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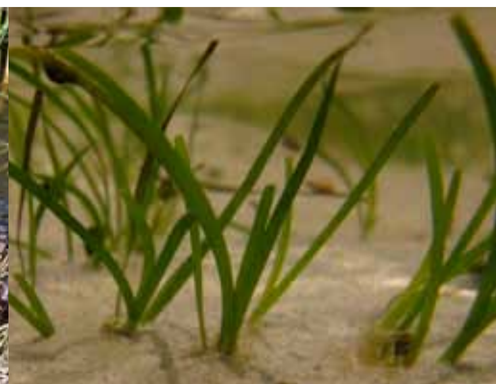


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Trial translocations into edaphically modified habitats enhanced the regeneration of prickly raspwort on Eyre Peninsula, South Australia

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Introduction

Prickly raspwort, *Haloragis eyreana* Orchard (Haloragaceae) is a perennial herb 10 - 30 cm high with a deep stoloniferous rootstock. Endemic to southern Eyre Peninsula, South Australia, it favours grey, brown or reddish clay to clay/loam soils that set hard in summer and may become waterlogged in winter. It is usually found growing in more or less disturbed, open grassland communities dominated by *Danthonia caespitosa*, often in low-lying wet sites such as drains, seepage hollows, crabholes, or areas of high water run-off (roadsides, road intersections, rail corridors). Less frequently it is also found in relatively undisturbed sites under mature mallees (*Eucalyptus incrassata* or *E.* aff *dumosa*) or under *Melaleuca decussata*. Regeneration occurs from seed or as regrowth from root suckers. Plant numbers at five population monitoring points have been steadily declining over the last 12 years. 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 (2001) criteria (CR B2b(v)c(iv)). Extensive surveys over 1997 - 1999 counted approximately 16,000 individuals with an extent of occurrence of 711 km^2 and an area of occupancy of 0.8 km^2, reflecting the

Layout of excavation showing 4 crests (H,L,H,L) and interstitial trenches © M. Jusaitis

***Haloragis eyreana* plants ready for translocation © M. Jusaitis**

rather specific habitat requirements of this species and the fragmented nature of its habitat.

Goals

- Goal 1: Examine the influence of planting-site proximity to the water table on translocation success.
- Goal 2: Create artificial habitats with microsites optimized for the establishment and regeneration of *H. eyreana*.

Success Indicators

- Indicator 1: The completion of an experimental trial to evaluate the success of translocating *H. eyreana* to sites that have been artificially-lowered by soil excavation.
- Indicator 2: Creation of micro-habitats where *H. eyreana* translocants successfully survive, flower, reproduce and recruit over a period of 8 years following translocation.

Project Summary

The available habitat for *H. eyreana* has been in decline since most of its natural range was cleared for agriculture, leaving remnant populations largely restricted to roadside and rail reserves. Weed encroachment and soil compaction caused by road working machinery, particularly at road intersections, has contributed to losses of *H. eyreana* at many sites within its population range. In its current state, the species requires ongoing investment of resources into weed management at many extant sites. The natural habitat of *H. eyreana* covers low-lying sites prone to inundation following heavy rainfall in winter (Jusaitis & Freebairn, 2010). We wanted to explore the importance of this edaphic property for successful translocation and establishment of this species. If it were possible to artificially create such habitat, *H. eyreana* numbers could be augmented, new population sites could be established and potentially, weed control could be minimised. These trials were set up in collaboration with the local council in an attempt to engage them in species conservation and to demonstrate the potential for development and conservation to coexist.

At four locations along a roadside near Cummins, a backhoe was used to excavate a series of five trenches (400 - 500 mm deep, 700 mm wide), spaced about 500 mm apart. Trenches were separated by four undisturbed remnant soil columns (crests) about 5 m long and 500 mm wide. Two of these crests were left at natural soil level, and two were lowered by scraping about 200 mm of soil from the surface. Thus, we were left with three surface levels; crests at natural soil level (high), crests at 200 mm below soil level (low), and five interstitial trenches at 400 - 500 mm depth. All excavated soil was removed from the site. *H. eyreana* was micropropagated using explants sourced from eight local provenances (Lee & Jusaitis, 2000). 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 trenches. At the same time, 20 plants were transplanted as controls in undisturbed soil near the excavation. Survival and regeneration of *H. eyreana* at the three soil levels (high, low, trenches) and control sites were monitored annually.

Although plant survival on low crests and in controls was generally slightly higher than on high crests, the number of original transplants in all treatments declined steadily over 4 years, when none remained alive. However, during year 3, recruitment of new seedlings and sucker regrowths 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. Trench plants were more likely to perenniate from year to year than crest plants. Controls showed no recruitment until the 5th year, averaging 2 plants/m^2 by year 8. The lower recruitment in controls and on crests may be at least party due to competitive effects of weeds and other herbs, which were less prevalent in trenches. 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, but the ensuing transient submergence of plants did not appear to adversely affect their subsequent survival, growth or flowering.

A separate trial was set up to study translocation by direct seeding. A pre-weighed quantity of *H. eyreana* seed (0.3 g per quadrat, 3 replicates) was sown on crests and into control quadrats (30 x 30 cm) in August 2003. Some seedlings had germinated and emerged by December that year, albeit in low numbers (0.14% on low crests, 0.03% on high crests, 0% in controls). More seeds germinated the following winter, yielding a total germination of 1.1% on low crests, 0.8% on high crests, and 1.0% in controls. By the end of their second year, low crests had significantly more seedlings (6/quadrat) than did controls (2/quadrat), with high crests falling in between (4/quadrat). Seedlings usually did not flower until their second year, whereas transplants flowered and set seed in their first year.

The four planting locations varied considerably in their ability to sustain translocants over the long term. Differences in soil structure, moisture holding capacity, and weediness contributed to sustainability, with one site performing outstandingly better than the others. Although this variability reduced the power of statistical analyses, general trends in the data showed that trenches supported the best growth and regeneration of *H. eyreana*, followed by low crests, then high crests, and lastly controls. The improved performance of high crests compared

Natural recruitment in trenches in year 5 - note weeds along far rim of trench © M. Jusaitis

with controls may be attributable to the additional soil disturbance and vegetation clearance afforded the former during their construction.

Major difficulties faced

- Translocation sites varied considerable in soil structure and weediness so that some proved less suitable than others for plant establishment on crests. However, most trenches proved to be ideal sites to support good growth and regeneration of *H. eyreana*.
- Presence of water in trenches during wet winters made monitoring difficult.

Major lessons learned

- Natural regeneration of *H. eyreana* was significantly enhanced by edaphic modification of its habitat.
- 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 favorably to a certain amount of soil disturbance, provided weed encroachment is minimized.
- Trenches supported the best regeneration of *H. eyreana* in these trials, probably due to their closer proximity to the water table and ensuing protection from drought conditions. Furthermore they provided ideal catchments for seed, which mostly falls within 0.5 m of parent plants.
- 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.
- Translocation was successful using either transplants or direct seeding. However, transplants resulted in more rapid establishment, flowering and subsequent recruitment than occurred with direct seeding.

Success of project

Highly Successful	Successful	Partially Successful	Failure
√			

Reasons for success/failure:

- Edaphic amelioration provided an ideal micro-habitat for growth, flowering and recruitment of *H. eyreana*. In 8 years, the population was increased by over 1,000 new plants regenerating at four new sites within the population range.
- 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.
- Consecutive years of below average rainfall (2006 - 2007) caused marked reductions in *H. eyreana* numbers, but populations recovered in subsequent good seasons.
- At one location, severe weed competition led to reduced survival and failure to recruit new individuals.

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