazing, beyond some threshold level, which may become critical during drying of soil, for survival of the collection of tillers that make up a perennial grass.

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