



Forest Genetic Resources

(IFA Forest Policy Statement No. 1.2)

Key Statement

The Institute of Foresters of Australia advocates the need for the implementation of in situ and ex situ measures and ongoing research to adequately conserve the full range of Australia's unique forest genetic resources, for both their intrinsic biodiversity value and their existing and potential uses for mankind.

The Issue

Australia's forests have a high level of endemism and an enormous diversity of genetic resources. As a nation we have a global responsibility to conserve these important genetic resources, including both within species and between species diversity. Clearing, habitat modification, unsustainable land management practices and the impacts of exotic species and "genetic pollution" of native forests all pose potential threats to maintenance of genetic resources. The vast geographic range of Australia's forests, the occurrence of many forest species with limited distributions, and the variation between geographically different populations or provenances of widespread species creates a challenge for the comprehensive conservation of Australia's forest gene resources.

Background

Australia's large continental area, with its broad geographic range, wide climatic diversity, and long isolation from the other continents has produced a unique flora. Botanists continue to refine our knowledge of the Australian flora, which contains 77 orders, 251 families and more than 15,000 species. About one third of seed bearing plant genera in Australia are endemic, while over 90% of species are unique to Australia. Of the 566 endemic genera, 270 are represented in Australia by endemic species only.

Approximately 164 million ha or 21% of the continent supports forest cover; defined as trees of greater than 2 metres in height with a crown cover of at least 20%. Approximately 74% of the forest is woodland and mallee. Eucalypts and related genera dominate, comprising 80% of forest types. *Acacia* (wattle) forests are common in drier regions, making up around 10%. *Callitris* (cypress) is Australia's most common softwood genus, making up 1%. Rainforests account for 3 per cent of Australia's forests but contain 25% of all plant genera. *Melaleuca* ('paperbark'), casuarinas, mangroves and a range of other species make up the remainder of Australia's forest types.

The fundamental basis of different species, their adaptations to different conditions, and their capacity to adapt to changing conditions is their genetic diversity. This can be viewed at two levels: (i) the genetic diversity between species, and (ii) the genetic diversity within species. Conservation of species variability is obviously important from the viewpoint of responsible stewardship, but conservation of variation within species is equally important: to maintain species viability with respect to inbreeding; and to maintain the resource of allelic variation necessary to allow species to evolve in the long term by adapting to changing environmental conditions. Maintenance of the species and allelic variation within species is also important to maintain the genetic resource that may be exploited for new products, or to introduce useful traits into existing cultivated forms of a species.

Many of Australia's forest species are restricted to particular regions, while others show patterns of variation within species that correlate to particular regions or provenances. Research to quantify within species variation, particularly at the allelic level, is limited, but studies to date indicate that genetic distance is not always related to geographic distance, and may have involved historical introgression with other species via pathways not necessarily obvious today.

The conservation of genetic resources requires a detailed understanding of the natural variation within and between species as well as of the impacts of exotic species, changes in land use practices and climate change. Genetic resources can be conserved "in situ" within forests and conservation reserves

and “ex situ” within arboreta, gardens and seed stores. For example, commercial nursery propagation has been used to assist the conservation of the recently discovered rare and endangered Wollemi pine.

Under Australia’s National Forest Policy Statement, one of the major strategies used to conserve forest genetic diversity is the establishment of a comprehensive, adequate and representative (CAR) reserve system. The CAR reserve system seeks to ensure reserves that: protect threatened species; capture diversity across forest communities; are large enough to maintain species viability; and are representative of the diversity within native forest communities across their range, and are actively managed to conserve this diversity.

In situ conservation of forest communities and their inherent gene resources remains important outside of reserves. This is achieved through measures contained in Codes of Forest Practice, including the use of local genetic material when regenerating native forests following timber harvesting, and the retention of appropriate examples of remnant native vegetation on farmland and when plantations are established. Ex situ conservation strategies are mainly used for threatened or endangered species.

There are more than 500 species of Australian plants regarded as endangered and most of these occur on private land or unreserved Crown land.

Australia has a National Strategy on the Conservation of Australia's Biological Diversity (1996) and a National Biotechnology Strategy (2000). In 2005, the Australian Government developed regulations to facilitate access to, and regulate the use of, our native genetic and biochemical resources. The regulations will also ensure that Australia's genetic resources are used for research and development on mutually agreed terms, with prior informed consent and an equitable return to Australia, while ensuring the environment is protected.

Clearing and other forms of habitat modification, such as timber harvesting or modified fire regimes, may have impacts on species survival and genetic diversity. Plantations of exotic species, including non-local native provenance material of native species, in some circumstances may threaten the conservation of native stands. Introgression of genes within plantations or from plantations to native forest stands, labelled “genetic pollution”, is also increasingly being seen as a threat to genetic and ecological integrity, while climatic and environmental changes such as salinisation and isolation by extensive clearing pose a potential threat to long term conservation of genetic diversity between and within species.

The term “genetic pollution” is often used with little substantive data or understanding of the barriers to natural hybridisation between species, the dynamics of “genetic drift”, the difference between conservation of genes *per se*, the preservation of gene frequencies of in-situ native stands, and adaptive changes in response to environmental changes that force drift in population gene frequencies as well as the consequent ecological effects. This issue demonstrates the need to research and reach pragmatic and informed balances between conservation and production objectives.

Policy

The Institute of Foresters of Australia (IFA) considers:

- Australia has a global responsibility to conserve its unique forest genetic resources, because of the high level of endemism within Australian forests and the international importance of Australian timber species. Australia can also assist with the conservation of exotic forest genetic resources, particularly those of commercial importance in Australia or threatened in their natural habitat.
- Genetic conservation of a species does not depend on the attempted preservation of particular or individual communities, but rather the continued existence of their genes, and that production native forests managed through natural regeneration have an important role in conservation of forest genetic resources complementary to a system of CAR reserves.
- A register should be maintained of endangered species and of species threatened by loss of their natural ecological range or other means and extended to subspecies, varieties, forms and outstanding individuals.

The IFA supports and encourages:

- The primary conservation of Australian forest species and genetic variation within species through the comprehensive, adequate and representative system of reserves, which are actively

managed with respect to biotic and abiotic influences including fire, pollen contamination, exotic species .

- Recognition of the role of vegetation clearing legislation and Codes of Forest Practice to protect and regulate the use of genetic resources outside of conservation reserves.
- The use of “ex situ” measures to conserve genetic diversity of rare, endangered or commercially significant Australian flora.
- Continued research into the genetic structure of forest communities, species and populations to quantify genetic relationships and levels of allelic variation in order to provide both a sound basis for conservation of gene pools, as well as to facilitate utilisation of genetic resources.
- Continued research into gene flow between plantations and native stands to quantify the risk of seed and pollen dispersal, allelic introgression, and their impact on native gene frequencies.

Further Information

<http://www.anbg.gov.au/flora/index.html>

<http://www.deh.gov.au/biodiversity>

Anon (1986) Tropical Rainforests of north Queensland – Their conservation significance. Australian Heritage Commission Special Australian Heritage Publication Series No. 3. Aust. Govt. Publ. Serv., Canberra. 195pp.

Boland, D.J., Brooker, M.I.H, Chippendale, G.M., Hall, N., Hyland, B., Johnson, R.D., Kleinig, D.A., and Turner, J.D. (1984) *Forest Trees of Australia*. Thomas Nelson Australia, Melbourne. 697pp.

Potts, B., Barbour, R.C. and Hingston, A.B. (2001) Genetic pollution from farm forestry. RIRDC Publication No 01/114. 109pp.

Stebbins, G. L. – Several works including 1950 *Variation and Evolution in Plants*.

Morley, B D; & Toelken, H R (1983) *Flowering Plants in Australia*. Rigby, Adelaide. 416pp

Orchard, A.E. (ed) (1999) *Flora of Australia Vol 1 Introduction 2nd Edition*, Australian Biological Resources Study/CSIRO, Canberra.

Leigh, J., Boden, R. & J. Briggs (1984) *Extinct and endangered plants of Australia*. Macmillan Australia, Melbourne. 369pp.

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