

Threatened plant translocation case study:

Macadamia janseni (Bulburin nut), Proteaceae

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The species

Macadamia janseni (Bulburin nut) is Endangered (under the EPBC Act) and only known in the wild from a single population of around 60 plants (>1m in height) distributed over 1 km along a single creek within Bulburin National Park, Queensland, 180 km north of the other *Macadamia* species. The Australian Government Threatened Species Strategy lists the Bulburin nut as one of 30 threatened plant species with priority for conservation and a commitment for action by 2020.

Threatening processes

Weeds, fire, human interference.

Deciding to translocate

The *Macadamia* recovery plan (Costelo *et al.* 2009) recommended a reintroduction program to safe guard against chance extinction.

Aim of the translocation

To establish new populations of the species in the wild.

Translocation working group and key stakeholders

Macadamia Conservation Committee (MCC), University Sunshine Coast (USC), Australian Macadamia Society (AMS), Macadamia Conservation Trust (MCT), Gidarjil Cultural Heritage Corporation (representing traditional owners), Queensland National Parks (rangers responsible for Bulburin National Park).

Biology and ecology

M. janseni is a long-lived rainforest species with wild trees growing up to 12m in height. The species is thought to be insect pollinated, and survey work indicated that the plants produce few seeds in the wild, which is similar to wild populations of other *Macadamia* species despite often abundant flower production. The wild population has a pulsed size distribution with low levels of recruitment evident. (*Editors note: A pulsed size distribution indicates that recruitment into the population has been event-based rather than constant*). Population genetic studies indicated moderate genetic diversity and



Figure 1. Undertaking the original wild population survey, Alison Shapcott with Gidarjil Caring for Country Rangers. Photo: Alison Shapcott



Figure 2. *Macadamia janseni* in flower in the wild. Photo: Alison Shapcott

no significant inbreeding which was not expected given the very small population size. Genetic studies on other *Macadamia* species have found that moderate genetic diversity and low inbreeding levels are maintained by pollen dispersal among closely located small populations and this information was used to guide reintroduction site selection (Neal 2007, O'Connor *et al.* 2015).



Figure 3. Left to right: Collecting plant material for cutting from the wild population with Gidarjil Caring for Country (CRC) rangers and QPWS ranger for Bulburin National Park. Alison Shapcott and Macadamia propagators. Photos: Alison Shapcott

Site selection

We used species habitat suitability distribution modelling (SDM) within the local region to identify areas most likely to be suitable for reintroduction (Shapcott and Powell 2011). We then ground-truthed potential sites for ecological and practical suitability and accessibility for planting. Two sites were selected within Bulburin National Park in collaboration with local QPWS rangers; one at a higher altitude than the existing population in order to allow for anticipated future climate change (Powell *et al.* 2014). A further two sites within land owned and managed by the Gidarjil Cultural Heritage Corporation representing traditional owners were also selected and occurred close to the wild population. All sites were located within the potential range of long distance dispersal of pollen by insect pollinators, among themselves and the wild population, based on genetic estimates (Neal 2007).

Translocation proposal

The translocation/reintroduction proposal was developed by USC in collaboration with all stakeholders including the MCC and was submitted to the Queensland National Parks as part of obtaining permission to take cuttings from the wild population for propagation.

Pre-translocation preparation, design, implementation and ongoing maintenance

Original population maps of individual plant locations and sizes were used to relocate individual plants to take cuttings from all plants larger than a minimum size specified by the EPA permit. The same plant identification

codes were given to samples for propagation as used in the original population genetics study which conducted a complete population genetic survey (Shapcott and Powell 2011). Plant identification codes were maintained throughout the reintroduction program. Cuttings were selected as the propagation method in order to capture the genetic diversity of the population and because very few seeds are produced; propagation by cuttings is a method well established by the macadamia growers industry. This method enabled multiple copies of clones representing individual plants to be created. The four new populations were each planted with a complete set of clones, representing approximately 85% of individuals in the wild population greater than 3m tall. The plantings were conducted over four stages, each 1-2 years apart. The location, identity and survival of all plants at each planting site was documented, and plants that died were replaced with the same clone. Clones were re-established in the nursery from the original set of "mother plant clones". Prior to the last planting in 2017, 40 plants had successfully established across the four sites (average 10 per site). This is comparable with the 60 plants in the wild population which is spread across three subpopulations (Shapcott and Powell 2011), and is similar to that of many wild populations of Macadamia (Costelo *et al.* 2009). The low survival rate of translocated plant was, in part, attributed to at least two severe flooding events during the project. This reintroduction aimed to mimic wild populations with minimal ongoing maintenance and site disturbance, following on from initial watering in when planted as well as a supply of hydrated water crystals. The Gidarjil rangers lead ongoing site monitoring and remove weeds.

Subsequent actions

A recent new search has located additional plants in the wild. A final census of both the reintroduced and wild populations is scheduled for 2019 after which the project will be assessed. A complete set of clones has also been established at Tondoon Botanical Gardens in Gladstone so that any new propagation or new reintroduction does not need to interfere with the wild population. A new planting is now also scheduled for 2019. The Macadamia Conservation Trust (MCT) through Tondoon Botanic Gardens is planning to establish additional 'insurance populations' at four Botanic Gardens and/or other secure sites.

Outcomes

While the populations are currently small we have successfully reintroduced this species within its natural range with hardy plants that do not require human interference.

What we learned

There is high mortality among young plants less than 1m tall both in wild populations and in reintroduced populations. We found plant establishment to take two years. A project that repeatedly introduces plants over time is more likely to be successful in the long term and a two-year period is needed to assess if plants will become established. Projects should plan for plant replacement as a high mortality rate of young plants is common in wild and introduced populations and should not be seen as a sign of project failure. The good will, generosity and persistence of those involved have been essential for this project.

References and further reading

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Figure 4. Left to right: *M. jansenii* cuttings ready for planting. Planting *M. jansenii* on Gidarjil property. *M. jansenii* established for several years. Photos: Alison Shapcott