National Environmental Research Program

TROPICAL ECOSYSTEMS hub

NERP TE Hub Research Snapshot: Rainforest

January to June 2013 Compiled by RRRC

About the NERP

National Environmental Research Program

The overall objective of the National Environmental Research Program is to improve our capacity to understand, manage and conserve Australia's unique biodiversity and ecosystems. It will achieve this through the generation of world-class research and its delivery to Australian environmental decision makers and other stakeholders. The Program features five research hubs, including the Tropical Ecosystems Hub.

The Tropical Ecosystem Hub

The Tropical Ecosystem Hub is a $61.89m investment that address issues of concern for the management, conservation and sustainable use of the World Heritage listed Great Barrier Reef and its catchments; tropical rainforests, including the Wet Tropics World Heritage Area; and the terrestrial and marine assets underpinning resilient communities in the Torres Strait.

www.nerptropical.edu.au

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

Front cover Image: Wayne Spencer (RRRC)

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Rainforest

The TE Hub supports 38 research projects, with eleven focused on Rainforests within three Programs:

- Condition and trends of North Queensland rainforests
- Threats to rainforest health
- Managing for resilience in rainforests

For further information on TE Hub structure please go to:
www.nerptropical.edu.au

Image: RRRC

Programs & Projects

The NERP TE Hub Rainforest Node

Program 3: Condition and trends of North Queensland rainforests

Project 3.1: Rainforest Biodiversity.

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

Project 3.4: Monitoring of key vertebrate species.

Program 7: Threats to rainforest health

Project 7.1: Fire and rainforests.

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

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

Program 12: Managing for resilience in rainforests

Project 12.1: Indigenous co-management and biodiversity protection.

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

Project 12.3: Relative social and economic values of residents and tourists in the Wet Tropics World Heritage Area.

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.

Image: RRRC

Researcher Profile

Professor Steve Williams

James Cook University (JCU)

Professor Steve Williams is a Professor at James Cook University's Centre for Tropical Biodiversity and Climate Change (CTBCC). He received his doctorate in 1998 from JCU and was a Postdoctoral Research Fellow from 1997-1999 in the Rainforest CRC. His research was the first to identify global climate change as a severe threatening process in the tropics and to predict the possibility of species extinctions in mountain systems around the world.

Professor Williams has broad research interests in rainforest biodiversity, ecology, ecosystem processes and the related impacts of climate change. His research covers the Wet Tropics region in North Queensland and has recently expanded to include tropical savanna woodlands and the rainforests of Cape York and mid-east Queensland. Professor Williams' research outcomes have been incorporated into the Wet Tropics Conservation Strategy, Qld Climate Change Policy, National Biodiversity & Climate Change Action Plan, State of the Worlds Birds and IUCN Climate Change reports.

As part of the standard longterm monitoring of vertebrate sampling in the Wet Tropics we conduct dawn Bird surveys, here at our 1000m site in Paluma Range. *Image: CTBCC Image Library*

Project 3.1: Rainforest Biodiversity.
Project Leader: Professor Steve Williams, JCU

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

The ongoing sampling of monitoring sites has continued and the establishment of sites for the ground truthing of refugial areas has been carried out. The provision of metadata, uploading of data and visualisation of data and models is ongoing.

Analysis of long term monitoring data has provided preliminary results and while further analysis is still to be completed, there are detectable changes, seen as both increases and decreases, in some bird and mammal species in the Wet Tropics Rainforest. These changes are consistent with predictions based on climate change scenarios and may be the first evidence of actual climate change impacts on fauna in the Wet Tropics rainforest.

A curious find during a spotlighting survey. A Green-eyed Tree Frog (*Litoria serrata*) found in amplexus with a Orange-eyed tree Frog (*Litoria xanthomera*).

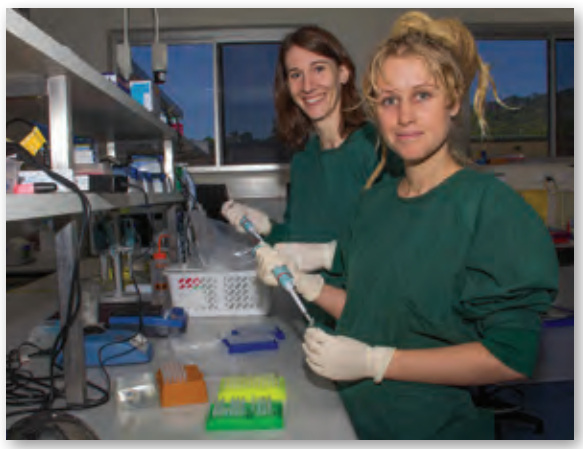
Researcher Profile

Professor Darren Crayn

Australian Tropical Herbarium (ATH)

Professor Darren Crayn is Director of the Australian Tropical Herbarium at James Cook University. On completion of his PhD in 1998, he took up a Smithsonian Institution postdoctoral research position in the Republic of Panama. His research examined a phylogenetic approach to understanding the evolution of Crassulacean acid metabolism (CAM) in bromeliads. He returned to Australia in 2000 as a research scientist at the National Herbarium of NSW and in 2008 took up the inaugural Directorship of the Australian Tropical Herbarium.

Professor Crayn's research is in the field of plant systematics and evolution. His team uses a range of traditional and cutting edge techniques, from field surveys and herbarium taxonomy to scanning electron microscopy, DNA-barcoding and genomics. The research discovers, classifies and names new plant species, determines evolutionary relationships, maps the distribution of ecosystems, species and genetic variation within species across the landscape and uncovers deep-time origins and ancient migration pathways of plant groups found in tropical Australia.



Genetic diversity is key to the resilience of native species to environmental threats such as climate change. NERP-funded PhD student Lalita Simpson (at front) analyses the molecular genetics of highland orchid species under the guidance of Dr. Katharina Schulte (at rear). *Image: Andrea Lim (JCU)*

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, ATH*

Project Background

This project is investigating 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 is providing 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 has occurred, 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 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

Phylogenetic diversity (PD) provides a robust biodiversity measure that maximises evolutionary potential for conservation priority-setting. While traditional hotspot (taxon richness) approaches are generally good surrogates for PD, PD can identify evolutionary patterns in the landscape that taxon richness cannot. The project uses the largest molecular phylogeny compiled to date for tropical flora and incorporates PD and data on historical biogeography into a novel statistical model to distinguish ancient refugia from convergence zones in northeast Queensland's World Heritage rainforests.

The project shows that areas with higher PD than expected contain a higher proportion of immigrant plant lineages dispersed mostly from Southeast Asia within the past few million years. The use of PD, in this case, may bias conservation priorities toward locations with more immigrant species, begging the question: What's more important, the museum or the cradle; evolutionary relics or fronts? Australia's last remaining tropical refugia of Gondwanan heritage or zones of recent intercontinental intermixing and evolutionary potential? The project team has demonstrated how the integration of historical data and PD can more effectively inform conservation priority-setting particularly in biomes with complex evolutionary histories.

Knowledge of which species are found in high altitude tropical rainforests is critical if we are to effectively manage them under climate change, but fungi diversity is very poorly documented. NERP-funded PhD student Kaylene Bransgrove surveys for fungi in the Wet Tropics.
Image: Arianne Prioa (JCU)

Researcher Profiles

Dr. Conrad Hoskin

James Cook University (JCU)

Dr. Hoskin is currently on an Australian Biological Resources Study (ABRS) Postdoctoral Fellowship resolving the diversity, systematics and taxonomy of several reptile and frog groups of eastern and northern Australia. His research interests include evolution, ecology and conservation, systematics and taxonomy, with a particular focus on processes of population divergence (particularly in mating traits) and the formation of new species, particularly in frogs and reptiles. His current work involves hybrid zones between lineages of Green-eyed Treefrogs (*Litoria serrata* and *L. myola*) in rainforests of the Wet Tropics.

Dr. Robert Puschendorf

Plymouth University, UK

Dr. Rob Puschendorf undertook much of his work on Project 3.3 while an ARC Postdoctoral Research Fellow at James Cook University. He is currently a Lecturer in Animal Physiology and Health at Plymouth University, UK.

Dr. Puschendorf has always been interested in ecology, evolution and conservation of tropical systems threatened by disease and climate change. Most of his work has focused on enigmatic amphibian declines and the disease known as chytridiomycosis (amphibian chytrid fungus disease), which has been linked to these declines. Originally from Costa Rica, he initially focused on patterns of infection across systems in the Neotropics, which evolved into environmental effects on the host-pathogen interaction between amphibians and the fungus. His current research focuses on environmental refuges from disease driven extinctions, identifying and understanding the mechanisms that allow hosts and pathogens to coexist.

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. Conrad Hoskin, JCU and Dr. Robert Puschendorf, Plymouth University

Project Background

This project investigates the degree to which some frog species have declined in the rainforest, previous 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. 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. These areas represent a gap in Wet Tropics and Eungella biodiversity knowledge.

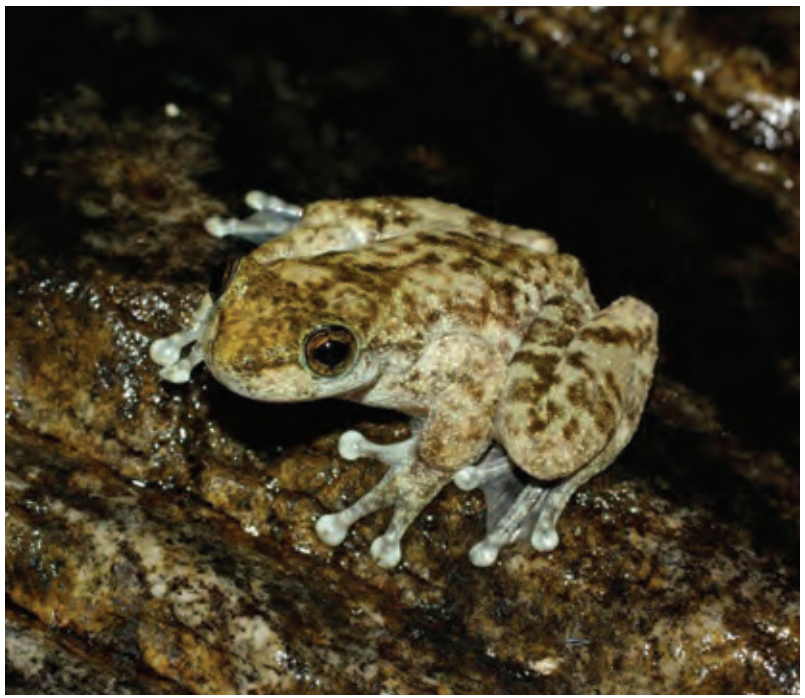
Project Progress

Recent surveys failed to find the Armoured Mistfrog (*Litoria lorica*) at remaining northern Wet Tropics sites normally associated with the species. Good numbers of the endangered species *L. nannotis* were found at all sites, and *L. rheocola* was found at several locations. The occurrence of these two species in upland rainforest supports observations from elsewhere that they appear to be recolonising upland rainforest following disease declines.

The single known *L. lorica* site was surveyed in detail as part of ongoing monitoring. From this an estimated total population of 600 adults (range 500-1000) was derived for 4 km of river habitat, with targeted surveys of all other potential sites revealing that *L. lorica* is restricted to this area.

A collaborative management plan involving a proposed translocation is currently being developed with the DEHP (Threatened Species Branch), with activation expected later in 2013.

The Tinkerfrog (*Taudactylus rheophilus*) was last known from Mt Lewis (late 1990s) and Mt Bellenden Ker (2000), however surveys of these and other historic sites failed to detect any of the frogs, suggesting that the species may now be extinct. Automatic call recorders have been deployed at the historic sites to test this observation. Surveys for endangered frogs at Mt Elliot, Hinchinbrook Island, Mt Lewis, Mt Fisher and Big Tableland resulted in good data for threatened microhylid frogs but not endangered stream frogs.



The armoured mist frog (Litoria lorica) was thought to be extinct until we rediscovered in the periphery of its known distribution. We have focused our research on these habitats hoping to rediscover other missing species of frogs in the region. *Image: Robert Puschendorf (JCU)*

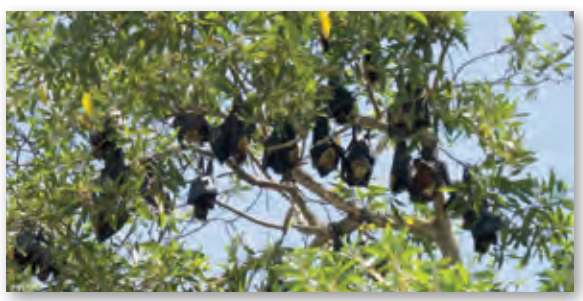
Researcher Profile

Dr. David Westcott

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Dr. David Westcott joined CSIRO in 1995 after completing a PhD at the University of British Columbia. He currently leads the Ecosystem Function and Prediction Stream in CSIRO's Healthy Terrestrial Ecosystems at Atherton, and is responsible for a team of scientists and technical staff studying the ecology of tropical rainforests and landscapes.

Dr. Westcott's expertise is vertebrate movement and landscape ecology, conservation biology, behaviour and evolution. His current projects include identification and impact of invasive pests in the Wet Tropics rainforests; cassowary genetics and population monitoring; biodiversity in Wet Tropics floodplains; predicting and managing invasive spread in rainforest habitats and flying fox ecology and management.



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 Ecosystem Sciences

Project Background

Monitoring is a fundamental component of the management of threatened species, and is of particular importance when these species come into direct conflict with humans and their interests. 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 debates, often with financial and legal implications. 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 to the process. This project is monitoring the abundance and distribution of the Southern Cassowary and the Spectacled Flying Fox in north Queensland. Natural resource managers will be provided with estimates of the sizes, age structures, and dynamics of these populations to support informed decision making.

Project Progress

Monthly censuses of the spectacled flying-fox population were conducted and this data has been fed into the management process at all levels of government. The results show a return to the dynamics observed in non-cyclone years. Cassowary surveys were conducted across the region and produced similar distributions to those observed in the previous year.

Little-red flying-foxes (Pteropus scapulatus) are about half the size of other Pteropus. They are sometimes found roosting in a corner of a spectacled flying-fox camp, usually in tight clusters. *Image: David Westcott*

Researcher Profile

Dr. Dan Metcalfe

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Dr. Dan Metcalfe is Research Program Leader for the Ecology Program at CSIRO Ecosystem Sciences. He completed fieldwork for his PhD in the rainforests of South-east Asia before taking up a post-doctoral position in Australia working on the ecology and physiology of rainforest seedlings. He then returned to the UK for eight years working in academia before returning to Australia in 2004 to work with CSIRO Atherton. He has worked on community and landscape ecological questions including management of threatened species, impacts of natural disturbance events on forest succession, weed ecology and management, and the biogeography of Australian rainforest plants.

Dr. Metcalfe's current research focuses on fire ecology of rainforests and allied vegetation; the role of functional traits in determining community responses to change; the management of threatened ecosystems and the development of sustainable forest use practices.

Weeds and grasses growing at the edge of littoral rainforest may provide sufficient fuel to allow fire in communities adjacent to littoral rainforest to propagate into it. Past experience suggests that few species in littoral rainforest are capable of surviving fire, causing habitat fragmentation, failure of recruitment and allowing weeds an even stronger foothold. *Image: Dan Metcalfe*

Project 7.1: Fire and rainforests.

Project Leader: Dr. Dan Metcalfe, CSIRO Ecosystem Sciences

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 region. Mahogany Gliders are endangered vertebrates that are reliant on lowland eucalypt forest in the Wet Tropics. Changed fire regimes and intensities have allowed rainforest plant 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.

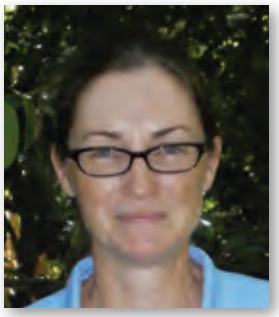
Project Progress

Seedling monitoring plots have been set up in disturbed rainforest and plans made to burn leaf litter to record the response of each rainforest species to being 100% scorched. Vegetation changes will be monitored over the next year in all plots to better understand rainforest-sclerophyll dynamics. This information will be used to facilitate an informed management approach to controlling fire in mahogany glider habitat. Examination of images from photopoints have revealed rapid changes to the understory in relatively short times, particularly in sites significantly impacted by severe tropical cyclone Yasi, highlighting the need for fire regimes to be considered as a way of reversing this transition.

A separate report on the transformer weeds of littoral rainforest is being prepared, as is an objective assessment based on recently published IUCN criteria (Keith et al., 2013) of the conservation status of lowland rainforests.

Workshops with Indigenous representatives have highlighted the need to ensure better integration of Traditional Ecological Knowledge into proposed fire management approaches, and negotiations are underway for workshops to exchange understandings through the Rainforest Aboriginal Peoples' Alliance.

Gliders bite the stems and inflorescences of grass trees (Xanthorrhoea) causing them to 'bleed' a sticky sap, which the gliders feed on when they return. *Image: Dan Metcalfe*



Researcher Profile

Dr. Helen Murphy

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Dr. Helen Murphy is a Research Scientist at CSIRO Ecosystem Sciences in Atherton. She joined CSIRO in 2005 as a Post-Doctoral Research Fellow examining how weeds impacted on rainforest community structure and function. The work provided information to land managers on which weeds had the greatest impact, and where in the landscape these impacts were most evident. She also established a large field-based program monitoring the response of weed species to Tropical Cyclone Larry and maintains close links with weed managers in the Wet Tropics and Biosecurity Queensland.

Dr. Murphy currently leads a team that addresses species, population and community level processes driving tropical forest dynamics. The research focus is on broad spatial and temporal scale patterns and processes driving invasive species distributions.

Stevia ovata along a powerline easement near Ravenshoe.
Image: Andrew Ford (CSIRO)

Project 7.2: Invasive species risks and responses in the Wet Tropics.
Project Leader: Dr. Helen Murphy, CSIRO Ecosystem Sciences

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 focused approach. 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

The analysis of future weed risks in the Wet Tropics has been completed and a database of high-risk emerging weeds for the Wet Tropics compiled. Consideration has also been given to the occurrence and nature of incursion pathways for these species. The bioclimatic modelling for emerging weed risks in the Wet Tropics indicates that while climatic suitability may decrease for some species, most will find parts of the region suitable. Therefore, while the projected ranges of some species show a net shift to the south under future climate conditions, the Wet Tropics will likely offer refugia for tropical weeds.

The project has conducted participatory workshops with Terrain NRM managers, researchers and on-ground staff to build a systems diagram description of factors expected to be important to pig population dynamics, perceptions of pig damage, and the impact of pig management actions now and in the future across the Wet Tropics. This systems diagram is now being used to inform a detailed spatial model of the interaction between feral pig dynamics and management actions.

A net present value analysis of the relative costs of eradication and containment of invasive species has been performed and shows that while containment can be more cost-effective than eradication for some infestations, it is by no means always the case. Moreover, the success of both containment and eradication programs are threatened by rare events, mis-estimated parameters, or imperfect detection. Importantly, the project has demonstrated that viewing containment as a default fall-back for eradication is generally not justified.

Collecting samples of invasive Miconia calvescens, El Arish, North Queensland. *Image: Helen Murphy (CSIRO)*

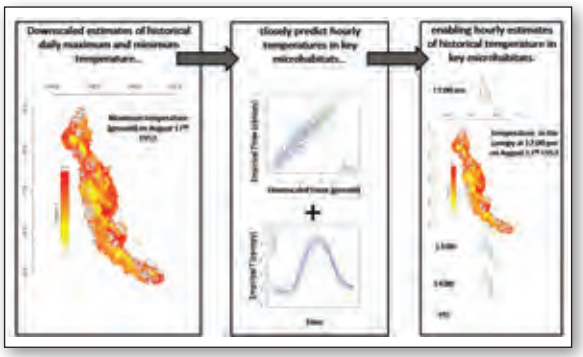
Researcher Profile

Dr. Justin Welbergen

James Cook University (JCU)

Dr. Justin Welbergen joined JCU's Centre for Tropical Biodiversity and Climate Change as an ARC Senior Research Fellow in June 2011, after doctoral work on grey-headed flying foxes in northern New South Wales.

His research covers a range of subjects in whole organism biology and evolutionary ecology, particularly the ways in which organisms adapt to changes in their social, ecological, and physical environment. During the last five years he has expanded his work into climate change biology, and particularly into the impacts of extreme events on biodiversity. Dr. Welbergen's current research examines the vulnerability of terrestrial species under threat from climate change and extreme climatic events.



Schematic representation of our approach for quantifying the thermal exposure as experienced in key microhabitats (canopy, litter, surface, soil, logs) (objective 1b). By linking our downscaled estimates of daily max and min temperature (objective 1a) to empirical microhabitat-specific hourly temperature curves (a), we can produce highly accurate estimates of hourly temperatures in the key microhabitats across the Wet Tropics, for example the temperature at 19 meters under the canopy at 12 pm on August 17th, 1953 (b). *Image: J. A. Welbergen (JCU)*

Project 7.3: Climate change and the impacts of extreme climatic events on Australia's Wet Tropics biodiversity.
Project Leader: Dr. Justin Welbergen, JCU

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

An extensive review of the literature on thermo-physiology of Wet Tropics vertebrates has been finalised and 43 species identified where thermal tolerance limits are known. In the last three decades, thermal tolerance has been assessed in a range of vertebrate fauna of the Wet Tropics, particularly skinks, snakes and frogs. However, significant gaps remain for mammals and birds which hinder assessments of the sensitivity to extreme temperature events across the vertebrate fauna.

To address these gaps, a relatively benign thermo-physiology experiment has been designed using up to 100 individuals from a maximum of 30 species and, with ethics approval, will measure tolerance to specific conditions of temperature and humidity The information on thermal tolerances will be combined with the information on species resilience and adaptive capacity to estimate thermal sensitivity across the vertebrate fauna of the Wet Tropics.

Green ringtail possum, (*Pseudochirops archeri*).
Image: J. A. Welbergen (JCU)

Researcher Profile

Dr. Rosemary Hill

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Dr. Rosemary Hill is the Research Team Leader, Geography, Human Ecology and Sustainability Science Group at CSIRO Cairns. Dr. Hill is a human geographer specialising in collaborative environmental governance and planning research with communities at multiple scales to foster social-ecological sustainability, with a particular focus on Indigenous systems. Her research interests lie in strategic natural resource governance and planning, specialising in biodiversity, sustainability, Indigenous and protected areas.

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 12.1: Indigenous co-management and biodiversity protection.
Project Leader: Dr. Rosemary Hill, CSIRO Ecosystem Sciences

Project Background

This project is undertaking co-research with Indigenous peoples and protected area managers in north Queensland to understand the capability of Indigenous Protected Areas and other collaborative models and tools to recognise Indigenous values and world views, and to identify the conditions under which these arrangements could lead to effective joint management of the Wet Tropics World Heritage Area between governments and Rainforest Aboriginal people, in partnership with communities. Traditional Owners are engaging with national parks managers 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

The draft framework to underpin participatory evaluation of the status of Indigenous co-management and biodiversity protection in the Wet Tropics has been further developed with participatory input from 28 community, Traditional Owner and government stakeholders from the Wet Tropics, and ongoing discussions with the co-research team. The refined framework includes the 'pathway to joint management of the WTWHA' for which preliminary thresholds have been identified.

A further participatory workshop will be held in early 2014. The co-research team has suggested the participatory evaluation of the status of Indigenous engagement towards joint management of the WTWHA will be developed via participatory case studies. The outcomes of the case studies will be shared at the workshop as part of the evaluation process. Discussions for the first case study are underway with Girringun Aboriginal Corporation.

The framework and complementary evaluation tool (both working documents developed in partnership with the co-research team) will be used to guide each of the participatory case studies enabling the framework to be tested and improved via ongoing participatory process.

Girringun artists and rangers prepare for arts workshop with CSIRO researchers, Gyambol wetlands.
Image: K. Maclean

Researcher Profiles

Professor Carla Catterall

Griffith University (GU)

Professor Carla Catterall is an ecologist and environmental scientist in the School of Environment at Griffith University. Her research interests lie in the responses of diverse organisms to habitat change in subtropical and tropical ecosystems.

Professor Catterall has conducted extensive research into wildlife responses to habitat change, ranging from the behaviour of individual animals to the composition of plant and animal communities, and the roles of animal-plant interactions. Her work spans the impacts of deforestation, reforestation and urbanisation and focuses on the discovery and testing of methods to encourage the persistence of plant and animal diversity within landscapes. For the past 13 years she has led research projects investigating the ecological outcomes of different techniques of rainforest restoration. Carla enjoys working with land managers and the community to improve conservation and restoration of biodiversity.

Dr. Luke Shoo

James Cook University (JCU)

Dr. Luke Shoo is a Postdoctoral Research Fellow at the School of Biological Sciences, University of Queensland. Dr. Shoo has worked on a wide range of systems from mountaintop birds in tropical cloud forests to naturally regenerating rainforest in former agricultural landscapes. He has a strong interest in topical conservation issues including prioritisation of conservation actions to reduce tropical deforestation and restore degraded environments, and management of biodiversity under climate change. His current research is concerned with harnessing natural regeneration for cost effective tropical forest restoration.

Project 12.2: Harnessing natural regeneration for cost-effective rainforest restoration. *Project Leaders: Professor Carla Catterall, GU and Dr. Luke Shoo, JCU*

Project Background

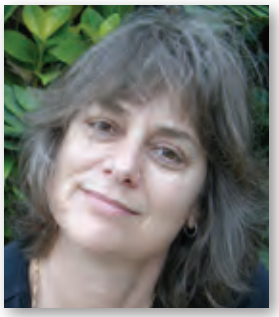
This project is focused on naturally-regenerating forests and the potential of re-growth to offer a much needed low cost option to restore critical habitat over large areas. The project is based in the Wet Tropics uplands and is measuring and monitoring the rate and pattern of vegetation development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

Project Progress

A desktop review published by the project team has reported the emergence of a wide range of intervention strategies (other than tree planting) over the past two decades to stimulate regeneration of tropical forest in disused agricultural land. Outcomes and costs vary greatly; and current knowledge is insufficient to enable sound choices of method. It is apparent that interventions which suppress pasture grasses and those which improve the supply of plant propagules are likely to accelerate forest regeneration if used in combination, but are infrequently effective when either is used alone.

The project is also combining the field measurements of regrowth vegetation structure with remotely sensed spatial data to develop methods for detecting regrowth development at broader scales.

Rainforest regrowth patch in retired pasture, estimated age 8-20 years; in the Wet Tropics uplands.
Image: Kylie Freebody (Griffith University)



Researcher Profile

Professor Natalie Stoeckl

James Cook University (JCU)

Professor Natalie Stoeckl is with the Faculty of Law, Business and Creative Arts and the Cairns Institute at James Cook University. She describes herself as an economist with a keen interest in the environmental and social/distributional issues associated with economic growth. Natalie has extensive experience with a variety of non-market valuation techniques. What distinguishes her from many other economists is her track record of collaborative, cross-disciplinary research using models that combine economic, environmental and social variables to explore interactions between socio-economic and ecological systems. She has published widely in both national and international forums and supervises many research students.

Rainforest tours in the Wet Tropics World Heritage Area (WTWHA).
Image: GBRMPA

Project 12.3: Relative social and economic values of residents and tourists in the Wet Tropics World Heritage Area.
Project Leader: Professor Natalie Stoeckl, JCU

Project Background

This project will identify and prioritise social and economic values that tourists and residents place on the Wet Tropics World Heritage 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 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. 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 (e.g. aesthetics).

Project Progress

A range of key 'values' have been identified for further investigation in this project, including those associated with the WTWHA, and those pinpointing key challenges facing managers. Key 'values' include those associated with forest health, landscape, iconic species, culture, accessibility, quality of access, water quality, and employment. Key management challenges highlighted during the project team's investigations and workshops include those associated with the need and/or desire to protect native flora & fauna; improve or maintain undeveloped scenic beauty; and improve water quality and clarity. These qualitative insights have been used to construct a questionnaire that investigates 'values', management issues, and trade-offs facing stakeholders in the region.

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

Researcher Profile

Associate Professor Allan Dale

James Cook University (JCU)

Associate Professor Allan Dale is the Leader of Tropical Regional Development at The Cairns Institute, James Cook University, and before that he was CEO of Terrain NRM for the Wet Tropics Region. He is currently Chair of Regional Development Australian Far North Queensland and Torres Strait, and accesses an international network of research expertise in the NRM governance field, with strong linkages to Charles Darwin University, Griffith University and CSIRO.

Professor Dale has a strong interest in integrated natural resource policy and management in northern Australia. He has both extensive research and policy expertise in governance systems and integrated natural resource management.

The Terrain Office in Innisfail post-Cyclone Larry: Climate change potentially means more intense cyclones and reduced landscape resilience in the Wet Tropics region. *Image: Terrain NRM*

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, JCU

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

Effective governance systems and planning foundations have been reviewed, trialed and evaluated for regional and landscape scale adaptation to climate change. Specific science innovations to help inform emerging opportunities for building landscape resilience via Growth Green Agriculture (GGA) markets have included a focus on building a stronger theoretical and a practical evaluative basis for the integration of GGA policy and programs into achieving landscape outcomes. Strong international and national publication outcomes are already influencing this new research field.

The project's main science contributions include work in governance theory, significantly influencing Australia's approach to linking GGA to landscape change; and work in planning theory, influencing Australia's approach to the next generation of NRM planning. Practical outcomes in governance and planning practice have significantly supported capacity building across all Queensland NRMs and helped the region to secure over $4 million in Stream I and II funding. This project was completed on the 30 June 2013.

Strategic riparian rehabilitation represents an ideal CFI Project opportunity on the Atherton Tablelands. *Image: Terrain NRM*

Researcher Profile

Dr. Eric Lawrey

Australian Institute of Marine Science (AIMS)

Following completion of a PhD on modelling improved techniques for wireless communication, Dr. Lawrey took up the position of Chief Technical Officer at Code Valley; a software engineering company researching a new way of developing software using distributed computing. In 2008 Dr. Lawrey joined AIMS as the e-Atlas developer and in 2011 took over as project leader for the e-Atlas, where he now focuses on data processing and stakeholder engagement.

Dr. Lawrey's current research interest is in design and development of the e-Atlas web platform, enabling knowledge developed through environmental science to be spatially visualised and told as data driven stories. This work includes development of web technology for delivery of the content, tools for processing environmental data and base-maps for the Great Barrier Reef, its catchments and the Torres Strait.

Project 13.1: e-Atlas. *Project Leader: Dr. Eric Lawrey, AIMS*

Project Background

This project is further developing the e-Atlas which is a website, mapping system and set of data visualisation tools for presenting research data in an accessible form that promotes greater use of this information. The e-Atlas serves as the primary data and knowledge repository for all NERP Tropical Ecosystems Hub projects, which focus on the Great Barrier Reef, Wet Tropics rainforest and Torres Strait. The e-Atlas captures and records research outcomes, making them available to research-users and hosts meta-data records, providing an enduring repository for raw data. It is also developing and hosting web visualisations to allow viewing of information using a simple and intuitive interface. In doing so the e-Atlas is assist scientists with data discovery and allowing environmental managers to access and investigate research data.

Project Progress

The e-Atlas (http://e-atlas.org.au) has a new front page, revised meta-database and individual project pages have been established as have links with the NERP TE Hub website. The project leader has now received data contributions from many NERP projects and is working closely with TSRA to integrate e-Atlas with their Integrated Management Strategy.

Additions and updates include shearwater seabird feeding tracks (Project 6.3 Brad Congdon); long term monitoring program (LTMP) COTS density modeling, update and animation; a new version of Atlas mapper (http://code.google.com/p/atlasmapper) and Torres Strait monitoring reef pages (http://e-atlas.org.au/ts/nerp-te/aims-monitoring-health-torres-strait-reefs-2-3).

National Environmental Research Program

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The Reef and Rainforest Research Centre (RRRC) administrates the Australian Government's National Environmental Research Program Tropical Ecosystems (NERP TE) Hub.

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