



National Environmental  
Research Program

TROPICAL ECOSYSTEMS *hub*



**NERP Tropical Ecosystems Hub**

**Rainforest Program Update, December 2012**

Compiled by RRRC



### Project 3.1: Rainforest Biodiversity

*Project Leader: Professor Stephen Williams,  
James Cook University*

#### **Project Background**

This project assesses the vulnerability and resilience of rainforest biodiversity in Australian tropical forests. Environmental refugia will be mapped, and patterns and drivers for biodiversity identified. Biodiversity is the range of species in a given ecosystem and refugia are those places where species may go if forced by changing climatic conditions. Using a combination of available knowledge, existing datasets and strategic research the project will develop strategies for promoting persistence of biodiversity. This new knowledge will allow an identification of threats in time and space and allow prioritisation of vulnerable species, in order to maximise management efficiency. The project will act as a focus point within the broader rainforest project node, allowing strategic targeting of research gaps, and increasing our understanding of the drivers of rainforest biodiversity.

#### **Project Progress**

Two probable types of climate refugia have been identified, separated by size. "Micro" refugia have been defined as 250 metre cells that are coolest or most seasonally buffered, compared to the surrounding conditions. "Meso" (i.e. middle sized) refugia have been defined as the 5 kilometre climate cells with the greatest range of thermal micro-climate conditions. Given the combination of complex landscape, habitat and topographic features within the WT bioregion there is a considerable potential for existence of climatic refugia, particularly at higher elevations in the rainforest. The potential distributional area change for 202 rainforest vertebrate species has now been modelled and initial summaries generated. The next stage is to select the most accessible, cost-efficient locations at which to test the refugia concept. Statistical analysis suggests that each location should be sampled at least twice a year in order to detect biologically significant trends such as 10% change in species abundance over a ten-year period, possible more often for less abundant species.

**Project 3.2:** What is at risk? Identifying rainforest refugia and hotspots of plant genetic diversity in the Wet Tropics and Cape York Peninsula.

*Project Leader: Professor Darren Crayn,  
Australian Tropical Herbarium*

#### **Project Background**

This project will investigate the distribution of plant and fungal taxonomic richness, endemism, and genetic diversity (as a measure of evolutionary history) across the Wet Tropics bioregion at the level of genus, species, and population. This information will provide a solid foundation for conservation prioritisation efforts in the region. Australia's tropical rainforest in far north

Queensland is internationally renowned for preserving one of the most complete and continuous records of Earth's evolutionary history, and harbours much of the remaining Gondwanan flora that was once widespread across the continent. Little is known however, about what, how much, and where evolutionary change occurs, particularly for plants and fungi. Where are the hotspots of this evolutionary history and what is the relationship between these endemic species and taxonomic hotspots, that is, areas where there are large numbers of species? A species is considered endemic if it is found only in a given region or place, and nowhere else in the world. The project consists of two nested subprojects. Project A is mapping patterns of genetic diversity across the NE Qld rainforests. Project B (mountain-top diversity) is taking a finer scale look at population-level genetic diversity on mountain-tops which are highly restricted rainforest ecosystems projected to be most threatened by climate change.

#### **Project Progress**

Five hundred and eighty five genera of flowering plants have been identified in the Wet Tropics and Cape York Peninsula region. Representative species and genera have been selected, and sequencing of DNA barcode markers



Lemuroid Ringtail Possums (*Hemibelideus lemuroides*) discovered during a spotlighting survey as part of our longterm sampling and monitoring of vertebrates in the Wet Tropics.

*Image: © Stephen Zozaya. All Rights Reserved*

completed. A barcode marker is a short genetic marker in an organism's DNA that identifies it as belonging to a particular species. A manuscript has been completed for publication outlining the use of molecular genetics and phylogenetic diversity measures to distinguish ancient refugia from convergence zones in northeast Queensland's World Heritage rainforests. The paper highlights that areas with more species than expected have been predominantly affected by immigration from Southeast Asia within the past few million years. This demonstrates that the integration of historical data and information on phylogenetic diversity can effectively inform conservation priority setting, particularly in areas with complex evolutionary histories such as the Queensland Wet Tropics World Heritage Area.

**Project 3.3:** Targeted surveys for missing and critically endangered rainforest frogs in ecotonal areas, and assessment of whether populations are recovering from disease

*Project Leaders: Dr. Rob Puschendorf and Dr. Conrad Hoskin, James Cook University*

#### **Project Background**

This project investigates the degree to which some frog species have declined in the rainforest but persist in the lowlands, and recent surveys suggesting that some species are starting to reappear at upland rainforest sites and whether it represents population recovery. Ten frog species disappeared from the upland rainforests of the Wet Tropics and Eungella regions during outbreaks of amphibian chytrid fungus in the late 1980s and early 1990s, representing 25% of the frogs endemic to the Wet Tropics and all of the Eungella endemics. Four of these species are found only in the uplands and have been presumed extinct as they have not been found despite intensive searches. The Armoured Mistfrog has been rediscovered

during surveys in high elevation dry sclerophyll forest, very close to rainforest sites it from which it vanished. The population coexists with the chytrid fungus, suggesting the development of resistance, and that the other missing frogs may still be out there as searches have focused on the rainforest, not the adjacent dry forest. This project targets the ecotonal (i.e. transition) zones between rainforests and dry forests, zones which may be the key to understanding how frogs survive during disease outbreaks but which are rarely surveyed for these or other vertebrate species. As such, these areas represent a gap in Wet Tropics and Eungella biodiversity knowledge.

#### **Project Progress**

Rigorous, targeted surveys are underway for the missing, critically endangered and endangered rainforest frog species of the Wet Tropics and Eungella. Whilst field surveys are conducted, disease status is also noted as is the presence of other vertebrates. The surveys have found new and important populations of Torrent Frogs and an apparent recolonisation and increase in populations of rainforest frogs into upland rainforest areas. The torrent tree frog has expanded its range at Cloudy Creek (Paluma), recolonising upstream from where it disappeared more than two decades ago. The same species is also in good numbers at sites on Clohesy River (Lamb Range) where it was absent or rare five years ago, and small number of the Australian Lace Lid Frog are also starting to appear. This strongly suggests a recovery of frog populations on these streams over recent years. Surveys of the Eungella region have found the endangered Eungella Torrent Frog has been persisting in good numbers at Rawsons Creek. A new breeding site for the endangered Eungella Tinker Frog was identified and several breeding sites for the poorly known Eungella population of the Whirring Tree Frog were also recorded. Sites north of Eungella, specifically Mt Aberdeen, Mt Hector and Mt Pluto, have produced new populations of rainforest skinks and a new population of leaf-tail gecko, with genetic analysis currently underway to determine whether this is a new species.



A group of spectacled flying-foxes (*Pteropus conspicillatus*) roosting at the Kennedy camp near Cardwell. Image: David Westcott

### Project 3.4: Monitoring of Key Vertebrate Species

Project Leader: Dr. David Westcott, CSIRO

#### Project Background

This project employs recently developed methods to monitor the abundance and distribution of the Southern Cassowary and the Spectacled Flying Fox in north Queensland. Estimates will be provided of population sizes and structure, distributions and dynamics for management decisions. Monitoring is a fundamental component of the management of threatened species, and is of particular importance when those species come into direct conflict with humans and their interests. In such circumstances up-to-date information on population status, trends and distribution become key inputs into decision making and conflict resolution processes, with good data critical imperative to the process. In the Wet Tropics the endangered Southern Cassowary (*Casuarius casuarius*) and the vulnerable Spectacled Flying Fox (*Pteropus conspicillatus*) are the focus of repeated demands for management, and are frequently the focus of bitter debates, often with financial and legal implications.

#### Project Progress

As our population grows and spreads, people's contact with nature increases. In the Wet Tropics Region two species that have frequently been the focus of demands for intervention in some form are the endangered Southern Cassowary (*Casuarius casuarius*), and the threatened Spectacled Flying Fox (*Pteropus conspicillatus*). Despite being the cause of much conflict over the years, for neither species is there adequate data on their population sizes and trends, or of the dynamics in the spatial distribution. In the cassowary section of the project, the June to December reporting period was focused primarily on completing the laboratory processing of dung samples collected in 2012 and analysing the resulting data. This analysis indicates that individuals can be successfully discriminated from dung samples and that recapture from different dungs is possible, something that opens up additional analysis approaches. The second year's field surveys began but due to low dung availability in the field, these were postponed until after the beginning of the wet season. Monthly flying-fox surveys were completed throughout the period, with peak numbers developing in November and December.

### Project 7.1: Fire and rainforests

Project Leader: Dr. Dan Metcalfe, CSIRO

#### Project Background

This project aims to increase the understanding of the rainforest and fire dynamic, its impact on key species, and to inform fire management in the Wet Tropics. Mahogany Gliders are endangered vertebrates that are reliant on lowland eucalypt forest in the Wet Tropics. Changed fire regimes and indifferent intensities have allowed rainforest species to colonise these lowland

eucalypt systems and in some places dominate it, suppressing eucalypt regeneration and interfering with glide paths. Fire however, has the potential to reduce rainforest invasion whilst encouraging regeneration of eucalypt communities.

#### Project Progress

The project has been concentrating particularly on the development of mapping protocols for the EPBC-listed critically endangered littoral rainforest community, and understanding the key threats posed to the community through inappropriate management, fire, transformer weeds and natural processes. Severe Tropical Cyclone Yasi caused massive structural change to the community through much of its range in the Wet Tropics, and understanding how threats combine (e.g. weedy grasses providing fuel loads when introducing fire into the system) will help to target future management priorities. The



Fire occurs naturally in lowland eucalypt woodlands, removing grasses, vines and rainforest tree seedlings. The eucalypts and associated species recover rapidly from such fires, but we are interested in the extent to which fire suppresses rainforest invasion and improves woodland habitat condition for mahogany gliders. Image: Dan Metcalfe

project also continues to monitor the effects of fire on cyclone-ravaged Mahogany Glider habitat in the coastal lowlands of the Wet Tropics between Cardwell and Tully. This work includes the monitoring of seedling plots in disturbed rainforest and burned leaf litter to record the response of each rainforest species to being 100% scorched. Vegetation changes will be monitored over the next two years to allow a better understanding of rainforest-sclerophyll (i.e. drier forest) dynamics so that an informed management approach to controlling fire in mahogany glider habitat can be established.

### **Project 7.2:** Invasive species risks and responses in the Wet Tropics

*Project Leader: Dr. Helen T Murphy, CSIRO*

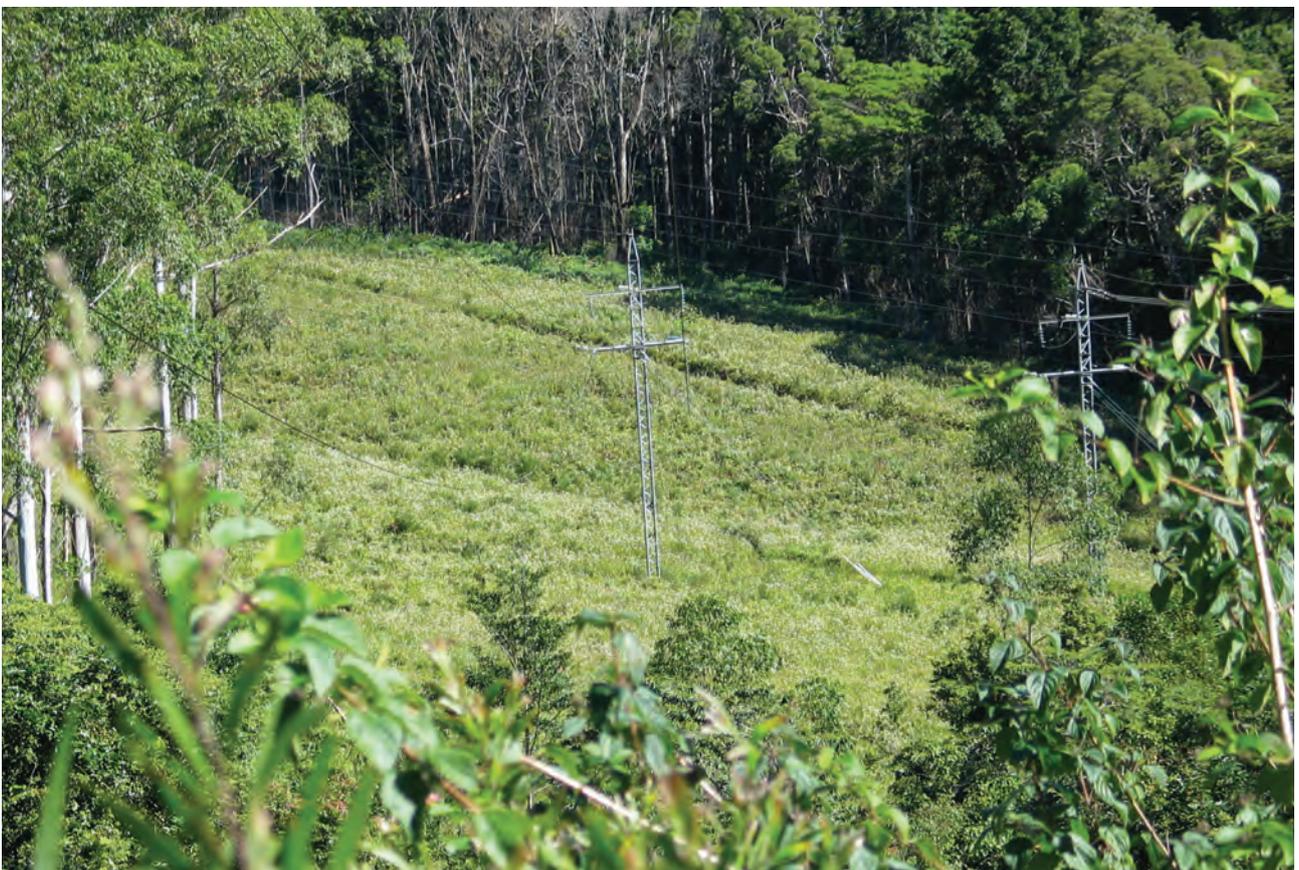
#### **Project Background**

This project focuses on understanding the current and future risks and responses of invasive species in the Wet Tropics. Invasive species management in the Wet Tropics is currently driven by a species focussed approach, as are weed and pest animal management activities globally. The aim of the project is to develop a strategic approach to pest management for land managers in the region who are increasingly recognising the need for regional-scale population prioritisation tools that incorporate complex ecological processes of invasive species spread and establishment, and take account of the values and

assets in the landscape. Additionally, climate change and intense cyclones will enhance the capacity of non-native species to establish, spread and transform the Wet Tropics ecosystems. Such emerging risks will be considered under future climate scenarios and factored into long term strategic management strategies across northern Australia.

#### **Project Progress**

Climate matching analyses have been used to identify high-risk source areas for future Wet Tropics weeds. A database was generated of known invasive species whose native (and/or invasive) range intersects areas globally with high climate similarity to the Wet Tropics. To address future threats from existing weeds or from sleeper weeds, the project has compiled climate models to understand which species will experience improving conditions and which will experience deteriorating conditions under future climate scenarios. A novel methodology has been developed to understand networks of weed spread within the Wet Tropics to inform management tactics and strategies for early intervention. The project is working with stakeholders to develop Pest Adaptation Response Plans to underpin strategic management of weeds at a regional scale. The modelling component of the work has already produced results useful for management and submitted for publication. The most recent results quantify the improvement in likelihood of eradication gained by considering landscape context and structure in management tactics and strategies for invasive species.



*Stevia ovata* along a powerline easement near Ravenshoe. Image: Andrew Ford, CSIRO



Eastern Kuku Yalanji Elders Roslyn Port and Ena Shipton performing warming ceremony to prepare visitors to walk on country.  
Image: Courtesy Jabalbina Yalanji Aboriginal Corporation

**Project 7.3:** Climate change and the impacts of extreme climatic events on Australia’s Wet Tropics biodiversity.

*Project Leader: Dr. Justin A. Welbergen, James Cook University*

**Project Background**

This project investigates in detail the exposure and sensitivity of Wet Tropics animals to extreme climate and weather events, such as heat waves, fires, flooding rain and cyclones. The resulting information will be used to assess and map the vulnerability of biodiversity to the impacts of current and future extreme events in the Wet Tropics bioregion. The information gathered in the Wet Tropics can potentially be applied to other regions in Australia and elsewhere to predict and mitigate the impacts of extreme climatic events on biodiversity

**Project progress**

In the second half of 2012, the project quantified the ‘resilience’ of all the Wet Tropics vertebrate species from known traits that affect a species’ ability to survive and recover from an environmental disturbance. The quantitative measure of resilience used in the project relies on the novel idea that extinction filtering will tend to have removed less resilient species from areas where habitat was less stable over the past 18,000 years. It was found that the mean habitat stability within a species’ range was closely correlated with traits that are conventionally thought to affect a species’ ability to bounce back from a disturbance, indicating that a species’ mean habitat stability can be used as a valid quantitative index of resilience. Secondly, the project aimed to quantify the ‘adaptive capacity’ of species, that is, the reduction in thermal exposure that results when, for example during a hot day, individuals move into the microhabitat that is

most thermally favourable and available to them. This was calculated for the 95th percentile of maximum daily temperatures encountered by Wet Tropics vertebrate species in their respective microhabitats, and the methodology that was developed allows for quick quantification of a species’ capacity to adapt to any regime of extreme temperature events.

**Project 12.1:** Indigenous co-management and biodiversity protection

*Project Leader: Dr. Rosemary Hill, CSIRO*

**Project Background**

This project will undertake co-research with Indigenous peoples and protected area managers to further investigate the potential of Indigenous Protected Areas and other collaborative models and tools to engage Indigenous values and world views, and to identify the conditions under which these arrangements could lead to effective protected area joint management. The overall goal of the project is to provide a means for recognition of Indigenous knowledge and values, and joint management of the Wet Tropics World Heritage Area between governments and Rainforest Aboriginal people, in partnership with communities. Although key planning initiatives in the Wet Tropics region more recently have improved engagement with Indigenous peoples in biodiversity management, both government agencies and the Rainforest Aboriginal Peoples identify that a gap remains between the current status, and aspirations for equitable co-management arrangements of conservation areas, including the Wet Tropics World Heritage Area. The current Girringun, Eastern Kuku-Yalanji, and Mandingalbay Yidinji Indigenous Protected Area (IPA) consultation projects are showing potential as an effective means of capturing Indigenous knowledge and values

into conservation decision-making and management. IPAs may provide a means to integrate rights-recognition (through ILUA and native title), cultural-values recognition (through heritage listing) and engagement in management (through NRM arrangements) as an effective platform for co-management. Traditional Owners are also engaging with national park management planning in the Wet Tropics region, and opportunities exist to make these collaborations more effective in delivering mutual benefits for biodiversity conservation and integration of Indigenous rights, cultural knowledge and management practices.

### **Project Progress**

A workshop held in October 2012 considered the status of Indigenous co-management of biodiversity protection in the Wet Tropics. The themes identified were:

- Effective and responsible co-management now and in the future involving local-level TO groups;
- Conflict resolution, particularly with respect to boundary understandings across TO groups;
- The need for an overarching document recognising tribal autonomy to support the framework, including principles such as free, prior and informed consent, and recognition of Indigenous rights, as set out in the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP);
- That the case for government investment with respect to protection and transmission of Aboriginal cultural values, health, well-being, education and employment;
- Change to mainstream organisations is required with respect to cultural self-awareness, and intercultural awareness and competency;
- Greater clarity and consistency in government policy would assist to progress implementation of co-management;

### **Project 12.2: Harnessing natural regeneration for cost-effective rainforest restoration**

*Project Leaders: Professor Carla Catterall, Griffith University*

#### **Project Background**

This project is focused on naturally-regenerating forests (regrowth) and the potential to offer a much needed low cost option to restore critical habitat over large areas. The project is based in the Wet Tropics uplands and is measuring and monitoring the rate and pattern of vegetation development in both replanted sites and regrowth sites. The project will combine three inter-related approaches: field investigation and data analyses of how regrowth rainforest develops and how it differs from replanted rainforest; information synthesis and field trials of novel approaches to accelerate regrowth development; and landscape analysis to identify areas of highest potential for low-cost regrowth. The project will provide decision-support options to optimise regional investments in restoration using the most appropriate restoration method for any particular ecological and economic scenario.

#### **Project Progress**

The project has successfully established a network of 20 accessible re-growth sites of different ages (2-40 years) with fourteen sites now marked on the ground and data collection completed at four of the sites. All remaining sites will be established in the first half of 2013. A literature review completed on approaches to stimulating natural regeneration of tropical forest on degraded land has found that interventions combining simultaneous suppression of unwanted vegetation and increased propagule (i.e. a bud or other offshoot that aids in species dispersal) supply worked best in promoting forest restoration. These combined interventions have only been tested in a few studies. Other important deficiencies that hamper progress in this area include: poor reporting of implementation costs; inadequate use of "do nothing" controls in experimental studies, and the small scale of manipulation experiments relative to applied restoration projects. The establishment of local experimental trials of different approaches to manipulation for regrowth acceleration is improving capacity to address some of these deficiencies. The project has also developed a "notional menu" of diverse potential approaches to manipulation for regrowth acceleration relevant to the Wet Tropics uplands.

### **Project 12.3: Relative social and economic values of residents and tourists in the WTWHA** *Project Leader: Professor Natalie Stoeckl, James Cook University*

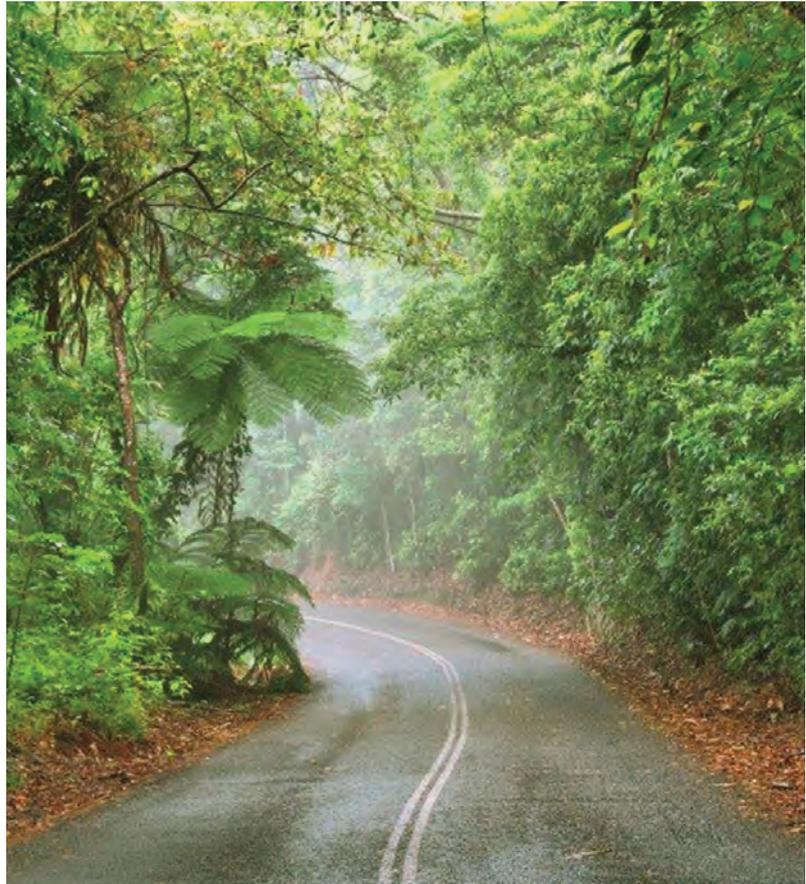
#### **Project Background**

This project will identify and prioritise social and economic values that tourists and residents place on the Wet Tropics World Heritage Area (WTWHA) and test non-monetary values against traditional economic valuations of the area. Critical information gaps will be addressed with regard to the relative importance of these key attributes (or 'values') to stakeholders (e.g. tourists, Indigenous and Non-Indigenous residents, business owners) and the way in which those 'values' might be affected by a range of external influences (e.g. different types of economic development, increases in population, changes in the mix of visitors). The project will also allow researchers to make predictions about the way in which residents and tourists assign 'values', and thus management, conservation and marketing priorities may alter in the future as both population and tourist numbers change. Finally, methods for assessing 'value' will be improved. State-of-the art non-monetary valuation techniques will be compared with more 'traditional' valuation techniques, highlighting the strengths and weaknesses of each. The project will provide managers throughout the world with an illustrated, easy to understand, example of a cost-effective, robust, and equitable means of assessing the relative value (or importance) of non-market goods and services (i.e. aesthetics).

#### **Project Progress**

A working group of tourism businesses, associations and local government met in September 2012 to identify the

core values and attributes for assessment with tourists and residents. As expected, many values overlapped between residents and visitors. For residents, natural, cultural and economic values of the WTWHA were deemed as imperative for assessment. These included: forest health; rainforest aesthetic values; Indigenous and European (e.g. mining, cattle) culture of the region; accessibility to the WTWHA; quality of access; sense of community (i.e. social cohesion); and the ability to provide employment (a value which could potentially be compared to and/or traded off against other 'core' values). For tourists, the most important assessment values identified were the presence of iconic species; landscape (e.g. waterfall, scenic drives); water quality; and walking tracks. Other values for evaluation included: therapeutic values; opportunities for solitude; the quality of guided tours; uniqueness of Australian rainforests; accessibility to WHA sites; cultural festivals; botanical gardens; cultural history; and healthy parks. The most significant development changes &/or management issues identified that affect the 'core' values of the WTWHA were related to access; roads and other infrastructures; iconic species, and water.



Accessibility to the Wet Tropics World Heritage Area (WTWHA) is important to many stakeholders however development goals such as building more roads may impact on the values of the area.  
Image: iStock ID000018583

**Project 12.4:** Governance, planning and the effective application of emerging ecosystem service markets to secure climate change adaptation and landscape resilience in Far North Queensland

*Project Leader: Associate Professor Allan Dale, James Cook University*

#### **Project Background**

The project will guide policy and program directions associated with the national and regional scale roll-out of the Australian Government's \$1.6 billion Clean Energy Package Land Sector Abatement Program. The project directly underpins a significant National Working Group proposal supporting the effective development of a clear national approach to the treatment of carbon-related issues in next generation NRM planning; and an emerging significant Extension and Outreach Fund proposal being developed by the National NRM Working Group. Global agreement on Greenhouse Gas Abatement (GGA) and climate change adaptation is rapidly evolving, with recognition that regionally-prioritised land management practices have the potential to deliver both significant abatement and bio-sequestration opportunities, and improved landscape resilience, in the face of climate change. Partnerships will be developed with the region's

key stakeholders to review, trial and evaluate the most effective governance systems and planning foundations for regional and landscape scale adaptation to climate change. In particular, within the context of these governance systems and planning arrangements, focus will be on the potential application of emerging ecosystem service markets to secure landscape-scale resilience for biodiversity in the face of climate change.

#### **Project Progress**

A comprehensive "Practical Manual" has been developed for NRM Bodies on regional scale planning and carbon market integration. Arrangements are in place for the completion of State-wide training based on the manual, to be delivered across Queensland regional NRM bodies in early 2013. Three theory-based publications have been completed on NRM governance systems and planning for adaptation and ecosystem service market guidance. These publications have influenced the development of regional principles across north Queensland for the next generation of regional NRM planning and hence the region's Stream II research proposal for the Wet Tropics Cluster. Preliminary project work and the original discussion paper are continuing to influence national NRM Body and Commonwealth Government policy and the recently established Australian Government and the Queensland Regional Group's Collective principles for next generation NRM plans.





## National Environmental Research Program

**TROPICAL ECOSYSTEMS** *hub*

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