Australia's State of the Forests Report
Case studies

Criterion 1
Conservation of biological diversity

Case study 13: Recovery plans in South Australia

Spider orchids

The white and pink-lipped spider orchids (*Caladenia rigida* and *Caladenia behrii*) both occur in forest reserves in the Mt Lofty Ranges near Adelaide and both have experienced a decline in range due to clearance and habitat destruction. Most current sub populations of the species occur in reasonably close proximity and genetic differences are thought to be low; outlier sub populations may be critical for genetic variation. A recovery plan has been prepared under a regional recovery program coordinated by the South Australian Department for Environment and Heritage. It includes the ongoing monitoring of all sub populations, hand pollination, seed collection, seed dispersal and translocation, and the management of orchid populations through prescribed burning in forest reserves, weed control and fencing.

Southern emu-wren

The range of the Mt Lofty Ranges southern emu-wren (*Stipiturus malachurus intermedius*), a sub species of the southern emu-wren, has been reduced by the clearance, degradation and fragmentation of its habitat. This tiny, almost flightless bird inhabits a range of swamp and dry-heath habitats, including heathy low open forests in the southern Mt Lofty Ranges. Three sub populations are known in forest reserves. Under a national recovery plan coordinated by the Conservation Council of South Australia, measures such as population counts, translocation trials, investigations into the use of prescribed burning to protect the species from wildfire, and revegetation and weed control to buffer habitat areas and improve habitat quality are being carried out.

Spider orchid (*Caladenia behrii*).

Southern emu-wren (*Stipiturus malachurus intermedius*) Mount Lofty Ranges, SA.

Source: www.environment.sa.gov.au/biodiversity/threatened.html

Case study 14: *Eucalyptus benthamii*

E. benthamii (Camden white gum), a forest tree occurring on the alluvial floodplains of the Nepean River and its tributaries southwest of Sydney, is of interest for both conservation and plantation forestry. It is vulnerable to extinction because of the widespread clearance of its habitat for agriculture that took place in the nineteenth century. A dam which flooded the Cox Valley for Sydney's water supply further decreased the species' distribution and it is now confined to one population of approximately 6,500 trees in the Kedumba Valley and three remnant populations on the Nepean River at Bents Basin (about 300 trees), Wallacia (9 trees) and Camden (about 30 trees). Increased nutrient levels, inappropriate fire regimes and weed invasion constitute threats to the species. Moreover, the frequency of small floods has decreased since the Warragamba Dam was built. Not only has this affected potential germination events, it has also permitted the build-up of driftwood and sand, potentially causing a fire risk and root smothering. In situ conservation of a portion of the Bents Basin population is managed within the Bents Basin State Recreation Area managed by the State's Department of Environment and Climate Change and the larger Kedumba Valley population is within land managed by Sydney Water as a special area.

Genetic analysis of the four populations revealed significant genetic differences among all populations, even though the three remnant populations are separated by only a few kilometres. The ages of the trees in these populations have been estimated to range between 35 and 200 years, suggesting that the genetic divergence among populations occurred prior to land clearing. Inter-species gene flow increased after fragmentation, since 20% of the progeny from Camden and 30% of the progeny from Wallacia were hybrids, principally with *E. viminalis*. Seed viability and germination rates were significantly lower in the remnant populations, reducing their value as seed sources for regeneration and plantation forestry.

Sources: Butcher et al (2005), Thomas et al (1984)

Case study 16: Gene flow studies for *Acacia saligna* and *Eucalyptus loxophleba*

Acacia saligna is used in minesite rehabilitation, revegetation, agroforestry, amenity plantings and as a fodder plant for stock, and is being considered in the management of dryland salinity and as a commercial tree crop species. *A. saligna* shows significant genetic variation; if genes are able to flow between variants, planting one variant within the natural range of another could affect the genetic integrity of the natural population.

A project in Western Australia is investigating the potential for introgression between natural and planted populations of *A. saligna* by studying pollen dispersal and cross compatibility between variants. The aim is to maintain diversity in natural populations of *A. saligna* in Western Australia and increase knowledge about the potential invasiveness of the species throughout Australia.

A similar project is investigating gene flow among natural and planted populations of *Eucalyptus loxophleba*. This species has four subspecies: two with a mallee growth form and two with a tree form. The mallees are commonly used in agroforestry plantings to produce oil mallee but planting these subspecies inside the range of tree subspecies may contaminate the natural tree populations. The project is investigating the extent of pollen dispersal to determine the planting distances that must be employed to maintain the genetic integrity of the natural populations.

Source: www.futurefarmcrc.com.au

Case study 17: Breeding *Eucalyptus globulus* in the Southern Tree Breeding Association

The Southern Tree Breeding Association's (STBA) *Eucalyptus globulus* breeding program began in 1994 when founder members decided to merge their genetic resources. The program has a base of 1,200 native stand parents and over 225,000 progeny from which to breed.

Fundamental to the program's success are a formal breeding strategy that defines the objectives and provides guidelines on how to achieve these, and provides strong links to research organisations to ensure that programs and operations are scientifically valid and adopt the most appropriate methods available. The STBA does not undertake research in-house as this would divert the focus from making genetic gains.

The program's primary objective is to maximise profit by growing forests for Kraft pulp production. A profit index is used for selection: genetic values for volume growth, wood basic density and Kraft pulp yield are weighted by their economic importance and summed.

Under the program's 'rolling front' work plan, all tasks – crossing, trial establishment, trial assessment, genetic analysis and selection – are carried out every year; on average, the program has made 64 cross combinations per year since it started. Seeds from these crosses are planted to 2–5 progeny trials per year; to date, 35 trials have been established involving over 54,000 trees from nearly 700 families. Trials are typically assessed at years 4, 6 and 8 for growth, year 4 for core basic density (and, if possible, predicted pulp yield using near-infrared spectroscopy), and before year 2 for *Mycosphorella* leaf disease.

The program involves a large number of trials spread geographically but linked by pedigree. Maximum gains can be achieved when all available data (all traits in all trials across all generations) are analysed simultaneously. Best Linear Unbiased Predictor methods are considered optimal for this. However, existing software cannot perform such a large-scale analysis; thus, the TREEPLAN® genetic analysis system has been developed in conjunction with the Animal Genetics Breeding Unit of the University of New England. This system produces breeding and family values (and clonal values if data exist) for all individuals in the population and can be run routinely whenever more data are added.

Source: www.stba.com.au

Case study 18: *Eucalyptus gunnii* subsp. *divaricata* ex-situ seed orchard and conservation plantings in Tasmania

Eucalyptus gunnii subsp. *divaricata* (Miena cider gum) occurs at Miena on the Central Plateau in Tasmania, where it intergrades clinally with *E. gunnii* subsp. *gunnii* and *E. archeri*. Core populations of this subspecies are highly frost resistant and the juvenile foliage is of interest to the floriculture industry. Historically, the sap of the subspecies was used by Indigenous people and early European settlers and is reported to have an intoxicating effect when fermented. In the last decade, high mortality and poor seed crops coupled with low seedling recruitment have threatened the long-term survival of this taxon in the wild. It is listed as endangered under Tasmania's threatened species' legislation and is being considered for listing under Commonwealth legislation.

Several institutions have been working to conserve the sub species. Forestry Tasmania established a conservation planting in 2000 and collected seeds from the Miena population from remaining trees with open-pollinated seed capsules. The University of Tasmania, Forestry Tasmania and the Tasmanian Department of Primary Industries Water and Environment jointly established another conservation planting in 2002 using seeds collected from 36 native stand trees in the core/type population by the University of Tasmania in the late 1980s prior to the death of mature trees. The planting comprises seven complete replicates and four incomplete blocks of single-tree plots.

Sources: B Potts, University of Tasmania, pers comm 2007; Potts et al 2001

Prepared by the Montreal Process Implementation Group for Australia
on behalf of the Australian, state and territory governments.

Contact details:
Bureau of Rural Sciences
GPO Box 858, Canberra ACT 2601
Copies available from:
BRS Publication Sales
GPO Box 858, Canberra ACT 2601
Ph: 1800 020 157 | Fax: 02 6272 4747
Email: salesbrs@brs.gov.au | Web: www.brs.gov.au