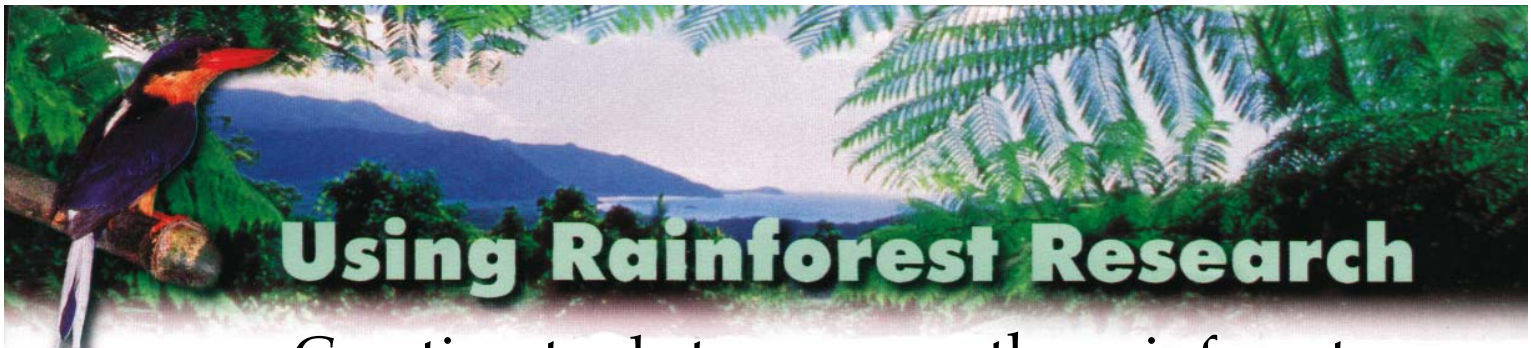


Using Rainforest Research

Creating tools to manage the rainforest

April 2002

The Wet Tropics World Heritage Area (WTWHA) encompasses nearly 900,000 hectares of tropical rainforest between Cooktown and Townsville. In 1988, in recognition of their unique biological treasures, these forests were designated as a World Heritage Area, granting special protection to the forests to ensure their survival for future generations.

One of the primary reasons the Wet Tropics rainforests were selected for world heritage listing is their superlative natural values. These extraordinary forests are well known for their evolutionary history, rich biological diversity and large number of unique species. While information about the plants and animals in the rainforests is vital, preserving the integrity of rainforest ecosystems requires managing for natural changes as well as human activities.

The challenges of managing such a large area are as complex and diverse as the forests themselves. These ecosystems experience natural and human induced changes which may affect individual species, habitats, and specific forests. In addition, the Wet Tropics is subject to a range of land tenures with more than 700 different land owners within the world heritage boundaries. Activities occurring in and around the Wet Tropics are varied, including residential developments, agriculture, tourism and forestry, and can sometimes present conflicting demands on the rainforests. Managing for the future requires strategic planning and decision makers need high quality information. The Centre has a strong portfolio of research directed specifically for this purpose.

The information unfolding from the Centre's multidisciplinary research is being used in a number of ways. In particular, it is being used to develop tools to assist with the management of Wet Tropics World Heritage Area.

Management is of key interest to government and native custodians as well as the communities and industries which use the rainforest. Tools which have been created range from monitoring techniques for endangered species to computer models which can predict future patterns of rainforest distribution. Some of these are described here.

Wet Tropics World Heritage Area - protecting the treasures of the rainforests for future generations

Disappearing Frogs

Several frogs, native to the Wet Tropics, are suffering the same mysterious disappearance which is affecting frogs around the world. Six species of frogs that breed in high elevation rainforest streams have drastically declined in numbers since 1990. Despite intensive monitoring, searches, and surveys, three species have not been seen since 1994.

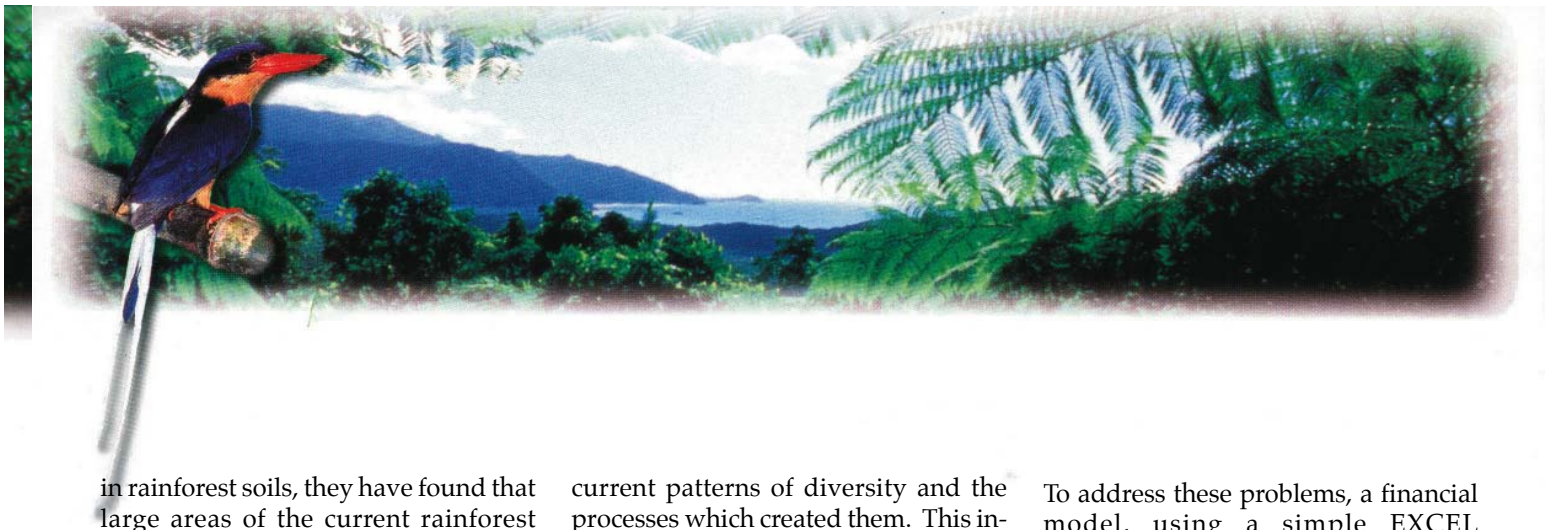
The Centre's timely research on frog behaviour, such as how far they travel from their preferred habitat during different periods of their life, has provided critical information about these disappearing frogs. Some scientists believe that certain species of frog might be prone to decline because of their habitat specialisation.

Recently, Centre scientists discovered a means of monitoring frog populations for signs of impending declines. 'Fluctuating asymmetry' is the term used to describe size differences between the appendages on both sides of the body of an animal and is a symptom of environmental stress experienced during development. Scientists examined specimens of *Litoria nanotis* and *Litora genimaculata*, whose high evaluation populations disappeared in the early 1990s. They found that levels of fluctuating asymmetry increased dramatically the year before the populations declined and were linked to periods of increased environmental stress.

This finding has led to a new monitoring technique being used by the Queensland Department of Environment and the
frog recovery program. Its application could signal the approach of imminent declines. Advanced warning will then give scientist a chance to monitor for the sources of environmental stresses and establish captive breeding programs if necessary.

Modelling the past to predict the future

Centre researchers have uncovered evidence that the Wet Tropics rainforests have been expanding since the last ice-age. By identifying and carbon-dating charcoal fragments found



in rainforest soils, they have found that large areas of the current rainforest landscape were once covered by dry eucalypt woodlands. Around 13,000 years ago when the climate was cooler and drier, rainforests retreated to only the wettest locations, usually along creeks and rivers. As the climate became wetter, rainforests began reclaiming their old territory. The reservoirs of flora and fauna which survived in these 'refugia' provided the source of today's diversity.

At the same time, scientists have been using molecular technology to examine how different species, which were isolated by the rainforest's retreat, have responded to the forest's return. DNA analysis revealed significant genetic differences between populations of several species of birds and lizards on either side of what is known as the Black Mountain Barrier (BMB) – a large rift of dry forest created when the rainforests contracted during the last ice-age.

This finding points to the presence of two very different evolutionary lineages within these narrowly distributed species. Now that the rainforest has returned to the BMB, scientists believe that the once isolated populations are again mixing or 'hybridising' into new species. This has significant conservation implications, as the disappearance of species from one rainforest patch could represent the loss of significant evolutionary diversity rather than just a local extinction.

The carbon-dating and genetic research, when considered together, are giving scientists a better understanding of the current patterns of diversity and the processes which created them. This information is being used to create computer models with the aid of artificial neural networks to help unearth the origins of rainforest flora and fauna and peer into the future to forecast future rainforest distributions. Knowing how rainforests are likely to change can indicate how forests might recover from deforestation and climate change. This knowledge will help scientists and land managers with conservation planning and design of reserves.

Reviving the timber industry

Since its World Heritage listing, logging activities within the Wet Tropics have ceased. However, high quality rainforest timber is still in strong demand. Government sponsored programs such as the Community Rainforest Reforestation Program have been established to encourage native timber plantations on private holdings to meet these demands and create sources of quality timber in the future. However, government efforts to establish plantations have been minimal because landowners need sound information on ecological, silvicultural and economic aspects of growing rainforest trees for timber.

Socio-economic research undertaken by Centre researchers has pinpointed a major impediment in the growth of farm-forestry. There is an apparent unwillingness of many farmers to invest in farm-forestry because of the uncertainty of the returns. It is also very difficult for land agents to estimate the added value of reforestation without dependable information.

To address these problems, a financial model, using a simple EXCEL spreadsheet, was developed to predict potential financial returns of small-scale native species plantations. The model allows for the prediction of the internal rate of return and the net present value for mixed species plantations incorporating up to five rainforest species.

Centre scientists have also been working to understand the physiological attributes and ecological requirements of plantation species suitable for north Queensland plantations. Combining information on the financial aspects with biological information of native trees will help farm foresters maximize their plantation investments. A suite of the most promising trees has been selected for both upland and lowland sites, based on their growth in plantation field trials and their timber quality. Current research is exploring site-species relationship at a finer, landscape scale, which takes into consideration geological and topographic variations.

For more information

For more information about these and other research projects of the Tropical Rainforest CRC please contact:

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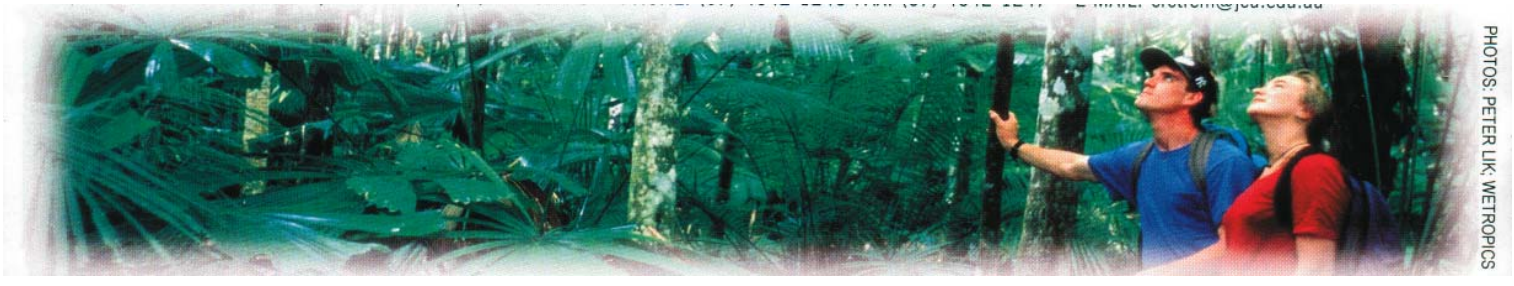

PHOTOS: PETER LIK: WETROPICS