Science for Policy

Research findings in brief

Project 4.3

Threatened Species Recovery Hub

National Environmental Science Programme

Threatened plant translocation in Australia: A review

In brief

The translocation of plants has become increasingly common over the past two decades, particularly as actions for recovery of threatened plants and when threatened plants are within the area of a proposed development. However, it is not yet clear how successful the practice is in achieving long-term conservation outcomes.

New research has combined a review of all available literature with extensive consultations with translocation practitioners to gather information about translocations of threatened Australian plants.

We documented 1001 translocations occurring in Australia, which included 376 species and subspecies. We had sufficient data to assess 724 of these.

We found that many translocations involved propagation of extremely small numbers of plants (45% involved less than 50), 42% had less than 10 surviving plants and only 13% had 50 or more with some second-generation recruitment. We found that the chance of creating a viable population increased with the use of at least 500 founder individuals.

Four decades after the first conservation translocations, our evaluation highlights the need to consider translocation in the broad context of conservation actions for threatened species recovery and the need for long-term commitment to monitoring, site maintenance and documentation.

Leonie Monks, Rebecca Dillon and Sarah Barrett collecting seed from a Lambertia orbifolia *translocation. Photo: Dave Coates*

Background

The practice of translocation (or moving species) has become widespread in biodiversity conservation globally as the pressure of human activity on ecosystems and species accelerates.

Plant translocation is the deliberate transfer of plants or regenerative plant material from one location to another. The source plants can come from either a natural population or an *ex-situ* source such as plants propagated in a nursery. The receiving location could be a new natural or managed location. The usual aim is to establish a resilient, self-sustaining population, and thus reduce the risk of extinction.

Translocations are being increasingly used to mitigate the impacts of developments, such as where populations of rare and threatened plants are in within the path of a development. Also, with the increasing effects of climate change, the prevalence and imperatives for translocations will continue to grow.

However, very few studies have been published on the practice of translocation or the rates of success, therefore there is little evidence regarding whether translocation should be viewed as a viable long-term conservation strategy. The consensus of the few global studies to date highlights translocation as a relatively high-risk, high-cost and challenging strategy, and we set out to add knowledge from the Australian context to this emerging picture.

The University of Queensland Australia · The University of Melbourne · The University of Adelaide · Australian National University · Department of Biodiversity, Conservation and Attractions, Government of Western Australia · Biodiversity and Conservation Science · Royal Botanic Gardens Victoria · Botanic Gardens and State Herbarium

Research aims

The research investigated: how many plant translocations for conservation have taken place in Australia (and how many of these have been reported in the published literature); where these translocations have been concentrated; what species and plant types have been involved; who has undertaken translocations; and why. We used this information to address the following questions:

1. What techniques and methods are commonly used in Australian plant translocations?
2. How have these translocations performed?
3. What are the key biological or management factors that are correlated with success?

Our aim is to improve translocation science and practice in Australia and globally by enabling more informed decisions to be made on when and where translocation is likely to be an effective management tool, and to provide practical guidance on improving outcomes for translocations.

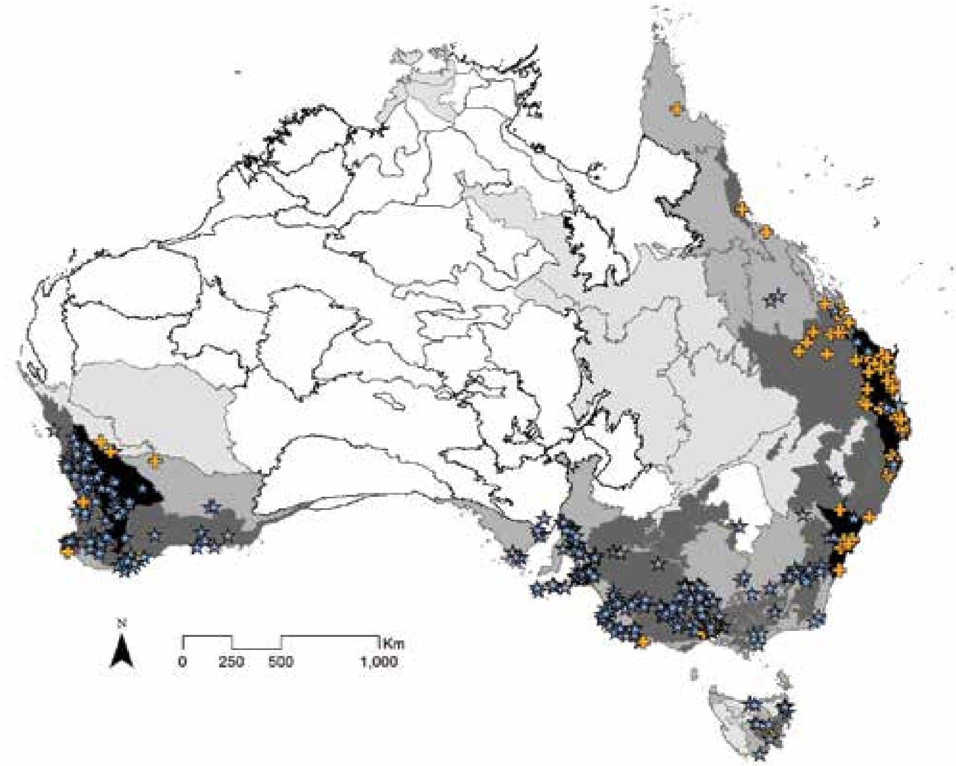

Figure 1: *Translocations documented in Australia. Stars represent conservation translocations and crosses represent development mitigation translocations. Australia's 89 biogeographic regions are shaded according to number of state and federally listed Endangered and Critically Endangered plant species: white = 0–2, light grey = 3–10, medium grey = 11–30 and black = 73–119.*

What we did

We undertook an extensive literature review; however, the vast majority of translocations are not published in the scientific literature, and even those that are do not usually contain sufficient or the most up-to-date information.To overcome this, between July 2016 and August 2017 we interviewed more than 130 botanists, researchers, natural resource management group representatives and environmental consultants about translocations that they had been involved in or had knowledge of. In combination, the literature review and interviews brought together the most up-to-date information on this increasingly prominent but poorly documented practice.

One challenge of reviewing projects was defining success. This is especially difficult for long-lived species. Only after decades or even centuries of monitoring can it be determined if the goals of translocation have been met – that is, for translocated individuals to have become established, shown seedling recruitment and created viable, self-sustaining populations. Given this, we devised short, medium and long-term success criteria – respectively, percentage of plants surviving the first year; establishment of a viable population with evidence of flowering and/or fruiting; and establishment of a self-sustaining population with recruitment similar to natural populations. We also modelled the variation in translocation success, using as our variables the number of surviving plants and whether recruitment had occurred.

LEFT: Grevillea wilkinsonii *flowers. (Photo: J. Briggs)*

Key findings

We documented a total of 1001 translocations involving 376 species and subspecies, concentrated in regions and habitats with high numbers of threatened species. These spanned all the Australian states and territories except the Northern Territory. New South Wales had the most documented translocations (258), followed by Victoria (243), South Australia (209) and Western Australia (148) (*see Figure 1 - LEFT*).

Translocation is an increasingly used strategy in conservation biology. Over 85% of plant translocations have taken place since 2000, half of these since 2010. There has been an especially rapid increase in development mitigation translocations, which account for 30% of all translocations documented. Only a small proportion of the translocation attempts were documented in peer-reviewed literature: 109 translocation attempts encompassing 71 species or subspecies.

Translocations have mostly occurred in highly modified habitats, especially temperate grasslands and grassy woodlands (253), southern Australian heathlands and shrublands on infertile soils (224), rainforest and wet sclerophyll forests (64), coastal shrubland and heathland (57) and mallee communities (52) (*see Figure 2*).

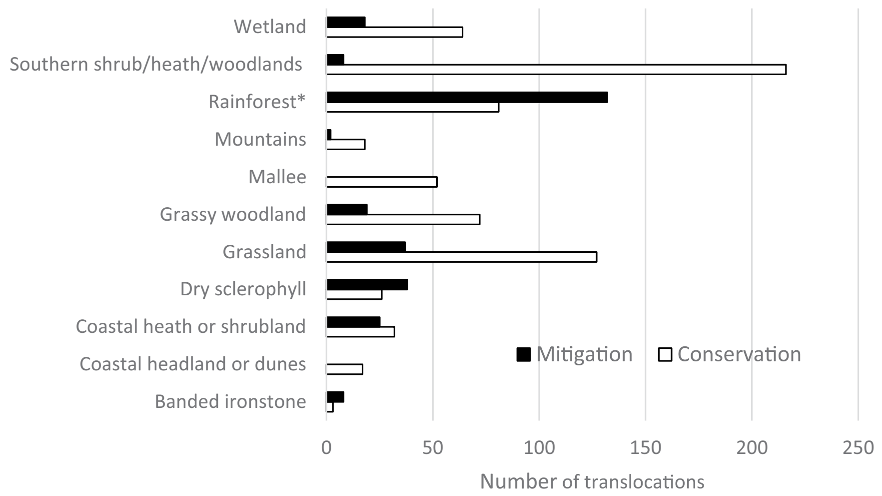

***Figure 2:** Number of plant translocations by broad habitat groups in Australia. *Rainforest includes wet sclerophyll forests on rainforest margins.*

An examination of the types of plant material employed for propagation (propagules) that were used in translocations found that while more than a quarter of translocations have used multiple propagule types, seedlings propagated *ex-situ* (in a nursery) were the most common, used in 59% of translocations, followed by cuttings (26%). Twenty percent of translocations moved whole plants, whether adults or seedlings. Many translocations involved extremely small numbers of propagules, with 45% using less than 50 propagules and only 16% using more than 250.

Planting techniques were detailed for 884 translocations, and included site preparation (soil surface preparation and weeding/slashing), grazing protection (using fencing, cages or guards), watering, post-planting weeding and planned burning in a range of different habitats.

The factors that were identified as leading to success included taking an experimental approach, correct choice of propagule or selection of good habitat or microsite, long-term maintenance, monitoring and commitment to the project, climate (good rains following planting), protection from grazing and/or trampling, species being inherently good to work with, sound biological and ecological knowledge, watering, weeding and nursery and/or planting techniques.

Short-term success of translocations is generally high, with 72% of translocations showing at least 50% survival of propagules after one year and 41% with at least three-quarters of propagules surviving this period.

Translocation performance, measured by the number of plants surviving and second-generation recruitment, we found to be highly variable between plant lifeforms, habitats and propagule type. However, species was more variable than all of these, suggesting that some species respond better than others to translocation.

Over the longer term, of the 724 translocations with sufficient data to assess performance, 42% saw less than 10 plants surviving and a further 21% had fewer plants surviving than is considered necessary to establish self-sustaining populations. Just 13% had at least 50 plants surviving plus some second-generation recruitment into the population.

Importantly, we found that using at least 500 founder individuals increased the chances of creating a viable population. Further, we found that with the notable exception of semi-arid grassland forbs and species that reproduce vegetatively, second generation recruitment is generally lacking and is the major factor inhibiting success in translocations that had adequate numbers of founder individuals and good survival rates.

ABOVE: *Wire cage around* Prostanthera eurybioides *to discourage grazers. Photo: M Jusaitis*

Recommendations

We found that the strongest predictor of translocation success is the use of a sufficient number of propagules at planting. If a suitably large number of propagules is not available for a particular species, then consideration should be given as to whether translocation is the best conservation action to be undertaken for that species.

After four decades, translocation of threatened plants in Australia remains largely at the experimental stage, and our results show that, so far, only a small proportion of translocations have reached the ultimate objective of becoming self-sustaining populations. This suggests that caution should be exercised in relying on the use of translocation to mitigate impacts of development on threatened species. It also highlights the value of experimental approaches, whereby information learnt about plant life history, habitat requirements and translocation methods can improve future translocations, as well as *in-situ* conservation actions. Well-documented experimental translocations can also inform protocols and contribute to knowledge of this emerging science beyond individual species and sites.

When considered in the context of a range of conservation actions required to secure species recovery, translocation can be an effective conservation tool for some of our most imperilled species. Using sufficient numbers of founder propagules, ensuring good early survival, and a commitment to long-term maintenance, monitoring and documentation will all underpin success into an uncertain future.

Chris Crottey of Botanical Gardens and Centennial Parklands, Sydney, with a newly planted Wollemia nobilis*. Photo: Jaime Plaza*

Work cited

Silcock et al. 2019 Threatened plant translocation in Australia: a review, *Biological Conservation* 236:211-222.

Further Information

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