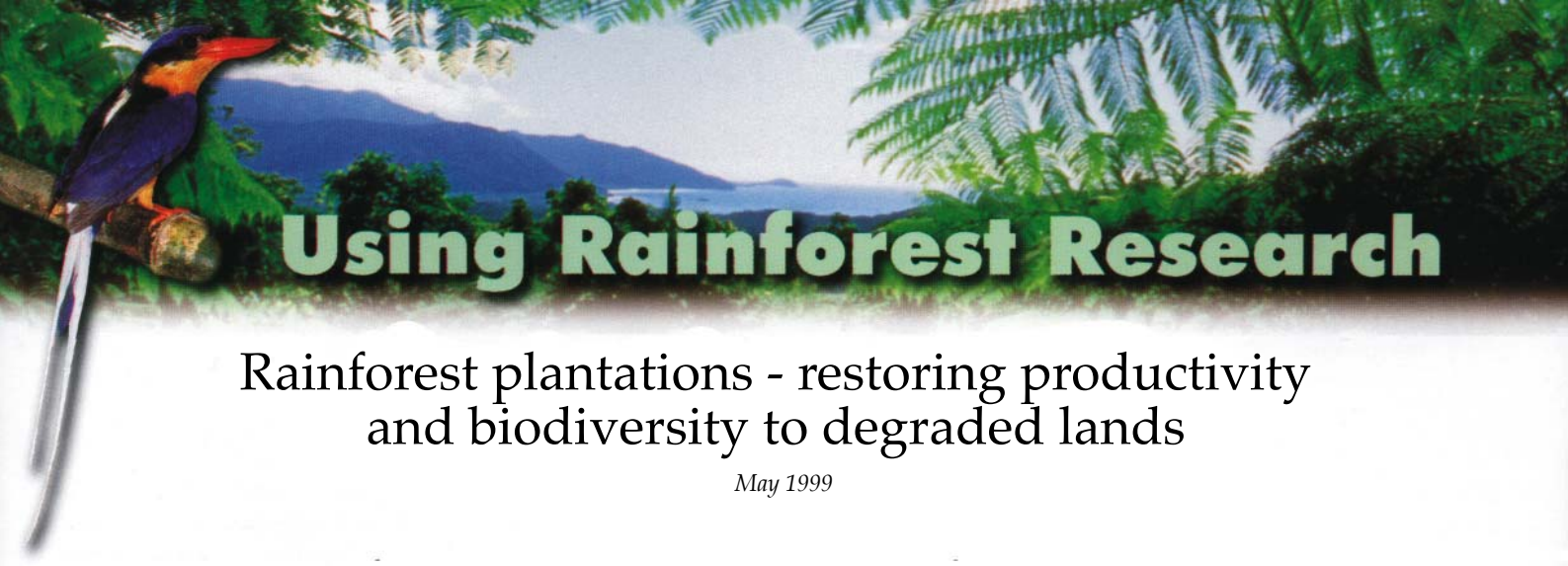

Rainforest plantations - restoring productivity and biodiversity to degraded lands

May 1999

Rainforests around the world continue to be cleared or degraded at rapid rates. Some of these lands are now being used productively, but many are not. Plantations of rainforest species may hold the key to returning productivity, biodiversity and community benefits through the ecological restoration of these lands. The cessation of most rainforest logging in north Queensland in 1988 renewed interest in rainforest plantations and their potential. While much is known about traditional monoculture plantations based on exotic pines, silviculture knowledge for new forms of rainforest plantations is in its early days. Could the higher market value of these timbers compensate for their slower growth, now timber from native forests is no longer available? If so, how should these plantations be established?

Seeing the trees for the forest

Researchers are tackling some of these big questions about rainforest plantations in a collaborative program with landholders in north Queensland, particularly with Errol Wiles of Babinda. Program Leader David Lamb says that the rainforest plantation research is asking four main questions:

1. Which species to use?
2. Which are the best sites?
3. What plantation design to use?
4. What are the best plantation management practices?

Practical research to address these questions requires long term trials and plantations. A number of plantations were established in north Queensland in the past by the Queensland Forest Service, some over 60 years old. These provide baseline data on growth rates of commercially attractive trees but it is clear that better growth rates might be possible if more up-to-date establishment and management methods are used.

In more recent years there have been extensive rainforest plantings in north Queensland by the Community Rainforest Reafforestation Program (CRRP) and these plantings are providing valuable data. Current research is being undertaken by the Rainforest Cooperative Research Centre working with landholders to establish trial plantations on their lands. Establishing a plantation is a considerable long term investment for landholders, and many are unwilling to invest while they cannot be guaranteed a market for the timbers. Paradoxically, no market exists until plantations are created.

Top: *Young mixed species plantation*
Bottom: *Older monoculture plantation with developing understorey of rainforest species (photographs: Rod Keenan)*

Which species to use?

The attributes of commercially successful plantation trees include rapid growth under plantation conditions, straight stems with limited branching, and appropriate wood quality for particular end-uses. Plantation species should be tolerant of a wide variety of soils and site conditions and be resistant to pests and diseases. The CRRP has explored a large list of up to 80 species in their plantings.

Researchers are now focussing field trials on a smaller simpler list of promising species as follows:

Eucalyptus cloeziana Gympie Messmate
Eucalyptus microcorys Tallow Wood
Eucalyptus grandis Blue Gum
Toona ciliata Red Cedar
Melia azerderach White Cedar
Agathis robusta Kauri Pine
Flindersia brayleyana Queensland Maple
Araucaria cunninghamii Hoop Pine
Eucalyptus pellita Red Mahogany
Elaeocarpus angustifolia Blue Quandong
Acacia aulacocarpa Hickory Wattle

The Rainforest CRC is a research partnership involving the Commonwealth and Queensland State governments, the Wet Tropics Management Authority, the tourism industry, Aboriginal groups, CSIRO, James Cook University, Griffith University and The University of Queensland

Which are the best sites?

CRRP planting sites are being examined to draw from their experience. A large number of species have been planted at a variety of sites. In some places they have grown well but in others their growth has been less vigorous. What are the reasons for these differences? Is is due to climatic factors such as rainfall or temperature or because of differences in other factors? The objective is to end up with a set of predictors describing the best sites for particular species. Note that the alterations following clearing (eg. pasture establishment, fertilising) mean that these optimum sites may not be exactly the same sites these species originally occupied.

What plantation design to use?

While traditional plantations are grown as monocultures (single-species plantations), mixed plantings of rainforest species may hold the key to higher productivity and increased biodiversity. Mixtures have many potential benefits. Using nitrogen fixing species in deficient soils can boost the growth of the other species. Mixing trees with different root or canopy architectures can reduce between-tree competition. Mixed species plantations might also be less susceptible to fungal, insect or animal damage than monoculture plantations.

Trials suggest that a mixture of rainforest and eucalypts associated with rainforest margins may provide the best productivity. Trial plots of different mixtures have been planted at a number of sites to explore growth patterns and relationships and the beneficial effects of individual plants upon each other. Early results so far suggest mixtures can improve the growth of some species over that they would have when planted in a monoculture. On the other hand, the growth of some other species is worse in mixtures than in monocultures. Researchers are examining these differences, and recommendations about which species to combine or not should be drafted after the trials have been operative for 5 years.

What are the best plantation management practices?

Pruning ensures trees grow straight and tall and early pruning has been found to be very important from the first year on. There is a high market value for straight unknotted timber, but there is a tradeoff - pruning side branches can slow photosynthesis and growth. Research results show that half the crown can be pruned without slowing growth.

Competition between trees is a big issue. The questions of when, how often and how intensely to thin out trees are being investigated. There are also tradeoffs concerning planting density and space. Traditional plantings are in 3m x 3m grids (densities of 1100 trees per hectare) which shade out grasses and competing weeds. Trees grow quickly at first and then slow down, the crowns merge and start to interfere with each other. Thinning of slower growing trees and those with poor form is then needed to reduce trees to around 300 trees per hectare. This begs the question - why not just start with 300 trees per hectare? The answer is that with low density plantings weeds become a major management problem and their control may be costly.

Biodiversity and commercial value

A mixed plantation can also be a more biodiverse one. Researchers are exploring how to build biodiversity without impeding commercial value. This research is challenging the traditional notion that plantations are biological deserts. In north Queensland it is possible to have your cake (biodiversity) and eat it too (economic return). Here the distances to intact forests are not so far, soils are richer, and rainforest plantations need regular burning regimes like southern plantations, so northern plantations can support a variety of native plant and animal life.

Understanding the tradeoffs is crucial. By encouraging biodiversity in plantation design, at what point does biodiversity impact on commercial productivity? In some situations the biodiversity benefits will come at no additional cost or may even improve production, in others increasing biodiversity may slow production. This raises many other questions about how judgements are made on non market values? What is the price of clean air and water or of increasing wildlife, and how are these factored into the commercial value of the plantation? These questions are acutely important and are being investigated by researchers Steve Harrison (UQ) and John Herbohn (JCU).

Plantation researchers include David Lamb, David Doley, David Yates and Robin Thwaites from the University of Queensland; Bob Congdon of James Cook University and Rod Keenan of the Department of Primary Industries Forest Research Institute.

For further information:

Dr David Lamb, Botany Department ,
University of Queensland,
St Lucia, QLD 4072.

Phone: (07)3365 2045,
Fax (07)3365 2045
Email: d.lamb@botany.uq.edu.au

P.O. Box 6811, Cairns, Queensland, Australia 4870 • PHONE: (07) 4042 1246 • FAX: (07) 4042 1247
EMAIL: rainforestcrc@jcu.edu.au • WEBSITE: rainforest-crc.jcu.edu.au