



Corangamite Guidelines

Defining seed collection ranges for indigenous plants

Introduction

This guideline is intended for those who are involved in indigenous seed collection and the coordination of indigenous revegetation projects within the Corangamite region. It explores a comprehensive method of assessing plant species, given our current understanding, to give clear seed collection ranges that will guide best practice. By providing these guidelines, it is hoped that improved seed collection methods will be adopted to maintain the genetic diversity of precious remnants, individual species and revegetation projects.

It is often assumed that collecting provenance seed will maintain local gene pools and increase the survival rate of revegetation owing to local adaptation. In Corangamite, revegetation practitioners commonly nominate a provenance for indigenous seed and nursery plants used in funded projects. Usually, far less attention is paid to matching site factors such as soil type and landscape position and ensuring enough genetic material has been collected for the ongoing regeneration of revegetated sites. With a limited understanding of the genetics and environmental influences on populations and a lack of local research and assessment of project results, there is a real concern that the viability of revegetation efforts is at risk.

Revegetated sites with low genetic diversity have a limited gene pool to respond to environmental changes and may have a limited number of reproductive partners, while non-local seed can introduce poorly adapted genes into the local gene pool. This can happen in a variety of ways—collecting seed from too few plants, collecting from hybridised or already inbred, isolated or small populations and substituting plants for related species from other regions. An example would be replacing a Ballarat Wirilda with the coast form from Geelong or one local to South Australia.

The fragmentation of our landscapes has also affected the way pollinators move around, many of which play a vital role in spreading pollen across plant communities. An understanding of plant pollinators is important for plant regeneration.

The remnants we see now in the landscape are only a partial reflection of the broader plant communities previously present, giving us a distorted view of natural plant boundaries. This has also reinforced the concept of local collection which in turn puts further pressure on small remnants to supply provenance seed.

This guideline explores a more comprehensive assessment to the current cautionary approach to seed collection. It relies more heavily on an assessment of individual species history, distribution, fragmentation and pollination processes and is based on available knowledge. The process was modelled from the FloraBank Guideline 10: Seed Collection Ranges For Revegetation and involved literature searches and input from community, natural resource management staff and plant biology experts. It is detailed below.

An approach to defining seed collection range

Initially, twenty common revegetation species were selected for a detailed assessment of seed collection ranges. A literature search was undertaken to populate individual species information sheets. Detail about the morphology, geographic range, breeding systems and seed was collated. Distribution maps from the Flora Information System, DSE were also used to highlight population boundaries. Population density and fragmentation history was difficult to obtain through literature searches. Gaps in information were filled where possible through



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discussion with botanists, seed collectors, nurseries and others who were familiar with particular species and localities.

A species range template (Table 1) was then developed to assess each species and develop a suitable seed collection range based on the best available information.

Provenance—Opening Pandora’s Box, Creswick 2004

At a workshop on provenance, around sixty participants worked through small facilitated group discussions to help determine seed collection ranges for some of the species. They were given distribution maps and literature search results for each species and the Species Range template (Table 1). Working through the template allowed gaps to be identified for further research. Where possible, groups supplied local information and made comments about what was an appropriate range for seed collection. Further literature searches and refinement of species ranges with the template followed as a result. The seed collection ranges used are a modification to those detailed in the Florabank Guideline 10: Seed Collection Ranges for Revegetation, additional input from the workshop and CSIRO.

SEED COLLECTION RANGES

Narrow collection range— within which, seed should be collected from remnant stands that are close to the revegetation project.

An example for Corangamite is *Acacia verticillata* Prickly Moses. Limited research of the genetics in relation to geography and wide variation from provenance to provenance within short distances requires a cautious approach to seed collection in regard to this species.

Intermediate collection range— within which, collection can be extended to formally contiguous remnants.

This may include species that were once previously contiguous stands and are now fragmented as a result of recent clearing (i.e. within the last 200 years).

An example is *Banksia marginata* Silver Banksia. Once widespread, Banksia stands are now extremely small. Seed should be sourced and mixed from a wide sample of sites to increase the genetics for revegetation. By collecting from wider samples, this should reduce the pressure on particular stands unnecessarily supplying provenance seed.

Sub-regional collection range— within which, seed can be collected from remnant stands from a very broad range across the Corangamite region, not withstanding natural boundaries.

In this case, it is more important to observe broad natural geographic boundaries and match soil type, rainfall and site conditions than to ensure localised seed collection. (Boundaries may include for example the volcanic plains separating inland populations from coastal populations.)

An example is *Acacia mearnsii*, Black Wattle—a colonising species where populations are easily established on disturbed sites and the species has a low level of inbreeding. Provenance boundaries are considered extremely broad.

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Table I SPECIES RANGE TEMPLATE

Family			
Genus			
Species			
Subspecies			
Hybrids formed			
Place a cross in box if factor/information is relevant			X
			Comments
Taxonomic status	Gymnosperm		
	Angiosperm—monocot		
	Angiosperm—dicot		
Life form	Annual		
	Perennial—short lived		
	Perennial—long lived		
Geographic range	Endemic		
	Widespread		
Fragmentation time frame	Recent (< 200 years)		
	Historic		
Morphology	Marked physical variation		
	Known distinct provenance		
Population density	< 100 adults		
	100—500 adults		
	> 500 adults		
Breeding system—pollination mechanisms	Self fertilisation		
	Outcrossing	Wind	
		Birds or bats	
		Water	
		Insects	
Pollen production	Prolific		
	Moderate or reliable		
	Poor		
Seed dispersal	Long distance	Water	
		Wind	
		Birds	
		Animals	
	Short distance	Wind	
		Ants	
		Heat (ejection)	
		Other...	
Seed crop	Prolific or heavy		
	Moderate		
	Poor or light		
	Cyclical (years)		
RANGE	Narrow—close to remnant		
	Intermediate—formerly contiguous population		
	Regional—remnants across Corangamite region		
Research needed			
Known hybrid populations in region			
Areas where subspecies overlap			
Areas where morphological forms overlap			

Definitions of terms used in Species Range Template

Family

Scientific classification category for grouping together related plants with similar features—broadest grouping to the most specific (kingdom, phylum, class, order, **family**, genus, species). An example is the Myrtaceae family which includes eucalypts, bottlebrushes and teatrees.

Fragmentation

Clearing of vegetation since European settlement is considered recent fragmentation while older changes to plant communities (through volcanic activity for example) is considered historic. Recent fragmentation can reduce genetic diversity, produce highly inbred seed and promote hybridisation.

Genus

Part of the scientific category below family. Genus (plural genera) has one or more related and morphologically similar species (eg *Eucalyptus* genera).

Geographic range

Refers to the mapped area (in Corangamite, Victoria and state levels) enclosing all populations of a plant species. The range may also make note of soil type, rainfall and natural barriers. Endemic species are unique to the region, found nowhere else. A widespread species is indigenous to the region but its range extends beyond the catchment.

Hybrid

Refers to the offspring of a cross between two different species (for example, *Eucalyptus viminalis* with *Eucalyptus ovata*). Hybrid populations can indicate an imbalance in an ecosystem. Hybrids occur naturally but usually at low numbers. Collecting seed from hybrid plants or hybrid stands of plants for revegetation purposes will not give plants true to type. Hybrids can exhibit lower seed viability and and poor growth but may also be more vigorous. Some hybrid combinations can be sterile.

Indigenous

Indigenous often refers to a plant or animal that originates from a particular area or region and is thus native to that site. For the purposes of these notes, indigenous refers to plant species that occur naturally in the Corangamite region at particular localities. For example, *Hakea decurrens* is a native plant of the Corangamite region but is only indigenous to the northern part of the catchment.

Life form

Is a plant's characteristic structure—tree, shrub, herb, grass etc (in the simplest format). In terms of life cycle, this has also been broken down into **Annual** (a plant that completes its life cycle in one year) and **Perennial** (a plant that produces flowers and seeds several times in its life cycle, living more than one year). Perennial usually applies to herbaceous plants which tend to be short lived. It can also be applied to woody plants such as trees and shrubs which tend to be long lived.

Morphology

Provides a description of the form and structure of the plant species. Notes are made on physical variations in form and sites or populations of known provenances.

Pollination mechanisms -Self fertilisation

The process in which the pollen fertilises the ovules of a given flower in the same plant. This is also known as selfing. Certain plant species do this more readily than other species (around 20% of plants). Others have natural barriers in place to prevent selfing (such as through flower design) or through self-incompatibility where pollen will not germinate on the same plant. In fragmented landscapes, plants that prefer to outcross but are forced to mate with related individuals or to self-pollinate at higher levels than normal are likely to experience elevated inbreeding. Characteristics reduced or affected by inbreeding include pollen quantity and quality, number of ovules, amount of seed, germination rate, growth rates and competitive abilities.

Pollination mechanisms -Outcrossing

The opposite to selfing. Outcrossing refers to the process of fertilisation to produce offspring from unrelated or more distantly related individuals through random crosses. Connectivity of remnant plant communities increases the chances of outcrossing and helps to maintain genetically healthy populations by encouraging

pollinators to move among plants. Identifying pollinator needs will improve management decisions affecting the regeneration of plants.

Population density

Refers to the number of individual plants of a species in a group over an area. This takes into account the historic spread of the population, including natural boundaries which may separate populations. Fragmented individual stands of a species may be part of a larger population. Low plant numbers reduces the ability of the species to maintain genetic viability in the long term.

Provenance

The simplest meaning is a collection point but it often refers to an area where a species is found naturally, showing variation from the same species found in other locations. It may appear physically different or perform differently from seed or plants from another location of the same species.

Seed crop

The amount of seed produced on a plant—prolific or heavy (high seed set, fruit is usually dense over the entire plant crown), moderate or reliable (seed set is relatively even) and poor or light seed set in which only a few fruit can be found. Some species produce large quantities of seed in certain years (cyclic). This is useful information to be aware of when collecting seed.

Seed dispersal

Refers to the method by which a plant spreads its seed. Some plants drop seed closely (for example, fruit opens in heat and ejects seed) and others are picked up by birds and animals to be scattered around the landscape.

Species

The taxonomic unit below genus indicating a group of individuals capable of interbreeding to produce fertile offspring.

Subspecies

Strong variation occurs within a species such that a subspecies may be recognised if it is a geographically distinct population that differs from other geographic populations. The term is somewhat arbitrary but is useful for ensuring separate seed collections within a species. Subspecies is used when this is recognised but it may be also important to record when unrecognised different forms occur in the same area (morphological form overlap).

Taxonomic status

Current studies by botanists may result in name changes or the reclassification of some species into different genera. Recent changes have altered the taxonomic status of many Eucalypts for example. Spotted Gum is now *Corymbia maculata* from *Eucalyptus maculata*. If a genus or species is under current review, a note is made under the taxonomic status.

Gymnosperms are seed-bearing plants that that don't produce flowers. They release pollen into the air to the female ovule, causing fertilization. Their seeds develop without a protective covering. Most produce the seed on the scales of cones such as conifers and cycads.

Angiosperms include all of the flowering plants. These produce seed enclosed in an ovary.

A **monocot** is an angiosperm in which the seed has one embryonic leaf (cotyledon). The leaves of monocots often have parallel veins, fibrous roots and flower parts usually in multiples of three. Examples include grasses and orchids.

Dicots are the other major angiosperm group. Dicots have two cotyledons, floral parts in multiples of four or five, and leaves with net-veins. Examples include wattles and eucalypts.

References

FloraBank (1998) Guideline 10: Seed Collection Ranges For Revegetation www.florabank.org.au
Dr Linda Broadhurst, CSIRO (pers comm)

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