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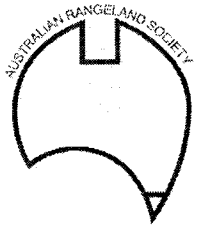

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THE EFFECTS OF RAINFALL REDISTRIBUTION ON HERBAGE PRODUCTION IN THREE GEOMORPHIC ZONES IN SEMI-ARID WOODED RANGELANDS

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ABSTRACT

Following discrete rainfall events, soil-water measurements showed that for each of the rainfall events, pronounced redistribution of rainfall from runoff (source) into runon (sink) zones occurred, redistribution increasing with the amount of rainfall. The amount of soil-water in the 0-300 mm layer followed the order: mulga grove>interception zone>runoff zone.

*Impairment of surface hydrology had a significant effect on dry matter production by resident perennial grass populations. In the runoff zone, production by woollybutt (*Eragrostis eriopoda*) was significantly enhanced when incident rainfall was contained* in situ. *Conversely, dry matter production by mulga grass (*Thyridolepis mitchelliana*) in the lower interception zone was significantly depressed by barriers preventing access by overland flow.*

INTRODUCTION

The partitioning of vegetation into a mosaic of groves and intergroves is a common feature of many arid and semi-arid woodlands and shrublands (Montaña 1992, Tongway and Ludwig 1990). These vegetation mosaics usually occur on slopes of < 1.0% and are a consequence of the redistribution of rainfall by sheetflow (Montaña 1992). In a patterned sequence of alternating groves and intergroves in a semi-arid mulga (*Acacia aneura*) woodland near Louth, NSW, Tongway and Ludwig (1990) distinguished three contiguous geomorphic zones consisting of: (i) a runoff zone of stony, severely sealed, surface soil, (ii) an interception zone at the bottom of the runoff zone and adjoining the third zone, (iii) a runon zone of mulga groves.

Previous studies in the mulga woodlands of central and eastern Australia by Perry (1970) and Greene (1992) respectively, have shown that there is a delicate balance of rainfall infiltration and runoff redistribution between the grove and intergrove areas. However, very little is known about the processes controlling infiltration and redistribution into these zones and the response of these processes to grazing management. Yet rainfall redistribution is recognised as a critical factor influencing herbage productivity in arid and semi-arid lands. Noy-Meir (1985) has claimed that, within a given area, overall herbage productivity is significantly enhanced where there is a redistribution of runoff to fertile patches. However, this response has yet to be quantified.

This study was directed towards partially quantifying the Noy-Meir hypothesis. It was carried out in the area of semi-arid mulga (*Acacia aneura*) woodland described by Tongway and Ludwig (1990). A series of warm and cool season rainfall events were monitored. Following each rainfall event, measurements of the soil-water content (0-300 mm) and the resulting herbage production were made in each of the three zones. These measurements were carried out over a range of grazing intensities.

METHODS

The study site was situated on 'Lake Mere' station, 35 km north of Louth, NSW (144°54'E, 30°16'S) in an area of near pristine semi-arid mulga woodland. The site consists of a patterned sequence of groves and intergroves (Tongway and Ludwig 1990) in which the three contiguous geomorphic zones described earlier can be distinguished.

Soil-water was measured in the runoff zone and interception zone after major redistribution events in August and November 1992 using TDR equipment. The vegetation response was measured after several weeks. To test the effects of redistribution on herbage production, impairment of surface hydrology was effected by the erection of metal barriers around plots in both source (runoff) and sink (interception) zones.

RESULTS AND DISCUSSION

The soil-water measurements showed that for each of the rainfall events, pronounced redistribution of rainfall from runoff (source) into runon (sink) zones occurred, redistribution increasing with the amount of rainfall. The amount of soil-water in the 0-300 mm layer followed the order: runon zone>interception zone>runoff zone. Similarly, redistribution of rainfall resulted in significant differences in the amount of herbage production in each of the three zones and followed the order: runon zone>interception zone>runoff zone (unpublished data).

Impairment of surface hydrology following the erection of metal barriers around plots in both source and sink zones had a significant effect on dry matter production by resident perennial grass populations. In the runoff zone, production by woollybutt (*Eragrostis eriopoda*) was significantly enhanced when incident rainfall was contained *in situ*. Conversely, dry matter production by mulga grass (*Thyridolepis mitchelliana)* in the lower interception zone was significantly depressed by barriers preventing access by overland flow.

These results demonstrate the major effects of rainfall redistribution on soil-water content and the concomitant effects on herbage production. More detailed studies are required to investigate the role of grazing in altering surface conditions, especially soil hydraulic properties and hence rainfall redistribution.

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