SUSTAINABLE TROPICAL FOREST LANDSCAPES

RAINFOREST CRC 10TH ANNUAL CONFERENCE

Hilton Cairns
10 -12 November 2003

Cooperative Research Centre for Tropical Rainforest Ecology and Management

Established and supported
under the Australian Cooperative
Research Centres Program

Welcome to the 10th Annual Conference of the Rainforest CRC

This conference marks the milestone of a decade of research that has seen the Centre emerge as a national and international model for delivery of rainforest research and sustainable management. In this time we have produced over 1000 scientific publications and over 120 graduate student theses.

The past ten years has seen Rainforest CRC research focus strongly on stakeholder outcomes and our commitment to providing a sound scientific basis for conservation and management of tropical forests, to assisting in the development of a tourism industry in harmony with the resource on which its depends, and to promoting Indigenous involvement in all facets of research and management.

Government Reviews of the Centre invariably refer to the potential for growth in research output and praise the collaborative nature of the Centre. Our Annual Conference is an important vehicle for bringing this highly regarded research to a wider audience. In particular, the workshops and symposia on the second day have been designed to attract and involve our stakeholders in interactive exchanges based around the ways in which our research has focused on their needs and requirements.

It is appropriate at this point in the life cycle of the Rainforest CRC that we look back with a sense of pride at our research achievements over the past decade. These achievements provide a very solid foundation for our re-bid for the Centre next year.

Contents

Keynote Speakers

Professor Nigel Stork

Rainforest CRC Chief Executive Officer

Professor Nigel Stork has been the CEO of the Rainforest CRC since 1995, successfully guiding the Centre through the 1998 rebid process and a number of government reviews. He spent the prior 17 years firstly as a Division Leader at the Natural History Museum in London and then working in tropical forests all round the World. Professor Stork has collaborated with a number or organisations, including UNESCO, UNEP and CIFOR on biodiversity issues, particularly relating to tropical forests.

During the first few years of his time at the Rainforest CRC, he was responsible for the concept and development of the Australian Canopy Crane Research Facility at Cape Tribulation, the first such facility in the southern hemisphere, and now an important link in an international network of canopy cranes. Currently, he champions the development of the Australian Tropical Forest Institute (ATFI) as a means of creating greater critical mass and synergies for tropical forest research, both in Australia and across the world and, in 2001, led a successful bid for $7.8 million from the Queensland Smart State Funds to finance construction of a building to house ATFI.

Besides heading the Rainforest CRC, Professor Stork maintains a high scientific profile, has co-authored nine books and recently co-authored a paper in the Journal 'Science' Journal on the role of canopies.

Professor Richard Pearson

Director, Australian Centre for Tropical Freshwater Research and Head of School of Tropical Biology, James Cook University, Townsville

Richard Pearson is Professor of Zoology and Tropical Ecology and Head of the School of Tropical Biology at James Cook University. Until recently he was Director of the Australian Centre for Tropical Freshwater Research at JCU, a position he held for about ten years. He has worked as an ecologist in Townsville for nearly 30 years. He regards this region as the best in the world to study ecology because of the richness of the biota, and the safe environment – marginally better than his native Yorkshire.

His special interest is in river ecology, and his research has focussed on explaining why local tropical streams have such high diversity – at least equalling any in the world – and how human impacts on this diversity can be ameliorated. Recently he has been investigating how agricultural r . Richard was one of the founding scientists for the original CRC for Tropical Rainforest Ecology and Management, leading biodiversity projects on fresh waters and on terrestrial vertebrates. The first of these has evolved into the new *Catchment to Reef* Rainforest CRC – CRC Reef joint program, while the latter became the continuing vertebrate project led by Steve Williams.

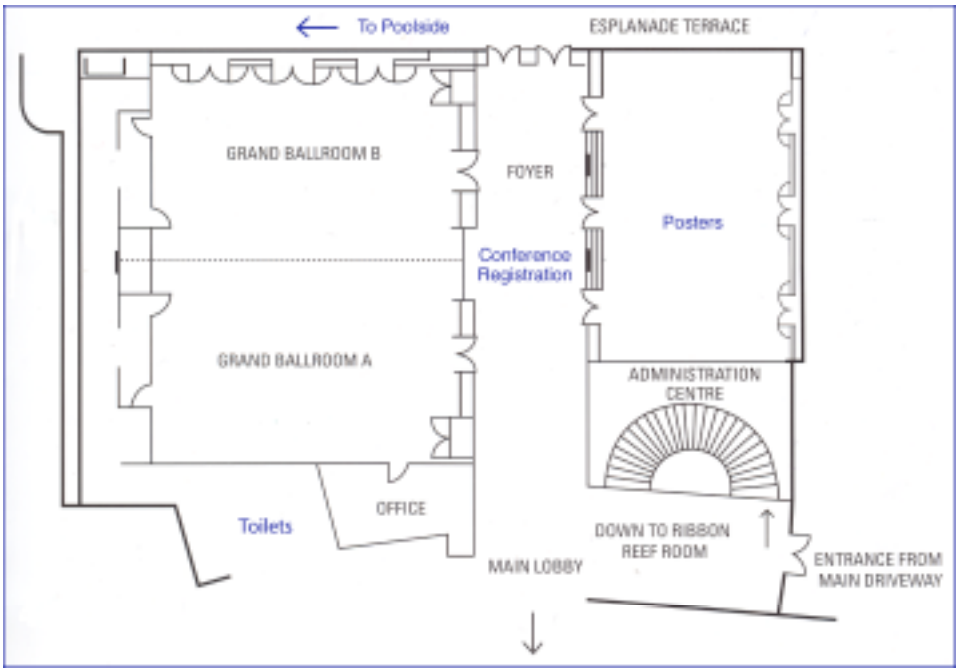
Richard is a keen proponent of both discovery science and science transfer, through formal educational processes and through scientific advice to government and community bodies.

General Information

Registration

For the Welcome Reception, registration will take place poolside. For the remainder of the conference, the registration desk will be located in the foyer outside the Grand Ballroom of the Hilton Hotel. There will be a notice board nearby for conference notices, delegate messages, and media releases. Public telephones, toilets and the Hilton Business Centre are in the same area. The registration desk will be attended at the following times:

Monday 10 November 7.30 am – 5.00 pm
Tuesday 11 November 7.30 am – 5.00 pm
Wednesday 12 November 8.00 am – 12.00 pm



Parking

Undercover parking is available beneath the Hilton Hotel at a cost of $4 per car per day. This is a special conference delegate price and tokens must be purchased at the Hilton Reception desk.

Poster Set Up

Posters will be set up in the Hilton Beaches Room for the duration of the Conference and authors should inform staff that they have a poster when registering. Presenters are requested to stand alongside their posters during the Poster Session on Monday night between 5.30 pm and 7.00 pm to answer queries from interested delegates and the public. See the Social Program for further details.

Audiovisual Equipment

Presentations will be given in the Hilton Ballroom B. The following facilities are available:

Data Projector with remote and laser pointer.
Large fixed 10 x 7.5 draped screen and whiteboard.
Overhead projector and slide projector.
Lectern with microphone.

If you have other requirements, please discuss them with the registration desk staff.

General Information

Media Liaison

Media liaison during the Conference will be undertaken by our media consultant Pip Miller. Pip will meet and greet journalists and news crews and schedule interviews with researchers and presenters. Pip's mobile number is 0419 681 543.

Secretarial Services (Hilton Business Centre and Services)

The Hilton Hotel has a secretarial service which is available to delegates at the following rates:

Typing of correspondence	$40 per hour
CD Burning	$25 per CD (including CD)
Blank CD	$ 5 each
Blank Floppy Disc	$ 5 each
Emails In / Out	$ 5 per email
Scanning	$ 2 per page
Facsimiles In / Out	$ 1 per page
Laminating	$ 1 per page
Photocopies	$ 0.40c per page (first 10 complimentary)

Who to contact for assistance

Registration and General Enquiries:	Ms Sue Lowth and Ms Shannon Hogan
Workshops:	Ms Jann O'Keefe
Media liaison:	Ms Pip Miller
Audiovisual equipment:	Mr Matt Pye
Poster placement:	Mr Catherine Pohlman
Conference Dinner Arrangements:	Mr Chris Pratt

General Catering Arrangements

Coffee, tea and biscuits will be available to delegates upon arrival each morning.

Morning and Afternoon tea will be provided for all delegates during the conference and will be served in the foyer outside the Hilton Ballroom. Times for tea breaks, which differ each day, can be found in the Program. During Day 2 of the conference, we expect extra numbers at both morning and afternoon tea as a result of one or half day workshop and symposia attendances.

A buffet lunch will be served poolside to conference delegates on each of the three days of the conference. Colour coded Lunch vouchers will be issued at registration and these will be collected each day as delegates enter the poolside area for lunch. Times for lunch breaks, which differ each day, can be found in the Program.

Conference Organisation

Conference Organiser:	Ms Jann O'Keefe
Science Program:	Associate Professor Steve Turton
Conference Secretariat:	Ms Frances Repcsak
	Ms Sue Lowth
	Ms Shannon Hogan

This year, a number of Rainforest CRC students volunteered to assist with conference preparations and tasks and the Centre would like to thank Ms Catherine Pohlman, Mr Matthew Pye and Mr Chris Pratt for their help, especially with poster installation, audio-visual services, time-keeping – and most importantly, set up and knock down.

Social Program

Welcome Reception – Sunday 9 November

Conference registration and installation of posters begins at 5.00 pm. Delegates are invited to mingle with other conference participants and enjoy complimentary drinks and nibbles served at the Hilton poolside.

The official Welcome Reception begins at 6.00 pm and will include a Welcome to Country. The evening will conclude at 7.30 pm.

'Stickers for Drinks' Poster Session – Monday 10 November

The Poster Session will be held in the Beaches Room, beginning at 5.30 pm and preceding a Public Forum that will be open to both the public and conference delegates. Poster presenters are requested to stand by their posters during this session to answer questions from interested parties. In order to encourage this interaction, presenters in the Student Poster Competition will be issued with special stickers to distribute at their discretion to individuals who have shown a lively interest in their work. These stickers can then be exchanged for free drinks at the bar.

Free drinks will be limited to beer, wine and champagne, however the bar will be stocked with a full range of purchasable drinks, including beer, wine and spirits.

Public Forum – Monday 10 November

The Public Forum is entitled 'Current and Emerging Threats to Tropical Forests' and will be held from 7.00 pm to 8.30 pm in the Hilton Ballroom B.

A panel of five researchers will give short overviews on what they consider to be the most significant threats followed by questions from the floor to a roving microphone. ABC Radio will compere the forum, which will also be recorded for future use by the Station.

The Panel has been selected to cover a broad range of expected topics and issues and includes Dr Chris Margules, CSIRO (biodiversity), Dr Dave Hilbert, CSIRO (climate change), Dr Jim Mitchell, Natural Resources and Mines (feral animals and weeds), Dr Joan Bentrupperb umer, JCU (tourism and visitors) and Professor Richard Pearson, JCU (water quality and supply).

Conference Dinner

This year, the Conference Dinner has been included as part of registration and will take place during a three hour boat cruise in Trinity Inlet with Ocean Spirit Cruises. Free champagne and orange juice will be served to delegates on Breezes Terrace at the Hilton from 5.30 pm onwards. Delegates are welcome to purchase further drinks.

The dinner menu has something to please everyone and will include cold platters, a hot buffet, a choice of salads and desert. A bar with beer, wine and soft drinks is included as part of the package, however spirits must be purchased.

BOARDING TIME: All delegates must be assembled on Breezes Terrace by 6.30 pm for a waterside walk to the boat for boarding by 6.45 pm and departure promptly at 7.00 pm – no exceptions.

Annual Awards

Presentation of the infamous Annual Awards for exceptional feats or faux pas will take place during the Conference Dinner. These have become a highlight of the social program over the past few years and nominations for Awards can be placed in a special box on the Registration Desk at any time up to end of lunchtime on Tuesday 11th.

Student Competitions

This year, prizes will be awarded to students who produce the best poster and deliver the best oral presentation. First prize in each category is $500 with a runner up prize of $250.

Only registered Rainforest CRC students are eligible to enter the competitions, and presentations must be primarily the student's own work. Posters will be on display in the Beaches Room at the Hilton Hotel for the duration of the Conference.

Poster Competition

A Panel of three judges will assess student posters against the following criteria:

- A poster or presentation that is engaging and inspires the audience to want to know more.
- Well organised information.
- Clarity, brevity and relevance.
- Proper acknowledgement of the Rainforest CRC, funding bodies and other assistance.
- Evidence that the student understands the significance of their research in relation to Rainforest CRC objectives of sustainable use, conservation and management of tropical rainforest resources.

Panel of Judges – Posters

Ms Bryony Barnett – Extension Manager, Reef CRC.
Mr Gary Wilson – Queensland Herbarium, EPA.
Mr Trevor Parker – CSIRO Sustainable Ecosystems, Atherton.

Oral Presentation Competition

Oral presentations will be given by students on Wednesday morning 12 November in Ballroom B of the Hilton Hotel. The session will be chaired by the Rainforest CRC Deputy CEO, Associate Professor Steve Turton.

Presentations are to be 10 minutes duration and time-keeping will be strictly adhered to. The Chair will ring a bell at both the 7 minute and 9 minute mark.

Speakers will be assessed by a Panel of three judges against the following criteria:

- A presentation that is interesting and inspires the audience to want to know more.
- Well organised information.
- Clarity, brevity and relevance.
- Confident and appropriate use of presentation materials and/or technology.
- Proper acknowledgement of the Rainforest CRC, funding bodies and other assistance.
- Evidence that the student understands the significance of their research in relation to Rainforest CRC objectives of sustainable use, conservation and management of tropical rainforest resources.

Panel of Judges – Oral Presentations

Professor Dave Gillieson – Head of TESAG, James Cook University.
Dr Alison Shapcott – Plant and Vegetation Ecology, University of the Sunshine Coast.
Associate Professor Steve Harrison – School of Economics, The University of Queensland.

Conference Program

Sunday November 9 – Welcome Reception

From 5.00 pm	Conference Registration and poster installation
6.00 pm – 7.30 pm	Welcome to Country and informal poolside mixer

Monday November 10 – Presentations

7.30 am – 10.00 am	Conference Registration in Ballroom Foyer Poster installation in Beaches Room
8.30 am – 8.45 am	Welcome and Opening Address *Associate Professor Steve Turton, Rainforest CRC Deputy CEO*
8.45 am – 9.15 am	Keynote Address - Future Directions for the Rainforest CRC *Professor Nigel Stork, Rainforest CRC Chief Executive Officer*

SESSION 1: Bioregional and Conservation Planning

9.15 am – 9.20 am	Introduction from Chair of Session *Dr Chris Margules (CSIRO)*
9.25 am – 9.40 am	Regional planning for biodiversity conservation *Professor Geoff McDonald (CSIRO) and Mr Nigel Weston (JCU)*
9.45 am – 10.00 am	Vegetation communities modeling using GIS-integrated statistical, ecological and data models: An application in the Wet Tropics of northeastern Queensland, Australia *Mr Arnon Accad (Queensland Herbarium, EPA)*
10.05 am – 10.20 am	Fine-scaled vegetation and regional ecosystem mapping for the Wet Tropics Bioregion *Ms Ellen Weber, Mr Peter Stanton and Mr David Stanton (Wet Tropics Management Authority)*
10.25 am – 10.40 am	Genetics and the past and present distribution of the endangered *Triunia robusta* (Proteaceae) *Dr Alison Shapcott, Mr Michael Powell and Mr Arnon Acaad (Queensland Herbarium, EPA)*
10.40 am – 11.10 am	MORNING TEA

SESSION 2: Threatened Ecosystems and Threatening Processes

11.10 am – 11.15 am	Introduction from Chair of Session *Professor Dave Gillieson (JCU)*
11.15 am – 11.30 am	Searching for dynamic resilience in exploited landscapes *Dr David Hilbert (CSIRO)*
11.35 am – 11.50 am	The feral pig perspective: Threat or resource? *Dr Jim Mitchell (NR&M)*
11.55 am – 12.10 pm	Automatic cameras as a tool for endangered species research and management in north Queensland *Dr Scott Burnett (QPWS)*
12.15 pm – 12.30 pm	Understanding limits to the distribution of folivores: A way forward to a predictive model *Dr Andrew Krockenberger (JCU)*

12.30 pm – 1.30 pm LUNCH

SESSION 3: Human Interactions

1.30 pm – 1.35 pm	Introduction from Chair of Session *Dr Sandra Pannell (JCU)*
1.35 pm – 1.50 pm	The integration of plants, ecology and people: a case study in the Mangkuma Land Trust, Cape York *Dr Grant Wardell-Johnson, A. Professor Athol Chase, Mr David Fell and Dr David Pullar (UQ)*
1.55 pm – 2.10 pm	Role of the Wet Tropics in the life of the community *Dr Joan Bentrupperbäumer (JCU) and Dr Joe Reser (NTU)*
2.15 pm – 2.30 pm	Estimating rainforest canopy connectivity across highways in the Wet Tropics World Heritage Area *Professor Dave Gillieson (JCU) and Mr Les Searle (JCU)*
2.35 pm – 2.50 pm	Wait for me! It's not too late to let the fish through *Mr Ross Kapitzke (JCU)*
2.50 pm – 3.00 pm	Conference Notices
3.00 pm – 3.30 pm	AFTERNOON TEA

SESSION 4: Production versus Biodiversity Trade-offs

3.30 pm – 3.35 pm	Introduction from Chair of Session *Dr Grant Wardell-Johnson (UQ)*
	Individual Perspectives on the issue of Production versus Biodiversity Trade-offs in Farm Forestry Systems
3.35 pm – 3.45 pm	*Dr Peter Erskine* (UQ)
3.45 pm – 3.55 pm	*Mr Daryll Killin* (QDPI)
3.55 pm – 4.05 pm	*Mr Errol Wiles* (Australian Forest Growers State President)
4.05 pm – 4.15 pm	*Mr Mike Berwick* (Mayor, Douglas Shire)
4.15 pm – 4.25 pm	*Mr Nick Emtage* (UQ)
4.25 pm – 4.35 pm	*Mr Mark Hunt* (QFRI, QDPI)
4.35 pm – 4.45 pm	*Associate Professor Carla Catterall* (GU)
4.45 pm – 5.30 pm	Panel Discussion

5.30 pm: POSTER SESSION – Stickers for Drinks

7.00 pm: PUBLIC FORUM – Current and Emerging Threats to Tropical Forests

Tuesday 11 November - Themed Workshops

9.00 am **Keynote Address – Joint Catchment to Reef Program**
Professor Richard Pearson (JCU)

Concurrent Themed Workshops – 9.30 am – 12.30 pm

MORNING TEA – 11. 00 am – 11.30 am

Plant – Animal Interactions in Conservation and Restoration

Assoc Prof Carla Catterall, Dr Andrew Dennis, Dr John Kanowski, Dr David Westcott

Animals play key roles in rainforest dynamics, via pollination, seed dispersal, seed predation and herbivory. However, the clearing and fragmentation of rainforest has changed the population size, assemblage composition and behaviour of rainforest animals. These changes have implications for the maintenance of biodiversity in remnant forests, for the restoration of forest to degraded land, and for the interaction of rainforests with their surrounding landscapes. This workshop will bring together researchers examining plant-animal interactions in Australian rainforests to share perspectives on approaches to their research and to discuss the implications of their work for conservation and restoration.

The workshop will run over two 1.5 hour sessions. The first session will comprise presentations from invited speakers on a range of themes relevant to the workshop. In the second session, the workshop will break into groups to discuss key questions on selected topics, followed by a plenary session.

Speakers will include David Westcott, Andrew Dennis (seed dispersal), Ros Blanche (Pollination), Peter Green (seed and seedling dynamics), John Kanowski (restoration), Keith Smith (plant-animal interactions and conservation management), Marc Russell (Plant-animal interactions and restoration practice).

Tourism and Visitor Management

Dr Joan Bentrupperbäumer, Dr Joe Reser

Current research into tourism and visitation management in the Wet Tropics undertaken by researchers with the Rainforest CRC has explored the relationships indigenous and non indigenous people have with the natural/built/social/cultural environment in the WTWHA and their implications for tourism, environmental management and local communities in the region. A particular emphasis has been placed on the 'real world' application of results in terms of planning for, managing and monitoring visitation and use of this World Heritage region, developing practical mechanisms and strategies to mitigate negative impacts on its World Heritage features, and to promote the positive psychosocial experiences visitors have with these environments.

This workshop will explore some of these social science insights including who the visitors are and where do they go, the design and management of visitor settings, information dissemination and appraisal, interpretive materials, and visitor experience in this World Heritage Area. The workshop provides an opportunity for tourism industry and environmental management agency personnel and other interested participants to engage in discussion on how these results can better inform them about visitation and use of the WTWHA.

1.00 pm – 2.00 pm LUNCH

Tuesday 11 November - Themed Symposia

Concurrent Themed Workshops – 2.00 pm – 5.30 pm

AFTERNOON TEA – 3.30 pm – 4.00 pm

Does Culture Matter?
An exploration of sustainable landscapes through un-natural frameworks
Dr Sandra Pannell

Recent initiatives, such as the Regional Cultural Alliance in 'Outback Australia", the Dharnya Alliance in Victoria and Indigenous Regional Sustainability Strategies in the Kimberley, focus upon the social and cultural environment and seek solutions as to how it can best be sustained. These new partnerships go beyond the usual ideas about sustainability in terms of economic and natural values. They acknowledge that principles of sustainability must involve a holistic negotiation of economic, environmental, social and cultural issues.

This half-day symposium explores the topical questions of how cultural values and a range of societal interests are acknowledged in existing environmental management and sustainability frameworks and why recognising culture can contribute to new frameworks for approaching human-environment interactions.

The symposium will feature presentations from a number of Indigenous and non-Indigenous speakers and will conclude with a panel discussion on the issues raised and possible future directions. As part of what should be a lively and interesting debate about environmental sustainability, the symposium will also explore the related issues of rights, regional agreements and environmental governance.

Targeting Sustainable NRM in the Wet Tropics
Professor Geoff McDonald, Mr Nigel Weston

A new regional Natural Resource Management (NRM) Plan for the Wet Tropics is currently being developed. This Plan is to build on existing planning and information frameworks and conform to Commonwealth and State requirements for accreditation. In so doing, it will give regional direction to future funding and prioritise investment from a range of sources, especially the extension of the Natural Heritage Trust program.

The new generation NRM plans constitute the regional blueprint for managing, restoring, using and conserving the diverse natural resources within a region. They will assess the social, economic and biophysical drivers for NRM issues, develop short-term and long-term resource management targets and identify implementation strategies and priority actions to achieve them.

An analysis of relevant regional information, including a broad profile of natural resource condition and trends in the Wet Tropics, has already been undertaken and this half-day symposium will feature presentations by speakers involved in this process. A group discussion on the issues raised will precede roundtable discussions on target setting in the key investment areas of biodiversity conservation, land and water health.

The aim of the symposium is to bring together scientists, administrators, policy makers and concerned individuals from different backgrounds and disciplines to discuss the aforementioned plan elements in an open and relaxed atmosphere. The deliberations at this symposium will provide important inputs to the new regional NRM Plan for the Wet Tropics.

Conference Program

Wednesday 12 November – Student Presentations

8.50 am – 9.00 am	Introduction from Chair of Session *Associate Professor Steve Turton (Deputy CEO, Rainforest CRC)*
9.00 am – 9.10 am	Habitat fragmentation effects on beetle species in upland Australian Wet Tropics rainforests *Mr Peter Grimbacher (GU)*
9.15 am – 9.25 am	Paternity and maternity in spectacled flying-foxes on the Atherton Tablelands *Ms Samantha Fox (JCU)*
9.30 am – 9.40 am	Dispersal ability of rare and common microhylid frogs *Ms Yvette Williams (JCU)*
9.45 am – 9.55 am	Place attachment to the Wet Tropics World Heritage Area: A Wet Tropics Bioregion perspective *Ms Sue-Ellen O'Farrell (JCU)*
10.00 am – 10.10 am	The unseen costs of agricultural expansion: depauperate pollinator communities in isolated orchards *Ms Katie Pritchard (JCU)*
10.15 am – 10.25 am	Tiny predators in the Big Scrub: species diversity and habitat specificity of mites (Acari: Mesostigmata) in the rainforest *Mr Frédéric Beaulieu (UQ)*
10.25 am – 10.55 am	MORNING TEA
11.00 am – 11.10 am	Canopy tree reproduction – finding out about the birds and the bees *Ms Sarah Boulter (GU)*
11.15 am – 11.25 am	The influence of the thermal environment on lizard morphology, life history and performance *Mr Brett Goodman (JCU)*
11.30 am – 11.40 am	The determinants of vegetation pattern in Australian sub-tropical rainforests *Ms Melinda Laidlaw (UQ)*
11.45 am – 11.55 pm	Changes in frugivorous bird assemblage and rainforest seed dispersal in a fragmented landscape *Ms Cath Moran (GU)*
12.00 pm – 12.10 pm	Plant species' attributes and the spatial ecology of regeneration in secondary rainforests *Ms Jessie Wells (UQ)*
12.15 pm – 12.25 pm	The capacity of lantana (*Lantana camara* L.) to displace native vegetation *Mr Daniel Stock (GU)*
12.30 pm – 2.00 pm	LUNCH
2.00 pm – 3.30 pm	Media Workshop
3.30 pm – 4.00 pm	AFTERNOON TEA

Presentation Abstracts Index

Regional planning for biodiversity conservation

Professor Geoff McDonald[1,2] and Mr Nigel Weston[2]
[1]CSIRO and [2]Rainforest CRC

Biodiversity is the variety of all life forms – the plants, animals and microorganisms and the genes they contain and the ecosystems of which they form an essential part. There are many interrelated reasons why societies should conserve biodiversity including utilitarian reasons of maintaining natural systems productivity, but also to retain the contributions of biodiversity to the beauty of landscapes and, for ethical reasons of protecting life forms for future generations. In short, biodiversity contributes to the continued existence of a healthy planet, our own well-being and economies and accordingly, the conservation of biodiversity is now legally mandated in many places throughout the world, including Australia.

Biogeographic regions (bioregions) represent the primary level of biodiversity classification in Queensland (Sattler & Williams 1999). These are defined at the meso-scale using biological and physical information. While existing bioregional classifications provide a useful system for the description of both the land and seascapes of the Wet Tropics region, there are problems with their use as regional planning tools, not least because they fail to take into account socio-political boundaries.

Governments use many policies to achieve their commitments to biodiversity conservation including reserve systems such as National Parks, and statutory controls such as vegetation clearing and pollution controls. In recent years regional planning has emerged as a means of integrating these conservation efforts. Regional plans need to maximize biodiversity conservation while providing for on-going local economic activities. To do this, they must integrate social and economic as well as ecological factors and seek to bring all stakeholders together to own and build a dynamic and politically acceptable plan.

This paper discusses the special case of the Wet Tropics region. The Wet Tropics region is a biodiversity 'hotspot' of global importance- the listing of the Wet Tropics of Queensland and Great Barrier Reef World Heritage Areas bears testimony to this. Further, this biodiversity contributes substantially to the current and future economy of the region – its tourism industry, agriculture and fisheries.

The paper provides a brief chronology of the conservation of the region's tropical rainforests, and provides an assessment of the 'State of biodiversity' in the region. It details the range of responses to biodiversity conservation under various programs – WTMA, RVMP, FNQ2010, LG plans etc (but interestingly, not RFAs) and investigates an emerging approach to biodiversity conservation, that of target-setting by regional planning bodies.

The paper concludes by setting out a program for biodiversity conservation in the Wet Tropics under the framework developed for the extension of the Natural Heritage Trust. The Wet Tropics has a newly formed regional Board to oversee the preparation and implementation of an integrated regional plan, a major element of which is the conservation of the region's biodiversity in conjunction with the many existing programs.

Vegetation communities modelling using GIS-integrated statistical, ecological and data models: An application in the Wet Tropics of northeastern Queensland, Australia

Mr Arnon Accad
Queensland Herbarium (EPA) and The University of Queensland

This research was conducted in the Innisfail Lowlands subregion of the Wet Tropics bioregion of northeastern Queensland, Australia. As the subregion has very rich soils and high rainfall, the area was targeted early in the 1930-40's for the purpose of agriculture. The 1940's aerial photographs show that the majority of the Innisfail Lowlands subregion had already been cleared before they were flown. As a result it is impossible to develop a pre-clearing vegetation coverage using mapping derived from the mid 20th century aerial photographs (Neldner *et al*., 1999). Therefore, for the Innisfail Lowlands subregion, the options are to interpret the 1940s aerial photographs and in cleared areas complement this with old survey records (Fensham and Fairfax, 1997) or to apply vegetation-modelling techniques, described in this paper, to predict the distribution of the vegetation communities before clearing.

Traditional mapping methods (as applied in the study area by Tracey and Webb (1975) and followed by Stanton and Stanton (2001) use labor-intensive aerial photography interpretation which is limited by:

- the extent of remnant vegetation on the earliest available aerial photography,
- differing scale and quality of aerial photography;
- cloud cover and shadows; and
- similar canopy features with significant floristic differences may not be delineated.

An alternative approach is proposed which integrates a data model, a statistical model and an ecological model using sophisticated Geographic Information Systems (GIS) techniques and rule-based systems to support large-scale vegetation communities' modelling. This approach relies on high quality Digital Elevation Models (Accad, 1996), and climate (Turton *et al*., 1999) and soil nutrient status surfaces (Whitehead, 1995; NRM, 2002).

Such models were developed for the Innisfail Lowland subregion and successfully applied to modelling the pre-clearing vegetation distribution. The models also allowed the potential effect of climate change on the rainforest vegetation communities to be predicted.

This research has demonstrated the efficacy of vegetation communities' modelling using GIS-integrated statistical, ecological and data models, and further demonstrated that climate change (Walsh *et al*., 2001) is predicted to affect vegetation communities in the Innisfail Lowlands subregion. The modelling has generated information which planners and land managers, responsible for the management of this complex environment, can utilise in management plans, and to assist in rehabilitation, reafforestation, and plantation design.

Fine-scaled vegetation and regional ecosystem mapping for the Wet Tropics Bioregion

Ellen Weber[1], Peter Stanton[2], David Stanton[2]
[1]Wet Tropics Management Authority, [2]Consultants to WTMA

Vegetation mapping of the Wet Tropics has been captured at various scales following different basic principles over a lengthy time period. The differences in capture, scale, methodology and capture rates have resulted in an inconsistent coverage of the bioregion.

Since 1997, Peter and David Stanton have been funded by the Wet Tropics Management Authority to map the vegetation of the Wet Tropics Bioregion. The Wet Tropics Vegetation Mapping Project is designed to produce a series of 1:50,000 maps across the whole of the Wet Tropics Bioregion that consistently categorise vegetation types and their links to soil types. Vegetation types also include codes to show variations such as understorey plants, kinds of disturbance and degradation, plantations and regrowth. The project builds on past Tracy and Webb 1:100,000 vegetation mapping and provides finer detail and more accurate mapping of the vegetation of the Wet Tropics.

A series of reports accompany the vegetation mapping. They describe the main vegetation types of each map sheet area and identify significant ecosystems and vegetation and discuss the condition of the vegetation. They then make management recommendations regarding conservation or rehabilitation needs.

The Stanton & Stanton mapping will be used to refine and update the Wet Tropics Regional Ecosystems (RE's), the framework adopted by the State Government for management of remnant vegetation and biodiversity conservation planning. It is anticipated that the mapping information will be invaluable in supporting a wide range of further research and planning. Applications include priority biodiversity mapping, threatened species habitat, fire planning, weed and pest mapping, rehabilitation programs, environmental impact assessment, visitor management, Native Title negotiations and monitoring the state of the Wet Tropics. Already it has provided an opportunity to measure changes in vegetation since previous studies such as Tracy and Webb.

Genetics and the past and present distribution of the endangered *Triunia robusta* (Proteaceae)

Dr Alison Shapcott[1], Michael Powell[1], Arnon Accad[2]
[1]University of the Sunshine Coast, Sunshine Coast Qld: [2]Queensland Herbarium Qld Environmental Protection Agency.

Patterns of genetic diversity and gene flow within and among populations of the endangered rainforest shrub *Triunia robusta* (Proteaceae) were compared with common *T.youngiana*. The past and present distribution of *T.robusta* was modelled using GIS layers and related to patterns of genetic diversity and gene flow to identify conservation priorities.

Searching for dynamic resilience in exploited landscapes

Dr David Hilbert
CSIRO Tropical Forest Research Centre, Atherton and the Rainforest CRC

This talk will briefly summarise an approach that combines simple models of land exploitation with multi-objective optimisation methods in order to search for general rules that lead to long-term environmental and economic resilience.

Landscapes are complex systems composed of interacting social, economic and biophysical subsystems. Widespread degradation of landscapes suggests that human exploitation of natural capital often leads to landscape systems with undesirable dynamical properties and states. One of the possible causes of this is that, heretofore, humans have employed exploitative strategies that optimise for short time-scale, small spatial-scale and single objectives. This may have been effective when populations where small and technology was limiting but is certainly causing concern now. With the tools of complex systems science it may be possible to discover broad generalities about land exploitation that provide more long-term and large-scale strategies that are less destructive of biodiversity and other forms of natural capital while still providing for human social and economic well-being.

Preliminary analyses suggest that ecological predator-prey models are a useful starting point for the development of generic land-use models. These models display the range of behaviours that are observed in human land-use such as over exploitation and system collapse, single steady states, multiple attractors, and stable limit cycles. The initial, “local” model has two state variables (natural and human-made capital) and parameters that represent the physical environment, the economic environment, and an exploitation strategy. This model can be imbedded in a spatially explicit model where many local systems interact. I then use an evolutionary computing technique to find land-exploitation strategies that lead to resilience in the kind of environment specified. The goal is to build up a picture of the best spatial arrangements and mix of strategies that lead to resilience for a range of environments (both biophysical and economic).

The feral pig perspective: Threat or resource?

Dr. Jim Mitchell
Department of Natural Resources and Mines, Charters Towers

The initial step in managing any animal pest species is to define the parameters of the problem – what impacts are occurring and the scope of the problem. Feral pigs have been variously regarded as an environmental an/or economic pest and also as a social and financial resource. However these conflicting community views have not been based on scientific information.

What is the pig threat.

- Environmental – research has shown that pigs do have an impact on certain aspects of rainforest ecology.
- Economic – research has documented the financial cost of feral pig impacts to agricultural industries bordering the World Heritage Area
- Disease – studies have documented the threat feral pigs pose in hosting and distributing a number of endemic and exotic diseases.

What is the pig resource

- Social issues – hunting is an industry that generates significant income and has caused divisive views within the community
- Aboriginal issues – feral pigs are considered a hunting and food resource to some aboriginal communities.
- Financial resource – studies have demonstrate that feral pigs can be a viable export industry

Three management strategies are currently available – eradication, sustained control or strategic control. Strategic control is the only viable management option currently available. Pigs do have a significant impact in specific situations but are not considered a significant threat to overriding WHA conservation values. Specific small microhabitats and rare and endangered species are the most vulnerable to pig impacts. Management strategies should be directed at controlling pig populations where there is a defined threat to a valued resource. Pig management must be prioritised by developing a ranking matrix system. The limited available resources must be utilised more effectively to minimise pig impact on WHA values. Pig populations will never be reduced to an acceptable level within the total WHA but more effective and strategic control can reduce their impacts on selected high valued resources.

Automatic cameras as a tool for endangered species research and management in north Queensland

Dr Scott Burnett
Queensland Parks and Wildlife Service, Atherton

Digital automatic camera "traps" have been used for endangered species research in north Queensland for the past 2 years. Each camera unit consists of a digital camera housed in a custom made plastic housing. Cameras are triggered to fire when a passive infra-red beam is broken. We have had mixed successes with these cameras; they have proven very useful for there projects, but have been unsuccessful for Cassowary monitoring.

Cameras have been successfully used for presence/absence studies of the endangered Northern Bettong, *Bettongia tropica*. These studies extend from searches for new populations to determining the spatial limits of known Bettong populations. Cameras are also being successfully used for Quoll studies. Because individual quolls are recognizable by their spot patterns, much more information can be gained about their populations than is the case with Bettongs. In addition to presence/absence data, cameras collect information on population numbers, movement behaviour and longevity for individual Spotted-tailed Quolls. Cameras have also been used successfully to monitor visitation of non-target animals to mock poison-bait stations, where they have captured images of mammals and birds.

All attempts to use cameras to count Cassowaries have failed. It is not clear why the cameras don't work, but footprints, scats, and sightings remain the most effective means of monitoring cassowary populations.

Camera trapping has a number of advantages over live-trapping including; (i) a negligible risk of injury or death compared with live-trapping, (ii) they are less intensive than trapping, i.e. cameras can be deployed and left unchecked for one week, (iii) they capture a wide range of species. Disadvantages of the camera trapping system are that, (i) as in the case of the Northern bettong, you can't calculate population estimates, only presence/absence, and (ii) the units are expensive to purchase.

Understanding limits to distribution of folivores: A way forward to a predictive model

Dr Andrew Krockenberger
James Cook University

Folivorous marsupials are distributed unevenly across the landscape, with most individuals found within a small proportion of the woodlands and forests. Understanding the limits to their distribution has become urgent with the need to accurately predict the effects of climate change on distribution and abundance of this iconic group that includes koalas, tree kangaroos and the possums. In the Wet Tropics, bioclimatic modelling of marsupial folivore ranges suggests that even the small rises in temperature that are considered almost certain will result in massive range reductions of these species during this century. Laboratory data suggests that rainforest ringtail possums are intolerant of extreme temperatures, but that their strategy of dealing with extreme temperatures is designed to conserve water. This paper will discuss proposed tests of the hypothesis that rainforest ringtail possums are limited by an interaction between temperature extremes, water availability and limitations on intake imposed by plant secondary metabolites.

The integration of plants, ecology and people: a case study in the Mangkuma Land Trust, Cape York

Dr Grant W. Wardell-Johnson[1], Assoc. Prof. Athol Chase[2], Mr David Fell[1], Dr David Pullar[3]
[1]School of Natural and Rural Systems Management, The University of Queensland, Brisbane, [2]60 Glenwood Avenue, Chelmer, Qld 4068, [3]Department of Geographical Sciences and Planning, The University of Queensland.

There is a long and continuing history of complex interactions between Aboriginal people and plant communities, which has fashioned the Australian landscape. We integrate floristic assemblage data with data on human ecological, economic and cultural uses, to assess landscapes for management planning in the Mangkuma Land Trust, Cape York. Floristic data from 99 quadrats in the immediate environs of five outstations were combined with recorded local Aboriginal people's uses of the plant species. Integrating the analysis of floristic pattern with plant uses reveals congruency between vegetation types, and economic and cultural landscapes. All plant communities defined include species valued for various economic and cultural purposes (ceremony, food, shelter, medicine and tools) by local people. However, some communities include proportionately more categorised useful species, receive greater use, and are accorded different levels of importance for particular cultural and economic practises than others. For example, coastal vineforest communities demonstrate highest historic Aboriginal population densities, greatest use by people and highest numbers of plant species used for a wide array of purposes. These are also the environments where vegetation structure and species composition are most readily manipulated using fire to achieve different economic and cultural outcomes. This work has application in the identification, mapping and prioritisation of cultural landscapes for management actions, but does not imply that particular cultural landscapes are any more constant than the plant communities with which they are associated.

Role of the Wet Tropics in the life of the Community

DrJoan M Bentrupperbäumer[1] and DrJoseph P Reser[2]
[1]James Cook University, [2]Northern Territory University

This paper examines the perceptions, attitudes and appraisals of the community residing in the Wet Tropics bioregion with respect to the Wet Tropics World Heritage *Area* (WTWHA), the Wet Tropics Management *Authority* (WTMA) and other Management Agencies, and the role of the WTWHA in the life of the community. The reported results are based on the responses of 788 residents of the Wet Tropics bioregion participating in a community survey and a further 1012 community residents who participated in a companion WTWHA site level visitor survey. In contrast to the *community survey* the content focus of the *site level survey* (including community residents) was on perceptions and appraisals of the natural environment, the infrastructure and facilities, the social environment, and visitors' experience at WTWHA visitor sites. Overlapping areas of survey content focus included community awareness and knowledge levels with respect to the WTWHA and WTMA, levels of support for and appraisals of management effectiveness and performance, and identification and concern for threatening processes. The survey findings show that the community residing in the Wet Tropics bioregion views the WTWH *Area* as an integral and cherished part of their surrounding natural and cultural landscape and natural environment. Furthermore, the findings suggest that community views have changed substantially over the past two decades leading up to and following the controversy and debate with respect to the WTWHA listing in 1988, with the World Heritage status of the Wet Tropics well recognised, fully accepted and endorsed by the community, and highly valued.

Estimating rainforest canopy connectivity across highways in the Wet Tropics World Heritage Area

Professor David Gillieson[1] **and Mr Les Searle**[1]
[1]School of Tropical Environment Studies & Geography
James Cook University, Cairns

The availability of high resolution (metre to sub-metre) digital imagery presents opportunities for the estimation of landscape ecology metrics at the individual tree canopy scale. In the Wet Tropics of Queensland, linear barriers such as roads and powerlines fragment rainforests, and limit connectivity for a variety of species. In this study we estimate the canopy connectivity and road verge condition across a major road that bisects rainforest communities on the coastal escarpment near Cairns. Road details are gained using AutoCAD files from the Main Roads Department, while canopy details are gained from orthorectified digital aerial photography and video imagery. Their analysis in GIS by image classification and vector intersection techniques enables estimation of both canopy connectivity and cover type and percentage along road segments. The implications of this analysis for "No Net Loss" in World Heritage values during road upgrade are discussed.

Wait for me! It's not too late to let the fish through

Mr Ross Kapitzke
Senior Research Engineer (Environmental), School of Engineering,
James Cook University, Townsville

Society's move from traditional to more sustainable resource development goals and practices is manifested in infrastructure designs that must meet utilitarian demands for integrity and function, while protecting biodiversity, amenity and cultural values. Practitioners and managers involved in infrastructure development in rainforest and other sensitive environments can only meet these sustainability goals, however, if the appropriate technology is available, and if they are equipped with adequate protocols for planning, design and implementation. This situation is achieved, in turn, via fundamental science, innovation and practical application of concepts through R & D programs such as those in the Rainforest CRC. Many advances have been made in sustainable design for linear infrastructure such as roads, where for example, biophysical impacts related to terrestrial fauna passage and stormwater runoff; and socio-cultural impacts related to heritage, amenity and user needs are now mitigated through application of new technologies (e.g. fauna underpasses and water collection systems), and innovative planning and design tools (e.g. no-net-loss and multi-objective decision support).

Similar and more ubiquitous problems abound, however, in fish passage barriers at road-stream crossings, where obstacles to fish movement such as high velocities, shallow water and excessive exit drops, can severely deplete fish populations and reduce species diversity within a catchment by obstructing their migration to critical spawning or growth habitats. Unfortunately, many proposals for fish passage remediation are largely speculative, and hence unsuccessful, as they are based on poorly developed planning and design protocols and remediation techniques. This paper describes R & D activities based on fundamental hydraulic and biological science, innovative design and case study applications that are leading to new fish passage technologies and planning and design protocols for practitioners and managers. Field and laboratory test results for culvert fishway techniques are discussed, conceptual designs are described, and case study examples of fish passage remediation are presented. Researchers, managers and practitioners from various disciplinary backgrounds will benefit from this presentation, which gives hope for resource managers and practitioners, and provides a future for fish waiting to be let into the action.

PRODUCTION VERSUS BIODIVERSITY
Session Preamble

Mr Peter Erskine[1], Dr John Kanowski[2], Associate Professor Carla Catterall[2]
[1]The University of Queensland, Brisbane, [2]Griffith University, Nathan.

In the former rainforest areas of Australia, tree-planting has been used for various purposes, and different people have planted trees in different ways. For example, large areas of monoculture hoop pine planted by DPI-Forestry were meant to be productive and to provide a return for treasury investment dollars. At the other extreme are the dense and diverse plantings that aim to restore rainforest biodiversity to a site, for example those undertaken by community-based organisations and recently funded by the NHT scheme.

But there is an increasing interest in forms of reforestation that might in some way blend the outcomes of timber production and biodiversity. For example, rural landowners often establish small-scale farm forestry plots with mixed goals. However, such plantings also run the risk of not achieving either goal. The future may also bring novel combinations of reforestation with industrial projects (for example, to provide economic benefits associated with eco-accreditation, carbon credits or biodiversity credits)

This session aims to address the opportunities and limits to combining production and biodiversity goals. It will draw especially on past experience with farm forestry systems, but also consider future scenarios and challenges.

Some relevant questions include:

What does "biodiversity" mean?
What is production trying to maximise?
What are (or should be) the objectives of farm forestry systems?
What mechanisms would help landholders include greater levels of biodiversity in their plantations?
Does it make sense to combine production and biodiversity goals? In what circumstances?
What can be achieved through site versus landscape design ?
What are the important knowledge gaps?

Six speakers will give brief 10-minute cameo views of selected aspects (7-8 min talk, 2-3 questions), based on their experience and/or research findings in tropical and subtropical rainforest regions of Australia.

This will be followed by a panel discussion involving the six speakers, with questions and comments from the audience.

Student Presentation Abstracts Index

Habitat fragmentation effects on beetle species in upland Australian Wet Tropics rainforest

Mr Peter Grimbacher, Associate Professor Carla Catterall, Professor Roger Kitching
Griffith University, Nathan

The conversion of tropical rainforest into pasture or croplands and subsequent fragmentation of remaining rainforest is considered to be a major threat to biodiversity. Because of their high species and trophic diversity beetles make excellent study organisms to test habitat fragmentation theories. A basic premise is that pasture would have a different species composition from that of intact rainforest. Theories of patch-related species extinction predict that small remnants could contain a subset of forest species. However, if edge effects are important, the species composition in edges and small remnants should together differ from that of forest interiors.

The Atherton Tablelands landscape in North Queensland contains rainforest remnants of varying sizes surrounded by a matrix of pasture. Within this landscape beetles were sampled from six well-separated replicate sites within each of: pasture, small (0.75-4.80 ha) rainforest remnants, and both interiors and edges of large (40-400 ha) rainforest remnants. Four flight interception traps were operated for two weeks at each site. The 5935 beetles captured were placed into 325 species within ten family/ sub-family groups. Pasture sites were characterised by a species composition that differed significantly from that of intact rainforest sites (ANOSIM, $P<0.001$). When northern site outliers (corresponding to a drier climate) were excluded from analysis, the species composition of small remnants was most dissimilar to that from rainforest interiors (ANOSIM, $P =0.01$). Edges from large remnants were more similar to interior sites than small remnants. The relative abundance of 75 of the most common species were tested amongst intact rainforest sites with 21 species showing significant differences (ANOVA $P <0.04$). Thirteen of these species showed a response consistent with an edge effect mediated by microclimate changes.

These results suggest that edge effects are drying out small remnants and edges, with some beetles showing species specific responses by increasing or decreasing in abundance with increasing aridity.

Paternity and maternity in spectacled flying-foxes on the Atherton Tablelands

Samantha Fox
School of Tropical Biology, James Cook University, Townsville

Understanding the mating system of a species is important when considering relatedness, gene flow and the possibility of inbreeding depression. With a species in decline it becomes even more important as aspects of the mating system may reduce the capacity of a population to recover from disturbance or decline. The spectacled flying-fox is listed as Vulnerable under the Commonwealth's 'Environmental Protection and Biodiversity Conservation' Act (EPBC), however this listing is controversial among various groups that interact with the species. Basic population dynamics are not fully understood for this species, with the mating system being one parameter of the life history that is completely unknown.

Looking at patterns of relatedness within and between colonies using analysis of microsatellite loci will provide some insight into the mating system used by this species. Tissue samples were collected from paralysis tick-affected animals from two colonies on the Atherton Tablelands during the months of October - December 2002. Using mother-baby pairs and males from these two colonies I screened 200 individuals across five microsatellite loci to give a genotypic 'map' of the Tolga scrub and Powley Rd colonies to infer patterns of relatedness in these two adjacent locations.

Dispersal ability of rare and common Microhylid frogs

Yvette Williams, Michelle Waycott, Chris Johnson, Ross Alford
School of Tropical Biology, James Cook University, Townsville

Dispersal is often cited as a key factor in determining the relative rarity of a species. However, it is a difficult parameter to measure, especially in such small animals as microhylid frogs. Many studies of rarity either ignore dispersal or make qualitative estimates of dispersal ability. Here I present preliminary results measuring dispersal rates of 3 species of frog from the genus *Cophixalus* (1 common species and 2 rare species). Tissue samples were collected from 10-25 individuals at each of seven points at increasing distances apart. Mean dispersal distance was calculated using the molecular technique of Inter-simple sequence repeats (ISSR's). These analyses enable me to quantify the relationships between geographic rarity, as measured by distribution size, and dispersal ability for these species. The ability to determine if dispersal is limiting range size and the use of a relatively new genetic technique to measure dispersal makes this research innovative and will significantly improve our understanding of rarity.

Place attachment to the Wet Tropics World Heritage Area: A Wet Tropics bioregion perspective

Miss Sue-Ellen O'Farrell, Dr. Joan M. Bentrupperbäumer, Associate Professor Joseph P. Reser
School of Psychology, James Cook University, Cairns, School of Tropical Environment Studies and Geography, James Cook University, Cairns, School of Psychology Northern Territory University, Darwin.

Place Attachment is the emotional relationship or bond that exists between a person and a place that is considered to be special. Place attachment can develop through direct and active experience with the place, cognitive evaluations and also the vicarious experience of the place.

This research has explored place attachment to the Wet Tropics World Heritage Area (WTWHA) from the perspective of residents of the bioregion. The WTWHA is an interesting place to study due to the impacts that it has on surrounding communities. For example, the WTWHA provides a livelihood for residents who are associated with the tourism industries and through direct visitation, it provides places of recreation, social opportunities and relaxation. Also, due to the WTWHA forming such a dominant part of the North Queensland landscape, it provides residents of surrounding communities a high quality environment to live in.

The research utilised a regional survey designed for a larger research project. The aim of the survey was to elicit respondent views, knowledge and uses with respect to the different facets of living in the Wet Tropics bioregion. Through quantitative and qualitative measures, places of attachment and displacement were identified. Reasons for these feelings towards places were also explored. These findings have provided a foundation for future place attachment research and have generated recommendations for management agencies.

Detecting climate change impacts: where should we be looking?

Luke P. Shoo[1], Stephen E. Williams[2] ,& and Jean-Marc Hero[1]
[1]Griffith University Gold Coast, [2]James Cook University, Townsville

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Species are expected to shift up mountains and away from the equator in response to warmer temperatures associated with climate change. Shifts in ranges will lead to extinctions where climatically suitable environments are no longer available or cannot be reached. Previous efforts to detect change have focused on the edge of species ranges. We find that change will be detected more quickly and reliably if the same effort is spent tracking shifts in areas of high abundance that occur inside range boundaries. This approach will improve the capacity of conservation managers to identify and respond to threats of climate change.

The unseen costs of agricultural expansion: depauperate pollinator communities in isolated orchards

Katie Pritchard
James Cook University of north Queensland, Tropical Forest Research Centre, Atherton and the Rainforest CRC

Biotic pollination has been identified as a critically important ecosystem process under threat. Biotic pollinator declines have been attributed to pollinator habitat loss, habitat fragmentation, pesticide use and pathogens and disease. In agricultural landscapes, expansion of areas of land under cultivation inevitably results in a decline in native habitat. Decreased areas of remaining native ecosystems coincide with increased isolation of crops from them.

The diversity and total abundance of native pollinators visiting crop plants declines with increasing crop isolation. This in turn reduces total seed and fruit production.

In this study I tested the hypotheses that: (1) native pollinator species diversity and abundance declined with increasing isolation from rainforest habitat (2) these changes were reflected in declines in crop productivity (3) declines in productivity were due to pollinator limitation.

I tested these hypotheses in the tropical horticultural species *Annona squamosa* x *Annona cherimola* (custard apple) growing in 9 orchards of varying distance from naturally occurring rainforest habitat on the Atherton Tablelands, north Queensland. Pollinator diversity and abundance significantly declined with increasing crop isolation. While results indicated that custard apple production was pollinator limited in all orchards, fruit initiation in the orchard closest to rainforest habitat was significantly higher than all the other orchards isolated from rainforest by distances greater than 100 metres.

These results emphasise the benefit of incorporating native habitats (pollinator sources) into agricultural landscapes.

Tiny predators in the Big Scrub: species diversity and habitat specificity of mites (Acari: Mesostigmata) in the rainforest

Frédéric Beaulieu[1], Dr David Walter[2], Dr Heather Proctor[2], Professor Roger Kitching[3]
[1]University of Queensland, Brisbane, [2]University of Alberta, Edmonton,
[3]Griffith University, Nathan

Because of their cryptic nature, mites (Acari) are among the least studied animal groups, especially in tropical areas. The aims of this project are to assess the species diversity of predatory mites (Acari: Mesostigmata) and their specificity to rainforests, and to the canopy. Leaf litter of three broad forest types (rainforest, wet and dry sclerophyll) and suspended litter in the rainforest canopy were sampled in three localities, namely Lamington National Park, Brisbane Forest Park and Gambubal Research Station, in South East Queensland.

To test whether mite species are specific to rainforest, one hectare was randomly sampled on each side of a sharp transition between two forest types in 11 sites. To test the specificity of mites to the rainforest canopy, the litter from the crown of 56 crow's nest ferns (*Asplenium australasicum*) was sampled and compared with litter of the forest floor in three sites. In total, 211 morphospecies were identified, including 54 from rainforest only, 106 from rainforest and wet sclerophyll only, and 21 from dry sclerophyll forests only. The index *IndVal* (Legendre 1998) was used to identify indicator species, i.e. common in a given forest type, present in most sites, and rare or absent in other forest types.

Fourteen species were identified as indicators of rainforest, nine as indicators of rainforest and wet sclerophyll, and seven as indicators of dry sclerophyll forests. The rainforest canopy harbours almost as many species as the forest floor and at least 12 species were identified as canopy specialists. In addition to this high diversity and habitat specificity observed, many species were restricted to one of the three localities studied, suggesting that any rainforest and wet sclerophyll areas have locally endemic species. Therefore, at a global scale, these forests are very important reservoirs of mite biodiversity.

Canopy tree reproduction – finding out about the birds and the bees

S. Boulter, R. L. Kitching, B. Howlett
Australian School of Environmental Studies, Griffith University, Nathan.

The availability of canopy access tools, such as the canopy crane at Cape Tribulation, north Queensland, allows the opportunity to closely examine plant-animal interactions in the little-known rain forest canopy. As part of an on-going study of canopy tree reproductive biology, two congeneric tree species commonly found within access of the crane, have been studied for two years. Very different reproductive strategies were found for these two species.

The small white flowers of *Syzygium gustavioides* appear sporadically throughout the year in an almost continuous flowering pattern and have a broadly generalist reproductive biology. Coleoptera, Diptera, Thysanoptera and Hymenoptera were the most abundant flower visitors, although the dominant visitors appear to change with time. Short pollination trials using exclusion traps and scoring the growth of pollen tubes, showed small Hymenoptera as successful pollinators. However, exclusion of different size classes of visitors, suggest a range of insects may affect successful pollination. By contrast,

Syzygium sayeri flowers for 3-4 months during the dry season. Dominant visitors switched from bats at night to honeyeaters by day. Exclusion trials on this species suggest some low-level pollination success with insect visitors, but dominance of vertebrates in this pollination system. These contrasting reproductive strategies are likely to have implications for gene flow and reproductive success of these species, particularly if considered in disturbed or fragmented systems. Importantly, this study emphasises that one-off sampling of flower visitors for some generalist species will fail to identify important pollinators.

The influence of thermal environment on lizard morphology, life history and performance

Brett A. Goodman* and Andrew K. Krockenberger
School of Tropical Biology, James Cook University, Cairns .

Typically, the thermal environment varies gr ies' geographic range due to various factors (e.g., altitude and latitude). However, in reptiles, because temperature directly influences the amount of time individuals can spend within their preferred body temperature range, populations also vary in the amount of daily and annual activity time that is available. As a direct result, populations also vary in the amount of time individuals have available for both resource acquisition and assimilation, and therefore, allocation to growth and reproduction. As a consequence of this increase in activity, such populations are also likely to experience elevated levels of mortality. All of these, seemingly opposing, costs and benefits are likely to have a powerful influence on lizard morphology and life histories. Further, because lizard morphology has a powerful influence on locomotor performance at ecologically relevant tasks (e.g., sprinting, climbing, etc.) lizard life history may also affect lizard performance, via its affect on morphology. Thus, among-population differences in lizard morphology are likely to occur as a direct result of; differences in thermal environment, or, a local adaptive response to contemporary processes (e.g., predation). This research examined patterns of morphological, life history and performance variation, in response to shifts in the thermal environment of the tropical skink, Carlia rubrigularis. The and the implications of global climate change on these traits are discussed.

The determinants of vegetation pattern in Australian sub-tropical rainforests

[1]D.Yates, [2]G. Wardell-Johnson, [1]K. Richardson and [3]W. J. F. McDonald, [1]Laidlaw, M.
[1]School of Life Sciences, The University of Queensland, Brisbane, [2]School of Natural and Rural Systems Management, The University of Queensland, Gatton, [3] Queensland Herbarium (EPA)

Floristic patterns inherent in rainforest communities can be observed at many scales of resolution. At a regional scale, geographical variation in soil typology, topography, microclimate and disturbance can result in high levels of environmental heterogeneity. These variables and processes together produce a set of conditions which will determine the nature of the regional flora and in turn, the direction of conservation and management strategies that may be needed. This project will endeavour to explain regional patterns within the rainforest vegetation communities of southeast Queensland and northern New South Wales, and their association with climatic, geographic and edaphic processes. Remotely mapped environmental layers and vegetation survey data will allow the identification of those factors most responsible for vegetation community variation. This project will also examine the significance of biogeographic history, edaphic compensation and climatic patterns in determining the distribution of selected species. This information will then be used to model the potential distributions of known rare and endemic species within the region and to examine the implications of climate change for these rainforest communities.

Changes in a frugivorous bird assemblage and rainforest seed dispersal in a fragmented landscape

Ms Cath Moran
Australian School of Environmental Studies, Griffith University, Nathan

Frugivorous birds disperse the seeds of a large proportion of rainforest plants, hence differences in frugivorous bird abundance between fragmented and forested parts of the landscape may affect seed dispersal and rainforest regeneration dynamics. We investigated frugivorous bird use of rainforest habitats in a fragmented subtropical landscape in south-east Queensland. Frugivorous bird abundance was surveyed in three site types – extensive forest, remnant and regrowth patches. Individual bird species varied in abundance between the three site types. A suite of species showed decreasing patterns of abundance in remnants and regrowth patches, while others exhibited increasing abundance in these sites. If birds in the 'decreaser' group disperse seeds from a different set of plant species to those in the 'increaser' group, seed dispersal in rainforest remnants and regrowth patches will be different from that in extensive forest. We present analyses of dietary composition information and discuss consequences for seed dispersal and rainforest regeneration. Our results suggest that certain plants, including large-seeded species and particular plant famlies are less likely to be dispersed in fragmented and disturbed parts of the study landscape than in large tracts of forest.

Plant species' attributes and the spatial ecology of regeneration in secondary rainforests

Ms Jessie Wells [1,2]
[1]The Ecology Centre, University of Queensland, [2]CSIRO Tropical Forest Research Centre, Atherton

In view of extensive loss, fragmentation and disturbance of rainforests over the past century, further understanding of secondary rainforest ecology is vital to conservation and management of altered rainforest landscapes in the Wet Tropics. This project combines perspectives from spatial ecology and plant functional ecology, relating spatial patterns of regeneration to i)spatial distributions of rainforest cover and source plants, and ii) ecological traits of plant species, including dispersal mechanisms, age of reproduction, life-span, and attributes of seeds, stems, and leaves.

This research is based on studies of plant regeneration in secondary rainforests on abandoned pastures, and adjacent, intact rainforests on the Atherton Tablelands, Queensland, and at La Selva Biological Station, Costa Rica.

'Comprehensive' studies quantify changes in representation of plant species and functional traits with distance from intact rainforest, and through strata from understorey to canopy. Analyses consider six attributes of each species present along 180m transects from primary into secondary rainforest. Focal Species studies at 13 sites involve analysis of a more-extensive set of functional traits and their inter-relations, and spatial modelling of 'regeneration shadows' for individual species, based on source distributions and the estimation of source strengths and probability density functions for dispersal distances, via Likelihood methods.

The capacity of lantana (*Lantana camara* L.) to displace native vegetation

Mr Daniel Harry Stock [1,2] **and Dr Clyde Hamilton Wild** [1]
[1]School of Environmental and Applied Sciences, Faculty of Environmental Sciences, Griffith University, [2]Rainforest CRC

Lantana is a highly aggressive weed well established throughout eastern Australia and is able to displace native vegetation under a range of circumstances. Whether lantana is able to displace native vegetation in the absence of anthropogenic disturbance is subject of some disagreement in the literature. Some authors claim lantana can displace rainforest and resist its reestablishment. For example in dense subtropical rainforest, it has been shown that lantana thickets can displace dense subtropical rainforest, prevent its reestablishment and disrupt succession of disturbed sites.

On the other hand, some authors claim that lantana cannot displace rainforest. For example in the tropical rainforest of northern Queensland, it is stated that lantana is not considered as a conservation threat as it is unable to displace rainforest and only persists along edges and where the canopy is open. In southeast Queensland, it is postulated that lantana cannot displace rainforest, as it cannot live under closed canopy. It is further stated that in cleared/disturbed moist subtropical rainforest in southeast Queensland, lantana can be prevented from further displacing rainforest and from preventing succession at these disturbed sites.

Poster Abstracts Index

Poster abstracts are listed alphabetically. Student presenters are marked with a *

Dr Ros Blanche[1], **Mr Rob Bauer**[1] **and Dr Saul Cunningham**[2]
[1]CSIRO Entomology Atherton; [2]CSIRO Entomology Canberra

Insect-assisted pollination of peanut flowers: An untapped ecosystem service?

Flowers of peanut (*Arachis hypogaea* L.) are primarily self-fertilised but yields are reportedly increased if bees trigger pollen release. We tested whether bees on the Atherton Tablelands were providing this service and whether bees in peanut crops were associated with rainforest. We collected insects in peanut crops for the duration of the flowering period and measured peanut yield in three treatments at each crop site. In one treatment plants were caged to exclude bees, in another plants were partly caged to take shading into account and in a third plants were enclosed only by the cage frame, so that bees had free access. Three crop sites were located within 500 m of rainforest and four sites were 5-10 km from rainforest. We chose sites near and far from rainforest to establish a contrast in the pool of bees available to visit peanut flowers. The design was based on the assumption that native bees would be associated with the kind of vegetation near the crop site. We caught few bees capable of triggering pollen release and found no evidence that peanut yields were improved by bees. This could mean that insect-assisted pollen release does not enhance yields of the peanut varieties grown on the Atherton Tablelands. Alternatively it could mean that the current crop environment does not attract bees in sufficient numbers to have a measurable impact on peanut yields and that managing crops to increase bee visitation could result in higher yields.

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Mixed species plantations: does diversity help tropical eucalypts grow faster, better, longer?

The sustainability of intensively managed monoculture plantation forestry is an important problem facing growers, especially companies, worldwide. Declines in site fertility can limit sustained plantation forestry in tropical environments. Because of either resource partitioning or facilitative processes, mixed-species planting using nitrogen-fixing species have been used to examine sustaining or improving soil fertility.

Preliminary results from two-species mixtures including the fast growing *Eucalyptus pellita* have shown some productivity advantages, and some disadvantages. The reasons for these results are not well known. Furthermore, the longer-term effect of growing these valuable timber species in mixtures on both the tree form, the wood characteristics and the soil nutrient concentrations are not well known.

With support from an ARC-Linkage project, and using established trials and community plantings in north Queensland, this project aims to answer questions about the productivity and sustainability of growing tropical eucalypts in mixed-species designs compared with using traditional, cheaper and more easily managed single-species designs. With measurements of above and below ground variables, including stand growth, tree form, branching habits, nutrient analysis of soil, organic matter, foliar and leaf litter, growth models will be used to assess whether mixed species plantations help tropical eucalypts grow faster, better and longer.

Ms Caroline Bruce, Dr David Hilbert, Mr Trevor Parker
CSIRO Tropical Forest Research Centre and Rainforest CRC

Landcover Change in Tropical North Queensland, 1988 – 1999

Remote sensing has been used extensively for the mapping of landcover, as it can offer a cost-effective alternative means of mapping large and inaccessible areas. Where historic remotely sensed imagery exists, classification of these datasets allows also an analysis of landcover change over time.

This poster presents the landcover mapping and change detection results for 3 eras (1988, 1994 and 1999) of Landsat TM/ETM+ satellite imagery covering the Wet Tropics region of Queensland. After application of a number of pre-processing routines to reduce the occurrence of brightness and spatial errors over space and time, a number of derived bands was produced. A subset of the derived and original bands, optimal to the output landcover and vegetation classes, was then selected by applying Transformed Divergence separability. A number of different parametric and non-parametric classification procedures was applied to a test area and the procedure which gave the best accuracy was applied to the complete dataset for each era. A post-classification comparison change detection algorithm was applied to determine landcover changes between 1988 and 1999.

Dr Scott Burnett
Queensland Parks and Wildlife Service, Atherton

Monitoring mountaintop mammals: an owl of an exercise

Wildlife communities on the mountaintops and upper slopes of wet tropical north-east Queensland have been identified as particularly susceptible to projected climatic trends over the next 50 years. The hotter and drier conditions anticipated over this period are expected to raise the altitudinal limits of the mesotherm archipeligo such that most endemic species become extremely localised or extinct in the wet tropics.

Monitoring these changes can be time consuming and costly, and where mammals are concerned, can be ineffective due to low trap success or observability. This problem can be circumvented by the use of prey skeletal remains left by Owls at their daytime roosts. Of the three rainforest owls in the wet tropics area, Sooty Owls, *Tyto tenebricosa multipunctata,* are the most appropriate species to use: (i) they prey almost exclusively on mammals, and (ii) they exhibit very high roost site fidelity. Sooty Owls consume all small and medium-sized, terrestrial and arboreal wet tropical mammal species, and regularly roost in easily accessible sites where they regurgitate the intact skulls of their mammalian prey, fascilitating easy identification. Once Sooty Owl roosts are located, they can be visited at predetermined intervals and all prey material removed and identified in the lab, in a matter of hours per site. It is not possible to monitor many of the small endemic mammals using conventional techniques, and for those that are trappable, many days are required in the field per site. Potential problems with the technique include: (i) the unknown effect of individual dietary choice among owls, and, (ii), if prey community changes are very abrupt, owl populations maybe impacted and roost sites become vacant. These problems can be circumvented by sampling a high number of roosts within each geographic area. Data collected over the past 10 years at upland sites in the Lamb Range and the Windsor Tableland do not indicate any changes in density of endemic wet tropical mammal community structure.

Karen Coombes
School of Tropical Biology, James Cook University and Rainforest CRC

Gastrointestinal morphology in Lumholtz tree-kangaroo, *Dendrolagus lumholtzi,* an arboreal folivore of tropical north Queensland

Tree-kangaroos are the largest and the only foregut fermenting arboreal folivores in Australia. Arboreal folivory is an unusual ecological niche for a kangaroo. Macropods inhabit a range of ecological niches from moist forest to desert and their gut morphology varies accordingly, with a trend toward increasing relative size of the tubiform forestomach with increasing body size and grazing. Tree-kangaroos are browsers and have a gut morphology that fits intermediately between browsers and grazers, with large sacciform and tubiform forestomach regions of similar size. This study examined the gut morphology of 22 road-killed Lumholtz's tree-kangaroos, *Dendrolagus lumholtzi,* on the Atherton Tablelands and compared them to previous studies on other macropod species. *D. lumholtzi* has a greater stomach capacity and a larger percentage of stomach contents for its bodyweight (14.6%±1) than other kangaroos, but is similar to sloths and colobine monkeys which are also foregut fermenting arboreal folivores. It has been suggested that a larger sacciform forestomach allows for more low quality, high fibre plant material to be processed.

Ian Curtis
School of Tropical Environmental Science and Geography, James Cook University

Valuing Ecosystem Services in a Green Economy

The primary aim of the research was to develop a new or modified approach to the economic conundrum of valuing non-market (unpriced) goods, typically environmental goods and services. The approach adopted had to be practical, encourage accounting and investment in natural assets, and have application with respect to methods by which acquisition of ecosystem services, preservation of current conservation values and rehabilitation could be financed.

The economic theory of value is the study of market phenomena, which attempts to analyse and explain price triggers *a posteriori* under a variety of hypothetical market situations. Conversely the theory of valuation is concerned with *a priori* interplays in actual market situations. As there is an exponential relationship between human population density and property values, and hence scarcity of ecosystem services, the surrogate market for this study was the property market. The surrogate market enabled shadow prices for ecosystem services to be derived. The value of land at any point in time is dependent on the benefits or benefits stream that it is estimated can be derived from it in the future. The unimproved or rateable value of a local government area will take into consideration all of the uses to which land is put. As some ecosystem services are essential to planetary life support, it follows that unrateable land, ie land held in the public domain (conservation areas) must be worth at least as much for the ecosystem services that they provide as rateable land put to its highest and best use. Non-pecuniary weightings for individual ecosystem services were derived by way of a multi-model multiple criteria analysis utilising anthropocentric and utilitarian criteria, which were then sensitised to threats, risk, uncertainty, precaution and the resistance and resilience of ecosystems. These non-pecuniary weightings were provided by a group of 50 scientists and economists using the Delphi technique.

However, the provision of ecosystem services can co-exist with land put to other uses, rather than just conservation areas. The level of provision of ecosystem services for the various tenure categories in the case study area was determined by the use of two models, the LOP (level of protection) and LUC (land use characteristic) models. The capital value for the areal component of a region that produces ecosystem services was then used to determine an annual flow (stream of benefits), known as the *Usus Fructus per annum*[1].

[1] **Included in the extended definition of *usufruct* attributed to Simpson and Weiner (Oxford Dictionary 1989) is a reference to Marsh (1864:35) 'Man in Nature', wherein he stated: *"Man has too long forgotten that the earth was given to him for usufruct alone, not for consumption". Usufruct* is a fine word and a fine definition of economic, environmental and ecological sustainability, yet it has all but disappeared from the literature. In the English-speaking world the term *usufruct*** was enturies h tenants holding *usufructuary* rights over land that provided them with life-support. Since colonialism, the term was used to describe certain rights of indigenous people to the land they occupied. *Usufruct* is used in this study in the context of its original meaning, 'use of the fruit of the land', but conceptually extended to include all of the goods and services, and in this sense the *usufruct* is the production function of the land. As the planetary life-support functions provided by ecosystems are the 'highest and best use' of land, the unimproved capital value of land in a bioregion or an LGA is a logical surrogate for the capital value of land that hosts ecosystem services. The *usus fructus per annum* is the capitalised annual value of these services.

Mr Andrew Ford
CSIRO Tropical Forest Research Centre, Atherton and Rainforest CRC

Why trudging with leeches, mozzies and getting scratched to pieces is important: The value of collecting expeditions for plants.

Carefully targeted expeditionary research to collect botanical specimens is vital for understanding biodiversity across the Wet Tropics. An extensive database consisting of historical data from the major herbaria and recent collections is used in this study to evaluate the taxonomic, geographical and environmental "completeness" of the existing data. Analysis of the collecting effort reveals heavy biases in the number of taxa collected per site and the actual species collected. A specially designed survey gap analysis tool was employed to evaluate how well the collections cover the environmental space, defined by climatic and other abiotic variables. This analysis revealed interesting survey gaps, some of which have formed the basis of recent collecting expeditions and have resulted in the discovery of 6 new species for the Wet Tropics bioregion, and 51 range extensions. A comparison is made on the "value-added" to a historical collection when further, well targeted, expeditions are made, as well as the difference in using expert opinion and modelled environmental parameters to select new survey sites using the specialised tool. Results demonstrate that further collections in undersampled areas vastly improve our understanding of plant distribution and biodiversity patterns.

Samantha Fox and Caitlin Mitchell
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Age estimation in flying-foxes

Spectacled flying-foxes (*Pteropus conspicillatus*) are one of four main species of flying-fox found in Australia and are listed as vulnerable under the federal EPBC act. A Conservation Plan and a Recovery Plan are currently being designed and implemented for this species, although the *Action Plan for Australian Bats* states that there is insufficient information on this species to adequately assess its' conservation status. One of the biggest debates surrounding the welfare of the spectacled flying-fox is whether or not this species is in decline or not. The fruit farmers who suffer crop losses due to marauding flying-foxes believe there are more than ever, while conservationists involved in annual censusing believe the species is in serious trouble. One of the key factors unknown in the life history of the spectacled flying-fox is longevity in the wild. The most important aspect in determining this factor is understanding the potential for recovery in a declining species. Spectacled flying-fox females give birth and rear their first young successfully at the age of 3 years and only have a single young each year. If we know the average longevity for this species we can determine whether the potential rate of increase outweighs the mortality rate and therefore gives the species a chance of recovery. By working out a demographic profile for a population we can also determine whether there are any age groups which suffer higher than average mortality rates and try and establish why. Aging is achieved by measuring the accumulation of cementum layers around the canine teeth. Methods and applications of this data are discussed.

Brett A. Goodman
School of Tropical Biology, James Cook University, Cairns.

Habitat specificity and thermal biology of some tropical Australian skinks

Habitat loss, habitat modification and global climate change are generally accepted as the main threats to the future survival of most species. However, in order to establish and implement appropriate conservation measures, a quantified examination of the microhabitat requirements of currently threatened taxa is required. This is because many organisms exhibit specific physiological requirements and/or morphological traits that may preclude them from other microhabitats. In tropical northern Australia, a number of threatened and rare skink species persist as; single populations, or are limited to single mountain ranges, or are reliant on distinct substrate types. This research quantified the; i/. substrate specificity, ii/. microhabitat requirements, and iii/. tested whether body temperature was determined by habitat type for 17 skink species from 6 genera.

Stephen McKenna
Faculty of Environmental Science, Griffith University

Fragmentation effects on the vegetation of tropical and subtropical rainforest fragments

The clearing and fragmentation of rainforest reduces biodiversity and alters important ecological processes. In Australia, considerable amounts of remnant rainforest exists as isolated fragments, but relatively little is known about the effects of fragmentation on the vegetation of these patches. However, Australia's unique evolutionary history, together with the relatively small area of past and present rainforest cover, mean that it is important to fill this knowledge gap.

This research project aims to identify the effects of rainforest fragmentation on the vegetation of rainforest fragments. The density of all plant species in a range of size classes (juvenile to adult) is being quantitatively assessed in a series of fragments and matched, non-fragmented, continuous forest sites located in two regional contexts: tropical Queensland and subtropical Queensland/New South Wales. The project will compare patterns of plant abundance and species richness, vegetation structure and floristic composition between habitat types and regions. The project will also compare the effects of fragmentation plant regeneration patterns from a guild-based perspective. For example, seed dispersal-mode guilds, such as large-seeded vertebrate-dispersed plants (whose putative dispersers are absent in some sampled fragments) compared with the possibly less fragmentation-affected canopy wind-dispersed tree species. Preliminary results from fieldwork recently conducted on the Atherton Tablelands will be presented and the direction of further research identified.

Mr Akihiro Nakamura[1], Assoc Prof Carla Catterall[1], Professor Roger Kitching[1], Dr Alan House[2]
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Development of soil and litter arthropod assemblages in rainforest restoration

The present study investigates factors that influence the diversity of soil and litter dwelling arthropods in rainforest restoration plantings. While the success of arthropod recolonization cannot be completely controlled, there are several factors that are potentially under control of restoration management. The effect of distance of restored sites from remnant rainforests on recolonization patterns of arthropod; inoculation (re-introduction of soil and litter dwelling arthropods); litter quality and quantity; and the efficacy of timber plantations versus ecological restoration in terms of the development of arthropod diversity have been identified as potential controlling factors. This PhD project includes a baseline survey of arthropods in pasture and rainforest. In addition, a field experiment that directly examines the factors listed above has commenced. A set of replicated sites has been selected on the Maleny plateau, in the Sunshine Coast hinterland. Arthropods were collected from the baseline survey from January to May 2003, and first sample collection of arthropods for the field experiment was conducted in September 2003. Various arthropod taxa are used in the present study, with particular emphasis on ants (Formicidae) and/or mites (Acari, Mesostigmata). Preliminary results are presented.

Ms Kerry O'Brien [1], Dr Steve Turton [1,2]
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Evaluating road cut/fill design: A biophysical assessment of major cuts and fills along existing State-controlled roads in the Wet Tropics World Heritage Area

Roads traverse forested landscapes, fragmenting habitats and disrupting natural processes that have been evolving for millions of years. In particular, road cuts and fills dominate a forested environment, causing physical and ecological impacts and compromising the visual quality natural landscape. This project is designed to evaluate the success of cut/fill design in addressing a range of biophysical success criteria along roads in the Wet Tropics World Heritage Area.

Cut and fill batters should be designed to a stable slope based on the site-specific considerations of topography, soil type, vegetation and rock formations. In sensitive forest environments, it is desirable to construct roads with the smallest possible footprint of clearing. Steep, narrow cuttings, particularly necessary in rocky areas, create the least initial disturbance, yet present i ck instability, erosion and sediment runoff, and are difficult to successfully revegetate, thereby increasing the linear barrier effect. In flatter terrain there is more of an opportunity to provide wider cuttings, which involve the greatest initial disturbance yet provide more opportunities for revegetation, allowing canopy connectivity to be retained and lowering the linear barrier effect of the road.

By studying the success of current cut/fill designs based on a range of engineering, ecological and aesthetic criteria, we can determine best practice environmental design for cuts and fills for roads in tropical rainforest environments.

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Place attachment to the Wet Tropics World Heritage Area: A socio-cultural exploration

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Place Attachment is the emotional relationship or bond that exists between a person and a place that is considered to be special.
This research has explored place attachment to the Wet Tropics World Heritage Area (WTWHA) by utilising a socio-cultural model of place attachment developed by Low (1992) as a framework. The model is comprised of six symbolic processes of people-place linkage:
a) genealogical linkage to place through history or family lineage; b) linkage to land through loss or destruction;
c) linkage to land through ownership and politics;
d) cosmological linkage through religious and mythological relationships;
e) linkage through pilgrimage;
f) narrative linkage through place naming and story telling.

The aim of this research was not only to explore residents' place attachment to the WTWHA by utilising Low's socio-cultural model, but also to extend the theoretical model to natural environments and different populations.

Catherine Pohlman, Dr Miriam Goosem and Assoc Professor Steve Turton
TESAG, James Cook University, Cairns and Rainforest CRC

Edge effects of linear canopy openings on rainforest seedlings

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Little is known about the effects of roads and powerlines on the ecology of native plants in the Australian Wet Tropics (Siegenthaler 1999). Linear clearings may cause alterations in the physical and biological characteristics of the adjacent rainforest. The long-term consequences of these "edge effects" for understorey microclimate and the distribution of rainforest plant species are unknown. We are investigating the edge effects of highways and powerline corridors in relation to the understorey microclimate, the distribution of native plant species and the impacts of physical disturbance (eg through fallen debris and increased wind speeds). We are also examining whether there are any similarities between the edge effects associated with anthropogenic linear canopy openings and those associated with natural linear canopy openings (ie watercourses).

Mr Chris Pratt
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The dispersal and bioavailability of heavy metals in roadside corridors adjacent to the Kuranda Range Road, Cairns

Heavy metal contaminants derived from automotive sources have been demonstrated to accumulate in roadside corridors.

Proposed upgrading works on the Kuranda Range Road in Far North Queensland would see an increase in the level of heavy metal contamination along this road. This road transgresses a section of Wet Tropics World Heritage Area (WTWHA) listed rainforest.

The proposed upgrading works have prompted this investigation into the dispersal and bioavailability of heavy metals in roadside environments adjacent to the Kuranda Range Road.

Specifically the aims of the investigation are to;

- identify the level of heavy metal contaminants in sediments that accumulate in roadside gutters along the Kuranda Range Road;
- establish the proportion of these contaminants that are available to organisms that live in roadside corridors;
- determine the mobility and solubility of heavy metal contaminants in roadside runoff; and
- understand the behaviour of heavy metal traffic contaminants associated with street sediments in order to design remediation strategies to minimise their release into sensitive ecosystems in roadside corridors.

Street sediments were collected from the Kuranda Range Road, composited and analysed for the heavy metals cadmium, copper, lead, nickel and zinc. Mean lead, nickel and zinc concentrations exceed the Australian and New Zealand Environment and Conservation Council (ANZECC) Draft Low Interim Sediment Quality Guidelines (2000).

The bioavailable proportion of these metals may be consumed by aquatic organisms in surface water bodies and detrital soil feeders in roadside corridors. It is difficult to accurately assess the bioavailable fraction of contaminants in soils, sediments and water because bioavailability varies with factors such as species, age and habitat.

Several extraction techniques have been developed to infer the bioavailable fraction of heavy metals in soils and sediments. These extraction techniques involve solutions comprising complexing agents such as EDTA or DTPA, which, when mixed with metal-contaminated soils or sediments, simulate transfer of these contaminants across cellular membranes.

Results from this investigation show that a large proportion of heavy metals in street sediments may be available to organisms that live in roadside environments. Essentially, heavy metals in roadside sediments may pose a threat to organisms that live in roadside corridors.

Further results from this investigation indicate that the bulk proportion of mobile metals is transported in the first volume of water, or ‘first flush’ of runoff in roadside corridors.

In summary, treatment of this ‘first flush’ runoff, containing elevated bioavailable metal loads, may be viewed as a critical component of tackling roadside pollution.

Mr Matthew Pye
Department of Tropical Plant Sciences, James Cook University, Cairns

Habitat fragmentation, population diversity and divergence in Bunyas (*Araucaria bidwillii*)

The Araucariaceae display an ancient association with rainforest communities in Australia. These communities have been subjected to a series of historical range contractions and expansions driven by climate change, leading to substantial fragmentation even within the same ecosystem. However, little is known about the impact of these processes in determining extant plant distributions or the diversity and divergence of species.

Placed in monotypic section Bunya, *Araucaria bidwillii* is the sole survivor of a once more speciose group. It is now confined to two disjunct occurrences in Queensland: the Bunya Mountains and Conondale Range in southern Queensland, and small populations at Cannabullen Falls and Mt Lewis in northern Queensland. Population genetic structure was investigated using RAPD markers, and is displayed here in an UPGMA dendrogram constructed using $_{ST}$ values obtained from AMOVA analyses. A large genetic divergence (of approximately 50%) characterises the large geographic disjunction between northern and southern Bunya populations, each presumably identifying refugia during non-favourable (i.e. drier) periods. The vicariant intrusion into the mesic tropics since the Cretaceous, with a subsequent loss of suitable intervening habitat, has been accompanied by differential fixation of genotypes between northern and southern Bunyas. However, genetic divergence within Bunyas does not follow an isolation by distance model: there is a closer association of the Conondale population with 'core' Bunya Mountains populations (e.g. Paradise) than that which exists between several populations within the Bunya Mountains. These populations have therefore responded in variable ways to historical processes, which have led to their extant distribution and genetic structure. Obviously, this historical genetic structure is a conservative view of the possibilities of the contemporary: accelerated habitat fragmentation and species-specific exploitation can only have exacerbated this structure over what represents a fraction of the generation time of this iconic species.

Mr Thomas Rayner
James Cook University, Townsville.

The feeding ecology of freshwater fishes of an Australian rainforest river

In equatorial regions, seasonality of rainfall creates distinct wet and dry seasons, with a corresponding pattern of river discharge. This seasonal flood cycle results in a seasonal shift in primary production, which in turn influences the structure and function of the aquatic food web. Fish species, often the dominant consumer group of aquatic food webs, have been shown to display marked seasonality of food uptake in relation to the flood cycle; periods of fasting coincide with low or falling water levels, whilst high feeding rates are associated with the increased abundance and diversity of prey items during the wet season. The dependence of fish species on seasonal patterns of hydrology has important management implications as gaining knowledge of seasonal behaviour allows for predictions to be made concerning events which occur at regular intervals. Unfortunately, most research to date has been conducted internationally. The majority of our knowledge of the trophic ecology of Australian freshwater fishes stems from autecological studies of single native or exotic species, or studies that have added a basic dietary analysis to a primary investigation of community structure. Research is required into the temporal aspects of fish feeding of Australian fishes at the community level. Such research would provide information for the management of Australian rainforest river catchments, which are under increasing pressure from activities such as the construction of dams and weirs, industrial water use, land clearing for the agricultural cropping on floodplain areas and potential future climate change.

Ms Anna Richards[1], Dr Ram Dalal[2], Assoc Prof David Lamb[1], Dr Susanne Schmidt[1]
[1]University of Queensland, Brisbane,[2]Queensland Department
of Natural Resources and Mines, Brisbane

The functional importance of forest biodiversity for carbon sequestration

Forestry practices worldwide are undergoing changes as the forest resources they relied upon are becoming scarce. This has been coupled to a changing perception that felling of old-growth forests and subsequent rapid loss of biodiversity is unsustainable from a long-term economic and environmental perspective. There is now a strong interest in developing new forms of tropical timber plantations and produce goods such as high-value timber, as well as ecological services, such as biodiversity and carbon sinks. While mixed rainforest plantations increase regional biodiversity compared to monocultures, there is also an indication that an 'over yielding' effect or production gain, relative to a monoculture can occur. If mixed species plantations are characterised by higher productivity compared to monocultures, then biodiverse stands of trees may increase carbon sequestration leading to a more productive stand.

To understand the importance of biodiversity for carbon sequestration, both below and aboveground measurements will be made: (1) soil carbon pools will be quantified beneath mixed and monoculture tree plantations using analysis of water-stable aggregates and nuclear magnetic resonance techniques; (2) Seasonal aboveground physiological measurements of nitrogen and carbon cycling will be studied in a two-species mixture of *Araucaria cunninghamii* and *Flindersia brayleyana* and compared to their respective monocultures. Photosynthetic measurements combined with leaf and shoot nitrogen transport compounds will be used to detect competitive or complementary relationships between the two species.

The outcomes from this study include optimisation of soil carbon models after reforestation with subtropical plantations of varying diversity levels. In addition, physiological information will be used to understand plantation establishment and growth under different species combinations and conditions to achieve optimal production. This is particularly important if we are to develop sustainable forestry systems that provide multiple benefits.

Mr Stephen Setter, Ms Melissa Setter, Mr Owen Zeimer, Ms Jodie Bocking
Queensland Dept. of Natural Resources and Mines, South Johnstone.

Chromolaena odorata seed longevity: A field study

The soil seed bank under a dense infestation of *Chromolaena odorata* (Siam weed) at Bingil Bay in North Queensland was sampled in 1994 and found to have a seed bank of 9050 seeds m^2. This site is typical of the type of location and environmental conditions existing for the majority of areas in North Queensland affected by *C.odorata* receiving an average annual rainfall of 3300mm. All of the plants in the infestation were destroyed. The same area was re-sampled 7 years later in 2001.The re-sampling showed a 99.9% reduction in the seed bank over the 7 years. Although the seed bank had decreased markedly, there were still 12.5 viable seed per m^2, potentially enough to cause a dense re-infestation. Initially there was a difference in the distribution of the viable seed within the soil profile with a higher percentage being found in the litter-1cm zone (70%) than at 1-5cm(30%). This was mirrored in the subsequent re-sampling. This study suggests that *C.odorata* seed remains viable in the field for at least 7 years under these environmental conditions. Further sampling of this site will be done in the future. As there are new infestations of this weed of national significance still being found we envisage an eradication program having to be continued for the next decade at the minimum.

Mr Daniel Harry Stock [1,2] and Dr Clyde Hamilton Wild [1]
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Invasion dynamics of lantana (*Lantana camara*) in the subtropical rainforest of southeast Queensland

Lantana is a highly aggressive weed well established throughout eastern Australia and is able to displace native vegetation under a range of circumstances. Whether lantana is able to displace native vegetation in the absence of anthropogenic disturbance is the subject of some disagreement.

Some authors claim lantana can displace rainforest and resist its reestablishment. For example in dense subtropical rainforest, it has been shown that lantana thickets can displace dense subtropical rainforest, prevent its reestablishment and disrupt succession of disturbed sites. In the wet sclerophyll and warm temperate rainforests of northern New South Wales, it is stated that lantana is capable of displacing and altering the structure of these forest types.

On the other hand some authors claim that lantana cannot displace rainforest, in the tropical rainforest of northern Queensland, it is stated that lantana is not considered as a conservation threat as it is unable to displace rainforest and only persists along edges and where the canopy is open. In southeast Queensland, there are also theories that lantana cannot displace rainforest, as it cannot live under closed forest canopy.

Typically, the mechanism whereby lantana is able to displace forest is reported to be by altered fire regimes or increase soil nutrients. In the rainforests of southeast Queensland, where typically fire is excluded and the natural soil nutrient levels are high, neither of these mechanisms would be likely. Lantana in these forests is able to maintain large and dense patches apparently for long periods. This leaves open the question whether lantana in these forests is able to displace the forest or whether the rainforest displaces lantana. The study being pursued here explores the reasons for the apparent inability of lantana to displace forest and focuses particularly on the shading of lantana and the capacity of forest species to grow through patches of lantana.

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Mapping and monitoring rainforest environments – regional scale applications From imaging radar and daily image data sets

Remote sensing has long been identified as an important tool for mapping and monitoring the environment at regional scales (>1000km^2) over time scales that now range from daily to decadal. Monitoring a rainforest environment initially requires a baseline map of the environmental variable, or indicator, of interest (e.g. vegetation type or cover), followed by a time series of maps to enable changes to the environment to be mapped and monitored. Radar (e.g. JERS-1) and optical (e.g. Landsat) remote sensing data provides different, yet complementary information. In forest, optical remote sensing provides information related to vegetation contour and chemistry, while radar is related to structure and moisture content. The complementarily of these data allows accurate baseline mapping, which can then be systematically updated using high temporal resolution data.

The recent launch of NASA's TERRA and AQUA satellites, both of which carry a MODIS (Moderate Resolution Imaging Spectroradiometer) sensor, allow the collection of regional scale data twice daily, over the entire earth. Image data from these satellites are processed into map-products (e.g. land cover, vegetation type, temperature) and distributed freely across the internet. These data represent a significant source of easily accessed information for agencies responsible for regional scale monitoring. This poster details a number of remote sensing applications for mapping and imagery for regional scale mapping, change detection techniques using optical and radar; and regional scale mapping using MODIS imagery. These applications demonstrate a rapid and cost effective remote sensing solution based on monitoring selected State of the Wet Tropics Indicators. The results show that: changes to the rainforest, such as canopy damage, can be detected depending on image resolution and extent of change; and the integration of optical and radar imagery can improve land-cover classifications compared to classifications using optical or radar alone. Future work will concentrate on operationalising these approaches.