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IDENTIFYING THE SENSITIVE ZONE IN A CHENOPOD SHRUBLAND IN SEMI-ARID SOUTH AUSTRALIA

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ABSTRACT

The influence of livestock grazing on five major chenopod shrubland species in quadrats along a distance gradient from a watering point was studied in a semi-arid area of South Australia. Cluster analysis of plant features showed that the unpalatable plants are located principally around the water point to about 300 m and along a line into the predominant wind direction. The tallest and widest plants of the palatable species were mostly more than 700 m from the water point, with shorter, less spreading palatable plants between these two zones.

INTRODUCTION

The uneven distribution of animal grazing and trampling produces a recognisable vegetation pattern around watering points. Osborn *et al.* (1932) first reported this pattern in a chenopod shrubland in South Australia, and Lange (1969) coined the term piosphere (Greek *pios* = to drink) to describe such zonation. He described the interaction that occurs between livestock, plants, soils and watering points. This project aims to develop a set of potential indicators or signals of threshold in chenopod shrublands which might signal major changes in community structure or productivity.

MATERIALS AND METHODS

The research was undertaken in Purpunda paddock on Middleback Station (32° 57′S, 137° 24'E), 15 km north-west of Whyalla in the semi-arid zone of South Australia. A system of transects was established radiating from a watering point along twelve compass bearings oriented at 15° intervals between 255° and 90°. The 5 × 5 m sampling quadrats were spaced at 50 m, 100 m and then every 100 m up to 800 m, and 1000 m, 1250 m and 1500 m from the water point. For each quadrat, five features (frequency and average crown cover, height, width and biomass) for each of five perennial shrub species (*Atriplex stipitata, A. vesicaria, Maireana georgii, M. pyramidata* and *M. sedifolia*) were measured. Above-ground biomass was estimated using the Adelaide technique (Andrew *et al.* 1979).

These quadrats were clustered using Bray-Curtis UPGMA in PATN (Belbin 1991). They were also ordinated using semi-strong hybrid multidimensional scaling (MDS) and indirect gradient analysis with principal canonical correlation (PCC). The group definition and group statistic options (GDEF and GSTA) were used to assess significant character differences between dendrogram groups.

RESULTS

Three plant-based quadrat groups were identified, of which Group I was most dissimilar from the other two (Fig.1). In the MDS ordination, the PCC aligned the *M. pyramidata* and *A. stipitata* vectors with Group I, *M. sedifolia* with Group II and to a lesser extent plant number with both Group II and Group III. *A. vesicaria* and *M. georgii* were associated with Group III for high values of all features.

DISCUSSION

Overgrazing around troughs often results in an increased density of inedible shrubs and a decrease or disappearance of more palatable species. The highly unpalatable *M. pyramidata* is most common around the water point, extending toward the predominant wind direction. The presence of *M. sedifolia* in Group II might be related to soil attributes, as *A. vesicaria* and *M. sedifolia* often grow in different soil types (Carrodus and Specht 1965), but the isolated Group II quadrats near the water

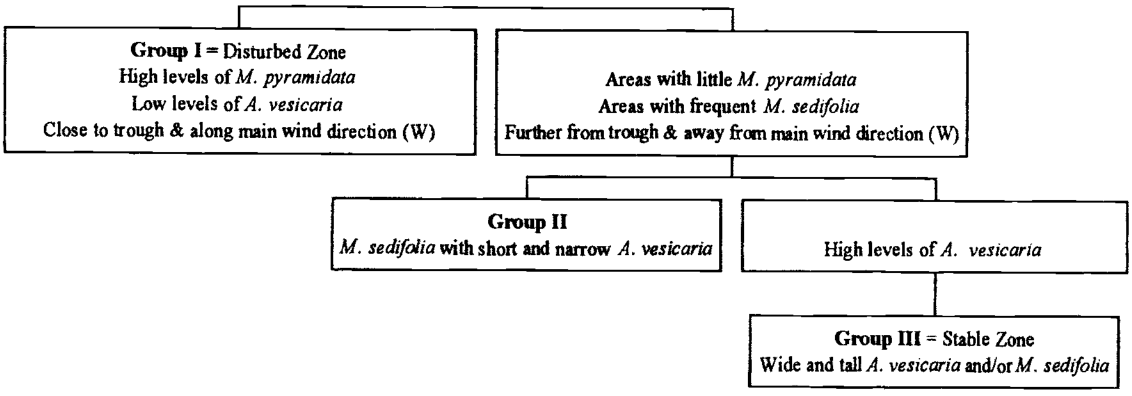

Figure 1. Summarised dendrogram of the major groups resulting from a Bray-Curtis/UPGMA analysis of the 144 quadrats in Purpunda paddock. Indicator features were derived from a GSTA Kruskal-Wallis analysis of the three groups.

point may also reflect its reduced palatability relative to *A. vesicaria* and *M. georgii*. The lowest values for *M. sedifolia* occur in Group I. Although *M. sedifolia* is long-lived (Wilson 1990), it can become rare because of increased mortality and lack of recruitment in grazed areas (Lange and Purdie 1976). *M. georgii* was so rare that it was not significantly associated with any group, although there was a non-significant trend toward higher values in Group III. *A. vesicaria* is most abundant away from the water point, declining rapidly along the transect towards water, and appears as low quality vegetation around the water point and into the predominant wind direction. Therefore, wide and tall *A. vesicaria* and/or *M. sedifolia* were probably good indicators of the stable zone. A high foliage cover of *M. pyramidata* and *A. stipitata*, plus narrow and small plants of *A. vesicaria*, could represent the disturbed (degraded) zone. Hence, three zones could be distinguished in this paddock: the disturbed (degraded) zone; the sensitive zone (the boundary region between the other two zones); and the stable zone. These are located at increasing distances from the water point respectively. The behavioural patterns of livestock might also lead to the development of the heavily grazed and semi-grazed patches such as those seen in Group II, because the sheep do not graze uniformly around the water point, tending instead to graze into the wind, and selectively graze some fodder species over others.

REFERENCES

Andrew, M.H., Noble, I.R. and Lange, R.T. (1979). A non-destructive method for estimating the weight of forage on shrubs. *Australian Rangeland Journal* 1: 225-231.

Belbin, L. (1991). The analysis of pattern in bio-survey data. *In* 'Nature conservation: cost effective biological surveys data analysis'. (Eds C. R. Margules and M. P. Austin). CSIRO, Aust. pp. 176-190.

Carrodus B.B. and Specht R.L. (1965). Factors affecting the relative distribution of *Atriplex vesicaria* and *Kochia sedifolia* (Chenopodiaceae) in the arid zone of South Australia. *Aust. J. Bot.* 13: 419-433.

Lange, R.T. (1969). The piosphere: sheep track and dung patterns. *J. Range Manage.* 22: 396-400.

Lange R.T. and Purdie R. (1976). Western myall (*Acacia sowdenii),* its survival prospects and management needs. *Aust. Range. J.* 1: 64-69.

Osborn, T.G.B., Wood J.G. and Paltridge T.B. (1932). On the growth and reaction to grazing of the perennial saltbush, (*Atriplex vesicarium*). An ecological study of the biotic factor. *Proc. Linn. Soc. NSW.* 57: 377-402.

Wilson, A.D. (1990). The effects of grazing in Australian ecosystems. *Proc. Ecol. Soc. Aust.* 16: 235-244.