PRACTICALITIES - REVEGETATION

SEED COLLECTION FOR REVEGETATION :
GUIDELINES FOR DETERMINING THE REQUIREMENT FOR LOCAL SEED

Melissa Millar

The collection of seed from natural populations is an important issue for revegetation programs. Current approaches tend to follow the precautionary principle where seed is collected from 'local provenance' or 'local' populations only.

The precautionary principle

When collecting seed from natural populations for revegetation the precautionary principle has generally been followed for a number of reasons:

- Natural populations may possess genetic adaptation to local environmental conditions including climatic (temperature, rainfall), edaphic (soil) and other environmental variables (aspect, hydrology). Seed collected from 'local' populations is therefore likely to have a 'home site advantage' being well adapted and displaying enhanced long term viability, fitness and survival at a nearby revegetation site.
- Natural populations located further away may not be well adapted to the environmental conditions at the revegetation site. Seed collected from them may perform poorly on the revegetation site.
- Seed collected from populations located further away may pose a risk to nearby natural remnant vegetation via pollen contamination. Pollen contamination from genetically divergent plants may result in the production of hybrid progeny within natural remnants. If outbreeding depression occurs in the hybrid progeny, hybrid seedlings may have reduced viability, fitness and survival and this may threaten the overall health and long term persistence of the remnant population.
- Lastly, the use of local provenance seed in revegetation is also considered to prevent a range of other negative ecological interactions with nearby remnant vegetation such as invasiveness, displacement of the local form, and changes to the community structure.

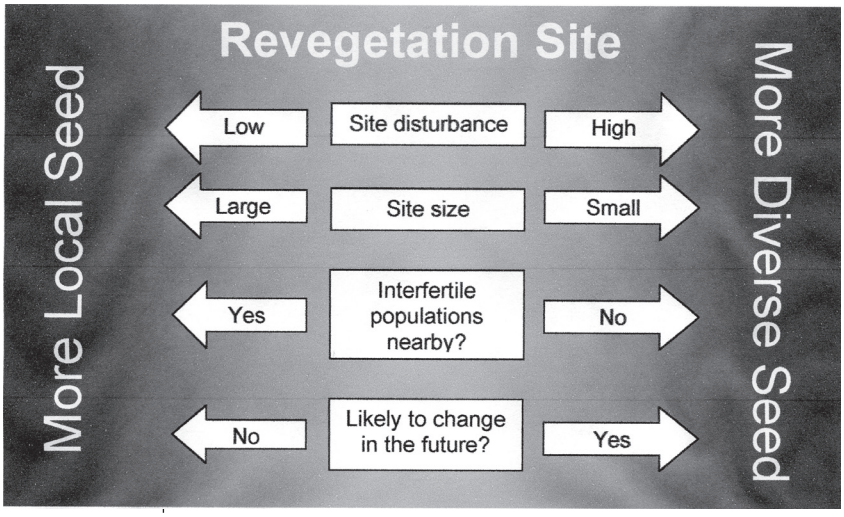
Although the term 'local' is not well defined, limiting seed collections to 'local' populations has led to highly geographically restricted seed collection zones, anecdotally as small as 15 km. In some cases, however, the use of strictly 'local' seed collection zones is not possible, nor may it be the most appropriate approach for all revegetation programs and species.

Guidelines can be used in determining the requirement for strictly 'local' seed collections for a given revegetation task and in determining the possible size of seed collection zones for a given revegetation species. These guidelines incorporate assessment of a range of characteristics regarding

- the aim of the revegetation program,
- current and future aspects of the revegetation site,
- the known or likely patterns of genetic variation or of local adaptation in the revegetation species, and
- the availability and quality of seed sources.

The aim of the revegetation program

Revegetation programs are conducted with a range of goals and the appropriate seed collection strategy will vary for different programs. The goal of some revegetation projects is the restoration of degraded land with the rapid establishment of plants with a high survival rate. Others may focus on the restoration of a specific endangered species in which case the availability of seed for revegetation may be limiting. Other revegetation goals include the provision of specific habitat, the prevention of invasion by exotics and the re-establishment of select ecological functions, and these goals may have different seed requirements. The aim of many present day revegetation programs is the re-establishment of fully functional and compositionally biodiverse, self-sustaining ecosystems, that survive well into the future. Each of the factors affecting seed collection strategies is discussed below in the context of this kind of sustainable revegetation program.



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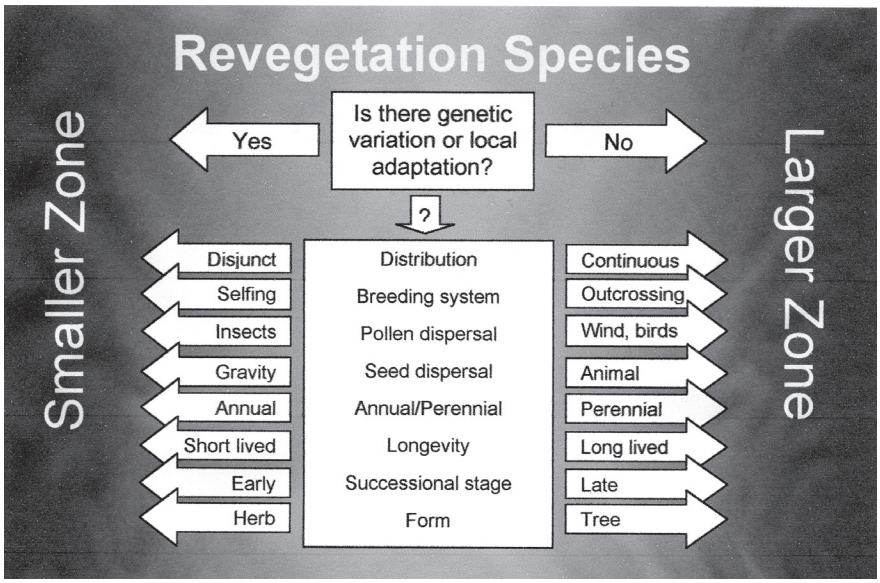
Current and future aspects of the re-vegetation site

In any revegetation project an 'eco-geographic' or ***'habitat matching'*** *approach should always be used. This means seed collection sites and revegetation sites should always be matched as closely as possible for environmental variables including temperature, rainfall, soil, aspect and hydrology, regardless of the geographic distance between them.*



Using a habitat matching approach means that 'local' populations are often well suited as seed collection sites. Further factors that influence the appropriate seed collection strategy include the degree of disturbance at the site, the size of the site, its proximity to remnant populations, and the likelihood of future environmental changes at the site. The requirement of collecting seed from 'local' populations is reduced when:

- disturbance at the revegetation site increases, for example, with highly altered hydrology or soil chemistry. In this case environmental conditions may be significantly altered or completely novel compared to the original state and 'local' seed may no longer be well adapted to the site,
- the revegetation site is only small in relation to nearby remnants,
- there are no suspected interfertile remnant populations of the same or a closely related species nearby. In the case of a small site with no interfertile populations nearby the risk of genetic contamination into remnant populations is greatly reduced, and
- the potential for future environmental changes at the revegetation site, including climate change, increases.

For smaller revegetation sites not in close proximity to interfertile natural populations and those that are highly disturbed and/or predicted to undergo significant future changes, the size of seed collection zones can be expanded. For these sites an approach that makes use of seed lots collected from a number of large healthy populations with more diverse origins and a mixture of genotypes which will have greater levels of genetic diversity and may be more successful in both the short and long term.

Genetic variation and local adaptation in the revegetation species

Assessment of the aims of the revegetation program and of aspects of the revegetation site may indicate a strong requirement for revegetation with seed of 'local' provenance. In this case, how exactly do you determine a specific geographic scale or size of a 'local' seed collection zone? For some species there may be information on genetic diversity or local adaptation and this can be used to determine seed collection zones. For most species there is no such information. Following the precautionary principle can also be important if little variation in morphological and physiological traits is observed, as strong genetic diversity may still be present among populations with significant adaptation to local conditions.

When information is not available, a range of life history traits can be assessed to give an idea of the likelihood of significant levels of genetic diversity or local adaptation. Factors affecting patterns of genetic diversity include the distribution of populations and individuals, breeding system, pollen and seed dispersal mechanisms, successional stage, whether it is annual or perennial, whether it is short-lived or long-lived, and its life form, such as herbaceous, shrub or tree.

Greater levels of genetic diversity between populations and hence local adaptation may be expected for species with limited distributions and highly disjunct populations; those that are predominantly self pollinated; have limited seed dispersal mechanisms (seed falls to the ground and is not dispersed by animals) and pollen dispersal mechanisms (small insects); are short lived (a shrub that lives five years), and those of early successional stage (small annuals and herbaceous perennials) and more herbaceous forms. For these species 'local' seed collection zones should be smaller.

Levels of genetic diversity between populations are often lower and local adaptation would be expected

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In Brief

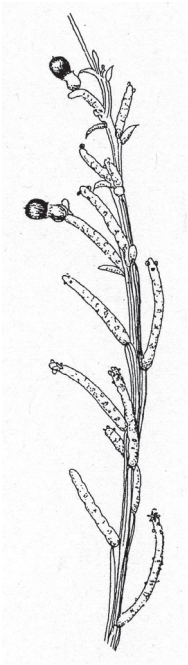
BIRDS LIKE BERRIES

William Davis and Harry Recher have been studying birds in the Great Western Woodlands (GWW) for many years, and in the process have built up a vast knowledge of the natural history of the area. A recent article in *The Western Australian Naturalist* illustrates one such case*.

The native cherry (*Exocarpos aphyllus*) is an important food source for birds in the GWW in late winter and spring. Thirteen species took berries and 12 species foraged for invertebrates on foliage and bark, including five species that took no fruit.

Because of its importance to birds, anyone undertaking revegetation in the Wheatbelt should consider including this species or its close relative, broom ballart (*Exocarpos sparteus*) in their projects.

*[*For ref, contact Ed.]*



The illustration is of Exocarpos sparteus*, drawn by Margaret Pieroni, and is taken from the book Leaf and Branch (reviewed last issue).*

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to be less pronounced for common species with widespread distributions and large continuous populations, those that are predominantly outcrossing (most trees), have long distance seed dispersal (animal dispersed, river dispersed) and pollen dispersal mechanisms (bird pollinated, wind pollinated), perennial species, long-lived species and those of late successional stage including many long-lived woody perennials, shrub and tree species,. For species such as these, 'local' seed collection zones may be expanded however seed collection zones and revegetation sites should not be interrupted by physical barriers that may limit gene flow among populations such as rivers and large areas cleared of native vegetation.

Availability and quality of seed sources

In most revegetation situations, quality of the seed source is more important than sourcing from the nearest local population. Seed should always be collected from large healthy populations that are not suffering from effects of small population size such as poor seed set, or exhibiting poor flowering or excessive predation. Only 20 % of available seed should be collected from a natural population in order to ensure future health of the population.

Seed collected from a range of habitat matched populations with high levels of genetic diversity will almost always be more appropriate material for revegetation than seed collected from a restricted number of 'unhealthy', small or isolated populations on a local geographic scale.

Mellissa Millar is based in DEC's Science Division at Kensington. She can be contacted by email: melissa.millar@dec.wa.gov.au

HUNTSMAN SPIDERS

After the article on wolf spiders last July, a number of readers contacted the Editor to ask if they are the same as huntsman spiders, and if not, is there an easy way to tell the two groups apart? Volker Framenau from the WA Museum provided an answer:

"They are in two different families, wolf spiders are in the family Lycosidae, huntsman spiders in the family Sparassidae. There are three easy ways to tell them apart.

- Look at the eyes. Wolf spiders have four small frontal eyes and four large eyes in almost a square on top of the carapace. Huntsman spiders have two rows of eyes, four and four, almost equal in size.
- Positioning of the legs. Wolf spiders' legs have two pairs pointing more or less forward, two more or less backward, whereas huntsman spiders' legs stretch out sideways and they tend to scuttle sideways like a crab.
- Broodcare. Wolf spiders carry their egg sac around with them, but huntsmen spiders make a silken brood chamber in which they deposit their egg sac. They will remain beside this chamber to guard it.

Hope this helps, folks!"

Thank you, Volker.