MANIPULATION OF BOTANICAL COMPOSITION OF NATIVE PASTURES BY GRAZING IN TEMPERATE SOUTH-EAST AUSTRALIA

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ABSTRACT
Historical evidence indicates that substantial changes have occurred in the botanical composition of native pastures in temperate south-east Australia as a result of grazing by sheep and cattle. However, the resulting pastures now appear to be relatively stable and there has been limited success in changing composition experimentally. This paper reports the results of experiments conducted at four locations in south-east Australia designed to increase the proportion of desirable species in native pastures by grazing management.

KEYWORDS
Native, pastures, grazing, botanical, composition, herbage, mass, sheep

INTRODUCTION
Since European settlement in 1788, the native pastures of south-east Australia have been grazed by sheep and cattle. This, together with application of fertiliser, sowing of legumes and, frequently, replacement of pastures with sown species has caused large changes in botanical composition (Whalley and Lodge 1987). In temperate areas, grazing alone has resulted in many of the taller caespitose perennial grasses (eg *Poa, Themeda, Stipa*) being replaced by shorter or rhizomatous species (eg *Danthonia, Microlaena*) (Whalley *et al* 1978). As well, cool-season annual grasses, legumes and weeds have invaded the pastures. In general, such pastures are regarded as having superior production and quality and give higher animal performance than the original pastures (Whalley and Lodge 1987).

While there is historical evidence that these changes have taken place, there has been limited success in duplicating these changes in experimental studies (Whalley and Lodge 1987). One such study (Lodge and Whalley 1985) used grazing and resting periods related to grass phenology to reduce the presence of the undesirable species *Aristida ramosa* and increase *Danthonia linkii* var. *linkii*. However, there is little information available on the use of grazing management to change the composition of native pastures with other species mixes.

The studies reported here were part of the Temperate Pastures Sustainability Key Program conducted throughout the high rainfall zone (600-900mm) of temperate south-east Australia. This program was commenced to determine methods of changing the composition of a number of pasture types in temperate south-east Australia. Within the project there were four sites where grazing management effects on native or naturalised pastures were investigated (Table 1).

METHODS
A communally grazed design was used for the trials, with eight treatments common to all sites and a small number of local treatments. Two replications were used. Grazing treatments were imposed by opening and closing fenced plots (10x20m) located within a paddock which was continuously grazed by dry sheep. Control plots were left open throughout. A range of measurements were made on the pastures, including botanical composition, pasture mass and growth, basal area and frequency and seed banks and seedling recruitment. However, only the botanical composition measurements are reported here. Experiments commenced in September 1993 and pastures were sampled at 6-7 week intervals thereafter until April 1996. At each sampling, the Botanal technique (Tothill *et al* 1992) was used to assess herbage mass and botanical composition in 10 fixed quadrats along a transect in each plot.

RESULTS AND DISCUSSION
Much of south-east Australia was affected by drought during the period of the study, and results at most sites were influenced by this. Stocking rates were reduced at most sites during the drought but, in general, the native pasture sites required less stocking rate adjustment than sites based on introduced species. This demonstrates the stability of native pastures under dry conditions (Noy-Meir and Walker 1986) and reinforces the perception held by farmers that native pastures can be relied upon during drought (Dalglish 1993). The dry conditions also produced less change in perennial grass composition in the native pastures than that found in pastures based on introduced species - total perennial grass content generally remained constant at the native sites (Table 2) whereas it declined at many of the introduced pasture sites.

Treatment effects on botanical composition were also small. At the northern NSW site there was a general change from *Aristida* to *Bothriochloa*, mainly caused by recovery from the drought. A treatment previously designed to reduce *Aristida* (Lodge and Whalley 1985) was not effective during the drought conditions. The *Danthonia/Microlaena* pastures in Central and Southern NSW were generally stable. There was a suggestion that cell grazing at Orange may have increased *Microlaena*, but a similar treatment at Canberra had no effect. *Danthonia* appeared to be decreased at Canberra by resting the pasture from grazing in spring or autumn. However, this may have been a secondary effect as these treatments also significantly increased the amount of *Holcus lanatus* in the pasture. The *Themeda* dominant pasture in Tasmania was also relatively stable. A year-long rest followed by burning appeared to decrease the amount of *Themeda*. This was unexpected, as light grazing is normally regarded as beneficial to *Themeda* (Robinson and Dowling 1976) and *Themeda* is known to be well adapted to burning. However, this result may have been an artefact of the treatment as, following burning and opening up to grazing, sheep maintained the pasture in a shorter condition than on the control plots which had been continuously grazed.

These results demonstrate the stability of native pastures under grazing, even during drought conditions. Treatments to alter botanical composition may need to be more extreme, and be applied for a longer periods, than those used in these experiments. Studies of plant phenology and population dynamics of the species comprising the pastures may be required to effectively design treatments to cause rapid change.

ACKNOWLEDGMENT
Funding for this work was provided by the Australian Meat Research Corporation through the Temperate Pastures Sustainability Key Program.

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Table 1
Details of native pasture sites used in grazing management studies

Location	Annual Rainfall	Previous fertiliser	Pasture type	Major genera
Tamworth, Northern New South Wales	650mm	Limited	Unsown	*Aristida, Bothriochloa*
Orange, Central New South Wales	700mm	Moderate	Previously sown to introduced species	*Microlaena, Danthonia*
Canberra, Southern New South Wales	700mm	Limited	Unsown	*Danthonia, Microlaena*
Nile, Northern Tasmania	530mm	Nil	Unsown	*Themeda, Danthonia*

Table 2
Changes in major perennial grass components as a percentage of total herbage mass in continuously grazed pastures, Autumn 1994-Autumn 1996

	Aristida	*Bothriochloa*	*Microlaena*	*Danthonia*	*Themeda*
Tamworth, Northern New South Wales	Decrease 40%-20%	Increase 40%-80%			
Orange, Central New South Wales			Increase 35%-45%3	Increase 5%-40%	
Canberra, Southern New South Wales			Constant 25%	Constant 60%	
Nile, Northern Tasmania				Constant 20%	Increase 55%-60%