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The role of grazing management in the functioning of pasture ecosystems

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Declaration

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.

[redacted]

Judi Earl
February 1998

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Abstract

This thesis reports what is thought to be the first scientific analysis of the comparative effects of cell grazing and continuous grazing on botanical composition and soil physical properties undertaken in Australia. Vegetation change in grasslands is a dynamic process and involves both the recruitment of individuals from the seed bank and the loss of individuals and species from the community through mortality. Recruitment from the seed bank at two of the sites studied far exceeded most previous reports. At both sites small-seeded species dominated the seed bank, and there was a poor relationship between the composition of the seed bank and the existing vegetation. The findings indicated that there was a high potential for regression of the botanical composition to rushes and annual dicots if inappropriate management practices were imposed or extended periods of stress were experienced. Perennial grasses comprised only 26% and 16% of the seedling recruitment from soil cores collected from the two sites respectively.

The frequency of defoliation is one of the main factors affecting the productivity and persistence of perennial grasses. A pot experiment was undertaken over a 13 month period to determine the effect of defoliation at 2, 4 and 8 week intervals, or no defoliation, on the production of key indicator species from each site. As the defoliation interval was increased from 2 to 8 weeks above and below-ground biomass of the native grasses *Eragrostis leptostachya*, *Stipa scabra*, *Bothriochloa macra*, *Poa sieberiana* and *Sporobolus creber* increased to a greater extent than the biomass of the introduced species *Phalaris aquatica*. Defoliation at 2 week intervals had significant negative effects on both the herbage production and root biomass of all species tested. A vigorous root system is not only important for the survival of perennial grasses but also has implications for soil structure, providing an important source of below-ground organic matter.

Field trials were undertaken on three predominantly native pasture sites located on properties on the Northern Tablelands of NSW where cell grazing had recently been implemented by skilled managers. The Strathroy and Lana experimental sites were located on soils of granitic parent material and the pastures were dominated by warm season native perennial grasses. The Green Hills site was located on soils derived from basaltic parent material. The area had been sown with introduced pasture species in the past but was dominated by native species when the field studies were initiated. The continuously grazed and cell grazed paddocks selected at each property were originally part of a single larger paddock.

Under the cell grazing regime, pastures are rested from grazing for at least 95% of the time. Cell grazing was found to result in an improvement in the vegetation resource in comparison with continuous grazing. The basal diameters, relative frequency and contribution to dry weight of the most desirable pasture components either increased or remained constant under cell grazing, while declining significantly under continuous grazing. The converse was true for the least palatable components of the pasture, which declined significantly under cell grazing but changed little under continuous grazing. Percentage ground cover was significantly higher after two years of cell grazing than under continuous grazing. Possible mechanisms which operate in grazed pastures to influence these responses are discussed. The short-term changes recorded in pasture composition may have long-term benefits with respect to erosion control, nutrient cycling, hydrological function and the stability of animal production at the cell grazed sites.

The high stock densities associated with the cell grazing process were found to have no detrimental effects on a range of soil properties in comparison to continuous low density stocking. At two sites unsaturated hydraulic conductivity, soil strength and bulk density data were influenced to a greater degree by spatial variation than by grazing treatment. At the third site where cell grazing had been implemented for 18 months longer than the other sites the changes in soil physical properties were positive in comparison to the continuously grazed treatment.

Table of Contents

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

List of Tables

List of Figures

List of Plates