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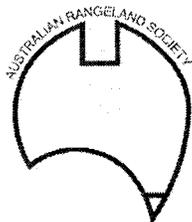
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SHEEP GRAZING INTENSITY, DROUGHT AND THE POPULATION DYNAMICS OF SALTBUSH

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INTRODUCTION

A whole-paddock study of the variation in the grazing intensity of saltbush (*Atriplex vesicaria*) by sheep and its effects on the plants' population dynamics is being carried out in South Australia. The study is concerned with the future productivity and management of the chenopod shrublands, with the aim of maintaining perennial shrub densities. This paper summarises progress for the first 2.5 years of the study. Data is still being collected and analysed. Indications are that a more flexible stocking system is needed to maintain the condition of these pastures.

MATERIALS AND METHODS

The project is located 50 km north-west of Whyalla. Mean annual rainfall is 210 mm. Vegetation is predominantly saltbush and bluebush (*Maireana sedifolia*) with an *Acacia papyrocarpa* overstorey. Sheep are grazed continuously at a stocking rate of 5 ha/sheep.

Grazing intensity is assessed by monitoring the loss of discretely marked saltbush shoots (1) on grazed and ungrazed plots at nine sites across the 1100 ha paddock. Saltbushes on these plots are mapped twice yearly to determine mortality and recruitment rates. Frequency of flowering and seed bank levels are also being studied.

RESULTS

Seasonal conditions

The project began in October 1987. Rainfall in that year was average. In 1988 and 1989 rainfall was 80% and 119% of mean annual rainfall respectively. Little ephemeral herbage grew in 1988 and from September 1988 to April 1989 (considered to be a period of severe drought by locals), herbage levels were negligible. Herbage levels in 1989 varied across the paddock from approximately 150 kg dry weight/ha to 2,000 kg dry weight/ha.

Grazing intensity

Grazing intensity over most of the paddock during 1988 was high with defoliation rates on grazed plots as high as 2.02%/day (97% marked shoots removed in 48 days) during winter. Overall, site and treatment (i.e. grazed/ungrazed) were both highly significant ($P < 0.001$). During the same period the mean defoliation rate on ungrazed plots was 0.17%/day (8% removed in 48 days). At only two sites was defoliation on the grazed plots low (0.54%/day or 26% removed in 48 days). These sites were in excess of 2.8 km from water. This pattern of grazing continued for most of the year.

In winter 1989, following good rains, site and treatment were still significant ($P < 0.001$) but defoliation rates were much lower on grazed plots than in 1988 (mean 0.48%/day). Rates for ungrazed plots were higher than in 1988 (mean 0.43%/day), possibly reflecting natural leaf replacement.

Plant population dynamics

Substantial mortality of adult bushes occurred, mainly during the 1988-89 summer, at the heavily grazed sites (Table 1). Ungrazed exclosures which experienced heavy grazing prior to protection also suffered considerable

mortality. Recruitment of adult plants occurred mainly during winter in 1988 and 1989 at the better condition sites, but only in winter 1989 at the poorer sites. Because of differences in mortality and recruitment between grazed and ungrazed plots, generally the net effect on ungrazed plots has been an increase in plant numbers but a decrease on grazed plots. However at sites 7 and 9 which were only lightly grazed in 1988 (see above), there has been an increase in plant numbers on both grazed and ungrazed plots.

Table 1. Mean mortality and recruitment, Oct 1987 to Mar 1990 and mean soil seed bank levels for selected plots. "Old" seeds were discoloured and shrunken. Viability not yet tested. U = ungrazed, G = grazed

Site and treatment	Grazing levels	Original no. of adults	Recruitment (%)	Mortality (%)	No. fresh seeds per female bush	No. old seeds
1 U		31	10	0		
1 G	Heavy	57	8	21	0.67	26.3
3 U		23	9	22		
3 G	Heavy	33	5	20	12.7	76.0
5 U		36	17	44		
5 G	V. Heavy	25	2	49	0.33	25.3
6 U		44	27	18		
6 G	V. Heavy	63	4	30	0.25	18.5
7 U		34	71	9		
7 G	Light	56	30	8	49.0	71.0

Low recruitment rates at some sites appear to be partly the result of the inhibition of flowering and seed production by heavy grazing. Overall the proportion of bushes in flower on grazed plots was significantly less ($P < 0.01$) than on ungrazed plots during several major flowering events. Again, sites 7 and 9 were the exception. The effects on the soil seed bank are clear. Initial results from March 1990 are shown in Table 1.

DISCUSSION AND CONCLUSIONS

Clearly grazing has had a considerable impact on the plant population at all sites except those that were lightly grazed. Recruitment in saltbush is normally continuous (2) but continuous grazing appears to inhibit it. The ability of the population to recover at the heavily grazed sites under a continuous grazing regime seems limited.

It appears a grazing management strategy is needed which will prevent grazing induced mortality during drought and also allow flowering and seed production during good periods. This is likely to involve spelling at these critical times. Without this, degradation, which can involve a change in state from saltbush dominance to a bare scald (3), may occur.

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