

WET TROPICS  MANAGEMENT AUTHORITY

Research Strategy 2010-2014

Improving management by building and communicating knowledge through collaboration



WET TROPICS OF QUEENSLAND
A Learning Landscape

Front cover photo: Rainforest near Paluma | Credit: Tourism Queensland

Back cover photo: *Licuala ramsayi* fan palm endemic to the Wet Tropics | Credit: Campbell Clarke WTMA



Australian Government



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Abbreviations

ACCRS	Australian Canopy Crane Research Station
Act	<i>Wet Tropics World Heritage Protection and Management Act 1993</i>
ATH	Australian Tropical Herbarium
GBRWHA	Great Barrier Reef World Heritage Area
CSIRO	Commonwealth Scientific and Industrial Research Organisation
GIS	Geographic Information System
ILTER	International Long Term Ecological Research Network
IUCN	International Union for the Conservation of Nature
JCU	James Cook University
MTSRF	Marine and Tropical Science Research Facility
NCRIS	National Collaborative Research Infrastructure Strategy
NERP	National Environmental Research Programme
OUV-I	Outstanding Universal Value and Integrity (World Heritage values)
QPWS	Queensland Parks and Wildlife Service
Rainforest CRC	Cooperative Research Centre for Tropical Rainforest Ecology and Management
RRRC	Reef and Rainforest Research Centre
SAC	WTMA's Scientific Advisory Committee
TERN	Terrestrial Ecosystem Research Network
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WHA	World Heritage Area
WTMA	Wet Tropics Management Authority
WTQWHA	Wet Tropics of Queensland World Heritage Area

The Wet Tropics: a learning landscape

The Wet Tropics of Queensland World Heritage Area (WTQWHA) is an area of iconic environmental significance with stunning biodiversity, much of it ancient in character and endemic to the region. The World Heritage Area (WHA) is a region of spectacular scenery and rugged topography with fast-flowing rivers, deep gorges and numerous waterfalls. Mountain summits provide expansive vistas of the oldest surviving rainforest in the world. The exceptional coastal scenery combines tropical rainforest, white sandy beaches and fringing reefs just offshore; a unique feature on a global scale.

Tropical rainforest dominates the region but there are also significant areas of other vegetation communities including sclerophyll and mangrove forests. The diverse habitats of the WTQWHA provide refuge for numerous species of rare and threatened plants and animals. Species diversity and endemism are exceptionally high, due to ancient biota being isolated for a long time – the Wet Tropics bioregion contains an almost complete record of the major stages in the evolution of plant life and provide refugia for many rainforest species that originated when Australia was part of Gondwana, and contains one of the most important living records of the history of marsupials and songbirds.

In addition to these natural values, the region is also culturally rich, comprising the traditional lands of 18 Rainforest Aboriginal tribes who maintain a continuing cultural affiliation with the WTQWHA.

The spectacular and unique features of the WTQWHA, combined with its very high natural integrity, make it of outstanding universal significance and extremely valuable for scientific research. The Wet Tropics region also has the natural assets, research infrastructure and credentials to become an internationally recognised research centre for tropical biodiversity and conservation biology.

Many of the elements to achieve this vision are already in place:

- extensive, accessible, protected, diverse tropical forested landscapes
- located in a country with a stable government, a modern economy, and a safe operating environment
- some of the best and most respected natural area research scientists
- established research infrastructure and supporting services
- a burgeoning nature-based tourism industry
- a high level of political and community support and a sense of identity centred round the region's rainforests and reef.

But there is much to learn. We have barely skimmed the surface of many of the complexities in our ancient forests and their responses to the myriad pressures wrought by human population growth and economic development. We don't know enough about how our ecological, social and cultural systems will respond to changes that are already happening and are likely to accelerate, particularly those associated with climate change.

This strategy promotes a renewed effort in tropical rainforest research through improved planning, co-ordination, collaboration and communication and identifies areas of research that will see Australia best

equipped to meet its international obligations to protect, conserve, present, rehabilitate and transmit to future generations the natural heritage of WTQWHA.

The Wet Tropics Management Authority (WTMA)'s responses to ongoing and emerging challenges and opportunities require innovative science and technology to:

- deliver a more complete understanding of our ecological, social and cultural systems
- allow better forecasting of the future
- formulate and test mitigation/adaptation measures in the face of global change.

The Wet Tropics of Queensland is a **learning landscape** that provides outstanding opportunities for collaborative research across disciplines such as ecology, climatology, tourism, sociology and economics based on tropical ecosystems.

A comparative advantage of undertaking research which benefits the management of World Heritage properties is that these iconic properties attract considerable attention and can influence the adoption of good management practices elsewhere. UNESCO encourages World Heritage properties to serve as laboratories where monitoring, mitigation and adaptation processes can be applied, tested and improved¹. They also encourage partnerships between relevant organisations in field activities on mitigation and adaptation strategies, methodologies, tools and/or pilot projects.

Well-focussed research is fundamental to effective management of a natural World Heritage area. Research needs to be responsive to the evolving array of challenges faced by natural area land management agencies, with outcomes that can be applied on the ground. WTMA has a long history of supporting solutions-based scientific research and collaborating on such research projects with academic institutions, other government agencies and community stakeholders to encourage research.

This Research Strategy identifies key research topics and tasks, and promotes and encourages research collaboration and partnerships. Working collaboratively will enable better leverage of regional resources and expand the breadth, applicability and capacity of the research undertaken in the Wet Tropics. Collaboration will also foster the transfer of knowledge and continue to build professionalism in Wet Tropics World Heritage management.

This Research Strategy aligns with the Queensland Government's long-term plan: *Towards Q2: Tomorrow's Queensland*² and is consistent with the *Queensland Research and Development Investment Strategy 2010-2020*³.

¹ The benefits and importance of undertaking research in World Heritage properties are noted in several UNESCO documents. The following may be of particular interest: UNESCO (2007). *Policy document on the impacts of climate change on World Heritage properties (WHC-0716.GA/10)*. <http://whc.unesco.org/document/9281>

² *Towards Q2: Tomorrow's Queensland*. http://www.thepremier.qld.gov.au/library/pdf/tomorrow/Towards_Q2_Tomorrows_Queensland.pdf

³ *Queensland Research and Development Investment Strategy 2010-2020*. <http://www.chiefscientist.qld.gov.au/research-and-development/investment-strategy.aspx>

Executive summary

WTMA recognises research as being a necessary and valuable component of effective natural area management. Scientific research supports integrated and adaptive management by providing an objective and defensible basis for making decisions and developing policy. Efficient transfer and application of scientific knowledge is crucial to successfully meeting the challenge of transmitting to future generations a resilient WTQWHA in a better condition than we inherited.

Through this Research Strategy, WTMA invites collaboration with research providers to build knowledge of the Wet Tropics bioregion, related environmental and cultural topics, the social and economic importance of the WHA, and how best to conserve and enhance the WTQWHA.

Our research objectives over the next five years are to:

- continue to identify priority research topics and questions which will benefit WTQWHA management
- promote appropriate research into World Heritage, conservation land management, environmental, cultural, social and economic issues, across the Wet Tropics bioregion and with a primary focus on the WTQWHA, policy development and operational decision making
- identify, and seek opportunities for, a variety of collaboration and partnership approaches to enable and encourage Wet Tropics natural area land management agencies (including WTMA), and scientists/researchers to work together on World Heritage related projects
- promote increased financial and in-kind support through advocacy, collaboration, and other means, to undertake research relevant and important to the WTQWHA
- build on the outcomes of previous research partnerships with the Rainforest CRC and MTSRF
- identify ways in which the WTMA can help facilitate research
- disseminate research findings to communities of interest in an effective and timely way.

This Strategy outlines our research priorities over the next five years. We have categorised our information needs into five research themes⁴ which provide the framework for this Research Strategy, with thirteen specific areas of management interest linked to these themes:

A. Understanding the condition and trends of the natural and cultural environment (C)

1. Ecological/forest 'health' (EH)
2. Priority species and ecosystems (SP)
3. Understanding the Wet Tropics outstanding universal values (UV)
4. Rainforest Aboriginal cultural studies (AB)

⁴ These priority research themes are based on UNESCO's *Operational Guidelines for the Implementation of the World Heritage Convention* <http://whc.unesco.org/archive/opguide08-en.pdf>, and the Primary Goal of management as defined in schedule 1 of the *Wet Tropics World Heritage Protection and Management Act 1993* <http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WetTropicsA93.pdf>

- B. Understanding risks and threats to the World Heritage Area (T)**
 - 5. Alien and invasive species (AI)
 - 6. Impact mitigation – community infrastructure (IM)
 - 7. Climate change impacts and adaptation strategies/regional responses (CC)
 - 8. Landuse change (LU)

- C. Sustainable use and management of the World Heritage Area (M)**
 - 9. World Heritage presentation, recreation and tourism (TO)
 - 10. Giving the WTQWHA a role in the life of the community (CO)
 - 11. Socio-economic & environmental benefits (ecological goods & services) (ES)

- D. Habitat management and restoration (H)**
 - 12. Habitat management and restoration (RR)

- E. Science/management partnership performance (S)**
 - 13. Adoption – making a difference (from science to application) (AD)

Information needs have been identified under each of these five themes and thirteen categories, and research questions have been prioritised into Top (.T), High (.H), and Other Priority (.P).

WTMA hopes that this Research Strategy will help us to build on previous research initiatives and collaborations in the region and attract new research effort and investment into the Wet Tropics.

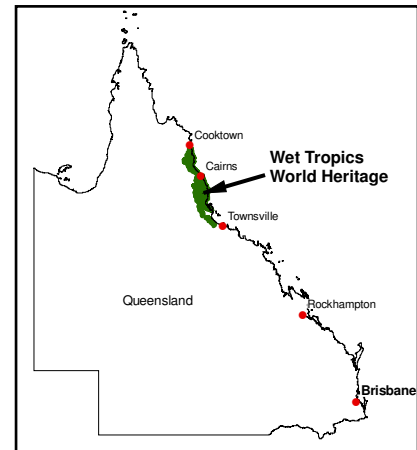
1. Introduction

The Wet Tropics of Queensland World Heritage Area (WTQWHA) is one of the world's most outstanding natural treasures. Managing WTQWHA presents us with the responsibility to transmit to future generations this environmental treasure undiminished by the enjoyment and use of our generation.

The region

The Wet Tropics of Queensland extends 400 km along the tropical coast of north-east Australia in the State of Queensland between Cooktown to the north and Townsville to its south.

The Wet Tropics is a global biodiversity hotspot and this is reflected in its inscription under the UNESCO *World Heritage Convention*⁵ for its outstanding universal natural values and integrity. In addition to these natural values, the region is also culturally rich, comprising the traditional lands of 18 Rainforest Aboriginal tribes.



The natural and cultural assets of the region provide a vital resource for regional tourism, which is the major contributor to the regional economy.

The region is immediately adjacent to Australia's Great Barrier Reef World Heritage Area (GBRWHA) making it a very attractive learning landscape for research. The rainforests of the region have a high level of accessibility centred round the major urban centre of Cairns. The region also has world class conferencing facilities in both Cairns and Townsville and well established, internationally recognised research infrastructure, including:

- James Cook University (JCU), with campuses in Cairns and Townsville, and several field stations in the region including the Australian Canopy Crane Research Station at Cape Tribulation
- Commonwealth Scientific, Industrial and Research Organisation (CSIRO) with laboratories in Cairns, Atherton and Townsville
- Several State Government research establishments at places such as South Johnstone, Cairns, Mareeba and Walkamin.

The region also has capable management institutions, including the Wet Tropics Management Authority (WTMA), the Queensland Department of Environment and Resource Management (DERM) and the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC).

⁵ UNESCO World Heritage Convention <http://whc.unesco.org/archive/convention-en.pdf>

The Wet Tropics Management Authority

The *Wet Tropics of Queensland World Heritage Area*⁶ (WTQWHA) was inscribed on the UNESCO World Heritage List of natural properties on 9 December 1988.

The Wet Tropics Management Authority⁷ (WTMA) was established to ensure that Australia's obligations under the World Heritage Convention are met. WTMA is a body corporate with statutory powers defined under the *Wet Tropics World Heritage Protection and Management Act 1993*⁸. Its primary task is:

“to provide for the implementation of Australia’s international duty for the protection, conservation, presentation, rehabilitation and transmission to future generations of the Wet Tropics of Queensland World Heritage Area, within the meaning of the World Heritage Convention.”

WTMA has a coordinating role with specific functions defined in its Act, which include:

- gather, research, analyse and disseminate information on the Wet Tropics area
- advise and report on the state of the Wet Tropics area
- prepare and implement management plans
- develop and implement management policies and programs
- administer funding arrangements in relation to the Wet Tropics area
- enter into arrangements for the provision of rehabilitation and restoration works
- develop public and community education programs
- promote the Wet Tropics area locally, nationally and internationally
- liaise with the governments and authorities of the State, the Commonwealth, other States and the Territories, and international and foreign organisations and agencies.

The Act requires WTMA to perform its functions consistent with the objectives and principles of the *National Strategy for Ecologically Sustainable Development*⁹ which includes:

- integrating the economic, social and environmental concerns and needs of the community
- accounting properly for the economic costs of environmental degradation
- understanding environmental risk and uncertainty.

The Act also requires WTMA, in performing its functions, to consider Aboriginal tradition and liaise and co-operate with Aboriginal people concerned with the WTQWHA, and to establish a scientific advisory committee (SAC) whose function is to provide advice to WTMA on:

- scientific research that will contribute to the protection and conservation of the Wet Tropics area
- scientific developments relevant to the protection or conservation of the area.

⁶ *Wet Tropics of Queensland World Heritage Area* <http://whc.unesco.org/en/list/486>

⁷ *Wet Tropics Management Authority* <http://www.wettropics.gov.au>

⁸ *Wet Tropics World Heritage Protection and Management Act 1993* <http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WetTropicsA93.pdf>

⁹ *National Strategy for Ecologically Sustainable Development* <http://www.environment.gov.au/about/esd/publications/strategy/index.html>

WTMA's Scientific Advisory Committee played a very important role in determining both the direction and development of this research strategy and will continue to have an important role in advising on its implementation.

Participation of Rainforest Aboriginal people

There are Rainforest Aboriginal communities and groups which have a continuing cultural affiliation with the WTQWHA. This affiliation includes cultural rights and responsibilities to own, access, use and manage environments and resources associated with their traditional estates. Researchers have an obligation to seek the meaningful involvement of appropriate Rainforest Aboriginal people and their organisations in their research projects. Involvement may vary from a desire to be kept informed about the project, to a requirement for active co-management of the project. Issues to be considered by Rainforest Aboriginal people may include:

- What procedures and processes are proposed to engage Rainforest Aboriginal people throughout the project, and report on the findings and implications of the project at its conclusion?
- Will the project be of benefit to Rainforest Aboriginal people?
- What are the potential impacts of the project on Rainforest Aboriginal estates, environments, resources, cultures, rights or life styles?
- What are the opportunities for training and/or employment of Rainforest Aboriginal people in the project?
- What are the safeguards for the recognition and protection of Rainforest Aboriginal intellectual property rights?
- What is the level of understanding among the researchers about Rainforest Aboriginal cultures, rights and interests associated with the research area?

Some Indigenous organisations have developed or are developing protocols and priorities to assist their people and research organisations to take a strategic approach to addressing issues such as those outlined above. The report documenting the outcomes of the Traditional Owners of the Wet Tropics Strategic Research Directions Workshop held in September 2009 for the Marine and Tropical Science Research Facility (MTSRF) helped to inform the content of this document.

2. Research objectives

Research is a necessary and valuable component of effective World Heritage management. Science supports an integrated and adaptive management approach to solving management issues and sets an objective basis for making decisions and policy development. Research is therefore a major and legitimate use of WHAs.

This Research Strategy is part of our response to the challenge of improving the management, protection, understanding, and use of the WHA and its natural and cultural heritage. WTMA aims to foster collaboration between the users of research and the providers of research to build a comprehensive knowledge bank about the WTQWHA from natural, cultural, economic and social perspectives and how best to conserve and enhance these attributes.

The purpose of this Strategy is to:

- assist in the process of knowledge transfer of the values, threats and management of the natural and cultural heritage of the Wet Tropics
- apply this knowledge to improve on-ground management and policy development
- apply this knowledge to obtain additional investment and other support.

This Research Strategy has also been produced to encourage partnerships between WTMA and other interested parties to investigate questions that are currently not well researched or understood by natural area land managers in the region.

This document provides an outline of the management areas and issues WTMA, and others with management responsibility for the WTQWHA, think important to improve the conservation management of the WTQWHA. It presents WTMA's vision for a more effective strategic approach to securing relevant scientific research. The vision is primarily the result of reflections and discussions held with the SAC, WTMA staff and others. The priorities were also strongly influenced by a review of WTMA's *Wet Tropics Research and Information Needs Report (2000)*¹⁰.

As well as focusing WTMA on our research priorities, the Strategy will assist land managers, researchers and funding bodies to understand our information and knowledge needs for the next five years, and provide a firm basis on which to expand and enhance interactions between research providers and research users in the region.

The relationship between the scientific research community, WTMA and its land management, industry and community partners needs to allow for exchanges, co-evolution, and joint construction of knowledge to enrich decision-making at different scales. This includes two main requirements, that:

- scientific information is relevant to WTMA's policy and on-ground management needs
- WTMA and partner organisations formulate their needs or questions in a way that are accessible for scientists to provide the relevant information.

¹⁰ WTMA (2000). *Wet Tropics Research and Information Needs*. http://www.wettropics.gov.au/res/downloads/rain_report.pdf

WTMA's major research objectives over the next five years are to:

1. continue to identify priority research topics and questions which will benefit WTQWHA management
2. promote appropriate research into World Heritage, conservation land management, environmental, cultural, social and economic issues, across the Wet Tropics bioregion and with a primary focus on the WTQWHA, policy development and operational decision making
3. identify, and seek opportunities for, a variety of collaboration and partnership approaches to enable and encourage Wet Tropics natural area land management agencies (including WTMA), and scientists/researchers to work together on world heritage related projects
4. promote increased financial and in-kind support through advocacy, collaboration and other means to undertake research relevant and important to the WTQWHA
5. build on the outcomes of previous research partnerships with the Rainforest CRC and MTSRF
6. identify ways in which WTMA can help facilitate research
7. disseminate research findings to communities of interest in an effective and timely way.

3. Collaboration, partnerships & best practice

WTMA recognises the critical importance of building professional capacity, using resources to best advantage, and fostering the ongoing interest of researchers, government and the broader community in WTQWHA management issues. WTMA hopes to maintain and build upon our existing long-term relationships with the research community, and will collaborate with researchers to clearly define research questions and identify useful research outcomes, and we are committed to integrating research findings into operational management.

WTMA encourages those with responsibilities for on-ground management within the WTQWHA to initiate adaptive management programs and to identify improvements in operational activities.

WTMA will:

- form partnerships between WTQWHA managers, industry partners and research institutions to increase the base of knowledge which underpins conservation management of the WTQWHA and the broader Wet Tropics bioregion
- form partnerships with international World Heritage property managers, industry partners and research institutions to provide global leadership in World Heritage and tropical landscape management and protection
- foster the role of the Wet Tropics as a living laboratory for global environmental management including of climate change adaptation
- imbue researchers with enthusiasm and respect for the international importance of the WTQWHA and the importance of their research in increasing our knowledge and understanding of its significance and the role of research in improving the management of the WTQWHA
- promote the importance and relevance of science-manager cooperation in the development of adaptive management approaches to improving on-ground operations
- ensure that research is responsive to the needs of the WTQWHA natural area managers by using science to identify solutions for the most significant regional natural area management issues
- promote the open exchange of research findings and dissemination of research outcomes by using a range of communication tools including the WTMA web site, WTMA newsletters and other publications, workshops, seminars, conference presentations and scientific journals
- where appropriate, use its influence and networks, to secure financial and in-kind support and expertise for delivery of the WTMA's research agenda.

Benefits of research collaboration and partnerships

The benefits of partnerships in research are numerous. Some of the many direct and indirect benefits of cooperative research include:

- bringing awareness of research outcomes to potential beneficiaries of the research
- framing of research questions to better answer real life management problems

- increasing the capacity and understanding of WTQWHA managers so that they can proactively address management issues
- increasing the focus of researchers on what are the issues of concern to managers and other potential research beneficiaries
- building upon the knowledge of decades of research already undertaken in the region by universities, CSIRO, the Rainforest CRC and MTSRF to further investigate Wet Tropics natural area management issues
- encouraging research which can be applied to current and expected management issues
- encouraging integrated approaches to solving environmental/cultural problems
- providing opportunities for graduate and undergraduate students to work closely with WTMA staff on medium-term and long-term projects, to learn about World Heritage management and thus build the next generation of scientists and WTQWHA managers
- securing financial and in-kind support, including contributions of expertise and resources of research partners, government, related sectors, industry and research institutions
- raising the general level of awareness and concern in the community about issues and challenges identified through scientific research about the state of the Wet Tropics.

The science-land manager relationship

The International Union for the Conservation of Nature (IUCN 2010)¹¹ list three important attributes of effective science-policy interactions:

1. **Salience**, or relevance, reflects the ability to be responsive to conditions and concerns, and to link to issues on which decision-makers focus and over which they have control
2. **Credibility** reflects the believability of produced knowledge to a defined user, i.e. on the extent to which actors perceive the contained facts, theories, ideas, models, causal beliefs, scenarios and options as valid or at least as a better guide to how the world works or how to address a specific issue
3. **Legitimacy** reflects the perceived fairness, political acceptability, transparency and trust in the processes of a science-policy interface, i.e. the perception that its processes have been respectful of stakeholders' divergent values and beliefs, unbiased in its conduct and fair in its treatment of opposing views and interests.

IUCN have also identified four main conditions for an effective science-policy interface which are relevant to this strategy:

- a) building a **common and shared knowledge base** which effectively supports policy, including the promotion of policy-relevant multidisciplinary research and the appropriate integration of non-formal knowledge, observation and monitoring, indicators, models and scenarios, and assessments
- b) providing for an **effective dialogue between science and policy** and other relevant stake- and knowledge-holders, including formal mechanisms of policy advice, processes of early warning and horizon scanning, communication and other aspects of effectively targeting decision makers
- c) providing the fundamental capacity to enable **full engagement in the science-policy interface of all relevant stake- and knowledge-holders**, be it to build the common and shared knowledge base, to

¹¹ IUCN (2010). *Enhancing the Science-Policy Interface on Biodiversity and Ecosystem Services*. Information Paper on IPBES – March 2010. http://cmsdata.iucn.org/downloads/ipbes_information_paper.pdf

communicate more effectively, or to more effectively use the knowledge for policy action/implementation

- d) increasing **synergy and coherence through coordination** of the different actors and activities and, in particular across scales, sectors and disciplines.

In practice, no one-size-fits-all model exists for effective science-land manager interactions.

4. Regional research capacity

The Wet Tropics of Queensland has a mega-biodiverse environment, world-class research capabilities and infrastructure based largely around the two campuses of James Cook University (JCU) and CSIRO laboratories. The region also adjoins a mega-biodiverse marine environment in the Great Barrier Reef with its well developed research infrastructure.

The region has rapidly developed its research capacity in rainforest ecology and management through Australian Government investment in:

- two rounds of Rainforest CRC funding (1993 – 2006)
- Marine & Tropical Sciences Research Facility (MTSRF) research investment (2006 – 2010)
- National Environmental Research Program (NERP) (2010 - ongoing).

WTMA has been an active collaborating research-user partnering in each of these multi-organisation collaborative regional research consortiums.

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

The **Australian Canopy Crane Research Station (ACCRS)** at Cape Tribulation is one of five Long Term Ecological Research sites in Australia allied to the International Long Term Ecological Research Network (ILTER), and is one of twelve canopy cranes in forests around the world. The Cape Tribulation monitoring plot is the exemplar site in the Wet Tropics, with more information being gathered on this 1 hectare of rainforest than any other hectare of ecosystem in Australia.

A hallmark of the region's rainforest, biodiversity, and conservation biology research in response to the region's challenging environmental issues, has been the collaborative, multidisciplinary approach to discovery, integration and application. This approach was strongly fostered with the commencement of the Rainforest CRC in 1993, and the subsequent establishment of the Cairns campus of James Cook University.

The 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 human disturbance ecology. The researchers and their institutions are acknowledged for their successful collaborations with government agencies, industry and the community.

Changing research landscape

The **National Environmental Research Program (NERP)** has recently been established by the Australian Government to replace MTSRF. NERP has retained a Wet Tropics rainforest research component but is no longer administered from within the region, being a component of a larger northern Australian research hub.

Other recent changes to the region's research landscape include:

The recently established **Australian Tropical Herbarium (ATH)** which is a joint venture between CSIRO, James Cook University, Queensland Department of Environmental and Resource Management and Queensland Department of State Development, Trade and Innovation. ATH amalgamates the CSIRO Atherton Herbarium (QRS), the Queensland Department of Environmental and Resource Management's Mareeba collection (MBA) and the James Cook University Townsville collection (JCT). Its geographic scope includes Australia's tropics; and related plant groups of Papua New Guinea, the Pacific, and Southeast Asia.

An initiative of the Australian Government's Department of Innovation, Industry, Science and Research is the National Collaborative Research Infrastructure Strategy (NCRIS). Part of this strategy includes establishing the **Terrestrial Ecosystem Research Network (TERN)**. TERN aims to provide a set of dedicated observation sites, standardized measurement methodologies, equipment, data, and information services for ecosystem research and natural resource management across Australia.

As part of TERN, a Supersite Network Demonstrator node has been established in the Wet Tropics through co-investment funding from the Queensland Government. The Supersite Network Demonstrators will link specific site-based observations to regional issues of significance. This will be facilitated by providing consistent, high-quality data streams to a central database facility. The Rainforest Biodiversity Node, coordinated by James Cook University, is establishing the large Robson Creek supersite and supports the Cape Tribulation supersite and canopy crane.

The **National Climate Change Adaptation Research Facility (NCCARF)** is a national interdisciplinary effort to generate the information needed by decision-makers in government and in vulnerable sectors and communities to manage the risks of climate change impacts. The **Terrestrial Biodiversity Adaptation Research Network** is hosted by James Cook University's Centre for Tropical Biodiversity and Climate Change. The primary goal of this network will be to develop practical strategies that increase the resilience of terrestrial ecosystems and maximise their adaptive potential under climate change.

National research networks such as NCCARF and TERN enable the region's researchers to collaborate with other Australian and international researchers to generate, share and apply research findings on a wider basis and increase their sphere of influence¹².

The Cairns Institute is a new international research, consulting and training hub based at James Cook University. It is a concentration of tropical knowledge and innovation, focussing on human, social and cultural

¹² A good summary of the region's recent collaborative rainforest research directions and examples of research outputs can be found in the following publication: Stork, N.E. & Turton, S.M. (eds) (2008). *Living in a Dynamic Tropical Forest Landscape*. Blackwell Publishing.

dimensions. The Cairns Institute integrates the expertise and intellectual resources of more than 20 academic disciplines across three campuses in Townsville, Cairns and Singapore.

These changes greatly increase the potential for the region to expand its role as a centre for professional environmental training and learning. The region has the advantage of being a wet tropical environment with a modern economy. Its close proximity to the Asia-Pacific region increases its attractiveness as a regional research hub and centre of excellence for tropical ecological research and management with international relevance.

5. Facilitating the research agenda

A major function of WTMA is to encourage strategic research and promote the sharing of knowledge. WTMA is a regionally located and focussed government entity whose defined functions include:

- promotion of the WTQWHA locally, nationally and internationally
- gathering, researching, analysing and dissemination of information on the WTQWHA
- development of public and community education programs
- managing funding arrangements in relation to the WTQWHA
- liaison with the governments and authorities of the State, the Commonwealth, other States and the Territories, and international and foreign organisations and agencies.

WTMA is therefore in an ideal position to facilitate broader collaboration across government agencies and industry sectors and advocate for financial and in-kind support.

WTMA recognises that we need to provide incentives if we are to effectively engage with researchers, and that to best achieve this we need to reposition our organisation and promote our role as a potential research facilitator, in addition to being a potential user of research. WTMA also needs to promote and increase the visibility of the scientific and technical partnerships and cooperative arrangements we have established over time, and the mutual benefits that have emerged from this collaboration.

Facilitating mechanisms

1. Communicating our information needs

- This Strategy is designed to produce a greater synergy between management (policy and practice) and research by informing researchers and research funders as to where their efforts might best be focussed.

2. Providing resources

- WTMA can increase our role as a communication platform (web site, newsletters, other publications, convening user-focussed seminars/workshops);
- WTMA can provide a wide range of in-kind support, reports and other sources of 'grey literature', office space and facilities, GIS data, services and expertise, staff time and established networks;
- The project structure of WTMA's operations is ideally suited for encouraging student placements, student internships, or other work experience projects.

3. Promotion and recognition

- WTMA is well positioned to act as a champion for particular research proposals, and to more generally promote and support research, researchers and funding applications;

- WTMA can give special recognition to a researcher's body of work which benefits the management of the WTQWHA through its science category of the WTMA's Cassowary Awards;

4. Liaison

- WTMA has regional, State, Commonwealth and international links and responsibilities;
- WTMA is well positioned to raise the region's biodiversity and World Heritage agenda/profile, and attract funding, due to the region's outstanding natural significance and the threats to these values.

5. International relevance

- UNESCO has urged World Heritage sites be used as research benchmark sites and to become part of international research networks;
- WTMA is in a position to 'twin' with other World Heritage Areas – this may open new funding opportunities not otherwise available to researchers.

6. Partnership approaches

WTMA must look at a variety of partnership approaches as the best means of influencing the nature and relevance of research being undertaken in the Wet Tropics, the more common of which are outlined below. The choice of approach will be influenced by circumstances.

Approach 1: Research commissioned by WTMA

WTMA commissions research by contracting researchers to tackle specific research questions, in a particular way, over a defined time-frame, outlined in a 'terms of reference' a 'list of deliverables' and 'milestone time-lines'.

In the past, WTMA was a major funding and administering body for natural area research in the region, however WTMA has not operated a formal research funding program since 2006.

WTMA's past research program consisted of three separate initiatives:

1. Research Grants Scheme (short-term contracts) – 1992 to 2006
 - i. established researchers
 - ii. post-graduate student research grants
 - iii. Post Doctoral Fellowships.
2. Project Gondwana – biophysical inventory (medium-term contracts) - 1996 to 2000.
3. Vegetation mapping of the Wet Tropics bioregion at a scale of 1:50,000 (long-term contract) – 1997 to 2008.

Pursuit of this approach in the future would depend on WTMA securing responsibility for administration of a substantial research investment fund over several years.

Approach 2: Collaborative research programs

Formal collaborative affiliations of this type between WTMA and researchers have been in place for many years, for example, through a long-term collaborative partnership with the Rainforest CRC (1993 – 2006) and more recently through MTSRF (2006 – 2010).

Individual projects are coordinated by the Reef and Rainforest Research Centre (for MTSRF funded projects) or through cooperative research centres in the case of the Rainforest CRC. WTMA's role, as an industry partner, is to assist in project selection; be represented on various Boards, steering committees and project support teams; attend and contribute to workshops and conferences; and review and comment on various reports and other documentation.

Approach 3: Projects initiated by researchers

In this partnership approach, research projects are initiated independently by researchers through their research institutions with input and support from WTMA as an industry partner. Generally, the support of WTMA is sought because there is a requirement for the researcher to prove the practical value of their proposal by accruing matching financial or other forms of in-kind contributions from an industry partner. This form of partnership is very opportunistic and *ad hoc* and difficult for WTMA to budget for in advance.

An example of this type of partnership approach is that WTMA is currently an industry partner or co-sponsor in the Smart State funding of James Cook University's Centre for Tropical Biodiversity and Climate Change which involves WTMA committing substantial in-kind support in the form of GIS resources and staff.

Approach 4: projects delivered through postgraduate student grants

WTMA recognises the importance of providing research support to postgraduate research students who demonstrate clear evidence of high research potential. Providing modest financial support can greatly improve their research effectiveness, confidence and productivity. Providing top-up-grants to assist student research recognises the importance of attracting, retaining and supporting talented candidates to research degrees, with the longer-term aim of building the region's research capacity. Not only is providing support to postgraduate researchers a very cost-efficient method of undertaking research, it is also recognition of the important contribution postgraduate student researchers are making.

Approach 5: Joint research with affiliated sectors

In this approach, WTMA initiates research projects, in collaboration with other research-user organisations. Examples of this approach include:

- joint visitor surveys and economic studies between WTMA and tourism industry researchers
- design, construction and monitoring of wildlife underpasses and overpasses involving the Queensland Department of Transport and Main Roads, WTMA and researchers.

As the contribution of the WTQWHA to the social, cultural and economic wellbeing of the community becomes more widely appreciated, the opportunity to conduct research with related sectors (e.g. Indigenous, tourism, economic, community service infrastructure providers and local government) increases. This creates the opportunity to spread the cost of the research over several organisations, and increase the relevance of the research findings across different sectors of the regional community.

Approach 6: Projects delivered through volunteers

Community science programs are now lauded for their benefits to the participating individuals, the projects and the host organisations. Baseline research and monitoring projects conducted, or heavily supported by the work of community groups or non-government organisations, can capture large amounts of data.

Community science programs can increase the capacity of organisations for research. They supply labour to collect quantitative statistics from a large number of sites. Successful programs in our region link the work of volunteers to formal scientific programs that monitor the condition of species or ecosystems, for example the Great Barrier Marine Park Authority Reef Monitoring Program, and several large rainforest research projects through Earthwatch.

Recent research projects supported by WTMA involving volunteers have included cassowary dung collections for DNA analysis to develop improved techniques for cassowary population census, and the feral 'Deer Watch' project based on community deer sighting information.

7. Priority research questions 2010-2014

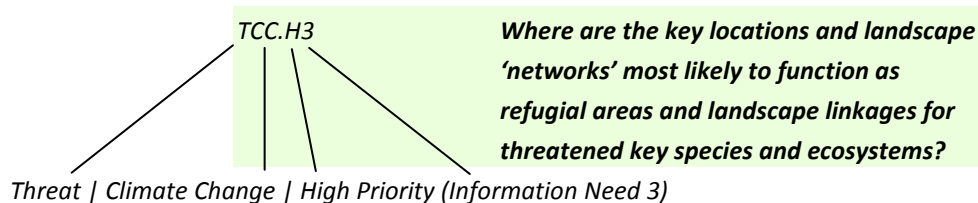
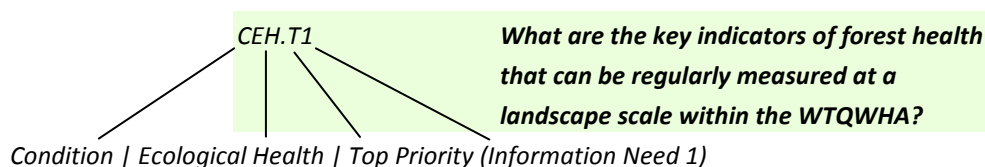
This Research Strategy identifies a small number of specific research questions of fundamental interest and relevance to WTMA, to which we are willing to commit greater resources in championing and supporting (presented below as **TOP PRIORITY research questions (.T)**), and a larger number of more general questions.

Of the general questions the **HIGH PRIORITY research questions (.H)** are those that WTMA has identified as of special interest and/or concern in the short to medium term, while the **OTHER PRIORITY research questions (.P)** are considered to be important but of lesser urgency. These three tiers also provide a broad indication of the scale of resources and time WTMA may be willing to invest in a project.

The scope of projects prompted by the more general questions will be dependent upon the capabilities of the researchers (e.g. student vs. established researcher, full-time vs. part-time research commitment etc) as well as financial and other resources. Some questions in isolation might be the basis of a small piece of research such as an honours thesis. Others might be scoped or combined in larger-scale projects. WTMA would welcome the opportunity to work collaboratively with researchers to develop projects that meet our needs and increase effectiveness and efficiency across our government and industry partners.

WTMA encourages its research partners to collaborate on long-term strategic issues as well as emerging threats that affect the WTQWHA. The focus of research and the priority topics will change over time with changes in the environmental, community, economic and political landscape, but the following information needs have been identified as priorities in the medium term (3–5 years).

Thirteen categories of management issues have been identified under five priority research themes, and information needs have been identified under each of these. Research questions have been prioritised into Top (.T), High (.H), and Other Priority (.P). These have been coded for ease of reference. The first letter refers to the relevant management function, the second and third letter to the relevant category, and the fourth to the priority. The final number is purely for ease of reference where there is more than one question identified for that category and priority.



In addition to the following list of questions, they have also been included as appendices sorted on the basis of 'top priority questions' (Appendix 1), 'high priority questions' (Appendix 2) and 'other priority questions' (Appendix 3).

Regional research capacity

Although not directly related to any specific research area, WTMA recognises the importance of supporting efforts directed at maintaining and strengthening regional research capacity, and the continued development of problem-solving oriented approaches for effective and sustainable World Heritage management. This research capacity, and the high quality research outcomes resulting from it, depends upon creating, maintaining and attracting:

- talented researchers
- adequate and up-to-date research infrastructure
- adequate and targeted funding
- good linkages to the best science overseas
- effective linkage to local users of knowledge and expertise
- consistent support over a long time-scale
- effective dissemination and promotion of research success
- successful translation of research resulting in significant environmental, social and economic impacts.

WTMA also recognises that all ecological research relies on accurate taxonomy. We are facing an increasing shortage of professional taxonomists and there is an urgent need to encourage more taxonomic expertise to the region. New technologies and software development, such as interactive plant identification keys, are particularly valuable and are considered a basic resource for research.

WTMA is also generally supportive of the continuation and expansion of long-term monitoring and inventory programs and the development and advancement in the discipline of ecological modelling and spatial analysis.

A. Understanding the condition and trends of the natural and cultural environment (C)

What do we wish to achieve?

We need to improve our understanding of the condition, trend and interdependencies of the natural and cultural environments of the Wet Tropics including methods to support ongoing regular assessment and reporting.

Ecological / Forest 'Health' (EH)

WTMA is responsible for reporting annually on the state of the WTQWHA to the Queensland and Australian governments, and also to UNESCO on a six yearly cycle. To understand whether and how the 'health' or

ecological integrity of the WTQWHA is changing we need to develop improved monitoring tools including methods and opportunities for using remote sensing technology.

TOP PRIORITY research questions

- | | |
|--------|---|
| CEH.T1 | What are the key indicators of forest health that can be regularly measured at a landscape scale within the WTQWHA? |
| CEH.T2 | Is there proven remote sensing technology able to be used to measure trends in these key indicators either directly or indirectly? |
| CEH.T3 | If not, what alternate approaches could be employed? |

Why are these priorities?

WTMA uses a variety of data and information but has not yet identified any practical measure to report on trends in 'health' of the WTQWHA at the 'whole-of-WTQWHA' scale. Remote sensing is the only technology that promises to provide a practical means of reporting on trends in overall WTQWHA 'health' or 'condition' in near real-time and on a regular, repeatable, affordable basis.

Considerations

WTMA has previously commissioned research in this area but several technological hurdles prevented it from being turned into simple routine procedures. Topography, the canopy, and cloud cover pose challenges to interpretation of remote sensing information for the WTQWHA.

HIGH PRIORITY research questions

- CEH.H1 What are the key indicators of forest health that can be used as a basis for assessment and reporting?
- CEH.H2 Is it possible to achieve high resolution mapping and monitoring of change and recovery by remote sensing in a topographically diverse landscape such as the Wet Tropics?
- CEH.H3 What are operational, cost-effective methods for monitoring trends in the 'condition' of landscapes, forests and waterways of the WTQWHA at a range of scales, incorporating the monitoring and assessment of risks and threats to the WTQWHA and the impacts of management actions, and how can monitoring results be incorporated into WTMA's statutory reporting?
- CEH.H4 How can the spatial distribution and magnitude of pressures impacting on the ecological condition of the WTQWHA be identified and mapped, including invasive species, development pressures, habitat fragmentation, wildlife diseases, water quality, upstream land uses and visitor pressures?
- CEH.H5 What are appropriate socio-economic and cultural indicators to describe the effects of changes in the ecological state of the region and changes in its management?

Priority Species and Ecosystems (SP)

There are several national and state Recovery Plans and Threat Abatement Plans¹³ which identify research priorities for threatened species and ecological communities. The following research questions are additional to those and of particular relevance to the WTQWHA.

TOP PRIORITY research question

CSP.T1 What are the condition, trends and projected futures of threatened species including cassowaries and arboreal mammals and other threatened species and ecosystems (including the identification and evaluation of the key threats to them and evaluation of available management options to improve their status)?

Why is this a priority?

The cassowary is classified as endangered in Australia. It is also recognised as a keystone species for seed dispersal in the WTQWHA. Cassowary populations are centred around the Mission Beach, Daintree and Kuranda areas, all of which are contested landscapes in term of development pressures. The cassowary is a high profile species and its survival or otherwise has become somewhat of a 'sustainability' indicator to the regional community. If we have good science to demonstrate that the population is definitely in decline this will give more weight for securing resources and government commitment to implementing impact mitigation measures. Improved understanding of population dynamics will also assist in designing such impact mitigation measures.

Considerations

WTMA and other organisations have already supported cassowary research by CSIRO and techniques for cassowary DNA-profiling have now been proved. CSIRO scientists have the capacity to build on this technology and undertake population dynamics research.

HIGH PRIORITY research questions

- CSP.H1 What aspects of population dynamics, DNA techniques, ecology, physiology, behaviour, and disease research are likely to be the most useful for on-ground recovery of threatened species such as the cassowary?
- CSP.H2 What is an appropriate L50 dose and what is an appropriate 1080 management strategy to ensure that the Wet Tropics race of the endangered spotted tailed quoll (*Dasyurus maculatus gracilis*) is not put at further risk from wild dog baiting programs?

¹³ National Recovery Plans and Threat Abatement Plans (required under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* <http://www.environment.gov.au/epbc/about/index.html> for threatened species and ecological communities, including the Southern Cassowary), can be found here: <http://www.environment.gov.au/biodiversity/threatened/index.html>
Recovery plans under the *Queensland Nature Conservation Act 1992* <http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/N/NatureConA92.pdf> can be found here: http://www.derm.qld.gov.au/wildlife-ecosystems/wildlife/threatened_plants_and_animals/recovery_conservation_plans.html

OTHER PRIORITY research questions

- CSP.P1 Are there valid surrogacy relationships between vegetation types/regional ecosystems and fauna habitat, and can this be used in the development of habitat mapping and improved predictive capacity especially with respect to threatened and endemic regional fauna?
- CSP.P2 What are the population trends, structure, distribution and genetics for key cassowary populations and what factors are the most likely cause of change for these populations?

Understanding the Wet Tropics' Outstanding Universal Value (UV)

The term Outstanding Universal Value (OUV) is the fundamental cornerstone of World Heritage (including nominations, monitoring and reporting) and is the basis for the protection and management of a World Heritage property. It is defined (in paragraph 49 of the *Operational Guidelines for the Implementation of the World Heritage Convention*¹⁴) as the:

“cultural and/or 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. As such, the permanent protection of this heritage is of the highest importance to the international community as a whole”

Interpreting Outstanding Universal Value (OUV) and its integrity (OUV-I) and applying it in practice can be difficult, but remains at the heart of the philosophy of World Heritage. There is an ongoing need, and obligation, to improve and update our knowledge of the OUV of the Wet Tropics and to incorporate new scientific evidence, understanding, theories and phylogenetic tools. We need better knowledge and understanding in relation to the four World Heritage criterion for which the Wet Tropics was inscribed (criterion vii, viii, ix and x):

- (vii) “contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance”:**

HIGH priority research questions

- CUV.H1 How can the aesthetic and scenic features and attributes of the WTQWHA, considered to be of outstanding universal value (OUV), be identified and described in greater detail as a basis for decisions about development in and around the WTQWHA?

OTHER PRIORITY research questions

- CUV.P1 How can the superlative natural phenomena displayed by the WTQWHA which could be considered to be of outstanding universal value (OUV) be identified and described in greater detail?

¹⁴ *Operational Guidelines for the Implementation of the World Heritage Convention* <http://whc.unesco.org/archive/opguide08-en.pdf>

- (viii) *“be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features”:*

HIGH PRIORITY research questions

- CUV.H2 How can the new understanding and theories of phylogenetics and the evolution of the angiosperms be used to update understanding of the OUV of the Wet Tropics; in particular, the concept and listing of ‘primitive’ or ‘basal’ angiosperms, Gondwanan taxa, species with a nodal position in evolution, and those species of Cretaceous origin and describe those aspects which could be considered to be of outstanding universal value?

OTHER PRIORITY research questions

- CUV.P2 What are the fossil, geological and geomorphologic features and attributes of the WTQWHA which could be considered to be of outstanding universal value be identified and described?

- (ix) *“be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals”;* and

- (x) *“contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation”.*

HIGH priority research questions

- CUV.H3 How can the climate sensitivity of species and ecosystems be determined to provide a greater indication of those outstanding universal values which are most susceptible to climate change and identify how much climate change (direction, magnitude, rate, means vs. extremes) is too much in relation to specific values including understanding the climatic thresholds of key species and communities?
- CUV.H4 Which species and ecosystems within the WTQWHA are most at risk from threatening processes and how can they be identified and quantified?

Rainforest Aboriginal Cultural Studies (AB)

Rainforest Aboriginal people have occupied, used and enjoyed their lands in the WTQWHA since time immemorial. 18 Aboriginal tribal groups continue to live in and around the WTQWHA and sustain their traditional cultural knowledge and connections to country. Conservation of the WTQWHA is inextricably linked with that of Aboriginal culture and spiritual values.

The long term special associations of Rainforest Aboriginal people with the land in the WTQWHA are recognised in the preambles of both State and Commonwealth legislation designed to direct management and

protection of the Area. The preamble of the *Wet Tropics World Heritage Protection and Management Act 1993*¹⁵ states:

"It is also the intention of the Parliament to acknowledge the significant contribution Aboriginal people can make to the future management of cultural and natural heritage within the Area, particularly through joint management agreements."

The *Wet Tropics World Heritage Area Regional Agreement 2005*¹⁶ provides for cooperative management between 18 Aboriginal tribal groups, WTMA and the Australian and Queensland governments, and WTMA is committed to ensuring involvement of Aboriginal people in management of the WTQWHA.

TOP PRIORITY research questions

CAB.T1	What are the aspirations and interests of Rainforest Aboriginal people in the use and joint management of different parts of the WTQWHA, and what systems of management can be developed to facilitate Aboriginal co-management of the WTQWHA?
CAB.T2	How can Wet Tropics Rainforest Aboriginal culture be documented, consistent with objectives of the Wet Tropics Regional Agreement?

Why are these priorities?

WTMA is committed to supporting increased meaningful involvement by Rainforest Aboriginal people in the management of the WTQWHA and recognises the need to work with Rainforest Aboriginal people in keeping with the principles of self-determination. In the spirit of reconciliation and improved management of the WTQWHA, we are taking positive steps to assist Rainforest Aboriginal people to achieve their aspirations to manage the Area.

Considerations

*The Queensland Nature Conservation Act 1992*¹⁷ and the *Wet Tropics World Heritage Protection and Management Act 1993*¹⁸ require the Environmental Protection Agency/Queensland Parks and Wildlife (QPWS) and WTMA to perform their functions, as far as practicable, in consultation and cooperation with Rainforest Aboriginal people.

Mechanisms for achieving greater Aboriginal involvement in management are provided under legislation such as the *Aboriginal Land Act (Queensland) 1991*¹⁹, the *Native Title Act (Commonwealth) 1993*²⁰, *Wet Tropics Management Plan (Queensland) 1998*²¹ or where land is owned by Aboriginal peoples (e.g. DOGIT, freehold/private, etc). Mechanisms can range from information sharing and consultation arrangements between Aboriginal people and land management agencies through to joint-decision making power.

¹⁵ *Wet Tropics World Heritage Protection and Management Act 1993* <http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WetTropicsA93.pdf>

¹⁶ *Wet Tropics World Heritage Area Regional Agreement 2005* http://www.wettropics.gov.au/rah/rah_pdf/regional_agreement.pdf

¹⁷ *The Queensland Nature Conservation Act 1992* <http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/N/NatureConA92.pdf>

¹⁸ *Wet Tropics World Heritage Protection and Management Act 1993* <http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WetTropicsA93.pdf>

¹⁹ *Aboriginal Land Act (Queensland) 1991* <http://legislation.govnet.qld.gov.au/LEGISLTN/CURRENT/A/AborLandA91.pdf>

²⁰ *Native Title Act (Commonwealth) 1993*

[http://www.comlaw.gov.au/ComLaw/Legislation/ActCompilation1.nsf/0/E2786B9A17728077CA25770D0019F960/\\$file/NativeTitle1993_WD02.pdf](http://www.comlaw.gov.au/ComLaw/Legislation/ActCompilation1.nsf/0/E2786B9A17728077CA25770D0019F960/$file/NativeTitle1993_WD02.pdf)

Native Title Act (Queensland) 1993 <http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/N/NativeTitleQA93.pdf>

²¹ *Wet Tropics Management Plan (Queensland) 1998* <http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WetTropMgmtP98.pdf>

HIGH PRIORITY research questions

- CAB.H1 How can Aboriginal capacity building and engagement in natural resource management be improved and implemented?
- CAB.H2 What are culturally important attributes of the WTQWHA and where are they located (cultural mapping)?

OTHER PRIORITY research questions

- CAB.P1 What is the status of traditional ecological knowledge as it applies to plants, animals, habitats, ecological processes, landscape function and caring for country in the Wet Tropics and how can it best be recorded, integrated and used in a culturally appropriate way?
- CAB.P2 What information is needed for the assessment and documentation of the case for recognition of Rainforest Aboriginal cultural heritage for national and international listing?
- CAB.P3 How can traditional Aboriginal ecological knowledge systems be applied in better management of the WTQWHA?
- CAB.P4 What is the potential for tourism as a vehicle for increasing involvement of rainforest Aboriginal people in the management of the WTQWHA?

B. Understanding Risks and Threats to the World Heritage Area (T)**What do we wish to achieve?**

We need to improve our understanding of the threats to, and their impact on, the Wet Tropics environment, develop options to mitigate them, and methods to identify priorities for action.

Alien and Invasive Species (AI)

Alien and invasive species are a major threat to the integrity of the WTQWHA and to rural industries in the region. Managers need to identify the best practices for prevention or control of pest species in the Wet Tropics, the implications of using these methods, and the habitat types and subregions that are most susceptible to invasive species, including better maps of current and projected distribution of spread, trends, and impacts at scales relevant to local and regional management.

TOP PRIORITY research questions

- TAI.T1 **Where should investment in pest animal research and management be directed and focused, considering the relative risk posed to the ecology and outstanding universal values and integrity (OUV-I) of the WTQWHA?**

Why is this a priority?

Current pest animal research and management is largely focussed on pig control and more recently on wild dogs and the pest fish, tilapia. However, there has recently been a proliferation of newly emerging pest animals (especially invertebrates) establishing in the region, including various tramp ant species, feral bees, feral worms and deer. Other pests, for example rabbits and foxes, have also been expanding their ranges. Many of these pests have the potential to have a significant impact upon rural economies. Natural area managers need to be better informed of the relative potential risks posed by these introductions.

Considerations

Socio-economic costs and benefits of both pests and their management is an important additional factor. For example, the environmental damage caused by feral pigs is recognised nationally as a key threatening process. There is widespread and high level community concern regarding pig damage to both the environment and rural industries in the region and increasing concern regarding the role of feral pigs in the spread of diseases of wildlife, domestic stock, and humans. Pig numbers are such that control measures designed to reduce numbers by killing need to be intensive and continuous. The response to the pig issue has diverted most of the region's protected area pest animal resources.

TAI.T2 Where are there identifiable, high-susceptibility areas where weeds and pest animals have the potential to become major drivers impacting the ecological health of particular communities, ecosystems or regions of the WTQWHA that should be the focus for keeping pest and/or weed free?

Why is this a priority?

If we knew which areas are most vulnerable, then WTMA could seek to have land managers focus pest and weed control / hygiene activities in these areas. Such 'parts' may be related to susceptibility or significance in terms of addressing climate change impacts, the significance of the site in terms of OUVs e.g. mountain tops and centres of endemism, particular vegetation types and their attractiveness to pest attack.

Considerations

Traditionally pest control has targeted specific pest species rather than targeting susceptible parts of the landscape. This change in emphasis will become more important when considering the interacting effects and impacts of climate change.

HIGH PRIORITY research questions

- CAI.H1 Which weed species cause, or are likely to cause, the greatest environmental harm, where are the key areas of susceptibility and what are their environmental impacts?
- CAI.H2 Are current infrastructure management/maintenance hygiene prescriptions appropriate and/or adequate with respect to potential weed and disease risks?
- CAI.H3 What are the impediments and management barriers to effective feral pig control in the Wet Tropics?

- CAIH4 Is the distribution and prevalence of *Phytophthora cinnamomi* within the WTQWHA increasing or decreasing: what factors drive change in distribution and virulence, and which of these are susceptible to management intervention?

OTHER PRIORITY research questions

- CAI.P1 What are the cost/benefits of different control measure options and is it possible to develop effective, species specific, and environmentally safe control methods (with an emphasis on the feral pig, tilapia and feral deer)?
- CAI.P2 What criteria should be used to prioritise expenditure on prevention, control, eradication or containment of weeds considered to pose a major threat to natural environments in the region?
- CAI.P3 What criteria should be used to prioritise expenditure on prevention, control, eradication or containment of vertebrate pests considered to pose a major threat to natural environments in the region?
- CAI.P4 What are the ecological and evolutionary impacts associated with the translocation of native species outside their natural range including fish stocking and tree planting?
- CAI.P5 What plant diseases or pests are, or could potentially, be associated with tree planting activities and what risk do they pose?

Impact Mitigation – Community Infrastructure and Activities (IM)

The provision of necessary community infrastructure is the main reason for permitting ongoing human disturbances within the WTQWHA, and managers are eager to minimise such disturbance.

For example, the presence of a road alters hydrology, fragments habitat and results in road-kill. Some native animals avoid roads, resulting in wildlife populations becoming isolated and causing a disruption to seasonal movements and genetic interchange. Roads are also a source of stream pollution and increased sediment load, while road culverts often result in the fragmentation of aquatic habitats and the altering of stream flow patterns. The habitat fragmentation impacts of a road can be amplified by road use which results in noise, vibration, movement, dust, emissions, and lights, each of which can interfere with wildlife activities and behaviour.

The clearings associated with power transmission lines typically have greater fragmentation and edge effect impacts than roads and can result in the intrusion of non-forest habitats (usually tall exotic grasslands or shrublands) into native forests which act as conduits for weeds, feral animals, wind and fire into the interior of the forest. Dams, weirs and culverts impact on aquatic ecosystems by causing changes in natural flow regimes as a result of water extraction and supply; by modifying or destroying habitats; by acting as barriers to the movement of plants and animals; by decreasing water quality and quantity; and increasing colonisation by introduced and exotic animal and plant species.

Guidelines relating to the design, construction and maintenance of these activities have been produced for the purpose of avoiding or mitigating undesirable impacts on the environment, but managers are always keen to keep strengthening them. We need information on ways to:

- Completely avoid particular impacts;
- Control the effects of unavoidable impacts; and
- Alleviate the effects of particular threats.

TOP PRIORITY research question

TIM.T1 What is the effectiveness of impact mitigation strategies and on-ground practices in restoring or maintaining ecological processes and function with respect to community infrastructure (e.g. roads, power supply and distribution, communications, water storage and water supply) design, construction, maintenance and use?

Why is this a priority?

As part of an adaptive management approach and to ensure that on-ground improvements are being achieved, it is important that researchers collaborate with WTMA, its on-ground managers and with infrastructure providers to monitor and provide feedback to continually improve design, construction and maintenance practices.

Considerations

Essential services supplied by community infrastructure are important for regional development but the construction and maintenance of infrastructure also impacts significantly on the condition of the natural environment, particularly where cleared corridors are required through rainforests.

HIGH PRIORITY research questions

- TIM.H1 What impacts do high altitude, low traffic presentation roads (e.g. Mt Lewis; ACB Roads) have on locally restricted endemic wildlife and what are appropriate design, maintenance and management considerations?
- TIM.H2 How can mountain-top sites within the WTQWHA be classified with respect to their ecological and evolutionary significance, vulnerability to disturbance and irreplaceability?
- TIM.H3 What impacts does the provision of community infrastructure have on water quality and on the ecological functioning of freshwater aquatic ecosystems?

OTHER PRIORITY research questions

- TIM.P1 What are suitable indicators for quantifying and monitoring grazing impacts?

Climate Change Impacts and Adaptation Strategies / Regional Responses (CC)

Climate change poses a significant threat to the Wet Tropics, particularly to species adapted to cool upland areas and isolated mountain tops, and many endemic species are predicted to decline significantly in range due to even slight increases in temperature. In 1997 the World Heritage Centre identified the WTQWHA as at particularly high risk from climate change.

We need predictions on the likely impacts of changing climate on key species, habitats and ecosystems, better understanding of how they might adapt, and to identify key species and ecosystems that are under most threat. To be able to mitigate the effects of climate change, we need to identify key refugia and landscape links, and develop guidelines for design of refugia to allow for movement of organisms and persistence of gene pools.

TOP PRIORITY research questions

TCC.T1	How resilient are different WTQWHA species and ecosystems to climate change and what management actions can be undertaken to maintain/improve ecosystem 'resilience' in the face of climate change?
TCC.T2	Where are the key locations and best landscape configurations most likely to function as refugial areas and landscape linkages for key threatened species and ecosystems?
TCC.T3	When and where is landscape connectivity a bad choice in relation to the maintenance and stability of refugial areas?

Why are these priorities?

A better understanding of the impacts of climate change would enable WTMA to encourage land managers and land use planners to focus on these areas to mitigate ongoing impacts and build the resilience of such networks and refugial areas.

Considerations

The principle of increasing landscape connectivity is strongly supported and promoted by the WTMA as a means of improving regional environmental resilience to a range of pressures such as clearing, fragmentation and climate change, and as a way of increasing access to a fragmented resource-base by wildlife, and mitigating the effects of population isolation and fragmentation. However, there may be special cases where climatically stable refugial areas with high levels of local endemism and highly specialist species, may be destabilised, and the resident species disadvantaged, by habitat invasion resulting from well-meaning but ill-conceived design.

HIGH PRIORITY research questions

TCC.H1	What are the short-term and long-term environmental, economic and social costs and benefits associated with particular climate change adaptation options and their likely effectiveness in the Wet Tropics?
TCC.H2	How will climate change impact on the natural and cultural environments of the WTQWHA and what is the level of spatial and temporal confidence associated with these predictions?
TCC.H3	Where are the key locations and landscape 'networks' most likely to function as refugial areas and landscape linkages for threatened key species and ecosystems?

OTHER PRIORITY research questions

- TCC.P1 How can climate change models and their underlying relationships and assumptions be tested and improved by the strategic collection of environmental and ecological data sets through the establishment of monitoring systems to enable early detection of climate change impacts on key species and ecosystems?
- TCC.P2 Which species are likely to be the best indicators of the effects of climate change on natural communities?
- TCC.P3 How will climate change and its primary impacts interact with other threats such as clearing, fragmentation, fire, weeds, feral animals, declining water quality, urbanisation and other land uses to impact on the outstanding universal values of the WTQWHA, including identification of those which have the greatest potential for substantial impact?
- TCC.P4 Under what circumstances and which places in the landscape could improving landscape connectivity result in negative ecological outcomes?
- TCC.P5 What design aspects and species selections need to be incorporated into rehabilitation projects to ensure that altitudinal and latitudinal buffers or corridors exist through the landscape?
- TCC.P6 How does the WTQWHA contribute to greenhouse gas emissions, sequestration and storage?
- TCC.P7 How resilient are key sectors of local industry, notably tourism and visitor services, with respect to the environmental impacts of climate change?

Land Use Change (LU)

There are many direct and indirect ecological impacts related to population growth and associated urban and rural development including habitat loss, modification and fragmentation. Far North Queensland has one of the fastest rates of population growth in Queensland. The regional population doubled from around 111,000 in 1976 to over 220,000 by 2006, and is predicted to grow by at least another 100,000 over the next 20 years. This will increase demand for resources like land, water, recreational opportunities, and agricultural products, which in turn will increase external pressures on the WTQWHA. Although over 65% of the WTQWHA is protected area estate, the remainder, and most of the surrounding landscape, falls under a range of different land tenures. While people may be attracted to live in the region in part because of its outstanding natural values, changes in land use surrounding the WTQWHA will inevitably put more pressure on those values.

The *Far North Queensland Regional Plan 2009-2031*²² aims to ensure this growth is sustainable and protects areas of significant environmental value (including WTQWHA and the GBRWHA). WTMA is keen to ensure that planning decisions are guided by the best available environmental science.

²² Queensland Government (2009) *Far North Queensland Regional Plan 2009-2031*. <http://www.dip.qld.gov.au/regional-planning/regional-plan-3.html>

HIGH PRIORITY research questions

- TLU.H1 What are the fragmentation, patch size and connectivity thresholds for maintenance of biodiversity and ecosystem processes?
- TLU.H2 What is the impact on water quality and on aquatic wildlife within the WTQWHA (in particular endangered amphibians and endemic freshwater fish) of agricultural chemicals used upstream of the WTQWHA?

OTHER PRIORITY research questions

- TLU.P1 Which Wet Tropics landscape and ecosystem processes are most at risk from changing landuses?
- TLU.P2 What is the comparative biological and ecological importance of regrowth, modified, disturbed and/or fragmented vegetation?
- TLU.P3 What are the impacts on water quality and local and regional water resource demands arising from land use change?
- TLU.P4 What impacts does groundwater extraction have on the condition of vegetation and freshwater aquatic communities in the WTQWHA?
- TLU.P5 What are the assessment and planning needs for sustainable native vegetation and biodiversity conservation at various planning scales?
- TLU.P6 How can ecosystem goods and services be defined and quantified as a framework for the application of incentive mechanisms with respect to development activities?

C. Sustainable use and management of the World Heritage Area (M)

What do we wish to achieve?

We need to better understand the current and potential community uses/benefits of the WTQWHA, its biodiversity and natural resources, with respect to ecological, social and economic sustainability. We need information and options to assist managers, industries and communities to minimise adverse impacts of use where they occur.

World Heritage Presentation, Recreation and Tourism (TO)

Nature-based tourism is the mainstay of the North Queensland economy, with visits to tourism sites in and around the WTQWHA estimated to be about 5 million per year. In order to protect both the integrity of the WTQWHA and the tourism industry itself, tourism in the area must be ecologically sustainable. WTMA also has an obligation under the World Heritage Convention to present the OUVs of the Wet Tropics to locals and visitors. Much useful information to improve the management of the WTQWHA can be gained through periodic visitor surveys aimed at assessing the effectiveness of tourism, and WTQWHA management, in achieving a 'matching' of visitor needs with tourism experiences.

HIGH PRIORITY research questions

- MTO.H1 What are the key determinants of visitor experience at WTQWHA recreation sites?
- MTO.H2 What are the key indicators of visitor behaviour, motivation and understanding and how might these be applied to improve management?

OTHER PRIORITY research questions

- MTO.P1 How can visitor perceptions of scenic and aesthetic importance be assessed and how might this information be used in impact assessment?
- MTO.P2 What constitutes best practice techniques for presentation of the WTQWHA, and what is the role of the tourism industry in this?
- MTO.P3 What are best practice techniques for design, construction and maintenance of nature-based visitor facilities within the context of a wet tropical environment?
- MTO.P4 What are the impacts on rainforest wildlife of visitor – wildlife interactions and can better wildlife viewing techniques be developed to mitigate adverse visitor impacts?
- MTO.P5 What particular issues are relevant to international visitors to the Wet Tropics and how could this be adopted in management?

Giving the WTQWHA a Role in the Life of the Community (CO)

World Heritage managers have an obligation, outlined in UNESCO's *Operational Guidelines for the Implementation of the World Heritage Convention*²³ to give their World Heritage property a role in the life of their community. A systematic approach to understanding community expectations and residents experience of the WTQWHA will help develop on-ground programs that increase appreciation of the WTQWHA and improve community satisfaction and support.

TOP PRIORITY research question

TCO.T1 How can business (particularly the tourism industry) and other community and Traditional Owner partners be engaged, benefit from, and contribute to the knowledge and management that is integral to WTQWHA protection and management?

Why is this a priority?

Industry, Traditional Owner and community benefits are an important *raison d'être* for WTMA. WTMA needs to know not only how to engage the community but also to show that this engagement is occurring and that benefits are derived from the engagement.

Considerations

Engagement models, for example those related to the cassowary as a focal species, are important to understand and to quantify the economic benefits that flow from such engagement.

²³ Operational Guidelines for the Implementation of the World Heritage Convention <http://whc.unesco.org/archive/opguide08-en.pdf>

HIGH PRIORITY research questions

- TCO.H1 What are community attitudes, knowledge levels, perceptions, expectations, concerns, needs and levels of support with respect to the use and management of the WTQWHA?
- TCO.H2 How can traditional knowledge or resource management techniques best be incorporated with mainstream or western-based management practice which is generally based on science and government policy?

OTHER PRIORITY research questions

- TCO.H3 How can we best promote the value of the WTQWHA to the community?
- TCO.H4 What are the reasons behind people's use and appreciation of the WTQWHA and the variation between different demographics or segments of the population?
- TCO.H5 How can WTMA best enhance community understanding and enjoyment of the WTQWHA?
- TCO.H6 How can WTMA understand, evaluate, document and promote the educational benefits of the WTQWHA?

Socio-economic and Environmental Benefits (Ecological Goods & Services) (SE)

The WTQWHA is an important source of numerous direct and indirect human benefits in the form of environmental goods and services. Examples of the range of services include products like clean drinking water, erosion control, flood mitigation and tourism; and processes such as litter decomposition and nutrient cycling, carbon sequestration and pollination. The majority of the region's rivers feed into the Great Barrier Reef lagoon, and water quality is a key threat to the integrity of GBRWHA values²⁴.

The WTQWHA is also a sanctuary from urban pressures, a place for exploration, and provides the community with a sense of place, cultural identity and spiritual nourishment. Although placing a financial value on these services is complex and contentious, they are nevertheless of enormous value to the regional economy, and to human health and wellbeing.

TOP PRIORITY research questions

- MSE.T1 What is the value of the goods and services provided by the WTQWHA across a range of parameters and what socio-economic contributions and benefits do they make to the community?**

Why is this a priority?

We need to demonstrate the importance of the WTQWHA, not only as a place to enjoy for its intrinsic World Heritage values but also the benefits it bestows on the community in terms of water, erosion-control, filtration, natural resources, Aboriginal health, and tourism. The research priority for next 3 – 5 years should focus on the WTQWHA and its role in water supply and water quality.

²⁴ Queensland Government (2009). *Reef Water Quality Protection Plan*. <http://www.reefplan.qld.gov.au/about/rwqpp.shtm>

Considerations

A better understanding of the nature, scale and range of ecological goods and services could also assist in developing incentive mechanisms with respect to development activities and better inform the concept of ecological offsets.

HIGH PRIORITY research questions

MSE.H1 What are the ecological goods and services provided by the WTQWHA for the regional community and the GBRWHA?

OTHER PRIORITY research questions

MSE.P1 What are the relative financial and economic values of key Wet Tropics' species (particularly the Cassowary), habitats and regional water resources?

MSE.P2 What is the role of the WTQWHA in maintaining prosperity together with social health and wellbeing?

MSE.P3 What are the ecological goods and services provided by the WTQWHA with respect to conservation benefits for the Great Barrier Reef?

Supporting Economic Activity (EA)

Tourism has been the fastest growing industry in North Queensland for the last three decades and makes a significant contribution to the local economy. Nature-based tourism is the main drawcard. Protection of the WTQWHA is essential to the sustainability of the local tourism industry, and tourism contributes significantly to political and community support for protection of the Great Barrier Reef and Wet Tropics rainforests.

HIGH PRIORITY research questions

MEA.H1 How does the WTQWHA support the regional nature-based tourism and recreational industry, and regional economic activity through employment and investments and how can this information be used in advocacy, policy development and planning?

MEA.H2 How sensitive is the economic contribution of the WTQWHA to land management options?

OTHER PRIORITY research questions

MEA.P1 What is the socio-economic value of the WTQWHA for the tourism industry and their flow-on benefits to the regional community and economy?

D. Habitat management and restoration (H)

What do we wish to achieve?

We need to improve our understanding of the current and potential uses of the WTQWHA with respect to maintenance, improvement and sustainable use of biodiversity and ecosystem function. More information is needed to assist WTMA, infrastructure agencies and communities, to plan effectively for sustainable land management, and to identify options for improving practices, reducing risks, and mitigating adverse impacts, and to measure the effectiveness of actions to halt and reverse declines.

The following priority research questions are additional to the national research priorities identified in several regionally relevant national Recovery Plans and Threat Abatement Plans²⁵.

Fragmentation is one of the major threats to the integrity of the WTQWHA. Queensland's *Vegetation Management and Other Legislation Amendment Regulation (No.1) (2004)*²⁶ restricts broad-scale clearing of native vegetation, but historical land-clearing, particularly on the flatter lands of the coast and Tablelands has resulted in a highly fragmented landscape. This increases the vulnerability of the WTQWHA to disturbance and decreases its resilience to threats such as weeds, feral animals and climate change. Rehabilitation efforts focused on restoring connectivity are therefore critical to increasing the resilience of Wet Tropics ecosystems.

Wildlife Corridors (WC)

TOP PRIORITY research question

HWC.T1 What are achievable, cost-effective techniques for rehabilitating degraded sites and re-establishing natural successional processes, including the restoration of ecological connectivity in infrastructure corridors?

Why is this a priority?

Establishing corridors across a contested landscape has many challenges and costs. It is important to have a reasonable level of research information available to know what is required to ensure a rehabilitation corridor will fulfil its intended ecological function.

Considerations

At this stage it is uncertain how to achieve the most effective habitat connectivity e.g. does connecting the landscape by rehabilitation with a preferred food source encourage wildlife movement or will it result in occupation and territorial behaviour inhibiting connectivity? Consideration also needs to be given to aquatic corridors that are currently fragmented (by dams, barriers, culverts, etc.) that may affect threatened and endemic aquatic species.

²⁵ National Recovery Plans and Threat Abatement Plans (required under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* <http://www.environment.gov.au/epbc/about/index.html> for threatened species and ecological communities, including the Southern Cassowary), can be found here: <http://www.environment.gov.au/biodiversity/threatened/index.html>

Recovery plans under the *Queensland Nature Conservation Act 1992* <http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/N/NatureConA92.pdf> can be found here: http://www.derm.qld.gov.au/wildlife-ecosystems/wildlife/threatened_plants_and_animals/recovery_conservation_plans.html

²⁶ Queensland Government (2004). *Vegetation Management and Other Legislation Amendment Regulation (No.1) (2004)* <http://legislation.govnet.qld.gov.au/LEGISLTN/SLS/2004/04SL063.pdf>

HIGH PRIORITY research questions

- HWC.H1 What constitutes critical patch size thresholds and corridor widths for wildlife associated with different landscape types?
- HWC.H2 By applying existing knowledge and trialling different designs, demonstrate how to design and rehabilitate a wildlife corridor to achieve improved habitat connectivity for identified species of World Heritage significance, and in particular the cassowary?

OTHER PRIORITY research questions

- HWC.P1 What evidence is there that wildlife corridors serving their intended purposes at a landscape scale?
- HWC.P2 What are the functional implications of riparian corridors with respect to width and connectivity?

Rehabilitation and Restoration (RR)**TOP PRIORITY research question**

- HRR.T1 **What are the preferred or priority areas for undertaking World Heritage ‘offset’ rehabilitation activities?**

Why is this a priority?

We need this information to assist in implementing WTMA’s offset policy and administration of the *Wet Tropics Management Plan*²⁷ with respect to offset requirements associated with community services infrastructure. Rehabilitation areas could be selected on the basis of improving connectivity for wildlife movement, ‘buffering’ significant ecosystems adjacent land uses impacting on the WHA, re-establishing threatened WH ecosystems, screening infrastructure which impacts on significant scenic amenity of the WHA.

Considerations

Net costs and benefits of any offsetting option need to be taken into account. WTMA would need to be very heavily involved in both developing and undertaking such a project.

HIGH PRIORITY research questions

- HRR.H1 What are the best practice designs for creating refuge habitats as a proactive response to shifts in climate zones due to climate change?
- HRR.H2 How can we effectively prioritize the most important large-scale ecological restoration projects that could be undertaken in the Wet Tropics?
- HRR.H3 What are the options for large-scale rehabilitation following decommissioning of redundant infrastructure (e.g. powerlines or roads)?

²⁷ *Wet Tropics Management Plan (1998)* <http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WetTropMgmtP98.pdf>

OTHER PRIORITY research questions

HRR.P4 What constitutes the best land rehabilitation practices and their costs and benefits in environmental, social and economic terms?

Fire Management (FM)

Many ecosystems in the Wet Tropics evolved under the influence of fire. Traditional Aboriginal fire management played a vital role in biodiversity conservation by creating a mosaic of ecological niches for plants and animals. Disruption of these historical fire patterns since European settlement has resulted in changes in ecological communities, particularly in the wet and dry sclerophyll communities along the boundaries of the rainforest, home to rare and threatened species such as the northern bettong, several species of gliders, and terrestrial orchids.

TOP PRIORITY research question

HFM.T1 What are the characteristics of the dynamics of rainforest/open forest edges and other ecosystem boundaries and how should these characteristics be considered when reviewing boundary fire management in response to a changing climate?

Why is this a priority?

A distinctive feature of rainforest in the Wet Tropics is the often abrupt boundary between the rainforest and eucalypt dominated vegetation. In the region wet sclerophyll forest dominated by tall (>40 metre) eucalypts typically forms a narrow fringe ranging from 300 metres to less than 4 kilometres wide along the rainforest margin. There is evidence that the extent of this forest type has been reduced to half its extent over the last 50 years, largely as a result of conversion to rainforest. Similar claims have been made regarding coastal sclerophyll forests being transformed to rainforest at an accelerating rate. There is currently poor understanding of the short and long term dynamic processes involved in this pattern of ecological change, and a poor appreciation of what constitutes appropriate short and long term management responses to this pattern of change.

Considerations

The vegetation dynamics of the rainforest boundary has been the subject of much scientific and management interest. While the rainforest boundaries appear abrupt and stable on short time frames, pollen records show that these boundaries have been expanding and contracting throughout geological history, and the current day expansion is partly a function of climatic amelioration and/or release from fire suppression. A number of researchers report that rainforest is expanding at the expense of eucalypt forest, due to altered changed fire regimes since European settlement.

HIGH PRIORITY research questions

HFM.H1 What are the criteria that need to be developed to identify key areas for fire management and other areas where expansion of rainforest is actually a desirable/natural outcome?

OTHER PRIORITY research questions

- HFM.P1 In light of the impact of climate change on ecosystems, how can WTQWHA on-ground land managers optimise their fire management while meeting biodiversity and cultural heritage conservation, recreational availability, and requirements for community safety?
- HFM.P2 What are the 'best' fire management regimes (for the protection of natural heritage values) for key vegetation types or areas?
- HFM.P3 How can traditional ecological knowledge be incorporated to effectively involve Aboriginal people in fire management programs?

E. Science / Management Partnership Performance (S)**What do we wish to achieve?**

We want to improve our understanding of how effective research findings are in terms of their influence on (uptake, adoption, contribution to) regional World Heritage conservation, policy, and management practices; and in building community knowledge, awareness and support.

Adoption – Making a Difference (AD)**TOP PRIORITY research question**

- SAD.T1 **How can social and ecological science be integrated into World Heritage conservation policy and management in order to build long-term social and environmental sustainability and resilience in the Wet Tropics?**

Why is this a priority?

There is growing recognition among conservation managers of the need to blend ecological science with social science in ecosystem-based management approaches in order to build long-term resilience and sustainability. We need to better understand how to turn scientific knowledge into effective real-world conservation actions supported by the community.

Considerations

Implementation of scientific knowledge into real-world conservation action is at the cutting edge of conservation management practice. Complex environmental challenges require multi-disciplinary, collaborative, approaches to managing them. Relevant, timely, and well-focussed research has a crucial role to play in informing management decisions and actions, and managers need to ensure that findings can be applied to conservation policy and practice.

HIGH PRIORITY research questions

- SAD.H1 What evidence is there that the findings from research and monitoring programs are influencing land management agencies in the region and what are the barriers to knowledge transfer?
- SAD.H2 What evidence is there that the partnerships and cooperative arrangements between WTMA and the research provider community is achieving desired outcomes?

OTHER PRIORITY research questions

- SAD.P1 What is the uptake of research recommendations by WTMA and other agencies with a role in managing the WTQWHA?
- SAD.P2 What evidence is there that research topics and grant applications are representing and responding to on-ground management challenges and issues?

Information Technology (IT)

New technologies are constantly emerging that enable land managers to increase their knowledge and improve management practices. The opportunities for using existing and emerging technologies, including web-based approaches, in WTQWHA management, interpretation and education, are immense, but not without cost.

HIGH PRIORITY research questions

- SIT.H1 How successful are WTMA's current programs, and how can WTMA and its research and development partners work together to use new technologies to maximise access/exposure benefits and minimise cost? Which new technologies are available to WTMA and how can they best be applied to operational systems?

8. Actions

Identifying these research questions is only one step in the process in meeting WTMA's information needs. We also need to communicate our priority research needs, foster partnerships, provide a range of incentives and other services, initiate or promote projects, collaborate as a research partner, disseminate major findings, and assist in securing financial and in-kind support. To further our research objectives, WTMA will:

1. Communicate WTMA's research strategy and priorities

WTMA will encourage research institutions and industry sector partners to undertake research that addresses strategic WTQWHA management issues. WTMA will promote research partnerships to investigate environmental, management, cultural, social and economic issues as outlines in the following section of this strategy.

2. Establish partnerships and promote investment to support Wet Tropics research

WTMA will participate cooperatively and facilitate collaboration on research projects that benefit the management of the WTQWHA. WTMA will promote, advocate, and champion investment into its priority research areas and research partnerships. Support may include providing letters of support or commitments as industry partners. Investment may be in the form of seed funding to initiate a new area of enquiry, co-investment or in-kind support for projects conducted through formal government or non-government grant schemes.

3. Facilitate research through a range of supportive mechanisms

WTMA will undertake to provide a range of supportive mechanisms and services to assist researchers in undertaking their studies, such as promoting the region as an outstanding location for tropical ecosystem research projects. WTMA will also offer a range of incentives to attract research interest by providing services such as the identification of collaboration opportunities and relevant research problems, a brokering service to help link people together, facilitation of research permits (liaison with QPWS), assistance with logistical needs, provision of office accommodation as appropriate, access to reports and other 'grey' literature, GIS data, products, services and expertise, work experience or supervision of in-house student projects and financial support subject to budgetary constraints.

4. Disseminate and adopt research findings

WTMA will improve its dissemination of research findings, knowledge and information on the management of the WTQWHA through its website and other publication resources. WTMA's website has the potential to develop into a focal point to connect, share and develop knowledge and resources relevant to the WTQWHA. A well designed and managed web-based focal point will encourage researchers to make their knowledge available. Electronic dissemination of information will be supported by the sharing of research findings through co-authored scientific papers, public seminars and conference presentations.

9. Key Performance Indicators

The following set of indicators will be used as a basis for reporting on progress towards the achievement of the WTMA's research objectives and evaluating the impact of this Strategy. Indicators have been organised under four main groupings based on the Actions identified in the previous section.

Action 1: Communicate WTMA's research strategy and priorities

Objective	Key performance indicators
1. Identify priority research topics and questions which will benefit WTQWHA management.	1a. Priority research topics reviewed annually to ensure priorities remain current.
2. Promote appropriate research into World Heritage, conservation land management, environmental, cultural, social and economic issues, across the Wet Tropics bioregion and with a primary focus on the WTQWHA, policy development and operational decision making.	2a. Numbers of significant research projects addressing Wet Tropics research priorities. 2b. Number of scientists with permits to undertake research in the WTQWHA. 2c. Evidence or examples of the research strategy being influential in attracting research investment to the region.

Action 2: Establish partnerships and promote investment to support Wet Tropics research

Objective	Key performance indicators
3. Identify, and seek opportunities for, a variety of collaboration and partnership approaches to enable and encourage Wet Tropics natural area land management agencies (including WTMA), and scientists/researchers to work together on world heritage related projects.	3a. Number of WTMA collaborative research partnerships with key organisations. 3b. Evidence of researcher/WTMA partnerships, including collaborative development of research proposals and in-kind support.
4. Promote increased financial and in-kind support through advocacy, collaboration and other means to undertake research relevant and important to the WTQWHA.	4a. Number of industry partner commitments from WTMA. 4b. Examples of WTMA financial investment or in-kind support for research projects. 4c. Examples of how the Research Strategy has been used in the formulation or justification of research funding proposals.
5. Build on the outcomes of previous research partnerships with the Rainforest CRC and MTSRF.	5a. Examples of research which builds on outcomes from previous WTMA research partnerships.

Action 3: Facilitate research through a range of supportive mechanisms

Objective	Key performance indicators
6. Identify ways in which WTMA can help facilitate research (e.g. through knowledge brokering, information sharing, project facilitation and capacity building).	6a. Number of researchers using WTMA office facilities. 6b. Evidence of use of WTMA library of grey literature and GIS resources. 6c. Number of students undertaking work experience, training or supervision at WTMA.

Action 4: Disseminate and adopt research findings

Objective	Key performance indicators
7. Disseminate research findings to communities of interest in an effective and timely way (e.g. research findings used by Wet Tropics land managers and other key stakeholders in evidence-based decision making).	7a. Number of technical and scientific publications about the Wet Tropics and the Wet Tropics of Queensland World Heritage Area in particular. 7b. Number of forums for land managers and other key stakeholders, to promote research and its findings, and provide an opportunity to consider the implications of this work for policy and practice. 7c. Examples of where research findings have been applied in making evidence-based decision-making, policy and planning, and on-ground management practice. 7d. Evidence of WTMA knowledge transfer being effective in informing key stakeholders of solutions-based research findings.

Appendix 1

TOP PRIORITY research questions (.T)

A. Understanding the condition and trends of the natural and cultural environment (C)

Ecological/forest 'health' (EH)

CEH.T1 What are the key indicators of forest health that can be regularly measured at a landscape scale within the WTQWHA? Is there proven remote sensing technology able to be used to measure trends in these key indicators either directly or indirectly? If not, what alternate approaches could be employed?

Priority species and ecosystems (SP)

CSP.T1 What is the condition, trends and projected futures of threatened species including cassowaries and arboreal mammals and other threatened species and ecosystems (including the identification and evaluation of the key threats to them and evaluation of available management options to improve their status)?

Rainforest Aboriginal cultural studies (AB)

CAB.T1 What are the aspirations and interests of Rainforest Aboriginal people in the use and joint management of different parts of the WTQWHA and what systems of management can be developed to facilitate Aboriginal co-management of the WTQWHA?

CAB.T2 How can Wet Tropics Rainforest Aboriginal culture be documented, consistent with objectives of the Wet Tropics Regional Agreement?

B. Understanding risks and threats to the World Heritage Area (T)

Alien and invasive species (AI)

TAI.T1 Where should investment in pest animal research and management be directed and focussed considering the relative risk posed to the ecology and outstanding universal values and integrity (OUV-I) of the WTQWHA?

TAI.T2 Where are there identifiable, high-susceptibility areas where weeds and pest animals have the potential to become major drivers impacting the ecological health of particular communities, ecosystems or regions of the WTQWHA that should be the focus for keeping pest and/or weed free?

Impact mitigation – community infrastructure and activities (IM)

- TIM.T1 What is the effectiveness of impact mitigation strategies and on-ground practices in restoring or maintaining ecological processes and function with respect to community infrastructure (e.g. roads, power supply and distribution, communications, water storage and water supply) design, construction, maintenance and use?

Climate change impacts and adaptation strategies/regional responses (CC)

- TCC.T1 How resilient are different WTQWHA species and ecosystems to climate change and what management actions can be undertaken to maintain/improve ecosystem ‘resilience’ in the face of climate change?
- TCC.T2 Where are the key locations and best landscape configurations most likely to function as refugial areas and landscape linkages for key threatened species and ecosystems?
- TCC.T3 When and where is landscape connectivity a bad choice in relation to the maintenance and stability of refugial areas?

C. Sustainable use and management of the World Heritage Area (M)

Giving the WTQWHA a role in the life of the community (CO)

- MCO.T1 How can business (particularly the tourism industry), community and Traditional Owner partners be engaged, benefit from and contribute to the knowledge and management that is integral to WTQWHA protection and management?

Socio-economic & environmental benefits (ecological goods & services) (SE)

- MSE.T1 What is the value of the goods and services provided by the WTQWHA across a range of parameters and what socio-economic contributions and benefits do they make to the community?

D. Habitat management and restoration (H)

Wildlife corridors (WC)

- HWC.T1 What are achievable, cost-effective techniques for rehabilitating degraded sites and re-establishing natural successional processes, including the restoration of ecological connectivity in infrastructure corridors?

Rehabilitation and restoration (RR)

- HRR.T1 What are the preferred or priority areas for undertaking World Heritage ‘offset’ rehabilitation activities?

Fire Management (FM)

HFM.T1 What are the characteristics of the dynamics of rainforest/open forest edges and other ecosystem boundaries and how should these characteristics be considered when reviewing boundary fire management in response to a changing climate?

E. Science/management partnership performance (S)

Adoption – making a difference (AD)

SAD.T1 How can the ecological and social dimensions of World Heritage conservation policy and management be linked to build resilience and long-term sustainability in the management of the WTQWHA?

Appendix 2

HIGH PRIORITY research questions (.H)

A. Understanding the condition and trends of the natural and cultural environment (C)

Ecological/forest 'health' (EH)

- CEH.H1 What are the key indicators of forest health that can be used as a basis for assessment and reporting?
- CEH.H2 Is it possible to achieve high resolution mapping and monitoring of change and recovery by remote sensing in a topographically diverse landscape such as the Wet Tropics?
- CEH.H3 What are operational, cost-effective methods for monitoring trends in the 'condition' of landscapes, forests and waterways of the WTQWHA at a range of scales, incorporating the monitoring and assessment of risks and threats to the WTQWHA and the impacts of management actions, and how can monitoring results be incorporated into WTMA's statutory reporting?
- CEH.H3 How can the spatial distribution and magnitude of pressures impacting on the ecological condition of the WTQWHA be identified and mapped, including invasive species, development pressures, habitat fragmentation, wildlife diseases, and visitor pressures?
- CEH.H4 What are appropriate socio-economic and cultural indicators to describe the effects of changes in the ecological state of the region and changes in its management?

Priority species and ecosystems (SP)

- CSP.H1 What aspects of population dynamics, DNA techniques, ecology, physiology, behaviour and disease research are likely to be the most useful for on-ground recovery of threatened species such as the cassowary?

Understanding the Wet Tropics' outstanding universal values (UV)

- CUV.H1 How can the aesthetic and scenic features and attributes of the WTQWHA, considered to be of outstanding universal value (OUV-I), be identified and described in greater detail as a basis for decisions about development in and around the WTQWHA?
- CUV.H2 How can the new understanding and theories of phylogenetics and the evolution of the angiosperms be used to update understanding of the OUV-I of the Wet Tropics; in particular, the concept and listing of 'primitive' or 'basal' angiosperms, Gondwanan taxa, species with a nodal position in evolution, and those species of Cretaceous origin and describe those aspects which could be considered to be of outstanding universal value?
- CUV.H3 How can the climate sensitivity of species and ecosystems be determined to provide a greater indication of those outstanding universal values which are most susceptible to climate change?

and identify how much climate change (direction, magnitude, rate, means vs. extremes) is too much in relation to specific values including understanding the climatic thresholds of key species and communities?

- CUV.H4 Which species and ecosystems within the WTQWHA are most at risk from threatening processes and how can they be identified and quantified?

Rainforest Aboriginal cultural studies (AB)

- CAB.H1 How can Aboriginal capacity building and engagement in natural resource management be improved and implemented?
- CAB.H2 What are culturally important attributes of the WTQWHA and where are they located (cultural mapping)?

B. Understanding risks and threats to the World Heritage Area (T)

Alien and invasive species (AI)

- TAI.H1 Which weed species cause, or are likely to cause, the greatest environmental harm, where are the key areas of susceptibility and what are their environmental impacts?
- TAI.H2 Are current infrastructure management/maintenance hygiene prescriptions appropriate and/or adequate with respect to potential weed and disease risks?
- TAI.H3 What are the impediments and management barriers to effective feral pig control in the Wet Tropics?
- TAI.H4 Is the distribution and prevalence of *Phytophthora cinnamomi* within the WTQWHA increasing or decreasing: what factors drive change in distribution and virulence, and which of these are susceptible to management intervention?

Impact mitigation – community infrastructure and activities (IM)

- TIM.H1 What impacts do high altitude, low traffic presentation roads (e.g. Mt Lewis; ACB Roads) have on locally restricted endemic wildlife and what are appropriate design, maintenance and management considerations?
- TIM.H2 How can mountain-top sites within the WTQWHA be classified with respect to their ecological and evolutionary significance, vulnerability to disturbance and irreplaceability?
- TIM.H3 What impacts does the provision of community infrastructure have on water quality and on the ecological functioning of freshwater aquatic ecosystems?

Climate change impacts and adaptation strategies/regional responses (CC)

- TCC.H1 What are the short-term and long-term environmental, economic and social costs and benefits associated with particular climate change adaptation options and their likely effectiveness in the Wet Tropics?
- TCC.H2 How will climate change impact on the natural and cultural environments of the WTQWHA and what is the level of spatial and temporal confidence associated with these predictions?
- TCC.H3 Where are the key locations and landscape 'networks' most likely to function as refugial areas and landscape linkages for threatened key species and ecosystems?

Landuse change (LU)

- TLU.H1 What are the fragmentation, patch size and connectivity thresholds for maintenance of biodiversity and ecosystem processes?
- TLU.H2 What is the impact on water quality and on aquatic wildlife within the WTQWHA (in particular endangered amphibians and endemic freshwater fish) of agricultural chemicals used upstream of the WTQWHA?

C. Sustainable use and management of the World Heritage Area (M)

World Heritage presentation, recreation and tourism (TO)

- MTO.H1 What are the key determinants of visitor experience at WTQWHA recreation sites?
- MTO.H2 What are the key indicators of visitor behaviour, motivation and understanding and how might these be applied to improve management?

Giving the WTQWHA a role in the life of the community (CO)

- MCO.H1 What are community attitudes, knowledge levels, perceptions, expectations, concerns, needs and levels of support with respect to the use and management of the WTQWHA?
- MCO.H2 How can traditional knowledge or resource management techniques best be incorporated with mainstream or western-based management practice which is generally based on science and government policy?

Socio-economic & environmental benefits (ecological goods & services) (SE)

- MSE.H1 What are the ecological goods and services provided by the WTQWHA for the regional community and the GBRWHA?
- MSE.H2 How does the WTQWHA support the regional nature-based tourism and recreational industry, and regional economic activity through employment and investments and how can this information be used in advocacy, policy development and planning?

MSE.H3 How sensitive is the economic contribution of the WTQWHA to land management options?

Supporting economic Activity (EA)

MEA.H1 How does the WTQWHA support the regional nature-based tourism and recreational industry, and regional economic activity through employment and investments and how can this information be used in advocacy, policy development and planning?

MEA.H2 How sensitive is the economic contribution of the WTQWHA to land management options?

D. Habitat management and restoration (H)

Wildlife corridors (WC)

HWC.H1 What constitutes critical patch size thresholds and corridor widths for wildlife associated with different landscape types?

HWC.H2 By applying existing knowledge and trialling different designs, demonstrate how to design and rehabilitate a wildlife corridor to achieve improved habitat connectivity for identified species of World Heritage significance, and in particular the cassowary?

Rehabilitation and restoration (RR)

HRR.H1 What are the best practice designs for creating refuge habitats as a proactive response to shifts in climate zones due to climate change?

HRR.H2 How can we effectively prioritize the most important large-scale ecological restoration projects that could be undertaken in the Wet Tropics?

HRR.H3 What are the options for large-scale rehabilitation following decommissioning of redundant infrastructure (e.g. powerlines or roads)?

Fire management (FM)

HFM.H1 What are the criteria that need to be developed to identify key areas for fire management and other areas where expansion of rainforest is actually a desirable/natural outcome?

E. Science/management partnership performance (S)

Adoption – making a difference (AD)

SAD.H1 What evidence is there that the findings from research and monitoring programs are influencing land management agencies in the region and what are the barriers to knowledge transfer?

- SAD.H2 What evidence is there that the partnerships and cooperative arrangements between WTMA and the research provider community is achieving desired outcomes?
- SAD.H3 How successful are WTMA's current programs and how can WTMA and its research and development partners work together to use new technologies to maximise access/exposure benefits and minimise cost? Which new technologies are available to WTMA and how can they be best applied to operational systems?

Appendix 3

OTHER PRIORITY research questions (.P)

A. Understanding the condition and trends of the natural and cultural environment (C)

Priority species and ecosystems (SP)

- CSP.P1 Are there valid surrogacy relationships between vegetation types/regional ecosystems and fauna habitat, and can this be used in the development of habitat mapping and improved predictive capacity especially with respect to threatened regional fauna?
- CSP.P2 What are the population trends, structure, distribution and genetics for key cassowary populations and what factors are the most likely cause of change for these populations?

Understanding the Wet Tropics' outstanding universal values (UV)

- CUV.P1 How can the superlative natural phenomena displayed by the WTQWHA which could be considered to be of outstanding universal value (OUV-I) be identified and described in greater detail?
- CUV.P2 What are the fossil, geological and geomorphologic features and attributes of the WTQWHA which could be considered to be of outstanding universal value be identified and described?

Rainforest Aboriginal cultural studies (AB)

- CAB.P1 What is the status of traditional ecological knowledge as it applies to plants, animals, habitats, ecological processes, landscape function and caring for country in the Wet Tropics and how can it best be recorded, integrated and used in a culturally appropriate way?
- CAB.P2 What information is needed for the assessment and documentation of the case for recognition of Rainforest Aboriginal cultural heritage for national and international listing?
- CAB.P3 How can traditional Aboriginal ecological knowledge systems be applied in better management of the WTQWHA?
- CAB.P4 What is the potential for tourism as a vehicle for increasing involvement of rainforest Aboriginal people in the management of the WTQWHA?

B. Understanding risks and threats to the World Heritage Area (T)

Alien and invasive species (AI)

- TAI.P1 What are the cost/benefits of different control measure options and is it possible to develop effective, species specific, and environmentally safe control methods (with an emphasis on the feral pig, tilapia and feral deer)?
- TAI.P2 What criteria should be used to prioritise expenditure on prevention, control, eradication or containment of weeds considered to pose a major threat to natural environments in the region?
- TAI.P3 What criteria should be used to prioritise expenditure on prevention, control, eradication or containment of vertebrate pests considered to pose a major threat to natural environments in the region?
- TAI.P4 What are the ecological and evolutionary impacts associated with the translocation of native species outside their natural range including fish stocking and tree planting?
- TAI.P5 What plant diseases or pests are, or could potentially, be associated with tree planting activities and what risk do they pose?

Impact mitigation – community infrastructure and activities (IM)

- TIM.P1 What are suitable indicators for quantifying and monitoring grazing impacts?

Climate change impacts and adaptation strategies/regional responses (CC)

- TCC.P1 How can climate change models and their underlying relationships and assumptions be tested and improved by the strategic collection of environmental and ecological data sets through the establishment of monitoring systems to enable early detection of climate change impacts on key species and ecosystems?
- TCC.P2 Which species are likely to be the best indicators of the effects of climate change on natural communities?
- TCC.P3 How will climate change and its primary impacts interact with other threats such as clearing, fragmentation, fire, weeds, feral animals, declining water quality, urbanisation and other land uses to impact on the outstanding universal values of the WTQWHA, including identification of those which have the greatest potential for substantial impact?
- TCC.P4 Under what circumstances and which places in the landscape could improving landscape connectivity result in negative ecological outcomes?
- TCC.P5 What design aspects and species selections need to be incorporated into rehabilitation projects to ensure that altitudinal and latitudinal buffers or corridors exist through the landscape?
- TCC.P6 How does the WTQWHA contribute to greenhouse gas emissions, sequestration and storage?
- TCC.P7 How resilient are key sectors of local industry, notably tourism and visitor services with respect to the environmental impacts of climate change?

Landuse change (LU)

- TLU.P1 Which Wet Tropics landscape and ecosystem processes are most at risk from changing landuses?
- TLU.P2 What is the comparative biological and ecological importance of regrowth, modified, disturbed and/or fragmented vegetation?
- TLU.P3 What are the impacts on water quality and local and regional water resource demands arising from land use change?
- TLU.P4 What impacts does groundwater extraction have on the condition of vegetation and freshwater aquatic communities in the WTQWHA?
- TLU.P5 What are the assessment and planning needs for sustainable native vegetation and biodiversity conservation at various planning scales?
- TLU.P6 How can ecosystem goods and services be defined and quantified as a framework for the application of incentive mechanisms with respect to development activities?

C. Sustainable use and management of the World Heritage Area (M)

World Heritage presentation, recreation and tourism (TO)

- MTO.P1 How can visitor perceptions of scenic and aesthetic importance be assessed and how might this information be used in impact assessment?
- MTO.P2 What constitutes best practice techniques for presentation of the WTQWHA, and what is the role of the tourism industry in this?
- MTO.P3 What are best practice techniques for design, construction and maintenance of nature-based visitor facilities within the context of a wet tropical environment?
- MTO.P4 What are the impacts on rainforest wildlife of visitor – wildlife interactions and can better wildlife viewing techniques be developed to mitigate adverse visitor impacts?
- MTO.P5 What particular issues are relevant to international visitors to the Wet Tropics and how could this be adopted in management?

Giving the WTQWHA a role in the life of the community (CO)

- MCO.P1 How can we best promote the value of the WTQWHA to the community?
- MCO.P2 What are the reasons behind people's use and appreciation of the WTQWHA and the variation between different demographics or segments of the population?
- MCO.P3 How can WTMA best enhance community understanding and enjoyment of the WTQWHA?
- MCO.P4 How can WTMA understand, evaluate, document and promote the educational benefits of the WTQWHA?

Socio-economic & environmental benefits (ecological goods & services) (SE)

- MSE.P1 What are the relative financial and economic values of key Wet Tropics' species (particularly the Cassowary), habitats and regional water resources?
- MSE.P2 What is the role of the WTQWHA in maintaining prosperity together with social health and wellbeing?
- MSE.P3 What are the ecological goods and services provided by the WTQWHA with respect to conservation benefits for the Great Barrier Reef?

Supporting economic activity (EA)

- MEA.P1 What is the socio-economic value of the WTQWHA for the tourism industry and their flow-on benefits to the regional community and economy?

D. Habitat management and restoration (H)

Wildlife corridors (WC)

- HWC.P1 What evidence is there that wildlife corridors serving their intended purposes at a landscape scale?
- HWC.P2 What are the functional implications of riparian corridors with respect to width and connectivity?

Rehabilitation and restoration (RR)

- HRR.P1 What constitutes the best land rehabilitation practices and their costs and benefits in environmental, social and economic terms?

Fire management (FM)

- HFM.P1 In light of the impact of climate change on ecosystems, how can WTQWHA on-ground land managers optimise their fire management while meeting biodiversity and cultural heritage conservation, recreational availability, and requirements for community safety?
- HFM.P2 What are the 'best' fire management regimes (for the protection of natural heritage values) for key vegetation types or areas?
- HFM.P3 How can traditional ecological knowledge be incorporated to effectively involve Aboriginal people in fire management programs?

E. Science/management partnership performance (S)

Adoption – making a difference (AD)

- SAD.P1 What is the uptake of research recommendations by WTMA and other agencies with a role in managing the WTQWHA?
- SAD.P2 What evidence is there that research topics and grant applications are representing and responding to on-ground management challenges and issues?

Appendix 4

WEB RESOURCES

Organisations & Entities

Australian Government

- Commonwealth Scientific, Industrial and Research Organisation (CSIRO) <http://www.csiro.au/>
 - CSIRO Tropical & Arid Systems Program http://www.csiro.au/science/Tropical-Arid-Systems--ci_pageNo-1.html
 - CSIRO Atherton Laboratory <http://www.csiro.au/places/Atherton.html>
 - CSIRO Townsville Davies Laboratory <http://www.csiro.au/places/Townsville-Davies.html>
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) <http://www.environment.gov.au/>
- National Climate Change Adaptation Research Facility (NCCARF) www.nccarf.edu.au/
 - Terrestrial Biodiversity Adaptation Research Network (TBARN) <http://www.nccarf.edu.au/adaptation-research-network-terrestrial-biodiversity>
- National Collaborative Research Infrastructure Strategy (NCRIS) <http://ncris.innovation.gov.au/>
- National Environmental Research Program (NERP) <http://www.environment.gov.au/about/programs/nerp/index.html>

Australian Tropical Herbarium (ATH) <http://www.ath.org.au/>

Great Barrier Reef Marine Park Authority (GBRMPA) <http://www.gbrmpa.gov.au>

International Long Term Ecological Research (ILTER) <http://www.ilternet.edu/>

International Union for Conservation of Nature (IUCN) www.iucn.org/

James Cook University (JCU) <http://www.jcu.edu.au>

- Australian Canopy Crane Research Station <http://www.jcu.edu.au/canopycrane/>
- The Cairns Institute www.jcu.edu.au/cairnsinstitute/about/
- Centre for Tropical Biodiversity and Climate Change www.jcu.edu.au/ctbcc/
- Cooperative Research Centre for Tropical Rainforest Ecology and Management (Rainforest CRC) <http://www.jcu.edu.au/rainforest/>

Reef and Rainforest Research Centre (RRRC) www.rrrc.org.au/

- Marine & Tropical Sciences Research Facility (MTSRF) <http://www.rrrc.org.au/mtsrif/index.html>

Terrestrial Ecosystem Research Network (TERN) <http://www.tern.org.au/>

Queensland Government

- Department of Environment and Resource Management (DERM) <http://www.derm.qld.gov.au/>

United Nations Educational, Scientific and Cultural Organisation (UNESCO) <http://www.unesco.org/new/en/unesco/>

- UNESCO World Heritage Centre: <http://whc.unesco.org/>
- UNESCO World Heritage List: Wet Tropics of Queensland World Heritage Area (WTQWHA) <http://whc.unesco.org/en/list/486>

Wet Tropics Management Authority (WTMA) <http://www.wettropics.gov.au>

- WTMA's Scientific Advisory Committee (SAC) http://www.wettropics.gov.au/mwha/mwha_sac.html

Legislation & Publications

Australian Government

Environment Protection and Biodiversity Conservation Act 1999

<http://www.environment.gov.au/epbc/about/index.html>

National Recovery Plans and Threat Abatement Plans (under the EPBC Act)

<http://www.environment.gov.au/biodiversity/threatened/index.html>

Native Title Act (Commonwealth) 1993

[http://www.comlaw.gov.au/ComLaw/Legislation/ActCompilation1.nsf/0/E2786B9A17728077CA25770D0019F960/\\$file/NativeTitle1993_WD02.pdf](http://www.comlaw.gov.au/ComLaw/Legislation/ActCompilation1.nsf/0/E2786B9A17728077CA25770D0019F960/$file/NativeTitle1993_WD02.pdf)

National Strategy for Ecologically Sustainable Development

<http://www.environment.gov.au/about/esd/publications/strategy/index.html>

IUCN (2010). *Enhancing the Science-Policy Interface on Biodiversity and Ecosystem Services*. Information Paper on IPBES – March 2010. http://cmsdata.iucn.org/downloads/ipbes_information_paper.pdf

Queensland Government

Aboriginal Land Act (Queensland) 1991

<http://legislation.govnet.qld.gov.au/LEGISLTN/CURRENT/A/AborLandA91.pdf>

Far North Queensland Regional Plan 2009-2031. <http://www.dip.qld.gov.au/regional-planning/regional-plan-3.html>

Native Title Act (Queensland) 1993

<http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/N/NativeTitleQA93.pdf>

Nature Conservation Act 1992 <http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/N/NatureConA92.pdf>

Recovery Plans (under the Nature Conservation Act). http://www.derm.qld.gov.au/wildlife-ecosystems/wildlife/threatened_plants_and_animals/recovery_conservation_plans.html

Towards Q2: Tomorrow's Queensland

http://www.thepremier.qld.gov.au/library/pdf/tomorrow/Towards_Q2_Tomorrows_Queensland.pdf

Queensland Research and Development Investment Strategy 2010-2020.

<http://www.chiefscientist.qld.gov.au/research-and-development/investment-strategy.aspx>

Wet Tropics Management Plan (Queensland) 1998

<http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WetTropMgmtP98.pdf>

Wet Tropics World Heritage Protection and Management Act 1993

<http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WetTropicsA93.pdf>

Stork, N.E. & Turton, S.M. (eds) (2008). *Living in a Dynamic Tropical Forest Landscape*. Blackwell Publishing. – available for purchase (hard copy and online version) through <http://au.wiley.com/WileyCDA/WileyTitle/productCd-1405156430.html>

UNESCO

Operational Guidelines for the Implementation of the World Heritage Convention

<http://whc.unesco.org/archive/opguide08-en.pdf>

Policy document on the impacts of climate change on World Heritage properties (WHC-0716.GA/10) 2007.

<http://whc.unesco.org/document/9281>

World Heritage Convention 1972. <http://whc.unesco.org/archive/convention-en.pdf>

Wet Tropics Management Authority (WTMA)

Maps of the Wet Tropics region http://www.wettropics.gov.au/map/map_default.html

State of the Wet Tropics Reports http://www.wettropics.gov.au/res/res_report.html

Wet Tropics Conservation Strategy 2004 http://www.wettropics.gov.au/mwaha/mwaha_conservation.html

Wet Tropics Research and Information Needs 2000.

http://www.wettropics.gov.au/res/downloads/rain_report.pdf

Wet Tropics World Heritage Area Regional Agreement 2005

http://www.wettropics.gov.au/rah/rah_pdf/regional_agreement.pdf



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