

GUEST EDITORIAL

THE FUTURE OF TROPICAL HARDWOOD TREE IMPROVEMENT: GREATER COOPERATION

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Tropical hardwood tree improvement began in northern Australia in the 1980s and focused on the conservation and breeding of native and exotic timber species. Resourced by commonwealth (CSIRO and AusAid) and/or state government agencies (Queensland, Northern Territory and Western Australia), these programmes included extensive initial seed collection for a diverse range of provenances and the establishment of species trials, provenance conservation facilities and commercial seed orchards. A number of these programmes subsequently became significant sources of germplasm of several tropical *Acacia*, *Eucalyptus* and other species for industrial tree planting programmes in Asia and elsewhere (Harwood 2005, 2011). Hardwood plantations of these species now cover several million hectares in China, southern India, Indonesia, Malaysia, Thailand and Vietnam and are the bases of flourishing forest products industries. In northern Australia, tree improvement programmes have also helped facilitate commercial plantations of *Eucalyptus pellita* in north Queensland, *Khaya senegalensis* (African mahogany) in the Northern Territory and *Santalum album* in Western Australia.

Prior to the mid-1980s, there was little interest in or need to develop tropical hardwood plantations and tree improvement in northern Australia due to sufficient wood supplies from the huge resource of native hardwood forests. This changed with a gradual paradigm shift in the Australian social conscience, whereby environmental and sustainability concerns encouraged transition of the State Forests (where sustainable harvesting was practised) to National Parks (where no commercial activities could proceed) and a change from the supply of hardwood timber from native forests to more socially acceptable plantation-based timber sources.

Large-scale hardwood plantation expansion in northern Australia commenced in the late 1990s, funded initially by government-supported programmes. Significant private plantation investment soon followed, primarily from Australian-based Managed Investment Schemes (MIS) but also from international investment programmes. Over the past decade approximately 130 000 ha of hardwood plantations have been established throughout northern Australia (Lee 2011), including over 10 000 ha of *K. senegalensis* plantations established since 2006 in the Northern Territory. Some of these companies also developed their own R&D programmes to support specific needs or to develop their own genetic resources for their priority species.

During the last decade, government base funding for hardwood plantation R&D has declined significantly across northern Australia, threatening the survival of a number of important collections of genetic resources. Some breeding programmes have been abandoned or neglected, risking many years of development and investment in the species, others have been greatly curtailed. In addition the global financial crisis of 2008–2009 resulted in severe hardship or collapse of some MIS forestry investment companies in Australia, with huge losses of intellectual property resources through staff retrenchment and threatening the integrity of numerous private hardwood tree improvement facilities.

The combined effects of reducing government inputs and collapses of several plantation companies place the future of tropical hardwood tree improvement in Australia at a crossroads. The long-term future for hardwood tree improvement requires a cooperative approach between the public and private sectors to provide an efficient means to pool and best use scarce resources. The relative stability and independence of government backing, combined with the flexibility and

creativity of active industry partners, should deliver needed long-term security for hardwood tree improvement programmes. Industry-alone cooperatives on the lines of highly successful and well-known programmes in southern and north-western United States, New Zealand and South Africa may not be possible in northern Australia due to the small numbers of companies planting particular species and because cash flows from log harvests are still some years away. Furthermore, the government programmes have tree genetic and human resources including technology and expertise to offer which should be used.

The *K. senegalensis* tree improvement programme in northern Australia is at such a crossroads. The Queensland and Northern Territory governments have actively collaborated on a *K. senegalensis* tree improvement joint venture since 2001. They manage the oldest and most genetically diverse *K. senegalensis* breeding population in the world, initially representing 23 provenances from 11 African countries (Nikles et al. 2008) and now comprising more than 150 selected trees from these and other resources. Grafted clonal seed orchards (CSOs) were established since 2001 and 2003 in the Northern Territory and north Queensland respectively, and a hedge garden comprising more than 500 seedlings from these resources was planted in the Northern Territory in 2004. Clone tests were established annually between 2005 and 2010, and progeny tests of many CSO clones in 2010 and 2011. The CSOs are producing sufficient seed for vegetative multiplication of seedlings from bulked seed (bulk clonal forestry) to be implemented on a modest scale and partially-tested clones are being identified.

Over the past five years, the *K. senegalensis* plantation industry has expanded rapidly, with over 10 000 ha established in northern Australia by five private forestry companies. Each company initiated its own seed procurement and tree domestication programmes, utilising African provenance and Australian landrace seed sources. Many new African provenances were imported into Australia by these companies, greatly extending the genetic base and permitting establishment of important multi-site provenance trials (Dickinson et al. 2009). However, the collapse of three of these companies in the aftermath of the global financial crisis, and the subsequent reduction of confidence in forestry plantation investment, threatens much of

these recent private-sector achievements in the domestication of *K. senegalensis*.

In a likely new paradigm of tropical hardwood tree improvement it is vital that stakeholders work closely together to preserve the outcomes of past public and private investment and build on the accumulated resources for the future of the tropical forestry industry. In many tropical countries, the gene pools of tropical hardwood species have been depleted by deforestation and unsustainable harvesting practices, threatening many native provenance populations of species such as *K. senegalensis* in sub-Saharan Africa. Future changes to government policies (environmental and commercial) may also limit access to key genetic resources. Hence it is important that the extensive genetic resources already established are not lost, as there may be no second chance to add these genes back into breeding programmes.

Private–public sector cooperation in tree improvement could go beyond preservation of the great wealth of genetic resources accumulated and facilities established. Cooperative tree improvement programmes of recurrent selection based on the pooled resources of the public and private sectors would provide many synergies and help maintain tree improvement momentum. Collaboration begun in 2011 between the North Territory–Queensland governments and the Centre National de Semences Forestières of Burkina Faso, west Africa has resulted in *K. senegalensis* seed exchange for the establishment of progeny trials in both countries. International cooperation provides additional benefits including greater public and private sector investments, increased innovation and likely increased support from donors. CAMCORE (Central American and Mexico Coniferous Resources Cooperative) is one such international programme which has demonstrated benefits to its members through the conservation and improvement of forest genetic resources within its portfolio of tropical hardwood and coniferous species.

History demonstrates that new challenges must be met with innovative new paradigms to secure survival and further progress. Cooperation among stakeholders, though not new in broad principle, is the new paradigm needed in forest tree improvement with an increasing number of tropical hardwoods in the Australasian region.

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