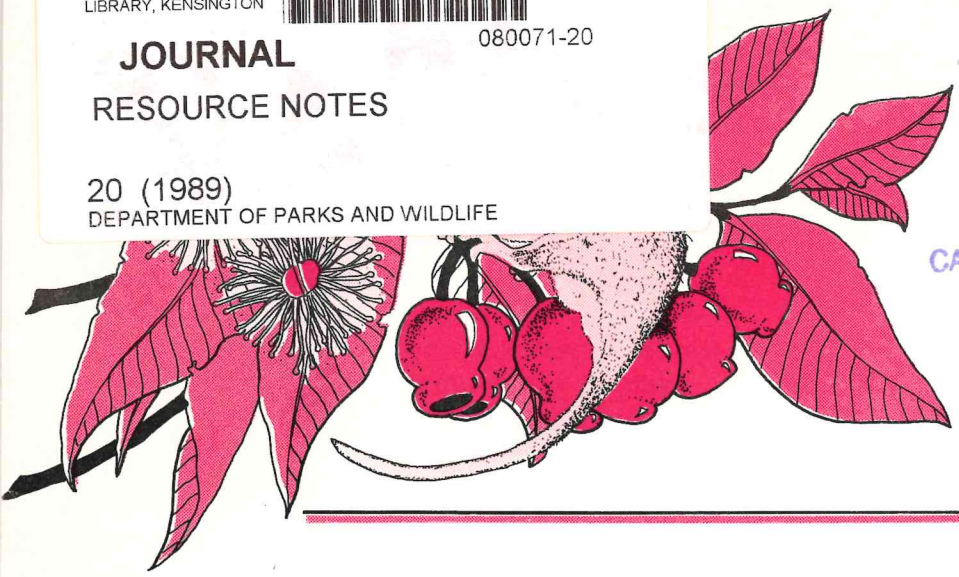


Resource Notes

Number 20 May 1989
Department of Conservation and Land Management, W.A.

GENETIC DIVERSITY AND CONSERVATION OF THE GRASS WATTLE

On the edge of the Darling Scarp, near Perth, there occurs an extremely rare wattle. Only about 250 plants of the species *Acacia anomala,* the grass wattle, are known. This rare wattle exists in ten populations, six in Chittering and four at Kalamunda. Because it occurs close to the metropolitan area, a number of populations have probably been destroyed or reduced in size and isolated in the past due to land clearing. Currently, five populations are on private property with the landowners taking considerable care to ensure their survival.

But this may not be enough. One of the survival problems facing the grass wattle is that, with so few plants there is likely to be very little genetic variation within the populations. When there are few plants in a population, inbreeding can result in poor specimens. For a species to survive in the short term there needs to be enough genetic variation within a population to produce healthy individuals with good reproductive potential. In the long term, genetic variation provides the ability to adapt to environmental change, such as climatic change or the arrival of a new pathogen.

The term genetic diversity is used to describe the total inherited (i.e. genetic) variation occurring within a species (sometimes the term genetic resources is used). Because both the long term and the short term survival of most species depends on sufficient levels of genetic diversity, it is usually important to put more effort into conserving a population with high genetic diversity than one with little genetic diversity.

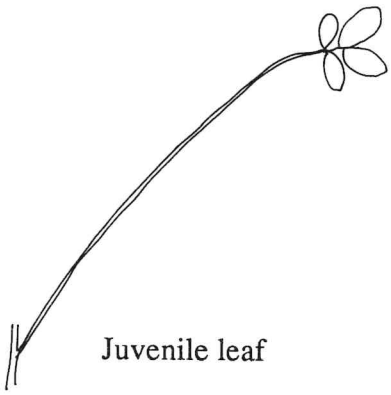
In 1986 we carried out a study to work out the levels of genetic diversity in the ten known populations of the grass wattle. This should enable us to:

1. Find which populations have greater genetic diversity and hence a better chance for long term survival.

2. Find which populations show higher levels of inbreeding and are therefore likely to be badly affected in the short term.

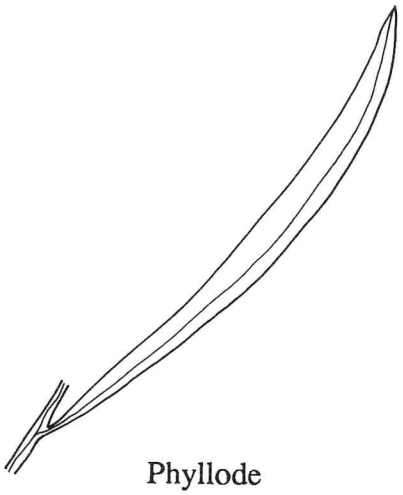
3. If necessary help select (based on measures of diversity and inbreeding) those populations which would be of more value to conserve.

Acacia anomala

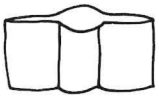


Juvenile leaf

Winged stem bearing
two flower heads



Phyllode



Section of stem showing the
two prominent wings (x 10)

To find the level of genetic diversity within each population the technique of protein electrophoresis was used. This involves investigating differences between proteins. Since genes code for these proteins, observed variation in a number of different proteins indicates variation in a number of different genes. This provides us with a way to estimate levels of genetic variation within populations of the grass wattle.

The proteins studied were extracted from one young flower head per plant, and individual plants were compared within each of the ten populations. Genetic variation was studied at 15 different gene loci, with the data summarised in the table below.

There are two important points to note from these data. Firstly the genetic diversity index indicates that the level of genetic diversity in the Chittering populations is at least double that in the Kalamunda populations (higher numbers indicate greater diversity). Second the inbreeding index which ranges from 1 (complete inbreeding) to -1 (complete outcrossing) indicates that the Chittering populations are at least partially outcrossing whereas the Kalamunda populations appear to be completely inbreeding. In fact it turns out that the Kalamunda populations reproduce entirely by vegetative means so that each population is a clone of genetically identical plants which don't seem to produce any seeds.

The Chittering populations, on the other hand, reproduce sexually with seed production resulting from both self and cross pollination.

How are these results likely to affect plans for the conservation of these two groups of populations?

1. The Chittering populations with relatively high levels of diversity and at least partial outcrossing have a good chance of long term survival providing they are adequately protected and the number of plants remain at its current level.

2. Chittering populations 2, 5 and 6 could be selected as more important populations for conservation given their higher levels of genetic diversity compared with the other populations. Of course other factors such as the status of the land (private property, nature reserve, road reserve etc.) and the number and condition of the plants also need to be taken into account.

3. Because the Kalamunda populations are clones with low genetic diversity they have less chance of long term survival. It seems they are extremely restricted in their ability to adapt and evolve.

4. Since each Kalamunda population consists of a clone of genetically identical plants there is no genetic reason to choose any population as a priority for conservation.

Populations	Genetic Diversity Index	Inbreeding Index
Chittering 1	2.0	0.1
Chittering 2	2.4	0.1
Chittering 3	2.0	0
Chittering 4	2.3	0.2
Chittering 5	2.4	0.2
Chittering 6	2.6	0
Kalamunda 1	1.0	1.0
Kalamunda 2	1.1	1.0
Kalamunda 3	0	1.0
Kalamunda 4	1.1	1.0

The genetic diversity data, combined with information of the ecology and life history of the grass wattle has provided us with the necessary biological information to develop a successful way to manage for the conservation of this extremely rare species. Similar studies are also currently being carried out on other rare or threatened native plants such as species of Banksias, orchids and Eucalypts.

It is clear that genetic variation is an extremely valuable resource which needs to be carefully managed not only to ensure the survival of native plants and animals but also to ensure the continued production and survival of our major crops, timber trees and livestock.

Written by *David Coates,*
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Further reading:

Genetics and Conservation: A reference to managing wild animals and plant populations. Ed. C.M. Schonewald-Cox, S. M. Chambers
B. Mcbride, L.Thomas 1983, Benjamin-Cummings Publishing Co. Inc, California.

Genetic diversity and population genetic structure in the rare Chittering grass wattle, *Acacia anomala* Court.
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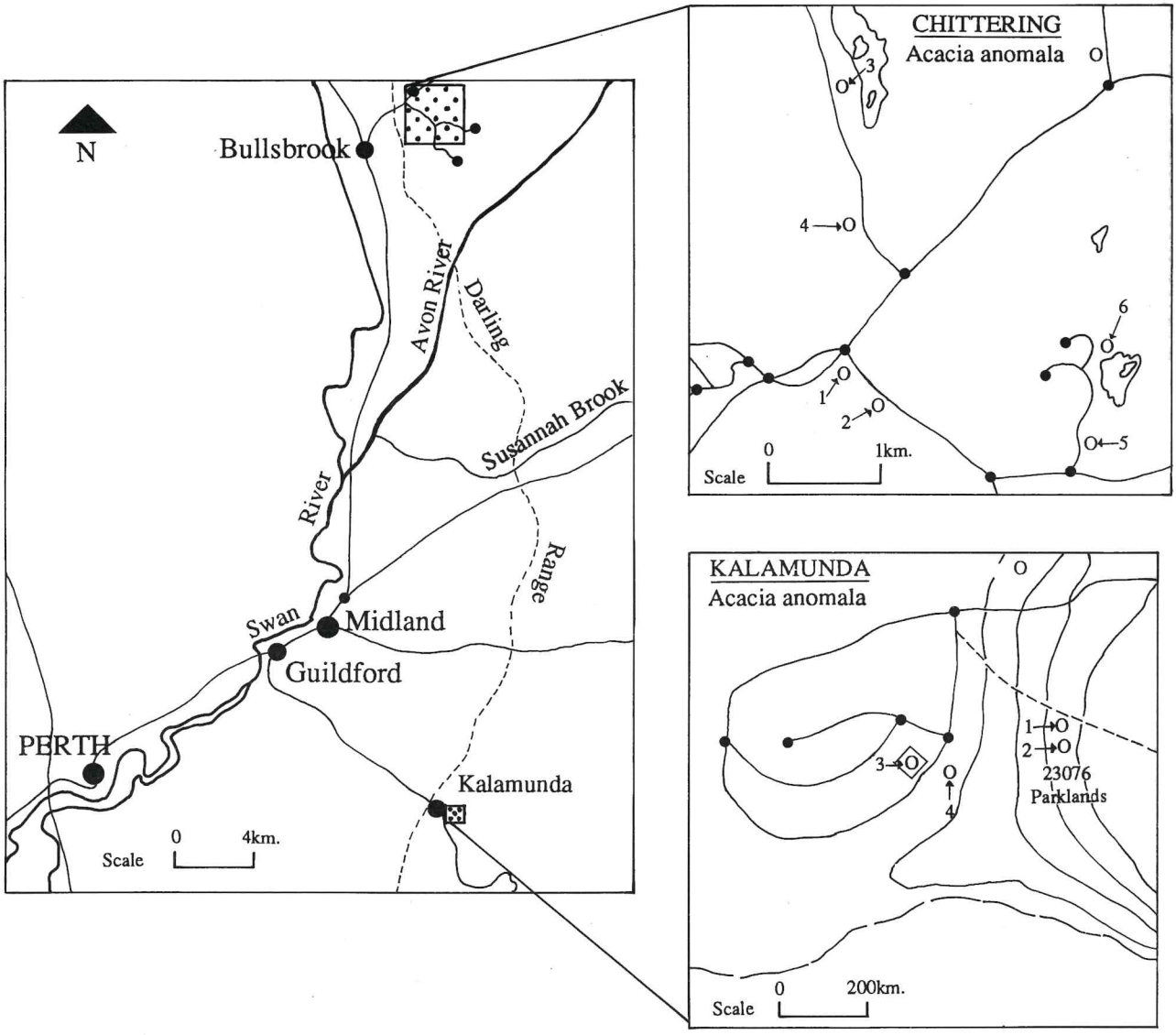

Distribution of the *Acacia anomala* Populations

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