Case study: Threatened plant translocation

The success of the endangered rainforest shrub *Graptophyllum reticulatum* (Buderim Holly, Veiny Graptophyllum) Acanthaceae, translocation, 20 years later

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The species

Graptophyllum reticulatum (Acanthaceae), also known as Veiny Graptophyllum or locally Buderim Holly, is a lowland subtropical rainforest shrub listed as endangered by the *Queensland Nature Conservation Act* 1992 (NCA) and the *Environment Protection and Biodiversity Conservation Act* 1999 (the EPBC Act). The species' geographical distribution is very restricted with very few known populations in the Sunshine Coast region of south-east Queensland (Shapcott 2007; Lynch 2007). This understorey shrub usually grows to 1–2.5 metres tall, although it can reach up to four metres (Figure 1).

G. reticulatum can regenerate through layering and resprouting, and usually flowers between September and December (Bean and Sharpe 1991). It grows along creek lines and nearby hillsides, on rocky, basaltic soils (Bean and Sharpe 1991; Lynch 2007). However, while the species is likely to be restricted to moist rainforest understorey habitat, it is less likely to be restricted by soil type (Thach *et al.* 2007). The total number of individuals was estimated to be 1300 in 2001 (Shapcott 2007); but since then, more populations have been located and a recent survey in 2023 estimated the species population size to be over 3000 (Shapcott *et al*. 2023, unpublished data).

Figure 1. (a) Multi-stemmed *Graptophyllum reticulatum* ; (b) leaves catching the light of plant growing on rock ; (c) flower. Photos: Alison Shapcott

Threatening processes and management

Historically, the main threat to *G. reticulatum* is human disturbance. The high nutrient basaltic soils, on which the species grows, were previously subject to extensive land clearing for agriculture, leading to habitat degradation and loss. More recently, urbanisation has further impacted the remaining populations in some areas both directly and indirectly as some populations are embedded within a dense urban matrix (Lynch and Drury 2006). Climate change has also been identified as a potential threat to rare rainforest species, because of their small populations, restricted distribution and potential narrow thermal tolerance (Shimizu-Kimura *et al.* 2017). Most remaining populations occur in protected land including Triunia National Park and several Sunshine Coast Council (SCC) Natural Area Reserves. The most threatened population is located in Buderim in an urban matrix where it is partially protected in the Buderim Holly Conservation Area. A recently discovered population is located solely on private land, part of which is covered by a Land for Wildlife agreement. To conserve *G. reticulatum*, management actions have been carried out through clearing restrictions and bushland regeneration actions such as weed management. Furthermore, half-a-dozen individuals are conserved in the *ex situ* collection of the Australian National Botanic Gardens (ANBG 2021).

Graptophyllum reticulatum's translocation

In addition to these conservation efforts, local Cooloolah Sunshine Institute of Technical and Further Education (TAFE) students designed and implemented a translocation project in 2003, in an effort to preserve the Buderim population. Rare endemic plant translocation is now a common means of conservation (IUCN 2013; Commander *et al.* 2018) and had been suggested for *G. reticulatum* (Maroochy Shire Council 1999; Shapcott 2002). The Buderim population had the largest number of known individuals (McDonald 2000; Shapcott 2002) and the highest genetic diversity of all populations studied (Shapcott 2007), yet it is mostly located on a small area of private land and had been subject to accidental and deliberate clearing. Therefore, along with the SCC's securing of land to protect this population, the aim of this translocation was to enable the settlement of individuals from the Buderim population to a nearby suitable and protected site, to secure its genetic diversity. Translocating individuals to a new site also adds a population to the landscape matrix of the species, which is especially significant for threatened species with very few populations such as *G. reticulatum*.

Site selection

Choosing a suitable site is one of the most important steps in successful translocations (Commander *et al.* 2018). Guidelines from the Australian Network for Plant Conservation (ANPC - Translocation working group, 1997) were followed to select the best translocation site. The Eric Joseph Foote War Memorial Sanctuary was chosen according to three criteria: ecological suitability, proximity to the wild population and land tenure. First, the Buderim population site and the translocation site are ecologically similar in geology, soil, topography, and aspect. Both sites have rocky basaltic soils, are located in gullies, have similar vegetation community structure and share some species. Second, the Joseph Foote Sanctuary is less than 700 metres away from the Buderim population. Selecting a close site enables potential gene flow between wild and translocated populations, via cross pollination and/or seed dispersal. Third, the translocation site was chosen for its secure land tenure and ongoing maintenance. The land is owned by SCC and has been maintained by the Eric Joseph Foote War Memorial Sanctuary Association since 1964. Their weeding efforts confirmed the choice for this site as any threatening processes, such as invasive species, should be identified and controlled in the translocation site (Commander *et al.* 2018).

Translocation material and protocol

Since *G. reticulatum* mostly regenerates through clonal propagation, translocation was based on collecting cuttings rather than seeds, which are rare and have low germination rates (Lynch 2007). Tip cuttings were taken from approximately 80 individuals from the Buderim population to maximise sampling of genetic diversity. A maximum of two cuttings was taken per individual. In total, around 160 cuttings were collected and propagated. Two months later, approximately 100 survivors, which were mostly less than 20 cm tall, were planted in the Foote Sanctuary site. The plantings aimed to preserve the wild population's topographic preferences (along creekside slopes) as well as demographic specificities, such as densities and spatial clumping. Translocated individuals were planted in two different clumps, a dozen meters apart, within the translocation site. Selecting two different locations is a way of increasing the chances of success, since the more locations there are, the more likely it is for one of the selected habitats to be suitable (Drayton and Primack 2012). Translocating in more than one location is also a way of facing unpredictable disturbance events, which have lower chances of occurring in all locations (IUCN 2013).

Ongoing maintenance and monitoring

Translocated individuals were monitored every week for a month. Since then, they have been re-surveyed three times: the number of survivors, their location, heights and reproductive status were recorded in 2011, 2022 and 2023.

Results

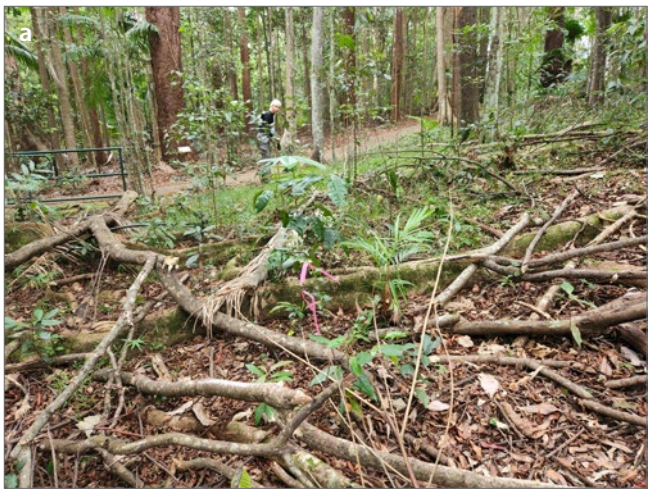
Around 90 plants were alive a month after the plantings (Hansen *et al.* 2003). Eight years later, in September 2011, 17 plants remained, and 20 years later, in December 2022 and April 2023, 15 individuals had survived (Figure 2; Shapcott *et al.* 2023, unpublished data). Therefore, the overall survival rate has been stable since 2011, only decreasing from 17% to 15% in 12 years. Individuals have grown faster in the location with the rockiest soil, where heights have doubled in average between 2011 and 2023, the tallest plant being 1.4 meter tall (Figure 2). In the other location, most plants were smaller than 0.5 meter in 2023, and none have grown over a meter. Furthermore, the translocated population is reproductive: one individual had flowers and seed pods during the 2022 monitoring. However, no seedlings have yet been observed.

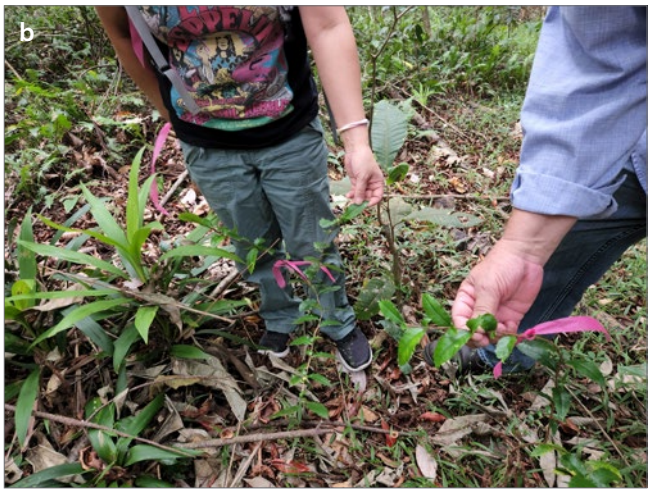
Conclusions

Translocated populations are rarely monitored in the long-term (Commander *et al.* 2018), although long-term monitoring is necessary to assess the translocation's success. Twenty years after *G. reticulatum*'s translocation, stable survival rates and reproductive individuals suggest that the translocated population has successfully settled in the long-term. This translocation captured some of the Buderim population's genetic diversity despite using clonal propagation, as cuttings were taken from multiple plants and from the most genetically diverse population. Furthermore, differences in growth rates between the two locations confirmed the importance of translocating in different sites to increase the chances of success in at least one of them. Finally, it is necessary to keep on monitoring the translocated population in the future, particularly to confirm its capacity to produce seedlings.

Acknowledgements

This work is the result of a cooperation between TAFE Queensland, the University of the Sunshine Coast (USC) and the Sunshine Coast Council. The translocation project was initially submitted in 2003 by Adrian Hansen, Angus McDermott, Mat Preston, Yoko Shimizu and Tracey Grose as a Community Conservation Project at the Cooloola Sunshine Institute of TAFE. The project was supervised by Stephen Flood from TAFE and Melissa Coyle from the Maroochy Shire Council. Collection of cuttings, propagation, planting, maintenance and monitoring were done in 2003 by Adrian Hansen, Yoko Shimizu, Angus McDermott, Mat Preston and Tracey Grose from TAFE, with the participation of the Eric Joseph Foote Sanctuary Association. The monitoring after 2003 was undertaken by Alison Shapcott, Yoko Shimizu and Amaya Richer from USC, Alissa George from TAFE and Elliot Bowerman from the Sunshine Coast Council. Adrian Hansen also participated in the 2023 surveys of the Buderim and the translocated populations. Furthermore, we acknowledge the traditional lands of the Kabi Kabi people, on which all known populations of the species are located.





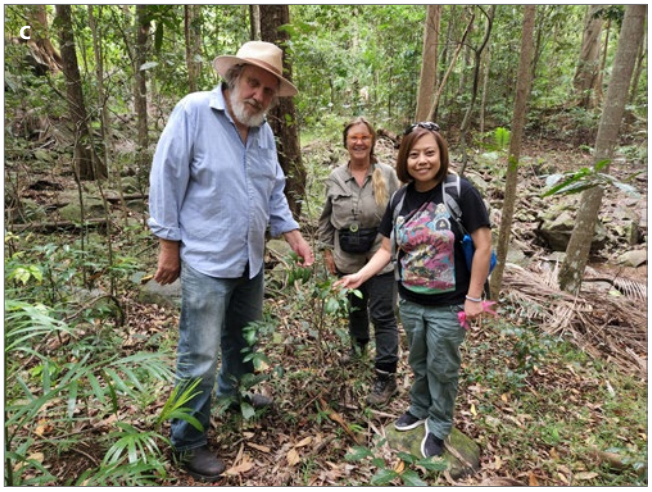


Figure 2. 2023 monitoring of the translocated population. (a) General view of the Eric Joseph Foote War Memorial Sanctuary site, with a tagged *G. reticulatum* in the foreground and Amaya Richer at rear; (b) a healthy translocated *G. reticulatum*; (c) the monitoring team standing next to the tallest individual (left to right: Adrian Hansen, Alison Shapcott and Yoko Shimizu). Photos: Alison Shapcott, Amaya Richer

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ASBP News

The Hustle to Save Bussell's

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The delicate and dainty flowers of Bussell's Spider Orchid (*Caladenia busselliana*) very nearly disappeared from the forests of south-west Western Australia in recent years. In 2018, just four individual plants were recorded across three populations. Habitat loss due to land clearing for agriculture and housing, a drying climate, low remaining numbers and poor recruitment were just a few of the factors contributing to the decline from the over 100 plants known in the early 1990's. Funding via The Rare Bloom Project, a partnership between WWF-Australia and Botanica by Air Wick, in collaboration with the Australian Seed Bank Partnership (ASBP), has supported Department of Biodiversity, Conservation and Attractions (DBCA) staff to make collections of seed and fungi from the remaining wild plants, resurrect seed that was previously collected from long term storage, conduct pollinator surveys for potential translocation sites and establish a translocation planting.

C. busselliana is found approximately 250km south of Perth in Western Australia. It occurs over a very small geographic area of approximately 75km^2 in the Jarrah and Marri forests of the northern end of the Leeuwin-Naturaliste ridge. The floral morphology of *C. busselliana* is unusual, as it possesses the clubbed osmophores typically associated with a sexually deceptive orchid that releases wasp-mimicking pheromones, as well as the white labellum of a typically food deceptive flower (see Figure 1). There are only four other species of *Caladenia* with a similar floral form. At the beginning of this work, very little was known about *C. busselliana* ecology or pollination. Only one natural seed set event had been observed between 2015 and 2018.

Plants were hand pollinated with parentage carefully managed between seed lots to ensure each capsule produced represented the maximum genetic diversity possible, and with a view to keeping future parentage