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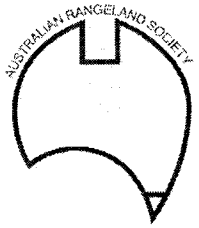

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SPATIAL VARIATION IN LAND DEGRADATION DUE TO CHANGES IN GRAZING PRESSURE DURING DROUGHT

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ABSTRACT

As part of two major grazing trials in sub-tropical Queensland, runoff and soil movement were recorded at a detailed (m^2) and landscape (ha) scale. The effect of grazing pressure on soil movement by its effect on vegetation, and hence runoff, was determined. A significant effect of stocking rate on soil movement occurred within a landscape, even during the worst drought on record. At one site spatial variation in hydrology and soil movement within the landscape was recorded, although this was not translated into total soil loss from the catchment. The effect of this source/sink movement within a landscape will have important consequences for the future stability of the landscape and the vegetation states that occur.

INTRODUCTION

Grazing pressure, through its effect on the soil surface and plant cover, affects rainfall infiltration and hence runoff and soil movement. The effects of this process on black speargrass (*Heteropogon contortus*) grazing lands were studied at a range of scales. Seventy percent of these lands in central and southern Queensland, which are a major source of beef production, have been degraded in the past (Tothill and Gillies 1992). This degradation can take the form of soil erosion or pasture degradation. Under medium to heavy grazing 'patchiness' has developed, with a change from *H. contortus* to *Aristida* spp., *Chrysopogon* spp. or annual grasses. Two large stocking rate projects established in central and southern Queensland examined the effects of grazing and management strategies on the long-term stability and productivity of this pasture resource at a range of scales. The spatial variation in runoff generation has been recorded elsewhere (Sallaway and Waters 1994). This paper reports on the soil movement that has occurred with these changes in pasture condition.

METHODOLOGY

Two existing grazing experiments, one at Glenwood, west of Mundubbera, and the other at Galloway Plains, west of Gladstone, were used to study the hydrology and soil movement under variable grazing pressures (Sallaway and Waters 1994). At both sites three stocking rates were used, ranging from an exclosure through a medium grazing pressure to heavy grazing pressure. Runoff and sediment measuring plots were installed. The Glenwood site consisted of a large landscape plot which ran from the top of the slope in the narrow-leaf ironbark area to the toe of the slope at the interchange of the silver-leaf ironbark to bluegum. In addition to landscape plots, at the Glenwood site paired small plots were established in each of the land classes (i.e. narrow-leaf and silver-leaf ironbark) for each of the stocking rates. Each 10 m × 7 m plot covered an area consisting of a speargrass and an *Aristida* patch. At Galloway Plains, landscape plots were installed on the silver-leaf ironbark land class only, for each of the stocking rates.

RESULTS AND DISCUSSION

The study was conducted during the most prolonged drought period on record for the Glenwood site. Rainfall during this period was well below average (decile 5) with seven seasons being below decile 2. Only three seasons, autumn 1992, spring 1993 and summer 1995-96, were above average.

Despite the below average seasonal conditions a large number of runoff events occurred, particularly on the heavier stocking rate sites. This was particularly so for the small plots at Glenwood. Associated with this runoff, a number of sediment producing events were recorded (Figure 1). The effect of

stocking rate is clearly visible, with the heavier stocking rate producing a cumulative soil movement of up to 3092 kg/ha for the higher stocking rate plots. For the exclosure areas, a soil movement of only 79 kg/ha was recorded. The effect of land class is also evident with the narrow-leaf ironbark land class producing more soil movement than the silver-leaf ironbark land class in the heavier stocking rate paddocks.

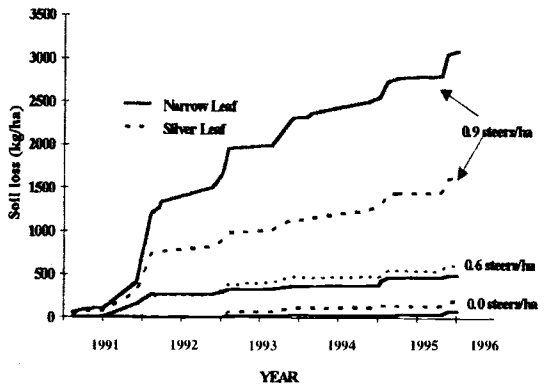

Figure 1. Cumulative soil movement (kg/ha) for three stocking rates by two land classes at Glenwood between 1991 and 1996.

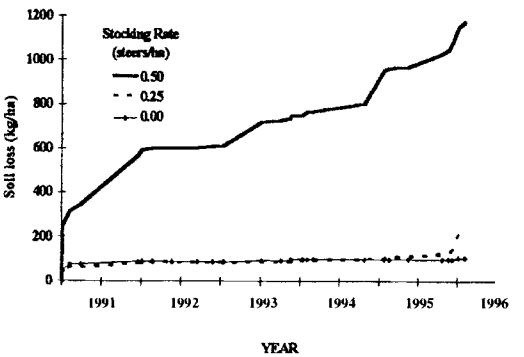

Figure 2. Cumulative soil movement (kg/ha) for three stocking rates at Galloway Plains between 1991 and 1996.

Runoff and soil movement at the landscape scale was variable between the two sites (i.e. Galloway Plains and Glenwood). The Galloway Plains site, with a less permeable soil (solodized solonetz) and higher rainfall (776 mm average), produced 27 sediment producing runoff events. For the Glenwood site, with a lower average rainfall (708 mm) and a more permeable surface soil (coarse grained yellow podzolic), no significant runoff events were recorded at the landscape scale during the drought period, and it was only in the last summer period with a return to 'average' rainfall that the landscape produced runoff. The sediment movement from the Galloway Plains site (Figure 2) followed a similar pattern to the land class plots at Glenwood with the heavier stocking rate plot producing significantly more soil movement than the exclosure.

It is noticeable in Figure 1 that sediment production for the 1995-96 summer period was not significantly greater than the earlier summer periods, despite the fact the increased rainfall resulted in much higher runoff. The 1995-96 summer period, which promoted greater growth, produced significantly less sediment per millimetre of runoff than occurred during the drought period when grass growth was greatly reduced.

It is evident that even during drought periods significant runoff producing events can occur from isolated high intensity rainfall events. These rainfall events result in significant soil movement due to the poor protective surface conditions.

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