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## BROADSCALE DISTRIBUTION PATTERNS OF THE PEARL BLUEBUSH (*MAIREANA SEDIFOLIA*) IN NORTHERN SOUTH AUSTRALIA

*Noelene J. Wotton*

Botany Department, The University of Adelaide

**ABSTRACT**

A survey encompassing 124 sites investigated the distribution of the perennial chenopod, *Maireana sedifolia* (pearl bluebush). Calcium carbonate and summer rainfall were delineated as primary environmental factors influencing the distribution using logistic regression (GLM). These results were compared to similar analyses for saltbush, blackbush and low bluebush. Correlation analyses revealed significant correlations between bluebush size and abundance and environmental factors including calcium carbonate, rainfall, elevation and soil texture.

**INTRODUCTION**

Chenopod species are sorted into communities primarily by edaphic factors and secondarily by climate. Soil factors determining plant-water regimes (e.g. wetting depth, salinity and texture) affect species distribution more so than chemical factors (Eldridge 1988). Anecdotal evidence implies soil texture and limestone may define the potential niche of bluebush (Carrodus and Specht 1965). This study investigates bluebush distribution to identify the abiotic variables that influence its occurrence, size and abundance.

**METHODS**

Sampling took place at 124 sites in semi-arid south-eastern Australia including north-western SA, Flinders Ranges, north-eastern Eyre Peninsula and north-eastern SA-Western NSW. Sites were located 30km apart along 3800km of road transect. At each site, the percentage cover of all perennial species was recorded within a 50 x 20m sampling quadrat. When present, bluebush density and size were measured within six 5 x 10m sub-quadrats. Climatic and environmental variables, including topography, slope, elevation and rainfall were collated. A soil profile was described and a soil sample collected for chemical analysis. The distribution of bluebush and three comparison species was modelled by logistic regression (GLM) using presence/absence data. Relationships between bluebush size and abundance and environmental variables were examined using rank correlation.

**RESULTS**

Depth to sheet and nodular limestone was found to be the primary influence on bluebush distribution with the probability of occurrence decreasing with increasing depth to limestone. Bluebush occurred at more than 50% of sites in which limestone was present within 70cm of the soil surface. It may also be present on limestone-free soils, although at lower frequencies than the other chenopods. Bluebush also possessed a bell-shaped response to summer rainfall and, along with saltbush, predominates in areas receiving 90-120mm of summer rain. In comparison, *M. astrotricha* is restricted to lower rainfall regions and blackbush to higher summer rainfall areas. The nodular limestone x summer rainfall interaction indicates bluebush occurs on shallow nodular limestone with less summer rainfall. Logistic regression models are summarised below.

Depth to limestone was the only measured factor influencing bluebush size, with smaller plants occurring in areas with shallow limestone. In contrast, several factors were correlated with bluebush abundance. Depth to sheet limestone was positively correlated, suggesting a decreased abundance on shallow soils. Bluebush abundance also decreased in areas of high elevation and topography. Winter rainfall and soil texture were positively correlated; bluebush was more abundant in higher winter rainfall areas and on loam-clay rather than sandy soils.

**Table I.** Variables included in the logistic regression models. Significance;* ,0.01<p<0.05; **, 0.001<p<0.01; ***, p<0.001

| VARIABLE | *Maireana sedifolia* | *Atriplex vesicaria* | *Maireana pyramidata* | *Maireana astrotricha* |
|---|---|---|---|---|
| Lime Nodules | * | ** | -- | -- |
| Sheet Lime | *** | -- | -- | -- |
| Carbonates | * | -- | * | -- |
| Winter Rainfall | -- | -- | * | *** |
| Summer Rainfall | ***(^2*) | -- | * | -- |
| Soil Texture | -- | * | -- | -- |
| Topography | -- | -- | -- | -- |
| Elevation | -- | -- | -- | * |
| Nods x S.Rain | * | -- | -- | -- |

## DISCUSSION

Soil water availability appears as a major control of bluebush distribution, size and abundance as shown by correlations with direct (rainfall) and indirect (elevation, topography, soil texture) factors. Strong correlation with limestone soils may indicate water relation effects with the deep-rooted bluebush competitively advantaged over more shallow-rooted species by the ability to penetrate limestone and obtain water stored deep in the profile. This preference may also indicate that bluebush is able to tolerate the adverse nutritional conditions often present in limestone soils (Jeffrey 1987); size and abundance reductions on shallow limestone soil would support this hypothesis. Comparison with other major chenopod species suggests distributional differences arise from physiological and morphological adaptations relating to water acquisition and requirement and tolerance to adverse nutritional conditions.

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