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THE EFFECTS OF GRAZING ON THE HYDROLOGIC AND MICROMORPHOLOGICAL
PROPERTIES OF A DUNEFIELD LAND SYSTEM NEAR COBAR, N.S.W., AUSTRALIA

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ABSTRACT

The effects of two different grazing regimes on the surface soil properties of a dunefield land system in the semi-arid woodlands of eastern Australia were investigated. The land system is comprised of sandy dunes, 2-4 m in height, inter-dispersed with swales consisting of Xerollic Haplargids (massive red earths). High intensity, short - term, grazing by feral goats was compared with that of low intensity, long - term grazing by sheep. A rainfall simulator, applying water at 30 mm h⁻¹, was used to measure the hydraulic properties of the surfaces formed under the two different grazing regimes. Undisturbed samples of the upper 5 cm of the soil surface were taken for micromorphological examination.

INTRODUCTION

Grazing by herbivores is the major enterprise in the semi-arid woodlands of eastern Australia. However, over-grazing can lead to degradation in the form of loss of perennial grasses, shrub encroachment and soil erosion. Shrub encroachment is a particularly serious problem in the semi-arid woodlands because it reduces carrying capacity and hinders livestock husbandry. A range of strategies to control shrubs have been attempted, and include burning, mechanical clearing of shrubs, chemicals and various combinations of these treatments. Also, on sandy red earth soils, where the main shrub is the edible *Dodonaea attenuata*, the use of goats to control shrubs, is possible.

A grazing trial was therefore established to investigate the feasibility of using goats to control woody weeds. Several goat grazing strategies were investigated and compared to a range of sheep grazing strategies. This paper investigates the effects of two of the grazing regimes ie. very high goats and low sheep, on soil infiltration and micromorphological properties.

METHODS

Experimental site

The 900 ha experimental site was located on Lynwood station, 130 km NW of Cobar NSW. and consisted of a range of sheep and goat grazing regimes located in sixteen 50 ha plots. It is situated in the Tiltagoona land system and was comprised of sandy dunes, 2-4 m in height, and swales.

Over the period September 1991 to April 1992, rainfall simulation and micromorphological measurements were carried out in four paddocks in the grazing trial. Two of the paddocks had experienced high intensity (4.0 goats ha⁻¹), short - term (9 months) grazing by feral goats in 1991 and the other two had had low intensity (0.2 - 0.33 sheep ha⁻¹), long - term (1988 - 1992) grazing by sheep. In both the high goat and low sheep grazing paddocks, initial examination of the dune tops showed that the soil surface was made up of a mosaic of either loose sandy areas or crusted areas. Rainfall simulation and micromorphological measurements were therefore stratified into these areas. The total carbon content (%) of the 0-2 cm layer was also measured by heating a 2.0 g sample of soil to 120°C in a Leco CR-12 furnace fitted with an infrared CO₂ detector.

RESULTS AND DISCUSSION

Table 1 shows that the high intensity, short term goat grazing treatment significantly reduced the total carbon content of the 0-2 cm layer in the dunes when compared with the low sheep grazing treatment. However, there was no significant difference between the treatments in the swales.

At low sheep grazing rates (0.2-0.33 sheep ha⁻¹), the soil surface on the dunes was maintained in an excellent condition and consisted of either sand with a good vegetative cover, or areas where the sand grains were bonded together by clay and organic matter to form an organic crust. Zero runoff was measured from both these surfaces during the applied 30 mm h⁻¹ rainfall intensity (Table 2). These surfaces also contained stable micro-aggregates of parna material distributed amongst the aeolian sand grains. High intensity (4.0 goats ha⁻¹), short - term (9 months) grazing with goats rapidly depleted the perennial grasses, killed most of the shrubs and converted the soil surface on the dunes to one that became highly susceptible to erosion by wind. Micromorphological examination indicated that the clay material was abraded off the sand grains and either lost by wind erosion, or alleviated down the profile where it concentrated amongst the sand grains to form a strong, physical crust. These physical crusts caused localised areas of runoff. However, in the swales there was no difference in the effects of the two grazing regimes on soil properties. The implications of these results suggest that high intensity, short term grazing management is detrimental to the long term stability of these semi-arid lands.

TABLE 1: RUNOFF DATA FROM LYNWOOD GOAT GRAZING TRIAL

Grazing Regime	Runoff (%) ^a on Dunes and Swales		
	Dunes Non-Crusted	Dunes Crusted	Swales
Low (0.2-0.33 sheep ha ⁻¹)	0	0	50.8
V.High (4.0 goats ha ⁻¹)	0	13.9	54.3

a). The runoff percentage for each of the runs was computed by taking the total runoff as a percentage of the total rain applied at 30 mm⁻¹.

TABLE 2: TOTAL CARBON CONTENT IN THE SURFACE 2 CM ON THE DUNES AND SWALES FROM THE LYNWOOD GOAT GRAZING TRIAL

Grazing Regime	Total Carbon (%) (0 - 2 cm)	
	Dunes	Swales
Low (0.2-0.33 sheep ha ⁻¹)	0.75	1.28
V.High (4.0 goats ha ⁻¹)	0.30	1.10
SIGNIFICANCE	p<0.01	n.s.

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