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Threatened plant translocation case study:

Astelia australiana (Tall Astelia) Asteliaceae

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The species

- Long-leaved, tufted, perennial herb.
- Reproduces both sexually and vegetatively.
- Long-lived (30+ years).
- Endemic to cool temperate rainforests and riparian forests of Victoria.
- Narrow and fragmented distribution in the Central Highlands (14 sites) and Otway Ranges (one site).
- Overall abundance is estimated at 10,000 plants.
- Abundance within sites is highly variable, from areas in which it is the dominant component of the understorey with ~4000 individuals to areas with fewer than 10 individuals.

Threatening processes

- Grazing by introduced herbivores (deer species).
- Wildfire.
- Diseases caused by *Pythium* and *Phytophthora* species.
- Seed predation through frugivory.
- Changes in stand structure.
- Habitat fragmentation.
- Climate change.

Deciding to translocate

Astelia australiana is listed as a threatened species (Cutler and Murphy 2010) due to the decline and fragmentation of its populations attributed to successive wildfires in the 1920s (Willis 1939). It is associated with the cool temperate rainforest community, which is also listed as a threatened vegetation community in Victoria, due to significant decline in its extent, which is attributed to an increase in wildfire frequency since European colonisation (Department of Sustainability and Environment 2009; SAC 1992). Long-term (20-year) monitoring of *A. australiana* populations revealed that the species has continued to decline across its range with a 57% reduction in abundance in monitored population between 1993 and 2013.

Aim of translocation

This translocation involved two translocation programs. The first program was a trial with the aim to assess if translocation was a viable option for the species and to assess if seed or seedlings could be used for translocation. The second program had several aims:

- To increase the species range.
- To reduce the risk of a single wildfire taking out remaining populations.
- To mitigate the risk of climate change on the species by moving individuals into a few higher elevation sites.
- To replace a population that had gone locally extinct in 2016 at one site.

Translocation working group and key stakeholders

- School of Ecosystem and Forest Sciences, The University of Melbourne.
- Conservation Ecology Centre, Otway Lighthouse Rd, Cape Otway, VIC 3233.
- Parks Victoria.
- Department of Environment, Land, Water and Planning (DELWP).
- Foundation for Australia's Most Endangered Species (FAME).

Biology and ecology

The Central Highlands and Otway Ranges are climatically similar with high mean annual rainfall (>1000 mm), mild summers with mean maximum temperatures of less than 27°C and mean annual temperatures between 5–14°C (Busby 1992; Hijmans *et al.* 2005; Peel 1999). *A. australiana* sites are characterised by cool temperate rainforest vegetation typically dominated by an overstory of Myrtle Beech (*Nothofagus cunninghamii*) and Southern Sassafras (*Atherosperma moschatum*), a middle stratum of Soft Tree Ferns (*Dicksonia antarctica*) and a lower story of fern species dominated by Hard Water Fern (*Blechnum wattsii*). The sites are generally limited to gullies adjacent to watercourses (Hill *et al.* 1988; Peel 1999; Worth *et al.* 2009).

Site selection

We used maps of the current distribution of cool temperate rainforest and watercourses across Victoria and overlayed predictions of suitable habitat from a species distribution model we developed for *A. australiana*. We then overlaid land tenure and forest management zones to identify potential translocation sites on public land and within special protection management zones. Permits were applied for and granted. Potential sites were then visited, and their suitability was assessed. Sites were rejected if there was evidence of deer presence, if the slopes were too steep, or if forest structure resulted in low light availability in the understorey.

Translocation proposal

To enable translocation, we completed a procedure statement for Translocation of Threatened Native Flora in Victoria plan. This plan involved explaining the aim and methods of the translocation and also obtaining written endorsement of the translocation proposal by two external referees. Once our proposal was approved we conducted a trial translocation of 54 individuals to assess the viability of translocation as a management tool for *A. australiana*. We then successfully obtained a Biodiversity On-ground Actions Regional Partnerships and Targeted Actions Project grant from DELWP to conduct translocations at additional sites.

Pre-translocation preparation, design, implementation and ongoing maintenance

The trial translocation of 54 individuals involved moving eighteen individuals into each of three sites (the source site (control), a locally absent site adjacent to the source site (1 km away); and a distant site (22 km away)). Plants were removed from the source site using a shovel to loosen the soil around their roots. The plant roots were then wrapped in a wet cloth and they were placed into large bags for carrying out of the site. The translocation site was cleared of understory vegetation using a shovel to relocate them as needed. *A. australiana* individuals were planted in shallow holes. Translocated plants had high survival rates, between 83–89%, and growth was similar between all sites. This trial also involved translocation of seeds and 10 seedlings into the same three sites.

Tim Willersdorf (left) and Craig Nitschke (right) carrying the source *Astelia australiana* for translocation into the locally absent site. Photo: Linda Parker

The second translocation involved moving 200 individuals from five source sites and planting them into five sites including the distant trial site described above (additional 25 plants). We translocated into one site where *A. asteliana* had recently become locally extinct, likely due to browsing by deer. This site is now fenced to exclude browsing (25 plants). We established new populations of 50 individuals each at two new sites within the Central Highlands and one site in the Otway Ranges. The translocation procedure was the same as described for the trial translocation. Multiple source sites were used to ensure genetic variability within the new populations.

Monitoring and evaluation

Translocation sites have been monitored on an annual basis with monitoring involving the recording of survivorship and growth. To date the translocation has been considered a success as survival has been high > 86% after one year. We have also had reproduction in the control trial translocation population. The monitoring will continue to determine if translocated individuals are able to become self-sustaining populations.

What we learned

- *A. australiana* can be successfully translocated.
- Translocation sites should be free of introduced herbivores or fenced.
- Seeds and seedlings did not translocate well.
- Translocated individuals should be planted in soil that is free draining. They should not be planted in saturated soils adjacent to watercourses as this will lead to increased mortality.

Translocated *Astelia australiana* in one of the distant translocation sites. Photo: Linda Parker

Outcomes

A. australiana individuals that were involved in the initial trial translocation had high survival rates (89%, 83%, and 83% at the absent, present, and locally absent sites respectively). Growth in terms of number of green leaves, leaf length and leaf width did not differ across the three site types. As most translocated individuals survived, our results suggest that the species may be absent from sites for other reasons than habitat limitation. Dispersal limitation or low success of seed-based recruitment may explain the absence of *A. australiana* at these sites, however, habitat population dynamics can be complex and these factors alone may not explain a species absence at all sites. Translocation appears to be a viable management option to expanding the range of *A. australiana* and overcoming dispersal limitation. It would also reduce the effects of isolation on its population demographics. Current research focusing on *A. australiana* genetics, within and between populations, should inform the degree that isolationism is having on the species and how future translocation efforts can be undertaken to promote genetic diversity and gene flow.

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All research was conducted with approval from DELWP and research permits were issued under The Flora and Fauna Guarantee Act 1988 and The National Parks Act 1975 (10006488) and The Forests Act 1958 (FS/14/3694/1/3).

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