Outcomes

The aim to successfully establish three populations covering the three genetically and biogeographically distinct conservation units recognised in *B. brownii* has been met although long term viability has yet to be established. While all three translocated populations have flowered and produced seed from multiple plants, recruitment has only been observed at Site 2. The decline in plant numbers at site 1 has aided in more accurately defining the site characteristics required for this species, with further translocations at wetter sites required to conserve the Stirling Range population group. At Site 3, initial plantings in open granite habitat had poor survival, subsequent plantings targeted deeper, more vegetated soils.

What we learned

- It is possible to establish new populations of this species.
- Using an experimental framework when establishing translocations can provide critical information for long-term translocation success.
- This species may require higher moisture conditions than other Proteaceae from the region.
- Fencing and summer watering improves survival of planted seedlings.
- At site 3, optimal micro-habitat within the site was identified to ensure success.

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Threatened plant translocation case study:

Haloragis eyreana (Prickly Raspwort), Haloragaceae

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The Species

- Small, perennial herb with a deep stoloniferous rootstock.
- Endemic to southern Eyre Peninsula, South Australia.

Threatening Processes

- Habitat loss and fragmentation through agricultural development.
- Weed competition.
- Roadside management activities.
- Altered hydrological regimes.

Deciding to translocate

Extensive surveys between 1997-1999 counted approximately 16,000 individuals with an area of occupancy of 0.8 km^2 and an extent of occurrence of 711 km^2 (Jusaitis and Freebairn 2011). Since 1999, plant numbers at five population monitoring points have been steadily declining. The species is listed as Endangered under the Australian Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*), and assessed as Critically Endangered under IUCN criteria. *Haloragis eyreana* has rather specific habitat requirements, being found in low lying, disturbed areas subject to inundation or water runoff during winter.

We wanted to examine the influence of planting-site proximity to the water table on translocation success. This case study describes a translocation trial that led to the serendipitous discovery of an ideal microsite for plant establishment and ongoing recruitment of this species.

Aim of the translocation

By creating artificial micro-habitats, this translocation trial aimed to examine the influence of planting-site proximity to the water table on translocation success.

Translocation working group and key stakeholders

- Conservation Biology Unit, Botanic Gardens of South Australia – plan and implement the translocation and perform ongoing monitoring and maintenance of the translocation site.
- Threatened Flora Project Officer (Anthony Freebairn), National Parks and Wildlife Service South Australia (NPWSA), Eyre Peninsula – assist with planning and implementation of the trial.
- District Council of Lower Eyre Peninsula – provided machinery and operators for excavation of planting microsites.
- *Haloragis eyreana* Recovery Team and subsequently Ark on Eyre Threatened Flora Recovery Team – oversee planning and implementation of the translocation.

Biology and Ecology

- The species has specific habitat requirements, being confined to disturbed areas (roadsides, road intersections, rail corridors) that are subject to inundation or water runoff during winter. It is often found in low lying areas such as roadside gutters, drains, seepage hollows and crabholes, usually on heavy clay loam soils.
- Readily propagated from seed, cuttings or by tissue culture.
- Seeds are surrounded by a hard, woody fruit containing a germination inhibitor which can be leached from the fruit with water, or counteracted by gibberellic acid treatment (Jusaitis *et al*. 2000).
- Flowers are wind pollinated (Jusaitis *et al*. 2000).
- Regeneration is from seed or as regrowth from rootstocks or suckers (Jusaitis and Freebairn 2010).

Site selection

This trial was located along the Bratten Way, a road that runs through the natural population of *H. eyreana* near Cummins. Sites were chosen within the natural population in order to maximise site suitability for plant establishment, allowing us to focus on the main factor of interest, proximity to the water table.

Translocation proposal

The design for this experiment was submitted to and approved by the *H. eyreana* Recovery Team and was supported by the District Council of Lower Eyre Peninsula.

Pre-translocation preparation, design, implementation and ongoing maintenance

A series of five trenches were excavated at each of four locations along the Bratten Way. Trenches were approximately 0.4-0.5 m deep and 0.7 m wide, and separated by four crests about 5 m long and 0.5 m wide (Figures 1 and 2). Two crests were left at natural soil level (high crests) and two were lowered by scraping about 200 mm of soil from the surface (low crests). All excavated soils were removed from each site.

Haloragis eyreana was micropropagated using explants sourced from eight local provenances (Lee and Jusaitis 2000). (Editor's note: Micropropagation is the propagation of plants by growing plantlets in tissue culture and then planting them out). In August, 2003, ten plants (2-5 cm high) were transplanted onto each crest, a total of 40 plants per location. No planting took place in the trenches. At the same time, 20 plants were transplanted as controls in undisturbed soil near each excavation. Survival and regeneration of *H. eyreana* at the two soil levels (high, low) and at the control sites were monitored annually for nine years. Plant recruitment in the trenches was also monitored.

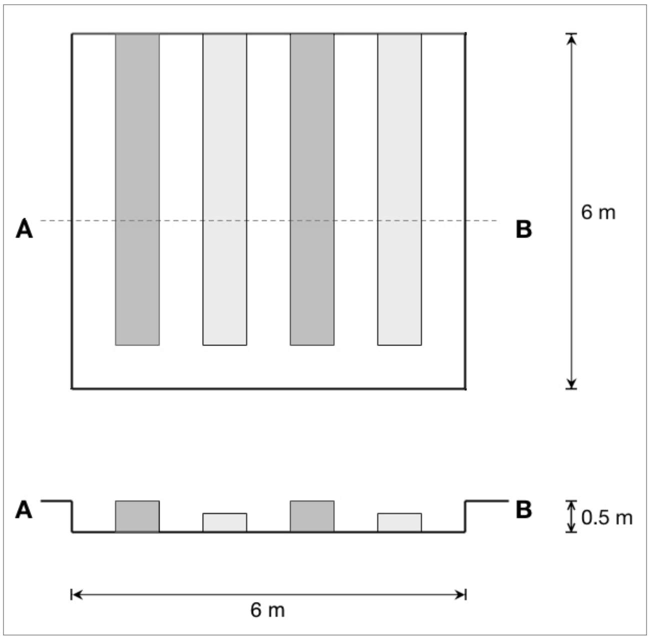

Figure 1. Layout of *Haloragis eyreana* translocation trial showing high (dark) and low (light) crests and interstitial trenches. The lower diagram shows a cross-section through A-B.

Monitoring and evaluation

Although plant survival on low crests and in controls was generally slightly higher than on high crests (Figure 3), the number of original transplants in all treatments declined steadily over 4 years, to when none remained alive (Figure 4). However, during year 3, recruitment of new seedlings and sucker regrowth was observed around the original transplants on all crests. The total number of regenerants did not vary significantly between high or low crests, ranging between 1-5 plants/m^2 over years 4-8. Natural recruitment was also observed in trenches during year 3, and from then the number of plants increased exponentially so that trenches averaged 18 plants/m^2 by year 8 (Figure 5).

Trench plants were more likely to perenniate (survive and grow perennially) from year to year than crest plants. Controls showed no recruitment until the fifth year, averaging 2 plants/m^2 by year 8. The lower recruitment in controls and on crests may be at least partly due to competitive effects of weeds and other herbs, which were less prevalent in trenches (Figure 5). Measurements of soil moisture content demonstrated that trench soils had consistently higher moisture levels than crest or control soils, regardless of time-of-year. Trenches occasionally flooded with water during wet winter periods (Figure 2), but the ensuing transient submergence of plants did not appear to adversely affect their subsequent survival, growth or flowering.

Outcomes

Edaphic amelioration provided an ideal micro-habitat for growth, flowering and recruitment of *H. eyreana*. In 8 years, the population was increased by over 1000 new plants regenerating at four new sites within the population range.

Figure 2. Layout of *Haloragis eyreana* translocation trial showing the four crests (H, L, H, L) and interstitial trenches on the day of translocation. Photo: Manfred Jusaitis

Figure 3. *Haloragis eyreana* transplants a year after translocation onto a high crest. Photo: Manfred Jusaitis

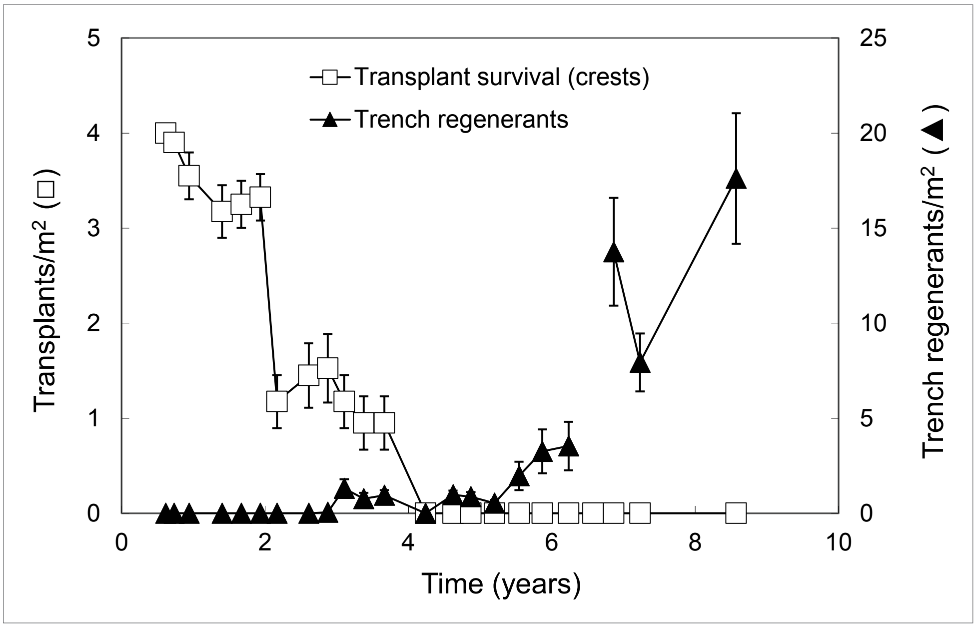

Figure 4. Survival of *Haloragis eyreana* transplants (average of high and low crests at 4 sites) and recruitment of plants in the trenches (average of 5 trenches x 4 sites). In July 2009, the trenches were flooded and regenerants could not be counted (break in the graph). Error bars represent the standard error of the mean (*n* = 16 for transplants and *n* = 20 for trench regenerants).

Figure 5. Natural recruitment of *Haloragis eyreana* in trenches six years after plants were translocated to crests. Photo: Manfred Jusaitis

Excavated trenches provided excellent soil-moisture conditions and protected plants from wind damage and drying. When ideal conditions were provided, plants had no difficulty in regenerating from seed, rootstocks and suckers.

What we learned

- It is possible to establish new populations of this species.
- Natural regeneration of *H. eyreana* was significantly enhanced by edaphic modification of its habitat to produce suitable microsites.
- Trenches supported the best growth, recruitment and regeneration of *H. eyreana*, followed by low crests, then high crests, and lastly controls.
- The improved performance of high crests over controls may be attributable to the additional soil disturbance and vegetation clearance from crests during their construction.
- Construction of low-lying drains, trenches or swales can create suitable micro-habitats that retain and conserve soil moisture to support successful germination and proliferation of this plant.
- The plant appears to respond favourably to a certain amount of soil disturbance, provided weed encroachment is minimized.
- The four translocation locations tested varied considerably in their ability to sustain *H. eyreana*, indicating that proximity to the water table was not the only factor involved. Optimal locations also required appropriate soil structure and moisture-holding capacities, as well as low competitive pressure from weeds and other vegetation.
- Even though our original aim was to only compare high and low crests, longer-term monitoring beyond year 4 revealed the serendipitous discovery that trenches provided the best microsite for regeneration (Jusaitis 2012).

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