

# Piecing together the patches

*CSIRO Plant Industry scientists investigating the health of Australia's remnant vegetation have formulated a series of broad management guidelines designed to improve the viability of remnant ecosystems and help maintain their role as resources for revegetation activities.*

## Remnants at Risk

Grasslands and heathlands are two of the most endangered ecosystems in Australia. An estimated two per cent of temperate native grassland is left in south east Australia – the rest has been cleared for agriculture and urban development. Grasslands are an important ecosystem for native grasses and herbs as well as many animals such as the rare legless lizard. They are also important components of native pasture grazing systems.

Heathlands in Western Australia are also under threat – having been largely cleared for wheat production. A unique assortment of plants including many banksias, dryandras and acacias are found only in the heathlands and, like grasslands, they provide important habitats for many of our native birds and animals.

Much of the grasslands and heathlands that remain in southern Australia are in small isolated patches, making them vulnerable to further degradation. When isolated in small patches, plants are exposed to a range of genetic and ecological threats such as loss of pollinators, which can limit seed set, and inbreeding, which reduces seedling fitness. These biological problems can limit the persistence of these populations and reduce their value as locally adapted seed sources for revegetation.

## Testing ecosystem fragmentation

In the first large-scale, multi-species investigation of its kind, CSIRO Plant Industry, with the Western Australia state government Department of Environment and Conservation (DEC) and Water Australia (LWA), investigated how ecosystem fragmentation affects the genetic and ecological health of remnant populations of common plant species.

Two contrasting landscapes were chosen for the study – the grasslands and grassy woodlands of south eastern New South Wales and the kwongan shrublands and heathlands of the Dongolocking area in southern Western Australia. Seven species were selected to represent different classes of plants with varied reproductive mechanisms.

Using a multidisciplinary approach that incorporated field-based demographic modelling, experimental growth trials and molecular marker analysis the research team made some interesting and important discoveries.



## The findings

### *High risk to common plants*

The study found that ecosystem fragmentation is having a serious impact on the health of common plants – not just rare plants. This affects both the health of common plant remnants and their value as seed sources for revegetation programs.

### *Bigger is better*

Population size was identified as one of the main factors affecting remnant health. Smaller populations face a number of challenges to their viability including reduced fertilisation and seed set, lower genetic variation, increased inbreeding, and poorer seedling fitness.

### *The big picture*

Population isolation was also shown to negatively affect its fitness. Higher inter-population gene flow than expected was observed in one of the study species, which means larger populations may be 'genetically rescuing' nearby smaller populations. This suggests that populations do not exist independently, and that what happens to one – such as a dramatic reduction in genetic variation – may have consequences for neighbouring populations.

## Guidelines to remnant health

From these findings, the research team devised a number of broad landscape management guidelines designed to improve the ecological and genetic viability of Australia's native remnant populations.

### *Maintain large populations*

Large populations have better reproductive success, higher genetic diversity and lower inbreeding than smaller populations, so it is important to maintain large populations of reproductive plants.

### *Minimise the distance between populations*

Reducing the isolation of populations helps maintain biological connectedness through the sharing of pollen and seeds.

### *Site condition is not as important as previously thought*

Population size and isolation were demonstrated to be more important to remnant persistence than the condition of the site. Site condition should be given less consideration in landscape planning.

### *Manage populations in a whole-landscape context*

Remnant populations co-exist. By managing several populations in an area as a whole ecosystem, the populations are more likely to thrive.

## Next steps

New research in partnership with DEC and LWA is now focussing on the importance of gene flow and seed dispersal among populations. Findings from this study will provide information on the inter-population processes that are important when considering landscape design.



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