



National Environmental  
Research Program

TROPICAL ECOSYSTEMS *hub*



Australian Government

Department of the Environment

# NERP Tropical Ecosystems Hub Conference 2014

5th-7th November  
Pullman Reef Hotel Casino, Cairns

Program Handbook





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## Welcome from the Conference Chair

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Welcome to the final conference of the National Environmental Research Program Tropical Ecosystems Hub. This 3-day event showcases the findings of four years of research and communication activities designed to help guide management of key north Queensland natural assets, the Torres Strait, tropical rainforests and the Great Barrier Reef. The release of the 2014 Outlook Report for the Great Barrier Reef reminds us again of the big challenges to achieving the sustainability goal of healthy and resilient natural ecosystems that underpin viable communities and sustainable livelihoods. The Tropical Ecosystems Hub investment has included research addressing biophysical and social-economic studies and the development of decision support systems that will contribute to meeting these challenges. The conference sessions are designed to continue the Hub's approach of the last four years, namely distilling the key findings of recent research and discussing these findings with users, and then jointly providing advice for ongoing priorities. Thus, the final five sessions focusing on "where to from here" are as important as the 12 sessions focusing on the impressive body of research carried out since 2011. Throughout the conference there will be many opportunities to relax, network and meet new colleagues. On behalf of the conference organising committee thank you for joining us and we look forward to an interesting program of presentations, discussion and new ideas.

**Di Tarte**  
*Chair, Steering Committee*  
*NERP Tropical Ecosystems Hub*





## Keynote Address

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Dr Wendy Craik is a Commissioner with the Productivity Commission and has considerable expertise in natural resource management and environmental issues and public policy more generally. She has held many senior positions including Chief Executive for the Murray-Darling Basin Commission (MDBC), President of the National Competition Council (NCC), Chair of the Australian Fisheries Management Authority (AFMA), Executive Director of National Farmers Federation (NFF) and Executive Officer of the Great Barrier Reef Marine Park Authority (GBRMPA). She has also been a director of a number of boards. She is currently a Board member of Dairy Australia, Chair of the Australian Rural Leadership Foundation, Deputy Chancellor at the University of South Australia and Chair of the NSW Marine Estate Management Authority. Wendy was awarded the Member of the Order of Australia in 2007 for service to the natural resource sector of the economy, particularly in the areas of fisheries, marine ecology and management of water reform, and for contributions to policies affecting rural and regional Australia.

Dr Wendy Craik  
*Commissioner*  
*Productivity Commission*











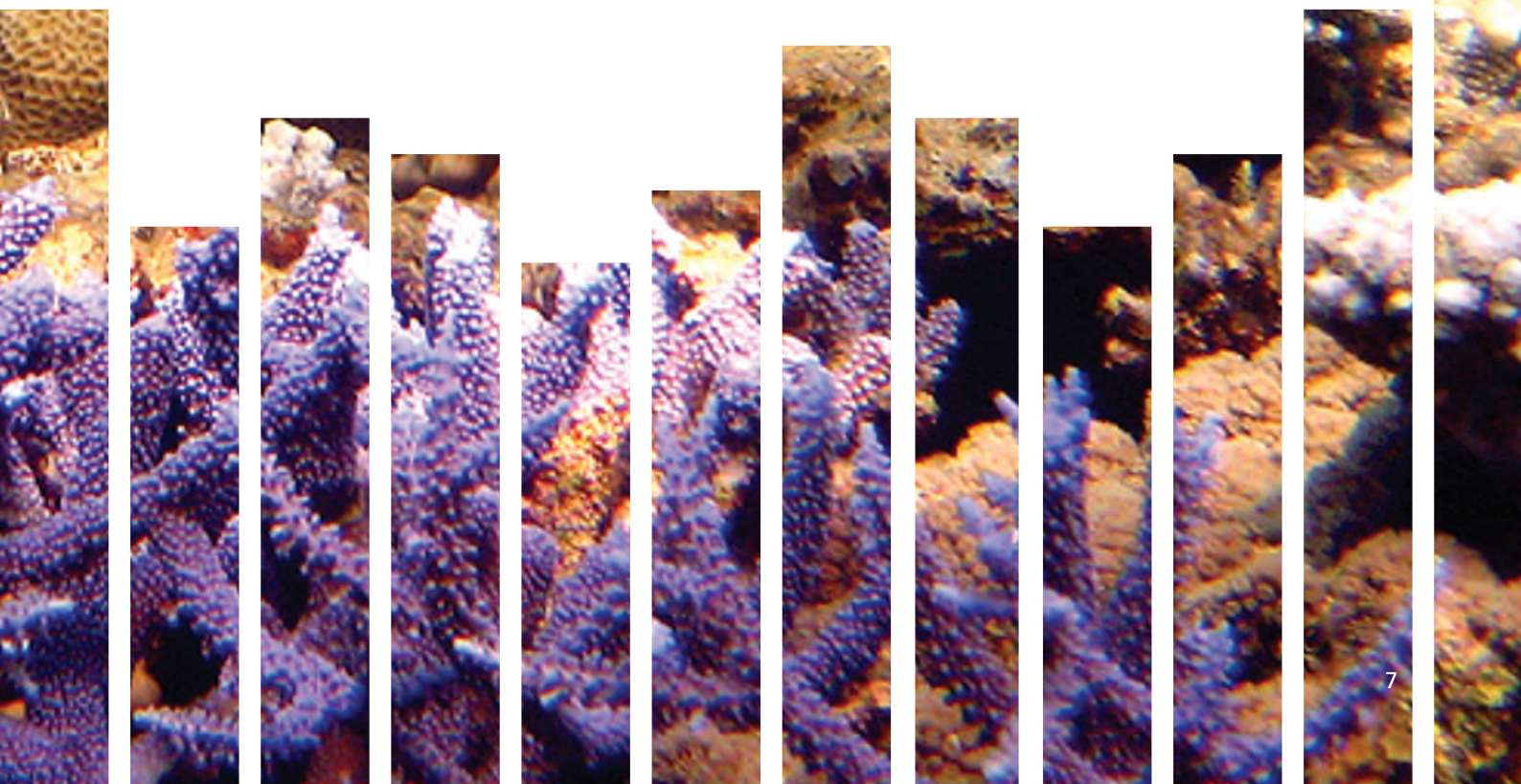


## Introducing the NERP Tropical Ecosystems Hub

The NERP TE Hub is an example of a transdisciplinary research program, which involves collaboration between researchers and research-users. The success of the collaborative research model depends on two-way sharing of knowledge among partners at all stages from program design, through project delivery, to final reporting. In 2011, a selection process involving a broad range of research users led to a science program for the NERP TE Hub consisting of 39 discovery projects, involving 240 researchers from at least six organisations. Since then, 15 new projects have been added for knowledge extension. The 2014 Conference of the NERP TE Hub is a final report from the whole program to a broad audience. To accommodate the range of interests, the Conference will be presented in themed sessions; each based on 3-4 aligned projects. Sessions will be convened by an appropriate research-user, who will bookend the science presentations and then elicit a forward-looking discussion from the audience. To all delegates, I thank you for making time to attend our final conference. I'm confident that you will find much of interest among the different sessions and I urge you to participate in the discussions with thoughts about "where do we go from here"?

**Dr Peter Doherty**  
*Science Leader*  
*Australian Institute of Marine Science*

Photo: RRRC







## Knowledge Brokering and Communication

Bridging the gap between research providers and research users is a persistent challenge for the uptake of advances in knowledge for management of our environmental assets. Integration of identified research users into Tropical Ecosystems Hub projects provides valuable direct and incremental extension to research application. However, research users are many and varied and fulfil myriad roles within our communities. The Reef and Rainforest Research Centre is an experienced knowledge broker and science communicator. The organisation develops a wide range of extension products aimed at maximising exposure of the applied research to primary producers, industry associations, regional bodies and conservation groups – all the way through to economic development groups and the three levels of government. Advances in knowledge that are published through the rigorous peer review process are distilled and simplified for extension to a broader audience. The development of accessible communication products, including a suite of web-based tools such as RSS feeds and links to the eAtlas, enables advances in knowledge generated through the Hub to reach a wide audience. Accessible dissemination of science is essential for the uptake and application of new knowledge.

Sheriden Morris  
Managing Director  
RRRC









# National Environment Research Program

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The National Environmental Research Program (NERP) provides for applied public good research. The overall objective of the program is to improve our capacity to understand, manage and conserve Australia's unique biodiversity and ecosystems through the generation of world-class research and its delivery to Australian environmental decision makers and other stakeholders.

The NERP builds on the lessons learned from the Commonwealth Environment Research Facilities program, replacing that program and focusing more specifically on biodiversity and improving research delivery to the Australian Government, other research-users and stakeholders.

NERP funding was allocated for biodiversity research and delivered information that the Australian Government needs to better inform environmental management, policy and decision making, both in the short-term and into the future. This includes understanding how ecosystems function, monitoring their health, maintaining and building their resilience, using them sustainably and exploring how to better use markets to protect biodiversity.

The NERP was conducted through five research hubs. The program attracted \$68.5 million in funding over four years to provide first-class science that is essential for sustainably managing Australia's environment. The Hubs are:

- Tropical Ecosystems
- Environmental Decisions
- Northern Australia
- Landscapes and Policy
- Marine Biodiversity

## Tropical Ecosystems Hub

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The largest of the Hubs, Tropical Ecosystems is a partnership between research providers with on-ground presence in Queensland, particularly AIMS, CSIRO, JCU, UQ along with other research providers and research-users, including government agencies (Federal, State), statutory authorities (GBRMPA, TSRA, WTMA), Natural Resource Management bodies, conservation NGOs, regional industries, Indigenous communities and the general public.

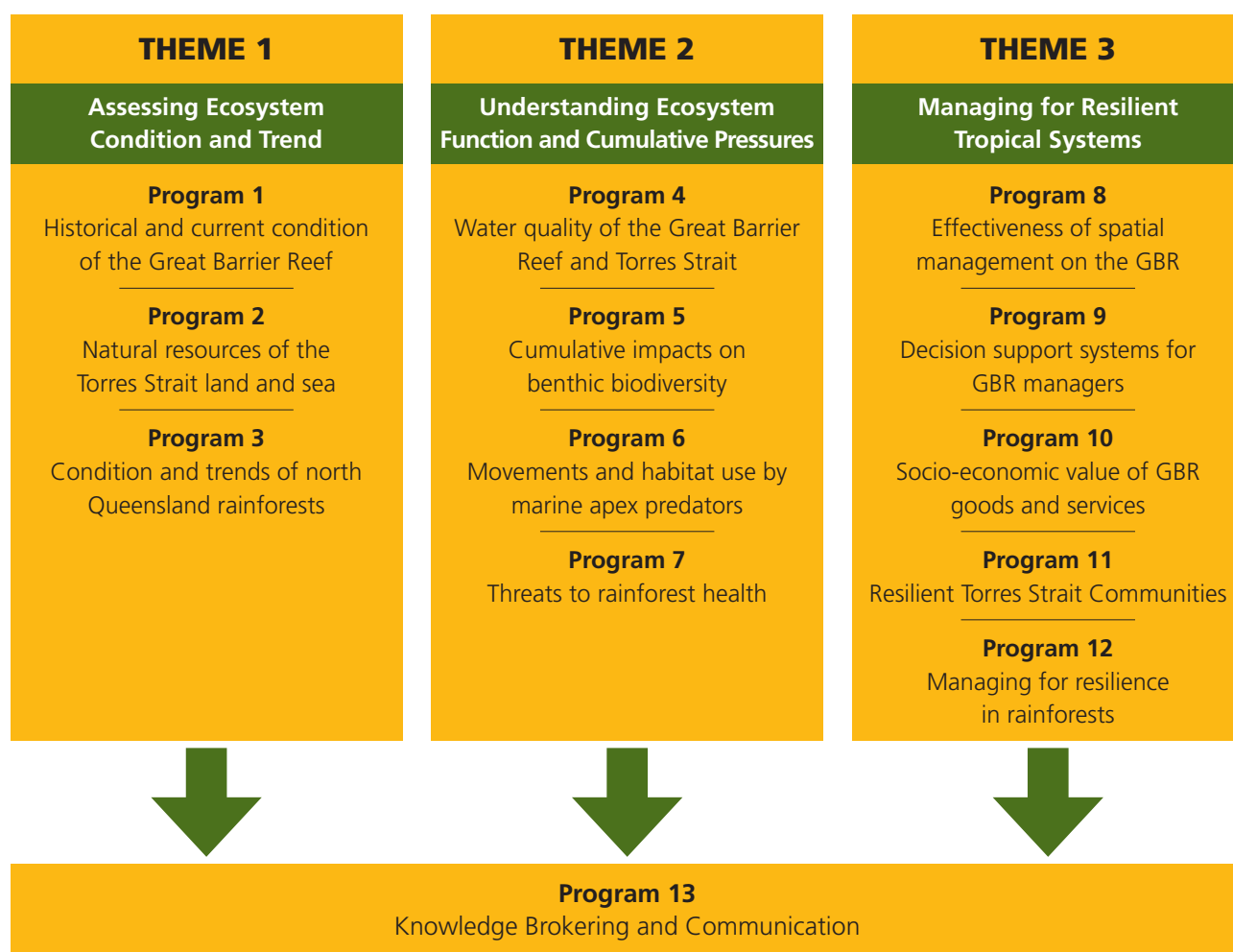
The Tropical Ecosystems Hub addresses issues of concern for the management, conservation and sustainable use of the World Heritage listed Great Barrier Reef (GBR) and its catchments, tropical rainforests including the Wet Tropics World Heritage Area (WTWHA), and the terrestrial and marine assets underpinning resilient communities in the Torres Strait, through the generation and transfer of world-class research and shared knowledge.

The Hub has a matrix structure of three themes and twelve programs designed to deliver the Hub goals on a thematic and geographical basis. While the Themes directly address the Hub goals, the program structure enables effective aggregation at the specific ecosystem scale. Table 1 outlines the Themes and Programs of the Hub.





Table 1: Themes and programs of the NERP Tropical Ecosystem Hub









# Wednesday 5th November

## MICHAELMAS CAY BALLROOM

8:30 Registration

9:00 Opening

9:10 Welcome to Country

9:30 Keynote Address

10:15 Science Leader

10:30-11:00 Morning Tea

### MICHAELMAS CAY BALLROOM

#### Historical and current condition of the GBR

*Convener* – Fergus Molloy (GBRMPA)

Dating coral mortality and characterizing drivers in the GBR

Ecological responses to environmental change on the GBR

27-year decline of coral cover on the GBR

Down and staying down?

Signs of recovery in GBR corals

### REEF ROOM

#### Key habitats of the Torres Strait land and sea

*Convener* – Damian Miley (TSRA)

Mangrove and freshwater habitat status of Torres Strait islands

Monitoring the health of Torres Strait coral reefs

Hazard assessment for water quality threats to Torres Strait marine waters and ecosystems

12:30-13:30 Lunch

#### Decision support systems for GBR managers

*Convener* – Randall Owens (GBRMPA)

Decision support for a vulnerable GBR under environmental change

Local people influencing regional coastal management: Decision support tools and experiences through case studies

Decision support for prioritising management actions on GBR islands

Using Bayesian networks for assessing cumulative impacts: A case study on the GBR zone

#### Resilient Torres Strait communities

*Convener* – Vic McGrath (TSRA)

Building resilient communities for Torres Strait futures

Improved disease detection and prevention of spread in Torres Strait

Torres Strait eAtlas

15:00-15:30 Afternoon Tea

### Socio-economic value of the GBR

*Convener* – Col McKenzie (AMPTO)

Social and Economic Long-Term Monitoring Programme (SELTMP)

Socio-economic systems and reef resilience

GBR eAtlas: making environmental research data accessible

### Managing turtle and dugong populations

*Convener* – Damian Miley (TSRA)

Dugongs and turtles in Torres Strait and the GBR: The big picture

Turtles and dugongs in Torres Strait and the GBR: Insights for each animal

17:00 End of Day 1

17:30-19:30 Evening Event: Indigenous Focus (**Urchins Room & Arlington Bar**, Level 2)



# Thursday 6th November

9:00 Start

## MICHAELMAS CAY BALLROOM

### Movements and habitat use by mobile predators

*Convener* – Darren Cameron (GBRMPA)

Maximising the benefits of mobile predators to GBR ecosystems: The importance of movement, habitat and environment

Drivers of juvenile shark biodiversity and abundance in inshore ecosystems of the GBR

Critical seabird foraging locations and trophic relationships for the GBR

## REEF ROOM

### Patterns of rainforest biodiversity

*Convener* – Steve Goosem (WTMA)

Rainforest biodiversity

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

The importance of peripheral areas of the Wet Tropics for conservation of biodiversity

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

10:30-11:00 Morning Tea

### Effectiveness of spatial management on the GBR

*Convener* – David Wachenfeld (GBRMPA)

Some effects of protection from fishing on offshore reefs of the GBRWHA

Do green zones work? Assessing the ecological effects of management zoning on inshore reefs of the GBR Marine Park

Do green zone networks work? Seascape connectivity among coral trout populations on the GBR

### Maintaining rainforest values

*Convener* – Travis Sydes (FNQROC)

Monitoring of key vertebrate species

Fire and rainforests

Invasive species risks and responses in the Wet Tropics

Harnessing natural regeneration for cost-effective rainforest restoration

12:30-13:30 Lunch

### Water quality of the GBR: Priority pollutants and threatening processes

*Convener* – John Bennett (EHP)

The effects of river discharge on regional turbidity in the GBR

The chronic effects of pesticides and their persistence in tropical waters

Experimental and field investigations of combined water quality and climate effects on corals and other reef organisms

Vulnerability of seagrasses to flood plumes

### People and rainforests

*Convener* – Jeff Sayer (JCU)

Towards co-governance with Rainforest Aboriginal peoples: Delivering biodiversity conservation and multiple co-benefits in our tropical forests

Relative social and economic values of residents and tourists in the WTWHA

Governance, planning and effective adaptation of ecosystem service markets to climate adaptation and landscape resilience

15:00-15:30 Afternoon Tea

### Water quality of the GBR: Policy responses

*Convener* – John Bennett (EHP)

*Research user speakers*

### Wet Tropics rainforests: Where to from here?

*Convener* – Andrew Maclean (WTMA)

17:00 End of Day 2

17:30-19:00 Poster Session with refreshments (**Urchins Room & Arlington Bar**, Level 2)

19:00-Late Evening Event: stand up finger food and drinks (**Coral Lounge**, Pool Deck Level 4)











# Friday 7th November

9:00 Start

## MICHAELMAS CAY BALLROOM

**Crown-of-thorns starfish:  
Where to from here?**

*Convener – Steve Moon (AMPTO)*

**Knowledge brokering across the landscape:  
Where to from here?**

*Convener – Carole Sweatman  
(Terrain NRM)*

## REEF ROOM

**Indigenous research:  
Where to from here?**

*Convener – Melissa George*

**Marine and terrestrial tourism:  
Where to from here?**

*Convener – John Courtenay  
(Alliance for Sustainable Tourism)*

11:00-11:30 Morning Tea

## MICHAELMAS CAY BALLROOM

**Concluding session**

*Convener – Di Tarte  
(Tropical Ecosystems Hub Steering Committee Chair)  
plus IG Chairs*

13:00 Conference Close with Lunch



# Session Synopses

Wednesday 5th November 11:00-12:30 Michaelmas Cay Ballroom



## Historical and current condition of the GBR

**Convener: Dr Fergus Molloy, Great Barrier Reef Marine Park Authority**

New analysis of systematically collected monitoring data over the past three decades has given a clear understanding of status and trend of coral reef condition in most of the Great Barrier Reef Marine Park. Two to three decades prior to this, ad-hoc surveys conducted by scientists and other interested parties provided sketchy data on condition. Earlier still, before the development of SCUBA and underwater survey techniques, we have only had above water photographs, written observations and anecdotal information to indicate what the Reef was like. New techniques now allow us to look much farther back into the history of GBR coral reefs and how they have changed over time. Putting current condition in the context of short, medium and long-term historical condition, as well as understanding how the system has responded (declined and recovered) to stressors are critical inputs to predicting what future trajectories might be and where management should be setting targets and focusing effort. Management has used condition at the start of systematic surveys as a baseline, however this may be a shifted baseline and recent declines may be a continuation of a decline that started long before.



## Dating coral mortality and characterizing drivers in the GBR

**Professor Jian-xin Zhao, University of Queensland**

Recent climate change and European settlement have had severe impacts on GBR coral communities, resulting in bleaching, mortality, diversity loss and habitat deterioration. However, the exact timing of such events is poorly defined, and unresolved issues exist regarding their extent and significance, notably, what state and dynamics should be considered "natural". The reconstruction and understanding of past changes provides a strong basis for assessing current status, linking reef degradation to stressors and devising targeted management strategies. Bearing this in mind, we have obtained >1500 high-precision U-series dates on dead coral rubbles or in situ colonies from the sea-floor surfaces, short sediment cores, storm ridges or uplifted coral blocks on reef flats and in situ fossil micro-atolls across the entire length of inshore GBR. The results show that: (1) Dead *Acropora* corals display spatial and temporal variability in their mortality age distribution patterns that appear to be related to disturbance events (e.g. cyclones, floods, bleaching, etc.) impacting individual sites, but their recovery has delayed in regions experiencing severe water quality deterioration since European settlement; (2) There was an increase in the mortality of robust massive corals (e.g. *Porites*) toward more recent time; (3) Storm/cyclone activity and flood history appear to correlate with PDO and ENSO cycles; (4) Reef accretion in the last 7000 years was episodic and shows large spatial and temporal variability; (5) Centennial sea-level fluctuations during mid-late Holocene (in the absence of high atmospheric CO<sub>2</sub>) may exceed the rate of sea-level rise in the last two decades.



## Ecological responses to environmental change on the GBR

**Professor John Pandolfi, University of Queensland**

Most records of the long-term ecological history of coral reefs are confined to the past few decades, long after degradation of such habitats first emerged. Prior results of ecological degradation associated with European colonization at sites in the Palm Islands and Moreton Bay led to a comprehensive study of inner reefs of the Great Barrier Reef extending from the Cape York Peninsula to Hervey Bay. Sediment coring coupled with U-series radiometric age dating allowed reconstruction of the ecological history of reef communities over the past few thousand years. Combined records from cores, death assemblages, and recent monitoring of life assemblages resulted in exceptional ecological



and temporal precision from past reefs through to their living counterparts in a continuous time series. We found spatial variability of coral reef communities in response to both natural environmental (climate) change prior to European colonization and after, when land use changes resulted in degraded water quality. Northern sites from Cairns to the Palm Islands were the most heavily impacted since European colonization, whereas sites further south in the Keppel Islands and further north along Cape York were less impacted. At impacted sites, historic community composition differs markedly from that derived from present-day and decadal-scale monitoring. The timing of reef community degradation argues against climate change as a major driver and focuses attention on water quality as an agent for limiting coral recruitment that is crucial for recovery from natural and anthropogenic disturbance. To avoid basing decisions on a much shifted ecological baseline, GBR managers need to consider the long-term history of individual reefs in determining drivers of change, deciding appropriate strategies for re-invigorating living reefs, and measuring the success of specific management objectives.



### **27-year decline in coral cover on the GBR**

**Dr Glenn De'ath, Australian Institute of Marine Science**

There is increasing concern about anthropogenic risks to the GBR, including mortality of the reef-building corals due to rising seawater temperatures, water pollution from terrestrial runoff and dredging, destructive fishing, over-fishing, and coastal development. Coral reefs degradation is a world-wide problem, yet specific causes of regional-scale decline and options to assist recovery have rarely been identified. Based on an extensive time series data on reef condition (AIMS LTMP: 2258 surveys of 214 reefs over 1985-2012), we have shown a major decline in coral cover from 28.0% to 13.8% (0.53% per yr); a loss of 50.7% of initial coral cover. Tropical cyclones, coral predation by crown-of-thorns starfish (COTS) and bleaching accounted for mortality of 1.42, 1.62 and 0.34% per year (42%, 48% and 10%) respectively, giving a mean total mortality of 3.38% per year. Given the estimated rate of decline of 0.45% per year for 1985-2011, the estimated net growth of coral cover was 2.93% per year for coral cover levels of 20%. Since this does not take into account any losses due to other agents (e.g. reduced calcification, diseases), this estimate can be interpreted as a lower bound of the increase in coral cover for the period 1985-2012. At the current rate of decline, coral cover will fall to 5.2% (CI=2.9%, 8.7%) by 2025.



### **Down and staying down? Signs of recovery in GBR corals**

**Dr Hugh Sweatman, Australian Institute of Marine Science**

The recent study by De'ath and co-workers showed that average coral cover on reefs of the GBR had halved over the preceding 27 years, based on AIMS Long-term Monitoring data. The rate of decline was not constant, and had been particularly rapid in recent years, substantially because a series of large storms affected large areas of the GBR. Here I report on the evidence that recovery is underway. While damaged colonies and some fragments can re-grow after storm damage, colonisation by coral larvae is thought to be the major contributor to recovery of coral communities. Such recolonisation depends on the existence of breeding populations to export larvae, but the large footprints, particularly of TC Yasi and TC Hamish, suggested that surviving populations could be distant and recolonisation could be slowed. Recent surveys of outer reefs have found increasing numbers of juvenile corals, evidence that GBR reefs retain the capacity to regain coral cover in the absence of disturbance. However, there has been another large cyclone (TC Ita) in the period, and a further wave of outbreaks of *Acanthaster* is underway north of Cairns and spreading southwards, so it remains to be seen how much GBR coral communities can recover before the next acute disturbance.



# Session Synopses

Wednesday 5th November 11:00-12:30 Reef Room



## Key habitats of the Torres Strait land and sea

**Convenor:** Damian Miley, Torres Strait Regional Authority

The Torres Strait is a region of rich biodiversity and cultural significance, and its ecosystems are amongst the most pristine in the world. The region provides a multitude of habitats for highly diverse Indo-Pacific marine flora and fauna, including dugongs and marine turtles. It has the largest continuous area of seagrass meadows in the world, significant areas of coral reefs with high diversity, extensive areas of coastal mangroves and productive fisheries. A suite of projects investigating the diversity, extent and health of mangrove and freshwater habitats, coral reefs and marine water quality issues has confirmed the importance of key Torres Strait habitats from not only a regional perspective, but also nationally, and internationally. Research regarding the ecological functions of these key habitats, and the threats posed to them, supports communities and management agencies in developing appropriate plans and implementing measures to protect them. Rangers are now employed in all outer island communities in Torres Strait, and have played an integral role in supporting this research and monitoring taking place in a culturally appropriate way. Effective collaboration between researchers and Rangers, facilitated by TSRA Land and Sea Management project teams, has ensured that management efforts are well targeted, based on the best available scientific information, and aligned with community priorities, and local and customary knowledge.



## Mangrove and freshwater habitats of Torres Strait islands

**Dr Damien Burrows, James Cook University**

The wetland ecosystems (mangroves, salt marsh and freshwaters) of Torres Strait are poorly known. We have undertaken wetland condition and biodiversity assessments on 20 islands. Highlights include recording 35 mangrove species, more than half the worlds total; finding two mangrove species new to Queensland and one new to Australia; greatly increasing the recorded diversity of mangroves on each island; recording more than 50 freshwater fish species; and recording the first freshwater crabs and turtles on several islands. Wetland condition has been assessed for 463km of shoreline on 20 islands, mostly via aerial videography, providing an extensive, permanent and reviewable archival baseline of wetland condition, against which future changes can be assessed. There are many forces driving change in wetlands (e.g. erosion, storm damage, feral animals, ghost nets etc.) and these vary considerably between islands. Management actions for improved wetland protection will be island specific. Torres Strait islanders have a long and intimate knowledge of their wetland habitats. Island rangers have been present on all our field trips, greatly increasing knowledge sharing and the mutual understanding of values and threats to these wetlands.





### **Monitoring the health of Torres Strait coral reefs**

**Dr Scott Bainbridge, Australian Institute of Marine Science**

Coral reefs of the Torres Strait represent the northern tip of the GBR and while they are ecologically important and of clear importance to island communities, comparatively little work has been done. This project has established a monitoring program to enable resource managers to keep abreast of key indicators of coral health and has trained local rangers to undertake ongoing monitoring. The project has documented 279 coral species and 301 fish species of which 92 are new records for the Torres Strait and nine are new for Australia. While the reefs are in good condition there is evidence they are at risk. Evidence was seen of crown-of-thorns starfish, coral disease and a reduction in some temperature sensitive corals. While the data show no long-term ocean warming, a small temperature rise and calm conditions in 2010 saw widespread coral bleaching for the first time. To understand this threat temperature loggers and ocean monitoring stations have been deployed and satellite images have been used to understand how patterns of warming in the Pacific Ocean impact the Torres Strait. Data shows conditions for the last few years were cooler than normal with a low risk of bleaching. The satellite data however shows warming in the Pacific, which may move the Straits back into warmer conditions.



### **Hazard assessment for water quality threats to Torres Strait marine waters and ecosystems**

**Jon Brodie, James Cook University**

The Torres Strait marine environment is of national and international significance. We undertook a qualitative assessment of water quality threats on the Torres Strait region using previous studies, analysis of remote sensing imagery, development of a hydrodynamic model and island inspections. We concluded that the current hazards to the environmental values of the region from water quality are relatively minor, and are specific to local areas. However, a number of important future threats were identified. Most importantly, the potential hazards from the transit of large ships through the region, including oil or chemical spills and groundings, are of greatest concern. Large-scale development in Papua New Guinea including gas platforms, oil palm expansion and port development may also be significant. Project recommendations for monitoring these potential impacts have been adopted by TSRA, with a number of activities commencing in 2014. These include measurement of the influence of the Fly River through analysis of remote sensing imagery and heavy metal analysis using water quality loggers, oysters and artificial bivalves at locations across the region. This study is the first regional hazard assessment of water quality risks and provides guidance for managers to make decisions regarding the relative importance of pollutant sources at a range of scales.



# Session Synopses

Wednesday 5th November 13:30-15:00 Michaelmas Cay Ballroom



## Decision support systems for GBR managers

**Convener:** Randall Owens, Great Barrier Reef Marine Park Authority

The Great Barrier Reef catchment is a desirable place to live and work. Our coastal communities are growing and the needs of local communities and economies are driving ever-evolving patterns of land use and stresses to the landscape. Overlay this with the environmental changes accompanying a changing climate and the challenges for the management of the GBR are considerably escalated. This is recognised and made clear in the Great Barrier Reef Marine Park Authority's 2014 Outlook Report and highlights the importance of good information to underpin decision making. The four projects presented in this session are meeting the challenge of providing decision support systems for GBR managers into the future. They each take a different perspective, but in essence are seeking, via their investigative methods and project outcomes, to provide a range of alternative solutions to ecological and associated societal management challenges that will facilitate focused decision-making informed by a heightened awareness of the various consequences, ecological and social, of actions taken (or not taken) by management. They tackle issues of cumulative impact and provide guidance as to the expected value of alternative scenarios that may result from applied management action.



## Decision support for a vulnerable GBR under environmental change

**Dr Ken Anthony, Australian Institute of Marine Science**

The GBR is under pressure from multiple stressors ranging from coastal development and run-off to climate change and ocean acidification. Understanding which areas of the GBR can be made more resilient and allowed to persist under global and local pressures are high management priorities. The purpose of this project is two-fold: (1) to model the spatial resilience and vulnerability of GBR corals under environmental change scenarios, and (2) identify the most cost-effective management actions to sustain coral cover GBR-wide, regionally and locally at priority sites. We demonstrate that climate change is projected to be the most significant pressure on the GBR as we approach year 2050, mainly explained by its global zone of influence. Locally and regionally, however, strategic investments in improved land-use practices can have positive flow-on effects on coral resilience. Of particular interest are factors driving COTS outbreaks and opportunities for interventions. We use decision analyses to propose strategic investments into land-use change and direct COTS control. Last, we conclude that triage represents smart resilience-based management under global and regional environmental change. Specifically, prioritisation of a subset of resilient GBR reefs and their goods and services are likely to present itself as a future management strategy.



## Local people influencing regional coastal management: Decision support tools and experiences through case studies

**Dr Cathy Dichmont,**

**Commonwealth Scientific and Industrial Research Organisation**

Stakeholder engagement is important for successful management, both to make effective decisions and to obtain support. However, in the context of coastal management, questions remain on how to effectively link decisions made in the catchment with objectives for marine biodiversity and fisheries productivity. Moreover, there is much uncertainty on how to best inform and elicit community input. A decision support process is described that elicits management objectives, priorities and options using two case studies. The case studies show that demand for local input and regional management is high, but local conditions influence the relative success. Differences between case study outcomes highlight the importance of discussing objectives prior



to suggesting management actions. In that regard, eliciting the broader community's objectives can be undertaken cost effectively through new survey methods. Governance arrangements can be developed that link managers and community members but continuity is essential. A big contributor to success is providing local information to community groups and embedding managers and influencers within groups. Access to local information and decision-making is key to both managers and locals. Of great value to positive outcomes, the scientists, managers and community members were prepared to work together and offer enormous volunteer time to work towards a common solution. The project has uncovered an expected conundrum that does challenge the effectiveness of management: there can be a significant gap between what managers think is happening or resulting from their actions and the perception of the community as to the effectiveness (and wisdom) of the management actions.



### **Decision support for prioritising management actions on GBR islands** **Dr Amelia Wenger, James Cook University (proxy for Professor Bob Pressey)**

Managers of islands in the Great Barrier Reef face difficult decisions when it comes to prioritising conservation management actions. GBR islands contain a wide variety of natural and cultural values, which face multiple and dynamic threats. The threats have to be managed within a fixed budget, using actions with varying levels of effectiveness and costs. Involving close collaboration with the Great Barrier Reef Marine Park Authority (GBRMPA) and the Queensland Government, the project has developed a prototype decision support tool. The information used to parameterize the tool is comprised of the best available information on species distributions, current island threats, management actions possible to mitigate threats, and the cost and effectiveness of these actions. This tool will help managers to identify management priorities within and between islands. It allows managers to maximise conservation outcomes, defined by specific objectives for diverse natural features (e.g. native animal species, vegetation assemblages, breeding aggregations). The project delivers results that are useful to a range of stakeholder organisations including state and Australian Government bodies, the tourism sector, and conservation planners and managers. Research-users include the Queensland Government, the Australian Department of the Environment, and GBRMPA.



### **Using Bayesian networks for assessing cumulative impacts: A case study on the GBR**

**Ben Reid, James Cook University (proxy for Professor Bob Pressey)**

The cumulative impacts of coastal development and its associated activities are placing multiple stressors on the Great Barrier Reef, causing declines in abundances of some species and degradation of marine ecosystems. Cumulative impact assessment has proven difficult because we cannot determine: a) exactly what developments will occur in the future; and b) the response of many of the GBR's species and ecosystems to multiple stressors. We use scenario planning, coupled with Bayesian networks applied to selected species and ecosystems to, first, depict plausible development futures for the GBR coastal zone and, second, develop best-available models of the effects of multiple pressures on better-known species and ecosystems. Our range of spatially-explicit 2035 scenarios incorporates uncertainty around demand for food, mineral resources, tourism, and environmental services, and takes into account technical advances, preference for coastal living, and governance. Our Bayesian modelling captures both data and expert opinion on the related factors linking land-use changes in the coastal zone and related changes in the GBR's marine environment to impacts on specific marine species and ecosystems. We propose an extension of our approach as a tool for large-scale planning and decision-support for managers and policy-makers to minimise the impacts of coastal development.



# Session Synopses

Wednesday 5th November 13:30-15:00 Reef Room



## Resilient Torres Strait communities

**Convenor:** Vic McGrath, Torres Strait Regional Authority

The Torres Strait region is known for its ecological complexity, biodiversity and relatively pristine marine and island environments. Torres Strait communities continue to depend on the functioning of these ecosystems for their livelihoods and cultural practices. The strategic location of the Torres Strait places it at risk from the downstream impacts of shipping, mining, resource over-exploitation, increasing tropical diseases and future climate change. Tropical diseases represent serious threats to human health, agriculture and biodiversity and there is a need to improve understanding of how diseases move across the Torres Strait and what methods are best for detecting disease incursions and managing outbreaks within the region. A suite of projects investigating the key drivers of change for Torres Strait communities and disease dynamics has provided important information for management. Central to these scientific research projects, is the critical involvement of Torres Strait people and communities in research and monitoring. As key end-users of research findings, great care is taken to ensure that communities are included throughout the process from inception to reporting. This research places Torres Strait communities and the region in good stead for making informed decisions in the process of adapting to climate change and other threats to ecosystem and human health.



## Building resilient communities for Torres Strait futures

**Dr Erin Bohensky,**

**Commonwealth Scientific and Industrial Research Organisation**

Resilient communities are able to survive and bounce back after unexpected shocks. The Torres Strait is under increasing pressure from a range of factors, including PNG population growth, mining and development impacts, increased shipping, and climate change, to name a few. However, in spite of these pressures and uncertainties, Torres Strait communities are accepting of the need to look into the future with their eyes open to these threats to their islands, their culture, way of life and livelihoods. Torres Strait islanders also have a wealth of historical experiences, cultural knowledge, and community cohesion to draw upon throughout this process. This project, lead by the team from CSIRO, has pioneered an innovative way of supporting communities to make decisions in the face of uncertainty. Torres Strait communities have embraced this opportunity to start the process of pro-actively planning for predicted changes, rather than waiting for change to happen and responding re-actively. This has taken courage, vision and leadership on the part of communities participating in the project, and the scientists working alongside them on this journey into the future.





## **Improved disease detection and prevention of spread in Torres Strait**

**Associate Professor Susan Laurance, James Cook University**

The Torres Strait has long been recognised as a biological bridge to mainland Australia, including for emerging infectious diseases, and there is concern regarding its potential to facilitate disease movement to the mainland. Inadequate surveillance is one reason why tropical frontier regions are considered “hotspots” for emerging infectious disease. The biggest challenge in the surveillance of remote frontiers is the absence of vector sampling techniques that are practical, portable and inexpensive. We trialled a novel method of capturing mosquitoes in towns and forest habitats over two consecutive wet seasons (2013 & 2014) at four islands: Saibai, Boigu, Badu and Moa. Our trial method, while still in development was highly successful in capturing mosquitoes with its novel attractant that generated CO<sub>2</sub> from yeast and sugar. We trapped >11,000 mosquitoes of 34 species. In total, five times more mosquitoes were recorded in forest habitats compared to villages, with Saibai and Boigu recording 4-5 times more mosquitoes than Moa and Badu during our sampling period. In the first census, we recorded the malaria-vector *Anopheles* spp. only on Saibai and Boigu islands. The dengue and chikungunya vector *Aedes albopictus* was recorded in all sampled villages and in the forest of Badu. The other dengue vector *Aedes aegypti* was only recorded in Boigu. The Torres Straits is one of the most vulnerable communities in Australia with respect to mosquito-borne disease outbreaks. The management of vector breeding habitat near towns has to be a high priority to ensure the continued health of Torres Strait communities.



## **Torres Strait eAtlas**

**Dr Eric Lawrey, Australian Institute of Marine Science**

The Torres Strait eAtlas is a valuable tool that will enhance community access to information about their environments. Using an innovative website (<http://ts.eatlas.org.au>) and interactive mapping system for presenting environmental research data, the eAtlas has effectively promoted greater use and application of this information, including by local communities and management staff. The Torres Strait eAtlas is a regional implementation and tailoring of the main eAtlas to reduce clutter from content outside the region and to provide the capacity for regional managers to publish and share their own content. This project has also developed improved regional maps including detailed reef and island mapping and an improved satellite and aerial image basemap. These have a broad community appeal and provide context for research results. It is also a valuable data management system for preserving and encouraging re-use of this data and repatriating research knowledge back to users, thereby enabling ongoing collaboration and information sharing between management agencies, researchers, industry and community groups to support sustainable management efforts.

# Session Synopses

Wednesday 5th November 15:30-17:00 Michaelmas Cay Ballroom



## Socio-economic value of the GBR

**Convener:** Col McKenzie, Association of Marine Park Tourism Operators

We have all at time had to make decisions without full information or data. The lack of that data leaves the decisions made open to challenge or even worse, no decision is made. The projects presented in this session are critical to informed decision making by government and industry. The research findings allow us to look at the implications of the competing priorities between tourism, mining and fishing. It provides information on how the community values the Great Barrier Reef and how it is likely to respond to projects like the development of Abbott Point. The research allows us to look at the interconnectivity between mining and tourism in areas like salaries, accommodation costs and environmental protection. Without this research we would not be able to quantify the social and economic value of the GBR, which in turn would mean it would be difficult to justify actions by government, industry or researchers. For marine tourism, these are the most important research projects undertaken by NERP and we look to see this research continue in the next round of funding.



## Social and Economic Long-Term Monitoring Programme (SELTMP)

**Dr Nadine Marshall,**

**Commonwealth Scientific and Industrial Research Organisation**

The Great Barrier Reef is a complex socio-ecological system with very many competing demands upon it. Management decisions require science-based evidence for transparency and very little data is available to help Reef managers effectively consider the human dimension of the region. The Social and Economic Long term Monitoring Program (SELTMP) for the Great Barrier Reef was set up to provide essential data to Reef managers about the human dimension of the Great Barrier Reef. Data from primary and secondary sources are compiled on each of the following: i) how people use the Reef, ii) how people are vulnerable to changes in the Reef, iii) the wellbeing that is derived from the Reef, and iv) contextual information that describes important socio-cultural drivers such as perceptions, attitudes, values, experiences, knowledge, concerns, behaviours and norms. The value of many data-sets, such as SELTMP's, increases with repetitive sampling. The baseline primary dataset currently contains responses from 8,300 coastal residents, Australians, tourists, tourism operators and commercial fishers. Anticipated annual updates of this baseline will mean that current conditions and trends can be reported and integrated into important decision-making processes. They can also be used in scientific models (e.g. project 10.2) to refine our understanding of the human dimension of the region.





### **Socio-economic systems and reef resilience**

**Professor Natalie Stoeckl, James Cook University**

We know quite a bit about some of the value of the Great Barrier Reef for some things (e.g. tourism) but do not know how these values compare to other (e.g. intrinsic) values; neither do we know how these values might be affected by change or how they are changing over time. Using data collected from more than 4000 residents of and visitors to the GBR catchment area and historical data from the Burdekin Catchment, this project developed several different models to quantitatively assess: (a) the relative 'value' of various ecosystem services provided by the GBR for industry, recreation/lifestyle, and intrinsic purposes, (b) the potential financial impact of degradation of these services, (c) people's willingness to pay to mitigate various threats to the GBR, and (d) the way in which changes prices have, historically, affected sediment loads in the Burdekin catchment. This project thus highlights the importance of the GBR to residents of and tourists to the catchment and to various sectors of the economy. The information generated from this project can also be used to make predictions about some of the potential side-effects of developments or 'change', to draw inferences about the likely financial consequences of those side-effects and to consider people's willingness to accept (trade-off) those impacts.



### **GBR eAtlas: Making environmental research data accessible**

**Dr Eric Lawrey, Australian Institute of Marine Science**

Historically the majority of environmental research data was gathered, processed and managed by individuals or groups of scientists for the purposes of publishing journal papers. Data management, in particular documentation about the data, was usually non-existent or given a low priority. The discoverability and access to these datasets was often only through personal relationships greatly limiting their potential reuse. The eAtlas is a data repository, an innovative website and mapping system for preserving, sharing and facilitating reuse of environmental data. It promotes greater use and application of this information by environmental managers, scientists and the general community. The eAtlas has been working with the NERP Tropical Ecosystem scientists to ensure research products are captured and made easily accessible via the web. This presentation will provide an introduction and demonstration of the eAtlas (<http://eatlas.org.au>), available data, its tools and the role the eAtlas plays in ensuring good data management of research data.

# Session Synopses

Wednesday 5th November 15:30-17:00 Reef Room



## Managing turtle and dugong populations

**Convenor:** Damian Miley, Torres Strait Regional Authority

Dugongs and turtles are of immense spiritual significance to the people of the Torres Strait, and play a vital role in the region's ecology and cultural economy. Recent aerial survey results confirm that Torres Strait dugong populations are healthy and relatively stable, and confirm the region's status as the 'dugong capital' of the world. Turtle rookeries found in the Torres Strait region are important to the future health and viability of the northern Great Barrier Reef populations, which are declining at a concerning rate. This project, lead by James Cook University, has provided Torres Strait communities and management partners with reliable and robust information, based on state of the art technologies, about dugong and turtle populations in the region, their spatial distribution and threats to these populations. The information generated under these projects have translated into management actions at a regional and local level, including in relation to the potential northern expansion of the Torres Strait Dugong Sanctuary and inclusion of turtles in the protective regime, and voluntary community-level seasonal and spatial hunting closures. These projects have been highly complementary to the successful community-based management approach for dugongs and turtles that TSRA has facilitated since 2008, and their findings reinforce the importance of maintaining strong support for this process into the future to ensure the sustainability of these species.



## Dugongs and Turtles in Torres Strait and the Great Barrier Reef: The Big Picture

**Professor Helene Marsh, James Cook University**

The Torres Strait dugong population is much larger than that off eastern Cape York (NGBR), which is larger than that of the urban coast (SGBR). The status of the dugong population is also much healthier in Torres Strait than in GBR. The 'harvestable' turtle population of western and central Torres Strait (females greater than 90 cm carapace length) is at least 100 times larger than annual harvest estimates. On average, a member of the Torres Strait Islander Diaspora consumes a total of approximately one kilo of dugong and turtle meat per year. The cultural significance of dugong and turtle meat to all Torres Strait Islanders indicates that banning the transport of meat between remote communities and the urban coast is likely to increase legal Indigenous hunting on the urban coast. This research indicates: (1) that dugong hotspots in SGBR require higher protection, (2) the imperative of reducing deaths of nesting turtles and increasing recruitment at Raine Island, and (3) that banning the movement of dugong and turtle meat will increase pressure on SGBR stocks.





## **Turtles and dugongs in Torres Strait and the GBR: Insights for each animal**

**Dr Mark Hamann, James Cook University**

Marine turtles and dugong are species of high cultural and economic importance to Torres Strait communities. The Torres Strait marine environment supports globally significant populations of dugong green and flatback turtles. Concerns have been raised about the status of dugong and green turtles. With funding from NERP and TSRA, we have:

1. Studied dugong and turtle populations using aerial surveys,
2. Tracked both species with satellite linked GPS tags, and
3. Initiated monitoring of flatback turtles breeding in western Torres Strait.

With regard to dugong and green turtles, our data indicate that Torres Strait has one of the largest aggregations of dugong in Australia and the dugong move between reef and non-reef areas and use waters of both Australia and Papua New Guinea. Recent data collected on the diving behavior of dugong have enabled us to improve estimates of abundance and density for both green turtles and dugong. The aerial surveys, and information on diving behavior have also allowed improved estimates of green turtle abundance. With regard to flatback turtles, tracking data demonstrate that flatback turtles migrate west as far as the Kimberly coast of Western Australia and northwards into the waters of Indonesia and PNG. Collectively, turtle and dugong monitoring has helped improve the capacity of local Indigenous ranger groups to monitor resources and provided data to underpin management policy at local, state and national levels.

# Session Synopses

Thursday 6th November 09:00-10:30 Michaelmas Cay Ballroom



## **Movements and habitat use by mobile predators**

**Convener:** Darren Cameron, Great Barrier Reef Marine Park Authority

Natural resource managers more than ever have to support and rely upon quality and innovative biological research to positively influence biodiversity protection. In the Great Barrier Reef (GBR), predators are considered to play a key role in ecosystem health and resilience. The GBR Outlook Report 2014 has identified the extraction of predators as high risk and incidental catch of species of conservation concern as very high risk. Predators comprise the vast majority of the fish and shark catch in key commercial fisheries. Some predatory birds in turn utilise multi-jurisdictional waters where industrial-scale fisheries operate. The projects in this program utilise research tools and technologies, most of which were not readily available less than a decade ago. Using these tools, data on predator fidelity to reefs, or embayments and GBR regions; larger scale movements within and outside the GBR; and spatial and temporal variability in dependence on a range of habitats will be presented. The responsible management of harvested predators within the GBR, or impacted by activities within the GBR is continually challenging. Responsible management of GBR-associated predators across broader national and international jurisdictions is a new and more complex challenge. Against a background of future climate variability and change, I look forward to discussing where the next phase of research on predators should head and identification of management options that will likely need to be as innovative as the research presented.



## **Maximising the benefits of mobile predators to GBR ecosystems: The importance of movement, habitat and environment**

**Mario Espinoza, James Cook University (proxy for Dr Michelle Heupel)**

Concern about the status of reef predators is increasing around the globe. Understanding the efficacy of spatial management zones for reef predators within the Great Barrier Reef is crucial to successful management and conservation of these populations. This research examined the movement ecology of several reef predator species to examine how much time was spent at individual reefs and within management zones. Data indicated that different species have different movement patterns resulting in some species receiving greater protection under current management arrangements than others. For example, most fish species were highly resident at a single reef indicating closure at a reef scale is protecting a portion of those populations. Some reef shark species, such as the grey reef shark, spent the majority of their time at a single reef, but did move between reefs indicating moderate protection for these slightly more mobile individuals. Several other sharks (e.g. bull, tiger, silvertip), however, moved widely between reefs and zones and appear to receive little benefit from current spatial management. These results indicate current marine protected areas will benefit some species more than others and that management of mobile species requires additional measures such as catch limits to ensure their populations remain viable.





### **Drivers of juvenile shark biodiversity and abundance in inshore ecosystems of the GBR**

**Dr Andrew Tobin,**

**James Cook University (proxy for Professor Colin Simpfendorfer)**

Nearshore waters play important roles in the early life history of many shark species that live within the Great Barrier Reef Marine Park. This study examined spatio-temporal variation in the functioning of nearshore areas to better understand their role in maintaining shark biodiversity and abundance. Seasonal surveys (dry, early wet and wet) of sharks in five bays on the central GBR coast demonstrated the importance of these bays for both juvenile sharks and the adults of some small shark species. The importance to individual species of sharks varied between bays, demonstrating that each bay played different roles, potentially leading to greater stability within shark populations due to portfolio effects. Environmental drivers such as salinity, turbidity and temperature appear to be the main reasons for differences in function between bays. The results of this study demonstrate that inshore protected areas are important for maintaining the biodiversity of sharks within the inshore areas of the Great Barrier Reef. The sustainability of the shark take by the East Coast Inshore Finfish Fishery may be enhanced by the improved understanding of the role of nearshore areas for sharks generated by this project.



### **Critical seabird foraging locations and trophic relationships for the GBR**

**Dr Brad Congdon, James Cook University**

Effective management of seabirds on the GBR requires detailed information on foraging areas, resource use and links to oceanography. Without this information it is not possible to identify or manage anthropogenic threats outside of nesting colonies. This study mapped core foraging areas for southern GBR seabirds at multiple spatial scales over a three-year period. When provisioning chicks, adults are restricted to near-colony foraging grounds (<200km). On longer self-provisioning trips some species routinely travel to distant foraging grounds in the Coral and Tasman Seas. Foraging success at all sites is linked to local upwelling driven by steep bathymetric change and large-scale fronts and eddies. Some near-colony foraging sites are also influenced by river outflows and associated small-scale fronts. Many important foraging sites are outside of the GBR management zone and foraging activity overlaps significantly with commercial fishing activity. When not breeding GBR shearwaters are trans-equatorial migrants that overwinter in Micronesia in a region known globally for its commercial tuna catch. These results provide a basis for predicting how future climate variation and/or other anthropogenic stressors may influence breeding success. Importantly, they also demonstrate the dynamic nature of oceanic features that are important to these wide-ranging taxa.

# Session Synopses

Thursday 6th November 09:00-10:30 Reef Room



## Patterns of rainforest biodiversity

**Convener: Dr Steve Goosem, Wet Tropics Management Authority**

Many of the animals and plants in the rainforests of the Wet Tropics have been found to be particularly vulnerable to environmental change. This finding raises important questions such as: how is the environment changing, which biological entities are at greatest risk from these changes, and where and how quickly are the impacts of these changes occurring? Answers to these questions can play an important role in informing the development of policy, legislation, and regulation aimed at addressing the underlying drivers of environmental change. Spatially explicit regional-scale studies can also inform cost-effective prioritisation and allocation of conservation resources to on-ground actions aimed at combatting the adverse impacts of identified environmental change. The four presentations in this session provide different approaches to identifying areas of biodiversity and evolutionary significance and vulnerability. This session will focus on how these findings can be used to identify the types of management actions that will be most beneficial in increasing the resilience of the Wet Tropics to environmental change, and how the research can be used to influence policy, planning and on-ground management.



## Rainforest biodiversity

**Professor Stephen Williams, James Cook University**

This project provides an integrated focus within the rainforest theme to strategically target research gaps and increase our understanding of the drivers of rainforest biodiversity. An understanding of the drivers of biodiversity and species resilience is crucial to predicting impacts from a variety of threats and ensuring effective conservation planning and management. Here we report on a long-term biodiversity project that combines standardised monitoring of a variety of taxa across elevational and latitudinal gradients that sample 95% of available environmental space in the Australian Wet Tropics Bioregion. We utilise these data in a combination of spatially-explicit species distribution modelling, estimates of resilience based on biological traits and future climate projections to examine a range of environmental and evolutionary drivers of biodiversity. We validate our resilience estimates by testing our predictions against patterns of paleo-climatic extinction filtering driven by paleostability of habitat and climate across several temporal scales. Analyses based on current patterns of assemblage resilience and paleostability produce concordant results on the factors affecting species resilience to climatic change. The outputs from this research have applications in any conservation or management action that can benefit from informed prioritisation of places or species based on their relative resilience/vulnerability. The results clearly demonstrate the value of long-term biodiversity monitoring that utilises the steep environmental gradients offered by elevation and latitude to provide the basic scientific underpinnings for evidence-based policy and management.



## What is at risk? Identifying rainforest refugia and hotspots of plant genetic diversity in the Wet Tropics and Cape York Peninsula

**Professor Darren Crayn, James Cook University**

Australia's tropical rainforests of far north Queensland are globally renowned for preserving one of the most complete and continuous records of the evolutionary history of Earth's biota, and harbour much of the remaining Gondwanan flora that was once widespread across the continent. Much remains to be discovered however, about the distribution of this evolutionary history within the region, particularly for plants and fungi. Where are the refugia and hotspots of phylogenetic diversity (concentrations of evolutionarily distinct species)? How is genetic diversity within species, a strong



predictor of resilience to environmental threats, distributed across the landscape? In this multifaceted project we are mapping diversity across a range of scales - species, populations and genes - of selected plants and fungi of the Wet Tropics and Cape York. A current focus is on species potentially at most risk: mountaintop specialists whose cool, wet habitat is projected to be severely impacted under a warming climate. Our research suggests that the plants restricted to these unique habitats will face severe habitat loss in the coming decades, threatening their survival. This research is enhancing the scientific basis for conservation priority-setting and planning for future environmental change.



### **The importance of peripheral areas of the Wet Tropics for conservation of biodiversity**

**Dr Conrad Hoskin, James Cook University**

The core areas of the Wet Tropics are well studied compared to many of the peripheral areas. 'Peripheral areas' are: (1) rainforest ecotones and neighbouring drier forests, and (2) small rainforest isolates disjunct from the core rainforest areas. Peripheral areas provide different abiotic and biotic environments to core rainforest areas, hence enhancing the resilience of the Wet Tropics. For example, some endangered rainforest frogs are abundant in ecotonal areas. We targeted peripheral areas to: (1) survey vertebrate diversity, (2) determine which threatened frogs persist in them, (3) understand the mechanism of this persistence, and (4) derive management actions for these species. We found that dry habitats on the western periphery of the Wet Tropics rainforest are an environmental refuge from chytrid fungus disease for several threatened frogs. Chytrid disease nearly drove the Armoured Mistfrog (*Litoria lorica*) to extinction but it survived at one site, in dry forest habitat on the western Carbine Tableland. This population has chytrid but warmer environmental temperatures and/or evolved resistance mean it does not move to the disease stage. Individuals from this population were reintroduced to a site upstream to establish a second wild population of this critically endangered species. Our results show that peripheral populations are vital to the long-term resilience of the Wet Tropics. Not only do they harbour unique diversity, but populations in these areas may be the most able to persist through, and respond to, future change.



### **Climate change and the impacts of extreme climatic events on Australia's Wet Tropics biodiversity**

**Dr Justin Welbergen, James Cook University**

There is a growing realisation that changes in the regimes of extreme weather and climate events, rather than shifts in climate means, will be the primary mechanism by which organisms directly experience the impacts of anthropogenic climate change. Extreme temperature events are of special concern, not only because of their direct impacts on organism health, but also because of their effects on the frequency and intensity of droughts and wildfires. Our study on the impacts of extreme temperature events on Wet Tropics vertebrates represents the first detailed quantitative assessment of the vulnerability of biodiversity to extreme events. Specifically, we identified the areas in the Wet Tropics where vertebrate biodiversity is most vulnerable ('thermal hotspots') and least vulnerable ('thermal refugia') to temperature extremes, both now and in the future. The thermal hotspots (e.g., Tully River Catchment) are important for habitat restoration and species' conservation because they represent areas where vulnerable species would benefit most from habitat restoration (e.g. establishment of thermally sheltered microhabitats, including understory and logs). The thermal refugia (e.g., Mt Windsor and the Carbine Tablelands), on the other hand, would benefit most from habitat preservation. Thus, the outputs of this project are useful for species conservation and habitat restoration management because they provide spatially-explicit foci for conservation management actions.

## Session Synopses

Thursday 6th November 11:00-12:30 Michaelmas Cay Ballroom



### **Effectiveness of spatial management on the GBR**

**Convener: Dr David Wachenfeld,  
Great Barrier Reef Marine Park Authority**

The Great Barrier Reef Marine Park was created in 1975 by an Act of Australian Parliament. The primary tool for protection of the plants and animals of the Reef is the Zoning Plan; a marine equivalent to a town planning scheme, it dictates which activities can occur in different locations. By the mid 1990's, scientific evidence had built up that strongly indicated the Zoning was no longer sufficient and needed a major overhaul. Between 1999 and 2004, the Great Barrier Reef Marine Park Authority undertook a systematic planning and consultative program to develop new zoning for the Marine Park. Seventy bio-regions were identified, each with a unique set of habitats, plants and animals. A range of scientific principles were developed to guide the development of the new zoning. These principles covered the ecology of the system, and also the social, economic and cultural values held by people. The new Zoning Plan was passed by Australian Parliament in 2003 and implemented in 2004. Part of that implementation was the development of a scientific program to keep an eye on the effectiveness of the new Zoning Plan and inform any future adaptive management of the Marine Park. The talks in this session present the results of that scientific program.



### **Some effects of protection from fishing on offshore reefs of the GBRWHA**

**Dr Hugh Sweatman, Australian Institute of Marine Science**

The current zoning plan for the GBR Marine Park greatly increased the number of reefs that were closed to fishing when it came into effect in 2004. AIMS has monitored the effects of this major management action on offshore reefs by surveying pairs of similar neighbouring reefs where one reef in each pair was closed to fishing in 2004. Over the last 10 years, prevention of fishing has led to a general increase in the number and size (and hence the weight) of coral trout and other exploited species, though the extent of the change has been markedly greater in southern regions of the GBR and has fluctuated through time. Herbivorous fishes are not subject to fishing on the GBR and their numbers are similar on reefs that are open and closed to fishing. There is some evidence that closed reefs have more reef sharks. Concerning possible indirect effects that closure to fishing has on other components of reef communities, there was no clear difference in coral cover or in the numbers of diseased coral colonies between open and closed reefs. There is an indication that reefs that are closed to fishing may be less likely to have outbreaks of crown-of-thorns starfish.





## **Do green zones work? Assessing the ecological effects of management zoning on inshore reefs of the GBR Marine Park**

**Dr David Williamson,**

**James Cook University (proxy for Professor Garry Russ)**

No-take marine reserves (green zones) are widely embraced as a tool for conserving biodiversity, enhancing ecosystem resilience and sustaining fisheries. In the Great Barrier Reef Marine Park (GBRMP), networks of green zones have been the cornerstone of management since the late 1980's. In this study, we assessed the ecological effects of green zones using underwater visual census to monitor fish communities on inshore reefs of the GBRMP between 1984 and 2014, and belt transects to monitor coral health in 2012. Abundances of fishery-targeted species (eg. coral trout) have increased significantly on most green zone reefs, while populations on non-reserve reefs have remained relatively stable. In contrast, abundances of non-targeted fishes were similar between green zones and non-reserve reefs. Strikingly, coral diseases were two to seven times more prevalent on non-reserve reefs than within green zones. Although green zones can effectively increase populations of targeted fishes, enhance coral health, and protect biodiversity, they cannot prevent reef degradation from a range of acute and chronic disturbances such as cyclones, floods, and coral bleaching events, declining water quality and increasing sedimentation. These stressors must be addressed through effective coastal catchment and water quality management, as well as decisive global action on climate change.



## **Do green zone networks work? Seascape connectivity among coral trout populations on the GBR**

**Professor Geoff Jones, James Cook University**

It is well known that we can expect an increase in stocks of exploited fishes within marine reserves (green zones). It is hoped that reserves can also benefit fish stocks in a larger seascape, by supplementing fish populations in fished areas (blue zones) and promoting population connectivity and resilience across networks of reserves. However, the potential scale of larval dispersal sourced from adults in reserves has been hard to measure. In this study we used a new genetic parentage approach to directly measure larval retention within and dispersal among coral trout populations at three clusters of reefs separated by over 200km near the southern Great Barrier Reef. DNA profiles of juvenile fishes were matched to potential parents sampled at the three locations. We found high levels of coral trout larval exchange among reefs within regions (dispersal <50km) and exchange between regions (50 – 250km). Large-scale connectivity appears to be multi-directional, but with net larval dispersal from south to north. Observed dispersal trajectories closely matched a biophysical model predicting larval dispersal of coral trout in the region. Our study confirms exchange of larvae between green and blue zones, and between different green zones at both local and regional scales.

# Session Synopses

Thursday 6th November 11:00-12:30 Reef Room



## Maintaining rainforest values

Convenor: Travis Sydes,

Far North Queensland Regional Organisation of Councils

At a cursory glance the projects within this session are somewhat disparate from each other, each in fact embodying an established area of research within the ecological sciences (restoration, behaviour, invasion, community dynamics). In a landscape management context and from the perspective of end user however, there are many interactions and parallels between the projects. We will be exploring these relationships across the following two themes that will help guide discussion in an open forum. Investigating assumptions through science - policy and practical implementation of management in the Wet Tropics is often guided by broad assumptions that have evolved from management/research experience. Research projects in this session have investigated some of these fundamental assumptions in detail with a view to enable an operationalization of a new understanding or a refined knowledge. Navigating through controversial, complex or conflicting areas of implementation with science knowledge – clarifying the ecological basis of management assumptions can shed light on new solutions and understanding in our communication and implementation of ecological management principles.



## Monitoring of key vertebrate species

Dr David Westcott,

Commonwealth Scientific and Industrial Research Organisation

The Southern Cassowary and the Spectacled Flying Fox are the focus of repeated demands for management in the Wet Tropics. The species are frequently the focus of debate, often with financial and legal implications. In such circumstances, up-to-date information on population status, trends and distribution become key inputs into decision-making and conflict resolution, with good data critical to the process. This project monitors the abundance and distribution of these species in north Queensland. The purpose of this research is to inform decision-making with regard to management of critical habitat for cassowaries, and management of agricultural and urban nuisance and future disease risks from flying foxes.



## Fire and rainforests

Dr Dan Metcalfe,

Commonwealth Scientific and Industrial Research Organisation

Fire is a significant environmental driver of change across most of Australia, yet we know little of the effects of fire on tropical rainforest communities. Tropical rainforests used to cover almost all of Australia, but today only account for about 2% of the land, so how does that tiny remnant respond to fire at its margins? Current approaches to managing fires that threaten rainforests are driven by concerns over infrastructure protection, public perception, research into fire impacts in other countries, and by the availability of trained staff to deal with such threats. We report on research that gives us insights into the role of fire in Australian rainforests, and on how traditional ecological knowledge also needs to be incorporated into our understanding of the problems faced by managers and decision makers.





## **Invasive species risks and responses in the Wet Tropics**

**Dr Helen Murphy,**

**Commonwealth Scientific and Industrial Research Organisation**

The aim of this project was to assess current and future invasive species risks and responses in the Wet Tropics and provide managers with tools for prioritising management activities at a regional scale, and allocating resources and effort on the ground. We have described the likely consequences of climate change for invasive species risks and responses in the Wet Tropics. Of particular note is that the interacting effects of increasingly intense cyclones and an increasing number and diversity of invasive species is likely to result in significant changes in the composition and structure of tropical forests. Among these likely changes is a decrease in diversity of native species, slower rates of forest succession, increasing degradation of forest fragments, and ultimately a decrease in ecosystem function. In our assessment of alternative strategies for managing weed invasions we show that while containment is commonly perceived as a valid fall-back option for when eradication has failed, many infestations are no more amenable to containment than they are to eradication. Crucially, there is a threshold invasion size below which it will be better to eradicate than contain, and above which the opposite is true. We have synthesized project outcomes in the form of a Pest Adaptation Response Strategy (PARS). The PARS indicates in which parts of the landscape future investment is likely to need to increase in order to minimise future weed impacts, where it will need to remain stable, or where it may potentially decrease over time as the risk of spread or establishment is low.



## **Harnessing natural regeneration for cost-effective rainforest restoration**

**Dr Luke Shoo, Griffith University (proxy for Professor Carla Catterall)**

A major emerging task for biodiversity conservation is to 'scale-up' restoration of degraded land from the local/patch level to landscape/regional scales to meet demands for landscape repair. This poses significant challenges for prioritising investments, most notably because: (a) restoring native vegetation involves considerable uncertainty and time lags over at least several decades; and (b) restoration typically involves a range of different potential actions, each with its own costs, time frame and likelihood of success. Conceivably, investment in low cost programs that foster natural regrowth in targeted areas may complement or even provide greater aggregated benefits than commonly applied active tree planting. However, natural regrowth is rarely pursued as a deliberate reforestation action because of a perceived unacceptably low level of certainty for delivering on objectives. Here we evaluate time lags and uncertainty of recovery for different elements of woody plant (tree or shrub) biomass and species richness using site chronosequences of both passive regrowth and active planting, in the Australian wet tropics uplands. We then use these comparisons of outcome between reforestation pathways to inform decisions about when it might be most efficient to invest in either or both restoration actions.

# Session Synopses

Thursday 6th November 13:30-15:00 Michaelmas Cay Ballroom



## **Water quality on the GBR: Priority pollutants and threatening processes**

**Convenor:** John Bennett,  
Queensland Department of Environment and Heritage Protection

The conference's two water quality sessions aim to present firstly the findings of the recent NERP and associated science; secondly four examples of how reef managers have and are using the science; and concluding with a lengthy open discussion session with all speakers and the audience on the subject of science informing reef water quality and broader ecosystem health management. The presenters in the first session, titled Priority Pollutants and Threatening Processes, will outline findings of their NERP research into the impacts of sediments, nutrients and pesticides on priority seagrass and reef ecosystems. The discussion session will allow for discussion of their findings and links between their findings.



## **The effects of river discharge on regional turbidity in the GBR**

**Jon Brodie, James Cook University (proxy for Dr Katharina Fabricius)**

Water clarity is a key factor for marine ecosystems. We used 11-years (2002-2013) of daily 1 km<sup>2</sup> MODIS-Aqua remote sensing data to investigate time scales and processes affecting water clarity in the whole Great Barrier Reef. 'Photic depth' from MODIS-Aqua (the penetration depth for 10% of surface irradiance), standardised for waves and tides, was strongly negatively related to the freshwater discharge of the main rivers in all coastal, inshore and lagoonal zones, except in the Cape York region. Water clarity started to decline with the onset of river floods, and typically took 150 – 260 days until complete recovery. South of the Burdekin regions, river runoff predominantly affected the inshore GBR. However for the Central and Northern GBR (i.e. Burdekin River to Lizard Island) river loads were strongly correlated with water clarity across most of the reef matrix, possibly due to the narrowness of its continental shelf combined with relatively high anthropogenic contributions to river nutrient loads. The relationships were strongest in the Northern Wet Tropics all the way across from the inshore to the mid and outer shelf zones. This most affected section (Cairns to Lizard Island) happens to coincide with the main initiation area of primary outbreaks of crown-of-thorns starfish.



## **The persistence of herbicides and their toxicity to seagrasses of the GBR**

**Dr Andrew Negri, Australian Institute of Marine Science**

The photosystem II herbicides originating from agricultural runoff can be detected year-round in nearshore waters of the Great Barrier Reef (GBR). In order to better understand their potential risks we undertook a series of laboratory experiments to (i) quantify their toxic thresholds on seagrasses and (ii) determine their persistence in seawater. The acute toxic thresholds of four priority PSII herbicides to GBR seagrasses were quantified and the chronic exposure of seagrass to Diuron affected photosynthesis, stored energy and finally growth and shoot density. Low temperatures and high temperatures and light increased the sensitivity of seagrass to Diuron. The PSII herbicides were broken down slowly by bacteria in seawater and half-lives ranged from months to years in flask and pond experiments. While PSII herbicides are persistent in seawater and both acutely and chronically toxic to seagrass, they



are most likely to threaten coastal seagrasses and corals in combination with other monsoonal pressures including high and low light, rising sea surface temperatures and low salinity. Major outcomes from this project include: contributions of the results to cumulative risk models and pollution targets for the GBR and (ii) formation of the GBR Pesticide Working Group, the first forum of its kind for researchers, farming groups, management and regulatory agencies to meet and communicate ideas and information on a regular basis.

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### **Experimental and field investigations of combined water quality and climate effects on corals and other reef organisms**

**Dr Andrew Negri,**

**Australian Institute of Marine Science (proxy for Dr Sven Uthicke)**

Water quality influenced by terrestrial runoff has significantly altered Great Barrier Reef ecosystems, especially on its inshore reefs. In addition, global stressors such as increasing temperatures and ocean acidification (OA) are expected to put increasing pressure on GBR reefs over the next few decades. The cumulative effects of these global and local stressors are poorly understood. This project has conducted over 15 long-term studies to assess individual and cumulative impacts of water quality, ocean warming and ocean acidification. We assessed the effects of organic and inorganic nutrients, salinity, turbidity/light/sedimentation, in combination with elevated temperature and OA induced stress. Organisms investigated included key species of corals, algae, seagrasses, foraminifera and echinoderms. In most cases, the combination of stressors showed additive effects, thus clearly suggesting that land-management can ameliorate impacts of climate change. Future work on cumulative impacts can build on our findings, and contribute to informing the development of measurable climate- and regionally adjusted water quality targets and cumulative impact guidelines. Our work will also serve to populate ecosystem models assisting managers to prioritise decision-making. In addition, multi-generational experiments are needed to investigate the potential of acclimation and adaptation to cumulative impacts.



### **Vulnerability of seagrasses to flood plumes**

**Dr Catherine Collier, James Cook University**

Floodwaters have low salinity, high nutrient concentrations (triggering “green water”), toxicants and both dissolved (“coloured water”) and particulate matter (“brown water”) that creates low light conditions. Flood plumes were detected using satellite imagery. Coastal seagrasses were exposed to brown water for ~20% and green water for ~50% of the wet season months (Nov-April) from 2005-2013. This flooding caused extensive seagrass loss throughout the GBR in 2009-2011. We tested seagrass responses to flooding, starting with low salinity and found that they have broad hypo-salinity tolerance. Therefore, we prioritized testing effects of low light (simulating muddy water or green water in flood waters). Seagrasses provided early warning of light stress, including shoot loss and changes in nutrient and sugar content. We also developed light thresholds that can be used to set water quality guidelines for seagrass meadow protection. All species required more light in summer temperatures compared to winter, and some species died quickly (<1 month) in low light while others were more tolerant (>3 months). This study has contributed to management outcomes, including identifying seagrass meadows at high risk of exposure to flood waters; developing new environmental thresholds (light and salinity); and confirmed indicator selection for long-term monitoring.

# Session Synopses

Thursday 6th November 13:30-15:00 Reef Room



## People and rainforests

**Convener:** Professor Jeff Sayer, James Cook University

Rainforests throughout the world are under unprecedented pressure for conversion. Expansion of agriculture, commercial forestry and human settlements are transforming tropical forest landscapes. Loss and fragmentation of forests endangers biodiversity, ecosystem functions and the livelihoods and cultures of forest dependent peoples. Many of these forests in transition occur in developing countries with weak management institutions and unclear land rights. The process of change in the Australian Wet Tropics has been equally turbulent as the present deforestation in many parts of the tropical developing world. The object of this session is to identify lessons from the Australian experience that might have application in those countries that are at an earlier stage of the "forest transition". What have we learned in Australia that can be applied elsewhere, what might we have done differently, what messages and expertise can we provide to those seeking to mediate the processes of change in other countries. Have the Wet Tropics reached a "steady state" or will new challenges arise which may bring further transformations to our tropical landscapes. Researchers will present evidence for the implications for peoples' livelihoods of the changes that have occurred in the Wet Tropics and will identify lessons for broader application. Many management problems (associated with conserving the WTWHA's biodiversity or heritage values) or marketing problems (associated with attracting and managing tourists) could, arguably, be better handled if more were known about the numerous non-market values associated with the region.



## **Towards co-governance with Rainforest Aboriginal peoples: Delivering biodiversity conservation and multiple co-benefits in our tropical forests**

**Dr Ro Hill,**

**Commonwealth Scientific and Industrial Research Organisation**

Rainforest Aboriginal peoples' knowledge of wet tropics country, collected and handed down over generations, is an invaluable asset to managing biodiversity and cultural values in our rainforests. We report here the findings of a participatory evaluation of the current status, and potential ways to improve, Indigenous co-management for looking after wet tropics country, including the World Heritage Area. The evaluations identified Rainforest Aboriginal peoples' roles on country generates multiple benefits including: employment; enhanced job-readiness and transition from school to work; moving from welfare dependency to business development; improved disaster readiness and response; mobilizing people out of passivity and empowering leadership; biodiversity protection and restoration; enhanced reconciliation between local Indigenous and non-Indigenous communities; intergenerational knowledge transfer; and cultural renewal and reconnection. The evaluations identified that a collaborative governance approach was the best overall strategy to further effective partnerships. However, both Indigenous and their partners' governance of wet tropics country is currently underdeveloped, and the outcomes from agreement-making are sub-optimal. This paper presents several exciting directions that will better support engagement of Rainforest Aboriginal knowledge and values including a transformative knowledge network, improved agreement-making processes and the delivery of value-added Indigenous Protected Areas.





### **Relative social and economic values of residents and tourists in the WTWHA**

**Michelle Esparon, James Cook University**

Many management problems (associated with conserving the WTWHA's biodiversity or heritage values) or marketing problems (associated with attracting and managing tourists) could, arguably, be better handled if more were known about the numerous non-market values associated with the region. Using data collected from more than 500 residents of and more than 400 visitors to the WTWHA, this project provides information that allows one to quantitatively assesses (a) the relative 'value' of various ecosystem services provided by the WTWHA – benchmarked against other social and economic 'values'; (b) the potential financial impact of degradation of some of those ecosystem services; (c) people's willingness to pay (WTP) to mitigate various threats to the WTWHA; and (d) WTP to provide greater protection for Indigenous cultural values. This project highlights the importance of the WTWHA and of Indigenous cultural values to residents of and tourists to the region and to various sectors of the economy. The information generated from this project could also be used to make predictions about the potential side-effects of developments, to draw inferences about the likely financial consequences of those side-effects and to consider people's willingness to accept (trade-off) those impacts.



### **Governance, planning and effective adaptation of ecosystem service markets to climate adaptation and landscape resilience**

**Professor Allan Dale, James Cook University**

Australia and the wider world are ever-so-slowly inching towards the emergence of an economy that will increasingly value and contribute to payments for ecosystem services. The Wet Tropics region has internationally significant biodiversity, cultural and carbon values that potentially make it a "jewel in the crown" product in any emerging ecosystem service markets. This paper explores how such markets are already evolving, and may continue to evolve in the future. It argues, however, that our regional community will have to lead by example in the development of appropriate policies that support the continued evolution and maturation of such markets. As a synthesis of a considerable body of governance research undertaken within the Tropical Ecosystems Hub, the paper outlines the preconditions for this region being able to attract and to grow emerging ecosystem service markets. It also outlines the strategies we will need to develop to conceptualize such approaches and to agitate for appropriate national and international reforms. Getting this right in the Wet Tropics could present great hope for other rainforest regions.

# Session Synopses

Thursday 6th November 15:30-17:00 Michaelmas Cay Ballroom



## Water quality on the GBR: Policy responses

*Convenor:* John Bennett,

Queensland Department of Environment and Heritage Protection

This second water quality session is designed to show how the science has and will influence reef management. The four aspects being explored are whole of GBR water quality planning and management (Reef Plan); regional water quality improvement planning (WQIPs); GBRMPA's strategic assessment and Outlook Report; and concluding with the latest Reef 2050 Long Term Sustainability Plan and its associated Reef Trust and National Environmental Science Programs.

Thursday 6th November 15:30-17:00 Reef Room



## Wet Tropics rainforests: Where to from here?

*Convenor:* Andrew Maclean, Wet Tropics Management Authority

The National Environmental Research Program is the most recent of a series of investments into applied research for the Wet Tropics that date back over 20 years. These investments have provided a rich legacy of knowledge about the values and management of this globally significant landscape and a correspondingly rich legacy of regional research capacity. The knowledge and capability generated by these investments are valuable not just for the Wet Tropics, but for tropical forest ecosystems elsewhere. The Wet Tropics Management Authority has recognised these achievements as the foundation of its 'Learning Landscape' project that seeks to promote continued research based on the Wet Tropics and to facilitate its uptake in management and policy. This session will reflect on the results of the soon to be completed NERP rainforest investment. It will take the form of a facilitated workshop addressing these questions:

1. What are some of the stand out discoveries emerging from the rainforest research program?
2. How are these research outputs relevant to current and likely future policy and management issues?
3. What are the major future research needs for the Wet Tropics?

The output of the workshop will be a brief consensus statement intended to capitalise on the collected scientific, policy and management expertise among conference participants. A draft of the statement, to be prepared by the NERP Rainforest Implementation Group, will be circulated prior to the workshop.





### **Crown-of-thorns starfish: Where to from here?**

**Convenor:** Steve Moon, Association of Marine Park Tourism Operators

Crown-of-thorns starfish (CoTS) can develop into plague proportions and consume large areas of coral reefs. Outbreaks of CoTS have been a significant contributor to the 50% decline in Great Barrier Reef coral cover on mid-shelf and off-shore reefs that has occurred over the past 27 years. CoTS are a direct threat to Australia's \$2 billion Reef Tourism Industry. Current outbreaks have been identified on over 30% of the reefs surveyed on the northern and central area of the Great Barrier Reef by the Australian Institute of Marine Science, with estimates of approximately 1.5 million adult CoTS reef wide. It is anticipated that the population will continue to grow with numbers peaking in 12 months and lasting for two more years. Long term monitoring of CoTS populations has shown that outbreaks are increasing in frequency. This increase has been linked to the impacts of degraded water quality along the developed Queensland coast. The capacity to deal with current and future threats to the Great Barrier Reef is variable. There are both tactical and strategic approaches to managing biological invasion and recent advances in pest management allow new strategies to be applied to CoTS control so what has been happening and what does the future hold?



### **Indigenous research: Where to from here?**

**Convenor:** Melissa George

As we move towards the new National Environment Science Program (NESP) it is going to be important for Indigenous people to consider their place and in particular, determine what research questions they want answered. Recently there has been a conversation with the Northern Australian NERP hub about developing a level of consistency around how Indigenous communities are engaged and what process researches need to observe to ensure that this engagement is meaningful and most importantly practical and beneficial. This session will focus on identifying future research needs for both Sea and Rainforest Country. There has already been a large amount of work undertaken by Traditional Owners over the years to identify these needs through various plans and strategies. Now is the time for us to consolidate our ideas and develop a process for Indigenous engagement within the NESP.

# Session Synopses

Friday 7th November 10:00-11:00 Michaelmas Cay Ballroom



## Knowledge brokering across the landscape: Where to from here?

**Convenor:** Carole Sweatman, Terrain Natural Resource Management

Natural Resource Management (NRM) organisations work with communities to help guide the wise use of resources, such as land, water, soil, plants and animals. They aim to secure a sustainable and healthy landscape as the basis for a good quality of life for all. NRM organisations are custodians of community-based regional NRM plans, which helps determine goals and priorities at the regional scale. Importantly, NRM organisations are in the business of knowledge brokering for a whole of landscape benefit. Knowledge is critical to the development of NRM priorities and implementation of long-term stewardship across the landscape. The outcomes of formal research are a critical form of knowledge informing NRM. The challenges for NRM organisations are to: (1) build enduring relationships and connections between research and community, (2) ensure that research is filling critical knowledge gaps and delivering results that can translate to practical applications across the community, and (3) do a better job at understanding, collating and linking to other forms of knowledge outside mainstream formal research institutes. This session will outline the current uses of NERP research knowledge in NRM planning and knowledge brokering, and where to next on the research agenda.

Friday 7th November 10:00-11:00 Reef Room



## Marine and terrestrial tourism: Where to from here?

**Convenor:** John Courtenay, Alliance for Sustainable Tourism

The alliance for sustainable tourism, the peak tourism body that deals with tourism in the environment and protected areas is establishing a "Tourism Futures Incubator" to explore and address research needs and style of the tourist industry of Tropical North Queensland into the future. The objective of the Tourism Futures Incubator is to identify knowledge gaps and generate insight into global trends that impact or provide opportunities for future tourism within Tropical North Queensland. The Alliance will disseminate this information to all stakeholders to facilitate high quality decision-making and ensure long-term growth and profitability of the region's tourism industry. The Tourism Futures Incubator will address critical issues for research into the future to:

- Identify the best practice processes to manage potential impacts of community and tourism visitation to sensitive natural areas.
- Identify the best practice processes for infrastructure development to use in sensitive and natural areas, including presentation, trails, roads, accommodation, campsites, public infrastructure, and resource extraction.
- Identify best practice processes for the breeding, retention and presentation, and release into the environment of rare and endangered species.
- Explore the use of modern technology in a user-friendly way that leads to high value presentation of environmental assets leading to sustainability benefits.

An industry panel will comprise of a number of speakers to present industry needs and allow for questions and answers during the session.





### **Concluding session**

**Convenor:** Diane Tarte,

**Steering Committee Chair, NERP Tropical Ecosystems Hub**

Over the past 15 years there has been significant co-investment by government, research institutions and industry in applied environmental research for north Queensland. This has provided sound evidence to help determine management priorities for our natural assets. With the wrap-up of the National Environmental Research Program (NERP) the challenge is to clearly define the priorities for future investment. The concluding session will draw together the discussions from the previous five sessions that looked at the implications of relevant research findings for major management issues. These included addressing improving water quality in the Great Barrier Reef, Wet Tropics rainforest management, mitigation of Crown of Thorns Starfish outbreaks, Indigenous communities' priorities, marine and terrestrial tourism, and natural resource management investment priorities. A synthesis of this session's discussions will be provided to conference participants and is intended to contribute to the scope of the proposed National Environmental Science Program, the successor to NERP, and other priority setting processes of our research partners.

# Publications List

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## Interim Reports

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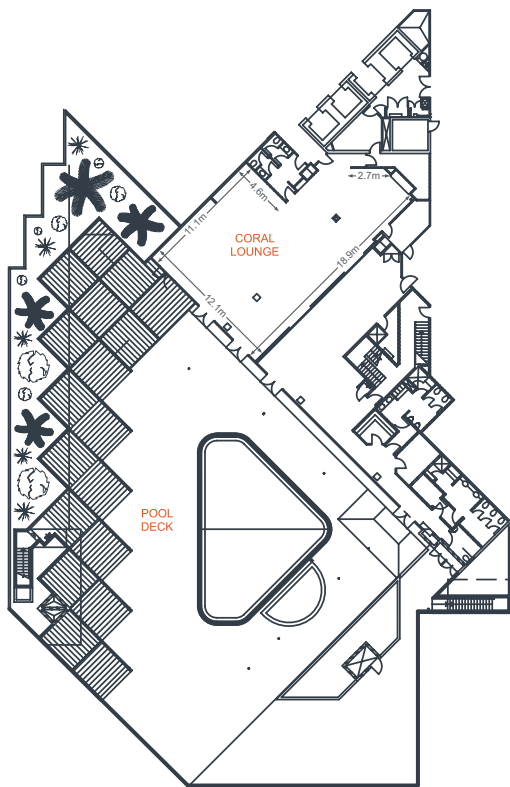
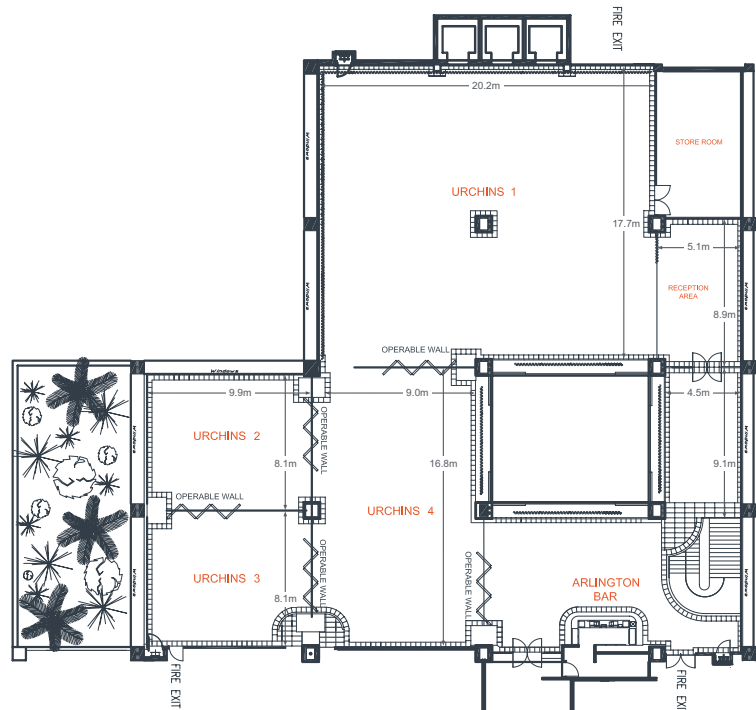
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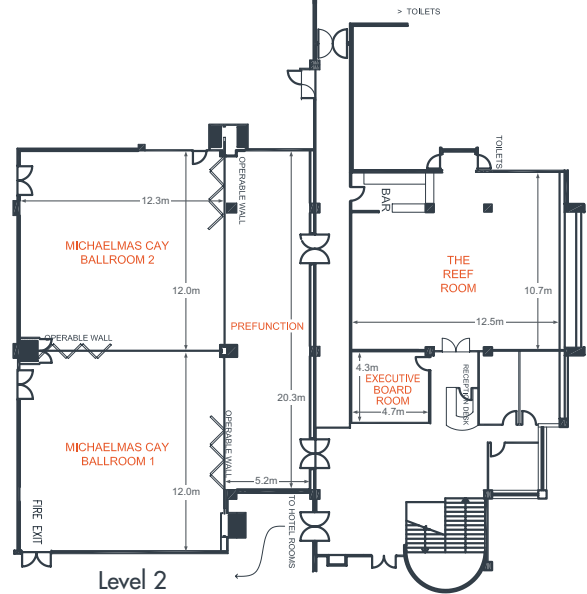


## Notes

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