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Introduction

The chalky wattle (*Acacia cretacea* Maslin & Whibley, Leguminosae) is a spindly, usually single-stemmed small tree with an open, straggly crown and chalky-white branchlets, inflorescences and legumes. The plant proliferates both from seed and vegetatively by root suckering or basal regrowth following disturbance or injury. It occurs in low shrubland and mallee scrub on deep red sand in gently undulating country with low sand ridges and is endemic to north-eastern Eyre Peninsula, South Australia (Jusaitis & Sorensen, 1994). Remnant populations are found along roadsides and on adjacent uncleared sand dunes in otherwise arable country near the northernmost limit of productive cropping. Surveys indicate a range of about 3 x 2 km with an extent of occurrence of 5.1 km^2 and an area of occupancy of 0.33 km^2 (Jusaitis *et al*., 2000). The population is threatened by its extremely small area of occupancy, and by grazing of young shoots of seedlings and root suckers by rabbits, kangaroos and domestic stock. The species does not occur in any conservation reserve and is listed as Endangered under the Australian Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), and assessed as Critically Endangered under IUCN (2001) criteria (CR B1&2ab(i)(iii)) (Pobke, 2007).

Acacia cretacea **shoots in flower © M. Jusaitis**

Goals

- Goal 1: Safeguard the natural populations of *A. cretacea* by re-inforcing plant numbers in declining populations.
- Goal 2: Examine the influence of herbivore grazing on growth and survival of transplants.
- Goal 3: Examine the use of water storage crystals to improve translocation success.
- Goal 4: Examine the influence of founder propagule on translocation success.

Success Indicators

Acacia cretacea **visible in the foreground and extending above the canopy of eucalypts as tall spindly trees © M. Jusaitis**

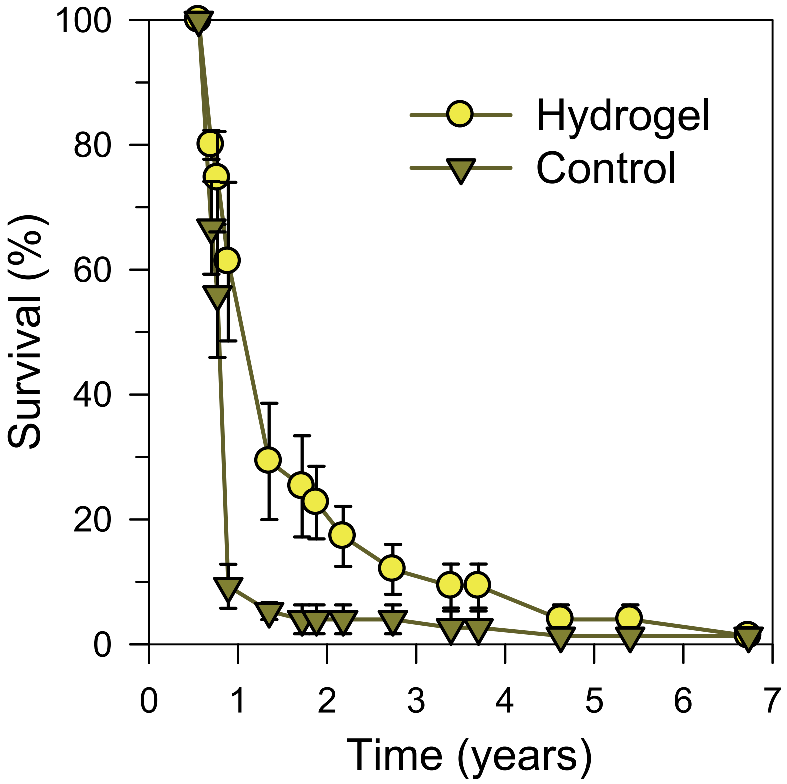
- Indicator 1: Survival, flowering, reproduction and recruitment of *A. cretacea* following translocation into natural populations.
- Indicator 2: The completion of an experimental translocation to evaluate the effect of herbivores on plant establishment.
- Indicator 3: The completion of an experimental translocation to evaluate the effect of water storage crystals on establishment success.
- Indicator 4: The completion of translocation trials to evaluate the establishment and survival of seed and seedling founders.

Project Summary

1992 translocation: This first translocation (36 seedlings, half of which were fenced) was planted during the winter of 1992, which proved to be a year of above average rainfall for the region (Jusaitis, 2005). The meteorological station at nearby Cowell recorded an annual rainfall of 552.6 mm that year, the highest on record for over 120 years (annual average 282.3 mm). The highest monthly rainfall for 1992 occurred during October and December, and more than likely contributed to the high survival and growth observed. After 7 years, transplants had reached average heights of 2.8 ± 0.3 m (fenced) and 1.3 ± 0.4 m (unfenced), survival had stabilized to 85% and 36% in each area respectively, and fenced plants had flowered and set fruit. Losses of unfenced seedlings were largely due to grazing damage, particularly during their first 2 years. These results demonstrated that with appropriate grazing protection, good survival and establishment of *A. cretacea* was possible if planted in a year of abundant rainfall.

Grazing effects: In 1996, a stock-proof fence (excluded stock but not kangaroos) was erected to enclose the largest remnant population (6 ha of over 400 *A. cretacea*). Inside this, a smaller (0.2 ha) rabbit-proof enclosure was constructed. Thirty four *A. cretacea* seedlings were planted into each of three areas (rabbit-proof enclosure, stock-proof enclosure and unfenced). The results of this trial are published elsewhere (Jusaitis, 2005) and revealed a 60% mortality due to dry conditions during the first summer, and 30 - 35% mortality due to herbivore grazing. No transplants survived their first summer without some form of grazing

Figure 1. Effect of hydrogel on survival of *Acacia cretacea* transplanted in 1997. Results are averaged over the three fencing treatments. Vertical bars represent ± SE Mean (*n* = 3).



protection, and the only plants to put on net growth were those protected by rabbit-proof fencing (Jusaitis *et al*., 2000).

Use of water storage crystals: Hydrogel is a synthetic hydrophilic acrylamide polymer that acts as a super-sponge, absorbing and storing hundreds of times its weight in plant available water. Commercially available as a potting-media amendment to reduce watering requirements, in this trial it was tested as a potential tool to improve establishment and survival of translocated *A. cretacea*. In July 1997, 50 seedlings were transplanted in pairs (~1 m apart), in each of the three areas established above (rabbit-proof, stock-proof, and unfenced). One of each pair was planted with about 200 ml of hydrated hydrogel placed at the bottom of the planting hole, the other was given no hydrogel. Treatment seedlings were planted with their lower roots in contact with the wet hydrogel. Soil conditions were very dry at planting and no rain fell for nearly 2 weeks after planting.

Hydrogel had a dramatic effect on early survival of transplants (Figure 1). Within 6 months of transplanting, most control plants had died, regardless of which grazing treatment they were in. However, plants treated with hydrogel had over 70% survival in both enclosures, and 36% survival when unfenced (Jusaitis *et al*., 2000). Although an unseasonably dry autumn and winter in 1999 resulted in further plant losses through moisture stress and grazing damage, the overall survival of hydrogel-treated plants remained significantly higher than that of control plants until year four. By year six, only two plants remained in the rabbit-proof enclosure, one hydrogel-treated and one a control. Both survived until at least year 11. Hydrogel-treated plants also responded with increased growth (in height) over control plants in all grazing treatments. Generally, transplants in the rabbit-proof enclosure put on the most growth due to restricted grazing. However, during the unseasonably dry 1999, we observed evidence of kangaroos having entered the rabbit-proof enclosure and plants in all three fencing treatments received a similar amount of grazing that year.

Translocated *Acacia cretacea* showing grazing damage caused by kangaroos © M. Jusaitis

Seed as a founder propagule: *A. cretacea* seed were pretreated the night before sowing by covering them with just-boiled water and allowing them to stand until the water had cooled to room temperature (Sorensen & Jusaitis, 1995). The next day (24th July 1997), the moist seeds were sown using a 1 m^2 (10 x 10) grid to facilitate subsequent monitoring. Fifty seeds were sown (1 cm deep) in each of three replicates, in each of three fenced areas (rabbit-proof, stock-proof and unfenced). The soil was dry at sowing and no water was applied. No seedlings emerged in the rabbit-proof enclosure and only three emerged in the stock-proof enclosure, all dying during their first summer. The only significant emergences were seen in one replicate in the unfenced area. This replicate was in a shady area beneath a mallee (a form of eucalypt species that grows with multiple stems emerging from a lignotuber), and therefore may have had a better moisture regime than some of the other more exposed sites. For this replicate, seedlings were first observed 2 months after sowing and a maximum of 16% of seeds emerged by 3 months. Thereafter their numbers declined as soil dried out over summer, and all had died by their third year.

Further translocations: Between 1998 and 2000, nearly 400 more seedlings were translocated into existing populations, but none of these trials had the success rate of the original 1992 translocation. All these translocants died within 4 years of planting.

Major difficulties faced

- *A. cretacea* occurs in a region of low rainfall (282.3 mm/annum) and it proved very difficult to establish plants from seed or transplants in this environment without any supplementary watering. The hot and dry summers desiccated plants in their first year before roots were able to grow deep enough to tap into subsoil moisture.
- Grazing or damage by rabbits, kangaroos and stock was observed on plants of all ages, but particularly on younger plants and especially during periods of unseasonably dry weather.
- The remoteness of the population site and travelling distance from Adelaide made frequent visitation for watering and maintenance of trials difficult and expensive.

Major lessons learnt

- The condition of transplants was critical to successful establishment. Young transplants (1 - 2 phyllode stage) were preferable to older seedlings. Pot-bound seedlings were less likely to establish quickly, and more likely to result in an unstable plant with a poorly developed root system.
- Seeds were less effective founder propagules than transplants. Translocations using seed will require the use of pre-treated (scarified) seed, additional watering during the first summer (depending on seasonal conditions), and protection from grazing after the second year of establishment.
- The first summer after transplantation was the most critical period for plant establishment. Provision of adequate soil moisture and protection from grazers during this time were essential to ensure ongoing plant survival. Best results were obtained by transplanting in years of extremely high rainfall, although supplementary summer-watering may alleviate this requirement.
- Hydrogel water storage crystals were effective in improving early survival and growth of *A. cretacea,* particularly over the first 4 years of establishment. Favorable rainfall events following translocation should further improve long-term establishment.
- Transplants must be protected on an individual basis (e.g.., plant guard) or on a community basis (e.g.., fencing). The latter method is more economical, particularly if large numbers of plants are to be protected. Fencing has additional long-term benefits for the ecosystem, in that all plants (including natural regenerants) are protected, and soil disturbance is reduced.
- The spiny *Triodia irritans* was commonly associated with *A. cretacea*, and transplants placed within or near a clump of *T. irritans* were invariably protected from grazing, at least in their early growth stages.
- Herbivory was more significant on younger plants and declined as plants matured. Grazing damage was also more severe following unseasonably dry periods.
- Herbivore damage was also observed on mature *A. cretacea*. Bark stripping and ring-barking of mature plants by kangaroos usually resulted in death of affected plants.

Success of Project

Highly Successful	Successful	**Partially Successful**	Failure
		√	

Reasons for success/failure:

- The first translocation trial planted in 1992 proved very successful as a result of extremely high rainfall events during that year, particularly in summer, allowing plants to quickly establish deep roots while soil remained moist.
- Translocations in other years proved difficult due to insufficient soil moisture to enable rapid deep root establishment.
- Grazing during early stages of growth hampered plant establishment and was particularly severe during unseasonably dry periods.

- In the direct seeding trial, rainfall during July when the seeds were sown was well below the average for the area, and the result may have been improved by sowing earlier in the season, or during a month/year of higher rainfall.

References

IUCN (2001) IUCN Red List Categories and Criteria: Version 3.1. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

Jusaitis, M. (2005) Translocation trials confirm specific factors affecting the establishment of three endangered plant species. Ecological Management & Restoration 6: 61-67.

Jusaitis, M. & Sorensen, B. (1994) Conservation studies on endangered plant species for South Australia's agricultural regions. Black Hill Flora Centre, Botanic Gardens of Adelaide, South Australia.

Jusaitis, M., A. Bond, K. Smith, B. Sorensen & Polomka, L. (2000) *Acacia cretacea* recovery plan annual report. Plant Biodiversity Centre, Department for Environment and Heritage, South Australia.

Pobke, K. (2007) Draft recovery plan for 23 threatened flora taxa on Eyre Peninsula, South Australia 2007-2012. Department for Environment and Heritage, South Australia.

Sorensen, B. & Jusaitis, M. (1995) Seed germination of endangered South Australian plants. Proceedings of the International Plant Propagators' Society 45: 86-92.