experimental translocation trial demonstrated that plants propagated from cuttings had the highest survival. Furthermore, protecting plants from frost and macropod grazing increased survival in the short-term.

Over 100 volunteers from the local community assisted in the translocation plantings of *P. pauciflora* in 2016 and 2017 (Figure 3). Feedback gathered across three community planting days was resoundingly positive, and a translocation team member continues to provide information on *P. pauciflora* for the community.

What we learned

- A small translocation trial using an experimental framework was important in understanding factors important for establishment and survival.
- Attention to appropriate planting material is required.
- Fencing provides protection from macropod grazing, but can inhibit growth due to an increase in plant competition.
- Involving the local community in plantings encourages stewardship and respect for the plight of threatened species.

Acknowledgements

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Threatened plant translocation case study:

Cassinia rugata (Wrinkled Dollybush), Asteraceae

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The Species

Cassinia rugata (Wrinkled Dollybush) was rediscovered in Tasmania in 2010, and is known from two private properties in the central north: (1) Rubicon that is covenanted with about 6 to 9 ha of suitable habitat, and (2) on Squeaking Point Road that has an informal area set aside of approximately 0.6 ha. A few plants were mapped on roadsides in 2010 in the neighbourhood of these properties. The total population in Tasmania in 2014 was approximately 500 mature plants. It is listed as Endangered in Tasmania and Vulnerable nationally, with only a few small populations known in Victoria (Carter and Walsh 2006).

Biology and Ecology

In central north Tasmania, *C. rugata* is a multi-branched shrub that grows to about 1.5 m in wet (sedgy) heathland. Plants decline rapidly when shaded by shrubs or trees, and plants in long-undisturbed open situations tend to become straggly and die back. Experiments at Rubicon showed that after fire, caged plants survived and grew faster than uncaged plants. However, response to fire is not predictable or well-understood.

Threatening Processes

All known roadside plants neighbouring the two extant Tasmanian populations have disappeared for reasons unknown within the last five years. The Squeaking Point Road population was threatened recently by conversion of its wet heathland habitat to a horse paddock; only a last-minute intervention with a willing land-owner prevented the extirpation of this population. Any other currently unknown populations are subject to similar risks, especially if not within view of a public road and a knowledgeable public.

Disturbance by slashing or burning to reduce competition seem essential to the survival of the species in Tasmania. Only one population has a management plan that requires this treatment.

Deciding to translocate

At Rubicon, we have prioritised *C. rugata* for active and experimental management. Gaps in our knowledge are reflected in the inconsistent response following the 2013 burn, where some groups of plants have largely vanished, while elsewhere seedlings appear to be thriving. Given our very limited knowledge about population dynamics, we decided that it would be prudent to experiment with translocation, which could provide a fall-back method should more groups of plants be seen to decline.

Aim of the translocation

The aim of the translocation was to learn more about possible methods for successful translocation, and to establish a new small self-sustaining population at Rubicon.

Translocation working group and key stakeholders

The landowners, Phil Collier and Robin Garnett, initiated the translocation experiments. Dr Wendy Potts, then Senior Botanist, Threatened Species Section, Department of Primary Industries, Parks, Water and Environment (DPIPWE), reviewed our proposed method and issued permit TFL14098 that permits the 'taking' of *C. rugata* plant material.

Figure 1. Translocated *Cassinia rugata* seedling at site 2. Photo: Phil Collier

We had previously collected *C. rugata* seeds under permit for James Wood, Seedbank Manager, Royal Tasmanian Botanical Gardens. These seeds, once cleaned and sorted, passed the Seedbank viability test, which is 75% germination.

Site selection

A site was selected in sedgy heathland at Rubicon (covenanted private land) that was burnt in April 2014. The site was similar to habitat where *C. rugata* occurs naturally, particularly in terms of seasonal inundation. It was about 100 metres from a known population, and closer to an isolated plant previously recorded that has since disappeared. The site previously did not support *C. rugata* plants, nor other priority species at Rubicon.

Translocation proposal

A proposal for a *Cassinia rugata* translocation and germination trial was prepared and circulated in April 2014, in part to assist with gaining a permit from DPIWE.

Pre-translocation preparation, design, implementation and ongoing maintenance

Experimental design

At the selected site, plots were located 3 m apart along four transects that were also 3 m apart. The plots were offset by 1.5 m on adjacent transects. Each plot was assigned a number from 1 to 30. Plots were first randomly assigned to be one of the 10 plots for seed sowing or 20 plots for transplanting seedlings. Within these two groups, plots were randomly allocated to the caged or uncaged treatment.

Seed collection and sowing

Seeds were collected from as many adult *C. rugata* plants as possible in February 2014 and bulked. Ten batches of viable-looking seeds were mixed with about 25 mL of dried sand and spread across the plots. The remaining seeds and seed heads were spread over a nearby burnt area, and 6 additional post hoc seed plots were established where seed had germinated in this area. Three of these plots were caged and the other three uncaged.

Transplants of seedlings that had germinated in the field

Translocated plants were sourced from a site that was burnt in April 2013. These were one-year-old seedling plants that had germinated naturally. Seedlings were selected that were generally very close to adult plants or close to other seedlings. Each seedling was excavated using a bulb planter with a minimum diameter of 60 mm at the base. The tool was rotated and pushed into the ground to a depth of about 110 mm and the resulting peaty soil was gently eased out while still inside the tube. This produced a consistent and stable cylinder of soil that included each seedling plant, or sometimes more than one plant.

Figure 2. *Cassinia rugata* adult plant. Photo: Phil Collier

Figure 3. *Cassinia rugata* flower head. Photo: Phil Collier

Tagging plants and cage construction

Once the seeds were sown and plants translocated, a numbered flag was installed a measured distance from translocated plants and in the middle of each germination site. Cages were then installed at the allocated sites. Each cage was constructed from high-quality 60/4/1.4 netting i.e., 60 cm tall, 4 cm mesh spacing, 1.4mm wire. 1 m lengths of netting were cut ends joined to form a cylinder approximately 300 mm in diameter. Cages were secured to the ground with three galvanized metal stakes at the base and are robust enough to stand erect in this configuration.

Monitoring

After the translocation and seed sowing, the site was visited about every six months to check the cages and monitor the progress of the plants, including height and number of flower clusters. At each germination site, the number of seedling plants within 150 mm of its marker flag are counted. More recently, as the number of seedlings has declined, we have also measured the height of the tallest seedling at each site.

Outcomes

Results for translocated plants are based on analysis of monitoring data collected in January 2018 and, where required, a comparison with April 2014 data:

- 4 out of 14 uncaged plants are still alive compared with 10 out of 12 caged plants.
- Median height of living uncaged plants = 394 mm, median height of caged plants = 806 mm.
- In January 2018, none of the four living uncaged plants were flowering, while 5 of the 10 living caged plants were flowering. Two of the caged flowering plants were over 1000 mm tall and can reasonably be called mature plants.

For the germination experiment, we examined the number of surviving seedlings and the maximum height of the tallest living seedling at each plot. Combined results for plots where seeds were sown under experimental conditions and identified post hoc indicate no significant difference between caged and uncaged conditions. Very few of the seedlings are healthy and robust, and appear to be struggling to complete with surrounding vegetation.

Figure 4. Excavated *Cassinia rugata* seedling to be transplanted and bulb planter. Photo: Robin Garnett

What we learned

Despite its limitation with sample size, the translocation experiment demonstrates that translocation is feasible, and that caging of plants provides reduced plant mortality, increased plant height and earlier flowering. This is because, immediately following the burn, the translocated plants were the dominant 'green pick' at the site and uncaged plants were grazed by macropods and/or rabbits, either setting them back or killing them.

In contrast, seeds sown at the same site did not benefit from caging. A likely reason for this is that these seedlings were tiny at the time surrounding vegetation was recovering from the burn. Unfortunately, the seedlings have remained relatively small compared to competing vegetation, and seem unlikely to survive to maturity, and/or the next scheduled burn.

Translocated plants in the experiment were one-year seedlings in an area that had just been burnt. As such they had a potential advantage over all other regenerating vegetation at the site. Comparison of the heights of plants in the translocation and germination experiments strongly indicates that any damage arising from the translocation process was much less significant than this one-year head-start in growth.

From a resource perspective, sourcing plants to translocate from a nearby burnt area is a major benefit. This also minimises any possible negative effects from introducing foreign soil or potting mix to the site. Caging of plants is resource-intensive from the perspective of materials, labour and maintenance. Translocating seedlings in the spring, when the surrounding vegetation is growing and potentially providing some protection, is worthy of a follow-up experiment, as this may reduce the need for caging. Lastly, the benefits of caging reflect the abundance of grazing animals near this location, which was not measured or controlled in the experiment.

Figure 5. Site preparation, showing cages. Photo: Robin Garnett

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News from the Australian Seed Bank Partnership

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New Zealand Seed Conservation Techniques Training – December 2017

In early December 2017 the Australian Seed Bank Partnership (ASBP) sent two seed conservation experts to Auckland and Wellington, New Zealand to join Te Tira Whakamātaki (the Māori Biosecurity Network) and the Millennium Seed Bank Partnership (MSBP; RBG Kew) with delivery of Seed Conservation Techniques workshops to a range of stakeholders, including representatives of 11 hapū (sub-tribes), iwi (tribes) and Māori organisations.

Jason Halford from the Brisbane Botanic Gardens, Mt Coot-tha in Queensland and Graeme Errington from Australian PlantBank at the Australian Botanic Garden, Mount Annan in New South Wales spent a week each sharing their knowledge of seed conservation techniques, as well as the identification of species susceptible to the impact of *Austropuccinia psidii*, more commonly known as Myrtle Rust.