# AUSTRALIA'S WET TROPICS

*An outstanding learning landscape.*

WET TROPICS
MANAGEMENT AUTHORITY

PATRIMONIO MUNDIAL • WORLD HERITAGE • PATRIMOINE MONDIAL

*The Wet Tropics of Queensland is a mega-diverse region, and is represented on The Global 200 list which is a collection of the Earth's 200 most outstanding, important and diverse terrestrial, freshwater and marine habitats.*

## What makes Australia's Wet Tropics an important place for research?

### INTERNATIONALLY RECOGNISED IMPORTANCE

The extraordinary natural history, richness and complexity of life in the ecosystems of the Wet Tropics have been recognised in its inscription onto the World Heritage List in December 1988. Properties are listed on the World Heritage List in recognition of their 'Outstanding Universal Value' (OUV) which means they possess *"natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity".*

While OUV lies at the core of the World Heritage Convention it also places equal weight on the importance of integrity and the standard of management. Therefore, it is not enough for the extraordinary values alone to be recognised; there is also an international obligation to ensure they are afforded the highest global standards of care and protection.

The Wet Tropics of Queensland is a mega-diverse region, and is represented on The Global 200 list which is a collection of the Earth's 200 most outstanding, important and diverse terrestrial, freshwater and marine habitats.

Although representing only 0.013 percent of the earth's land surface, the Wet Tropics makes a significant contribution to global biodiversity. A 2013 study published in the journal Science identified the Wet Tropics of Queensland World Heritage Area as the sixth most irreplaceable area on earth for the conservation of amphibian, bird and mammal species. It also ranked globally as the second most irreplaceable natural World Heritage site. These rankings were based on data on 173,000 terrestrial protected areas and assessments of 21,500 species and highlight the global importance of Australia's Wet Tropics.

### A HOTSPOT OF BIODIVERSITY

While the Wet Tropics may only occupy 0.26 percent of the Australian continent's land surface it contains an amazingly large share of Australia's terrestrial biodiversity.

| Proportion of Australia's species found in the Wet Tropics | | | |
|---|---|---|---|
| **Plants** | **%** | **Animals** | **%** |
| Ferns | 65 | Marsupials | 30 |
| Cycads | 21 | Bats | 58 |
| Conifers | 37 | Rodents | 25 |
| Orchids | 30 | Birds | 40 |
| Vascular plants | 26 | Frogs | 29 |
| | | Reptiles | 20 |
| | | Freshwater fish | 42 |

*The global importance of the Wet Tropics World Heritage Area offers an outstanding opportunity to enrich the lives of people everywhere through scientific research and tourism.*

*A key role of local organisations such as the Wet Tropics Management Authority and Terrain NRM is in linking science with management and ensuring that research results with management significance are effectively transmitted to land managers and translated and distributed to the wider community.*

*The Wet Tropics has been described by Sir David Attenborough as "The most spectacular and diverse rainforest region on earth".*




## Why focus on the Wet Tropics?

Queensland's Wet Tropics is renowned for its biological diversity, exquisite beauty, Aboriginal cultures and economic productivity. Because of these features, the region is seen as a desirable place to live, visit and invest in. As a result, human activity is increasing, which in turn places increasing pressures on the natural environment.

The Wet Tropics region is the most populous area of northern Australia with more than 200,000 residents. Most human activities depend on the region's natural environment, whether it be the values that attract and support a major ecotourism industry; or the climate that supports tropical agriculture.

The landscapes of the Wet Tropics World Heritage Area are substantially intact, which is why they are attractive to tourists, valued by scientists and conservationists, and present such tantalising opportunities for ecotourism. Each year nearly two million domestic visitors and one million international visitors come to the region, directly supporting tourism businesses, and indirectly a substantial part of the regional economy.

People have lived in the Wet Tropics for tens of thousands of years. Rainforest Aboriginal people and the natural environment are interlinked and their connection represents complex interrelated cultural, social, economic and spiritual relationships.

This long continuous connection has been recognised with the 2012 National Heritage listing of the Wet Tropics for its Indigenous cultural values.

The proximity of the Wet Tropics and the Great Barrier Reef World Heritage-listed areas means the region has a wealth of unique research sites, information and knowledge at its doorstep, and the ability to attract internationally-renowned environmental scientists to our shores. Environmental research undertaken in the Wet Tropics informs decisions regarding domestic environmental protection and enhances Australia's ability to contribute to international solutions to global environmental challenges particularly those in the tropics.

*The Wet Tropics starts with the great advantage of its location in an extraordinary ecological, cultural and social environment.*

# A region of research opportunities

## STABLE AREA WITH ESTABLISHED RESEARCH INFRASTRUCTURE

The Wet Tropics provides an ideal location to undertake globally relevant applied tropical ecosystem research that allows us to understand, conserve, and responsibly manage tropical ecosystems. The Wet Tropics is well placed to become a world leader in tropical know-how by servicing the needs of developing tropical nations, while simultaneously improving the quality of life of Australians living in the tropics.

Some of the advantages of undertaking research in the Wet Tropics include:

- extensive, accessible, protected, diverse tropical forested landscapes
- some of the best and most respected environmental research scientists
- established research infrastructure and supporting services
- land managers with a long history of supporting solutions-based scientific research
- a burgeoning nature-based tourism industry
- a high level of community support
- a community with a sense of pride and identity centred on the region's iconic rainforests and reef.

***Recognising the overarching objective of safeguarding the outstanding universal value of World Heritage properties, UNESCO encourages World Heritage properties be used as laboratories where monitoring, mitigation and adaptation processes can be applied, tested and improved because these iconic properties can influence the adoption of good management practices elsewhere.***

## RESEARCH INSTITUTIONS AND INFRASTRUCTURE

Today, as a consequence of government support of Wet Tropics rainforest research, a vibrant, world-class environmental research culture has developed, producing a string of major advances in fields including climate change science, infrastructure management, biodiversity monitoring, canopy research, restoration ecology and Rainforest Aboriginal cultural research.

This applied research expertise in rainforest ecology and management has been made possible through the establishment of a range of research centres, investment in various research infrastructure facilities and several large environmental research programs:

### RESEARCH CENTRES

- Centre for Tropical Biodiversity and Climate Change
- Centre for Tropical Environmental Sustainability and Sciences
- Centre for Tropical Water & Aquatic Ecosystem Research (TropWATER)
- Cairns Institute
- Australian Tropical Herbarium
- CSIRO/JCU Tropical Landscapes Joint Venture
- CSIRO laboratories at Atherton, Cairns and Townsville
- Daintree Rainforest Observatory
- The Anton Breinl Centre for Public Medicine & Tropical Health

### RESEARCH INFRASTRUCTURE

- Advanced Analytical Centre
- Australian Tropical Sciences and Innovation Precinct
- JCU High Performance Computing and eResearch Centre
- Canopy crane
- Rainforest flux towers
- TERN Rainforest Super Site monitoring network
- Cyclone Testing Station
- Kirrama Field Station
- Paluma Field Station

### RESEARCH PROGRAMS

- Cooperative Research Centre for Tropical Rainforest Ecology and Management (Rainforest CRC) (1993-2006)
- Marine & Tropical Sciences Research Facility (MTSRF) (2006-2010)
- National Environmental Research Program (NERP) (2010-ongoing)
- Terrestrial Ecosystem Research Network (TERN) (2009-ongoing)
- Australian Research Council (ARC) grants
- Reef Rescue (2008-2013)
- Catchment to Reef (2003-2006)

Governments and regional institutions have invested in a range of research infrastructure including a comprehensive network of long-term rainforest monitoring plots. These have been established to examine long-term rainforest dynamic processes and to monitor climate change signals and their ecological impacts.

The rainforest canopy crane based at JCU's Daintree Rainforest Observatory at Cape Tribulation is one of only twelve canopy cranes in forests around the world. The recently established 25 hectare super-plot at Robson Creek is the largest forest monitoring plot in Australia.

The region also adjoins a mega-biodiverse marine environment in the Great Barrier Reef with its well-developed research infrastructure.

Australia's Wet Tropics region has established world-class research faculties, infrastructure and capabilities centred on the two campuses of James Cook University (JCU) at Townsville and Cairns, CSIRO laboratories in Cairns, Atherton and Townsville, and the Australian Tropical Herbarium in Cairns.

- Where are the areas at highest risk and what options are available to mitigate and/or adapt to environmental change?
- What are the effects of changes in land use and land cover, economic drivers and resource use on the composition, structure, and function of Wet Tropics ecosystems?

*Fragmentation*

- What are the effects of past regional clearing patterns and habitat fragmentation on present and future composition, structure, and function of Wet Tropics ecosystems?
- What are the effects of fragmentation on dispersal, invasive species and the spread of diseases?
- What is the fragmentation; patch size and connectivity thresholds for the maintenance of biodiversity and ecosystem processes?

*Invasive species*

- What are the effects of invasive weeds, vertebrate and invertebrate pest species and diseases on present and future composition, structure, and function of Wet Tropics ecosystems?
- What are cost-effective approaches to predicting, identifying and eradicating novel invasive species?

*Restoration*

- What are the biological, social, economic, and political limitations to restoration of tropical ecosystems? How might one overcome these limitations?
- What are achievable, cost-effective techniques for rehabilitating degraded sites and re-establishing natural successional processes, including the restoration of ecological connectivity?

*Sustainable use*

- How does agricultural and urban land uses impact on biodiversity and ecosystem function at both local and landscape scales and how can they be managed to minimise impacts?
- How is tourist visitation to high biodiversity or environmentally sensitive areas best managed to minimise impacts?

## 3. Understanding the social drivers of change and the social responses to managing tropical rainforest ecosystems

Studying the social forces that impact rainforest ecosystems is central to their sustained management. Improved understanding of the complex drivers of change both inside and outside Australia's Wet Tropics will contribute to better policies, actions and management for conservation and sustainable use.

### KEY QUESTIONS

*Governance*

- What is the role of Aboriginal traditional knowledge and community based management in the conservation of Australia's tropical rainforest ecosystems?
- What is the relative effectiveness of conservation policies, management and governance regimes in curtailing habitat degradation in Australia's Wet Tropics?
- How can business and other community and Traditional Owner partners be engaged, benefit from, and contribute to the knowledge and management that is integral to World Heritage protection and management?

*Presentation*

- What are the key determinants of visitor experience in the Wet Tropics?
- What are the key indicators of visitor behaviour, motivation and understanding and how might these be applied to improve management and education?
- What constitutes best practice techniques for presentation of World Heritage, and what is the role of the tourism industry in this?

*Ecosystem services*

- What is the economic value of biological diversity? What are the best measures of ecosystem services?
- How is human welfare related to the maintenance of biodiversity and ecosystem services and what are the economic and non-economic "valuations" of these services?
- What is the role of Australia's tropical rainforests in the global carbon budget and can Australia's tropical rainforest ecosystems serve as indicators of climate change?
- What are the dynamics of water in Australia's wet tropical rainforests and what are the impacts of its use on freshwater aquatic biodiversity and ecosystem services?

*The overall objective of continued investment into Wet Tropics' rainforest research is to improve our capacity to understand, manage and conserve Australia's unique tropical rainforest biodiversity and ecosystems .*

# Research informing management

## RESEARCH: THE BUILDING BLOCKS OF POLICY

For policies and management actions to be effective and to be accepted by society, they need to have a strong rationale and be supported by scientific evidence. It is important that environmental research embraces the twin tasks of both awareness raising and providing solutions.

A hallmark of the region's rainforest research in tackling challenging environmental issues has been its collaborative, networked and applied nature. The region has successfully harnessed the efforts and involvement of university and CSIRO researchers, government agencies, natural resource managers, and Indigenous and tourism bodies to inform World Heritage, environmental and natural resources management and policy.

It is important that we continue to improve Australia's capacity to understand, manage, conserve and sustainably use the unique biodiversity and ecosystems of the Wet Tropics through the generation of world class research and its application.

## WHAT TYPE OF RESEARCH?

As economic growth and regional prosperity is based to a large extent on the exploitation of natural resources, it is essential that we learn to better manage these resources to make sure our exploitation is not detrimental.

Research is required to improve our understanding of how ecosystems function, to be able to monitor their health, maintain and build their resilience to current and future threats and to be able to use ecosystems sustainably. These needs can be addressed by investing in three broad research areas:

1. Understanding Australia's tropical rainforest ecosystems.
2. Understanding the causes of change to Australia's tropical rainforest ecosystems and how to maintain, restore and monitor their ecological resilience to change.
3. Understanding the social drivers of change and the social responses to managing tropical rainforest ecosystems.

## 1. Understanding Australia's tropical rainforest ecosystems

Understanding the outstanding universal value, biological diversity, function, and maintenance of Australia's tropical rainforest ecosystems and the long-term Aboriginal association with the region remains the foundation of conserving, managing and presenting these important ecosystems.

The origin and maintenance of biodiversity and the impact of humans on this biodiversity is essential knowledge for their informed management. Some fundamental questions about biodiversity are listed below:

### KEY QUESTIONS

***Describing Australia's wet tropical diversity***

- What are the attributes that contribute to the outstanding universal value of Australia's wet tropical rainforest ecosystems?
- What are the patterns of diversity in Australia's wet tropical rainforest ecosystems?
- What factors and processes explain the current patterns and distribution of diversity at the population and species levels?

***Origin, patterns, and maintenance of Australia's wet tropical diversity***

- How has history influenced genetic and species diversity?
- What factors explain species abundances and richness?
- What is the role of biotic interactions in the structure and function of Australia's wet tropical ecosystems?
- How did Aboriginal occupancy influence the ecology of Australia's wet tropical ecosystems?
- How did diversity originate in natural ecosystems and how can it be maintained in human-impacted landscapes?

***Functioning of Australia's wet tropical ecosystems***

- How are biodiversity and ecosystem functioning linked in different habitat types?
- What are the characteristics and dynamics of rainforest/open forest boundaries, ecotones and other ecosystem margins and how should these characteristics be incorporated into improved fire management practices?

## 2. Understanding the causes of change to Australia's tropical rainforest ecosystems and how to maintain, restore and monitor their ecological resilience to change

Invasive species, fragmentation, and climate change threaten many habitats and there is compelling evidence that these threats will increase in the future. Understanding the responses of biodiversity and ecosystems to natural and man-made changes is fundamental to appropriate and timely management intervention.

Research priorities include evaluating the multitude of human impacts on Australia's wet tropical rainforests. Responses of these ecosystems to management strategies designed to conserve and restore them also need to be assessed.

As environmental issues have no borders and require a global approach, research being undertaken in the Wet Tropics is also relevant to many other parts of the world.

### KEY QUESTIONS

***Human impacts on ecosystems***

- What are the levels of environmental change that natural systems can tolerate before fundamental ecological processes are irreversibly altered?

***The ecosystems of the Wet Tropics are complex and dynamic and we do not yet know enough to accurately describe their current state and trends, which is important if we are to intelligently plan and manage for the future.***

## Research recognition

A defining feature of the Wet Tropics is its location and its track record for research excellence in disciplines of particular relevance to the tropics. James Cook University (JCU) is a recognised leader in research addressing the major challenges facing the tropical world and is ranked in the top four percent of universities worldwide based on assessments by two of the world's leading university ranking systems.

JCU has also consistently ranked in the world's top three for research performance in the areas of ecology and environment, plant and animal sciences and geosciences, is ranked among the top 12 tourism education institutions in the world, and is recognised for its special focus on ecotourism. The Thompson's Essential Science Indicator ranks JCU first in Australia for Environmental Ecology citations and is ranked second in the world for ISI Citations in Climate Change (behind the Smithsonian Institute which ranked first and ahead of NASA which ranked third).

The applied research programs of the Rainforest CRC, MTSRF and NERP have all focussed on the environment and human interactions with it. The region's scientists have provided national and international leadership in tropical rainforest and conservation biology, climate change and biodiversity monitoring and modelling, and human disturbance and restoration ecology. The researchers and their institutions are acknowledged for their successful collaborations with government agencies, industry and the community.

Australia needs to seize these opportunities and capitalise on this previous research investment to ensure that the Wet Tropics retains and fosters the best trained people, infrastructure, research programs and resourcing. This will involve a commitment to on-going investment into environmental research to understand and manage Australia's wet tropical ecosystems in the future. We also need to build on the region's strengths in applying world-class environmental research to real world problems.

*Research is the creation of new knowledge or the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understandings.*

# *The Wet Tropics: a learning landscape for sustainable World Heritage management*

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*Several other Queensland and interstate universities and research institutions are acknowledged for their valuable contribution to research in the Wet Tropics. The traditional knowledge of Rainforest Aboriginal people is also recognised and greatly valued.*

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