

REPORT: Non-native *Carpobrotus* risk to native *Carpobrotus glaucescens* from hybridisation and invasiveness.

By Peter Hardwick, Wildfood Researcher, February 8 2023. Edited 26/4/2023.

Acknowledgement of Traditional Owners and Country

The author acknowledges Australia's Traditional Owners and pays respect to the past and present Elders of the nation's Aboriginal and Torres Strait Islander communities. He honours and celebrates the spiritual, cultural and customary connections of Traditional Owners to country and the biodiversity that forms part of that country.

Introduction

Carpobrotus glaucescens (C.g.) is a native food plant of significance to First Nations people. It grows naturally on the coastal sand dunes and headlands from Mackay, Qld to Eastern Victoria. Also commonly known as pigface, it plays an important role in the coastal ecosystems of Eastern Australia, especially in dune stabilisation.



Fig 1. Flowering *Carpobrotus glaucescens* displaying the characteristic white base of petaloids. Note flowers being worked by an insect pollinator.

Non-native *Carpobrotus* species are planted extensively in amenity horticulture and private gardens and are sold in retail nursery outlets. These non-native *Carpobrotus* spp. present a significant risk to *C.g.* via:

- Risk of hybridisation extinction to *C.g.* via insect cross pollination with non-native plant stock.
- Direct competition with *C.g.* from escaped non-native *Carpobrotus* species, and through direct competition with hybrids which typically have greater vigour than the standard *C.g.*

Direct competition with non-native *Carpobrotus* and hybridisation could foreseeably result in a decline of *C.g.*

Carpobrotus hybridisation is a potential threat to a traditional food source of First Nations people because it destroys the character of the original native *Carpobrotus* and threatens the species through hybridisation.

Although the *Carpobrotus* hybridisation/invasiveness issue has been extensively studied overseas and in parts of Australia, it appears that the threat of hybridisation is not well understood in Eastern Australia, although it's better understood in SA and WA. However, there is growing concern about the potential risk of non-native *Carpobrotus* to native *C.g.* on the East Coast.



Fig 2. Unknown invasive *Carpobrotus* species, Lennox Head, NSW. Note that petaloids are pink to the base, with no white band.

There is a window of opportunity to prevent/reduce the problem by actively removing amenity plantings of non-native *Carpobrotus*; removing invasive *Carpobrotus* where it has naturalised; discouraging people from planting *Carpobrotus* unless it is the verified local native variant of *C.g.* and actively re-establishing *C.g.*

C.g. is also at risk from coastal development, dune disturbance (trampling) and rising sea levels from climate change. Any efforts to improve *C.g.* conservation and an increase in numbers from regeneration will assist the species to survive foreseeable changes.

Background

Hybridisation of *Carpobrotus*

Hybridisation of *Carpobrotus* has been well documented in California, Southern Europe, Western Australia and South Australia.

In California and Europe non-native *Carpobrotus* spp. have hybridised to form what has been described as ‘hybrid swarms’ (Campoy et al 2018). These swarms consist of invasive hybrid *Carpobrotus* displaying hybrid vigour that smothers coastal ecosystems.

Carpobrotus edulis features in many severe invasive and hybridisation issues in Europe, California and Australia. In Australia *C.edulis* has hybridised with native *C.rossii* (SA - Waycott 2016) and *C.virescens* (WA – Keighory 2019), as well as other related species in the Aizoaceae family.

Given what we know, it would be prudent to assume that all *Carpobrotus* are vulnerable to hybridisation, unless we know otherwise.

Normally there are geographical barriers that prevent hybridisation between native *Carpobrotus* when they are growing within their natural range. Unfortunately, these barriers are also being compromised by the movement of native *Carpobrotus* into locations where other native *Carpobrotus* species naturally occur. Therefore, it’s not enough that a *Carpobrotus* is considered suitable for planting if it’s simply a “native” species. For planting it’s ideal to use the local variant of native *Carpobrotus*.

Existing ornamental variants

Botanists in S.A. said that DNA testing of ornamental varieties of *Carpobrotus* from plant nurseries indicated that the majority of cultivated *Carpobrotus* are hybrids (W.Waycott pers com). Of particular concern, this is also likely to include *Carpobrotus* sold as “native” or labelled as *C.g.* Therefore, it is probable that mislabelling of *Carpobrotus* is occurring and is creating confusion because many people are likely to be planting hybrids thinking that they are native *Carpobrotus*.

This is a significant concern for *Carpobrotus* conservation in Australia because it indicates that hybrids with hybrid vigour invasiveness are being distributed via plant nurseries into

gardens and amenity plantings – including coastal sites where *C.g.* is located - with an unknown risk to the gene pool of *C.g.*

Some of these newer ornamental *Carpobrotus* varieties have also been observed escaping from nearby amenity plantings to adjacent local beaches where native *C.g.* occur naturally. The author has observed this occurring in Ballina district where invasive outbreaks have occurred adjacent to amenity plantings.



Fig 3. Left picture: Invasive non-native (left), possibly hybrid, new ornamental type *Carpobrotus* collected on a beach near Ballina with native *Carpobrotus glaucescens* on the right. Right picture: Amenity planting in a council park in Lennox Head utilizing a range of ornamental *Carpobrotus* species.

Pollen from non-native *Carpobrotus* can also travel via insect pollinators, like bees, for as far as 10 km (introduced bee range), so there needs to be a buffer of at least 10 km between non-native *Carpobrotus* plantings and native *C.g.* sites.

In NSW, the non-native *C.edulis* and *C.aequilateris* are cited as coastal weeds. However, the botanical keys from the Royal Botanic Gardens and herbarium records do not include newer ornamental variants.

Invasive *Carpobrotus* hybrids are also difficult to identify using the botanical keys because they can have confusing intermediate characteristics between native and non-native species. This limits the use of botanical keys in identifying newer invasive ornamental hybrid *Carpobrotus*.

Invasive *Carpobrotus* known to occur in Australia:

Non-native invasive *Carpobrotus* species in Australia are:

- *Carpobrotus acinaciformis*, SA
- *Carpobrotus aequilaterus*, Qld, NSW, Vic, Tas, WA
- *Carpobrotus edulis*, NSW, Vic, Tas, SA, WA

Recommendations:

- That local Land Councils and Traditional Cultural Knowledge Holders are included in developing ongoing conservation strategies to ensure First Nation involvement in conserving native *Carpobrotus*, especially to develop a protocol for interacting with culturally sensitive Traditional Knowledge on *C.g.*
- Suggest that land councils, local government, Land Care, National Parks & Wildlife Service and DPI liaise to develop a conservation strategy to prevent potential hybridisation/invasive damage to local *C.g.*
- That coastal Councils develop best practice guidelines for use of *Carpobrotus* in amenity horticulture utilizing local native stock and removing non-native *Carpobrotus*.
- That a jointly sponsored educational pamphlet is published online to assist people in identifying the invasive types of *Carpobrotus*.
- That advice is sought from the existing agencies/academics in S.A., W.A. and overseas that have been involved with *Carpobrotus* invasion/hybridisation.
- That Land Care/Dune Care and Land Councils with NPWS actively identify native *C.g.* suitable for propagation based on physical plant characteristics and establish provenance based gene banks in suitable locations, with an aim to use DNA analysis to confirm taxonomy.
- That local councils and Land Care/Dune Care actively remove any *Carpobrotus* that can be clearly identified as non-native.
- That suitable botanical researchers are engaged to undertake DNA research to assist in the taxonomy of existing *Carpobrotus* populations and nursery stock to assess the risk to *C.g.* from hybridisation and ornamental *Carpobrotus* invasiveness.
- Have non-native *Carpobrotus* species (and hybrids) declared noxious weeds in coastal shires.
- Liaise with the nursery industry to get their cooperation in accurate labelling and awareness of nursery responsibility with sales of *Carpobrotus*.

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Appendix I.

Outline of methodology for replanting *Carpobrotus glaucescens*.

By Peter Hardwick, April, 2023.

Aim: To re-establish *C. glaucescens* on coastal sites by regenerating *C. glaucescens* from stock that is identified as native to the local coastal area. Natural occurring sites of *C.g.* are found on coastal foredunes, hind dunes and on headland sites.

Collecting *C.g.* propagation material provides an opportunity to survey *C.g.* health as well as collect propagation material. *C.g.* provenance gene bank collections should ideally be located at a central nursery facility relevant to regeneration. Options for site locations for *C.g.* collections include land councils and other First Nation projects, voluntary networks such as Land Care, local government, regional and state botanical governments.

Older wild *C.g.* plants are most suitable for providing cuttings because they are reliable genetically given that their age is more likely to pre-date modern ornamental varieties. Collecting cuttings from wild plants should be done as a one-off event - so disturbance to wild plants is minimal. Cuttings are preferred because growing seedlings from wild collected seed may have a greater risk in sites close to urban locations due to the risk from hybridising with surrounding non-native *Carpobrotus*.

Process: The following procedure is recommended for establishing plants using cutting propagation.

1. Assess the need for *C.g.* regeneration at each site. If it appears that there are low populations of *C.g.* which are exposed to ornamental varieties of *Carpobrotus* and high disturbance (e.g. urban sites) then proceed to use regeneration to recover the population.
2. Collect two healthy 15–25 cm long cuttings from each wild *C.g.* specimen choosing larger & older plants from natural occurring populations – not landscaping plants.
3. Select cuttings from older *C.g.* plants which are more likely to pre-date the introduction of ornamental varieties. Avoid collecting propagation material from plants in poor health with blotching as this may indicate the presence of plant diseases.
4. Clean secateurs with alcohol between each plant when collect cuttings. Alcohol assists in killing plant pathogens. This will reduce the risk of spreading plant diseases from plant to plant via secateurs.
5. Select cuttings or cutting material that don't have a severe soft scale insect infestation. Soft scale (*Pulvinaria* sp.) on *C.g.* is a sap sucking insect pest that will reduce the overall health of plantings.
6. Label or photograph record each parent plant in the field, and match this to labelling bags and potted plant grown material for later use and reference.
7. Aim to collect cuttings from at least 20 plants every 500 metres to optimise genetic diversity.
8. *C.g.* cuttings are relatively resilient and can last for several days if kept in cool, shady sites. Cuttings can also be kept for up to 10 days in refrigeration.
9. To propagate, make a suitable potting mix of sand, perlite and coco-peat with a slow-release fertiliser added.
10. Propagate into 75 mm pots and placing in deep trays. (see photograph)
11. Label each tube so individual plants can be tracked in the nursery. The label should include date, location and individual mother plant number.

12. With cuttings, remove the lower leaves and side shoots from the two selected cuttings from the lower nodes. Side shoots can also be used for propagation.
13. Plant one cutting per 75 mm pot (or similar size) with at least one node below the potting mix as roots will develop from the node. No rooting hormones are NOT necessary for *C.g.* cutting propagation.
14. Use one-off application of a granular systemic insecticide (imidacloprid) to kill any soft scale at the early propagation stage to ensure soft scale don't infest any stock and avoid spreading soft scale. Remove any flowers immediately after insecticide treatment to prevent harm occurring to pollinators. If done properly, this should not need to be repeated. N.B. Don't use white oil for scale control on *C.g.* as it kills *C.g.*
15. *C.g.* cuttings will develop roots relatively quickly and maybe ready to pot-on to a larger pot size 140-200 mm within 4 weeks.
16. Grow-out the cuttings in 200 mm pots and let them reach flowering to assess whether they are *C.g.* - looking for distinctive features like white at the base of petaloids and other *C.g.* identifying features available in online botanical keys.
17. If plants meet the criteria for classification as *C.g.* then proceed to use that specific plant as mother stock for further cutting propagation and regeneration.
18. Hold back on further propagation of anything that has ambiguous physical characteristics i.e. non-native have pink colouration all the way to the bottom of the petaloid. Also look out for plants with a mixture of features and extra vigour as this may indicate hybrid characteristics, but also allow for a diversity form within *C.g.*
19. Before planting out *C.g.* into the regeneration sites prepare the area by removing non-native *Carpobrotus* from the regeneration site.
20. Establish *C.g.* by planting cuttings from the collected mother plants by planting 20 cm long cuttings directly into the field at the location where the material was collected. This by-passes the need for growing in pots and is more cost effective.
21. Replant from where the stock is originally sourced. However, if *C.g.* is no longer available, plant with stock from the nearest available site.
22. Monitor the regeneration sites to assess success and do follow-up replanting as required.



Photograph: Pic 1. Freshly collected cuttings of *Carpobrotus glaucescens* from the field with lower leaves removed. Small side branches are also being used in propagation. Pic. 2. First generation cuttings planted directly into 75 mm grow-tubes. At the stage ready for repotting to larger pots after 3 weeks. Labelling provides number, collection site and date, so plant stock can be tracked in the nursery.

By Peter Hardwick, April, 2023.

