

Sourcing Plant Material for Restoration in the Swan Region - a decision tree

Restoration site parameters for restoration/revegetation

S1. Is the site

a) In the Swan Coastal District?
Source only from the Swan Coastal Plain or for sites on Gingin Scarp or Dandaragan Plateau, the associated landforms

b) In the Perth Hills District?
Source only from the Darling Plateau and scarp or for sites on the Swan Coastal Plain, the associated landforms

Vegetation

V.1. Identify the taxon to be used for restoration/revegetation to sub species level: Is there any known morphological or genetic structure in the taxa?

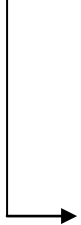
- a) Yes – stay within the structural boundary. Go to V.2.
- b) No / no information available – collect only from the identified taxon Go to V.2.

V.2. Is the species to be used

- a) widespread or common? Go to V.3.
- b) known to have a highly localised distribution, a number of sub species or be restricted to a single landform/landscape conservation unit?
Go to V.4

V.3. Is the species to be used

- a) available from the same landform/ landscape conservation unit (Figure 1) as the revegetation area?
Stay within the appropriate unit. Go to C.1.
- b) not available from the same landform/landscape conservation unit? Source material from the sites closest to the revegetation area.
Move outwards until sufficient seed is collected. Go to C.1.



V.4. Is the species available from the same landform unit as the restoration/revegetation area?

- a) Yes - Source from the site or as close as possible to the site Go to C.1.
- b) No - Do not use: Choose an alternative species.

Collection priorities

C.1. At the collection site there are?

- a) < 250 healthy individuals of the target species. Go to C.2.
- b) > 250 healthy individuals of the target species. Go to C.3.

C.2. Is the site isolated?

- a) Yes – Do not source material from this site.
Look for an alternative larger or less isolated site as close to the regeneration site and return to C.1.
- b) No - Collect from this site and others to increase genetic diversity.
Go to C.3.

C.3. Parameters for seed collection and sourcing plant material

Check the identity of the donor population to the species/sub species level.

Collect from healthy plants with good seed production that do not show significant seed abortion (indicative of inbreeding depression) or damage from pests or disease. The timing of flowering and seed production may be affected by climatic and edaphic factors so that collection may have to be repeated within and between populations over time.

Do not over collect from any site or population so that it affects successful reproduction in the donor population. Only 20% of the available seed from any individual plant or site should be collected.

Collect from nearby suitable populations identified by this process first. If more seed is required repeat the selection process to identify further suitable donor material or select an alternative species.

Record location and other information about the donor population and link it to the collected seed.

Keep the seed in suitable conditions (breathable bag, 4– 25 C⁰) to protect the viability, maximise germination and provide healthy seedlings.

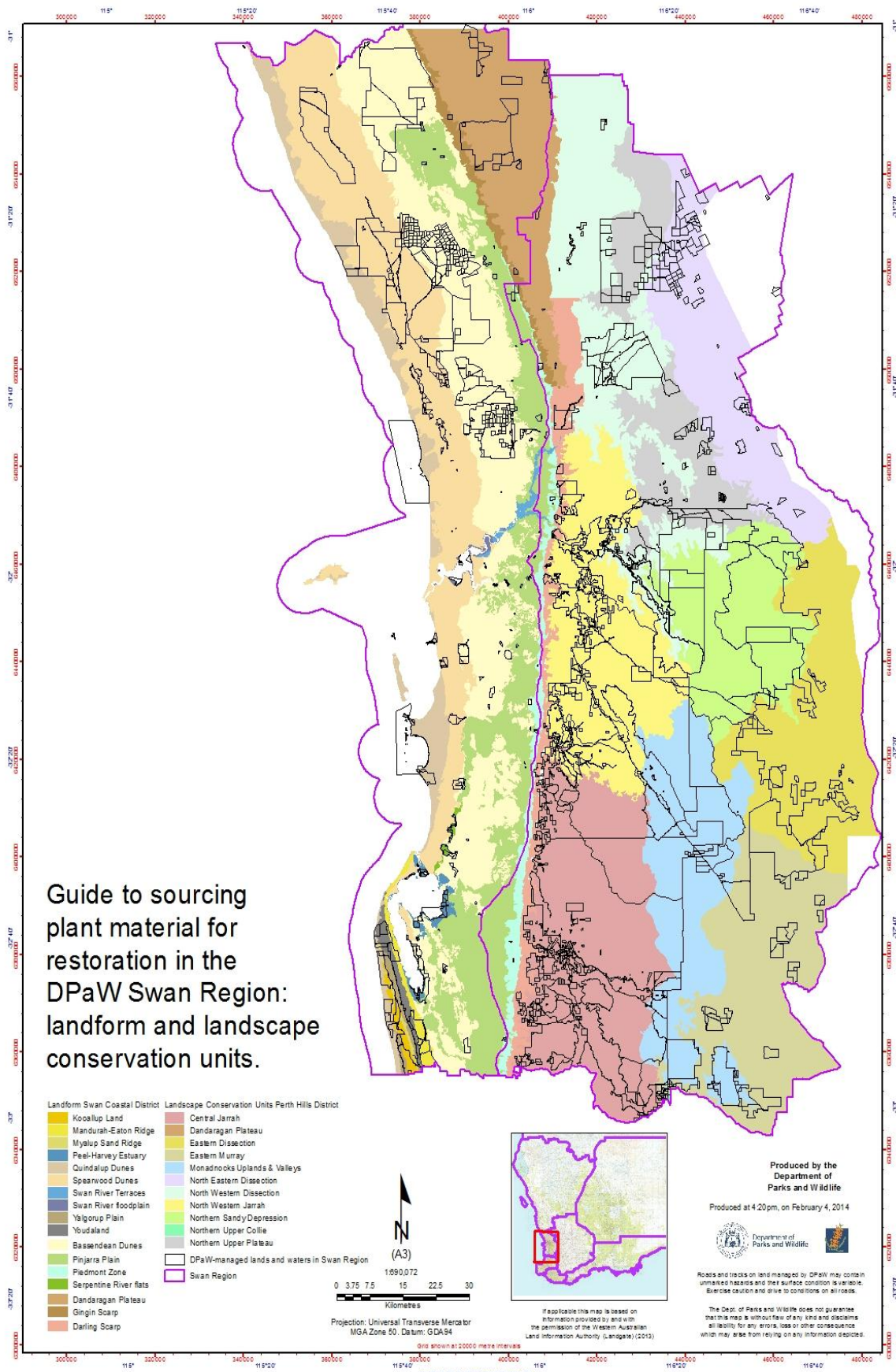


Figure 1: Landforms and landscape conservation units of DPaW managed lands in the Swan Region.

Guidelines for sourcing material for restoration and revegetation in the Perth Hills and on the Swan Coastal Plain

“Where should I source material for my restoration/revegetation project, and how should it be collected?”

What is desirable?

Individual bushland plant communities have often developed distinctive characteristics as the ecosystem has evolved. While restoration and revegetation should try, where possible, to maintain the local character by conserving this local genetic assemblage there is also the need to ensure good levels of genetic diversity to allow species to adapt to ongoing environmental change. The collection of seed for re-vegetation will therefore need to consider not only the local vegetation history but also sampling for sufficient levels of genetic diversity.

Seed Provenance: The characteristics that have had an effect on the development of the seed contribute to its provenance. If a local collection site has similarities to the restoration/revegetation site the seed collected may have a ‘home ground advantage’ and result in progeny that are better adapted to the climatic and soil characteristics (especially chemical or physical properties) of the revegetation site. However, local seed may not always be the best choice. A geographically close area may not have the same characteristics as the revegetation site. Biodiversity occurs at multiple scales and the term ‘local’ may be used at an ecosystem, species diversity or population level.

There are a large number of factors to consider when deciding how and from where seed should be sourced for an individual revegetation site.

Revegetation site parameters include:

- What is the aim of the revegetation?
- What are the characteristics of the site (size, climate, physical characteristics: soils, aspect, altitude, topography)?
- How degraded is the site and adjacent natural areas and what is the relationship of the site to the surrounding environment?
- The use of ‘local’ provenance is particularly pertinent to restoration of high conservation value sites such as Nature Reserves and Threatened Ecological Communities.
- When revegetating degraded sites adjacent to natural areas or to form linkages between intact sites the use of ‘local’ or matched seed sources will also be desirable.
- The need to use local or matched seed sources is reduced as the level and scale of disturbance of the revegetation site increases.

Source material site parameters include:

- The proximity and ‘match’ in characteristics of the source site to the revegetation site.
- Where information is available, the genetic relationship of the material to that on the revegetation site should be considered.
- The population size, maturity and health of the donor plants and the number and viability of seed to be collected. Collecting healthy seed will optimise the chance for successful revegetation.
- Taking care to limit seed removal to a level that will protect the successful reproduction of the donor population.
- Identification to subspecies level for taxa listed for the revegetation project and taxa in the source site.

NB. This decision tree does not address the issue of the selection of species for restoration at a given site.

Sourcing Plant Material for restoration and revegetation in the Swan Region – a decision tree

Introduction

This decision tree aims promote best practice in the selection of suitable sites for sourcing plant material for revegetation. Ideally source sites and planting sites should be matched for climatic, edaphic and other environmental variables. Given the different landscapes in the DPaW Swan Region, restoration sites on the Darling Plateau and Scarp should be matched for landscape conservation units, and sites on the Swan Coastal Plain should be matched for landforms (see attached maps).

This decision tree considers in turn the restoration site parameters, vegetation characteristics, and collection priorities.

See the attached flow chart

Guidance for answering the questions:

Restoration/revegetation site parameters

Q. S1. Is the site

**a) In the Swan Coastal District? Answer: Source seed only from the Swan Coastal District
Go to V.1.**

**b) In the Perth Hills District? Answer: Source seed only from the Darling plateau and scarp
Go to V.1.**

It is important that seed is collected from sites that are matched to the restoration/revegetation site for edaphic, climatic and vegetation characteristics.

Vegetation

Q. V 1. Identify the taxon to be used for restoration to sub species level: Is there any known morphological or genetic structure in the taxa?

a) Yes – stay within the structural boundary. Go to V.2.

b) No / no information available – collect only from the identified taxon Go to V.2.

Identifying material to species or sub species level may require the use of botanical keys, scientific references or consultation with experts such as Western Australian Herbarium or other Department of Parks and Wildlife (DPaW) staff. Use internet sites such as FloraBase

<http://florabase.dpaw.wa.gov.au/>.

Within the taxonomic classification (taxon) individual populations may show morphological differences which may, or may not, reflect genetic differences. If information about the genetic relationship between and within populations is available this should be used when choosing areas for seed collection. Consult with experts such as Western Australian Herbarium or other (DPaW) staff.

Q. V 2. Is the species

a) widespread or common?

Go to V.3.

In a widespread or common species seed collected (following the principles in C.3.) should reflect a wide genetic diversity, and provides potential for the species to tolerate a range of environments and adapt to ongoing environmental change.

b) known to have a highly localised distribution, a number of sub species or be restricted to a single landform/landscape conservation unit?

Go to V.4.

Where species are geographically or genetically fragmented care must be taken to ensure that the seed is collected from populations within the localised distribution of the planting site while also maintaining sufficient genetic diversity.

Q. V 3. Is the species

a) available from the same landform/landscape conservation unit (see attached maps) as the revegetation area ?

Stay within the appropriate unit

Go to C.1.

b) not available from the same landform unit?

Source material from the sites closest to the restoration/revegetation area in adjacent units moving outwards until sufficient seed is collected.

Go to C.1.

When seed needs to be sourced from an adjacent land unit is it preferable to collect closer to the restoration/revegetation site to maintain similarity with soil, climate and vegetation characteristics of the restoration site.

Q. V 4. Is the species available from the same landform unit as the restoration/revegetation area?

a) Yes – Source from the site or as close as possible, moving outwards until sufficient seed is collected.

Go to C.1.

c) No – Do not use. Choose an alternative species.

Seed collected from disjunct populations from geographically distant sites may have a greater genetic differentiation that potentially increases possibility of reduced chance of establishment and survival.

Collection priorities

C. 1. At the collection site there are?

a) <250 healthy individuals of the target species.

Go to C.2.

b) >250 healthy individuals of the target species.

Go to C.3.

Care must be taken to ensure that the seed collected will represent sufficient genetic diversity and to protect the reproductive capability of the source population. Increased inbreeding is likely in small population of <250 individuals.

C. 2. Is the site isolated?

a) Yes – Do not source material from this site. Look for an alternative larger or less isolated site as close to the regeneration site and return to C.1.

b) No - Collect from this site and others to increase genetic diversity.

Go to C.3.

Care must be taken to ensure that the seed collected will represent sufficient genetic diversity and to protect the reproductive capability of the source population. Sites that connected will have some

genetic exchange that will lead to an increase in the effective size of the populations. Increased inbreeding is likely in small population of <250 individuals that are isolated.

C.3. Parameters for seed collection and sourcing plant material

Check the identity of the donor population to the species/sub species level

Collect from healthy plants with good seed production that do not show significant seed abortion (indicates inbreeding depression) or damage from pests or disease. The timing of flowering and seed production may be affected by climatic and edaphic factors so that collection may have to be repeated within and between populations over time.

Do not over collect from any site or population so that it affects successful reproduction in the donor population. Only 20% of the available seed from any individual plant or site should be collected.

Collect from nearby suitable populations identified by this process first. If more seed is required repeat the selection process to identify further suitable donor material, select an alternative species or collect over several years.

Record location and other information about the donor population and link it to the collected seed.

Keep the seed in suitable conditions (breathable bag, 4– 25 C⁰) to protect the viability, maximise germination and provide healthy seedlings.

For more information about seed collection and storage see:

Plant Germplasm Conservation in Australia Strategies and Guidelines for developing, managing and utilising ex situ collections. Edited by Catherine A. Offord and Patricia F. Meagher. Published by the Australian Network for Plant Conservation Inc. (ANPC) in partnership with Australian Seed Conservation and Research (AuSCaR) September 2009

Glossary:

Edaphic - Qualities that characterize the soil itself, including drainage, texture, or chemical properties such as pH - especially as it affects living organisms.

Genetic Diversity – This describes the variation of inheritable characteristics and can refer to the total number of genetic characteristics in the genetic makeup of a species, population or community (biodiversity).

Greater genetic diversity provides an increased potential that some individuals in a population will possess variation that can be expressed as adaptation to a new or changing environment.

Hybridisation/outbreeding/outcrossing – Cross pollination between two dissimilar parents (may be within or between species) will result in a hybrid plant. These may exhibit traits from one or both parent plants or intermediate characteristics. These offspring often show superior qualities (hybrid vigour or heterosis) but may also show outbreeding depression (see below).

Inbreeding depression – this refers to the reduced survival and fertility (fitness) of subsequent generations as a result of the breeding of closely related individuals.

This may occur when the pool of potential mates is small, e.g. where populations have become fragmented and isolated, or where all the individuals in a population are closely related (e.g. if seed for revegetation is sourced from only a single or small number of individuals.)

Morphology – the appearance (structure, shape, size or form) of the organism. This may vary between individuals or populations of the same taxonomic group (taxon).

Differences in morphology may reflect differences in the environment (e.g. smaller leaves in drought conditions or flower colour with soil chemistry) but may not reflect genetic difference. However, fragmented populations may show morphological differences as a result of limited genetic exchange.

Outbreeding depression – May occur when parents are too genetically distant. This may result in incompatible genetic outcomes that may be lethal or reduce the fitness of subsequent generations.

Guidelines and flow chart prepared by C Munday, K Brown, M Byrne and D Coates
Dec 2013



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Parks and Wildlife

