



Australian Government

Department of the Environment, Water, Heritage and the Arts



Commonwealth Environment Research Facilities

Marine and Tropical Sciences Research Facility



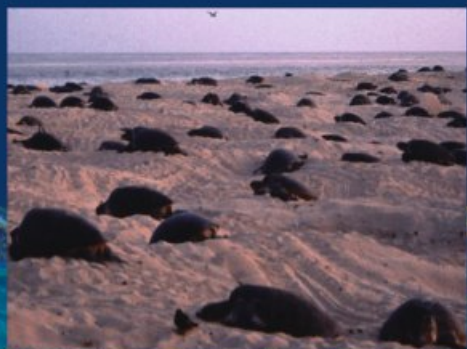
Report for 2006-2007



2006-2007



Reef & Rainforest
RESEARCH CENTRE



Marine and Tropical Sciences Research Facility Highlights 2006-2007

Facility Established in September 2005

The Marine and Tropical Sciences Research Facility (MTSRF) was created in May 2005 following a decision of the Australian Government to fund scientific research supporting the conservation and sustainable use of the high-value environmental assets of North Queensland, including Torres Strait – in particular, the Great Barrier Reef and the Wet Tropics Rainforests.

The Commonwealth Department of the Environment and Water Resources has let a contract to the Reef and Rainforest Research Centre Limited (RRRC) to represent the MTSRF in North Queensland.

The first Annual Research Plan was contracted in September 2006. The Research Programme covered all five themes in the Research Investment Strategy, supported by \$8,422,459 of MTSRF funds combined with cash and in-kind contributions from partners of a further \$1,259,998 and \$9,944,536 respectively, representing nearly \$20 million in investment in the first year of operation of the MTSRF. In all, fourteen research provider organisations were contracted to conduct research projects involving 295 scientists in North Queensland.

1. About the Marine and Tropical Sciences Research Facility

The MTSRF is part of the Commonwealth Environmental Research Facilities (CERF), which has created a national network of environmental research hubs (www.environment.gov.au/cerf).

Vision for the Marine and Tropical Sciences Research Facility

"Ensuring the health of North Queensland's public environmental assets – particularly the Great Barrier Reef and its catchments, tropical rainforests including the Wet Tropics World Heritage Area, and the Torres Strait – through the generation and transfer of world-class research and sharing knowledge."

Protection of the health of these environmental assets is a joint responsibility of governments, community and industry and requires the commitment of each if it is to be achieved. The MTSRF outcomes will support each of those parties in their endeavours to protect, conserve, sustainably use and manage North Queensland's public environmental assets.

Mission of the Marine and Tropical Sciences Research Facility

To achieve its vision, the MTSRF will plan, fund and coordinate the highest quality, cross-disciplinary research for public good to:

- Ensure the protection, conservation, sustainable use and management of environmental assets of the Great Barrier Reef and its catchments, tropical rainforests including the Wet Tropics World Heritage Area and the Torres Strait;
- Foster an understanding of the interactions of North Queensland's natural environment with the social and economic aspects of North Queensland communities;
- Support the adoption of science-based knowledge in policies and practices for ecologically-sustainable management; and



- Facilitate capacity-building for sustainable environmental management and environmental management research, in partnership with the community, environmental managers, research institutions, industry and policy-makers.

Goals and Research Strategy

MTSRF research is guided by a Research Investment Strategy¹ which deals with the following major themes:

- Theme 1:** Status of the Ecosystems
- Theme 2:** Risks and Threats to the Ecosystems
- Theme 3:** Water Quality in the Catchments of the Great Barrier Reef
- Theme 4:** Sustainable Use and Management
- Theme 5:** Enhancing the Delivery of Research Results

The Reef and Rainforest Research Centre

The Reef and Rainforest Research Centre² (RRRC) is a not-for-profit consortium of researchers, industry and community organisations that is committed to achieving the goals of the MTSRF. The RRRC represents the MTSRF in North Queensland after winning the Australian Government's publicly advertised tender in June 2006.

2. Key Partnerships in MTSRF Research

The effective delivery and adoption of research results relies on a close link between research providers and the environmental managers and related industries. The link should be working at the beginning when problems are specified, when research options are considered and then implemented and communicated. Without this engagement there is much less likelihood of the considerable expense on research leading to adoption of the results and better outcomes for the valuable natural assets – the coral reefs, catchments and rainforests of North Queensland.

End Users, Scientists and Managers – Cooperation for Better Outcomes

Principal users of MTSRF research include the Great Barrier Reef Marine Park Authority, the Wet Tropics Management Authority, the Reef Water Quality Partnership, the Torres Strait Regional Authority and other arms of the Australian and Queensland Governments with responsibility for environmental management. These agencies have strong consultative mechanisms with peak industry bodies and develop their priorities for research through that process. All of these groups participate in the MTSRF Steering and Operations Committees which help to guide MTSRF projects. The Association of Marine Park Tourism Operators, Tourism Tropical North Queensland, Skyrail Rainforest Foundation and the Great Barrier Reef Foundation have a strong interest in MTSRF projects. In all, there are twelve co-investors in the MTSRF Research Programme.

Raising public awareness of the status, risks and value of the environmental assets is also an important part of MTSRF. As the results of MTSRF research emerge from the projects currently underway, the results will be made freely and widely available.

¹ <http://www.environment.gov.au/programs/cerf/publications/mtsrfr-is.html>

² For more information on the Reef and Rainforest Research Centre Limited, visit www.rrrc.org.au

Research Providers

The largest providers of research for MTSRF are James Cook University, the CSIRO, the Australian Institute of Marine Science and The University of Queensland; however a total of thirty-one organisations are involved to some degree.

The research organisations contribute not only their scientific expertise to the MTSRF but also a very substantial commitment of resources of staff time and access to laboratories and field research facilities.

MTSRF investments also focus on building the regional capacity for scientific research by encouraging the involvement of university students in MTSRF projects.

2. MTSRF Achievements in 2006-2007

The MTSRF Research Programme was built on the work initiated by the Australian Cooperative Research Centres¹ for Rainforest and Reef. The following is a brief snapshot of some of the achievements of the MTSRF for 2006-2007.

Great Barrier Reef

Early warning system for starfish outbreaks



Crown-of-Thorns Starfish population outbreaks can devastate the corals of the Great Barrier Reef. In addition to damaging the biodiversity and age structure of the reef corals, previous outbreaks have also had significant follow-on impacts in terms of tourist visitation areas being badly damaged as the plague moves across the Reef.

Surveys were made of the region north of Cairns that is known to be the place where Crown-of-Thorns Starfish outbreaks first appear. Starfish surveys by researchers of the Australian Institute of Marine Science, supported by MTSRF, show that there will be no starfish outbreaks this season. An 'early warning system' developed by researchers allows the tourist industry to prepare protective measures against the starfish plague, having positive effects for both biodiversity and tourism.

Surveys show deep sea biodiversity also protected by the Zoning Plan

Following the rezoning of the Great Barrier Reef Marine Park, much of the attention focused on the protection of coral habitats. MTSRF researchers studied approximately 840 non-reefal seabed species to determine the level of protection provided to these species from the Marine Park rezoning. They found that prior to the rezoning only 160 species had greater than twenty percent of their population in highly protected areas. After the rezoning all 840 species had greater than twenty percent of the population in highly protected areas. The Reef isn't just about corals; species such as sponges, molluscs and crustaceans play an extremely important role in the functioning of the ecosystem. It is very important that they are also adequately protected.

Historical use of inshore fisheries key to sustainable future

Fishing is one of the most important commercial and recreational activities in inshore waters of the Great Barrier Reef World Heritage Area. MTSRF researchers from James Cook University and the Queensland Department of Primary Industries and Fisheries reviewed the available catch data for the commercial and charter sectors of the northern inshore fishery to map historical use of inshore species.

¹ Rainforest CRC (visit www.jcu.edu.au/rainforest) and CRC Reef Research Centre Limited (www.reef.crc.org.au).

Surprisingly, shark comprised thirty-five percent of the total inshore commercial fishery harvest in the Great Barrier Reef World Heritage Area, nearly double the contribution to take of any other species. However, a review of available biological (e.g. reproductive) information on key species of fish, sharks and rays from the fishery showed we currently have limited information for these target species to assist in setting sustainable harvest targets. These agencies are working towards filling these data gaps under the MTSRF in future.

High economic value of key species important for tourism

MTSRF researchers determined the impact of key marine species on marine tourism and found that marine turtles, sharks and maori (or napoleon) wrasse, potato cod, moray eels and leafy scorpion fish rated the highest. Tourists related the presence of these species to the health and environmental quality of the Great Barrier Reef.

The average visitor spends approximately \$328 AUD per day and approximately \$1,737 AUD per visit. Visitors who choose to undertake scuba diving spend approximately \$6,000 AUD in the region. The visitation by divers is strongly influenced by the presence of these marine species. The preliminary estimates of the per-visitor regional expenditure that is attributed to marine species is:

- Marine turtles \$1,360;
- Sharks \$1,375; and
- Large fish \$1,354.

It is the presence of these species that attracts visitors and makes the Great Barrier Reef special compared to many other reefs around the world.



Northern Great Barrier Reef and Torres Strait

Decline in breeding of green turtle

The northern part of the Great Barrier Reef is the most significant breeding area for Green turtles in the world. A serious decline in Green turtle breeding success has been identified with numbers racing to levels that directly threaten the survival of the species in this area. MTSRF researchers are working rapidly to determine the reason for the decline and to recommend methods to help the Green turtles in the near future.



Bath sponge aquaculture viable in Torres Strait

Sponges have an important ecological role within coral reef ecosystems and are a dominant organism on coral reefs throughout Torres Strait. Particular sponge species have a high commercial value and may be sold as bath sponges, putting them at risk from overfishing pressures. MTSRF researchers from the Australian Institute of Marine Science and the Torres Strait Regional Authority examined populations of the bath sponge *Coscinoderma* sp. in the Torres Strait. Results suggest that for sustainable management harvesting of sponges should be kept to less than ten percent of the available population and should only occur on deep reef around Masig Island. In addition to providing information for a potential new fishery for the Torres Strait, the work also contributed to our knowledge of the spatial patterns in Torres Strait of coral trout and crown-of-thorns starfish.



Wet Tropics Rainforests

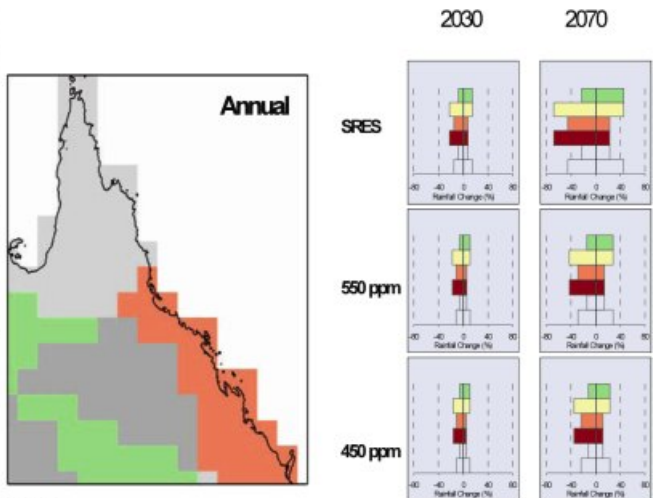
Predicting the spread of weeds helps weed control

MTSRF researchers have developed a simple but very effective simulation model for the dispersion processes of weeds or invasive species in tropical landscapes. How weeds and other invasive species spread are based on whether the weed seeds are dispersed by an animal, for example. We now have a way of mapping the potential geographic spread of an invasive species following an accidental introduction. This process allows local governments to rapidly and cost effectively target weeds and introduced pests. Making scientific information available in a way that local governments and land managers can utilise it is an important part of the MTSRF Research Programme.

Rainfall and temperature projections for the tropical rainforests of north Queensland

North Queensland tropical rainforests support more biodiversity than anywhere else in the country; a fundamental driver for the World Heritage listing of this area. Managing how this biodiversity may be affected by changes in climate requires a good understanding of what and how climatic variables will change over time for the region. MTSRF researchers from the CSIRO developed new models specific to the conditions of the region that show annual temperature for the region is projected to increase between 0.5 and 1.4°C by 2030 and between 1.0 and 4.2°C by 2070, and that by 2030, projected rainfall changes are between -6%

and +5% and between -19% and +14% by 2070.

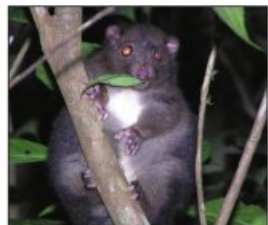


Above: Annual rainfall predictions under different CO₂ emission scenarios.

Different temperature and rainfall patterns are realised under different greenhouse gas emission scenarios. The models predict less warming and narrower ranges in rainfall under stabilized CO₂ concentrations.

Climate change may affect the spread of disease in the tropics

To measure the response to climate change, MTSRF researchers have developed methodology for monitoring disease vectors and disease prevalence in the Wet Tropics through molecular techniques and the use of sentinel chickens. The technique also includes trapping mosquitoes and obtaining blood from native birds to identify pathogens, especially avian malaria. Changes in climate may change the susceptibility of the Wet Tropics ecosystem to tropical diseases, which have important consequences for the future health of the region.



4. Forward Look – Directions for the MTSRF in 2007-2008

The RRRC convened the inaugural **MTSRF Research Synthesis Conference** in April 2007. The event brought together researchers, industry and the public from the Wet Tropics Rainforest, the Great Barrier Reef and Torres Strait for the first time to share information across ecological and socioeconomic areas.

Between March and June 2007, the RRRC conducted a substantive **review** of the first Annual Research Plan in partnership with approximately one hundred researchers and end users. The review focused on the research quality, researcher performance and importantly the industry relevance of the research deliveries. The review process, combined with extensive negotiations, led to the development of the **Annual Research Plan for 2007/2008**. The Minister for the Environment, Water, Heritage and the Arts approved the second Annual Research Plan in June 2007 and announced funding for the coming year in July 2007.



In the first year, the concept of an integrated report was explored for each MTSRF region. It is clear that no single report will suit all of the regions, however the underlying principles of effective reporting on the **risk and resilience** of the natural assets of North Queensland to influences such as climate change and declining water quality is clearly of paramount importance to all regions.

Benchmark reports synthesising existing and new information for each region have been completed in this first year of MTSRF activity. In Year 2, MTSRF programs will build on this knowledge base for each region, outline the state of knowledge and highlight important gaps in information needed for improved management and understanding.

5. MTSRF Governance and Reporting

Accountability and Reporting

The MTSRF fund is managed through a research services contract between the Commonwealth Department of the Environment, Water, Heritage and the Arts and the Reef and Rainforest Research Centre Limited. The RRRC subcontracts research providers to deliver Themes 1-4 and parts of Theme 5 of the MTSRF Research Programme.

The Governing Board of the RRRC oversees the delivery of the MTSRF contract to the Australian Government. The research projects and programs of the MTSRF are monitored and reviewed through Operations and Steering Committees as outlined below. These committees involve approximately one hundred experts from industry, community, government and research organisations.



MTSRF Advisory Committees



The Ministerial Advisory Council for MTSRF operates independently of the process outlined above and reports directly to the Minister for the Environment, Water, Heritage and the Arts.

Financial Summary for 2006-2007

Themes	MTSRF Funds	Other Funds	In-kind Contributions
Status of the Ecosystems	\$2,023,000	\$398,762	\$2,761,493
Risks and Threats to the Ecosystems	\$1,325,000	\$45,000	\$2,932,220
Halting and Reversing the Decline of Water Quality	\$1,175,000	-	\$2,234,000
Sustainable Use and Management of Resources	\$2,233,275	\$816,236	\$1,951,337
Enhancing Delivery	\$797,500	-	\$65,486
Administration	\$868,684	-	-
Contingency	-	-	-
Total	\$8,422,459	\$1,259,998	\$9,944,536



6. Appendix 1: Partners in MTSRF

These organisations contribute either cash or in-kind to support the MTSRF Research Programme:

1. Aboriginal Rainforest Council (ARC)
2. Association of Marine Park Tourism Operators (AMPTO)
3. Australian Defence Force Academy at University of New South Wales (ADFA@UNSW)
4. Australian Institute of Marine Science (AIMS)
5. Burdekin Dry Tropics NRM
6. Cairns Port Authority (CPA)
7. Canegrowers Queensland
8. Central Queensland Port Authority (CQPA)
9. Central Queensland University (CQU)
10. Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA)
11. Commonwealth Scientific and Industrial Research Organisation (CSIRO)
12. Digital Dimensions
13. FR Ireland Pty Ltd
14. Giringun Aboriginal Corporation
15. Graham Scott and Associates
16. Great Barrier Reef Foundation (GBRF)
17. Great Barrier Reef Marine Park Authority (GBRMPA)
18. Griffith University (GU)
19. Growcom Land and Water
20. James Cook University (JCU)
21. Ports Corporation of Queensland (PCQ)
22. Powerlink Queensland
23. Queensland Department of Natural Resources and Water (QDNRW)
24. Queensland Department of Primary Industries and Fisheries (QDPI&F)
25. Queensland Environmental Protection Agency (EPA)
26. Queensland Parks and Wildlife Service (QPWS)
27. Queensland Seafood Industry Association (QSIA)
28. Queensland Tourism Industry Council (QTIC)
29. Rainforest Alliance
30. Reef and Rainforest Research Centre Limited (RRRC)
31. Reef Check Australia (RCA)
32. Seagrass Watch (In-kind contributions only)
33. Skyrail Pty Ltd
34. Southern Cross University (SCU)
35. Terrain NRM
36. The Australian National University (ANU)
37. The University of Queensland (UQ)
38. Torres Strait Regional Authority (TSRA)
39. Tourism Tropical North Queensland (TTNQ)
40. University of New South Wales
41. Wet Tropics Management Authority (WTMA)
42. World Wildlife Fund (WWF)

Marine and Tropical Sciences Research Facility

List of Themes, Programs and Projects – Annual Research Plan 2 2007/2008

Theme, Program, Project.....	Lead Researcher and Organisation
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THEME 1: STATUS OF THE ECOSYSTEMS

Program 1: Status and Trends of Species and Ecosystems of the Great Barrier Reef.....	Dr Peter Doherty, AIMS
Project 1.1.1: Identification of indicators and thresholds of concern for ecosystem health on a bioregional scale for the Great Barrier Reef.....	A. Prof. Michelle Waycott JCU
Project 1.1.2: Condition and trend of the GBR ecosystem: Indicators, thresholds of potential concern and ecological influence of GBR Zoning Plan on mid and outer reefs.....	Dr Hugh Sweatman, AIMS
Project 1.1.3: Condition, trend and risk in coastal habitats: Seagrass indicators, distribution and thresholds of potential concern.....	A. Prof. Michelle Waycott JCU
Project 1.1.4: Dating and mapping historical changes in GBR coral communities.....	Dr Jian-Xin Zhao, UQ
Project 1.1.5: Reef Atlas: Risk, Resilience and Response.....	Dr Katharina Fabricius, AIMS
Program 2: Status and Trends of Species and Ecosystems in the Wet Tropics Rainforests.....	Dr James Butler, CSIRO
Project 1.2.1: Status and trends of biodiversity and ecosystem services.....	Dr James Butler, CSIRO
Program 3: Torres Strait – Status, Use and Trends.....	Dr Roland Pitcher, CSIRO
Project 1.3.1: Climate change Impacts in the Torres Strait: building resilience and planning adaptation strategies.....	Dr Donna Green, UNSW
Project 1.3.2: Ecological role and potential economic value of sponges to the Torres Strait.....	Dr Alan Duckworth, AIMS
Project 1.3.3: Economic analysis of alternative uses, trade-offs.....	Professor Sean Pascoe, CSIRO
Project 1.3.4: Communication, community engagement and enhanced delivery.....	Mr Damian Miley, TSRA
Project 1.3.5: Data integration and synthesis for development of reports on ecosystem health in the Torres Strait region.....	Mr Damian Miley, TSRA

Program 4: Species and Communities of Conservation Concern	Professor Helene Marsh, JCU
Project 1.4.1: Condition trends and projected futures of marine species of conservation concern	Dr Mark Hamann, JCU
Project 1.4.2: Sustainable use of marine species of conservation concern	Professor Helene Marsh, JCU
Project 1.4.3: Rainforest threatened species and communities and ecosystem processes	Dr Dan Metcalfe, CSIRO

THEME 2: RISKS AND THREATS TO THE ECOSYSTEMS

Program 5: Climate Change: Understanding the Threat, Ecosystem Impacts and Mitigation

Program 5i: Climate Change: Great Barrier Reef	Dr Julian Caley, AIMS
Project 2.5i.1: Regional climate scenarios	Dr Andreas Schiller, CSIRO
Project 2.5i.2: Early warning and assessment system for thermal stress on the Great Barrier Reef	Professor Ove Hoegh-Guldberg, UQ
Project 2.5i.3: Resilience to climate change	Professor Terry Hughes, JCU
Project 2.5i.4: Tools to support resilience-based management in the face of climate change	Dr Scott Wooldridge, AIMS

Program 5ii: Climate Change: Rainforests and Catchments	Professor Steve Turton, JCU
Project 2.5ii.1: Regional climate projections for tropical rainforests	Dr. Penny Whetton, CSIRO
Project 2.5ii.2: Climate change: scaling from trees to ecosystems	Dr Peter Franks, JCU
Project 2.5ii.3: Understanding climate change threat to ecosystems and ecological processes	Dr David Hilbert, CSIRO
Project 2.5ii.4: Impacts of climate change on biodiversity	Associate Professor Steve Williams, JCU

Program 6: Understanding Threats and Impacts of Invasive Pests on Ecosystems	Dr David Blair, JCU and Dr David Westcott, CSIRO
Project 2.6.1: Understanding threats and impacts of invasive pests in the Great Barrier Reef	Dr David Blair, JCU
Project 2.6.2: Identification and impact of invasive pests in the Wet Tropics rainforests	Dr David Westcott, CSIRO

THEME 3: HALTING AND REVERSING THE DECLINE OF WATER QUALITY

Program 7: Halting and Reversing the Decline of Water Quality	Dr K. Fabricius, AIMS; Prof. R. Pearson, JCU; Prof. I. Gordon, CSIRO
Project 3.7.1: Marine and estuarine indicators and thresholds of concern	Dr Katharina Fabricius, AIMS
Project 3.7.2: Connectivity and risk: tracing materials from the upper catchment to the reef	Mr Jon Brodie, JCU
Project 3.7.3: Freshwater indicators and thresholds of concern	Professor Richard Pearson, JCU and Professor Angela Arthington, GU
Project 3.7.4: Wetlands and floodplains: connectivity and hydro-ecological function	Dr Jim Wallace, CSIRO

Project 3.7.5: & 3.7.6: Socio-economic constraints to and incentives for the adoption of land use and management options for water quality improvement..... Dr Peter Roebeling, CSIRO

Project 3.7.7: Analysis and synthesis of information for reporting credible estimates of loads for compliance against targets and tracking trends in loads..... Dr. Bronwyn Hatch, CSIRO

THEME 4: SUSTAINABLE USE AND MANAGEMENT

Program 8: Sustainable Use and Management of Marine Resources of the Great Barrier Reef..... Dr Colin Simpfendorfer, JCU

Project 4.8.1: Resilience and connectivity..... Professor Terry Hughes, JCU

Project 4.8.2: Influence of the Great Barrier Reef Zoning Plan on inshore habitats and biodiversity, of which fish and corals are indicators..... Dr Peter Doherty, AIMS

Project 4.8.3: Evaluation of the resiliency of key inter-reefal fish species..... Dr Colin Simpfendorfer, JCU

Project 4.8.4: Evaluation of the impacts from industry and community uses on inshore biodiversity..... Dr Ashley Williams, JCU

Project 4.8.5: Incorporating stakeholders and their values, knowledge and aspirations in the care and development of the Great Barrier Reef Marine Park..... Dr Stephen Sutton, JCU

Project 4.8.6: Analysis of recreational and tourism use and impact on the Great Barrier Reef for managing sustainable tourism..... Prof. Bruce Prideaux, JCU

Project 4.8.7: Forecasting risk of exposure to irukandji..... Professor Michael Kingsford, JCU

Project 4.8.8: Communication, community engagement and enhanced delivery for GBR projects..... Dr Colin Simpfendorfer, JCU

Program 9: Sustainable Use, Planning and Management of Tropical Rainforest Landscapes..... Professor Steve Turton, JCU

Project 4.9.1: Indigenous landscapes of the Wet Tropics World Heritage Area..... Dr Michael Wood, JCU

Project 4.9.2: Sustainable nature based tourism: planning and management..... Prof. Bruce Prideaux, JCU

Project 4.9.3: Impacts of urbanisation on North Queensland environments: management and remediation..... Professor Steve Turton, JCU

Project 4.9.4: Integrating ecology, economics and people in forest and landscapes..... Dr. John Herobhn, UQ

Project 4.9.5: Restoring tropical forest landscapes..... Associate Professor Carla Catterall, GU

Project 4.9.6: Strategic Natural Resource Management and land use planning..... Dr Cathy Robinson, CSIRO

Project 4.9.7: Understanding social resilience and identification of social resilience indicators for management..... Prof. H. Ross, UQ; Dr T. Lynam, CSIRO; Dr M. Gooch, JCU

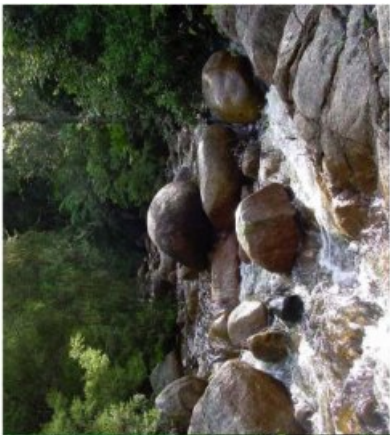
Theme 5: Enhancing Delivery

Program 10: Enhancing Delivery..... **Reef and Rainforest Research Centre Limited**

Project 5.10.1: Visual Documentation of MTSRF Projects Reef and Rainforest Research Centre Ltd

Project 5.10.2: Communication, engagement and enhanced delivery for tourism operators in the
Wet Tropics rainforests Ms Annie Riddet, TTNQ

Project 5.10.3: Communication, community engagement and enhanced delivery for Indigenous
knowledge of the Wet Tropics Rainforests..... Ms Allison Halliday, ARC





Further information

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This document is available for download at <http://www.rrrc.org.au/publications>

Credits: **Southern cassowary** Wet Tropics Management Authority; **Hill Inlet in the Whitsundays** Department of Foreign Affairs and Trade - Overseas Information Branch; **Butterfly fish** Robert Thorne; **Rainforest fruits** Wet Tropics Management Authority; **Rainforest C.** Totterdell and the Australian Heritage Photo Library; **Satellite image** compiled by Environmental Resources Information Network (Department of the Environment and Water Resources); **Other images within this report** MTSRF research community.