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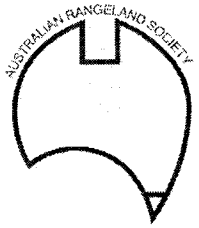

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HERBACEOUS WEED INVASION IN THE NORTH-EASTERN PASTORAL DISTRICTS OF SOUTH AUSTRALIA

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ABSTRACT

Percentage cover of herbaceous plant species, soil and environmental data were collected at 205 sites in the Olary Ranges in the North-East pastoral district of South Australia. Of 337 species recorded, 65 were exotic species (weeds), mostly of Mediterranean origin, and only 15 sites were free of weeds. Correlation and multi-variate linear modelling (GLIM) showed that increased levels of soil nutrients and available water permit greater weed invasion of grazed native pastures. Elevation is indirectly related to weed invasion due to auto-correlation with rainfall and the history of heavy grazing in the ranges.

INTRODUCTION

Widespread heavy rain made 1989 a remarkable year in the chenopod shrublands of eastern South Australia, and provided a unique opportunity to study the distribution of herbaceous plants on a broad scale. The aim of this study was to survey herbaceous plant distribution over a much larger area than had previously been attempted in South Australia, to assess the degree of invasion by introduced species (weeds), to see if this weediness is random or patterned, and to ascertain what factors are important in determining any such pattern.

METHODS

The study was carried out in a 60 000 km^2 area of the chenopod shrublands in the North East pastoral district of South Australia. The most significant feature of the landscape is the Olary Spur, an eastern extension of the Flinders Range. The land is used almost exclusively for pastoralism, so that all the vegetation is subjected to grazing. A series of eight transects were selected, 20km apart, and running north-south across the ranges. Sites were located every 10 km along each transect. All herbaceous species were listed and their total percentage cover estimated. The proportion of total herbaceous cover contributed by non-native species was calculated as a percentage. The fieldwork was carried out during one growing season, over the winter and spring of 1989.

A soil core was dug in the centre of each quadrat, and a sample taken at a standard depth of 20cm. These samples were analysed for a range of physical and chemical characteristics under supervision at the Analytical Services Section, Division of Soils, CSIRO, Adelaide. Monthly rainfall data going back to 1955 were obtained for 44 runs in the study area. These figures were used to construct rainfall contour maps from which the rainfall at each site could be estimated. Elevation to the nearest 50m above sea level was obtained from the 1:250 000 map series available for the area. From site descriptions taken in the field, topography type was classed as follows: creeks and watercourses (1); plains (2); rises and flanks (3); low hills and sand dunes (4); hills and ridges (5). Pearson Correlation Coefficients were calculated relating each environmental variable to the degree of weediness using the NTP computer program (Belbin et al., 1984). Linear regression was carried out using GLIM (Baker & Nelder, 1978) to determine which combination of measured environmental factors best predicted weediness.

RESULTS

Of 337 herbaceous species recorded, 65 were introduced exotics, usually of Mediterranean origin. The highest values for weed invasion corresponded to the areas of high elevation along the Olary Spur, although there were some local areas of high weed invasion away from the ranges. Eleven variables were correlated with weediness: calcium, potassium, % silt, phosphorus, annual

rainfall, range of summer rainfall, elevation, cation exchange capacity, organic carbon, % sand and summer rainfall. Of these variables, only elevation and cation exchange capacity appeared in the final GLIM; the remainder were auto-correlated to either of these. In addition, three variables which were not individually correlated with weediness (pH, sodium and topography), were included as significant components of the multiple regression. It is therefore inferred that these variables must complement the key variables in the GLIM and refine the regression.

DISCUSSION

This study has shown patterning in the degree of weed invasion in a rangeland at both broad and fine scales. At the broad scale, weeds are more prone to invade areas of higher rainfall and better nutrient status such as the high elevation areas of the ranges, conditions which more closely approximate those of the Mediterranean region. The more intense grazing history of the Olary Spur may also be a major factor At the finer scale, weeds also tend to invade areas prone to flooding because of disturbance and higher moisture status.

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