

Threatened plant translocation case study:

Grevillea wilkinsonii (Tumut Grevillea), Proteaceae

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The species

- Mostly large, upright, long-lived (20+ years) shrubs. At Gundagai the plants are prostrate.
- Endemic to south-east NSW.
- Known from nine natural sub-populations distributed along a 6 km stretch of the Goobarragandra River and from eight plants at Gundagai.

Threatening processes

- Habitat loss and significant habitat fragmentation through agricultural development.
- Grazing by domestic stock.
- Woody weed competition (mainly blackberry).
- Flooding.

Deciding to translocate

The Tumut Grevillea was discovered as recently as 1982 and was not formally described until 1993. In 1992 it was only known from a single small population of 140 plants on a road verge and on an adjoining Travelling Stock Reserve. The first Recovery Team was established in 1992 and this team developed and published the first formal Recovery plan in 1993 (Butler and Makinson 1993). The focus of this plan was on propagation and enrichment planting to bolster the population size. The first plantings of this species into the wild thus date back to 1993 when staff from the Australian National Botanic Garden (ANBG) undertook a small trial planting on a Travelling Stock Reserve (which also contained part of the natural population) and on adjoining private land (Site 1). The 1993 planting of eight plants on private land had done particularly well - expanding from eight plants to 350 adult and sub-adult plants plus at least another 100 seedlings by 2012 (Taws 2013). In 2000 the NSW Office of Environment and Heritage (OEH) thus commenced an enrichment planting project on another private land site where 13 natural plants survived (Site 2). Over the next several years 50 new individuals were successfully established and by 2005 the first natural recruitment from these plantings was observed.



Tumut Grevillea flowers. Photo: John Briggs

Following this success, plantings at two other sites (one on private land (Site 3), the other on public land (Site 4)) within the natural range of the species were commenced in 2008. These plantings were considered necessary as the existing natural populations were small and surviving in very small patches of remnant native vegetation where there was very limited scope for the populations to expand.

Aim of the translocation

The primary aim of the first translocation by OEH was to enhance a small existing population of 13 plants and hasten colonisation of the species into adjoining suitable habitat that had been fenced and cleared of a major blackberry infestation. Subsequent translocations were aimed at establishing new populations in relatively secure sites within the known range of the species where threats had been removed and suitable habitat was available to support self-sustaining populations.

Translocation working group and key stakeholders

- NSW Office of Environment and Heritage (formerly NSW National Parks and Wildlife Service) – to oversee development and implementation of translocations since 2000, including liaison with landholders, propagation and planting, ongoing monitoring and maintenance of translocation sites.
- The various Tumut Grevillea Recovery Teams operating since 1992 – preparation and updating of the Recovery Plan between 1993 and 2001, which included recommendations for translocation actions.
- Australian National Botanic Gardens and Society for Growing Australian Plants – propagation of seedlings and initial translocation plantings.
- Participating landholders – agreement to have plantings undertaken on their properties and assistance with watering and weed control.

Biology and ecology

- Flowering occurs in October and plants usually commence flowering once they are three years old.
- Insect pollinated and known to self-pollinate.
- Seed capsules ripen in December and usually contain only one seed.
- Seeds are gravity dispersed and appear to also be dispersed by ants.
- Seeds are physically dormant. Dormancy appears to be naturally broken through seed coat weathering. Seeds sown in cultivation often take between 12 and 18 months to germinate.
- New seedlings have first been observed on planted sites five years after planting.
- Individuals are known to live at least 25 years.
- Within its main occurrence the species occurs as an upright shrub in riparian shrub communities and sometimes extends into adjoining eucalypt woodland. At Gundagai the small population there occurs in White Box dominated grassy woodland.
- Soils are variable and range from sand and sandy loams to dark red-brown loams derived from Serpentinite rock.

Site selection

The 1993 planting site was chosen because it was adjoining a known natural population and thus had generally similar site characteristics. Most of the planting was on a Travelling Stock Reserve, but eight plants were planted on a section of uncleared private land located immediately across the river. This private land site was, however, drier and steeper than other sites supporting known populations.

Site 2 was chosen because it already supported 13 naturally occurring individuals and contained adjoining suitable habitat that the landowner was agreeable in allowing to be planted (following fencing and weeding) to enhance the existing population. At that time very few landowners with potential planting sites were willing to participate in such a program.

In 2008 planting commenced within the natural range of the species at two other sites: Site 3 on private land and Site 4 on national park.

Site 3 was chosen because it comprised a 0.75 km section of previously cleared river frontage that had been fenced, weeded and planted to native vegetation under a Landcare grant. At that time there was no readily available public money available to specifically assist the Grevillea recovery program so this Landcare planting site provided an ideal opportunity for expanding the Grevillea planting program. The site also supported some rocky areas still largely dominated by native grasses where it was thought the Grevillea could in time colonise naturally. Importantly, the landholder was enthusiastic about adding the Tumut Grevillea to the Landcare planting.

Site 4 was chosen because it was within the known natural range of the species and contained a 300 m section of river frontage that supported largely weed free native vegetation that seemed to be ideal potential habitat for the Grevillea. It also contained suitable areas into which it was expected that the Grevillea would in



Flowering shrub planted at Site 3 in 2013. Photo: John Briggs

time colonise. In 2004 this narrow tongue of park was fenced from the adjoining grazing property to exclude domestic stock in anticipation of it becoming a Tumut Grevillea translocation site. Between the time this section of park was fenced and the initial plantings commenced two Grevillea plants became naturally established on the river frontage.

Translocation proposal

The first Recovery Team was established in 1992 and this team developed and published the first formal Recovery Plan in 1993. This plan was then revised in 1995 (Butler 1995). The focus of these Recovery Plans was on propagation and enhancement planting. In the late 1990s, the Recovery Team was reconstituted and produced an updated NSW and national Recovery Plan (NSW NPWS 2001). This plan included many additional actions aimed at achieving protection and appropriate management of all the known sites as well as maintaining the option for further enhancement plantings. Implementation of the translocation action included in these plans did not involve preparation of a formal translocation proposal. Development of the current conservation project for the Tumut Grevillea under the NSW Saving our Species Program involved the input of an expert panel comprised of some representatives from the previous Recovery Team. The Saving our Species Project maintains translocation plantings as a priority management action for this species.

Pre-translocation preparation, design, implementation and ongoing maintenance

Plants for the 1993 planting were raised from cuttings taken from the adjoining natural population. Few details on the planting are available, but it is believed that the seedlings were planted in winter into hand dug holes and that no follow-up watering was undertaken. The eight individuals planted on private land represented five clones. It appears survival rates were high based on the first recorded counts in 2008.

Planting at Site 2 commenced in 2000 and was on private land where the owners were enthusiastic to host the planting project. The site consisted of an alluvial river terrace with deep fertile soil and also a rocky spur running up from the river terrace. Prior to commencement of planting an extensive infestation of blackberry was poisoned with herbicide and later the dead blackberry was burned to clear the site of debris. This planting also involved plants grown from cuttings that were taken from both natural plants growing at the site and also from individuals planted in 1993. Twenty three plants were initially placed in hand dug holes spaced about 5 m apart and each plant was protected within 60 cm high rabbit netting guards. Twelve clones were eventually represented in the planting and after a number of replacement plantings a total of 50 plants



Tumut Grevillea plantings above flood zone at Site 3. (2013 plantings at centre left and 2015 plantings at centre right). Photo: John Briggs



OEH staff member Sarah Goldin planting Tumut Grevillea at Site 3 in 2013. Photo: John Briggs

were established over a five year period. Plants were not regularly watered post planting and survival rates on the rocky ridge were only about 50%. Regular removal of blackberry and other herbaceous weeds such as Patterson's Curse and St John's Wort were required.

Planting at Site 3 commenced in 2008 after the interest of the landowners came to the attention of OEH. Prior to the Grevillea translocation the site had already been fenced, weeded and planted to other local native vegetation. Plants propagated from cuttings were again used for the first two years of translocation. Cuttings were sourced from plants growing from the 1993 planting and also from the closest natural population to Site 3. In 2010 an OEH officer had success in growing the species from seed and these individuals were found to have a stronger root system and have more vigorous foliage growth than cutting progeny. Thus from 2010 onwards plantings have generally involved progeny grown from seed as this also has the advantage of including greater genetic diversity. Seed has been sourced from both the 1993 plantings and also from the nearest natural population.

Planting at Site 4 also commenced in 2008. This site was selected because it had secure tenure, was within the natural range of the species and supported native vegetation which provided suitable habitat into which to plant.

All plantings since 2008 have been planted into hand dug holes and 60 cm high rabbit netting guards have been used to reduce trampling by wombats and browsing by wallabies. Guards are generally removed after two or three years. Water crystals are added to reduce the frequency of watering. Hand watering of about 16 l per plant about every three weeks after planting through until March has increased survival rates to about 95%. Total plantings of 129 plants at Site 3 and 80 plants at Site 4 were undertaken in the winters of 2008 and 2009. Since 2013 a total of between 40 and 50 plants have been planted across these two sites each winter/spring.

Monitoring and evaluation

There are no records of regular monitoring of the 1993 plantings. The first formal post planting assessment was made in 2008. At that time the eight plants placed on the private land had increased to 128. This population has rapidly expanded since then and in November 2017 totalled 763 plants (Taws 2018). Most of the plants on the Travelling Stock Reserve section have survived and there has been some recruitment, but not nearly to the same degree as on the private land site.

Annual counts of survivorship have been undertaken at all planting sites commenced since 2000.

The survival rate on the alluvial terrace section of Site 2 was almost 100%, however no recruitment occurred in that area, presumably due to the dense grass cover

(both native and exotic) there. In contrast, only about 50% of each of the new and replacement plantings on the rocky ridge section survived the first summer. Despite the greater difficulty in establishing plants on the rocky ridge section, after 5 years the first natural recruitment was observed in this section of the site, presumably because competition from the grassy groundcover was significantly less. By November 2017 the initial population of 50 plants had expanded to 222 (Taws 2018), despite the loss of half the original planting to a flood in 2012.

Survival rates at Sites 3 and 4 had been high (about 85%) until 2012. The losses until then were mainly due to a few plants being excavated by wombats and some losses of the most recent plantings due to a series of floods in 2010. A record flood event in March 2012 destroyed 80% of the plantings. Only 28 of the 129 plants established at Site 3 survived and only 23 of the 80 plants established at Site 4 survived.

Survival of the replacement plantings at these two sites since 2013 has been about 95% and a total of 183 plantings at Site 3 and 86 plantings at Site 4 have been established by November 2017. The first recruitment at Site 4 of 11 seedlings was observed in autumn 2017. Only one seedling recruit has been observed so far at Site 3.

Every few years a census of the total population (natural and planted) is undertaken. The population count includes assigning individuals to one of three height class categories (<0.2 m, 0.2–1 m and >1 m).

Figure 1 shows the overall positive population trend since 1998, including a breakdown of the number of plants that are natural and those that are planted or derived from plantings.



Riparian habitat damage from 2012 record flood at Tumut Grevillea planting Site 4. Photo: John Briggs

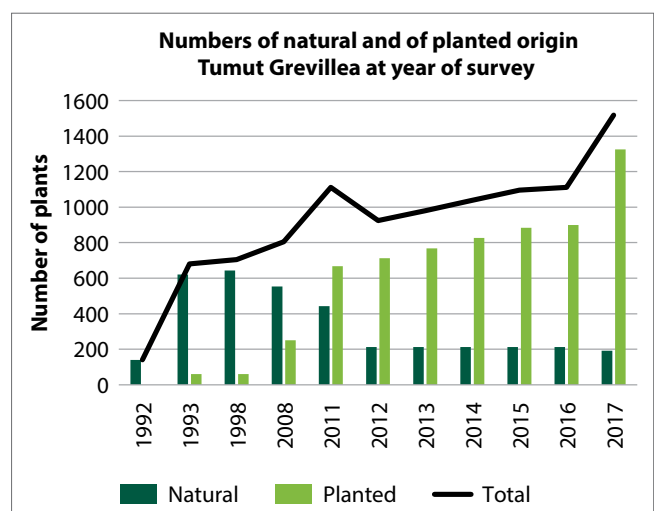


Figure 1. Numbers of Tumut Grevillea growing naturally and of planted origin

Subsequent actions

The decision by the Recovery Team to commence the second translocation was at least in part influenced by the success of the 1993 translocation where most plantings had survived with little post planting attention and some recruitment had been observed by 2000. The success of the translocation at Site 2, particularly the extensive natural recruitment commencing within five years of the first planting, meant that the two subsequent translocations could be commenced with confidence they were likely to also be successful. Following the success so far, an enhancement planting of the Gundagai population commenced in 2017, as did the commencement of a fifth planting site within the main distribution of the species.

The major flood events in 2010 and 2012 that caused a drastic reduction in the previous plantings at Sites 2, 3 and 4 (80% loss at sites 3 and 4) also reduced the natural populations by 50% and scoured the river bank, greatly reducing the amount of riparian habitat. These flood events have led to a revised planting strategy which is now targeting suitable habitat above the 2012 flood level.

A significant challenge to a future expansion of the conservation program is that very few additional sites remain within the species' known natural range that retain substantial native vegetation and that would thus be immediately suitable as future re-establishment sites. There is, however, potential for future trials to combine replanting sites with both the Tumut Grevillea and other native vegetation to create more suitable conditions for the species to recruit naturally.

Outcomes

Natural recruitment from the first two translocation plantings has been so successful that 87.3% of the 2017 total population of 1,517 plants is comprised of plantings and the progeny of plantings (Briggs, unpublished data; Taws 2018). The proportion of plantings and the progeny of plantings of the total population is expected to increase further over time.

What we learned

- In appropriate habitat it is relatively easy to establish new self-sustaining populations of this species.
- The extensive natural recruitment arising from the 1993 planting on a dry rocky slope has shown that previous understanding of suitable habitat for the Tumut Grevillea has been blinkered by a lack of knowledge of its previous distribution due to historic loss of populations prior to the species being discovered.
- Recruitment within planted populations has been most successful where the plantings have been on sites dominated by other native vegetation and there is a sparse groundcover that has allowed seedling establishment.
- Regular summer watering greatly improves survival of planted seedlings (from about 50% to 95%).
- Seedlings grown from seed rather than cuttings are more robust and have a better survival rate.
- Protection from wallaby browsing, at least in the population establishment stage, is essential at some sites.

References and further reading

- Butler, G. and Makinson, R. (1993). '*Species Recovery Plan for Grevillea wilkinsonii (Tumut Grevillea)*'. 1st edn. Australian National Botanic Gardens, Canberra.
- Butler, G. (1995). '*Species Recovery Plan for Grevillea wilkinsonii: previously Grevillea sp. nov. (Tumut) (Tumut Grevillea)*'. 2nd edn. Australian National Botanic Gardens, Canberra.
- NSW NPWS (2001). *Grevillea wilkinsonii (a shrub) Recovery Plan*. New South Wales National Parks and Wildlife Service, Sydney.
- Taws, N. (2013). '*Survey of the Tumut Grevillea, Grevillea wilkinsonii after Record Flood Heights in 2012*'. Unpublished report prepared for the NSW Office of Environment and Heritage, Department of Premier and Cabinet. (Greening Australia).
- Taws, N. (2018). '*Re-survey of the Tumut Grevillea, Grevillea wilkinsonii*'. Unpublished report prepared for the NSW Office of Environment and Heritage, Department of Premier and Cabinet. (Greening Australia).