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# THE EFFECT OF GRAZING ON LOCAL POPULATIONS OF *ERODIOPHYLLUM ELDERI*

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## ABSTRACT

*The Koonamore daisy (Erodiohyllum elderi) is a short-lived herbaceous perennial restricted to locally low-lying regions in parts of semi-arid South Australia. Due to the topography of the region this species has a naturally sub-divided population. We have been investigating the effect of different grazing regimes on various aspects of daisy population dynamics. Monitoring of patches for the last 2.5 years indicates that the populations have been significantly affected by the presence of sheep. Populations in heavily grazed areas have different dispersal patterns, different population size structure and greater temporal fluctuations. Long-term photographic records indicate that daisy plants are frequently absent from these patches (approximately 63% of the time), although the seedbank is still present in the form of seedheads. The seedheads gradually release seeds through time, enabling the population to persist through unfavourable conditions such as droughts. Browsing of flowers by sheep reduces seedhead production and leads to a significantly lower seedbank in heavily grazed areas.*

## INTRODUCTION

The Koonamore daisy is a short-lived herbaceous perennial shrub which lives in patches scattered throughout arid regions of SA, NSW and WA. This species grows in topographical depressions, and often forms a major component of the ephemeral herbland communities. It has been reported that the Koonamore daisy is not palatable to sheep, although sheep have been observed to browse on the flowers (L. Emmerson pers. obs., L. MacLachlan pers. comm.). Seeds are retained in woody seedheads, which form the seedbank. Long-term photo-records suggest that daisy patches persist through long periods of unfavourable conditions without the presence of live plants. This is likely to be via the seedbank in the seedhead, as the resprouting of adult daisy plants in a range of conditions has not been observed following the recent drought period.

The ecology of six local populations of the Koonamore daisy at Koonamore Station has been studied since November 1993. Four populations were located in sheep-grazed paddocks, two from lightly grazed areas and two from heavily grazed areas. An additional two populations were located inside the adjacent Koonamore Vegetation Reserve (KVR), from which sheep have been excluded since 1925. The effect of grazing regime on growth, survival, reproductive output and the dispersal of the seedbank has been studied. Small exclosures were erected to determine the short-term effect of excluding grazers in one of the heavily grazed local populations.

## METHODS

### Permanent Plots

Transects through these populations in November 1993 recorded size, abundance and reproductive output. Permanent plots were established in March 1994 and population data were collected every six months. Transition matrices were constructed by dividing the population into categories based on plant size and maturity. The proportions of daisies changing between categories were logit transformed and the likelihood of plants growing, shrinking or remaining in the same category was compared between patches and grazing regimes. Six small exclosures which were paired with quadrats in the permanent plots were erected in March 1995, during a dry period, in one of the heavily grazed patches. The dynamics of individuals and the production of seedheads within these exclosures were monitored.

### **Dispersal of Seedheads**

Dispersal experiments were conducted in all six patches. A total of 2280 seedheads were painted and released throughout each of the patches and the distance and direction they moved were monitored for 9.5 months. A second dispersal experiment was conducted to determine the direct influence of sheep and kangaroos. Seedheads were released in four patches inside the reserve and four heavily grazed patches outside the reserve. Half of the seed heads were positioned on sheep or kangaroo tracks and the remaining half adjacent to but clear of these tracks. Once again the seedheads were painted and followed for 9.5 months following their release. In this second experiment, a total of 2480 seedheads were released.

## **RESULTS AND DISCUSSION**

The dispersal of seedheads was greater in heavily grazed areas. This was due to their movement via animals and also because there was less vegetation to trap seeds. There was very limited dispersal inside the reserve (maximum 1 m). The second experiment replicated the result that dispersal was greatest outside the reserve in heavily grazed areas (33 m outside cf. 3 m inside). Also, the movement of seedheads was greatest on the tracks, both inside and outside the reserve. Movement away from the patches occurred outside the reserve. Dispersal rates of the seedbank are thus likely to have increased since the introduction of sheep.

Daisy plants were smaller and their abundance per unit area greater in the heavily grazed patches. The reproductive output in these patches was lower. This was probably partly due to the size of the plants, but also because of browsing of flowers by sheep. Daisies in heavily grazed patches were more likely to shrink or die compared with daisies in areas where the grazing pressure was lower. After just one year of drought, almost all daisies had died, irrespective of grazing regime. The vegetation inside the exclosures responded quickly after rain to the removal of sheep. Nearly all plants grew larger inside the exclosures within 6 months. There were also recently developed seedheads and living daisy plants inside these areas.

The seedbank is the most important stage of the daisy's life history as it buffers the population against unfavourable conditions. This study, although limited to a short time-frame, has shown grazing to have a dramatic effect on the production of seedheads and possibly even on the distribution of the species. However, if grazing continues to reduce seedhead inputs, the expectation is a change in the seedbank, and perhaps even local extinction of patches. Our data show that there has been a significant reduction of the seedbank. However, questions still exist about the long-term impact of grazing on the daisy populations. Since it is not possible to age seedheads it is difficult to understand when the most recent inputs into the system occurred. It is almost impossible to determine how long a patch can survive without any seed input. Long-term photographic records indicate that an ungrazed patch can last at least 10 years without seedhead inputs. With a seedbank that can last for at least that length of time, infrequent inputs into the system may be sufficient to allow local populations to persist. We are currently developing models to try to address the impact of this reduction in seedhead inputs on the long-term persistence of the species.

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