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More case studies from around the globe
Edited by Pritpal S. Soorae

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Translocation of the desert phebalium to Yookamurra Sanctuary, South Australia

Manfred Jusaitis

Senior Biologist, Department of Environment and Natural Resources, Botanic Gardens of Adelaide, North Terrace, Adelaide, South Australia, 5000, Australia & Affiliate Senior Lecturer, School of Earth and Environmental Sciences, University of Adelaide *manfred.jusaitis@sa.gov.au*

Introduction

Desert phebalium (*Phebalium glandulosum* Hook. ssp. *macrocalyx* RL Giles) (Rutaceae) is a rounded, compact shrub growing to 1.5 m high, bearing dense, terminal clusters of yellow flowers during spring. Although this subspecies has a relatively wide distribution throughout New South Wales and Queensland (Giles *et al*., 2008), it is listed as Rare in Victoria (Gullen *et al*., 1990) and Endangered in South Australia under the National Parks & Wildlife Act 1972. The South Australian population represents the western-most outlier, significantly disjunct from its nearest neighbour in Victoria, giving it vital biogeographic and genetic significance. Its range in South Australia extends from the upper Yorke Peninsula to the Mt. Lofty Ranges, and remnants are restricted to roadsides or privately-owned scrub surrounded by agricultural land. Threats include stock-grazing on private land and roadworks, weed encroachment and isolation for roadside populations. Trial translocations were conducted to examine the effect of propagule type on transplantation success and to establish secure populations in suitable protected habitat.

Goals

- Goal 1: Conserve the local genetic diversity of *P. glandulosum* by establishing a new population in a protected and secure habitat.
- Goal 2: Examine the influence of propagule type on translocation success.

Success Indicators

- Indicator 1: Survival, flowering, reproduction and recruitment of *P. glandulosum* over a period of 20 years following translocation to a suitable secure site.

***Phebalium glandulosum* at full bloom © M. Jusaitis**

***P. glandulosum* in flower 20 yr after planting seedlings (LHS) or cutting-derived (RHS) transplants © M. Jusaitis**

- Indicator 2: The completion of an experimental translocation to evaluate the effect of propagule type on establishment success.

Project Summary

P. glandulosum was translocated into two protected parks; Yookamurra Sanctuary, secured against rabbits and feral animals by a 2 m high electric fence around its boundary, and Brookfield Conservation Park, ostensibly free-range to rabbits, goats and other vermin. These parks are respectively 75 km and 60 km from the nearest wild population of *P. glandulosum* and are the closest conserved areas of similar habitat and soil types to those in the natural range of the species. Propagating material for all translocations was sourced from wild populations on Yorke Peninsula. Plants were propagated from seed or cuttings in a nursery and hardened-off in 100 ml propagating tubes prior to translocation (Jusaitis, 2000).

In June 1991, in a preliminary trial to assess microsite suitability, 80 plants were planted at each of three sites in each park. Transplants at all sites in Brookfield Conservation Park died within 6 months of planting, possibly due to insufficient soil moisture and herbivory by rabbits, goats, kangaroos and possibly sheep. However, two sites in Yookamurra Sanctuary located in low-lying, wetter areas showed prolonged survival of transplants and these favourable microsites were selected for the main translocation trial the following year.

In June 1992, three replicates of 10 plants each (cutting-derived), were planted at the first site at Yookamurra. At the second site, seedlings were compared with cutting-derived transplants and three replicates of 10 plants of each propagule type were planted. The two sites varied significantly in the response of cutting-derived transplants. Site 1 plants grew taller over 20 years, reaching a height of 830(±23) mm, while Site 2 plants averaged 650(±35) mm. However, more plants survived at Site 2 (55%) than at Site 1 (13%). Survival of transplants at both sites declined steeply after the first year, but stabilized after about 3 years. Losses appeared to be due to local soil moisture deficits. Surviving plants continued to put on growth over 20 years of monitoring and at no time was any significant herbivore grazing damage observed. Flower buds were first seen on plants at both sites a year after planting and from then plants flowered and set seed

annually. In 2003, seed production was examined and the average percentage of flowers that set seed was found to be similar for translocated (Yookamurra) and wild plants (Yorke Peninsula). Wild plants set seed on 30(±4.0)% of flowers, while translocated plants at Sites 1 and 2 set seed on 32(±3.8)% and 18(±3.6)% of flowers respectively. The lower seed set at Site 2 may be a reflection of the plant's smaller size at this site.

In 2010, eighteen years after translocation, the first recruitment of new individuals was observed at both sites. Twenty seven seedlings were found clustered around the base of, and up to 4 m away from, parent plants. Most were at the 2-leaf stage, but a few were older and up to 250 mm in height, suggesting they may have germinated a year or two earlier. A year later, the total number of recruits had risen to 49. Thus the full cycle of establishment, flowering, reproduction and recruitment took at least 16 years for this species at these sites. Some intrusion of Ward's weed (*Carrichtera annua*) was observed at both sites and may adversely affect future recruitment of *P. glandulosum* if allowed to continue unabated.

In the trial examining the influence of propagule type on translocation success, seedlings grew at a far greater rate than cutting-derived plants, particularly during their first summer when they almost doubled in height over 7 months (Jusaitis, 1996). Growth rates slowed subsequently, but seedlings continued to consistently outgrow cuttings over 20 years of monitoring. Seedlings demonstrated higher survival than cuttings, so that after 2.5 years, 95% of seedlings survived compared with 75% of cuttings. These proportions remained stable over the following 8 years before several drought years between 2006 and 2009 resulted in a few more plant losses. Survival after 20 years was 90% for seedlings and 55% for cuttings.

Significantly more cutting-derived plants (87%) than seedlings (53%) flowered in their second year, although by their third year the proportion of each propagule type with flowers was the same (95%). Seed was observed on all plants in the fifth year after translocation, although it is possible that seed may have set in earlier years but not been observed because plants were monitored when flowering rather than during seed set.

In summary, these trials showed that *P. glandulosum* could be successfully established at suitable sites in the Yookamurra Sanctuary. They also demonstrated that seedlings are the preferred founder propagule for *P.*

Naturally regenerated seedlings at Yookamurra Sanctuary © M. Jusaitis

glandulosum, yielding higher growth rates and superior survival compared with cutting-derived transplants.

Major difficulties faced

- Lack of suitable conserved habitat within the population range of *P. glandulosum* in South Australia resulted in translocation occurring outside it.
- Selection of microsites with suitable edaphic, biotic and environmental attributes to perpetuate the species was difficult. Adequate soil moisture was a vital attribute for prolonged survival.
- Grazing and uprooting of transplants by introduced or native animals at Brookfield Conservation Park.
- Several years of below average rainfall (between 2006 and 2009) in the region contributed to plant losses.

Major lessons learned

- The preliminary trial showed that *P. glandulosum* would not establish if exposed to animal damage or if planted into sites where soil failed to retain sufficient moisture during the establishment phase.
- Protection of translocants from grazing and uprooting damage caused by some animals is important to maximize survival.
- Use of seedlings rather than cutting-derived transplants will optimize growth and survival.
- Although seeds are ejected up to a metre from parent plants and potentially dispersed even further by ants (Jusaitis, 2000), many new seedling recruits were found clustered around the base of parent plants. It is postulated that the shade and resultant moisture retention around the base of parent plants provided an important germination niche for recruitment of new seedlings.
- Patience was necessary to observe the first naturally recruited seedlings, which did not emerge until at least 16 years after translocation. Recruitment did not require a disturbance event.

Success of project

Highly Successful	Successful	Partially Successful	Failure
√			

Reasons for success/failure:

- Established a new population of 33 *P. glandulosum* plants at 2 sites in the Yookamurra Sanctuary.
- The highly effective 2 m high electric fence around the Yookamurra Sanctuary was crucial to exclude feral animals from grazing or disrupting transplants.
- A preliminary translocation trial to examine microsite suitability resulted in subsequent translocations being sited in more appropriate locations. Choosing suitable microsites was an essential element of success.
- Demonstrated that the source of transplants (seed *vs.* cuttings) has a significant influence on translocation outcomes.

- Natural recruitment of the next generation of *P. glandulosum* was observed around parent plants 18 years after translocation, demonstrating completion of the full life cycle for this species at this site.
- Preliminary research on propagation methods for *P. glandulosum* (Jusaitis, 2000) enabled large numbers of plants to be propagated when required for translocation.
- Commitment to long term management and monitoring of translocated populations ensured goals were successfully achieved.
- The commitment of the Australian Wildlife Conservancy to maintaining Yookamurra as a conservation sanctuary for wildlife and for supporting research and education on threatened species.

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