Sustaining the Wet Tropics

A Regional Plan for Natural Resource Management

2004–2008

FNQ NRM LTD

Rainforest CRC

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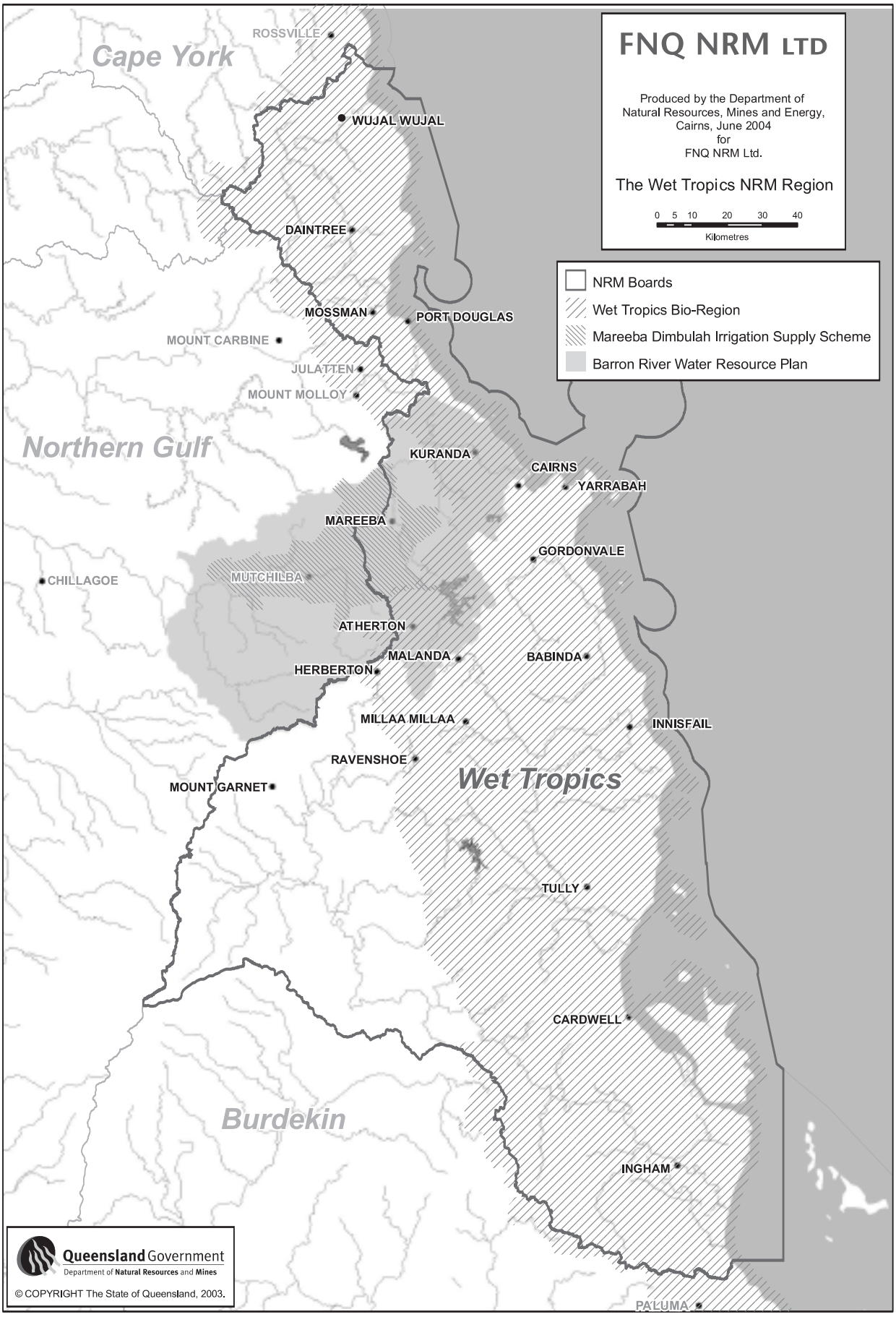
This publication may be cited as: FNQ NRM Ltd & Rainforest CRC (2004) Sustaining the Wet Tropics: A Regional Plan for Natural Resource Management 2004–2008. FNQ NRM Ltd, Innisfail (208pp).

Further copies may be obtained from
FNQ NRM Ltd, PO Box 1756, Innisfail, QLD, Australia, 4860.

<www.fnqnrm.com.au>

April, 2005.

ISBN 0 86443 745 5


FNQ NRM LTD
Produced by the Department of Natural Resources, Mines and Energy, Cairns, June 2004 for FNQ NRM Ltd.
The Wet Tropics NRM Region
0 5 10 20 30 40
Kilometres
NRM Boards
Wet Tropics Bio-Region
Mareeba Dimbulah Irrigation Supply Scheme
Barron River Water Resource Plan
Cape York
Northern Gulf
Wet Tropics
Burdekin
ROSSVILLE
WUJAL WUJAL
DAINTREE
MOSSMAN
PORT DOUGLAS
MOUNT CARBINE
JULATTEN
MOUNT MOLLOY
KURANDA
CAIRNS
YARRABAH
MAREEBA
GORDONVALE
CHILLAGOE
MUTCHILBA
ATHERTON
MALANDA
BABINDA
HERBERTON
MILLAA MILLAA
INNISFAIL
RAVENSHOE
MOUNT GARNET
TULLY
CARDWELL
INGHAM
PALUMA
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This Plan is dedicated to the memory of both Brad Dorrington and Garry Werren.

Both men played a very significant role in natural resource management in Far North Queensland

The Board deeply appreciates and would like to acknowledge the tremendous contribution of Brad Dorrington as Executive Officer of FNQ NRM Ltd. Brad's support aided the planning process through some difficult times and almost to completion.

Similarly, Garry assisted the preparation of the Plan in many ways. A true professional who was always willing to offer his assistance and expertise, Garry had a long history of involvement in natural resource management initiatives in the Far North

Chair's message

Managing our natural resources for sustainability is a responsibility that ultimately sustains our social and economic wellbeing, as well as the trust we hold on behalf of all future generations.

The Wet Tropics is a unique region in Australia because of its high rainfall, spectacular scenery, biological diversity, economic productivity and Aboriginal cultures. While the region is seen as a desirable place to live, visit and invest in; human activity is increasingly threatening the natural environment. Within this context, the Wet Tropics Regional Natural Resource Management Plan sets out a vision and an integrated planning framework for land, water, climate and biodiversity management in the region.

This Regional Plan for Natural Resource Management builds on existing planning and information frameworks, including the Wet Tropics Regional Strategy for NRM, developed by the original NRM Board in 2000, and the regional growth framework for the FNQ Region – FNQ Regional Plan. This Regional NRM Plan has been developed by FNQ NRM Ltd in conjunction with the Cooperative Research Centre for Tropical Rainforest Ecology and Management (Rainforest CRC), in consultation with Traditional Owners, Commonwealth and State Government agencies, local government, interest groups and the wider regional community.

The Plan takes an assets-based rather than issues-based approach, examining how these assets can be enhanced and how the threats they face can be addressed. In addition to the primary natural resource assets of the region – biodiversity, climate, land and water – the Plan identifies both Aboriginal values for natural resources and our community assets. 'Community' means everyone who lives and works in the Wet Tropics Region, those who visit it and those who have some other connection to it. FNQ NRM Ltd recognises that implementing the Plan is the responsibility of the whole community and that partnerships are the key to achieving this. On behalf of FNQ NRM Ltd I therefore invite the active participation of all our community partners.

This Regional Natural Resource Management Plan is being prepared in a setting where the Natural Heritage Trust (NHT) Program and the implementation of the Reef Water Quality Protection Plan will be guided by the planning framework outlined here. It should also be of use and a valued resource for all involved in NRM in the private sector and at the local, State and Commonwealth Government levels, Traditional Owner groups, community groups and the general public.

Mike Berwick

Chair, FNQ NRM Ltd.

FNQ NRM Ltd Board Members 2004:
From left to right (front row) Peter Stanton, Director Conservation; Cr Ray Byrnes, Director Local Government; Cr Mike Berwick, Chair; Chris Gloor, Director Coastal and Marine; Caroline Coppo, Director Catchment and Community, (back row) Troy Wyles-Whelan, Director Indigenous, Ken Atkinson, Director Upper Herbert; Bill Shannon, Director Industry, Peter Valentine, Director World Heritage.

Acknowledgements

This plan was prepared by the Board of FNQ NRM Ltd with the Rainforest CRC. Its development was supported through the Natural Heritage Trust.

The Board acknowledges those who have contributed to this plan, either through direct input to plan preparation, or through their involvement in earlier planning processes that underpin the development of the plan. Preparation of the plan has involved a large number of people from communities, interest groups and agencies both within and outside the Wet Tropics Region.

The Board particularly wants to acknowledge the assistance provided by representatives of the following government agencies:

- Commonwealth Department of Agriculture, Fisheries and Forestry
- Commonwealth Department of the Environment and Heritage
- Great Barrier Reef Marine Park Authority
- Wet Tropics Management Authority
- Queensland Department of Natural Resources and Mines
- Queensland Department of Primary Industries and Fisheries
- Queensland Department of Local Government, Planning, Sport and Recreation
- Queensland Environmental Protection Agency

The Board acknowledges the tremendous effort of the NRM Planning Team of Geoff McDonald, Nigel Weston, Libby Larsen and Cath de Voil from the Rainforest CRC, who were ably supported by staff of the Rainforest CRC and FNQ NRM Ltd.

Special mention should also be made of the following individuals who made significant contributions to this plan: Jacqueline Balston, Jenny Bellamy, Jon Brodie, Carla Catterall, Campbell Clarke, Caroline Coppo, Sophie Creighton, Jean Fenton, Mark Fenton, David Foster, Rowena Grace, Stefan Hajkowicz, Debra Harrison, Jim Kernot, Daryl Killin, Peter Latch, Ian Lowe, Keith McDonald, Katie O'Rourke, Sandra Pannell, Joe Rolfe, Kev Shaw, Neil Sing, David Skelton, Keith Smith, Dermot Smyth, Andy Stephens, David Temple-Smith, Emma Thomson, Chris Tidemann, Regional Liaison Officers Geoff Dyne and Mike Bradby as well as the members of the North Regional Coordination Group including Peter Gilbey, Regina Holden, Simon O'Donnell, Andrew Solomon and Adam West.

We would also like to thank those who made submissions on the draft plan and whose contributions made for an improved document. This includes Australian Government facilitators, Banana Growers Qld, Cairns and Hinchinbrook LMACs, Canegrowers, GBRMPA, Growcom, FNQROC, local governments, Innisfail banana and pawpaw growers associations, Johnstone Ecological Society, Lower Herbert River Catchment Group, Mulgrave Landcare and Catchment Group, Organic Producers Association, Qld Dairy Farmers organisation, Red Dog Rambutan, State Government Agencies, Trees for the Evelyn and Atherton Tablelands, Tree Kangaroo and Mammal Group, WTMA and the following individuals: Mila Bristow, Bryony Barnett, Damien Burrows, Saeed De Ridder, Paul Devine, Sonya Maley, David Rivett, Brian Roberts and Elinor Scambler.

The Background Report, Condition Reports and the Wet Tropics Aboriginal Cultural and Natural Resource Management Plan are acknowledged as particularly important source documents for this plan. The Board would like to thank the authors of these documents and all those who contributed to them.

Finally the Board acknowledges the Traditional Owners of the Wet Tropics Region for their support and input into this Plan, and recognises the special connections, knowledge and inherited custodial obligations that they have for the region.

Contents

Part A

Part B

Part C

Part D

Tables

Figures

PART A
purpose + scope

1.0 Context for the plan

A region's natural resources include its climate, land, water and biological assets. Natural resources are more than these elements alone – they are the combination that forms living ecosystems and landscapes that also supports farming and grazing activities, provides for residential lifestyles and underpins tourism attraction. These resources have been, and continue to be, central to Aboriginal Traditional Owners' spirituality, culture, social organisation and economic use (including food, medicines and tools). They are fundamental to the economy and quality of life in a region and need to be carefully managed to ensure that future generations can enjoy lifestyles and a quality of life at least as good as today.

The climate, spectacular scenery, biological diversity, cultural values (both Aboriginal and non-Aboriginal) and economic productivity of the Wet Tropics Region define its distinct character. While it is seen as a desirable place to live, visit and invest in, increasing human activity threatens the region's natural environment and associated cultural values. Over one hundred plans and strategies have been prepared for coasts, catchments, endangered species, local government areas, World Heritage Areas and so on in the Wet Tropics Region. By and large, these have helped identify the major threats and actions that need to be taken. The challenge of this Regional Plan for Natural Resource Management (Regional NRM Plan) is to integrate and update this previous work into a single coordinated action plan for the regional community to help protect, maintain and/or improve the condition of natural resources and their associated cultural values in the Wet Tropics NRM Region.

There have been substantial changes in environmental management systems in the Wet Tropics Region in recent years. To name a few:

- Many critical habitats are protected in two World Heritage Areas, National Parks and protected areas.
- Water Resource Plans assure environmental flows while providing for the sustainable extraction of water.
- Councils have upgraded wastewater treatment plants and waste dumps.
- Water on construction sites is better controlled.
- Local planning schemes commit to environmental protection.
- Negotiations are underway to protect the Daintree through a new IPA scheme.
- In agriculture, most cane fields have trash blankets, many farmers are using only the minimum fertilisers and pesticides required and adopting other sustainable management practices.

In producing this Plan the Board recognises the significant contribution made by many landholders, industry groups and other groups in implementing sustainable land use practices in our region and seeks to build upon the wealth of practical knowledge held by these innovative community members. Probably the most important change in recent years is the community acceptance of the importance of environmental protection.

Future efforts towards improved natural resource management in the Wet Tropics Region will focus on better management of the private land estate, improved planning of urban development in coastal areas, protecting (or rehabilitating) endangered ecosystems and riparian corridors to prevent further fragmentation, providing for transport and water infrastructure with minimal environmental impacts, reducing the impact of diffuse source pollution on the Great Barrier Reef and using water and energy more efficiently in urban areas by innovative designs and codes. These challenges require greater attention in the daily life of local governments, farmers and residents. Meeting these challenges requires a more cooperative community based approach given the limitations of narrow statutory approaches to deal with the way farmers and residents use their land. This Plan aims to facilitate this process.

1.1 Purpose of the plan

The purpose of this Plan is to develop actions, mechanisms and partnerships to manage natural resources and their associated cultural values sustainably in the Wet Tropics Region. The Plan should:

- Incorporate existing natural resource plans (e.g. water, vegetation and coastal) and fill planning and management gaps;
- Contain targets for managing the condition of natural and cultural resources;
- Have integrated outcomes, the actions of which could be funded from a range of sources including the $1 billion Natural Heritage Trust (NHT) extension but also potentially other government programs, private and philanthropic investment; and
- Help educate and inform policy makers and the public about the issues confronting community-based NRM in the region and the consequences of pursuing a range of options.

This Plan is presented in four parts. Part A describes the purpose and scope of the Plan. Part B provides an overview of the Wet Tropics Region and explains why and how the Plan was developed. Part C describes the assets, the threats or challenges to these assets and the current management arrangements. It sets performance goals and intermediate targets for improvement in resource condition and identifies management options that, if undertaken, could effect the changes needed to reach the targets and ultimately, the goal itself. For various reasons it is not possible to protect every asset from every challenge it faces, so part D identifies regional priorities for the investment of NRM funds. It also provides details on

the monitoring, evaluation and reporting arrangements linked to the achievement of regional targets and defines key roles and responsibilities of key stakeholders in delivering the Plan.

The Plan is based around the primary assets of biodiversity, climate, land and water as well as the human or social asset of community. Community is treated as an asset because it is recognised that the future health of the environment is dependent on the people of the region. Aboriginal cultural and natural resource management, incorporating traditional ecological knowledge and customary practices, is also recognised as a critical asset that can provide substantial benefits to the management of natural resources in the region. As such, the maintenance and revitalisation of this knowledge and customary management practices is critical.

Aboriginal Cultural and Natural Resource Management is a recurring theme in the Plan, but is primarily dealt with in the chapter Caring for Country. Much of the information in this Plan on Aboriginal issues and interests is sourced from the Wet Tropics Aboriginal Cultural and Natural Resource Management Plan (The Aboriginal Plan), which was developed in conjunction with this Plan.

The Plan is intended to be dynamic and responsive to community and regional needs and will be improved as; more information becomes available, feedback is obtained and on-ground change takes place. A Regional Investment Strategy (RIS) will also be developed annually to complement the Plan. The purpose of the RIS, essentially a business plan, is to attract funds from the State Government, the Commonwealth Government and other sources for priority actions that need to be undertaken.

1.2 Scope of the plan

1.2.1 Policy environment of the plan

The support of the State Governments and the Australian Government for community-based NRM is moving from a project-based approach to strategic investment at a regional scale. This is reflected in the National Action Plan for Salinity and Water Quality (NAP) and the Natural Heritage Trust (NHT), through which Regional NRM Bodies in all Australian regions have been asked to develop integrated catchment/regional NRM plans. These Regional NRM plans will form the basis for the development of investment strategies for each region, to implement strategic actions and investment in NRM issues identified in the plans. Although this Plan is not narrowly defined to meet only the requirements of the NHT, those requirements heavily influence the framework for the Plan.

The draft Bilateral Agreement for the NHT defines the three overarching objectives:

1. *Biodiversity Conservation* – the conservation of Australia's biodiversity through the protection and restoration of terrestrial, freshwater, estuarine, coastal and marine ecosystems and habitat for native plants and animals.
2. *Sustainable Use of Natural Resources* – the sustainable use and management of Australia's land, water and marine resources to maintain and improve the productivity and profitability of resource based industries.
3. *Community Capacity Building and Institutional Change* – support for individuals, landholders, industry and communities with skills, knowledge, information and institutional frameworks to promote biodiversity conservation and sustainable resource use and management.

NHT programs will invest in ten Activity Areas (see Box 1), through the Regional NRM Plans and Regional Investment Strategies, and the Australian Government Envirofund program (for individual projects under $30,000).

Box 1. Activity Areas of the Natural Heritage Trust (NHT)

1. Protecting and restoring the habitat of threatened species, threatened ecological communities and migratory birds;
2. Reversing the long-term decline in the extent and quality of Australia's native vegetation;
3. Protecting and restoring significant freshwater, marine and estuarine ecosystems;
4. Preventing or controlling the introduction and spread of feral animals, terrestrial, freshwater and marine pests, terrestrial invasive plants and marine species and other biological threats to biodiversity;
5. Establishing and effectively managing a comprehensive, adequate and representative system of protected areas;
6. Improving the condition of natural resources that underpins the sustainability and productivity of resource based industries;
7. Securing access to natural resources for sustainable productive use;
8. Encouraging the development of sustainable and profitable management systems for application by land-holders and other natural resource managers and users;
9. Providing land-holders, community groups and other natural resource managers with understanding and skills to contribute to biodiversity conservation and sustainable natural resource management; and
10. Establishing institutional and organisational frameworks that promote conservation and ecologically sustainable use and management of natural resources.

(Source: NHT Extension Framework Agreement, 2001)

The NHT (and NAP) program adds some distinctive features to regional planning:

- A clear acknowledgement that many NRM issues are most effectively managed within a region; and
- A high degree of community-based regional self-determination on outcomes, priorities and choice of on-ground actions.

In Queensland, the NAP and the NHT programs are jointly delivered by the Australian Government and Queensland Government[1]. The lead Queensland Government agency for delivery of the NAP and the NHT is the Department of Natural Resources and Mines (NR&M) through the Strategic Policy and Regional Arrangements. The lead Australian Government agencies for delivery of the NAP and the NHT nationally are the Department of Agriculture, Fisheries and Forestry (DAFF) and the Department of the Environment and Heritage (DEH) through the Australian Government NRM Team.

A joint Australian Government and Queensland Government Joint Steering Committee (JSC) has been established to oversee the development and implementation of the NAP and NHT in Queensland. Responsibilities of this group are:

- Developing principles and criteria to guide NAP and NHT investment;
- Assisting the Regional NRM Bodies in developing regional integrated natural resource management plans and investment strategies;
- Consideration of the integrated natural resource management plans and making recommendations to Australian Government and Queensland Government Ministers on accreditation of those plans;
- Recommending NAP and NHT investment programs to Australian Government and Queensland Government Ministers;
- Agreeing the release of funding to proponents from the joint Australian Government and Queensland Government account for the NAP and the NHT;
- Reviewing quarterly and six monthly reports for projects to Australian Government and Queensland Government Ministers; and
- The development and implementation of Communication; and Monitoring and Evaluation Strategies.

In Queensland, Regional Coordination Groups (RCGs) have also been established to foster strong community- government partnerships, coordinate whole of government processes and policies, and resolve policy inconsistencies at the regional level. RCGs consist of senior management level representatives from the core NRM agencies, including Natural Resources and Mines (NR&M), the Environmental Protection Agency (EPA), Department of Primary Industries and Fisheries (DPI&F), Department of Local Government, Planning, Sport and Recreation (DLGPS&R), plus other government agencies that have an interest in a particular region's NRM issues. In the Wet Tropics Region this includes the Great Barrier Reef Marine Park Authority (GBRMPA) and the Wet Tropics Management Authority (WTMA).

[1] NB. The Wet Tropics Region is a non-NAP region.

Box 2. Characteristics of Regional NRM Bodies and plans

Regional NRM Bodies:

- The Intergovernmental Agreement (IGA) states: they must have 'a suitable level of authority' to develop and implement NRM plans;
- Must (at least) be incorporated, as they are accountable for funds and for meeting targets;
- Must have majority community membership and must include local government (but not necessarily State or Commonwealth Government). Membership must 'balance production and conservation interests'. The Regional NRM bodies are required to seek 'effective participation by all relevant stakeholders, including indigenous interests'; and
- Must have the abilities and arrangements to work effectively and accountably (see range of detailed criteria in the IGA).

Regional NRM plans:

- Are to be accredited jointly by Commonwealth and State, following agreed criteria;
- Must cover all NRM issues (but NAP funds will only be provided for actions that address salinity and water quality objectives; likewise NHT funds will only be provided for specific priority areas or themes);
- Must have targets that are in line with national targets (although only 'matters for targets', not actual targets, are being set at the national level, for salinity, water quality and biodiversity – see 'framework' paper) and National and State priorities are also to be set under NHT;
- Must be based on 'good' science (data and models);
- Must demonstrate consistency with existing plans and targets;
- Must include and document economic and social assessment of impacts and tradeoffs; and
- Must account for caps on water extraction under Water Resource Plans developed by the Queensland government.

(Source: CEOs Committee, 2003)

1.2.2 Role of the Regional Body and Board

FNQ NRM Ltd is the new Regional NRM Body formed to guide and support the community in natural resource management in the Wet Tropics Region. Across Australia the Boards of Regional NRM Bodies, such as FNQ NRM Ltd, are the Australian Government and State Governments' primary mechanism to involve the community in making decisions about natural resources. The development of this management plan has been undertaken by FNQ NRM Ltd with the Rainforest CRC. Further information is contained in Appendix A on the role of the Regional Body and the establishment of the Board.

The Board is committed to strong connections with the regional community. In keeping with its commitment to being open and accessible, Board meetings are open to the public and minutes are available on the Board's website. The Board is also forming a Membership Body to be the essential link between the community and the Board of FNQ NRM Ltd. This partnership will mean shared decision-making and outcomes that are in the region's best interests. This will be a significant milestone for the region and culminates the formation of the new regional organisation.

It is important to note that Regional NRM Bodies are not statutory organisations in Queensland. No legislation has been introduced to support the arrangements. Similarly the plans they develop have no statutory authority but are intended to consolidate and build on existing planning and information frameworks.

Local governments in the Wet Tropics region remain seriously concerned that the "No Net Loss" aspirational targets for biodiversity outlined in the plan could take on regulatory significance if Regional NRM Plans were to become statutory documents. Both Local governments and FNQ NRM Ltd see this aspirational target as having no statutory significance. Its intended application will be consistent with the Regional (Growth Management) Plan.

More information on the role and responsibilities of the Regional NRM Body and Board is provided at Appendix A.

1.2.3 Preparing new Regional NRM plans

The significant new feature required in Regional NRM plans is the setting of targets as described in Box 3 (see also Appendix D). These must be developed to align with the national outcomes, matters for targets and core indicators as provided by the Australian Government in Appendix E. Furthermore, State resource and environmental agencies have set generic resource condition targets that all regions will need to consider as part of their integrated NRM planning process.[2]

Central to the setting of resource condition targets at the regional scale will be an understanding of the social and economic consequences that may arise in the delivery of actions towards the targets. It is important that an analysis is undertaken, based on an appropriate level of social, economic as well as environmental data.

It is proposed that funding to implement an accredited[3] Regional Plan will be determined on the basis of a Regional Investment Strategy (RIS) to be developed by the Regional NRM Body. The Guidelines note:

> *In many cases, a reasonable period of monitoring will be required to establish baselines or trends. Hence, many regions will not be in a position to set specific achievable targets for natural resource condition at the time their regional plans are put forward for accreditation'*

1.2.4 Plan principles

Principles provide guidance in decision-making. They are the 'rules' that it has been agreed need to be followed when making decisions. The three core planning principles applying to this plan are:

1. Use and management of the natural resource assets of the Wet Tropics Region will follow the principles of ecologically sustainable development recognizing, at all levels of decision-making, all dimensions of sustainability (ecological, economic, cultural, and social well-being, i.e. the quadruple bottom line) in both the short and long term. (see Box 4);
2. Planning and decision-making processes will be based on identified values and information, will be driven by the need to achieve the agreed vision, and will be oriented towards taking actions; and
3. Traditional Owners rights and responsibilities for natural and cultural resource management of their traditional land and sea Country will be recognised in all NRM activities to ensure that equitable consideration is given to Aboriginal interests for NRM, and that equitable partnerships are developed. (see Box 5).

Together, the application of these principles leads to the achievement of the Plan's desired outcomes.

Box 3. Target Setting

Aspirational Targets (Goals)

- Incorporates a Vision in the form of goals/aspirational statements.
- Long term 20 – 50+ years.
- Sets the context for measurable and achievable Targets.

Resource Condition Targets (RCT)

- RCTs relate to the condition of natural resources in the medium term (i.e. 10–20 years).
- Describe and quantify the desired resource condition: Specific, Measurable, Achievable, Realistic and Time bound (SMART targets).

Management Action Targets (MAT)

- MATs efficiently deliver RCTs in 1–5 yrs.
- Based on existing information on methods /technology to progress toward achieving the resource condition target and/or collection of information to develop resource condition targets.

Management Actions

- Identify strategic, prioritised and achievable actions to address the MATs.
- Includes an evaluation of the wider social, economic and environmental impacts of such actions, and of any actions needed to address such impacts.

[2] More detailed guidance on each of these elements can be found in the National Accreditation Guidelines (2002) and the Revised Interim National Framework for Natural Resource Management Standards and Targets (DAFF, 2001) and also Guidelines for Developing a Regional NRM Plan in Queensland (NR&M, 2002, 2003).

[3] Each Regional NRM Body is to develop a Regional NRM Plan which, after consultation with the RCG and community, is submitted to the JSC for accreditation.

Box 4. Ecologically Sustainable Development (ESD)

The National Strategy for Ecologically Sustainable Development defines ESD as:

> *Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.*

The National Strategy for ESD has been adopted as a guiding principle for the development of this Plan. The National Strategy is based on the following goals, objectives and principles:

The National ESD goal is:

- development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.

The three core objectives for ESD are:

- to enhance individual and community wellbeing and welfare by following a path of economic development that safeguards the welfare of future generations;
- to provide for equity within and between generations; and
- to protect biological diversity and maintain essential ecological processes and life-support systems.

Seven guiding principles have been derived from the goal and core objectives:

- decision making processes should effectively integrate both long and short term economic, environmental, social and equity considerations;
- where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
- the global dimension of environmental impacts of actions and policies should be recognised and considered;
- the need to develop a strong, growing and diversified economy, which can enhance the capacity for environmental protection, should be recognised;
- the need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised;
- cost-effective and flexible policy instructions should be adopted, such as improved valuation, pricing and incentive mechanisms; and
- decisions and actions should provide broad community involvement on issues which affect them.

National Strategy for Ecologically Sustainable Development Endorsed by the Council of Australian Governments, 1992.

Box 5. Overarching Principles for Traditional Owner Involvement in Natural and Cultural Resource Management

All NRM projects in the Wet Tropics Region will occur on the traditional land and sea country[4] of a particular Traditional Owner group. It is important that the correct Traditional Owners[5] are meaningfully consulted in regards to the planning, implementation and monitoring of all NRM activities that occur on their traditional country. The following Guiding Principles were developed with Traditional Owners over a ten-month consultation process. These principles represent a positive step towards recognising the rights and obligations that Traditional Owners have had, and continue to have in the management of the cultural and natural resources of the region on their traditional country. The recognition and support of the principles by NRM stakeholders will help to ensure that there is increased participation of Traditional Owners in NRM through the development of equitable partnerships.

- The Wet Tropics NRM region is recognised as a diverse set of living Aboriginal cultural landscapes of at least 17 major Traditional Owner Groups (many of which include several clan groups).
- Traditional Owners are recognised as the original owners of the Wet Tropics NRM region, and their ongoing rights and obligations to custodial responsibilities over the region are recognised and respected.
- Traditional Owners rights to be consulted and meaningfully involved with NRM issues on country at all stages of project planning through to implementation and monitoring are recognised as being a core protocol for all NRM activities.
- Traditional Owners priorities for cultural and natural resource management of country are recognised as being legitimate in their own right.
- The intellectual and cultural property rights held by Traditional Owners are respected in all NRM activities.
- Aboriginal cultural values for country (including cultural heritage and Native Title rights) are recognised and protected in all NRM projects.
- Aboriginal knowledge of country is recognised as being parallel to mainstream scientific knowledge systems in NRM activities.

[4] Country is a term used by Aboriginal people for their traditional lands, waters and airspace. It means place of origin, literally, culturally or spiritually. It refers to more than just geographical area: it is the shorthand for all of the values, places, resources, stories, and cultural obligations associated with that geographical area (Smyth 1994).

[5] An Aboriginal person who has traditional or familial links, and/or connection to particular traditional lands and/or waters (homeland estate) under traditional law, including rights, interests and responsibilities.

1.2.5 NRM Plan development process

Stakeholder consultation

Community ownership is essential to manage natural resources effectively to gain community commitment to joining partnerships and implementing solutions. As such, the process adopted in developing NRM plans is just as important as the content. Successful implementation will only be achieved if all those with an interest in the process and its outcomes believe they have had adequate opportunity to contribute to the process. This includes defining the problems, setting management actions and developing solutions. Regional communities are a rich source of knowledge, experience and energy and have much to contribute. In October 2003, the Board of Directors of FNQ NRM Ltd was formed to take carriage of the process.

The Plan's development was supported by a steering group of key government agencies, industry and community representatives. A technical advisory panel was also convened to provide scientific input into the planning process regarding topics such as water quality and management, biodiversity targets and needs, forest rehabilitation, information sources and monitoring requirements.

To ensure an integrated and strategic approach to planning activities and a direct link to the community, working groups were established to discuss specific issues such as biodiversity, land and water resources, riparian management, coasts, Indigenous NRM, capacity building and institutional change. These specific issues reflect the overarching objectives of the Natural Heritage Trust.

Based on a Community Participation and Information Strategy a three-stage public consultation process was developed. Stages one and two of the preliminary public consultation process were less formal, aimed at awareness raising and familiarising the community with potential outcomes and types of targets. Stage three is a formal public consultation process of this Plan. These stages are described below.

Preliminary public consultation process

A detailed explanation of the activities undertaken during the preliminary public consultation process is provided in Appendix B.

Stage one aimed to build the capacity of the community to participate and provide input into development of the Plan.

Stage two focused on gathering input into a range of draft targets and potential management actions drawn from existing NRM strategies in the region. The aim was to initiate a level of community discussion and debate on types of targets and management actions to generate information to refine, create or replace those targets lacking community or technical support prior to their inclusion in the draft Plan.

Landcare and catchment management groups played a key role in disseminating information and motivating community involvement in the process, as did the industry and environmental sectors. Both stages coincided with high levels of media exposure and the public release of the condition reports and summaries.

Public Consultation Malanda Show 2004 (Photos: Helen Irwin)

Formal public consultation process

A draft of the Regional NRM Plan was circulated to all stakeholder groups and the public for consideration in September 2004. In the following six-week period, community groups and individuals as well as key agency technical review groups were encouraged to evaluate the draft plan and submit comment. Various meetings were held that provided an opportunity to discuss the content of the Plan and clarify issues of concern. Close to forty formal submissions were received. All submissions have been considered and where appropriate improvements made as recommended by individuals, interest groups and agencies.

Core plan documents

Document set title *Sustaining the Wet Tropics: A Regional Plan for Natural Resource Management*,

Volume 1 *Background to the Plan* (McDonald & Weston 2004)

Volume 2A *Condition Report: Biodiversity Conservation* (Weston & Goosem 2004)

Volume 2B *Condition Report: Sustainable Use* (Armour et al., 2004)

Volume 2C *Capacity Building and Institutional Change* (Fenton 2004)

Volume 3 *The Wet Tropics Aboriginal Cultural and Natural Resource Management Plan*

Volume 4 ***Sustaining the Wet Tropics: A Regional Plan for Natural Resource Management*** (this volume)

Volume 5 *A Regional Investment Strategy 2004–2007*

Engaging the Region's Traditional Owners

FNQ NRM Ltd acknowledges that the region's natural resources have been actively managed and utilised by Aboriginal people for thousands of years. These customary management practices and the knowledge of the environment that Traditional Owners have today are recognised as being significant regional assets that can enhance and improve NRM in the region. Today Traditional Owners continue to maintain strong connections to their traditional country and have custodial obligations and responsibilities for the management of these estates. Being meaningfully involved in natural and cultural resource management on their traditional country is important for the cultural survival of the region's Traditional Owners. There are many social, cultural, economic and environmental benefits that will occur through the increased involvement of Traditional Owners in NRM on their country.

Traditional Owners do not see themselves as stakeholders in the region, but as the original owners of the region. They have significant rights in NRM that are recognised under both European and customary laws. The traditional land and sea country of the Traditional Owners of the region covers the entire Wet Tropics NRM region. Potentially 80%, and up to 98% of the WTWHA, is claimable under the provisions of the *Native Title Act 1993* (Cth) (Yarrow 1996). To date there are a number of native title claims that are at varying stages of negotiation in the region. Outside this western legislative approach to native title (under the *Native Title Act 1993* (Cth)), Aboriginal people assert their prior ownership of the region.

Thus, it is important that there is meaningful engagement and participation of the regions Traditional Owners in all NRM planning, management and decisions making processes.

Aboriginal Cultural and Natural Resource Management Plan

In March 2002, Wet Tropics Traditional Owners identified that they were not adequately involved in round one of the NHT process. This lack of involvement led to the unique process of developing the Wet Tropics Aboriginal Cultural and Natural Resource Management Plan (the Aboriginal Plan) to both complement the overarching Regional NRM Plan and give Traditional Owners a voice in how Country is managed. The process was an innovative approach between Wet Tropics Traditional Owners, FNQ NRM Ltd and the Rainforest CRC.

The Aboriginal Plan is a bottom-up approach to planning with regional Traditional Owners actively participating in a two-year consultation and negotiation process. Through this process the Traditional Owners were involved in creating their own process and plan, as well as playing a significant role in the development of this Regional NRM Plan.

The Aboriginal Plan provides strategies and actions to address natural and cultural resource management issues for the region's Traditional Owners and identifies opportunities for increased participation in management and decision making processes. The process aims to ensure each of the region's numerous Traditional Owner groups enjoy equal access and opportunity for participation in natural and cultural resource management in the region. [6]

Regional Workshop August 2003. (Photo: Libby Larsen)

[6] See Smyth, D. 2004. Case Study No 4 – Developing an Aboriginal Plan for the Wet Tropics NRM Region in North Queensland. In, Smyth, D., Szabo, S. & George, M. Case Studies in Indigenous Engagement in Natural Resource Management in Australia. Consultancy Report by Smyth and Bahrt Consultants for DEH, Canberra (Report available at www.nrm.gov.au).

State of the region reporting

A key element of the new emphasis on regional outcomes is that actions are based on sound science. This requires the best possible use of available data and scientific knowledge. At a high-level regional science meeting, held in late November 2002, it was agreed that the Plan should be based on a clear documentation of the state of resources in the region. While there had been a wealth of research publications on the region, there had been no synthesis of this material into a document for the consultation and plan preparation processes. 'Condition Reports' were subsequently prepared around two of the three overarching objectives of the NHT extension, namely:

- Biodiversity Conservation (Weston & Goosem 2004);
- Sustainable Use (Armour *et al*. 2004); and
- The third overarching objective of the NHT extension, Community Capacity Building, was addressed in a report on capacity and Capacity Building requirements in relation to NRM in the Wet Tropics (Fenton 2004).

The Condition Reports, on Biodiversity Conservation and Sustainable Use, adopt the condition-pressure-response framework used for State of the Environment reporting in most Australian jurisdictions. The framework organises information, compiled from both published and unpublished sources, into three broad categories:

- Information about the condition of natural resources (i.e. quality and the functioning of important processes);
- Information about human activities, or pressures, that affect these resources. Pressures do not necessarily imply harm, especially if the activity is appropriately managed; and
- Information about human efforts to address resource management issues.

The methodology of the third report, on community Capacity Building, is based primarily on qualitative key informant interviews undertaken throughout the catchments of the region.

All three reports are important compilations of the available research and natural resource management experience of the Wet Tropics Region. By providing much of the information used in this regional NRM Plan, they allow the regional NRM body to base their decisions on relevant and up-to-date information. They also create a system for tracking progress in NRM and providing direction for future policy development. [7]

[7] The first two condition reports were released in early 2004 and are available on the Rainforest CRC website <http://www.rainforest-crc.jcu.edu.au> or in hard copy from FNQ NRM Ltd. The third report will be released, in conjunction with this Regional NRM Plan. Additionally, a Background Report (McDonald & Weston 2004) was released in early 2004 to provide a background to, and context for, the Plan and associated technical documents. It is also available on the Rainforest CRC website or in hard copy from FNQ NRM Ltd.

Review of existing plans and strategies

As shown by Figure 1, many organisations are involved in the implementation of NRM initiatives in the Wet Tropics Region. The Wet Tropics Management Authority and the Great Barrier Reef Marine Park Authority have statutory responsibility for the region's World Heritage Areas, the state agencies Department of Natural Resources and Mines, Environment Protection Agency and Department of Primary Industries & Fisheries have natural resource management responsibilities and local authorities, through their development and land use planning functions, also have a significant role in the management of natural resources. In addition to these government organisations, the Wet Tropics Regional community has a well-established record of participation in Landcare, integrated catchment management, land rehabilitation, industry groups (such as Canegrowers, Growcom and Agforce), Indigenous groups and conservation organisations.

Consequently, there have been over one hundred plans and strategies prepared for coasts, catchments, endangered species, local authorities, World Heritage Areas, national parks and so on. Some are statutory but most are not enforceable by law. Their main function is to guide development and investment in the region. Two important examples are the first *Wet Tropics Regional Strategy for Natural Resource Management* (NRM Board, 2000), which is the base document for this Regional NRM Plan, and the *Far North Queensland Regional Plan* (FNQ RPAC, 2000). Importantly the latter, otherwise known as the FNQ Regional Plan, is the principal strategic framework addressing ecological sustainability in the region and deals with NRM issues within the broader context of balancing social and economic considerations.

The preparation of this Regional NRM Plan is one means by which implementation of FNQ Regional Plan outcomes can be achieved.

Table 1 outlines ten of the most important planning processes for sustainable natural resource use in the Wet Tropics. The key characteristics of selected processes are included at Appendix 1 in the Background Report.

Other major planning processes not listed in Table 1 include: the development of the Wet Tropics World Heritage Area Regional Agreement (see case study in Chapter Caring for Country); MoUs between Traditional Owners and relevant stakeholders and various Indigenous Land Use Agreements (ILUAs); strategies for management of World Heritage Areas; pest plant and animal management plans; threatened species recovery and threat abatement plans and licensing regimes for environmentally relevant activities under the Queensland *Environmental Protection Act 1994* (for a more comprehensive list of relevant strategies and plans, see Appendix 2 in the Background Report).

Another important process is the preparation of IPA compliant planning schemes by local governments in the region (see below).

Local government planning schemes and responsibility for NRM

Local government planning schemes prepared under the *Integrated Planning Act 1997* (Qld) (IPA) have considerable and increasing responsibility for managing natural resources. This arises because local governments have been delegated responsibility to manage development permit processes taking into account State and regional matters.

The State has reserve powers to "call-in" a development application where a State interest could be severely affected by the implementation of a development approval.

The State has the ability to protect its interest in local government planning schemes through State planning policies. State interests are integrated into local government planning schemes and regulatory authority of State agencies through the integrated development assessment system (IDAS).

Local government planning schemes can protect existing environments (e.g. riparian zones, wetlands and steep slopes) through development control of permitting material change of use (or rezoning), and operational works. Planning schemes can further prevent impacts of development on sensitive land (e.g. wetlands, World Heritage Areas, waterways) by triggering assessment of proposed new uses on or adjacent to these sensitive areas. The recognition and protection of Aboriginal values for their country (including cultural heritage and native title) should be recognised in all local government planning schemes.

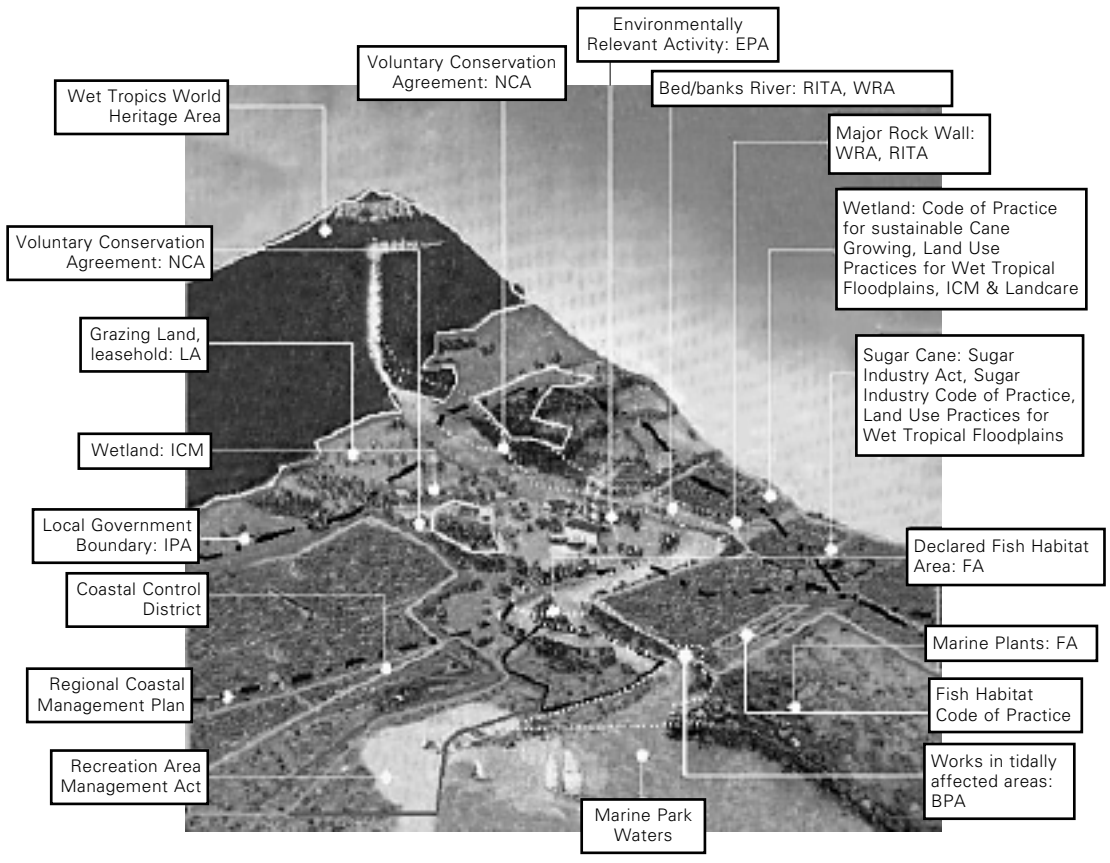


Figure 1. Institutional arrangements for environmental management in a Wet Tropics catchment (Source: Vella et al*, 2000)*

LA *Land Act 1994*
ICM Integrated Catchment Management
IPA *Integrated Planning Act 1997*
NCA *Nature Conservation Act 1992*
EPA *Environmental Protection Act 1994*
RITA *River Improvement Trust Act 1948*
WRA *Water Resources Act 1989* (see now *Water Act 2000*)
FA *Fisheries Act 1994*
BPA *Beach Protection Act 1968* (see now *Coastal Protection and Management Act 1995*)

It is important to note that Resource Condition Targets within this plan are not intended to be used as evidence in consideration of development approval under the Integrated Planning Act. They are aspirational rather than regulatory targets.

Gaps in outcomes and actions

There are substantial planning powers in these systems, it is yet to be determined whether the plans are consistent and in total comprehensive. Regional coverage of the FNQ Regional Plan is critical for establishing regional priorities. One problem is that the FNQ Regional Plan does not cover the entire Wet Tropics NRM planning region. It is also highly unlikely that:

- Priority assessment is at consistent detail across the region;
- Condition targets are defined and agreed;
- Actions to achieve targets may have been identified but are not always assessed for site specific conditions; and
- Actions to achieve targets have been assessed in terms of cost-effectiveness or social impact.

There may be adequate statutory powers to manage natural resources, but it cannot be taken for granted that these will implemented consistently across the region in an integrated way.

The Regional NRM Plan, once accredited, will contribute to further strategy development and implementation of the FNQ Regional Plan.

Plans and strategies – Aboriginal issues in NRM

Recognition of the special relationship, customary rights and obligations that Indigenous people have with the environment is acknowledged in various international, national, state and regional policies, and strategies. These include especially:

- State and Commonwealth Native Title Acts;
- Wet Tropics World Heritage Area legislation and plans

At a State level the Queensland Government's Ten Year Partnership Program 'Looking after Country Together' vision is as follows:

> *By 2012, Indigenous people have significant access to and involvement in the management of land and sea country. Indigenous people will have the resources and skills needed to effectively plan for and sustainably manage land and sea country to meet their aspirations.*

Table 1. Major planning processes for sustainable natural resource use in the Wet Tropics.

Plan Type	*Scope*
Wet Tropics Regional Strategy for NRM	Prepared by the NRM Board (Wet Tropics) and strategy accredited by the Queensland LCMC is a framework for ICM and Landcare activities in the region.
FNQ Regional Plan	The principal strategic planning framework guiding growth and development in the FNQ region over the next 20 years, developed through a cooperative planning process involving all three (3) levels of government, key regional stakeholders and the community. Endorsed by State and Local Government.
Reef Water Quality Protection Plan	A Commonwealth-State umbrella plan "Stabilising and reversing the decline in water quality entering the Great Barrier Reef as soon as possible".
ICM Plans	All major rivers in the region have community-based ICM groups that have undertaken assessment, strategy development and on ground works.
River and River Reach Management Plans	Prepared by River Improvement Trusts (RITs) – statutory partnerships between local government and local resource management groups.
Best Management Practices (BMPs)	BMPs have been produced by/for the aquaculture, horticulture and sugar industries.
Regional Vegetation Management Plans (RVMPs)	Prepared by the Regional Vegetation Committee under the *Vegetation Management Act 1999* (Qld). Draft Einasleigh and Wet Tropics RVMP completed in 2003.
Water Resource Plans (WRPs)	WRPs are prepared under the Water Act. Currently only for the Barron River. Wet Tropics WRP scheduled to commence circa 05/06.
Wet Tropics Conservation Strategy (2004)	Prepared by WTMA to establish regional priorities and promote cooperative management of world heritage values, wherever they occur.
Regional Coastal Management Plans (RCMPs)	Operate in conjunction with the State Coastal Plan and include region-specific policies. RCMPs prepared for Cardwell-Hinchinbrook and the Wet Tropical Coast have both been completed.

PART B
wet tropics region

2.0 Overview of the Wet Tropics region

The Wet Tropics NRM region covers approximately 2.2 million hectares and is generally defined as including Douglas Shire in the north, to Hinchinbrook in the south, extending west to include the Atherton Tableland and Upper Herbert catchment. For the purposes of the new Regional NRM Plan, the regional boundary is based on the catchment management planning units of the Daintree/Mossman (incorporating the Bloomfield), Barron, Russell/Mulgrave, Johnstone, Tully/Murray and Herbert Rivers as well as Trinity Inlet (see map at beginning of document). The seaward boundary of the region extends into the Coral Sea from the Bloomfield River south to Crystal Creek. The region includes 91 per cent of the Wet Tropics of Queensland World Heritage Area; part of the Great Barrier Reef World Heritage Area and Great Barrier Reef Marine Park, National Parks, State Forests and other protected areas. It includes the country of approximately 17 major Traditional Owner Groups (many of which have several clan groups).

Box 6. Catchments

NRM boundaries are based on 'catchment management planning units', all land is within a catchment and all uses of the land will have an impact on the catchment. Catchment boundaries can have varying and different landforms that shape its borders (hills, ridges and mountains) and catch the water that flows to a low point. This can be a river, a lake or the sea.

(Photo: Geoff McDonald)

Box 7. Bioregions

Bioregions are areas of land or sea composed of interacting ecosystems (Thackway & Cresswell, 1995). There are 64 bioregions across Australia (Thackway & Cresswell 1995), 19 occur in Queensland. Two vastly different bioregions converge within the Wet Tropics NRM region: the humid coastal part in the Wet Tropics and drier country to the west in the Einasleigh Uplands. It should be noted the **Wet Tropics NRM region is not the same as the Wet Tropics bioregion**.

Box 8. The Wet Tropics – the Australian Outback?

The Wet Tropics Region is synonymous with the reef and rainforest. But the Australian outback? At least 42 million television viewers in America (and countless others around the world) think so...

The second series of the reality television hit *Survivor* was filmed on Goshen Station, about 100 km from Mt Garnet. According to the show's website, this 'rugged and primitive environment', with its 'harsh elements' and 'threatening indigenous animals', was located 'deep in the Australian Outback'. This probably comes as a surprise to Goshen Station's Maxine and Ross Blennerhasset. They were certainly surprised at reports of a tourism boom in Belize after the small Central American country hosted another reality television show, *Temptation Island*.

According to Maxine and Ross, the tourism interest generated by *Survivor – the Australian Outback* lasted about 12 months. "We had some tours going for about 12 months," Maxine said, "but once the African *Survivor* started that became the place to go and our tours came to nothing. Americans are fanatical about the show and some people still come to have a look around, but at the moment all we have is a few campers who ask whether there is anything left of the set. But you wouldn't know they had even been there these days."

Part of the Survivor *set on Goshen Station, near Mt Garnet.*

(Photo: M&R Blennerhasset)

A detailed map of the Wet Tropics NRM region is provided earlier on page iii, and more information on boundary issues is provided in the Background Report prepared for this plan (McDonald & Weston 2004).

Climate

Climate is one of the dominant driving forces behind the diversity found in the Wet Tropics Region . Rainfall averages 1,580mm a year and is the distinguishing climatic factor. This annual rainfall is variable and seasonal, dominated by major events such as rain depressions, monsoons and cyclones. Generally the wettest years have almost twice as much rain as the driest. Temperatures are fairly uniform throughout the year, with means typically ranging from a minimum of 22°C on the coast down to 10°C inland and maximums from 29°C to 31°C.

The prevailing winds are east to southeasterly with the strongest winds usually occurring in April and August. During the summer months, north to northeasterly sea breezes dominate. Tropical cyclones are common during the summer months from November to April with a frequency of four to six a year, on average two cross the Queensland coast each year after developing in the Coral Sea (see Figure 2). In the Wet Tropics 1977 was the most active year to date with four cyclones affecting the Cairns region.

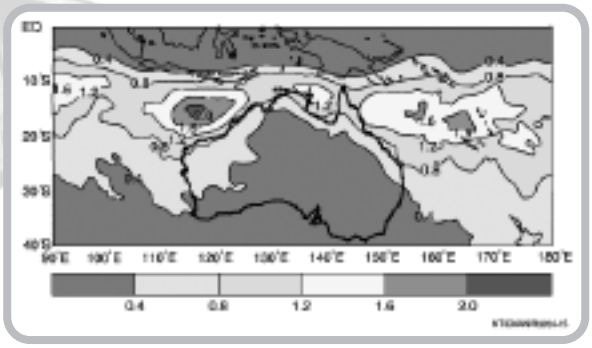


Figure 2. Map showing average annual frequency of tropical cyclones in the Australian region (Source: Bureau of Meteorology website– www.bom.gov.au).

Physiography

The Wet Tropics NRM region straddles the Peninsula and Burdekin provinces of the Eastern Upland division. The Great Escarpment is backed to the west by tablelands, ranges and on the east descends abruptly to a narrow coastal plain with coastal mountainous offshore islands. Fringing reefs occur in the northern section, most extensively between the Daintree and Bloomfield rivers. The major mountain masses exceed 1,000m. This geomorphic variability is a major determinant of ecosystem diversity and the scenic assets of the region.

Geology

Much of the landscape in the Plan area is of very old origin with very recent igneous intrusion from volcanic activity and mostly occurs within the Tasman orogenic zone – Palaeozonic to Mesozoic orogenic zone and overlaying basins. The Upper Herbert catchment is located over a Peterozoic shield area and consequently surface geology is diverse in terms of age and composition. Proterozoic strata (2,000 million to 500 million years old) comprise sediments and volcanics that have been folded, faulted and metamorphosed to varying degrees and widely intruded by granite and basic igneous rocks which are intensively mineralised. To the east Palaeozoic and early Mesozoic deposits dating back 500 million to 200 million years result in great thickness of sediments (including coral reefs) and volcanics, that were periodically folded and faulted, intruded by granite and finally uplifted. Quaternary marine deposits, coastal dunes, alluvial plains and piedmont fans occur along the coast (Goosem *et al*. 1999).

Box 9. The Wet Tropics Region – Aboriginal Cultural Landscapes

'Catchment units' and 'bioregions' are European concepts, based upon western scientific notions about what constitutes an interacting system or an integrated area. Aboriginal perceptions of 'country' do not necessarily conform to these scientific spaces and boundaries, even though Aboriginal ideas about country can be regarded as systematic and holistic. In recent times, the concept of 'cultural landscapes' has been used to describe Indigenous characterisations of country. The idea of a cultural landscape captures the 'whole-of-country' approach of Aboriginal groups to the environment, and directs our attention away from looking at Aboriginal space as a collection of disconnected sites or places. The extent of these cultural landscapes may be marked by tangible natural features, such as rivers or mountain ranges, or by intangible cultural elements, e.g. Dreaming tracks. Generally speaking, these cultural elements are manifest in the landscape as identifiable geographic forms, and thus nature and culture become inseparable within these environmental spaces.

The concept of cultural landscapes has been adopted by environment and heritage protection agencies at both the international and national level. For example, in 1995, the World Heritage definitions for cultural properties were expanded to include cultural landscapes under three main categories:

- Intentionally created landscapes (e.g. gardens and parklands);
- Organically evolved landscapes, either relic or continuing (e.g. farming landscapes), and;
- Associative cultural landscapes (e.g. natural landscapes with significant religious associations) (UNESCO 1995).

As a result of this new definition, Uluru Kata-Tjuta National Park, previously listed as a World Heritage property only for its natural values, was re-listed as an associative landscape with 'powerful religious, artistic and cultural associations of the natural element'. Preliminary research undertaken by Rainforest CRC researchers indicates that there is evidence to support the re-nomination of the Wet Tropics World Heritage Area as a series of Indigenous cultural landscapes (Horsfall 2002, 2003a & 2003b).

Soils

Soils types vary throughout the region and are determined by their parent rock, geomorphic and climate processes. Time and biota are also important determinants of soil formation in the region. Dominant soil types in the region include: Kandosols (red, yellow and grey earths, red and brown hardpan soils); Dermosols (prairie soils, some red and yellow podzolic soils); Ferrosols; and Sodosols (solodic soils, solodized solontz, soloths and desert loams).

Most predominant in the region are Kandosols, with physical properties favorable for plant growth but with low fertility and prone to erosion. Dermosols occur mostly in the humid coastal area and are

commonly quite fertile, they are the most widespread in the region. Ferrosols are prized for agriculture particularly for sugar cane, dairying and horticulture, they exist in higher rainfall coastal areas and they are the 'red soils' of the Atherton Tablelands. Sodosols are another dominant soil type that are low in fertility with many being saline at shallow depth (some have a sodic textural B horizon at shallow depth, whilst some may be saline in the sub-strata or regolith, but few in the region have been investigated until recently). Though susceptible to erosion and dryland salinity they are important soil types for grazing and hardwood timber.

Whilst the region contains relatively useful soils for various agricultural industries there is a necessity for management practices that maintain fertility and retain or improve soil physical structure accordingly.

Vegetation

The variation in rainfall, geology, drainage and altitude in the Wet Tropics combined with the complex evolutionary history of the region has resulted in a complex spectrum of plant communities and forest types. Rainforests, classified into 16 structural and 30 broad community types, dominate the narrow, coastal, high rain belt correlating with climatic zones and soils. These are fringed and dissected by a range of sclerophyll forest and woodland types, mangroves and swamp communities. Extensive seagrass meadows grow in a range of substrates along the coast.

Hydrology

The climatic and geomorphological conditions of the region are unique in Australia and result in fast flowing streams with high discharge rates. Water drains to the Coral Sea from six major catchments, as well as Trinity Inlet. Within these catchments there are many thousands of waterways. Although rainfall is highly seasonal, streamflow in the coastal catchments is more reliable than most other parts of Queensland and is close to perennial. The lower-lying areas of the region are subject to flood inundation.

Further information on the biophysical environment of the region can be found in the Background Report (p4 onwards).

Aboriginal cultural landscapes

The Wet Tropics Region has great cultural significance for the Aboriginal Traditional Owners. It is a series of 'living' Aboriginal cultural landscapes that has been shaped by management practices of Traditional Owners of the region for thousands of years. Today, Traditional Owner groups continue to retain strong and continuous connections to their land and sea country. They are not another stakeholder group, but the Traditional Owners of the region who are the proper custodians for their traditional estates, which includes the land and sea, their resources, and the knowledge and practices associated with these. For Aboriginal people the natural values and the cultural values of the region are interwoven and inseparable.

European settlement and colonisation

Edmund Kennedy was the first European to explore the Wet Tropics in 1848 and by the time George Elphinstone Dalrymple's expedition arrived in 1873 the groundwork had been laid for European settlement. By 1875 the gold rush was on and the timber industry had begun logging the coastal valleys. Timber cutters were working the western margins of the Atherton Tablelands by 1881. Tin mining began to have an impact in the 1880s and beef cattle were introduced to feed the miners and the growing coastal settlements. A dairy industry was established on the Atherton Tableland at the same time, resulting in extensive clearing of the forests. Meanwhile, lowland rainforest was being cleared for cropping or grazing under the government land scheme of the day. In 1931, the conservator of forests, Edward Swain, criticised the extensive clearing as shortsighted. After several decades some forests were protected from clearing and used for selective timber harvesting. The economy of the region remained reliant on primary production until the 1970s when tourism emerged as the major driver. Nevertheless, the expansion of intensive agriculture continues to place pressure on the region's water resources and the survival of remaining natural areas, particularly on the coastal lowlands. It also continues and exacerbates the negative impacts of settlement and colonisation on Aboriginal cultural values in the Wet Tropics Region .

As reported by Smyth (2004), Aboriginal people in the Wet Tropics Region suffered many of the consequences of colonisation that also occurred elsewhere in Australia – displacement, dispersal, massacres, introduced diseases, poisoning, discrimination and exploitation. However, many Aboriginal groups in the region remained living on or close to their traditional country, often through employment on farms and cattle properties, or living on missions and reserves established on their land. As a result, many people have retained some knowledge of their languages and considerable understanding of their connections and obligations to country.

Current population, economy and resource use

Most human activities one way or another depend on the natural assets of the region, whether it be the environmental values that attract tourists and support the massive tourist industry in the region; or whether it is the soils and climate resources that support tropical agriculture and forests resources.

Each year nearly two million domestic visitors and one million international visitors come to the region directly supporting tourism businesses, and indirectly supporting a substantial part of the regional economy. Tourism is by far the major source of revenue and total visitor expenditure levels exceed $2 billion annually.

Farmers produce approximately $750 million worth of crop and livestock products annually. Supporting agriculture engages many more people in transport, processing and marketing activities. While the sugar industry has struggled in recent years, the horticulture industry has grown rapidly producing high valued products for local and international markets. Further details on the value of agriculture are provided in asset chapter Land Resources.

At present approximately 216,000 people live in the region and depend directly or indirectly on these natural resource-based industries. That number is projected to increase to over 300,000 in the next 20 years. Therefore natural resource management, the sustainable use of Wet Tropics land and biological resources, is central to the long-term prosperity of the economy and the people who depend on it – that is almost everyone in the region. Further detail on population and its relationship to resource use, can be found in the Background Report (p12–29).

PART C
assets + actions

3.0 Assets and actions

3.0.1 Strategic framework – The asset framework

Until recently, natural resources management was "problem-based" and plans such as they were, tended to respond erratically to problems when they occurred rather than take a more reasoned approach. The new NHT/NAP programs require a more strategic approach dealing with **causes** of problems rather than symptoms alone, and to ask more probing questions about what is being managed in general. The new logic is that plans need to protect, and when necessary restore, **assets** both natural and cultural. Problems arise when assets are in **poor condition** relative to long-term social preferences or they are being **threatened**.

In the financial sense, an asset is a stock of resources of value that can generate ongoing wealth to its owners. An environmental asset is owned by society and is valued because of the **services** it provides such as food, fibre, recreation, cultural expression and aesthetic services. Looking after these assets is what this plan is all about. The primary natural assets are land, water, biodiversity and climate. The primary human assets as far as natural resources are concerned are community capacity for long-term adaptive management of their natural resources and the cultural values inherent in natural systems (especially for Aboriginal people). The primary asset addressed in this plan and secondary assets or the elements of them are shown in Table 2.

This section outlines these natural resource, cultural and community assets, briefly assesses current conditions and trends and provides goals and targets for the future condition of the assets.

Table 2. Primary Assets and Elements in the Wet Tropics Plan

Primary Assets	***Asset Elements***
Biodiversity	Native vegetation (regional ecosystems) (matters for targets include degradation and fragmentation, altered fire regimes and protection of high quality remnant vegetation) Rivers and freshwater wetlands (matters for targets include riparian zones, in-stream habitats and freshwater fisheries) Coastal, estuary and reef habitat (matters for targets include invasive species introductions, shipping and marine fisheries) Significant species and ecological communities (including marine species and species of cultural significance)
Climate	Air quality Greenhouse gas concentrations
Land resources	Arable lands (matters for targets include potential and actual acid sulphate soils, erosion, salinity, protection of good quality agricultural land and management of improved pastures) Native pastures Forests Urban lands (matters for targets include energy consumption and solid waste) Extractive resource areas Aboriginal cultural landscapes
Water resources	Water quality (matters for targets include nutrients, wastewater, sediments, pesticides and heavy metals) Water quantity (matters for targets include water supplies and use, environmental flows, flooding and drainage)
Caring for Country – Aboriginal cultural and natural resources	Access and use of country Aboriginal cultural landscapes and places Aboriginal knowledge of country Resource use and cultural maintenance
Community	All members of the community Federal, State and local governments Aboriginal people Non government organisations Industry Educational and research organisations Other community partnerships

4.0 Biodiversity

4.1 Goals

The extent, diversity and condition of native ecosystems and the services and functions they provide will be maintained and, where possible, rehabilitated.

Viable populations of regionally significant species, including threatened plants and animals, will be maintained or recovered.

The number of threatened ecological communities will decrease through increasing their extent and improving their quality to achieve a net gain.

Aboriginal knowledge of biodiversity will be conserved and revitalised.

Production systems will be developed around land management practices that conserve biodiversity.

4.1.1 Biodiversity: An overview of the asset and the services it provides

Biological diversity (biodiversity) is defined in the *National Strategy for the Conservation of Australia's Biological Diversity* as "the variety of all life forms – the different plants, animals and micro-organisms, the genes they contain and the ecosystems of which they form a part". Farmer-Bowers (1997) suggested that it might be more helpful to think of biodiversity as "native flora and fauna in sufficient quantities to ensure the natural variations in communities are maintained". As a natural resource asset, biodiversity includes: native vegetation communities (regional ecosystems), waterways, wetlands, estuarine and marine habitats as well as the individual plant and animal species they support.

4.1.2 Values of biodiversity

There are three main overlapping reasons for the conservation of biodiversity: beauty, utility and profit. Other values might include spiritual enrichment (possibly a subset of beauty) and the intrinsic right of species to exist. It is also an equity issue – it is doing something so other people are not disadvantaged in the future. Accordingly, the conservation of biodiversity is now legally mandated in many places throughout the world. In Australia, it has become an obligation for stakeholder groups at all levels. This is appropriate, because Australia is one of only 12 countries – and the only developed country – recognised by scientists as being a global centre of biodiversity or "megadiverse country". Our obligations here in the Wet Tropics are higher than anywhere else in the country and, quite possibly, the world.

Ecosystem Services

'The role played by organisms in creating a healthy environment for human beings, for example, in production of oxygen, soil formation, maintenance of water quality.' – State of the Environment, Queensland 1999

Aboriginal values for biodiversity

The on-going survival of Aboriginal people was based upon an intimate knowledge of the biodiversity of the region. Aboriginal knowledge of biodiversity includes knowledge about species, populations and ecosystems, names and uses of species, distribution patterns, behavioural, seasonal and ecological information, and management practices to maintain and enhance biodiversity.

For example the controlled use of fire by Aboriginal people was responsible for maintaining local scale ecological boundaries such as sclerophyll woodland

Box 10. Native wildlife and farm productivity

Some species of native animals can contribute to farm productivity. For example, birds and gliders pollinate many plants and help to control insect pests. A sugar glider may eat 25 Christmas beetles per day. These insects are serious pests of eucalypt trees. A colony of sugar gliders (comprising up to eight animals) may consume more than 200kg of beetles each year. Honeyeaters and other birds also eat insect pests, and may eat up to 60% of insects found on woodland trees. An ibis eats up to 250g of pasture insects each day and the Australian magpie can consume large numbers of damaging scarab beetle larvae. Larger reptiles such as the lace monitor (goanna) and carpet python eat pests such as mice and rabbits. Native insects pollinate homegrown fruit and vegetables and agricultural crops. These are just a few of the 'ecosystem services' provided by wildlife on farms.

Based on D. Lindenmayer et al. *(2003) Wildlife on Farms*

Box 11. Forests at your Service – Major functions performed by forest ecosystems

- Purification of air and water
- Detoxification and decomposition of wastes
- Generation and renewal of soil and soil fertility
- Pollination of crops and natural vegetation
- Control of agricultural pests
- Dispersal of seeds and translocation of nutrients
- Maintenance of biodiversity
- Partial climatic stabilization
- Moderation of temperature extremes
- Windbreaks
- Support for diverse human cultures
- Aesthetic beauty and landscape enrichment

Source: Daily 1997

patches within the region (Hill 1998). The decline of a species of plant or animal that is culturally significant for Aboriginal people may be as a direct result of the change in use or lack of ability to practice culture in regards to its use. For example, certain orchid species proliferate as a result of their use by Aboriginal people and the lack of their use can, over time, create a reduction locally in the species.

Many Traditional Owners have a relationship of mutual obligation or totemic relationships with certain species. For example, the personal totem for Ngadjon-Jii elder, Ernie Raymont, is *mapi/mabi* or Lumholtz's tree-kangaroo (*Dendrolagus lumholtzi*). Some people are named after and are known by the language name for their personal totem. For totems, there are a number of social prescriptions and requirements which can include a spiritual responsibility to respect and conserve the totems which may include a prohibition against consumption of the species in question. As Ernie Raymont explains, "if it is your totem you not supposed to eat that totem".

The values of biodiversity, which are described in this section, are inextricably liked with the Aboriginal cultural values. Table 3 shows that for Aboriginal people, biodiversity has many values including cultural, spiritual, socio-economic, health and intellectual and cultural property values. The values listed for each of these headings are not mutually exclusive. For example, various flora and fauna species are culturally significant in; customary law and ceremony, food and medicinal resources, cultural artifacts and creation stories. The diversity of Traditional Owner groups in the region means that there are differences between groups regarding the cultural significance of particular species. The protection of the Aboriginal values of biodiversity as highlighted in table 3 is essential to the maintenance of Aboriginal cultural traditions and traditional affiliations to country.

These values are further discussed in the Chapter on Caring for Country, in particular under the key theme Aboriginal Knowledge Systems. It is important to note that the threats to biodiversity as described in this chapter are a concern for Traditional Owners because they impact upon their values for country.

Table 3. Some Aboriginal values for biodiversity.

Socio-Economic	• Traditional trade • Subsistence use • Commerical opportunities • Employment • Benefits from use of intellectual and cultural property • Community well-being • Social well-being through use of resources, accessing country and practising culture • Transmission of cultural knowledge
Cultural	• Customary law • Ceremony • Arts and crafts • Artistic design and representation • Language
Spiritual	• Creation stories • Totems • Law • Management responsibility • Dreaming tracks
Knowledge of country	(Knowledge of) • Medicinal qualities • Language • Use of toxic plants • Bush tucker • Customary management techniques • Distribution and seasonality of plants • Life cycle of animals • Hunting and gathering techniques • Technologies/knowedge for gathering, processing and utilising resources
Health	• Traditional food • Medicine • Healthy culture • Well-being

Biodiversity in the Wet Tropics

As reported in the Biodiversity Conservation Condition Report (henceforth referred to as Biodiversity Report), the Wet Tropics Region conserves an extraordinarily high level of Australia's biodiversity at both the ecosystem and species levels (see Box 12). The region has been identified as a biodiversity 'hotspot' of global importance. The listing of two natural World Heritage Areas – the Great Barrier Reef and the Wet Tropics – bears testimony to this. The reef and the rainforest, together with the region's equable climate, underpin the region's primary industry, tourism, which is worth more than $2 billion per year (see the Biodiversity Report, p18). For this reason alone, the conservation of biodiversity is arguably the most important issue to be addressed through this plan.

This chapter deals with the following four elements:
- terrestrial ecosystems (vegetation communities);
- inland aquatic ecosystems (rivers and wetlands);
- coastal, estuary and marine ecosystems; and
- significant species and ecological communities.

It is recognised that the conservation of biodiversity is addressed indirectly through other aspects of this plan.

'The Wet Tropics, Australia's biological crown jewels'

– *Tim Low,* Feral Future*, 1999*

Box 12. Biodiversity in the Wet Tropics

Due largely to its isolation, Australia is one of the most biologically diverse countries in the world and a large portion of its plant and animal species are endemic (i.e. they are found nowhere else). Within this context, the Wet Tropics Region has the second highest level of species diversity within Australia (after the very species-rich south-west province of W.A.). The Wet Tropics has a high degree of biodiversity at higher taxonomic levels and a great regional endemism and, per unit area, possibly one of the highest levels of biodiversity in the world.

For example:

Although representing just one-tenth of one percent of the land surface of the Australian continent, the Wet Tropics Region contains:

- over 4,600 vascular plant species;
- Australia's largest range of ferns and the world's largest concentration of ancient flowering plants;
- the highest number of endemic mammals of any region in Australia;
- almost half of Australia's bird species;
- nearly a quarter of Australia's reptile species;
- a quarter of Australia's frog species, more than 20 of which are endemic;
- a greater diversity of freshwater fish than any other region in Australia; and
- outstanding invertebrate diversity, including well over 60% of Australia's butterflies.

The Great Barrier Reef is the world's most extensive coral reef system and is one of the world's richest areas in terms of florae and faunal diversity. This diversity reflects the maturity of the ecosystem, which has evolved over hundreds of thousands of years. It contains:

- 2,195 vascular plant species from 552 continental islands;
- 15 species of seagrasses and over 500 species of algae;
- 37 species of mangroves that are 54% of world mangrove flora
- a huge diversity of invertebrate species, including 1500 sponges, 350 echinoderms and over 300 corals;
- more than 1,500 and possibly as many as 2,000 fish species, occurring in densities as high as 9,000 fish per hectare;
- about two-thirds of Australia's marine reptile species;
- over 1 million breeding pairs of seabirds; and
- over 30 species of marine mammals, including whales, dolphins and large numbers of dugongs.

4.2 Terrestrial Ecosystems (Vegetation Communities)

As reported in the Biodiversity Report, there is a broad spectrum of plant communities and habitats in the Wet Tropics. In the 1970s, researchers Geoff Tracey and Len Webb developed a system of classifying the region's rainforests. They identified 16 major structural types and 30 broad community types correlated with climatic zones and soil parent material. These rainforest types are fringed and dissected by a range of sclerophyll forest and woodland types, mangroves and swamp communities. More recently, botanists at the Queensland Herbarium used an amalgamation of regional ecosystems (see Box 13) to form Broad Vegetation Groups (BVGs). The following 11 BVGs occur in the Wet Tropics NRM region:

- Eucalypt woodlands on ranges;
- Eucalypt open forest;
- *E. tetrodonta* woodlands/open forest;
- Mixed eucalypt woodlands;
- Low open woodlands on ranges with shallow soils;
- Riparian eucalypt woodland;
- Native grasslands;
- Rainforests and vine thickets;
- Wetlands;
- Mangroves and strand communities; and
- Heath or mixed shrublands.

The vegetation of the Wet Tropics, based on the work outlined above, is shown on Map 5 of the Biodiversity Report.

As noted in the Biodiversity Report (pp 61–72), two terrestrial bioregions – the Wet Tropics and Einasleigh Uplands – converge in the Wet Tropics NRM region. Thirteen sub-regions wholly or partly occur and 136 regional ecosystems (see Box 13) were officially recognised from the Plan area in mid 2003. Recent work indicates that this tally is considerably higher (≈257).

It is important to keep in mind that REs are not just comprised of trees (although they tend to be named after the dominant canopy species). While trees, especially stands of big old ones, provide important habitat for wildlife, other broad habitat types contained within REs are:

- Understorey trees and shrubs;
- Logs, rocks and groundcover such as native grasses; and
- Creeks, rivers and wetlands.

Artificial structures such as dams, mineshafts and buildings may also provide habitat for some native animals (Lindenmayer *et al*. 2003).

4.2.1 Status and threats

Conserving habitat and conserving biodiversity are closely intertwined. Habitat loss is the main reason why plants and animals have declined or become extinct all over the world (Lindenmayer *et al*. 2003). The conservation status of REs has been assessed in terms of three classes, endangered, of concern and no concern at present (see below). These classifications are enshrined in legislation and used in

Box 13. Bioregional classification system

Terrestrial **bioregions** are based on broad landscape patterns that reflect major structural geologies, climate, floristic and faunal assemblages. They are mapped at a scale of approximately 1:1,000,000–1:2,500,000. Each of these is subdivided into **sub-regions** (also known as provinces) based on finer variations in the above attributes. A **regional ecosystem** (RE) is defined as a vegetation community consistently associated with a particular combination of geology, landform and soil within a bioregion. The scale of identification is generally 1:100,000–1:250,000. At this scale, small communities such as patches or linear strips may be included within a broader RE. The concept of REs now forms the scientific basis of Queensland's conservation planning, biodiversity and vegetation management (for further information, see Sattler & Williams 1999).

Table 4. Conservation status classification system

Summary of classes and criteria of conservation status of regional ecosystems in Queensland (adapted from Sattler 1999)	
Class	Description
Endangered	Less than 10% of pre-European extent remains in an intact condition across the bioregion, or its distribution has contracted to less than 10% of its former range.
Of Concern	10–30% pre-European extent remains in an intact condition in the bioregion.
Not of Concern	Over 30% of pre-European extent remains in an intact condition in the bioregion.

considerations of applications to clear vegetation on both freehold and leasehold land in Queensland. The conservation status of regional ecosystems is dynamic and subject to change depending on the rate of clearing or the review of mapping.

Of the 136 REs officially recognised from the Plan area in mid 2003, 57 (42%) had an endangered or of concern conservation status. Most of the 25 endangered REs occur on lowlands that have largely been developed for agriculture, and many have a naturally restricted distribution. The 32 'of concern' REs include once extensive types that have been developed for agriculture, some that are subject to continuing resource use (e.g. forestry and pastoral activities) and others that are changing their structure and floristic composition due to altered fire regimes. The Biodiversity Report (see pp. 73–76) lists and describes the endangered and of concern REs of the Plan area. While the Wet Tropics Region is well known for its rainforests, it is worth noting that the majority of endangered and of concern REs are eucalypt forests, woodlands and other vegetation complexes.

The main threats to REs are posed by: continued land clearing; fragmentation of remnants; alterations to drainage systems and water tables; inappropriate fire regimes; and pest, plant and animal invasions. The impacts of diseases/pathogens (e.g. rainforest dieback, frog chytrid fungus) and visitation/use in the WTWHA are just beginning to be assessed. In the drier, western part of the Plan area, the major threats are grazing pressure and weeds. It has been suggested that broadscale tree clearing and changed hydrology leading to salinity are also threats (see *Australian Terrestrial Biodiversity Assessment 2002*, the National Land & Water Resources Audit) but this is debatable, given the small amount of clearing that has taken place in this area. More information on these threats, taken from the condition reports (except where otherwise stated) is provided below.

Although climate change is recognised as a threat to biodiversity, it is not addressed in this chapter. Responses to that threat have been developed and are outlined in the chapter on climate.

Vegetation clearing

Vegetation clearing destroys biodiversity. The clearance of native forests results in the loss and depletion of plant species and destroys the habitat for thousands of other species. It can fundamentally change the functioning of ecosystems, including altering regional climate, and severing connectivity of wildlife habitats across the landscape. According to the *Australian Terrestrial Biodiversity Assessment 2002*, vegetation clearing is the most significant threat to species and ecosystems in eastern Australia.

Wooded vegetation covers a little over 81% of the Wet Tropics NRM region. All catchments retain over 50% cover, with most retaining over 70% and the Daintree over 95% (see Biodiversity Report, Table 49). This compares favorably with other regions around the State and country. For example, less than 13% of the pre-1750 native vegetation cover has been retained across the North Central Region in Victoria (NCCMA 2003). Clearing has been most severe in the Wet Tropics in the coastal lowlands, along major river valleys and on the basalt soils of the Atherton-Evelyn Tablelands.

The rate of clearing has slowed considerably in the past decade. In the early 90s, more than 3,000 ha were being cleared each year in the Wet Tropics. The figure is now closer to 600 ha per year. Of the 1,837 ha cleared over the period 1999–2001, 905 ha (49%) were cleared in the Herbert catchment, mainly for pasture (grazing). In the remaining catchments, clearing occurs in small patches for agriculture and residential development or in strips for linear service-corridors. Forests in these areas are also sourced for a variety of commercial products, ranging from soil and gravel, seed and foliage, through to sawlogs and other timber products (see section on Production Forests). In a region like the Wet Tropics, where species are patchily distributed and many have specialised needs, these cumulative effects can have the same effect as broad-scale land clearance in the long term.

Terrestrial habitat fragmentation

The destruction and modification of native vegetation has left a legacy of patches of native vegetation of various sizes, shapes, connectivity and condition. Fragmentation of native forest creates new edges between the remaining forest and the cleared or disturbed land which leads to a range of 'edge effects'. These include physical changes to the forest in the border region such as different levels of exposure to the sun and wind and changes in water cycles and in the local air temperature. Ecological changes include invasion by opportunistic species with good dispersal or colonising abilities such as weeds and feral animals. In extreme cases, small patches can become all edge habitat, forcing out 'interior' species and favoring opportunistic species (see diagram, below). This is why larger areas of remnant vegetation, especially those that exceed several hectares, are often the most valuable ones for the maintenance of biodiversity.

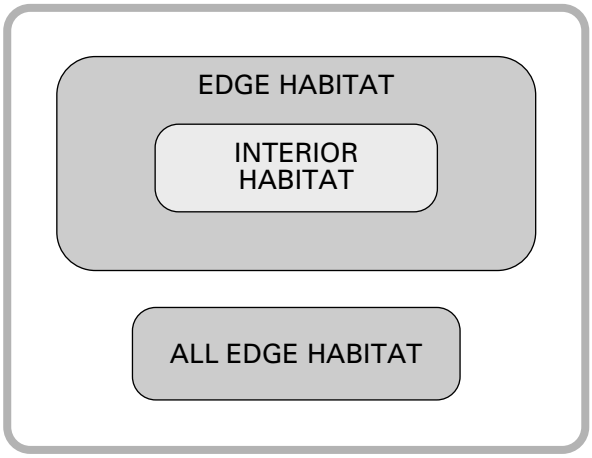


Figure 3. Small patches of remnant vegetation can become all edge habitat.

Fragmentation also isolates and creates barriers between patches of forest. Roads, powerlines and land cleared for agriculture can create artificial barriers preventing or restricting the movement of species between habitat fragments. An artificial barrier suddenly alters historic natural patterns of gene flow among populations that may have serious consequences for the long-term preservation of evolutionary diversity. In other words, large populations are divided into small sub-populations (or 'meta-populations') that are more prone to local extinction (see Box 14, Cairns Cassowaries). Research in the region has shown that once a fragment drops below 75ha in size, species start to disappear. Rainforest-dependent fauna, especially tree-dwelling species (particularly endemic possums and tree-kangaroos), appear to be the most seriously affected.

Fragmentation of the landscape has had significant impacts on Aboriginal cultural landscape values. For example, places of cultural significance in the landscape are connected to other places through meaningful associations such as a creation story, or a traditional pathway or route, which connects places.

Box 14. Cairns Cassowaries

Cassowaries are thought to be extinct in many areas where they once occurred in the Wet Tropics. For example, Mt Whitfield Conservation Park in Cairns once had a sizeable population and signs still advise visitors to beware of cassowaries. However, dogs killed the last bird in late 1996. Of course, the decline of cassowaries in Cairns began much earlier when urban development effectively isolated Mt Whitfield from the main range. This reduced the carrying capacity of the land for cassowaries and increased their vulnerability to other random events and threatening processes like dog attack. It is a good example of how habitat fragmentation can lead to the local extinction of significant species.

Photo: WTMA

Landscape fragmentation processes can break these connections and isolate culturally significant places from each other.

Alterations to drainage systems and watertables

Permanent alteration to the watertable and natural drainage systems, resulting from irrigation and land clearing, is threatening remaining habitats of the poorly drained coastal plain, particularly ecosystems dominated by sclerophyll species (Goosem *et al.* 1999). For more information, see sections on waterways and wetlands and water quantity following.

Inappropriate fire regimes

The ecological effects of a given fire regime vary depending on intensity, frequency, the season of the burn and the nature of the forest. Open forest plants and animals have evolved with a pre-European fire regime and alterations to this regime, such as exclusion of fire, are having a range of ecological impacts. This includes woody vegetation thickening, which occurs when there is a gradual change in the competitive balance between grasses and shrubs, favouring the latter and leading to thickening woody

species coverage. Apparent severe disruption of historical fire patterns has also resulted in ecologically significant changes to the rainforest/open forest boundary in the last 50 years, with large areas of wet sclerophyll forest types being progressively converted to simple rainforest (see Biodiversity Report, p109).

Pest plants and animals

Exotic and displaced species are major threats to biodiversity in the Wet Tropics. These ecologically invasive species can be defined as non-native plants, animals and diseases, and any native species whose range and/or abundance have changed because of human activities. These invasive species become established in natural ecosystems, disrupt natural ecological processes and threaten native biodiversity.

A regional pest management planning process recently completed by the Far North Regional Organisation of Councils (FNQROC) identified 84 weed species (see Biodiversity Report, p104) a substantial subset of which is relevant to the Wet Tropics NRM Region. The most immediate threats are from environmental weeds that have the capacity to invade and destroy whole ecosystems. These weeds include pond apple, *Annona glabra*, the ponded pasture grass *Hymenachne amplexicaulis* (both Weeds of National Significance or WONS) and harungana, *Harungana madagascariensis*, as well as the introduced forage legume *Leucaena leucocephala*.

The *FNQROC Regional Pest Management Plan* also identified several pest animal species requiring high to medium control attention. Those animals requiring high control attention were exotic species that are widespread and regionally significant (i.e. feral pigs, wild dogs/dingoes and cats). Feral pigs and cats are listed as threatening processes under the EPBC Act. Medium priority pest animals were those that are less controllable (e.g. cane toad, common myna), less widespread or which incur only on some parts of the planning area (e.g. rabbits in the south-west of the area, another threatening process under the EPBC Act).

It should also be noted that the *Wet Tropics Conservation Strategy* lists and prioritises emerging, established and potential invasive environmental weeds (Table 6, Wet Tropics Conservation Strategy) and feral animals (Table 7, Wet Tropics Conservation Strategy) which may threaten world heritage values.

Medium priority pest the common myna (Photo: Andrew Tatnell)

It is important to note that there can be conflicting values for pest plants and animals between Aboriginal and non-Aboriginal people. An example of this is feral pigs. For some Traditional Owners they are seen as a valuable resource, because they are hunted for food. These different values need to be considered in any feral pig management program in the region, especially where management techniques such as the use of poisonous baits can be detrimental to the health of Aboriginal people who utilise pigs for food. This is discussed further in the Caring for Country chapter.

Box 15. Leucaena – Fodder or foe?

Leucaena (*Leucaena leucocephala*) originates from Central America and the Yucatan Peninsula of Mexico. It was introduced to Australia in the late 1800's. Leucaena forage is extremely palatable, with a nutritive value similar to that of lucerne. Growth rates of cattle grazing leucaena are greater than those from other tropical forages. Once established, it provides the basis for a low maintenance system of producing high quality beef.

However, the Global Invasive Species Database lists *Leucaena leucocephala* as one of the 34 land plants among 'One Hundred of the World's Worst Invasive Exotic Species'. In Queensland, weedy infestations are encountered across the State, particularly along streams and about wetlands, but it has potential to be a serious environmental weed. It ranked second highest in an assessment of weeds of most concern for management of the Wet Tropics World Heritage Area (Werren 2001).

There are two main subspecies of *Leucaena leucocephala* in the Wet Tropics Region, namely *L.l. leucocephala* and *L.l. glabrata*. While most weed infestations are from long-term stands of ssp. *leucocephala*, the cultivated varieties (ssp. *glabrata*) of leucaena also may have potential to become weeds.

Leucaena leucocephala *foliage and pods*

Grazing leucaena in Queensland

(Photos: Max Shelton)

The draft Queensland Government policy recognises that Leucaena is valuable forage for parts of Queensland when managed properly, but it constitutes a threat to the natural environment if not contained in those areas in which it has been planted, or controlled in those areas that it has already invaded. Leucaena should only be planted in situations where containment is feasible and where no equally productive, less risky alternative species may be employed.

The Leucaena Network has developed a detailed Code of Conduct for beef producers to 'minimise the risk of commercial leucaena' adding to existing weed problems.

(Based on Sustainable Use Report, p57)

Rainforest dieback

Phytophthora cinnamomi is a fungus-like root rotting pathogen that is readily spread in soil or by surface or sub-surface water movement. It was first conclusively associated with dieback in jarrah (*Eucalyptus marginata*) in Western Australia in the mid 60s and since then its association with dieback has been widely reported in southern and eastern Australia (Worboys & Gadek 2004). Its effects on the region's rainforests presently vary from no visible impact to slight loss of canopy leaves in susceptible species to the death of all plants in virulent outbreaks. Dieback is listed as a threatening process under the EPBC Act.

Tourist and visitor impacts

Nature-based activities underpin a $2 billion tourism industry in the Wet Tropics. Based on 1996 figures, tourism in the WTWHA (over 90% of which falls within the Plan area) is estimated to generate over $750 million per year (Driml 1997). While tourism and recreation provide significant socioeconomic benefits, they are also placing an increasing pressure on the region's natural environment and associated Aboriginal cultural values. The major concern is the high concentration of tourism activities in specific parts of the region. These areas are primarily located along the coast between Cairns and Cape Tribulation.

Grazing pressure

As mentioned above, grazing is a major land use in the Wet Tropics Region and current clearing for pasture far exceeds that for any other land use in the region. Most grazing land (>90%) is native pasture (grasses and forbs) that occurs in both grassland and woodland settings. Even in areas where apparently intact habitat remains, processes that can lead to ecological degradation may threaten biodiversity. For more information, see section on native pastures in the Extensive Rangelands section 6.3, p81.

4.2.2 Management response

Traditionally, the establishment of protected areas has been regarded as one of the most effective mechanisms for protecting vegetation while permitting the sustainable use of natural resources elsewhere. At first glance, it would appear that the Wet Tropics, with two World Heritage Areas located side by side, is well served for protected areas. National parks and other conserved areas account for just under half of the total land area of the region. However, the Biodiversity Report (p126) found that management of these areas is ranked as 'fair' at best. The lack of representativeness of regional ecosystems in the protected area estate is also of concern.

The Queensland Environment Protection Agency and the Wet Tropics Management Authority, based in Cairns, share management of the protected area estate in the region. Just over 90% of the Wet Tropics World Heritage Area is contained within the plan area. Day-to-day management issues such as maintenance, routine permits, enforcement activities, management and planning issues such as for fire, weeds and feral animals are the responsibility of the Queensland Parks and Wildlife Service. Research on threatening processes, like dieback, is largely undertaken by James Cook University, the CSIRO Tropical Forest Research Institute in Atherton and the Rainforest CRC. CRC Weeds provides significant resources for private landholders, community conservation groups and catchment management groups in preparing management guides and manuals (see http://www.weeds.crc.org.au/publications). NR&M administer the *Land Protection (Pest and Stock Route Management) Act 2002* which provides the legislative measures to manage pests and address their environmental impacts.

It is important to note that some management responses, such as the designation of protected areas can be viewed as a threat by other groups such as Traditional Owners whose rights and obligations for country have been restricted by the designation of protected areas. The Wet Tropics World Heritage Area Regional Agreement between WTMA, EPA, NR&M, the Department of the Environment and Heritage and Aboriginal Rainforest Council is a positive step towards recognising these crucial issues.

Protected area status of Regional Ecosystems

As reported in the Biodiversity Report (p126), 87 of the 136 REs that are recognised within the NRM region (current to mid 2003) are represented in protected areas. This represents 64% of the total ecosystem diversity in the NRM region. By comparison, 67% of Australia's ecosystem diversity is captured by national parks and formal reserves, with a further 5% included in other protected areas and covenants on private land.

The goals of the National Reserve System (NRS) Program are the establishment and management of a comprehensive, adequate and representative system of protected areas. Under the NRS Program, a number of projects are funded through the NHT with the aim of extending the national reserve system and developing best practice management. According to the *Australian Terrestrial Biodiversity Assessment 2002*, the Wet Tropics:

> *'... contains extensive national parks and the World Heritage Area occurring over the upland sub-regions. However, the limited reservation, number of threatened species and ecosystems and degree of threatening processes throughout the lowlands identify these sub-regions as high priority for expanded reservation compared with low priority for a number of the upland sub-regions. Additional reservation of lowland alluvial ecosystems also will contribute significantly to the protection of wetlands and fisheries.' (NLWRA 2002, p.123)*

The main reservation priorities are lowland vine forest and sedgeland communities. In the drier, western parts of the Plan area the priorities consist of areas of serpentine, dry rainforest and fringing lake

communities. The Regional Ecosystem priorities to consolidate the national reserve system are listed in the Biodiversity Report (Table 59).

It should be noted that opportunities for acquisition of large tracts of land for conservation are diminishing, due in part to the small size of the many remnants (e.g. those on the Atherton Tablelands), urban development and acquisition costs. These costs are very high in the more fertile parts of the Plan area. An example is the scale of investment required to protect remaining habitat of the endangered mahogany glider (*Petaurus gracilis*) and other threatened lowland species and ecosystems at risk from sugarcane and other agricultural expansion.

Off-reserve conservation

It is becoming apparent that protected areas, constrained in size by human population pressures and political realities, will be inadequate to protect biodiversity in the long term (Hale & Lamb 1997). As noted in the Biodiversity Report, most of the Wet Tropics Region is still managed for production-oriented outcomes. About a quarter of the region is managed by private landholders under freehold tenure. Much of this land retains considerable biodiversity, e.g. while about 264,000 ha have already been cleared, 95,000 ha are still covered by rainforest vegetation (Annandale 2002). The amount of land managed for conservation purposes or used in an ecologically sustainable manner is not known. Hence, increased attention is being given to the protection and restoration of vegetation in production and urban landscapes.

Off-reserve conservation involves a range of strategies to involve landholders in the management of biodiversity on their land. Perhaps the most significant initiative has been the introduction of the *Vegetation Management Act 1999* by the Queensland Government (see Box 16). Non-regulatory approaches include financial incentives such as grants, rate deferrals and rebates, management agreements, covenants, revolving funds and development benefits. The adoption of industry codes of practice provides opportunities for biodiversity conservation, while community groups and networks have played a vital role in monitoring, organizing and linking individuals in community conservation activities. (The map overpage shows the distribution of community projects involving vegetation work undertaken between 1989–2001 under both the Wet Tropics Tree Planting Scheme and NHT programs. The map is based on data collected through the Regional Directory project – Catterall & Harrison, *in prep*.).

What is still lacking is a uniform, coordinated approach to conservation planning throughout the whole region. The FNQ Regional Plan does not include the shire of Hinchinbrook which is within the Wet Tropics NRM Planning boundary. Additionally since the introduction of the FNQ Regional Plan, newer statutory instruments have been introduced that aren't reflected. Hopefully this Plan will go part of the way towards rectifying this.

Subsequent iterations of this Plan will be informed by a CSIRO study that is using a land-use change modelling approach to identify conservation priority areas in the region. Supported by FNQ NRM Ltd, this study will identify significant areas outside the 'protected area network' that require habitat or species-specific protection. Strategies to enhance biodiversity conservation outside protected areas will be developed as a result.

Box 16. Vegetation Management Act 1999

The *Vegetation Management Act 1999* (Qld) (VMA) provides a framework for vegetation management principally by making clearing assessable under the *Integrated Planning Act 1997* (Qld). The VMA originally limited protection to remnant **endangered** REs on freehold land. However the Queensland Government put a hold on clearing applications and the VMA was rewritten in early 2004 to make it illegal to conduct broadscale clearing of mature bushland on all types of land after 2006. A $150 million financial assistance package was subsequently announced to help landholders to adapt and adjust to the new laws.

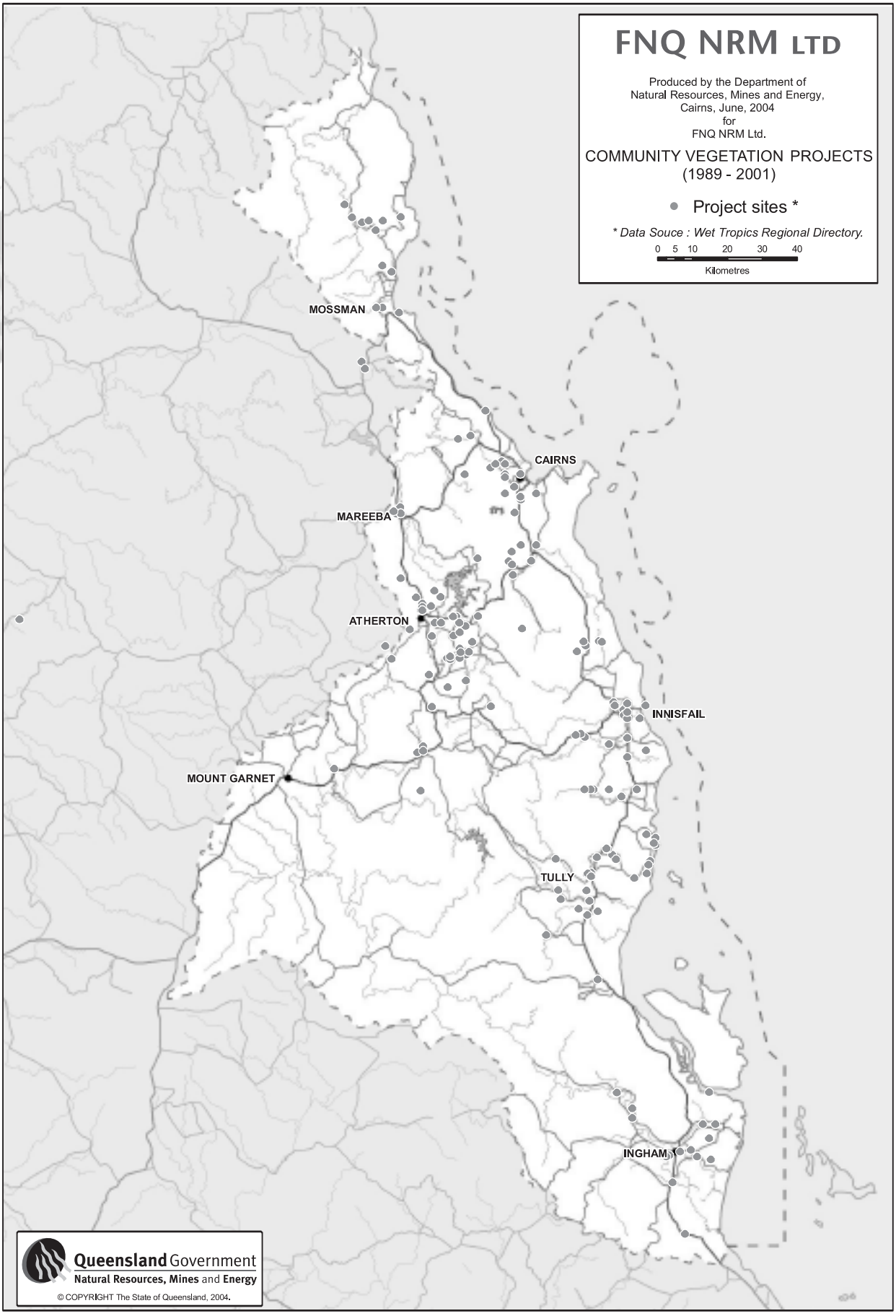
Box 17. Managing Tourism in the Rainforest

Providing visitor access to enjoy and appreciate the Wet Tropics World Heritage Area is important for the presentation of the area and its values, and for the area to have a role in the life of the community. However, such demands for access and visitor infrastructure can have impacts on ecological integrity. In order to properly provide for presentation of the area and manage visitor pressures, the Wet Tropics Management Authority developed the Nature Based Tourism Strategy 2000 and the Wet Tropics Walking Strategy 2001. The Authority also commissioned the Rainforest CRC to assist in the development of a visitor monitoring system for the area.

In a practical sense, land use activities within the World Heritage Area, including tourism, are regulated under the *Wet Tropics Management Plan 1998*. Some 1,000 permits were issues under the plan by the Queensland Parks and Wildlife Service as an approved permit entity during 2002–03. Most permits issued relate to the use of motor vehicles on 'presentation restricted roads'.

(Source: Wet Tropics Management Authority Annual Report 2002–2003)

Photo: Geoff McDonald


FNQ NRM LTD
Produced by the Department of
Natural Resources, Mines and Energy,
Cairns, June, 2004
for
FNQ NRM Ltd.
COMMUNITY VEGETATION PROJECTS
(1989 - 2001)
Project sites *
* Data Souce : Wet Tropics Regional Directory.
0 5 10 20 30 40
Kilometres
MOSSMAN
CAIRNS
MAREEBA
ATHERTON
INNISFAIL
MOUNT GARNET
TULLY
INGHAM
Queensland Government
Natural Resources, Mines and Energy
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Box 18. A vision of renewal

Botanical illustrator Peter Newling fell in love with the forests of the Wet Tropics while on holiday in 1989. Like so may others who visit the region he was drawn back to Mission Beach. Armed only with the 1982 edition of CSIRO's A Revised Card Key to the Rainforest Trees of North Queensland *Peter became engrossed in the study and interpretation of these forests. He writes:*

This was diving in at the deep end. With so few resources it was difficult to identify most species by name yet it was possible to appreciate the overall connections within this ecosystem. I could see first hand on that holiday in 1989 the diversity and vitality these forests contained. Holding a seedling in your hand you realise it has the potential to live up to half a millennium and become a critical factor in maintaining the balance of survival for a plethora of interdependent species heading together toward an uncertain future.

A striking feature of these forests is the abundance, colour and variety of fruit found on the forest floor. The vanguard of seedlings, their new growth of regal reds and purples are worn like the standards of an approaching army. It is hard to convey, to those who have not witnessed this unfolding, the intrinsic beauty and delicacy they possess.

My affection for these seedlings reached such a point that I began the process of collecting, identifying and growing them for a local environment group working to reclaim vital cassowary habitat. For several years, I worked steadily on a variety of projects, all the time falling deeper in love with the eclectic nature of these fruits and seeds. I patiently watched their fragile transformation into the next generation before returning the seeds to recolonise and redeem lost habitat.

During a trip to Cairns I made an important connection with the North Queensland Afforestation Association that led to the publication of the *Atlas of Tropical Seedlings, Lauraceae Vol. 1*. Seedlings illustrated were sourced from revegetation stocks used by the Wet Tropics Tree Planting Scheme. The Atlas acknowledges their efforts and dedication to restore the environment. Although basic, it has revealed a niche demand for information on seedling identification and subsequent publications. In conjunction with other community and environmental groups, we are upgrading and expanding the range of this work. The expanding body of artwork could form the basis of a nationwide travelling exhibition of both the unique values of the wet tropics vegetation and of traditional botanical illustration.

It is important to support research and environmental work that initially appears to have limited commercial value, because the flow-on effect provides employment and commercial growth, indirectly benefiting the whole community.

(Illustration: Peter Newling)

4.3 Inland Aquatic Ecosystems (Rivers and Wetlands)

The Wet Tropics Region drains to the Great Barrier Reef lagoon from six major coastal catchments, as well as Trinity Inlet. The six major catchments (progressing south) are the Daintree/Mossman (including the Bloomfield), Barron, Russell/Mulgrave, Johnstone, Tully/Murray and Herbert River catchments. Within these catchments there are many thousands of waterways. The Mulgrave River alone contains 1816 first order and 925 second order streams (Pusey *et al*. 1999).

The unique climatic and geomorphological conditions of the region mean that most waterways are fast flowing and have high discharge rates. Streamflow velocity can also be high, especially in southern catchments of the region. Although rainfall is highly seasonal, streamflow in the coastal catchments is more reliable than most other parts of Queensland and is predominantly perennial. More information on surface water and groundwater resources is provided in the chapter on Water Resources.

Wetland habitats are widespread throughout the Wet Tropics. Although they are commonly thought of as occurring only where land and sea join, natural wetlands are located in a range of landscapes, and include lakes, marshes, rivers and springs. Artificial wetlands have also been constructed throughout the region.

Waterways and wetlands are an essential part of natural hydrological cycles, providing water passage and storage and contributing to flood mitigation and the recharge of aquifers. Amongst those ecosystems described in the previous section, there are a number that depend on sustained stream flows and water supplies for wetlands. They also make a significant contribution to the region's economy by providing essential water sources for agricultural, urban and industrial uses. For more information, see chapter on Water Resources. This section deals primarily with the habitat values of these inland aquatic ecosystems and the species they support.

Habitat simply means the environment where a plant or animal lives and reproduces. In the case of freshwater ecosystems, habitat features include pools, riffles, snags and driftpiles. Riparian zones (are important elements of both freshwater and terrestrial ecosystems (see Box 19).

The freshwater ecosystems of the Wet Tropics support tremendous biodiversity. In particular, the region has an extremely high proportion of Australia's freshwater fish species. More than 80 species are recognised for the region, including approximately 70% of the fish genera, and 42% of the fish species, in Australia. The Russell/Mulgrave and Johnstone river catchments form the core of freshwater fish and aquatic plant biodiversity and endemism in the region. As well as freshwater fish, the Wet Tropics has Australia's highest aquatic invertebrate biodiversity and one of the highest recorded anywhere in the world (Burrows 2004, p11). Aquatic habitats are also important for many terrestrial species that spend some part of their lives in freshwater, e.g. stream-dwelling rainforest frogs.

Aboriginal values

Wetlands provide important food resources for Traditional Owners such as magpie geese. Many streams, creeks and rivers are important parts of creation stories and there are many important places, such as traditional camping and living areas along rivers in the region. For each Traditional Owner group, knowledge of the locality and seasonality of rivers, creeks and lagoons has always been important to know where to hunt and what food plants are available.

Box 19. Riparian zones

Riparian zones are the transitional areas between terrestrial and inland aquatic ecosystems. Riparian ecosystems (i.e. vegetation growing on the banks of streams or rivers) are important energy and nutrient sources for stream ecosystems. They provide food, habitat and shade for both terrestrial and aquatic organisms. They are important for streambank stability, guarding against excessive erosion and protecting water bodies from pollutants travelling overland in runoff. Riparian ecosystems provide refuge for plants and animals in times of environmental stress. They serve as important wildlife corridors for terrestrial species.

(Photo: Geoff McDonald)

4.3.1 Status and threats

An assessment of riparian zones, including condition trend and the processes threatening them, was undertaken as part of the *Australian Terrestrial Biodiversity Assessment 2002*. This assessment revealed that many coastal lowland floodplain areas in eastern Australia, including the Wet Tropics, are degraded. Similarly, the riparian zones in many sub-regions dominated by pastoralism were found to be in only fair condition or are degraded. Information on the average condition and trend for riparian zones in the region is given in the Biodiversity Report (Table 30). It shows that riparian zones were ranked as 'fair' at best, with the exception of the Daintree-Bloomfield and Kidston sub-regions, which were 'good'. A declining trend was found for all sub-regions. (see Map 1, Biodiversity Report for sub-regions).

In a report on key waterways in the FNQ Regional Plan region the Daintree and Mossman catchments were found to have generally better habitat conditions than most of the other areas surveyed (Burrows 1998). The habitats of the Daintree and Mission Beach area, including the Hull River and Maria Creek catchments, were found to be some of the most biodiverse in Australia. In an assessment of the conservation values of all waterways within or flowing through the WTWHA, substantial across-drainage variation was reported (Pusey *et al* 1999). Some drainages such as the Barron ranked highly for some attributes (i.e. frogs) but not others (i.e. fish) but overall there was a clear trend for the Johnstone, Russell and Mulgrave drainages to rank highly for all attributes.

The region contains 32 'wetlands of national significance', about one-fifth of Queensland's total. Including coastal and marine wetlands, mapped in Appendix N. A further 15 wetlands of regional significance were identified by the *Australian Terrestrial Biodiversity Assessment 2002* (see Biodiversity Report, p.79).

The Biodiversity Report (pp. 78–79) includes some information on the condition and trend of the region's 'wetlands of national significance'. The wetlands that have been assessed are generally in good condition and the trend is static. This probably has more to do with chance than good planning because in the past

Table 5. Number of 'Nationally Important Wetlands' by catchment

Catchment	*Wetlands*
Barron	1
Herbert	9
Johnstone	7
Mossman-Daintree	3
Mulgrave-Russell	8
Tully-Murray	5

Box 20. Wetland Projects in the lower floodplain of the Herbert River

By Caroline Coppo, coordinator Herbert River Catchment Group

Landholders in the lower Herbert River catchment are increasingly realising the importance of retaining wetlands as water retention areas on their properties for irrigation, wildlife habitat, improved downstream water quality and better use of otherwise unviable agricultural land. This is evidenced by the increasing number of landholder wetland projects being undertaken. Ten landholder projects have received funding, with the assistance of the Herbert River Catchment Group Inc., during the last two years. Many other landholders are undertaking wetland projects independently. Most projects initially require removal of built up sediment and invasive weeds and are designed so that access for future weed control and removal of build up sediment is possible. Local provenance seedlings (trees, shrubs and grasses) are then planted about the wetland to provide habitat and shade for the water and many wetland projects are also linked to riparian vegetation in adjacent waterways.

The Jabiru Wetland Project is a large landholder project that received funding from Envirofund in 2003 and required a considerable in-kind contribution from the landholder. It links a large, deep natural lagoon, a series of smaller wetlands and an artificial wetland with a vegetated corridor to the adjacent Cattle Creek. The project is nearly one kilometre long and took several months to complete. On-going maintenance of the revegetation is necessary but many trees are already over two metres high even though, at the time of writing, they are less than ten months old.

Most wetlands in the Herbert River floodplain, like Jabiru Wetlands, are degraded due to invasive weeds such as hymenachne, para grass and water hyacinth. Many lagoons which used to be clear are now covered by a thick mat of weeds which, even when sprayed, remain only to be thickened by regrowth. Physical removal of these weed mats, from the bank of the lagoon is the best solution at the moment. In other wetlands sedimentation has occurred and mechanical removal of this build up prevents eventual filling-in of the wetland.

The Herbert River Catchment Group Inc. is completing another Envirofund project to groundtruth EPA/GBRMPA wetland data for the catchment. This project will identify and verify with the community the location and extent of Herbert River wetlands which will facilitate strategic management of them in the future.

Jabiru Wetlands in 2003

Jabiru Wetlands in 2004

(Photos: Caroline Coppo)

these wetlands were considered as non-productive elements of landscapes and have consequently suffered substantial impacts due to drainage, filling and reduced water replenishment since European settlement. Wetlands in sub coastal and lowland floodplains, in particular, have declined in recent years to the detriment of their vital function in ecosystem processes for water filtration and supporting important ecological processes. Most have been largely non-tidal, freshwater wetlands. For instance, clearing from Cairns to Ingham has resulted in the loss of 60–70% of paperbark (*Melaleuca* spp.) swamps.

Vegetation clearing for agricultural and urban purposes, grazing, pest plants and animals, water pollutants and nutrients, and changes to hydrological processes impose the main threats to freshwater ecosystems. Vegetation clearing has been discussed in the section above. Suffice to say, riparian ecosystems of the coastal floodplains and elevated tablelands in the Wet Tropics Region have been heavily cleared for flood mitigation, intensive cropping (notably sugarcane and bananas), grazing and irrigation. Water pollutants and nutrients are discussed in the section on water quality. More information on changes to hydrological processes and pest plants and animals is given below.

Waterway and wetland modification

Inland aquatic ecosystems are dynamic and are affected by processes of erosion and sedimentation under natural and flood conditions. Waterway and wetland modification has occurred in all Wet Tropics catchments. These works usually involve rearranging the river bed or bank material. In the most extreme cases, streams have been diverted and channelised and wetlands have been drained and reclaimed for agricultural and urban development.

Short of complete destruction, waterway and wetland modification can affect aquatic biodiversity in a number of ways. When a river is completely 'channelised' for example, it removes all instream habitat. Dams, weirs and culverts are major landscape modifiers resulting in the direct loss of both terrestrial and aquatic habitats through drowning, the introduction of water barriers to

terrestrial fauna movement and acting as barriers to the upstream or downstream movement of fishes and aquatic invertebrates. Such barriers may also interfere with successful reproduction or recruitment of juveniles into habitat utilised by adults.

Less obvious effects of waterway and wetland modification are changes to energy and environmental flow regimes. As reported in the Biodiversity Report (p100), environmental flow regimes are the amount of water combined with the natural patterns and pulsing of that water that is needed in streams to meet the requirements of aquatic flora and fauna. Insufficient water, or water at the wrong time, can result in a loss of habitat, breeding failure and even death for some species.

Pest plants and animals

Degraded riparian zones have led to extensive weed invasions, among other things. In the Herbert catchment, for example, the introduced para grass (*Brachiaria mutica*) has spread from riparian zones to streams and has caused significant choking of watercourses. In a study on its effects on the hydraulic conductivity of tropical streams in Douglas Shire, Bunn *et al*. (1998) demonstrated that infestations have induced a massive reduction in stream hydraulic conductivity (of the order of 85%) at bankfull discharge, a reduction in channel capacity from 2.3 to 0.3 times the predicted 50-year flood discharge and the trapping of sediment in the vicinity of 20,000 tonnes/km^2. It is also important to recognise that para grass contributes virtually nothing to native aquatic food webs (Bunn *et al*. 1998). Although not strictly an aquatic weed, para grass has degraded natural stream processes and excluded native aquatic species.

The more recent introduction of a second, even more robust ponded pasture species, hymenachne, threatens to exacerbate such problems. Now classified as a WONS, this species has the potential to invade a suite of threatened regional ecosystems including riparian forest, freshwater sedgeland and swamps.

Throughout the region, waterways and wetlands receiving large amounts of nutrient rich water from farmlands or urban stormwater drains are often invaded by aquatic weeds. The Biodiversity Report (p103) lists seven aquatic weed species that pose an immediate serious environmental risk to the Wet Tropics. Floating aquatics such as water hyacinth (*Eichhornia crassipes*), water lettuce (*Pistia stratiotes*) and salvinia (*Salvinia molesta*) constitute less of a problem in the Wet Tropics Region than elsewhere due to usually reliable flushing flows, however, these do present problems in the floodplain lagoons of the Herbert River and in impoundments such as Lake Tinaroo. A submersed exotic aquatic, *Cabomba caroliniana*, presents localised problems within the Wet Tropics (e.g. along some tributaries of the Barron River and in places such as Canal Creek in the Russell catchment). The recent discovery of *Limnocharis flava* has caused considerable concern and an attempt is being made to eradicate it from the region.

The Biodiversity Report (p106) also identified six exotic fish species as 'sleeper' pest species, i.e. their level of impact is currently rated as moderate but they have substantial future potential. In fact, these fish may constitute the principal unrealised biological threat to the Wet Tropics and neighboring regions. Once established these species can dominate aquatic communities, modify habitat to their advantage and are extremely difficult to control. This is because of the intensity of control required and its highly negative impacts on non-target species.

Another threatening process is the translocation of native fishes and freshwater crocodiles. As reported by Burrows (2004), translocations have been occurring in the Wet Tropics for around 100 years, mostly done by private individuals and involving low numbers of fish. However, over 2 million fishes have now been stocked into regional waters. These tend to be large predatory fighting fish preferred by anglers. At last count, 36 native fish species (plus red-claw crayfish, *Cherax quadricarinatus*) appear to have been translocated (Burrows 2004). It is inconceivable that the introduction of so many predatory fish does not impact upon the natural values of the waterways into which they are released (see Box 21 Lake Eacham rainbowfish)

Box 21. Lake Eacham rainbowfish

One of the most widely publicised examples of the impact of translocated fish is the loss of Lake Eacham rainbowfish (*Melanotaenia eachamensis*) from its type locality (Lake Eacham). This species was only formally recognised in 1982 (Allen and Cross 1982) and until the late 1980's, Lake Eacham was its only known habitat. Barlow *et. al.* (1987) reported the loss in the wild of this fish species due to translocated native fish predators unofficially released into Lake Eacham during the 1980s.

The Lake Eacham rainbowfish was regarded as the first freshwater fish in Australia to have become extinct in the wild (some remained in captivity) since European occupation. Fortunately, since that time, it has been found in a number of new localities within the Wet Tropics, however it remains absent from Lake Eacham despite several reintroduction attempts. At present there are no feasible means of eradicating the translocated predatory fish from the lake without causing further major disruption to the ecology of the lake.

(Source: WTMA website)

4.3.2 Management response

All sectors of the community are engaged in a high and increasing level of activity in waterway and wetland management in the region. Private landowners, community groups and governments have undertaken projects to rehabilitate riparian vegetation, prevent or control stream bank erosion, fence streams to exclude stock and construct artificial wetlands. These projects have largely been supported through NHT funding and encompass the Landcare, Rivercare and Bushcare programs. The Queensland Government is developing riverine management plans to deal with instream activities that have impacts on river health, such as instream quarry material extraction. Local government is managing waterways and wetlands through planning schemes and vegetation management programs.

River Improvement Trusts (RIT) and catchment management organisations, in particular, have identified riverine degradation as a key issue requiring urgent attention. In the past, RITs conducted work programs to stabilise river channels, using mainly engineering solutions for the purpose of mitigating flood damage to land and property. In recent years, RITs have taken a more holistic approach to river management, taking a wider set of objectives into their plans and using a wider range of methods to achieve outcomes, including greater attention to protection and vegetative restoration. Catchment management groups have prepared management plans for most catchments in the region and have also been involved in the preparation of rehabilitation plans for some areas (see Box 22).

Box 22. River planning in the Wet Tropics

Catchment Management Plans (catchment/shire scale, prepared and administered by ICM groups/LGAs) are currently in place for the following catchments:

- Daintree/Mossman (Douglas Shire River Improvement Trust)
- Barron (Barron River Integrated Catchment Management Association)
- Trinity Inlet Waterways (Department of State Development)
- Russell/Mulgrave (Russell/Mulgrave Catchment Coordinating Committee)
- Johnstone (Johnstone River Catchment Management Assoc)
- Tully/Murray (Cardwell Shire Catchment Management Assoc)
- Herbert (Herbert River Catchment Group)

*River Improvement Trust Management and Action Plans (*generally reach scale for selected rivers within LGAs, administered by RITs). Following applies:

- Douglas Shire: Areas addressed by river management projects are in line with catchment plan and include: Saltwater Creek, Whyanbeel creek, Cassowary Creek RMP, Mossman River (Crees projects). Douglas Shire Water Quality Improvement Plan (Box 47 page 96).
- Cairns City: Barron RMAP (covers all of Barron River but Cairns RIT can only act on lower floodplain), Mulgrave RMAP and Reach 4 Russell River RMAP.
- Johnstone Shire: South Johnstone RMP in place with concomitant actions developed, Liverpool Creek RMP in place with concomitant actions developed, North Johnstone RMP to be finalized, Maria Creek RMP yet to be started.
- Cardwell Shire: Tully River MAP in place with concomitant actions developed, Jarra Creek MAP in place with concomitant actions developed, Meunga Creek MAP currently under development, Banyan, Echo and Davidson Creeks would benefit from MAP, Deep Creek an ongoing problem.
- Hinchinbrook Shire: A fairly extensive river management strategy produced in around 1994 forms basis for decision making on river works. Covers mainly Herbert River and main tributaries within Hinchinbrook Shire.

Catchment Rehabilitation Plans (reach scale, prepared and formerly administered by Joint Board/NQAA). Currently in place for following rivers:

- Barron
- Johnstone (revegetation, by Robin Bell)
- Russell-Mulgrave
- Tully-Murray (fine scale)

Near complete for:

- Herbert River
- Upper Mitchell Catchment (Wet Tropics/Northern Gulf)

Plans commissioned but not completed for:

- Douglas Shire
- Endeavour-Annan Rivers (Cape York)

A Revegetation Plan, compiled by Robin Bell exists for the Johnstone system.

Stream Habitat and Fisheries Resources Reports (catchment scale, including riparian zone assessments). Currently in place for following catchments:

- Daintree, Saltwater, Mossman and Mowbray
- Barron River
- Russell and Mulgrave Rivers
- Johnstone River
- Moresby River
- Liverpool, Maria and Hull

Box 23. Bridging a divide: riparian restoration in the Mulgrave catchment

Catchment issues often cross boundaries – the urban and rural divide for example or the gulf between the private and government sectors. Bruce Corcoran, Coordinator of the Mulgrave Landcare & Catchment Group, explains how a project to restore riparian vegetation has brought these various interest groups together to improve natural resource management in the region.

In 2003 the Mulgrave Landcare & Catchment Group was awarded an Australian Government Envirofund grant for a project to assist landholders, especially those not previously involved in such work, in watercourses on or adjacent to their own land. Twelve landholders participated, contributing 14 sites.

The majority of the 14 sites were in heavily flood prone areas, imposing a number of logistical limits. Site preparation could not begin due to risk of soil erosion before the end of March so planting could not start until the end of April. Soil ripping by tractor prior to planting was a no-no, as was conventional herbicide control of weeds during the following wet. Both induce severe soil and seedling loss under flood current. Species selection in these situations is a balance between a fast growth habit to beat extreme weed competition and the abilities to establish a fibrous root system and survive repeated inundation. Though a little slow, the notable hero among the 25 or so species planted, is river cherry (*Syzygium tierneyanum*). Post-flood replanting & maintenance also needed to be factored in to protect the investment of the original planting.

Prior to works, landowners signed a basic maintenance agreement, committing to watering and weed control until the trees are well established. They also undertook site preparation, usually two sprayings and a slashing. Where banks required re-profiling to provide a stable platform for planting, the landowner and the 'Project' shared the costs of machinery hire. A cooperative relationship with the Department of Natural Resources, Mines and Energy made the procurement of permits a relatively painless process, although stringent conditions to minimise offsite effects applied.

Bryan & Susan O'Shae property Camp Ck.

Face of rural Landcare – Chris Rossi. Farmer, harvesting contractor, MLCG member 14 yrs, Cassowary Award winner.

Plantings took place on Sundays and did not require getting out of bed at an obscene hour, going out to work in the increasingly hot sun & feeling like you've spent the day at the salt mines. Plantings started at 4pm taking about 2 hours as the afternoon cooled off. Free snacks and drinks finished off the day as farmers, volunteers and families unwound by the river. It's always a great atmosphere at dusk and is an excellent chance for busy families to spend quality time together.

The seedlings are now off on their perilous journey through the gamut of drought, fire, accident, pigs, vandalism, weeds – that we are sure have read 'Day of the Triffids'– and numerous industrial grade floods.

Some 9,000 seedlings were planted, revegetating 4.2km of gaps along local watercourses. Over 100 individual volunteers contributed labour and equipment. After 12 months and four major floods, 11 sites boast a seedling survival rate of greater than 90%. A repeat of this successful project is now underway in 2004.

In the Mulgrave catchment, the health and restoration of riparian vegetation was one environmental issue that connected the various interest groups. Urban communities got the chance to translate armchair support for environmental issues into tangible results. For agricultural communities it simultaneously represented a showcase for those who have always integrated riparian vegetation into their property management and a challenge to those who haven't. For the wider community, it is illustrative of an area's ability to manage for multiple NRM benefits, from biodiversity conservation, through improvements in water quality and land management, to building and maintaining strong and effective partnerships.

Photos: Bruce Corcoran

A serious dilemma in setting priorities for this work is that river channels naturally migrate down stream by eroding outside bends and depositing on inside bends. Just how much intervention should be taken in the public interest in these cases is questionable. Priority could be given to those stream reaches where treatments may produce lasting public benefits.

Strategic reinstatement and repair of riparian vegetation along priority streams within the Wet Tropics not only will improve streambank stability and reduce erosion with benefits for aquatic habitat, but it can enhance connectivity among natural vegetation fragments at a local landscape scale.

4.4 Coastal, Estuary and Marine Ecosystems

The coastal zone of the Wet Tropics region encompasses, with the exception of the Palm Island Group, all State coastal islands and waters between the Bloomfield River and Crystal Creek. Within this zone, a range of landforms and habitats can be identified on spatial scales ranging from metres to hundreds of kilometres. The major physically distinct shore types and environments of the coastal zone are sandy beaches, mud flats, mangroves, tidal wetlands and channels. In places, the World Heritage-listed Wet Tropics rainforests cascade down steep mountain ranges to the coast, where 'the rainforest meets the reef'. Numerous offshore continental islands are also dotted along the coast, including the internationally renowned Hinchinbrook Island. The Wet Tropics coast also contains some of the richest seagrass assemblages in Queensland.

The most significant feature of the coastal zone is the Great Barrier Reef ('the Reef'). Consisting of coral reefs, shoals and other formations, the Reef extends the entire length of the Plan area and beyond, north to Cape York and south to Bundaberg. Widely recognised as one of the world's great natural wonders, much of the Reef was inscribed on the World Heritage List in 1981. The Great Barrier Reef is the world's largest World Heritage Area and, along with the Wet Tropics, is one of only a few that satisfies all four natural World Heritage Criteria (see Box 24). The Reef has amazing biodiversity and is home to an estimated 1500 species of fish and more than 300 species of hard reef-building corals, between 3000 and 8000 mollusc species and 1500 species of sponge (Lucas *et al* 1997). Although the seaward boundary of the plan area has still not been officially defined, it includes up to 10% of the Great Barrier Reef World Heritage Area, as well as parts of the Great Barrier Reef Marine Park and state marine parks (Cairns and Townsville/Whitsunday).

Box 24. World Heritage criteria

Sites selected for World Heritage listing are inscribed after carefully assessing whether they represent the best example of cultural and/or natural heritage. A site listed for its natural values must meet one or more of the following criteria:

1. Be outstanding examples representing major stages of the earth's history, including the record of life, significant on-going process in the development of landforms, or significant geomorphic or physiographic features.
2. Be an outstanding example representing significant on-going ecological and biological processes in the evolution and development of terrestrial, freshwater, coastal and marine ecosystems and communities of plants and animals.
3. Contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.
4. 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.

Worldwide, there are currently 172 natural or mixed natural World Heritage Areas (including 15 in Australia). The Great Barrier Reef and Wet Tropics are among the very few properties on the World Heritage List selected for all four natural criteria.

The Plan area includes four marine and coastal bioregions. These are the Central Reef, Lucinda-Mackay Coast, Ribbons and Wet Tropics Coast. The Great Barrier Reef Marine Park Authority (GBRMPA) defined regions at a finer scale through its Representative Areas Program. Although termed 'bioregions', these GBRMPA regions are more or less the marine equivalent of the provinces or sub-regions. Each represents an area where the known animal and plant assemblages, and the physical features, are sufficiently distinct from the surroundings and the rest of the WHA. There are seven reef and eight non-reef GBRMPA bioregions and three deeper offshore areas mapped within the Wet Tropics NRM Region.

Fisheries and Aquaculture

As detailed in the Background Report, Cairns supports the largest fishing fleet in Australia with over 800 vessels fishing in regional waters for prawns, barramundi, reef fish, crabs, lobster and mackerel. This is supported by a burgeoning aquaculture industry, particularly in the area of prawn, barramundi and red claw. The commercial fishing industry is the region's third largest industry, employing about 1,600 people and injecting approximately $200 million each year into the local economy.

It is not known how much recreational fishing contributes to the regional economy, although the financial value of recreational fishing and boating across the GBRWHA has been estimated at $122 million.

Aboriginal values for sea country

For thousands of years Aboriginal traditional connections have been part of the unique living culture of the coasts and seas in the Wet Tropics Region. For coastal Traditional Owner groups the sea is part of a defined, inherited country for which they have inalienable rights and responsibilities, including the right to access, use and distribute resources, and the responsibility to manage those resources through time, from generation to generation. They have utilised and continue to use marine resources of the Wet Tropics Region. The social, cultural and economic values such as the knowledge, language and practices associated with these resources are essential to the maintenance of Aboriginal cultural traditions and traditional affiliations to sea country (Hunter & Williams 1997).

4.4.1 Status and threats

The *State of the Great Barrier Reef World Heritage Area 2003* report identified mounting pressures on the Reef. For example:

- since the European settlement of Australia, the annual flow from the land of sediments and nutrients into the Great Barrier Reef has increased four fold;
- since 1998, the Great Barrier Reef has suffered its two worst ever recorded coral bleaching events, caused by unusually warm sea water, in conjunction with other environmental factors (e.g. reduced salinity and lower water quality);
- the effort in the Reef Line Fishery has doubled since 1995; and
- recreational fishing effort continues to increase as population increases and fishing and boating technology improves.

Similar pressures, elsewhere in the world, have contributed to the loss of up to 25 percent of the world's coral reefs. Despite these pressures, the *State of the Great Barrier Reef World Heritage Area 2003* report found that the Great Barrier Reef is still a wonderful natural asset for Australia and the World and that many areas are still in very good condition. The prognosis for the future is also good, according to the first *Status of Coral Reefs of the World* report, published in 1998. However, these reports warned against complacency on the part of managers and the community.

The *State Coastal Management Plan* identified the following pressures on the coast: limited information, altered environmental flows, declining water quality, exotic weed and marine species, declining fish populations and a higher incidence of cyclonic events. Some of these pressures are discussed in more detail below. Others, such as declining water quality, are dealt with elsewhere in this plan although an important impact to keep in mind is the accumulation of pollutants in the marine food web.

Overfishing and marine habitat modification

Fishing effort in the region continues to increase as population increases and fishing and boating technology improves. The limited fisheries resources in the Wet Tropics are highly accessible, and face pressure from a combination of commercial and recreational/tourist fishing activities. It is expected that fishing pressure will become especially intense near large population centres such as Cairns. As well as depleting targeted fish stocks, fishing activities can also damage fish habitats (e.g. anchor damage to reefs, seabed disturbance by trawling).

Aquaculture development

The region supports a burgeoning aquaculture industry, particularly in the area of prawn, barramundi and red claw. The potential of other species for aquaculture in the region is being trialed but they are not currently in large-scale production. These include mud crabs, eels, jade perch, golden perch and sleepy cod. Additionally, there is some production of aquarium and ornamental fish including natives and exotics but the extent of these operations is relatively small.

Threats that aquaculture poses for the environment are varied but essentially they include:

- Habitat and agricultural land loss associated with pond construction;
- Discharge of waste and their interaction in the wider marine environment (e.g. excess nutrients);
- Disease impacts on wild and farmed stocks; and
- Escapes from fish farms and potential effects on wild populations.

Shipping and boating

Cairns is the east coast of Australia's most northern 'first port of entry' and deep-water passage through the GBR is available via Grafton Passage from the east or the inner reef passage via Torres Strait from the north. Other major ports in the Wet Tropics include Mourilyan and Lucinda, which are trading ports for the export of primary products (mainly sugar). Major marinas, such as those at Half Moon Bay and Dicksons Inlet, also receive international boat traffic.

Maritime incidents have the potential to significantly impact on the marine environment. Fuel or cargo spills, whether the result of vessel operations or accidental spillage, are likely to cause impacts within a short period of time yet have long lasting effects. Groundings may result in collateral damage and anti-foulant paint (i.e. tributyl tin – TBT) impacts to coral reef and seagrass ecosystems. These incidents may also result in oil spills, with serious ramifications for the environment in terms of damage to corals, mangroves, shorelines, dugongs, turtles and seabirds. Dumping of rubbish and other debris from ships into the marine environment has become an increasingly serious problem. The EPBC lists pollution, including marine debris, as a threatening process.

Pest plants and animals

As reported in the *Wet Tropical Coast Regional Coastal Management Plan*, there is significant potential for adverse impacts on the region's coastal resources from the introduction of exotic marine species, particularly from ballast water discharge or from fouling organisms transported on vessel hulls. For example, Cairns Seaport has experienced infestations of the Asian green mussel and Caribbean tubeworm.

Translocated native fishes and accidental releases from aquaculture facilities are also of concern. In addition, crown-of-thorns starfish outbreaks continue to be a major disturbance to reef ecology (see Box 25) and some pest plant species, like thunbergia, hymenachne and pond apple, threaten coastal plant communities in the region.

Box 25. Crown-of-thorns starfish

The crown-of-thorns starfish gets its name from the dense covering of long sharp spines covering its upper surface and is one of only a few animals that feed on living coral tissue. At low densities this animal is just another part of the ecology of a coral reef. However, when the crown-of-thorns starfish or COTS, reaches densities of more than 30 per hectare, it eats coral faster than the coral can grow and can create major disturbances to the ecology of the reef.

Outbreaks of COTS were first described at Green Island and nearby offshore reefs in 1962. A second outbreak occurred between 1979 and 1991. In 1993, the first stages of another outbreak were detected. This outbreak has slowly developed and as with previous outbreaks, spread south, possibly due to COTS larvae being transported by the East Australian Current. It decimated reefs in the Mission Beach area before moving to Townsville.

After a decade of research by the Australian Institute of Marine Science, scientific understanding of the biology and ecology of COTS has advanced, and there is now sufficient evidence to link the incidence of COTS outbreaks to water quality (De'ath *et al*, 2004). The COTS is an organism that can be viewed in two perspectives, as a component of the coral reef ecosystem or as a direct pressure on hard coral (as it feeds on them) and an indirect pressure on other reef organisms (such as many fish) that are reliant on hard corals for food or shelter.

Tourism and recreation

Tourism is the main commercial use of the Great Barrier Reef, contributing at least $770 million annually and bringing 1.8 million visitors to the area. While the environmental impact of tourism and tourists is variable and case-specific, the sheer size of the industry inevitably places pressure on the environment. Around 40% of tourists are serviced by the 10 largest operations. Destinations include a variety of coral reefs, continental islands and coral cays. Over 85% of visitors go to the offshore Cairns/Port Douglas and Whitsunday areas, which make up less than 10% of the GBR Marine Park. In Cairns, the tourism industry focuses on day visits to pontoons and moorings and extended diving and fishing charters to offshore reef destinations.

This concentration of visitation is placing significant localized pressure on the survival of coral reef environments, and other habitats such as sea grass, from anchor damage, poor diving practices, waste disposal, reef walking, and collecting. Other pressures include disturbance of turtles and seabirds, especially during nesting season. It has already been reported that increasing levels of human visitation are considered the most likely cause of seabird declines on Michaelmas Cay, near Cairns. These pressures also impact upon the cultural values of the Reef to Aboriginal people (e.g. impacts of marine anchorage on fish traps).

Inappropriate urban development

A trend towards increasing the intensity of development of coastal land is apparent along the major part of the Wet Tropics coast, particularly north of Cardwell-Hinchinbrook. Land use is changing from natural to agriculture to urban/built infrastructure. This trend is most apparent near major coastal urban centers that have reached an advanced stage of land development (e.g. Cairns, Innisfail and Ingham). More remote areas are progressing from a natural state to a more developed state that supports agriculture and tourism development (e.g. Cardwell, Mission Beach, Port Douglas and the Daintree region). Allowing development at inappropriate locations has sometimes aggravated the risk of flooding (see section on urban land), while some developments have caused significant harm to sensitive ecological sites and wildlife habitats and Aboriginal places of significance.

4.4.2 Management response

The coastal zone of the Wet Tropics corresponds to the Queensland coastal planning units of the Wet Tropical Coast and Cardwell-Hinchinbrook. Regional coastal management plans have been introduced describing how these coastal zones are to be managed. The plans, prepared under the Queensland *Coastal Protection and Management Act*, provide the foundation to lead coastal management through cooperation and partnerships between land managers, landholders, industry, the community and all levels of government.

The regional coastal management plans have the status of State Planning Policies for the purpose of making and amending planning schemes and assessing and deciding development applications. The Queensland EPA is the lead agency. The EPA also administers the *Environmental Protection Act*, which regulates aquaculture and other wastewater discharges, as well as the *Marine Parks Act*, and is responsible for responding to marine pest incursions in collaboration with other State agencies and the Great Barrier Reef Marine Park Authority (GBRMPA).

The Great Barrier Reef Marine Park was established under the Commonwealth *Great Barrier Reef Marine Park Act 1975*. The Act also established GBRMPA, which is responsible for the conservation and reasonable use of the Great Barrier Reef (although, like on land, day-to-day management issues, enforcement and compliance activities are the responsibility of the Queensland Parks and Wildlife Service). In 1981, the Great Barrier Reef was inscribed on the World Heritage List. It was and still is the largest World Heritage Area globally (WWF 2001). The World Heritage Convention requires that signatory States identify, conserve, protect, transmit to future generations, present and where necessary rehabilitate World Heritage Areas. There is no doubt that conservation and protection are the overriding principles by which the Great Barrier Reef is to be managed (WWF 2001).

GBRMPA is the lead agency for GBRWHA issues. In recent years, GBRMPA has introduced management plans to ensure the protection of the natural values and amenity of the Great Barrier Reef, and to effectively manage potential conflicts of use and tourism development in high use areas. Current activities to further protect the Reef include:

- The Representative Areas Program, which aims to protect representative portions of the entire biodiversity of the Great Barrier Reef in no-take areas. The new Zoning Plan has increased the total percentage of the Great Barrier Reef Marine Park in no-take areas from 4.6 percent to 32.5 percent.
- GBRMPA is also working with Queensland Department of Primary Industries and Fisheries (DPI&F), to develop a new management plan for the Reef Line Fishery. The objective of this plan is to help the fishery achieve ecological sustainability.

DPI&F administers the *Fisheries Act*, which provides the current legislative basis for managing and protecting the State's fisheries resources. This is largely achieved through regulations, management plans and declarations of closed seasons, closed waters and the protection of Fish Habitat Areas (currently 14 declared in the Wet Tropics) and marine plants. The introduction in 1998 of a Vessel Monitoring System by DPI&F aims to ensure greater compliance with restricted area zoning for the east coast trawl fishery, DPI&F estimate current compliance with boating and fisheries legislation is running at about 93%.

Box 26. Managing Tourism on the Reef

Maintaining the diversity, integrity and productivity of the Great Barrier Reef is essential for sustainable tourism use. The impacts of tourism also need to be managed. Ecological impacts of tourism are minimised or eliminated through the permits process of the Great Barrier Reef Marine Park Authority and Environmental Protection Agency. Great care is taken to locate tourism operations and restrict activities so that impacts are as small as possible. Particular attention is given to:

- Protecting coral reefs and other habitats such as seagrass from anchor damage, poor diving practices, waste disposal, reef walking and collecting;
- Protecting turtles and sea birds from disturbance, especially during nesting seasons;
- Respecting the cultural importance of the GBR to Aboriginal and Torres Strait Islanders; and
- Minimising conflicts in access within the multiple use Marine Park.

(Source: State of the Great Barrier Reef World Heritage Area 1998 Report; Biodiversity Report, p57)

Photo: Quicksilver

In the past, the Coasts and Clean Seas Program and Coastcare engaged the broader community and stakeholders in various research and monitoring programs and on-ground activities. Prior to the new Regional NRM arrangements these programs were delivered regionally by EPA, QPWS, DPI&F and local government.

Of particular relevance to this Regional NRM Plan, the State Government and the Commonwealth Government have jointly developed the Reef Water Quality Protection Plan (RWQPP) to address land use practices and declining water quality in coastal catchments to 2010. The RWQPP contains new actions, proposals for building on existing government policies and industry and community initiatives to achieve a sustainable future for the Reef and the industries in the Reef's catchments. Its overall aim is to halt and reverse the decline in the quality of water entering the Reef, within 10 years. Components of the RWQPP will be implemented through this Plan. More information is provided in the Water Resources chapter.

4.5 Significant Species and Ecological Communities

The Wet Tropics region conserves an extraordinarily high level of Australia's species diversity. Many species in the Wet Tropics are naturally rare or geographically restricted. Relative rarity is influenced by several factors that may influence a species total potential population size such as its geographic range, its local abundance and its ubiquity of occurrence within its range. It is often the case that species with small geographic ranges also have low local abundance, and are often patchily distributed within their ranges. These characteristics, either independently or in combination, increase the potential for extinction or make such species sensitive to environmental change/disturbance.

Because of the above attributes, rare species are often a primary focus of conservation planning and monitoring even when no overt or obvious threats to their survival are apparent. Endangered and vulnerable (i.e. threatened) species, on the other hand, are a specific sub-set of rarity. These species are presently considered to have endured substantial population declines and to be at immediate risk of disappearing from the wild as a result of threatening processes. In the context of this Plan, 'significant' species are generally those regarded as rare or threatened. Marsh (2001) contends that a transparent process that assigns management priorities for the region's wildlife on the basis of ecological and social factors, in addition to extinction risk *per se* is required.

The famous Tablelands landmark, the Curtain Fig Tree at Yungaburra, is found in Mabi Forest (Photo: Nigel Weston)

The rare Herbert River ringtail possum, aka 'Herbie', is the enduring symbol of the EPA (Photo: WTMA)

In this Plan significant ecological communities are simply those listed as critically endangered ecological communities under the Commonwealth EPBC Act. To date just one ecological community in the region, Mabi Forest (complex notophyll vine forest on upland basalts – Type 5b, *sensu* Tracey 1982) is listed (see Box 27).

4.5.1 Status and threats

A complete list of rare and threatened plant species known or expected to occur within the constituent catchments of the Wet Tropics is shown at Appendix A in the Biodiversity Report.

This list, created by Andrew Ford (CSIRO) and based on actual records and expert opinion, contains 395 species. Of these species, 17 are presumed extinct, 43 endangered, 59 vulnerable and 276 rare (based on their status under the *Nature Conservation Act 1992* (Qld) (NCA)). The number of rare and threatened species by catchment is given in the table below.

A complete list of rare and threatened animal species known or expected to occur within the constituent catchments of the Wet Tropics is shown at Appendix B in the Biodiversity Report. This list, based on actual records and expert opinion, contains 101 species. It includes coastal and marine species, such as marine turtles, dugong and cetaceans (i.e. dolphins and whales). Seventeen of the 101 species are listed as endangered, 58 vulnerable and 26 rare (based on their status under the NCA).[8] At least 13 are endemic to the Wet Tropics NRM Region (i.e. they are found nowhere else) (see Box 28). The number of rare and threatened species by catchment is given in the table below.

Three vertebrate species that occur in the region are prescribed as common but culturally significant under the NCA. These are the:

- koala, *Phascolarctos cinereus* subsp. *adustus*, which is sparsely distributed in eucalypt forests in the drier, western part of the plan area;
- platypus, *Ornithorynchus anatinus*, which is common in freshwater streams and impoundments on the Atherton Tablelands; and
- echidna, *Tachyglossus aculeatus*, which is found in all habitats across the area.

All threats identified earlier in this chapter impact upon significant species and ecological communities to some degree. Additional threats include road kill, chytrid fungus, fishing bycatch and hunting. Bioprospecting (the search for active compounds in biological material that can be developed into

[8] The spectacled flying-fox (*Pteropus conspicillatus*), although listed as 'vulnerable' under the EPBC Act, is not listed as rare or threatened under the NCA.

Box 27. Mabi Forest: A significant ecological community

By Joan Wright MBE, ME, BSc (Co-founder, TREAT)

Mabi Forest, also known as Complex Notophyll Vine Forest (or Type 5b), once covered the Atherton Tablelands area north and west of Malanda, occurring only on fertile basalt (red) soils in areas where rainfall is between 1300 and 1600mm. This forest type is now located largely within the Atherton Shire and is restricted to small remnants such as Tolga Scrub and the Curtain Fig Tree forest. It was originally classified in the 1960s by ecologists Len Webb and Geoff Tracey, based on its physical (structural) characteristics and species composition, using the Tolga Scrub as the basis for this description.

These structural characteristics include:

- many buttressed canopy trees up to 45m, with an uneven canopy
- a very well developed shrub layer one to three metres high
- presence of scattered, often deciduous and semi-evergreen trees
- tendency for heavy leaf fall in times of moisture stress
- stem diameters are uneven
- epiphytes are generally uncommon and orchids are rare

Mabi Forest draws its name from the local aboriginal name for Lumholtz's Tree-kangaroo (mabi or mapi), one of the most common large marsupials in this forest type. Predominantly a leaf eater, this rare species is most abundant on the Atherton Tablelands where it is restricted to rainforests and adjacent wet sclerophyll forests. This abundance is most likely related to climate, and the relatively high nutritional value of plant foliage in forests growing on these very fertile soils.

Widespread clearing of Mabi Forest has resulted in its listing as a **critically endangered** ecological community under the EPBC Act.

Mabi forest interior (Photo: Nigel Tucker)

Aerial shot of Wongabel State Forest (Photo: Nigel Tucker)

Table 6. Plants – Rare and threatened in Wet Tropics catchments.

Catchment	*Species*	*Expected to Occur*	*Total*
Barron	92	8	100
Daintree-Mossman	190	30	220
Herbert	78	22	100
Johnstone	92	5	97
Russell-Mulgrave	152	9	161
Tully-Murray	60	6	66
Trinity Inlet	7	22	29

Table 7. Animals – Rare and threatened in Wet Tropics catchments.

Catchment	*Species*	*Expected to occur*	*Total*
Barron	60	3	63
Daintree-Mossman	59	5	63
Herbert	60	5	65
Johnstone	49	2	51
Russell-Mulgrave	49	3	52
Tully-Murray	49	3	52
Trinity Inlet	33	3	36

commercial products) is an emerging threat. Additional information, taken from the condition reports except where otherwise stated, is provided below.

Road kill

As well as generating a barrier effect (see section on native vegetation), roads can also be a significant source of mortality for wildlife. For example, local researcher Miriam Goosem estimated that 5,000 vertebrates per kilometre (mostly amphibians) are killed on the Kuranda Range Road each year. For some species (e.g. cassowary, Lumholtz's tree-kangaroo), road kill is considered a threatening process.

Chytrid fungus

There is widespread evidence of a dramatic global decline of amphibian species, particularly in tropical forests. Eight locally endemic species are officially listed as rare or threatened. Populations of three of these species can no longer be located and another is only known from two small streams. The declines have occurred across a variety of tenures, including habitats remote from human interference.

Box 28. Rare and threatened animal species endemic to the Wet Tropics NRM region

Several listed rare and threatened animal species are found only in the Wet Tropics NRM Region, including:

- Atherton antechinus, *Antechinus godmani*
- Mahogany glider, *Petaurus gracilis*
- Skink, *Calyptotus thorntonensis*
- Skink, *Eulamprus frerei*
- Skink, *Lampropholis robertsi*
- Skink, *Bartleia jigurru*
- Magnificent broodfrog, *Pseudophryne covacevichae*
- Little waterfall frog, *Litoria lorica*
- Tapping nurseryfrog, *Cophixalus concinnus*
- Creaking nurseryfrog, *Cophixalus infacetus*
- Bellenden Ker nurseryfrog, *Cophixalus neglectus*
- Apollo jewel butterfly (Wet Tropics subspecies), *Hypochrysops apollo apollo*
- Cairns rainbowfish, *Cairnsichthys rhombosomoides*
- Many other species are confined to the Wet Tropics bioregion but their range extends into the Cape York and/or Burdekin-Dry Tropics NRM Regions, e.g. Bennett's tree-kangaroo, cassowary (southern population), green ringtail possum, and northern bettong. A select few, such as the Herbert River and lemuroid ringtail possums, Lumholtz's tree-kangaroo and the frogs, *Taudactylus rheophilus* and *Litoria nyakalensis*, occupy just a tiny fraction of the Northern Gulf NRM Region (the rainforested, western slopes of the Mt Windsor and Mt Carbine Tablelands of the upper Mitchell catchment) in addition to their core range in the Wet Tropics NRM Region.

Apart from listed rare and threatened animals, there are many otherwise significant species found only in the Wet Tropics NRM Region. These include the Mulgrave goby, *Glossogobius* sp.4, the Bloomfield River cod, *Guyu Wujalwujalensis*, and the giant blue earthworm, *Terriswalkeria terrae-reginae*.

Box 29. Cassowaries as an Aboriginal cultural resource

Cassowaries are culturally significant for many Rainforest Aboriginal people, who have customs, stories, songs and dances about cassowary. Cassowaries are prized food, and their feathers, claws and bones are used for ornaments and hunting. Cassowary images are found in rock art in the Wet Tropics. Many of the trees which cassowaries "plant" are foods which Rainforest Aboriginal people enjoy eating.

The fact that cassowaries are now endangered is also of grave concern to Rainforest Aboriginal people. As modern day pressures threaten the future of cassowaries, they also threaten the customs and traditions associated with cassowaries and impact on the long-term survival of Rainforest Aboriginal people.

(Source: Wet Tropics Conservation Strategy 2004, p30)

Until recently, it was not known what the causal factor(s) in the frog declines was. However an exotic chytrid fungus, known to be fatal to amphibians, has been detected in the skin of sick and dead frogs in Queensland. It has been suggested that the introduction, decades ago, of an African frog used in pregnancy testing was the source of this fungus.

Fishing bycatch

Trawling is one of the most widely used commercial fishing methods in Australia. In the northern section of the east Queensland coast between about Cape York and Babinda, prawns (predominantly tiger and endeavour species) make up nearly 97% of the catch and are also the major component of the catches between Mission Beach and Cardwell. As well as prawns, the prawn trawl fishery results in the harvesting of a wide variety of non-target species or bycatch, most of which consists of non-commercial species and are discarded. Occasionally, significant species such as marine turtles are caught, although the mandatory use of turtle exclusion devices has reduced turtle mortality. Marine turtles and other significant species such as dugongs and inshore dolphins are occasionally caught and drowned in set fishing nets.

Hunting

Indigenous hunting is a contentious issue in the Wet Tropics and is largely associated with hunting of dugong and marine turtles. The levels of hunting in the region are minimal (but are not well documented) and the impact of this activity is considered to be comparatively small. During the workshops conducted, many Traditional Owners talked about their concerns of the populations of turtle and dugong and want to be actively involved in their management (see the Caring for Country Chapter).

Bioprospecting

Bioprospecting (or biodiscovery) has the potential to be another lucrative industry in the Wet Tropics. Biodiscovery is the search for active compounds in biological material that can be developed into commercial products. The region's rich biodiversity, developed economy and research capabilities uniquely position it as a leader in the emerging biodiscovery industry. Because current administrative and regulatory frameworks were not designed for biodiscovery activities, the State Government released the draft *Biodiscovery Bill* in 2003 for public comment. The proposed Bill had three key objectives:

1. to facilitate sustainable access to the State's native biodiversity for biodiscovery;
2. to encourage the development of value added biodiscovery; and
3. to ensure the benefits arising from discoveries sourced from Queensland biodiversity are shared by all Queenslanders.

The Bill was not well received by environmentalists and Traditional Owners in the region because of concerns over its failure to respect traditional knowledge and its lack of strong environmental safeguards (S. Hall, EDO-NQ, *pers. comm.*).

4.5.2 Management response

Most of the management responses to the issues threatening significant species and ecological communities have already been discussed (e.g. protected areas, new vegetation management laws, non-regulatory measures such as grants and conservation covenants). Perhaps the most important initiative with respect to the protection of significant species and ecological communities *per se* is the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Act regulates actions that will, or are likely to, have a significant impact on 'matters of national environmental significance', including nationally threatened species and ecological communities, protected migratory species and the values of a declared World Heritage Area. This includes actions that occur outside the boundaries of a WHA (see Box 30 The Flying Fox Case). The Wet Tropics region contains many natural assets that are considered to be 'matters of national environmental significance' under the EPBC Act (see Appendix G).

The EPBC Act also provides for the development of recovery programs and plans. The Commonwealth's Endangered Species Program is implemented through parallel programs run by the QPWS. Recovery plans comprehensively describe, schedule and cost actions assessed as necessary to support the recovery of threatened species. Plans are currently in place for the following Wet Tropics species:

- Cassowary
- Cave-dwelling bats (three species, two within plan area)
- Magnificent broodfrog
- Mahogany glider
- Marine turtles (six species)
- Northern bettong
- Stream-dwelling rainforest frogs (seven species)

Resource constraints presently limit the implementation and expansion of recovery programs for the 150 or so threatened (i.e. endangered or vulnerable) plants and animals in the region. Plans being prepared include: a draft recovery plan for the spotted-tailed quoll; and one for Mabi Forest is currently underway. The *Australian Terrestrial Biodiversity Assessment 2002* identifies reptiles, rainforest frogs and freshwater fauna as the priority groups for recovery actions within the Wet Tropics. Freshwater fauna and reptiles require inventory, and life history information as initial recovery actions.

Complementary Commonwealth and State legislation creates a comprehensive scheme of environmental protection and management of the two World Heritage Areas in the region. Management arrangements for the Great Barrier Reef WHA have already been discussed (pp. 42–43). With respect to the Wet Tropics WHA, the Queensland *Wet Tropics World Heritage Protection and Management Act 1993* together with its subordinate statute, the *Wet Tropics Management Plan 1998*, provide the legal framework and mechanisms for management. This framework is described in detail in the Biodiversity Report but, in general, the legislation regulates activities within the WTWHA that have the potential to impact on World Heritage values. It also establishes the Wet Tropics Management Authority (WTMA) as the agency responsible for managing the Property according to Australia's obligations under the World Heritage Convention.

As already reported, WTMA is not responsible for day-to-day management issues. It is, however, responsible for the coordination of on-the-ground management to ensure the WHA is properly protected. Tam's activities include:

- Operation and enforcement of Wet Tropics legislation, including issuing of permits;
- Policy and planning – major strategic planning for the area including the Wet Tropics Plan, specific issue-based plans including strategies for Nature Based Tourism, Walking Tracks, and Conservation (see Box 32), and coordination with other regional planning processes such as FAN Regional Plan and the Regional NRM arrangements;

Box 30. The flying-fox case

The flying fox case involved an application by a conservationist to restrain the mass culling of spectacled flying-foxes, *Pteropus conspicillatus*, by a large aerial electric grid on a 60 ha lychee farm in the Wet Tropics. The electric grid consisted of 20 horizontal electrified wires, spaced 25 m apart, strung between poles at 4–9 m height (slightly above tree-top level), with 14 grid lines stretching for 470–820 m in length, a total of 6.4 km of grid lines. When flying foxes collide with any two of the wires (which are alternated earth – live) they create a circuit and are electrocuted by a high voltage current.

In the first full trial under the EPBC Act, it was decided to grant an injunction restraining an action found to be causing a significant impact on the world heritage values of the WTWHA. The case was considered to be a crucial test of the offence provisions for matters of national environmental significance under the Act and a landmark case highlighting the importance of open standing for public interest litigation to protect the environment.

In particular, the decision clarified a number of crucial issues for the operation of the EPBC Act. It was found that a 'significant impact' was an 'impact that was important, notable or of consequence having regard to its context of intensity' (the operation of the grid killed in the order of 18,000 spectacled flying-foxes in the 2000–2001 lychee season, which equated to roughly 20% of the Australian population at that time). A further important aspect of the case was that it established that an action taken outside a World Heritage Area can be regulated under the EPBC Act if it has, will have or is likely to have a significant impact on world heritage values.

(Source: McGrath 2001)

- Research and monitoring – enhancing understanding of the importance of the WHA and monitoring the state of the Wet Tropics on an annual basis;
- Funding – applying allocated funds for strategic outcomes, seeking new funding sources and new ways of value-adding to existing management programs;
- Education and interpretation – through visitor centres, signs and displays, public and education programs;
- Threat abatement – providing advice and strategic support for feral pig trapping programs, weed control, and fire management; and
- Involvement of Aboriginal communities – through the Interim Negotiating Forum process and Aboriginal Resource Management Unit.

Box 31. Key threatened species in the Wet Tropics

There are at least 395 plant species and 101 animals that are formally gazetted as rare or threatened (vulnerable, endangered or presumed extinct) in the Wet Tropics NRM Region. This underscores the importance of the region in respect to biodiversity conservation. Some key threatened species include the cassowary (southern population), mahogany glider and northern bettong and the perennial shrub Prostanthera clotteniana

The cassowary (*Casuarius casuarius*) is one of the most threatened vertebrate species in Australia's northern rainforests. Records suggest that the cassowary was once more widespread than the present range of two isolated populations. The southern population occurs in the rainforest areas between Cooktown and Townsville (i.e. Wet Tropics) and is listed as endangered. Approximately 1500 adults are thought to exist in the Wet Tropics and the population is still declining, mostly due to habitat destruction.

The mahogany glider (*Petaurus gracilis*) is one of the rarest mammals in Australia. It was thought to be extinct for more than 100 years until it was rediscovered by Queensland Museum scientists at Barrett's Lagoon near Tully in 1989. It is only found in tropical coastal lowland woodlands from Tully to just south of Ingham and is listed as endangered. Clearing has reduced this habitat to less than 20 percent of its former size. The remainder is fragmented and vulnerable to wildfires and further clearing.

The northern bettong (*Bettongia tropica*) is found in the tall and medium tall grassy forests closely associated with wet sclerophyll. It only occurs in a limited number of pockets on the western edge of the range, from Mt Windsor and the Carbine Tablelands south to Paluma and is listed as endangered. Its distribution appears to be linked to the availability of food resources, especially ectomycorrhizal fungi (truffles), which are most abundant in forest areas controlled by fire.

Prostanthera clotteniana is a Critically Endangered plant species confined to the rocky, rhyolite areas in the drier woodlands on steep hills west of the Atherton-Ravenshoe area. It is currently known from three small populations, comprising a total of 20 adult plants and a similar number of seedlings. The greatest threat to its survival is high intensity wildfire. Within the distribution of *P. clotteniana*, the vulnerable magnificent broodfrog (*Pseudophryne covacevichae*) has been found, primarily on rhyolite in seepage areas at the head of gullies where the water table rises.

*The cassowary (*Casuarius casuarius*) Photo: Doug Clague*

*The northern bettong (*Bettongia tropica*) Photo: EPA website*

*The mahogany glider (*Petaurus gracilis*) Photo: Department of the Environment and Heritage website*

Prostanthera clotteniana *Photo: A.R. Bean, Qld Herbarium*

References: Dennis (2002), EPA (1999), EPA website, McDonald et al (2002).

Box 32. Wet Tropics Conservation Strategy: Priorities in Brief

The *Wet Tropics Conservation Strategy* (2004) was developed by WTMA to promote cooperative conservation management to ensure the future ecological health of the WTWHA. According to the Executive Summary:

> *World Heritage legislation has contributed greatly to protecting the integrity of the WTWHA. However, a proactive conservation program is needed for the Area and surrounds to conserve and rehabilitate the values of the WHA and minimise threats. The strategy identifies where we should focus our conservation efforts and what actions are most achievable and cost-effective.*

Priorities in brief are to:

- Eradicate new incursions of Class 1 weeds. Increase capacity of specialised weed prevention and eradication teams.
- Provide better weed information and education and education for land managers and the community.
- Protect and restore landscape vegetation linkages between the main body of the WHA and outlying coastal and tableland sections.
- Prevent the establishment of new feral animals such as deer and fish species.
- Verify the current and potential impacts of climate change and the need for improved landscape connectivity.
- Review the status of redundant roads under the Wet Tropics Management Plan.
- Rehabilitate wetland and river systems which can be restored to their natural state.
- Complete vegetation mapping for the Wet Tropics Bioregion at 1:50,000.
- Recognise mapped areas of threatened ecosystems, threatened species habitat, and key vegetation corridors under State and Commonwealth legislation.
- Implement fire regimes in woodland and sclerophyll forests to maintain habitat diversity for rare and threatened species such as the mahogany glider, fluffy glider and northern bettong.
- Research and promote the community benefits of the WHA for services such as clean water, genetic resources, climate regulation, flood mitigation, recreation and tourism and scenic beauty.
- Encourage the introduction of tradeable rights and financial incentives for conservation on private lands.
- Foster coordinated, cooperative management of the Area and surrounding lands to ensure conservation of World Heritage values.
- Promote and support Aboriginal participation and the use of traditional knowledge in conservation management.

The Strategy can be viewed at www.wettropics.gov.au/mwha/mwha_pdf/wtmaConservationStrategy.pdf

In a *Regional Action Plan for the Conservation of Rare and/or Threatened Wet Tropics Biota*, Werren (1992) specifies various actions as part of the management strategy for the conservation of rare and/or threatened species:

- Urgent interventionist management (i.e. the implementation of Recovery Plans) for critically endangered species;
- Protection of lowland habitat remnants and other habitats poorly represented within the protected area network;
- Emplacement of day-to-day management programs (e.g. protected area patrols and enforcement of protection measures, visitor control management, fire management, feral animal and weed control programs) that are sensitive to the conservation requirements of rare and/or threatened species and habitats;
- Rehabilitation works to rebuild rare/threatened habitats, expand such habitats and to provide corridors to link habitat fragments; and
- Involve the wider community in rare/threatened species conservation initiatives.

In terms of active, on-the-ground management of significant species and ecological communities, QPWS has established a cassowary care centre at Mission Beach and recovery actions to minimize threats to cassowaries have been initiated by the Cassowary Advisory Group in partnership with community groups, other government agencies and local government. This community-based group is supported by WTMA and has been particularly active in the three cassowary hotspots of Mission Beach, the Daintree lowlands and Kuranda. Other active community-based groups include the Tablelands-based Tree-Kangaroo and Mammal Group (tree-kangaroos, quolls, Mabi Forest), the Wildlife Preservation Society of Queensland (spectacled flying foxes and false water rats), and the Cairns Frog Hospital. Aboriginal Communities have introduced community-based management initiatives for dugong and marine turtles (e.g. Kuku Yalanji Traditional Owners).

Another active group in conservation in the Wet Tropics is Birds Australia North Queensland. Birds Australia has responsibility in Australia for the Important Bird Area (IBA) Program of BirdLife International, which aims to identify, monitor and protect a global network of IBAs for the conservation of the world's birds and other biodiversity. Six of the first 20 IBAs approved by the Birds Australia Council are located in the Wet Tropics NRM region. They are the Coastal Wet Tropics, Daintree, Wooroonooran, Atherton Tablelands, Tinaroo and Trinity Inlet IBAs. The Atherton Tablelands covers the agricultural fields in the vicinity of Atherton, which now support significant populations of the globally vulnerable sarus crane (*Grus antigone*). The proposed Paluma IBA is located just outside the Wet Tropics NRM region, in the Burdekin Dry Tropics.

Research institutions such as the Rainforest CRC have carried out research on threats like the frog chytrid fungus and the impacts of roads on wildlife and have documented management strategies aimed at decreasing the risks.

4.6 Biodiversity Targets

This section outlines management actions required to progress towards the goals for biodiversity. Resource condition targets have been developed to indicate the desired outcomes of implementing these actions over the next 10–20 years. They reflect how the 'condition' of certain biodiversity assets (e.g., Regional Ecosystems, significant species) should change over that period.

Although several of the targets focus on Regional Ecosystems and their status, this is just one aspect of biodiversity assessment. While it is used as a surrogate for other levels of biodiversity in nature conservation planning, additional factors that need to be assessed include regional landscape function and context, habitat for rare and threatened species and other special values such as endemism and irreplaceability.

FNQ NRM Ltd's biodiversity officer, Rowena Grace, played a key role in developing these targets in conjunction with community groups and experts from State Government agencies and research institutions. Existing policies and plans (there are about 100 dealing with threatened species, World Heritage Areas, coasts, vegetation and so on – see Appendix 2 in the Background Report) also informed this process and provided the data for the composite maps showing regional management and rehabilitation priorities, and significant waterways and wetlands (Appendices L–N).

The most important documents used to create the regional management and rehabilitation priority maps were the *Regional Coastal and Vegetation Management Plans*, the *Wet Tropics Conservation Strategy* and the *FNQ Regional Plan*. The information used to create the significant waterways and wetlands map was derived from *A Directory of Important Wetlands in Australia* (national significance), the *Regional Coastal Management Plans* (state significance) and the *FNQ Regional Plan*.

A further note on the significant waterways and wetlands map – the watercourses shown (and therefore regarded as regionally significant) are those that appear on a map drawn to 1:1,500,000 scale (i.e. Wet Tropics region reduced to A3 size). This means that the watercourses are of regional 'landscape' significance, rather than significant by any other criterion, e.g. biodiversity. The layers shown are 'nationally important wetlands' according to A Directory of Important Wetlands in Australia, wetlands mapped as 'areas of state significance (natural resources) – significant coastal wetlands' in the Regional Coastal Management Plans for the Wet Tropical Coast and Cardwell-Hinchinbrook, and 'riparian corridors' mapped in the FNQ Regional Plan on Figure 13- Regional Rehabilitation Priorities for Biodiversity.

It should be noted that the *FNQ Regional Plan* predated the other source documents; hence the composite maps included in this Regional NRM Plan contain more comprehensive, up-to-date information. The different planning boundaries are also important in this context, particularly the inclusion of Hinchinbrook Shire in the Regional NRM planning arrangements. For example, the *FNQ Regional Plan*

Box 33. Case Study – Djabugay fauna survey, partnerships for natural resource management

The Djabugay Ranger Agency is the Cultural Land Management Agency of the Djabugay Tribal Aboriginal Corporation. They received a devolved grant from the NRM Board (Wet Tropics) to implement the recommendations of the Mona Mona Environmental Protection Plan. This involved setting up wildlife corridors, building strategic fencing areas and the rehabilitation of degraded areas to limit threatening processes caused by feral animals and weeds.

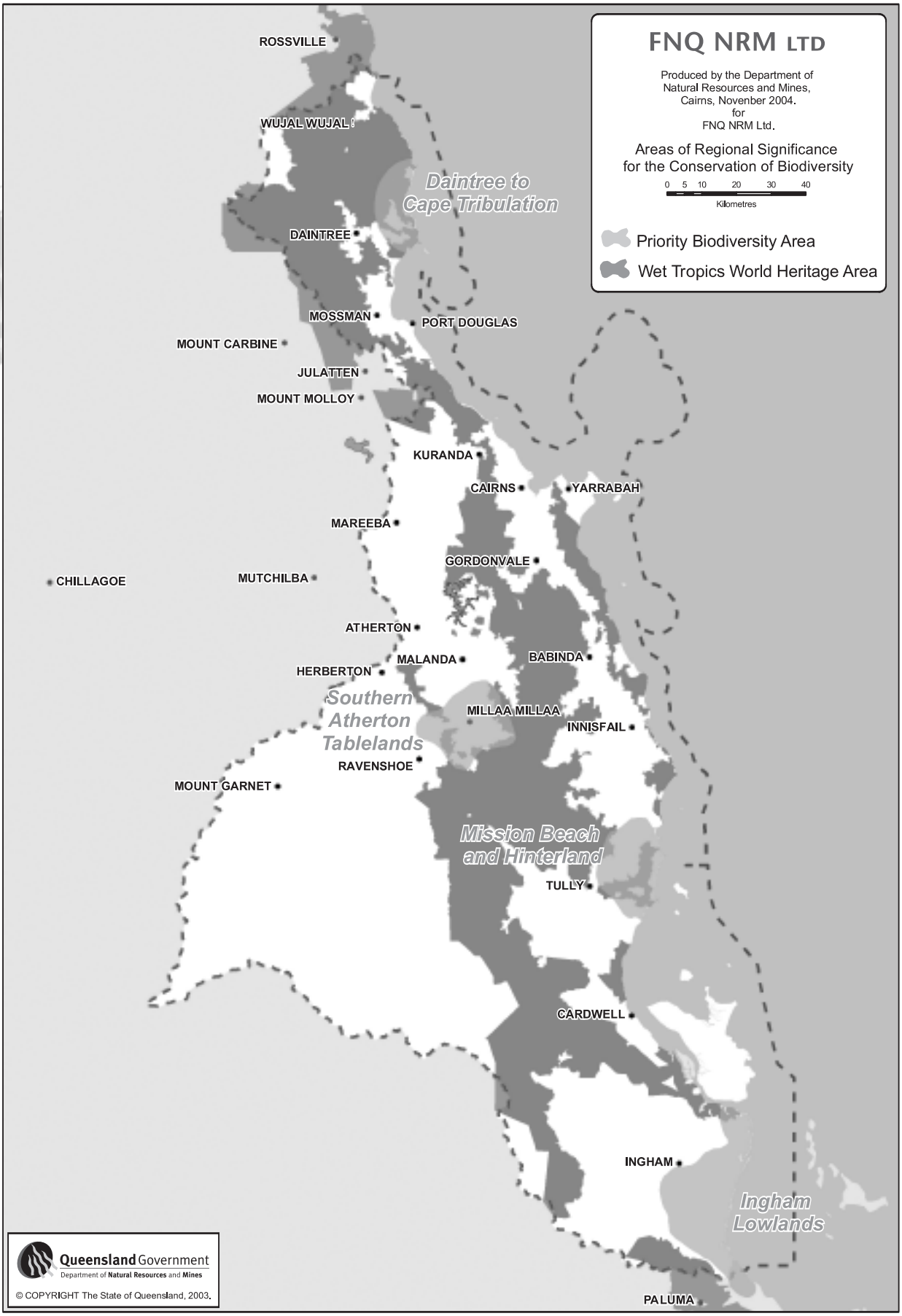
Activities undertaken included:

- Conducting a flora and fauna survey of key habitats in Mona Mona; and
- Implementing the Fauna Protection Plan including identification of habitat corridors.

The partner organisations were the Wet Tropics Management Authority and the Department of Aboriginal and Torres Strait Islander Policy and Development, with on ground support from the Environmental Protection Agency. The project provided an opportunity for people to get back to country and to learn about fauna surveys and the biology of fauna from a western scientific perspective, and for information gained to go back to the community.

"The project was about getting information back to the community. The money was used to get us on to country. We were able to pay four guys to be part of the team...we got to know the differences between melomys and other rats...we are learning more about the species, its biology..." (Barry Hunter Jnr. Forum Proceedings 2002).

Djabugay Fauna Survey (Photo: Barry Hunter Jnr)


FNQ NRM LTD
Produced by the Department of Natural Resources and Mines, Cairns, Novenber 2004. for FNQ NRM Ltd.
Areas of Regional Significance for the Conservation of Biodiversity
0 5 10 20 30 40
Kilometres
Priority Biodiversity Area
Wet Tropics World Heritage Area
ROSSVILLE
WUJAL WUJAL
Daintree to Cape Tribulation
DAINTREE
MOSSMAN
PORT DOUGLAS
MOUNT CARBINE
JULATTEN
MOUNT MOLLOY
KURANDA
CAIRNS
YARRABAH
MAREEBA
GORDONVALE
CHILLAGOE
MUTCHILBA
ATHERTON
MALANDA
BABINDA
HERBERTON
Southern Atherton Tablelands
MILLAA MILLAA
INNISFAIL
RAVENSHOE
MOUNT GARNET
Mission Beach and Hinterland
TULLY
CARDWELL
INGHAM
Ingham Lowlands
PALUMA
Queensland Government
Department of Natural Resources and Mines
© COPYRIGHT The State of Queensland, 2003.

identified three 'Areas of Regional Significance for the Conservation of Biodiversity' (see Figure 10 in the Biodiversity Report). These were:

1. Lowland Forests and Corridors Centered on Mission Beach;
2. Southern Atherton Tableland/Eveleyn. High Quality Rainforest on Basalt Soil; and
3. All Native Unprotected Forest in Lowlands north of Daintree River to Emmagen Creek.

Most experts agree that a fourth area, the coastal lowland forests between Cardwell and Ingham, also has extreme biodiversity significance.

All four areas are shown on the map (left) **Areas of Regional Significance for the Conservation of Biodiversity**.

No net loss

A basic definition of **no net loss** is: *habitat losses must be offset by habitat gains*. However, most definitions are more refined, referring to some measure of habitat extent or quality particularly in terms of ecological functions and values. Some also identify the criteria by which the no net loss policy is triggered (e.g. habitat loss must be unavoidable). However, the basic premise remains – to take something away, you must put it back.

Adapted from Huggett (1998)

4.7 Biodiversity targets and actions

Terrestrial ecosystems (vegetation communities)

Management Action Target (MAT)	*Type of MAT*[9]	*Management Actions*	*Links Targets*	*Potential Partners*
Resource Condition Target (RCT) B1. No net loss of the area of native vegetation across the region by 2008[10]				
B1.1 From 2004 the No Net Loss Principle applied to all developments in respect to native vegetation.	CB	**B1.1.1** Increase community awareness of the importance of native vegetation in respect to: • biodiversity and habitat extent and condition, and • ecological connectivity. **B1.1.2** Develop standard protocols for monitoring and reporting on the extent and condition of native vegetation. See also B2.2; B2.3; B3.1, B3.2; B3.3; B3.4; B7.1, B7.2, B8.2; B8.3, B11.1, B13.1, B14.1, B14.2, B14.3, B16.2, B17.1, B18.1, B19.2, B19.3, B19.4, B20.1, B20.2.	B2, B3, B6, B7, B8, B16, B18, B19, L1, L6, W1, W3, W4.	Aus Govt; NR&M; DPI&F; Corp Sponsors; Traditional Owners.
B1.2 Increase community involvement in monitoring and reporting by 2005.	CB	**B1.2.1** Increase community awareness of existing monitoring programs, especially SLATS. **B1.2.2** Establish and support an on-line integrated information network delivering publicly accessible NRM data, including SLATS. **B1.2.3** Develop and implement a framework for monitoring and evaluation of community-based vegetation works.	B2, B3, B6, B8, B16, B19, L1, L6, W1, W3, W4.	NR&M; DPI&F; Local Govt; Regional GIS Centres, Traditional Owners.
RCT B2. Quality and extent of Regional Ecosystems currently with an 'endangered' or 'of concern' conservation status under the* Vegetation Management Act 1999 *is maintained or improved by 2014				
B2.1 Fill gaps in current knowledge of endangered or of concern REs, especially where they occur outside nature reserves, by 2007.	RA	**B2.1.1** Complete vegetation mapping at 1:25,000 scale across the region. **B2.1.2** Identify and map at 1:10,000 scale all extant remnants of endangered and of concern REs outside nature reserves. **B2.1.3** Ground truth and report on condition of all extant remnants of endangered and of concern REs outside nature reserves. **B2.1.4** Prioritise endangered and of concern REs for conservation management. **B2.1.5** Add information to integrated information network (B1.2).	B1, B3, B8, B16, B19.	R&M; Industry organisations, Traditional Owners.

[9] Types of Management Action Targets: CB- Capacity Building, OGW- On-Ground Works, P- Planning, RA- Resource Assessment & Monitoring.

[10] As measured by SLATS (Statewide Landcover and Trees Study) data

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
B2.2 Review current legislation and recommended practice that allows degradation of endangered and of concern REs by 2008.	P	**B2.2.1** Seek to strengthen the *Vegetation Management Act* in particular to prevent logging of endangered regional ecosystems. **B2.2.2** Develop a *Code of Practice for Native Forest Timber Harvesting on Freehold Land*. **B2.2.3** Maximise the retention and enhancement of endangered and of concern REs under local government planning schemes and other statutory planning instruments. **B2.2.4** Establish environmental management arrangements with relevant agencies to ensure protection of endangered and of concern REs on smaller blocks of public land (e.g. road reserves).	B1, B3, B8, B16, B19.	Aus Govt; NR&M; DPI&F; Corp Sponsors; Traditional Owners.
B2.3 Manage, primarily for conservation, most existing remnants of endangered and of concern REs outside nature reserves by 2014.	OGW	**B2.3.1** Provide landholders with financial and other incentives to retain and enhance endangered and of concern REs on their land. **B2.3.2** See also actions under B1.1.	B1, B3, B5, B6, B8, B16, B18, B19, L1, L7, W1, W3, W4.	NR&M; Research Institutions, Traditional Owners.
RCT B3. Increase in the area, condition and integrity (i.e. net gain) of areas of 'regional biodiversity significance'[11] by 2014				
B3.1 Increase in extent of areas managed primarily for conservation within 'regional management priorities' (Appendix L) by 2008.	OGW	**B3.1.1** Complete CSIRO research into biodiversity surrogates and trade-offs in the region and realign priorities as required. **B3.1.2** Support directed research to fill data gaps (e.g. current management status of areas mapped as 'regional management priorities'; taxonomic studies, monitoring etc. in the Upper Herbert). **B3.1.3** Establish environmental management arrangements with relevant agencies to ensure protection of areas that are 'regional management priorities' on smaller blocks of public land (e.g. road reserves). **B3.1.4** Provide landholders with financial and other incentives to retain and enhance areas that are 'regional management priorities' on their land. **B3.1.5** Develop and implement a monitoring program to assess the effectiveness of financial and other incentives used. **B3.1.6** Encourage and support research into social and financial and other incentives and motivations for vegetation protection, rehabilitation and management. **B3.1.7** Increase community awareness of biodiversity values of vegetation outside of nature reserves and how they are affected by land use practices. **B3.1.8** Increase community awareness of threats to biodiversity i.e. clearing, weeds and pests, unmanaged tourism, fragmentation and degradation. **B3.1.9** In consultation with landholders, develop and promote the adoption of recommended management practice for remnant vegetation.	B1, B2, B6, B7, B8, B9, B12, B14, B16, B18, B19, B20, L1, L7, W1, W3, W4.	NR&M, Main Roads, Local Govt, Traditional Owners.
B3.2 Enhance, reinstate and manage for conservation ten areas mapped as 'regional rehabilitation priorities' (Appendix M) by 2014.	OGW	**B3.2.1** Ensure that all revegetation projects undertaken for ecological restoration purposes that are >1 ha in size are located in regional rehabilitation priority areas. **B3.2.2** Develop cost-effective and innovative methods of vegetation enhancement and reinstatement over large areas. **B3.2.3** Ensure that all enhancement and reinstatement projects are subject to careful and continuous monitoring. **B3.2.4** Publicise and promote the use of existing 'best practice' enhancement and reinstatement information in the region[12].	B1, B2, B6, B7, B8, B9, B12, B14, B16, B18, B19, B20, L1, L7, W1, W3, W4.	Aus Govt, NR&M, DPI&F, Corporate Sponsors, Traditional Owners.

[11] Appendices L,M,N

[12] For example: S Goosem & N Tucker, 1995, *Repairing the Rainforest*; R. Kapitzke and others, 1998, *Guide for Stream Bank Restoration in Tropical North Qld*; see also Catterall et al, 2004.

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
		B3.2.5 Promote the use of the *Wet Tropics Conservation Strategy* to prioritise rehabilitation activities. B3.2.6 Review existing catchment/river rehabilitation plans and promote their use to prioritise activities at local scales within areas mapped as 'regional rehabilitation priorities.'[13] See B1.1		
B3.3. Capture at least 75% of the region's total ecosystem diversity through the national reserve system or otherwise manage for conservation by 2014[14].	P	**B3.3.1** Ensure that examples of lowland vine forest, sedgeland, serpentine, dry rainforest, fringing lake communities (i.e. main reservation priorities) added to the national reserve system or otherwise managed for conservation purposes[15]. **B3.3.2** Include data on the comprehensiveness, adequacy and representativeness of the national reserve system on the integrated information network (B1.2). **B3.3.3** Support and encourage responsible agencies to improve management of reserves.	B1, B2, B6, B7, B8, B9, B12, B14, B16, B18, B19, B20, L1, L7, W1, W3, W4.	Aus Govt, NR&M, DPI&F, Corporate Sponsors, Traditional Owners.
B3.4 Enhance and reinstate areas of cultural significance by Traditional Owners according traditional law and customs by 2014.	OGW	**B3.4.1** Traditional Owners identify and prioritise areas of cultural significance. **B3.4.2** Traditional Owners are supported to enhance and reinstate areas of cultural significance according to traditional law and custom.	A1-6, B1, B3, B6, B8, B9, B11, B16, B19, B21, W1, W3.	Aus Govt, NR&M, ARC, DPI&F, Corporate Sponsors, Local Gov, Traditional Owners.
RCT B4. No new deliberate introductions of ecologically invasive species that threaten terrestrial ecosystems after 2006				
B4.1 Establish protocols that stop the introduction of ecologically invasive species by 2005.	P	**B4.1.1** Regional Pest Management Officer to work with industry groups and agencies to encourage commercial nurseries and transport operators to limit the cultivation and distribution of plants with environmental weed potential. **B4.1.2** Regional Pest Management Officer to work with industries and agencies and through current weed risk assessment processes to encourage more thorough testing of species introduced for production purposes to prevent establishment of environmentally damaging species. **B4.1.3** Regional Pest Management Officer to work with state agencies and industry groups to develop a number of measures, including establishment of network of "wash-down bays", and MoUs with Q-Rail and Port Authorities regarding regular inspection of equipment and facilities, that would reduce weed invasion and spread. **B4.1.4** Regional Pest Management Officer to develop close ties with those responsible for pest management in adjoining NRM regions and develop strategies to restrict movement of pest across regional boundaries. **B4.1.5** Regional Pest Management Officer to develop MoUs with associated councils that sleeper weeds are not propagated within botanic gardens. **B4.1.6** Seek to strengthen statutory instruments to stop deliberate introduction of invasive species. Refer B5.1.2	A2, B2, B3, B5, B8, B9, B16, B18, B19, B20, B21, L1, W3.	Nurseries, Transport Operators, Local Govt, NR&M, DPI&F, Traditional Owners.

[13] See Box 21 p38

[14] Currently 64% (p31)

[15] Complete list of RE priorities to consolidate the national reserve system shown in Biodiversity Report, Table 59

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
RCT B5. Eradication of Category 1 pests under the* FNQROC Regional Pest Management Plan *and strategic eradication or containment of other ecologically invasive species that threaten terrestrial ecosystems by 2014				
B5.1 Implement recommended priority actions from *FNQROC Regional Pest Management Plan* by 2006.	OGW	**B5.1.1** Provide support to landholders engaged in eradicating or implementing long-term control over weeds and pests, as per *FNQROC Regional Pest Management Plan*. **B5.1.2** Appoint and provide administrative and logistic support for a Regional Pest Management Officer to coordinate priority actions as recommended in the *FNQROC Regional Pest Management Plan*. **B5.1.3** Regional Pest Management Officer to develop a contingency plan for Category 1 incursions. **B5.1.4** Regional Pest Management Officer to coordinate a regional monitoring program. **B5.1.5** Regional Pest Management Officer to raise community awareness e.g. through a regional "Weed Watch" program. **B5.1.6** Regional Pest Management Officer to identify research priorities for effective control.	A3, B2, B3, B5, B8, B9, B16, B18, B19, B20, B21, ME1, ME2, L1, W3.	Local Govt, NR&M, Aus Govt, Traditional Owners.
B5.2 Control of weeds, pests and diseases contributing to an improving trend in the condition of terrestrial ecosystems, especially 'regional management priorities' by 2014.	OGW	**B5.2.1** Develop and implement incentives and support programs (e.g. supply of herbicides) in areas mapped as 'regional management priorities' to reduce impacts on ecological systems. **B5.2.2** Undertake targeted pest control programs in areas mapped as 'regional management priorities' to reduce impacts on ecological systems. **B5.2.3** Promote the use of the *Wet Tropics Conservation Strategy* to prioritise pest control activities where world heritage values are concerned. **B5.2.4** Develop a code of practice for the tourism industry to prevent the spread of diseases such as chytrid fungus and Phytophthora (rainforest dieback) across the region. **B5.2.5** Continue ongoing monitoring of Phytophthora-related dieback at established sites in upland and highland rainforest sites to determine long-term impacts. **B5.2.6** Promote community awareness of the *Phytophthora Code of Practice for Walking Tracks*.	A3, B2, B3, B5, B8, B9, B16, B18, B19, B20, B21, L1, W3.	Local Govt NR&M, Aus Govt, WTMA, DPI&F, Traditional Owners.
B5.3 Reduce the negative impact of weeds and pests on Aboriginal cultural values and assets; and recognise in policy, planning and management the cultural value of weeds and pests by 2009.	P	**B5.3.1** Recognise Traditional Owner groups and organisations as key delivery organisations for the management of pest plants and animals. **B5.3.2** Implement weed and pest eradication programs targeted to protect cultural and natural heritage (see also B5.1, B5.3.5). **B5.3.3** Develop an educational campaign to increase the awareness of NRM stakeholders about Aboriginal values for pest plants and animals. **B5.3.4** Undertake research to establish the cultural significance and extent of impacts on cultural values of introduced plants and animals for Traditional Owners. **B5.3.5** Assist implementation of the *FNQROC Regional Pest Management Plan* by establishing links & active exchange with Traditional Owner groups regarding pest management issues. **B5.3.6** Ensure that feral pig baiting programs are designed in consultation with Traditional Owners to consider the impact on human use.	A2, A3 A4, A5, A6, B21.	Traditional Owner Organisations, ARC, NR&M, DPI&F, Local Govt, Aus Govt, WTMA, Research Institutions, Traditional Owners.
RCT B6. Terrestrial ecosystems being managed for key threatening processes (other than ecologically invasive species) by 2014				
B6.1 Benchmarks and monitoring programs are in place, especially in areas mapped as 'regional management priorities' by 2006, (see Appendix L).	RA	**B6.1.1** With appropriate agency input, develop benchmarks and monitoring programs as a basis for managing key threatening processes such as altered fire regimes, grazing pressure, visitor impacts etc. **B6.1.2** Develop a MoU with adjacent Regional NRM Bodies (Burdekin-Dry Tropics, Northern Gulf, Cape York) on cross-regional delivery of programs for habitat management.	A4, B1, B2, B3, B16-B21.	Aus Govt, NR&M, DPI&F, NRM, Bodies, Traditional Owners

Inland Aquatic Ecosystems (Rivers and Wetlands)

Management Action Target (MAT)	*Type of MAT[16]*	*Management Actions*	*Links Targets*	*Potential Partners*
RCT B7. All wetlands of particular biodiversity significance protected from active clearance (direct and by grazing) and managed for conservation purposes by 2014				
B7.1 Protect and manage for conservation all wetlands mapped as having National and State significance by 2010.	OGW	**B7.1.1** Raise Government, community and landholder awareness of the ecological function and value of wetlands. **B7.1.2** Assist local government to incorporate mechanisms for the protection and management of significant wetlands in their planning and development assessment processes. **B7.1.3** Provide landholders with financial and other incentives to protect and enhance significant wetlands on their land (e.g. fencing, stock removal, provision of off-site watering points, weed control). **B7.1.4** Develop and implement strategies for the management of wetlands of National and State significance. See also B9.1	B3; B18, B19, L1, W1, W3, W4.	Industry Groups, NR&M;, Research Institutions, LGAQ Local Govt, DLGP, DPI&F, Traditional Owners.
B7.2 Protect and manage for conservation purposes additional wetlands of regional significance by 2008.	OGW	**B7.2.1** Complete whole of Government wetland mapping and inventory project to identify biodiversity values and priorities for action and realign priorities as required. **B7.2.2** Assist local government to incorporate mechanisms for the protection and management of significant wetlands in their planning and development assessment processes. **B7.2.3** Provide landholders with financial and other incentives to protect and enhance significant wetlands on their land. **B7.2.4** Develop and implement strategies for the management of wetlands of regional significance. **B7.2.5** Develop a complete inventory on biodiversity value, condition and management status of all significant wetlands across the region and include data on the integrated information network (B1.2).	B3; B18, B19, L1, W1, W3, W4.	Aus Govt, DPI&F, NR&M, Local Govt, DLGP, LGAQ, CSIRO, Traditional Owners.
RCT B8. Quality and extent of riparian ecosystems maintained and improved by 2014				
B8.1 Apply the No Net Loss Principle to all developments with respect to riparian vegetation, from 2004.	CB	**B8.1.1** Increase community awareness of the importance of riparian vegetation in respect to terrestrial and aquatic habitat, bank stability, nutrient and sediment filtration. **B8.1.2** Develop standard protocols for monitoring and reporting on the extent and condition of riparian vegetation. See also B1.1	B1, B2, B7, B9, B16, B18, B19, B20, L1, L7, W1, W3, W4.	Aus Govt, NR&M, DPI&F; Corporate Sponsors, Traditional Owners.
B8.2 Protect and manage for conservation purposes existing riparian vegetation on all significant waterways (see Appendix N) by 2008.	OGW	**B8.2.1** Assist local governments to incorporate mechanisms for the protection and management of riparian vegetation in their planning and development assessment processes. **B8.2.2** Provide landholders with technical advice, financial and other incentives to protect and enhance riparian vegetation on their land (e.g. fencing, stock removal, provision of off-site watering points). See B3.1	B1, B2, B6 -B9, B16, B18 - B20, L1, L7, W1, W3, W4.	DPI&F, NR&M, Aus Govt, Traditional Owners.
B8.3 Reinstate where absent and manage for conservation purposes riparian vegetation on all significant waterways (see Appendix N) by 2014.	OGW	**B8.3.1** Provide technical advice and incentives to landholders to enhance and reinstate riparian zones on their land. **B8.3.2** Encourage and support additional research, involving landowners, into various aspects of riparian revegetation such as optimum widths, legal rights, costs and benefits etc. **B8.3.3** Review existing catchment/river rehabilitation plans[17] and promote their use to prioritise activities at local scales. **B8.3.4** In conjunction with Traditional Owners conduct a cultural heritage survey of riparian areas before commencing on-ground activities. See B3.2	B1, B2, B7, B9, B16, B18, B19, B20, L1, L7, W1, W3, W4.	NR&M; DPI&F; Traditional Owner Groups; Aus Govt, Traditional Owners.

[16] Types of Management Action Targets: CB- Capacity Building, OGW- On-Ground Works, P- Planning, RA- Resource Assessment & Monitoring.

[17] See Box 22

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
RCT B9. Quality and extent of inland aquatic ecosystems maintained or improved by 2014				
B9.1 Increase understanding of the physical and biological requirements of inland aquatic ecosystems by 2010.	CB	**B9.1.1** Determine what environmental flows are critical to maintaining aquatic habitat, especially in waterways of particular biodiversity significance, through statutory water resource panning processes (See also W1, p109). **B9.1.2** Support directed research to fill data gaps (e.g. effect of riparian vegetation cover on aquatic ecological function; why so many floodplain lagoons support so few fish species cf. what they should support). **B9.1.3** Raise Government, community and landholder awareness of the ecological function and value of clean water and healthy aquatic habitats (snags, pools, riffles).	B7 - B9, B16 - B20, L1, L7, W1, W3, W4.	Research Institutions NR&M; DPI&F, Traditional Owners.
B9.2 Protect and manage for conservation purposes key freshwater habitat by 2014.	OGW	**B9.2.1** Identify key habitat areas for freshwater fishes, especially rare and threatened species or those with restricted distributions, and realign priorities as required. **B9.2.2** In conjunction with landholders, develop and implement guidelines for the management of key freshwater habitats, including development controls that prevent the further channelisation of watercourses. **B9.2.3** Provide technical advice and incentives to landholders to rehabilitate aquatic habitats (e.g. strategic placement of snags).	B7, B8, B9, B16, B17, B18, B19, L1, L7, W1, W3, W4.	DPI&F; Research Institutions Traditional Owners.
B9.3 Remove and/or modify all existing barriers to fish movement by 2014.	OGW	**B9.3.1** Investigate and remove redundant fish barriers or modify fishways, especially in key regional freshwater fish habitat areas (e.g. temporary removal of drop boards or raising of floodgates, restoring overland flow paths, improving water quality i.e. chemical barriers, altering aquatic habitat of stream sections that are channelised or dominated by weeds).	B16, B17, B19, W1, W2.	DPI&F, NR&M, Traditional Owners.
B9.4 Establish benchmarks and water quality monitoring programs by 2005.	RA	**B9.4.1** Identify and facilitate the collection, collation and analysis of detailed catchment data as a basis of land management. See also W1, W3.	B10, B12, B14, W1, W3, L1.	NR&M, RWQPP, Partners, Traditional Owners.
B9.5 Increase community involvement in monitoring of inland aquatic ecosystems by 2006.	CB	**B9.5.1** Increase community awareness of existing monitoring programs. **B9.5.2** Establish and support an on-line integrated information network delivering publicly accessible data. **B9.5.3** Engage local communities in key waterway and wetland and waterway monitoring and assessment. See also W1, W3.	B7, B8, B9, B16, B17, B18, B19, L1, L7, ME1, ME2, W1, W3, W4.	Local Govt, WTMA, Industry Groups, NR&M, DPI&F, RWQPP Partners, Traditional Owners.
RCT B10. No new deliberate introductions of ecologically invasive species that threaten inland aquatic ecosystems after 2006				
B10.1 Establish protocols that stop the introduction of aquatic invasive species by 2005.	P	**B10.1.1** Establish a code of practice for aquarists, commercial nurseries and transport operators to control spread of aquatic plants with environmental weed potential. **B10.1.2** Undertake an education program to encourage regular hull cleaning by boat owners to control the spread of aquatic weeds. **B10.1.3** Adopt DPI&F *Control of Exotic Pest Fish Strategy* where appropriate, particularly carrying out an education program to discourage the translocation of native and exotic fish species (including release of aquarium fish). **B10.1.4** Raise community and landholder awareness of DPI&F Fish Habitat Guidelines and NR&M Ponded Pasture Policy. **B10.1.5** Encourage more thorough testing of ponded pasture species introduced for production purposes to prevent establishment of ecologically invasive species.	B16, B17, B19.	Commercial Nurseries, Transport Operators, Local Govt, NR&M, DPI&F, Traditional Owners.

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
RCT B11. Eradication of Category 1 pests under the FNQROC* Regional Pest Management Plan *and strategic eradication or containment of other ecologically invasive species that threaten inland aquatic ecosystems by 2014				
B11.1 Control of aquatic weeds and pests contributing to an improving trend in the condition of inland aquatic ecosystems, especially 'significant waterways and wetlands' by 2014.	OGW	**B11.1.1** Determine key wetland environments for priority aquatic weed management and type of program required. **B11.1.2** Removal and follow-up management of floating aquatic weeds (e.g. water hyacinth – especially for Lower Herbert). **B11.1.3** Control of semi-aquatic grasses such as para grass and hymenachne, especially in coastal floodplain wetlands (control to a point where they do not dominate habitat). **B11.1.4** Encourage and provide financial assistance to landholders to participate in weed management of their local wetlands. **B11.1.5** Support local government to strategically control aquatic weeds in priority wetlands. **B11.1.6** Develop a tilapia management strategy for Wet Tropics waterways. **B11.1.7** Determine the distribution and most harmful locations of translocated native and exotic fishes, and develop containment and management strategies. See also B5.1, 5.2, 5.3.	B16, B17, B19.	DPI&F, Traditional Owners.

Estuarine, Coastal and Marine Ecosystems

Management Action Target (MAT)	*Type of MAT*[19]	*Management Actions*	*Links Targets*	*Potential Partners*
RCT B12. Progressive improvement in condition of coastal, estuarine and marine ecosystems by 2014				
B12.1 Document the quality and extent of estuarine, coastal and marine ecosystems by 2008.	RA	**B12.1.1** Collate information on existing coastal, intertidal and sub-tidal habitats for extension to stakeholder groups. **B12.1.2** Identify gaps in knowledge and build partnerships with stakeholders to map missing habitats. **B12.1.3** Supplement EPA *Regional Coastal Management Plans* with reporting on condition of all extant coastal habitats above highest astronomical tide. **B12.1.4** Prioritise endangered and of concern ecosystems for conservation management. **B12.1.5** Add information to integrated information network (B1.2).	B17, L1, L3, W1, W3, W4.	GBRMPA, QPWS, DPI&F, NR&M, Local Govt, Aus Govt, Traditional Owners.
B12.2 Establish programs to address threats to fisheries habitats by 2008.	P	**B12.2.1** Facilitate interaction between user groups, managers and researchers to build capacity for sustainable management of marine ecosystems. **B12.2.2** Establish a working group to prioritise R&D initiatives that address specific threats to coastal and marine habitats. **B12.2.3** In association with Local Marine Advisory Committees, develop regional extension and reporting network for marine habitats.	A2, B4, B8, B10.	GBRMPA, DPI&F, AIMS, CSIRO; JCU, Local Govt, Traditional Owners.
B12.3 Improve connectivity between freshwater and marine environments by 2010.	OGW	**B12.3.1** Remove or modify redundant barrages in tidally influenced waterways. **B12.3.2** Monitor changes in fauna and flora assemblages to gauge the success of barrage removal. **B12.3.3** Provide incentives for coastal landholders to remove obstructions to tidal flow.	B14, B17.	Local govt, DPI&F, NR&M, Main Roads, Traditional Owners.

[19] Types of Management Action Targets: CB- Capacity Building, OGW- On-Ground Works, P- Planning, RA- Resource Assessment & Monitoring.

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
B12.4 Involve the community in monitoring the extent and condition of coastal and marine ecosystems by 2006.	CB	**B12.4.1** Engage community in estuarine, coastal and marine monitoring and assessment. **B12.4.2** Identify and facilitate the collection, collation and analysis of detailed catchment data. See also B9, W1, W3.	B10, B12, B13, B14, W1, W3, L1, ME1, ME2.	GBRMPA, DPI&F, AIMS, CSIRO; JCU, Local Govt, Traditional Owners.
RCT B13. Reduce the impacts of commercial shipping and ports infrastructure on estuarine and marine ecosystems by 2014				
B13.1 Minimise the loss of coastal ecosystems through better management of existing port areas by 2010.	P	**B13.1.1** Maximise the economic potential of port areas by incorporating economic and environmental performance criteria for port leases areas. **B13.1.2** Providing financial incentives to relocate non-essential infrastructure from port-managed land. **B13.1.3** Assist the ports authorities with the rehabilitation of remnant ecosystems within port limits. **B13.1.4** Promote the incorporation of modern waste reception and pollution mitigation facilities at ports, wharves, marinas and slipways.	B11, B15, B17.	Local Govt, GBRMPA, PCQ, Main Roads DPI&F, Traditional Owners.
B13.2 Increase community involvement in monitoring and reporting introduced marine species by 2008.	CB	**B13.2.1** Support and encourage preparation and distribution of a introduced marine species guide for communities in northern Australia. **B13.2.2** Facilitate the involvement of recreational groups in introduced species monitoring and education programs.	A4, A5, B12, B17, CB1.	Local Govt, GBRMPA, WTMA, Industry Groups, NR&M, DPI&F, Traditional Owners.
RCT B14. No further decline in coastal resources associated with land development by 2014				
B14.1 Apply the No Net Loss Principle to all coastal and marine developments in respect to native vegetation from 2004.	CB	**B14.1.1** Develop and implement a targeted program to encourage landholders to preserve remnant coastal vegetation, especially in areas of particular biodiversity significance. **B14.1.2** Promote strategic coastal planning to prevent the duplication of infrastructure (marinas, wharves, slipways, roads, bridges) that impact on coastal and marine habitats. **B14.1.3** Develop standard protocols for monitoring and reporting on the extent and condition of coastal vegetation. See also B1.1.	B2, B3, B9, B13, CB1, W1, W3, W4, L1, L5, L8.	Aus Govt, NR&M, DPI&F; GBRMPA, Corporate Sponsors, Traditional Owners.
B14.2 Assist Local Government to have the capacity to improve the environmental outcomes for coastal developments by 2007.	CB	**B14.2.1** Provide technical support for Local Government to assist with the implementation of community based management of the coastal zone. **B14.2.2** Facilitate interaction between regulatory agencies, researchers and local governments via regional symposia and workshops to build the capacity of all stakeholders. **B14.2.3** Assist Local Government to integrate requirements of EPA *Regional Coastal Management Plans* into planning schemes. **B14.2.4** Incorporate best practice guidelines for planning and siting of coastal industries into planning, management and assessment processes.	B10, B14, L3, W3.	Local Govt, NRM Bodies, GBRMPA, DPI&F, Research Agencies.
B14.3 Develop industry specific environmental mitigation standards for coastal industries by 2008.	P	**B14.3.1** Establish benchmarks and water quality monitoring programs as a basis of land management. **B14.3.2** Develop best practice guidelines for mitigation of environmental impacts from coastal industries. **B14.3.3** Incorporate mechanisms for rehabilitation of abandoned industrial sites that have ceased operation.	B10, B12, B13, B16, L1, W1, W3.	Industry groups, DPI&F, GBRMPA.

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
B14.4 Improve the understanding of coastal and marine biodiversity issues within the broader community (including schools) by 2010.	CB	**B14.4.1** Promote existing programs that engage the community in understanding of biodiversity issues. **B14.4.2** Develop training material that better describes biodiversity change in the Wet Tropics Region and the implications (eg water extraction and the salinisation of river systems). **B14.4.3** Link biodiversity monitoring to climate modelling to identify ecosystems at risk.	A5, B19, C2, CB1.	DPI&F, NR&M, Local govt, GBRMPA, WTMA, Traditional Owners.
RCT B15. Traditional Owner values and priorities for sea country are identified and protected by 2014				
B15.1 Develop and implement agreements that allow for long-term cooperative management of coastal and marine resources by 2010.	P	**B15.1.1** Document Traditional Owner values and priorities for sea country in a culturally appropriate manner. **B15.1.2** Recognise and protect Traditional Owner values and priorities for sea country in all policy, planning and management arrangements. **B15.1.3** Promote greater understanding of cultural significance and Aboriginal use of coastal and marine resources. **B15.1.4** Develop cooperative agreements for management of sea country with state and federal regulatory agencies (including Traditional Use of Marine Resources Agreements). **B15.1.5** Support Traditional Owner groups to develop country-based fishery and resource management plans. **B15.1.6** Facilitate the involvement of Traditional Owners in the development of fishery and resource management plans at the regional scale. **B15.1.7** Assess current use and future requirements of Traditional Owners and incorporate into fishery and resource management plans at the regional scale.	A2-A6, B11, B15, CB1.	Traditional Owner Organisations , Rep Bodies, DPI&F, AFMA, GBRMPA.

Significant Species and Ecological Communities

Management Action Target (MAT)	*Type of MAT*[20]	*Management Actions*	*Links Targets*	*Potential Partners*
RCT B16. Critical habitat of threatened species*[21] *protected and managed to allow recovery and long term viability by 2014				
B16.1 Review current legislation that allows degradation of critical habitat by 2006.	P	**B16.1.1** Investigate the possibility of threatened species habitats and EPBC Act listed vegetation communities to be recognised as areas of high conservation value under State legislation (including regenerating habitat areas). See also B2.2.	B1, B2, B3, B6, B7, B8, B9, B12, B14, B17, B18, B19, B20.	NR&M, WTMA, Aus Govt,
B16.2 Protect and manage for conservation purposes critical habitat for threatened species by 2008.	OGW	**B16.2.1** Establish environmental management arrangements with relevant agencies to ensure protection of critical habitat that is on smaller blocks of public land (e.g. road reserves). **B16.2.2** Provide landholders with financial and other incentives to retain and enhance critical habitat on their land. **B16.2.3** Complete fine scale habitat mapping for threatened species[22]. **B16.2.4** Develop and implement appropriate fire and grazing regimes in critical habitat areas. **B16.2.5** Incorporate Aboriginal traditional law and customs into all fire management in the region. **B16.2.6** Lobby for implementation of appropriate fire and other management regimes for the protection of threatened species habitat on State-managed lands.	B1, B2, B3, B6, B7, B8, B9, B12, B14, B17, B18, B19, B20, C2, CB1, L1, W1.	WTMA, Aus Govt, Local Govt, DLGP, Traditional Owners.

[20] Types of Management Action Targets: CB- Capacity Building, OGW- On-Ground Works, P- Planning, RA- Resource Assessment & Monitoring.

[21] See Biodiversity Report Appendix C

[22] Already completed for cassowaries and mahogany gliders

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
RCT B17. Improved protection for significant coastal and marine species and the habitats that support them by 2014				
B17.1 Implement ecosystem based management of significant coastal and marine species, incorporating changes in habitat and climate by 2010.	OGW	**B17.1.1** Document extent, diversity and condition of estuarine, coastal and marine habitats for significant species. **B17.1.2** Facilitate the introduction of restricted access areas and navigation aids to protect important aquatic habitats from vessel damage (e.g. shallow seagrass meadows). **B17.1.3** Assist local government with targeted on ground works to restrict vehicle and dog access to beach and foreshore areas that support roosting, nesting and feeding birds.	A2, B4, B8, B10, CB1, ME1.	GBRMPA, DPI&F, AIMS, CSIRO, JCU, Local Govt, Traditional Owners, Community Groups.
B17.2 Facilitate inter and intra-regional programs for the management of wide ranging marine species by 2006.	P	**B17.2.1** Encourage research into the habitat requirements of significant coastal, estuarine and marine species. **B17.2.2** Identify knowledge gaps in the requirements of non-listed coastal, estuarine or marine species that are important to the community. **B17.2.3** Facilitate community involvement in existing programs for bird, turtle, dugong and cetacean monitoring, in conjunction with management agencies. **B17.2.4** Ensure that the results of important species monitoring programs are extended to stakeholder groups (including the broader community and industry).	A3, B10, CB1, ME1.	NRM Bodies, Research Institutions, GBRMPA, DEH, DPI&F, Traditional Owners, Community Groups.
RCT B18. All ecological communities listed as 'critically endangered' under the EPBC Act protected and managed for conservation purposes by 2008				
B18.1 Increase the area of Mabi forest communities protected and managed for conservation purposes by 2008.	OGW	**B18.1.1** Identify and map at 1:10,000 scale remaining remnants of Mabi forest communities outside nature reserves. **B18.1.2** Establish environmental management arrangements with relevant agencies to ensure protection of Mabi forest on smaller blocks of public land (e.g. road reserves). **B18.1.3** Provide landholders with financial and other incentives to retain and enhance areas of Mabi forest on their land. **B18.1.4** Support community group involvement in activities such as on-ground maintenance and negotiations with landholders for extension of key habitats.	B1, B3, B4.	Aus Govt; Local Govt; WTMA, Community Groups, Traditional Owners.
RCT B19. No decline in the conservation status of any native species[23] or regional ecosystem by 2014.				
B19.1 Make available to the community information on status of significant species and ecosystems by 2006.	CB	**B19.1.1** Complete biodiversity audits for Local Government to develop shire biodiversity plans. **B19.1.2** Encourage ecological research of significant species and ecosystems to assist recovery planning. **B19.1.3** Add information to integrated information network (B1.2).	B3, B6, B12, B14, B16, B17, B20, C2.	WTMA, NR&M, DPI, Research Institutions DLGP, Local Govt.
B19.2 Local Government planning schemes recognise and protect habitats of significant species and ecosystems by next IPA review.	P	**B19.2.1** Audit levels of protection within local government planning schemes. **B19.2.2** Assist Local Government to develop planning scheme mechanisms that protect regionally significant habitat and ecosystems. **B19.2.3** Promote model planning scheme and by law mechanisms that address the risks associated with pets and wildlife, especially in priority biodiversity areas. **B19.2.4** Develop and implement long term support systems to assist Local Government to manage for biodiversity outcomes. See also B1.1	B3, B6, B12, B14, B16, B17, B20, C2, L1, W3.	Local Govt, DLGP, WTMA,DPI&F, Research Institutions.

[23] See Background Report Appendix C

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
B19.3 Resource and implement recovery plans to protect regionally significant species and ecosystems by 2009.	OGW	**B19.3.1** Recovery actions implemented as per all Recovery Plan[24] schedules. **B19.3.2** EPBC Act nomination, listing and implementation of an integrated recovery plan for type 1a, 1b, 5a and 5b forest; RE 7.3.2 (Stanton Type 89 Wetland communities within volcanic craters).	B3, B6, B12, B14, B16, B17, B20, C2.	WTMA, NR&M, DPI&F, Research Institutions, DLGP, Local Govt, Traditional Owners
B19.4 Increase the capacity of regional communities to manage for biodiversity conservation outcomes by 2009.	CB	**B19.4.1** Establish and run a regional biodiversity working group to develop innovative methods of conserving biodiversity. **B19.4.2** Develop and implement targeted education programs to engage urban communities in biodiversity conservation. **B19.4.3** Undertake an education program to encourage responsible pet ownership by landholders, particularly in urban and rural-residential areas, to prevent predation of native species. **B19.4.4** Utilise the iconic status of threatened species to attract resources for conservation of priority species and ecosystems from broad sources including the corporate sector. **B19.4.5** Undertake research into finding acceptable solutions to manage the impact of endemic species on agriculture (and vice versa) and disseminate results. **B19.4.6** Adopt Best Practice Species Management in all NRM activities (e.g. Crane Friendly Wetland Management – Fencing Guidelines).[25] **B19.4.7** Incorporate managing for biodiversity outcomes in all NRM activities, including BMPs developed by various industry groups.	B1-3, B6, B7, B8, B9, B12, B14, B15, B16, B17, B18, B19, B20, C2, CB1, ME1.	DLGP, LGAQ, Local Govt, WTMA, Industry Groups, NR&M, DPI&F, DSD, Traditional Owners.
B19.5 Increase community involvement in monitoring and reporting of significant species and ecological communities by 2005	CB	**B19.5.1** Increase community awareness of existing monitoring programs. **B19.5.2** Promote and support existing programs that engage the community (e.g. annual spectacled flying-fox census, Birds Australia NQ Group's crane count).	B1, B2, B3, B6, B8, B16, B19, CB1, W1, W3, W4, L1, L5, ME1, ME2.	WTMA, Community Groups, GBRMPA, Traditional Owners.
RCT B20. The world heritage values of the Great Barrier Reef and Wet Tropics maintained by 2014				
B20.1 Recommended priority actions from Wet Tropics Conservation Strategy implemented by 2014.	OGW	**B20.1.1** See Box 31 (p42) for priority actions. See also B1.1	B1, B3, B5, B6, B8, B16, B19, C2, CB1, ME1.	WTMA, Research Institutions, Traditional Owners, Local Govt.
B20.2 Key recommendations of the Daintree Futures Study implemented by 2008.	OGW	**B20.2.1** Implement buyback program in the Daintree area north of the river. **B20.2.2** Assist Douglas Shire Council to implement temporary and long-term planning controls to ensure further development that does occur north of the Daintree River does not adversely affect ecological integrity. See also B1.1.	B1, B3, B5, B6, B8, B16, B19, C2	WTMA, Research Institutions, DSC, Community Organisations, Traditional Owners, State Govt, Aus Govt.

[24] Approved Recovery Plans have been developed for seven animals or animal groups in the region being: 1. Southern Cassowary; 2. Mahogany Glider; 3. Northern Bettong; 4. Marine Turtles; 5. Stream Dwelling Rainforest Frogs; 6. Magnificent Broodfrog; 7. Cave-Dwelling Bats. Recovery Plans can be viewed on the Department of the Environment and Heritage website http://www.deh.gov.au/biodiversity/threatened/recovery/list-common.html

[25] Developed by Elinor Scambler for the International Crane Foundation. Contact <cranesnorth@austarnet.com.au>

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
B20.3 Recommendations of the Reef Water Quality Protection Plan implemented by 2010.	OGW	**B20.3.1** With all levels of Government and stakeholders, undertake actions, develop mechanisms and partnerships to build on existing Government policies and industry and community initiatives. See also W3, W4.	B1, B3, B5, B6, B8, B16, B19, C2, CB1.	RWQPP Partners, Aus Govt, State Govt, Local Govt, Traditional Owners.
RCT B21. All native species of Aboriginal cultural significance are protected and managed to the satisfaction of Traditional Owners by 2014				
B21.1 Recognise Traditional Owner values and priorities for the use and management of culturally significant species in all policy, planning and management arrangements by 2008.	P	**B21.1.1** Review Traditional Owner engagement within Local Government, WTMA, GBRMPA, EPA and other planning and species management programs. **B21.1.2** Promote the employment and recognition of Traditional Owners as consultants in the research and management of threatened species. **B21.1.3** Promote Traditional Owner organisations as key delivery organisations for the management of species of biological and cultural significance. **B21.1.4** Determine the status and threats to culturally significant flora and fauna and promote greater awareness and understanding of Traditional Owner values for flora and fauna. **B21.1.5** Consult with Traditional Owners to ensure that culturally significant species are incorporated into all revegetation projects.	A2, A3, A4, A5, B15.	Traditional Owners, ARC, GBRMPA, WTMA.

5.0 Climate

5.1 Goal

Clean air and zero net greenhouse emissions in the Wet Tropics Region.

5.1.1 Climate: overview of the asset and the services it provides

The term 'climate' in the context of this plan includes both the condition of the atmosphere itself and the variability and trends of its weather systems. The climate of the Wet Tropics is unique in Australia, and in conjunction with the landscape, generates the necessary inputs for all other resources, including the extraordinarily high level of biodiversity discussed in the previous chapter. Because of this, any threats to the atmospheric system will have broad ranging impacts on all other assets discussed in this Plan, and any actions that minimise these threats will have benefits in many other areas.

Wind farm near Ravenshoe (Photo: Steve Dawson)

Aboriginal Values

Knowledge of seasonal variation was of vital importance in understanding when resources were available. People's ability to link events in the natural world to a cycle that permitted the prediction of seasonal events was a key factor in survival. Today, many Aboriginal people have extensive knowledge about these factors and understand that the reaction of certain plants and animals can be used to determine what is happening in the environment. In the Wet Tropics seasonal indicators informed Aboriginal people when different plants were fruiting or when certain animals were 'fat' and ready to eat.

The seasons also reflected when certain animals would be pregnant or birthing and hence when not to eat certain animals or take certain plants (WTMA website).

Rainforest Aboriginal cultures typically identify five seasons. The following is a summary of the five seasons identified by Kuku-Yalanji people in the Wujal Wujal area (Anderson 1984):

kambar	'proper wet time', heavy rainfall period (late December – March);
kabakabada	'winter rain time', occasional late rain (April – May);
buluriji	'cold time', drier weather, colder nights (June – September);
wungariji	'hot time', height of dry season (October – early November); and
jarramali	'storm time', thunderstorms and build-up of wet (late November – mid December).

In addition to the understanding of seasonal conditions, the Indigenous community holds invaluable information regarding anecdotal evidence of ecosystem vulnerability to specific climate thresholds. Aboriginal people in the region have linked the unseasonal behavior of a number of native species to global climate change and are concerned about the loss of biodiversity as a result of expected increases in temperature in the region.

5.1.2 Status and Threats

Although Cairns is the largest centre in the region it has no major industrial activity and so pollution is not considered to be an issue of concern. North Queensland does, however, show an increasing trend in UV radiation at a rate that is relatively higher than for other regions due to the degradation of the stratospheric ozone layer, a trend that may result in a higher risk of skin cancer and cataracts in humans. Changes to the stratospheric ozone layer might also lead to as yet undefined changes in the temperature profile and large-scale air circulations of the atmosphere which may affect the region.

Without doubt though, the greatest threat to the climate of the region is that of enhanced climate change resulting from an increase in greenhouse gasses in the atmosphere. New and stronger evidence reported by the Intergovernmental Panel on Climate Change attributed most of the warming observed over the last 50 years to human activities. Both maximum and minimum temperatures have increased across Queensland since 1957 by up to 1.5°C and are expected to increase by a further 0.3 to 5.2°C by 2070 in the Wet Tropics Region.

Increasing temperatures are expected to result in numerous climate changes and complex impacts to the region such as:

- Increased number of extreme hot days above 35°C;
- Sea level rise by up to 90cm by 2100 and increased storm surge levels;
- Increased evaporation and reduced water availability;
- Changes in extreme events, such as cyclones, and shorter return times;
- Increased incidence in flood and possible erosion events;
- Increased water demand and irrigation requirements, heat stress in crops and increased drought severity;
- Potential shoreline recession, inundation of coastal lowlands and salt-water intrusion of estuaries and aquifers and reduced coastal habitats due to changes in tidal inundation;
- Loss of coral reefs;
- Changes to rainforest habitats, tree species and vegetation quality and reduction in upland rainforest habitats;
- Increased extinction rate; and
- Changes to the agricultural growing season.

Reducing the future impacts of climate change relies primarily on the reduction of greenhouse gas emissions, increases in carbon sinks and the development of clear adaptation strategies for each region. Changes will in many cases be complex and difficult to quantify. However, many of the steps can be initiated at a 'no regrets' level until more specific data is available.

No regrets

No regrets options are by definition GHG emissions reduction options that have negative net costs, because they generate direct or indirect benefits that are large enough to offset the cost of implementing the options.

Intergovernmental Panel on Climate Change (2001)

5.1.3 Management response

In 1998, Australia became a signatory to the Kyoto Protocol, agreeing to limit its greenhouse emissions to within 8% above 1990 levels. However, the Australian Government has yet to ratify the Protocol and it will not be bound externally unless and until this happens.

The Australian Greenhouse Office (AGO) in Canberra is the lead agency responsible for Greenhouse issues and the National Greenhouse Strategy (NGS) outlines strategies to address emissions reduction, adaptation measures and education. National emissions of greenhouse gasses are audited annually by the National Greenhouse Gas Inventory (NGGI), which details emissions by State and sector. The latest results show Australia's net greenhouse emissions for 2002 were 550.1 Mt of carbon dioxide-equivalent (CO_2-e), 1.3% above the 1990 levels.

Box 34. The carbon balance

The carbon balance is important from the perspective of climate change since regions that are net sources of atmospheric carbon contribute to the global build up of carbon dioxide (CO_2) in the atmosphere. Two factors overwhelmingly determine a regions contribution to the build up of CO_2 in the global atmosphere: 1) use of fossil carbon; and 2) land use change. Since the Wet Tropics has a highly developed economy, people here have very high per capita rates of energy consumption, mostly coming from fossil fuel. Additionally, forest clearing adds somewhat to the total emissions of carbon. Unless the region's ecosystems are very large sinks for this emitted carbon, the region is a source of atmospheric CO_2 and contributes, albeit in a small way (due to its small population and land area), to global warming.

Neither the size of the carbon 'pool' or changes are known with precision in the Wet Tropics. We do know that the Wet Tropics cooler, highland rainforests have some of the highest densities of biomass found anywhere in the world. We also know that carbon flux measurements in the Daintree lowlands have demonstrated that in wet years the forest is a net sink for carbon, but in dry years it is more neutral.

The State of Queensland is one of the higher emitters of greenhouse gases in the nation with the four largest sources of greenhouse gasses identified in 1999 as (see Figure 4):

- vegetation clearing (37.8 Mt CO_2-e or about 28 percent of net emissions);
- electricity generation (35.3 Mt CO_2-e or about 26 percent);
- agriculture (25.1 Mt CO_2-e or about 19 percent); and
- transport (15.4 Mt CO_2-e or about 11 percent).

Emissions from the Wet Tropics Region have not been specifically quantified. The majority of the region's electricity needs are met by fossil fuel generated electricity imported via the national grid from Townsville, while the remainder is met by renewable sources (wind, hydro-electricity and co-generation).

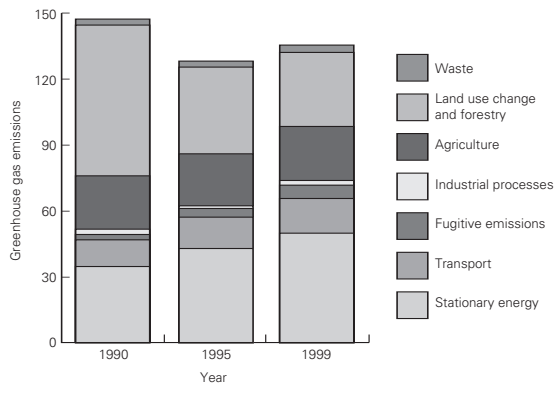


Figure 4. Queensland greenhouse gas emission trends for 1990, 1995 and 1999 in MtCO_2-e by sector (Source: EPA 2004)

From the transport sector, in the Cairns region alone there are in excess of 80,000 registered vehicles and urban and tourism requirements no doubt contribute significantly in the stationary energy sector. Since the introduction of the state policy on tree clearing, emissions from land use change have been reduced, but agriculture would still contribute greenhouse gasses from other sources including methane. Identifying and quantifying the sources of greenhouse gas emissions in the region is considered essential.

In 2004, the Queensland Government released its own *Greenhouse Policy Framework and Greenhouse Strategy*, which laid the foundations for future Government policies and programs on climate change. Other existing plans, policy and legislation which addresses the issue of climate change in the region include the *Queensland Energy Policy*, the *FNQ Regional Plan*, *Wet Tropical Coast Regional Coastal Management Plan*, Cairns City Council *Local Planning Policy No 1:04:20 – Flood Immunity within the Mulgrave Shire* and Cairns City Council *Local Planning Policy No 1:04:23 – Stormtide and Greenhouse Effects in Relation to Building and Development Applications*.

Interaction of impacts of climate variability/change and management are the subject of ongoing research. The modelling capacity of CSIRO and high-resolution climate change scenario development currently underway in NR&M will allow the robust assessment of projected change in the climate of the Wet Tropics.

Box 35. Greenhouse Gas Emissions – Why are they a regional issue?

As the FNQ Regional Plan technical report noted, the need to make more efficient use of the world's 'non-renewable' natural resources is a significant issue for all of the world's countries, particularly high per capita resource users such as Australia and other industrialised countries. Energy consumption is one of the main consumers of non-renewable resources in Australia.

Man-made greenhouse emissions in Australia occur primarily through coal- fired power generation, vegetation clearing and vehicle emissions. Therefore, reduction in greenhouse gas emissions is a significant regional issue, because the majority of the region's power needs are provided from coal-fired plants and private vehicles account for over 90 per cent of transport trips.

If all global regions treat greenhouse gases as beyond their control then no action will be taken. In fact all regions should do what is feasible to reduce emissions and maximise carbon sequestration in forest and soils. As a region with a strong 'green image' the Wet Tropics should accept this responsibility. As noted in a recent paper in the world's most influential scientific journal *Nature*, the Wet Tropics' biodiversity being on its climatic limits is at particular risk from climate change. Furthermore the region may benefit from carbon trading that provides financial incentives for landholders to engage in forestry activities.

Box 36. Cairns and Far North Environment Centre's Cool Communities Project

Peak environment group, the Cairns and Far North Environment Centre (CAFNEC), is tackling the problems of climate change at the local level. CAFNEC coordinator John Rainbird *explains how the Cool Communities initiative educates householders on positive and meaningful contributions to the reduction of greenhouse gas emissions.*

Everybody needs to play a part in combating greenhouse, not just business and government. Householders can play their part in the fight against global warming and save themselves dollars while they are reducing their natural resource consumption.

The Cairns and Far North Environment Centre is one of two Cool Communities projects in Queensland, and one of 16 nationally. The Cool Communities project focuses on assisting householders to reduce their greenhouse gas emissions through the reduction in energy usage in and around the home.

While the domestic sector is considered the small end of the energy consumption equation it is regarded as a key to controlling the demand and with it the consumption of energy. Householders can do simple things like turning electrical appliances off at the wall to save nine per cent of the $500 million a year wasted by stand-by appliances or reducing the average household water consumption, currently running at 70,000 l/year, by two thirds, simply by using a smaller shower head.

The Cool Communities Program evolved from discussions between the Queensland Conservation Council and the Australian Greenhouse Office on ways to address the issue of climate change at a community level. The program is funded through the Australian Greenhouse Office, facilitated in Queensland by the Queensland Conservation Council.

There have also been a number of reports that provide recommendations for actions required specifically to the Wet Tropics area and the issue of climate change. An AGO study to determine the scope and focus of an integrated assessment of climate change impacts and options for adaptation was undertaken in 2003 for the Cairns and Great Barrier Reef region, and outlined in detail probable impacts, knowledge gaps, actions and priorities. Two publications by the Rainforest CRC: 'Environmental Crisis: Climate Change and Terrestrial Biodiversity in Queensland' and 'Global Warming in the Wet Tropics' considered the specific impacts and actions required for the Wet Tropics rainforest region. All the above sources (National, State and regional) have been considered in developing the actions for this Regional NRM Plan.

These actions address not only the reduction of air pollution and greenhouse gas emissions but also options for increasing sinks in the region and necessary adaptation strategies to reduce the impacts of likely climate change on the region.

5.2 Climate targets and actions

Management Action Target (MAT)	*Type of MAT[26]*	*Management Actions*	*Links Targets*	*Potential Partners*
C1. Greenhouse emissions and air pollution levels are reduced to, or below, 1990 levels by 2012				
C1.1 Improve the understanding of baseline air quality data by 2005.	CB	**C1.1.1** Monitor and report annually on air quality in the region. **C1.1.2** Add information to integrated information network (B1.2).	C2, CB1, ME1, ME2.	NR&M, DES, Local Govt, SES, DPI&F, Research Organisations Community Organisations
C1.2 Revise practices in all sectors to reduce greenhouse gas emissions and improve air quality by 2008.	CB	**C1.2.1** Develop a greenhouse gas inventory to enable the region to monitor its contribution to the nation's greenhouse commitments from each sector. **C1.2.2** Increase community understanding of greenhouse issues through public information seminars, workshops and literature. **C1.2.3** Improve energy efficiency of public and government buildings through reduced electricity usage and improved design. **C1.2.4** Investigate carbon trading, local levies, compliance, use of ISO standards as market incentives as potentially viable options in the Wet Tropics. **C1.2.5** Implement an education program for farmers regarding the negative effects of burning cane trash on both air and soil quality and the techniques that would better address cane trash management. **C1.2.6** Implement an education program for farmers to reduce greenhouse gas emissions from fertiliser, correct fertilizer placement and timing, soils vulnerable to denitrification (eg water-logged soils). **C1.2.7** Implement regional education program for awareness and reporting of vehicles releasing excessively low quality exhaust fumes.	C1, C2, CB1, B16, B19, L10.	Industry Groups, Community Groups, Research Organisations, AGO, Traditional Owners.
C1.3 Increase carbon sinks in the region by 10% by 2012.	OGW	**C1.3.1** Increase stored soil carbon by encouraging agricultural practices that preserve and enhance organic matter in the soil and reduce degradation events. **C1.3.2** Increase tree planting in the region through support and encouragement of agroforestry, timber production, reforestation, and revegetation incentives programs.	C1, C2, B3, B16, B19, L7, L8.	Industry Groups, Community Groups, Research Organisations, AGO.
C1.4 Source twice the current amount of green energy in the region by 2012.	OGW	**C1.4.1** Calculate the current amount of energy sourced from renewables in the region. **C1.4.2** Reduce household greenhouse gas emissions through community education programs on energy efficiency, increased uptake of solar and gas hot water systems and encouraged use of energy efficient appliances, purchase of green power and independent green electricity generation. **C1.4.3** Review local government planning regulations on house and urban design in order to improve energy efficiency. **C1.4.4** Encourage local government to require solar hot water systems on new houses in consultation with development industry. **C1.4.5** Build on existing programs that encourage the use of car-pooling, public transport and walk/cycle paths. **C1.4.6** Encourage the development and uptake of 'green power' including hydro-electricity, wind power and co-generation from sugar mills / landfill.	C1, C2, CB1, ME1.	Industry Groups, Community Groups, Research Organisations, AGO, Local Govt, Utility Companies, DLGP, LGAQ.

[26] Types of Management Action Targets: CB- Capacity Building, OGW- On-Ground Works, P- Planning, RA- Resource Assessment & Monitoring

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
C2. Natural resources managed for potential impacts of climate change by 2012.				
C2.1 Quantify impacts of potential climate change by 2008.	RA	**C2.1.1** Support research to quantify regional specific climate changes and probable impacts. **C2.1.2** Publicise climate change information on a regular basis. **C2.1.3** Identify and map coastal areas and habitats at risk from sea level rise, increased storm surge and increased flood events. **C2.1.4** Develop ecosystem models as tools to forecast impacts on significant species of management plans, population growth and climate change.	B16, B18, C1, CB1, ME1.	NR&M, DPI&F, Local Govt, Research Organisations . Community Organisations .
C2.2 Commence strategies to deal with adaptation issues to inevitable climate change by 2012.	P	**C2.2.1** Develop revegetation plans, in consultation with landholders, which allow for the migration of species threatened by climate change. **C2.2.2** Develop strategies for the preservation of upland species threatened by increasing temperatures. **C2.2.3** Develop strategies to manage likely impacts of climate change on significant wildlife species and ecological communities. **C2.2.4** Develop strategies for key industries (e.g. tourism and agriculture) to increase the flexibility of current practices to account for climate variability.	B3, B16, B19, L7, L8, CB1, ME1.	NR&M, DPI&F, Local Govt, Research Organisations Community Organisations , Industry Organisations .
C2.3 Revise policies in all sectors impacted by climate change by 2007.	P	**C2.3.1** Revise current Government subsides to be consistent with policies relating to addressing the impacts of climate change. **C2.3.2** In consultation with local government and State Government agencies, review existing infrastructure, design standards and local planning regulations to consider the impacts of cyclones, storm surge and flood events under climate change.	C1, CB1.	NR&M, DPI&F, Local Govt, Research Organisations , DLGP.

6.0 Land resources

6.1 Goals

The land resources of the Wet Tropics are in good shape and continue to underpin viable rural industries.

Sustainable production systems, which maintain the productive capacity of the land and prevent degradation and, as far as possible, maintain biodiversity and ecosystem services.

The use and management of land for agriculture, forestry, and residential and other purposes will be consistent with its capability, and will follow the principles of ecologically sustainable development recognizing ecological, economic, Aboriginal cultural and social issues (the quadruple bottom line).

6.1.1 Land: an overview of the asset and the services it provides

For the purposes of this plan, 'land' includes areas used for commercial agriculture, timber production and grazing, minerals and extractive resources, as well as urban purposes. These areas comprise over half of the plan area and provide us with a place to live as well as much of what we need to survive. Contrasted with the reef and the rainforest, they contribute to a varied landscape that can be attractive and add to the amenity value of the region. These elements are dealt with under the following headings:

- **Cultivated and other improved land**;
- **Extensive rangelands**;
- **Production forests**;
- **Minerals and extractive resources**; and
- **Urban land**.

It is noted that Traditional Owners have significant interests in the region's land resources, and there are several native title claims that are being pursued in the region which are at varying stages. Many Traditional Owners groups are working in conjunction with landholders to develop positive mutually beneficial agreements that address many issues such as the protection of culturally significant places (such as burial sites), as well as access and use of their traditional lands. These issues are dealt with in the Caring for Country chapter.

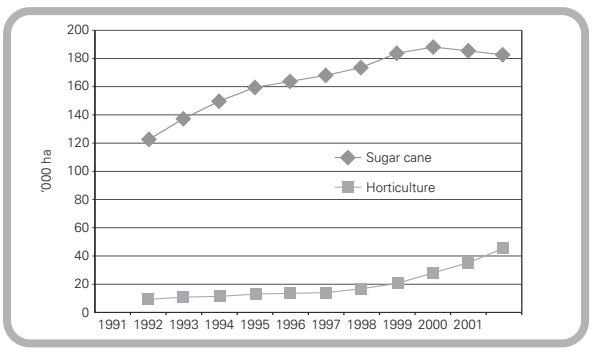


Figure 5. Area under sugar cane and horticultural crops in the Wet Tropics NRM Region.

6.2 Cultivated and other improved land

6.2.1 Status and threats

At present there are approximately 240,000ha cultivated in the Wet Tropics, predominantly for cane and horticulture. As stated in the Background Report (p21), the total gross value of agricultural production in the Wet Tropics NRM Region for the 1998/99 financial year was $754.2 million including crops and livestock products, representing 11.8% of the Queensland total. Crops comprised 83.9% of the regional total, with livestock disposals (sales) and products (especially dairy products) accounting for the remainder. The total value of crops in the region for the 1998/99 financial year represented 17.9% of the value of all crops produced in Queensland. Within the Cairns subregion, sugar cane production for the year ended March 1998 was valued at $232.8 million, accounting for 41% of the subregion's total agricultural output, and 19.6% of Queensland's total sugar output.

Sugar cane, the major crop on the coastal lowlands, expanded substantially through the 1990s, reaching a peak in 1999 (see Figure 5). Since then major economic pressures on the industry, mainly low export prices, have resulted in a reduced area of cane – a trend that may well continue if economic conditions do not improve. At the same time there has been a significant constant increase in the area of horticultural activities, especially bananas mostly in coastal districts. Significant growth in area under horticultural production in the Wet Tropics region now sees the region supporting 23% of the State's fruit growing area, with banana production currently ranked the most significant horticultural commodity. In addition there has been increasing diversity of, and a trend toward, the expansion and creation of new industries such as tropical fruits, livestock production, private forestry and aquaculture.

Cultivated land uses on the Atherton Tableland are rapidly changing. Tableland sugar cane areas appear to be declining due to poor profitability, tobacco has virtually disappeared and crops such as potatoes, bananas, maize and peanuts are on the increase. Mango and avocado production is increasing, and both currently have high economic value. Some crops, like tobacco and navy beans, are declining in importance, but the production of many others, such as macadamias, longans, lychees, custard apples, cut flowers and rare fruits are rapidly increasing. Consequential increases in the requirement for irrigation pose threats from irrigation induced salinity.

Livestock production constitutes approximately 16% of the total gross value of agricultural production in the Wet Tropics NRM Region. The number of beef cattle across all LGAs in the region rose from 308,032 in 1983 to 338,308 in 1997. Up to 45% are grazed on native pastures outside the Plan region in Mareeba Shire. Cattle production within the region is concentrated on native pastures in the Upper Herbert catchment (for more information, see section on Extensive Rangelands), although grazing of beef cattle on improved pastures is scattered around wetter parts of the region. The number of milk cattle in the region rose slightly from 26,701 in 1983 to 28,255 in 1997 (Figure 6), with about 71% located in Eacham Shire.

Mitigating the effects of the economic pressures threatening some activities on cultivated and other improved lands in the Wet Tropics is beyond the scope of what can be achieved through this Plan. The effects of economic pressures on land use change may significantly alter some of the underpinning assumptions of the Plan and require careful monitoring for revising the priorities of the Plan in future. Other threats (some created or made worse by the land uses themselves) are discussed in more detail below.

Inappropriate urban land development

Urban population growth in the Wet Tropics is placing increasing pressure upon the region's good quality agricultural land. Impacts of concern arising from land consumption for residential and other urban purposes include loss of land and viability of agriculture in the Cairns regions, urban encroachment associated with tourism development along the Wet Tropics coast north of the Daintree, Cairns Northern Beaches, Mission Beach and Cardwell. Over the period 1980–1995, the Hambledon mill area lost over 3000 ha of prime farmland to non-agricultural pursuits, which led to the closure of the Hambledon mill in 1991. Also during this period the Mossman mill area lost over 500 ha and the South Johnstone mill over 700 ha. In many cases, the relatively low housing densities being achieved exacerbate the impacts of urban expansion.

The current economic difficulties of the sugar industry are creating additional pressures on the conversion of farmland to other purposes. While in the short term this may provide some farmers with an exit strategy, it will further erode the availability of this critical natural resource for future generations and have significant social and aesthetic impacts if not managed well.

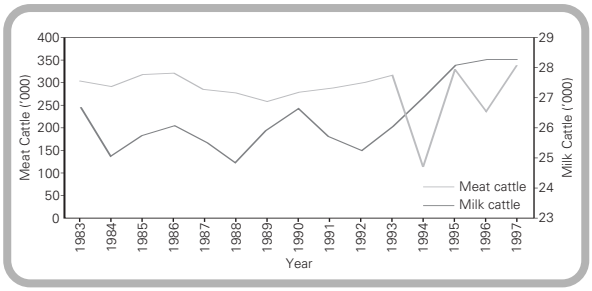


Figure 6. Number of beef and dairy cattle in the Wet Tropics NRM Region, 1983–1997.

Soil acidification

As noted in the Sustainable Use Report (p30), accelerated or induced acidification of soils is caused by agricultural production systems that have radically altered natural ecosystems. The major processes are:

- Export of alkalinity in produce (e.g. sugarcane, bananas, hay, milk etc); and
- Leaching of nitrate from ammonium-based N fertilisers like urea and DAP below roots. This turns the soil acidic.

Acidity is measured as a decrease in pH and contrasts with acidification of soils as a natural process, pH is dependant on parent material and the ecosystem. Reduced soil pH affects the availability of all plant nutrients, either directly or indirectly and represents a decline from the virgin state, a result can be reduced plant productivity. Soil acidity has been recognized as a serious national and international soil degradation issue.

While the export of produce is unavoidable, nitrate leaching can be managed to a certain degree. A key point is better matching N fertiliser supply with plant demand (total rate, dose, timing and placement). A practical method of correction of soil acidity is the use of nitrate-based fertilisers (e.g. potassium nitrate, calcium ammonium nitrate) in high value production systems. This is effective to at least 80 cm.

Acid sulphate soils

Acid Sulphate Soils (ASS) commonly occur in coastal wetlands as layers of Holocene marine muds and sands with high content of iron sulfides. ASS only becomes a problem when they are exposed to air, typically through excavation, drainage, extracting groundwater or filling land. When iron sulfides are oxidised, sulfuric acid forms and the soil becomes strongly acidic (usually below pH 4). The acid can mobilise the naturally occurring metals in the soil. These ASS, and any subsequent leachate, can have significant adverse effects on the natural and built environments, the economy and human health due to the presence of abundant acid, iron, aluminum, manganese and commonly other heavy metals. The annual cost of ASS disturbance and management in Queensland has been estimated to be more than $180 million (Sutherland & Powell 2000). These impacts include:

- Runoff from ASS may have very low concentrations of dissolved oxygen;
- The release of acid and metal contaminants into the environment can have significant adverse effects on the ecology of wetlands and shallow freshwater and brackish aquifer systems by degrading water quality, habitat and dependant ecosystems resulting in the killing or disease of fish and other aquatic organisms;

- The presence of actual ASS and any release of leachate can have significant adverse economic consequences upon crop productivity and commercial and recreational fisheries;
- ASS may affect groundwater quality as well as surface water;
- The leachate can corrode concrete and steel infrastructure, such as culverts, pipes, bridges and buildings, reducing their functional lifespan; and
- Ground and surface waters containing toxic concentrations of acid and metal contaminants can cause dermatitis, and dust from disturbed ASS may cause eye irritation.

Identification of ASS in the field is not always easy due to burial by more recently deposited soils of alluvial origin but in the Wet Tropics, any estuarine or coastal area below 5 m AHD is potentially at risk if disturbed. The most well known example is at East Trinity, 1 km east of the Cairns CBD.

Soil erosion

Soil erosion is the natural process that removes soil by water particularly where there is high intensity rainfall and steep slopes (wind is not a main force in this area). Types of erosion found in the area include:

- Splash erosion caused by raindrop;
- Sheet erosion, of a thin and more or less uniform layer of overland flow;
- Rill erosion is caused by concentrated overland flow;
- Gully erosion, where rills become large and not readily corrected by tillage;
- Stream bank erosion, entrainment and mass failure of stream banks into water flow; and
- Mass movement, of soil movement by the forces of gravity.

Soil erosion is a natural process that is greatly accelerated by overgrazing, clearing, cultivation, the presence of weeds and pest animals, and urban development. Associated degradation of riparian vegetation accelerates erosion of creek and riverbanks and reduces the capacity to trap sediment and nutrients.

Recent CSIRO modelling of the Herbert River catchment with *SedNet* calculated that hillslope erosion is the dominant source of sediment (52%), with equal contributions to the balance from gully and stream bank erosion (Bartley *et al.*, 2003). This work has identified the relative importance of land use and area of the catchment occupied by that land use to soil loss.

Soil erosion has serious impacts both on-site and off-site. The on-site effects are loss of topsoil and associated nutrients as well as a decline in soil structure under severe erosion and an associated loss in production. Loss of topsoil is particularly important in the transport of phosphorous from the landscape into streams.

Soil erosion has detrimental impacts on downstream streams, reservoirs, lakes, estuarine and marine environments. Impacts of increased sediment loads in estuarine environments include:

- Nutrification, especially phosphorus, and the associated organic fractions and their biological oxygen demand impacts;
- Reduced stream clarity;
- Diminished light available for photosynthesis;
- Increased treatment of water for human use;
- Increased flooding of land; and
- Reduced capacity of reservoirs.

Soil fertility decline

Fertility decline (also termed soil fatigue and soil degradation) may be due to chemical, physical or biological factors or a combination of these. These factors are explained in a little more detail below:

Chemical fertility

The most important aspects of chemical fertility decline are:

- Acidification with associated reduction in microbial activity/diversity as well as reduced cation exchange capacity in soils with variable charge (e.g. ferrosols);
- Organic matter decline and associated reduction in nutrient holding capacity, and
- Decline in fertility due to disparity between input from fertilizer and other sources and the nutrient output in produce.

Physical fertility

Soil physical degradation has been described in the most general sense as a 'change for the worst' in the soil structure. It is the loss of soil air spaces from compression and shear forces from cultivation or animal traffic. This reduces the ability of the soil to supply water and nutrients to plants, and allow gaseous exchange with the atmosphere. It also has significant influences on the soil biota, both macro and microorganisms. The compaction can reduce earthworm numbers and reduce habitat for free-living soil nematodes that are important for organic nutrient recycling. These changes are shown as an increase in bulk density and a reduction in total porosity.

Biological fertility

Soil biota includes a diverse range of organisms (e.g. bacteria, fungi and earthworms) that largely control soil chemical and physical properties. Examples of control are regulation of soil organic matter and nutrient cycling, maintenance of soil structure and biological degradation of pollutants ('ecosystem services'). The total biomass in fertile soils may exceed 10t/ha on a wet weight basis. A decline in the biological health of the soil includes loss of microbial biomass and biodiversity as well as an increase in pests (particularly soil pathogens).

Pest plants and animals

It is often the environment in which pests are growing that makes them pests. Environmental pests can be attractive/desired animals or ornamental garden specimens. Agricultural pests can be positive measures of the health of natural ecosystems, and natural area pests can be highly productive components of agricultural systems. The criteria for a pest will or may therefore change depending on the human induced or natural environment in which the organism is occurring, and the view of the human population at that time and place.

In Queensland, pest animals and plants have very significant environmental and social impacts. Their estimated costs to the agricultural industry of more than $500 million each year is nearly four times that of salinity (NR&M 2003). Plant pests affect agricultural industries in the Wet Tropics Region by competing with crops, possibly contaminating produce and possibly producing toxic substances in some plants on livestock. Significant agricultural plant pests in the pastoral context include parthenium, giant rats-tail, grader grass, sicklepod and bellyache bush. There is also a host of other pests, many of which may have originated as 'improved pasture' seed or seed contaminants imported for the pastoral industries that can impact on sugar cane cultivation and horticultural and other cropping systems. Examples include hymenachne, para grass, itch grass, aleman grass, guinea grass, siratro, glycine, praxelis and navua sedge.

Animal pests damage agriculture through yield reductions and lowering product quality. Significant animal pests include dingoes and feral pigs, and some native animals, as well as invertebrate pests such as greyback cane grubs, fruit-piercing moths and fruit-spotting bugs and the banana scab moth. It is ironic to note that one of northern Australia's worst vertebrate pests, the cane toad, was unsuccessfully introduced to control greyback cane grubs and other invertebrate pests of sugar cane.

Each industry has undertaken varying levels of research, development and extension depending on the actual and perceived nature of the pest plant and animal problem.

Pathogens and diseases

Pest diseases are problems in all landscapes and land uses. Diseases include fungal, bacterial and viral organisms. Critical issues associated with pest diseases for agriculture in the region are shown in the table below.

6.2.2 Management response

At the property scale, the management of cultivated land is largely the responsibility of private landowners. This extends to activities such as subdivision. However, any large-scale reduction in cane growing in the region will create a whole new set of issues and opportunities for natural resource managers. It cannot be assumed that the replacement of cane with other uses will have improved water quality outcomes either. Future uses may be a combination of:

- Conservation values including selective rehabilitation of natural systems, eg. riparian corridors;
- Maintenance of aesthetic and landscape vales important to an expanding urban region;
- Allowing for beneficial use of land including horticulture, field crops and agro-forestry wherever possible; and
- Limited urban development that may enhance or at least not reduce community values in the district.

The most important means of protecting farmland from urban encroachment is through the planning and control provisions of local government planning schemes. This is principally dealt with under the Queensland *Integrated Planning Act 1997* through State Planning Policy 1/92: *Development and Conservation of Agricultural Land*. This policy sets out broad principles for the protection of good quality agricultural land from inappropriate developments.

Acid sulphate soils are also dealt with under the Queensland *Integrated Planning Act 1997* through State Planning Policy 2/02: *Planning and Managing Development Involving Acid Sulphate Soils*. This policy requires local government authorities' planning schemes and development assessments ensure that ASS are either not disturbed, or are managed to

Table 8. Critical pest diseases for agriculture in the region.

Industry	***Impact***	***Current work***
Sugar cane	Orange Rust; Sugar Cane Smut	BSES, Quarantine
Field crops	Peanuts [Leaf spot (early, late), CBR (Black Rot)] Potatoes (Bacterial Wilt, Leaf Spot)	
Horticultural crops	Bananas (Black Sigatoka, Moko Disease, Panama Tropical race 4, Freckle Disease) Papaya (Black Spot, Phytophthora) Avocados (Phytophthora)	Integrated approaches using cultural and chemical practices Quarantine Banana Biosecurity Plan
Grazing (beef, dairy)	Hay contamination by fungus and fungicides	

prevent environmental damage. If the disturbance of ASS has already occurred or cannot be avoided the potential impacts of that disturbance must be treated and managed in accordance with State Planning Policy 2/02, although the policy cannot retrospectively mandate remediation of existing problem sites.

Identification of ASS in the field is not always easy but any estuarine or coastal area below 5 m AHD is potentially at risk if disturbed. The State Planning Policy does not necessitate detailed resource mapping, but it does require that LGA's delineate areas of 'high probability' in the preparation of planning schemes. These 'high probability' areas must be conservative in nature (s5.5, SPP 2/02 Guideline), and generally based on general, broad scale information such as elevation and geological units. The Sustainable Use Report (p31) contains a map of potential or actual acid sulphate soils in the *FNQ Regional Plan* region, but at a scale of 1:250,000. NR&M is currently mapping these soils at a finer scale.

Management of cultivated and other improved land at the property scale is the responsibility of the landowner, including the control of declared pests under the Queensland *Land Protection (Pest and Stock Route Management) Act 2002*. This includes State and local government in the case of State-owned and council-controlled lands. The FNQ Regional Organization of Councils (FNQROC) released a *Regional Pest Management Plan* in 2004, the main objective of which is to identify, record and prevent the establishment or the spread of pest plants and animals and animals within the FNQROC area, at the same time ensuring that councils and stakeholders meet their obligations under the *Land Protection (Pest and Stock Route Management) Act*. It provides strengthened linkage with national NRM initiatives and various other planning layers, including strategies for Weeds of National Significance.

As already reported, some native animals can become pests when they conflict with local or immediate human activities. These locally damaging species are protected under the *Nature Conservation Act* (and are managed by Queensland Parks and Wildlife Service to achieve conservation goals) they may also need to be controlled if either their negative impacts and/or numbers increase to unacceptable levels. Species management involves reducing the negative impact of problem animals rather than eliminating them. This requires a planned approach by various levels of government and by landholders (NR&M 2003).

As part of the current planning process, FNQ NRM Ltd commissioned Neil Sing (DPI&F) to develop a suite of management action targets for the major regional agricultural industries in the Wet Tropics (see Sing 2004). Detailed actions arising out of the resulting report are included at the conclusion of this chapter. It identifies only those management actions (best management practices or BMPs) that are likely to have a beneficial impact on the environment.

6.3 Extensive Rangelands

6.3.1 Status and Threats

Wet Tropics native pastures include a range of rainforest derived pastures of the lowlands and tableland, pastures on alluvial floodplains including wetland species and a large area of black speargrass pastures in the eucalypt woodlands of the upper Herbert catchment and other drier sections of the region. The latter support an important pastoral sector. Relatively little detailed and comprehensive information on the condition of native pastures in the region existed until June 2004 (Rolfe *et al* 2004). They used ABCD Land Condition Framework (Chilcott *et al* 2003) to assess land condition for grazing in the Upper Herbert (see Box 37). These new assessments provide the benchmarks for grazing targets in this Plan.

Pasture condition is affected by land management practices especially stocking rates (and total grazing pressure), fire regimes and watering practices. Tree thickening is an increasing problem in the region, attributed to a combination of the effects of grazing, changes in fire regimes and climatic conditions. It can result in a dramatic change in the original community from open and very open grassy woodland, to a high tree cover and low ground cover ecosystem, reducing pasture production and making cattle management more difficult (hence increasing costs). Thickening may also change species composition and biodiversity. Critically, from a land management perspective thickening can result in increased runoff and relative soil loss. The condition of river frontages is particularly important given their importance for both grazing management and resource conditions.

Maintenance of groundcover in good condition maximises water infiltration, reduces soil loss and retains nutrients in topsoil. Ground cover of 40–50% is the minimum below which accelerated erosion and run-off occur. Native pastures in good condition are also the primary means of protecting biodiversity in these landscapes outside the limited reserve system.

Extensive beef enterprises in the Upper Herbert district generally rely on constant stocking of paddocks and constant stock numbers (even increasing breeder numbers) to maintain incomes. Paddocks are few and breeder/weaning efficiencies are seldom higher than 50%–60%. Breeder death rates are often around 8% (Kernot *et al*, 2004).

Ecological sustainability and improved land condition will require more paddocks (for spelling and burning) and improved grazing management, so production efficiencies will need to be raised to offset costs. Mating practices, supplementation strategies, herd improvement and segregation of animal classes will need to be considered as serious options and precursors to improving land condition.

Dryland salinity

Dryland salinity refers to the salinisation of soil and water caused by changes to catchment water movement. These changes may mobilise stored salt towards the soil surface or into surface water with both on and off-site effects. Removal of trees is particularly important in increasing the amount of water moving into the watertable. As discussed in the section on native vegetation, most vegetation clearing in the region is currently being done for grazing in the Herbert River catchment.

Dryland salinity is one of Australia's most pressing natural resource management issues but in the Wet Tropics Region, very small areas are currently affected. These are in the northern part of the Mareeba-Dimbulah Water Supply Scheme area (McClurg, 1990; Malcolm *et al*. 1992). Northern parts of the Burdekin catchment, which have features that are similar to the adjacent Upper Herbert catchment, have been identified in the State Government's Salinity Hazard map and suggest vigilance in the upper Herbert district. The Cattle Creek area west of Mareeba is in the Mitchell River catchment, but is adjacent to the Wet Tropics Region and contains areas of saline groundwater. The direction of groundwater movement is unclear so that rising groundwater levels may threaten the quality of groundwater within the Wet Tropics.

Box 37. Grazing management targets to improve Regional Ecosystems, land condition and optimise primary production (EDGE Network 2002).

'A' Condition, or good condition
(100% of original Carrying Capacity)

- Good coverage of 3P (Perennial, Palatable and Productive) grasses for that land type with less than 30% bare ground.
- No significant weed infestations.
- No erosion and good soil surface condition.
- No sign, or early signs, of woodland thickening.

'B' Condition, or fair condition
(75% of original Carrying Capacity)

Has one or more of the following:

- Some decline in 3P grasses, increase in other species (less favoured grasses, weeds) and/or bare ground (>30% but <60%).
- Some decline in soil condition, some signs of previous and/or current susceptibility to erosion is a concern.
- Some thickening in density of woody plants.

'C' Condition, or poor condition
(45% of original Carrying Capacity)

Has one or more of the following:

- General decline of 3P grasses, large amounts of less favoured species and/or bare ground (>60%).
- Obvious signs of past erosion and/or susceptibility currently high.
- General thickening in density of woody plants.

'D' Condition, or very poor
(20% of original Carrying Capacity)

Has one or more of the following:

- General lack of any perennial grasses or forbs.
- Severe erosion or scalding, resulting in hostile environment for plant growth.
- Thickets of woody plant cover most of the area.

Adverse impacts from salinity include:
- Reduced agricultural productivity;
- Reduced water quality;
- Loss of biodiversity; and
- Damage to infrastructure (e.g. roads, buildings) with resultant increased costs for the whole community.

6.3.2 Management response

Improved land management practices of grazing areas by landowners are the predominant actions that can be taken to maintain native pastures in the region. Continual assessment of pasture condition is highly dependent on monitoring by landholders at the property scale. This includes monitoring land condition and changing land management practices accordingly.

With respect to salinity, three key issues for management are:
- The long response time between changed land management and changes in groundwater, often 100 years or more;
- An outbreak of salinity may appear a long way from the cause; and
- A range of scales, local, sub-catchment and regional with different time scales and different management responses.

In northern Australia, protection and prevention management options are still available, implying that northern Australia has potential to avoid degradation from dryland salinity. At the current rate of clearing, and with broad scale clearing set to be phased out by 2006, it is unlikely that salinity will become a major natural resource management problem in the Wet Tropics Region. In a general sense, however, agriculture and other land management should be adapted to suit Australian landscapes and take account of groundwater characteristics.

6.4 Production Forests

6.4.1 Status and Threats

Forestry once was one of the largest industries in the Wet Tropics Region. Its economic value in 1986 was around $26 million, which is equivalent to over $100 million in 2004 terms. However, since the listing of almost one million hectares of the region as part of the WTWHA in 1988, tourism and recreation have emerged as the new economic drivers. Forestry activities within the Wet Tropics NRM Region currently fall into four main categories: native forest on private land; native forest on Crown land; State-owned plantation and farm forestry.

One medium sized saw and processing mill continues to operate utilising a steady supply of softwood (hoop pine and Caribbean pine) from State owned plantations that amount to approximately 13,800 hectares at in the Ingham-Cardwell area and on the Atherton Tablelands. The State-owned plantation resource is managed by DPI Forestry, a business unit of DPI&F. DPI Forestry is currently negotiating a long term sale agreement for the purchase of approx. 200,000m3 of their Cardwell based pine resource. This agreement involves the establishment of a second processing facility in the region. DPI Forestry and other private investors continue to explore options for commercial plantation expansion in the region. Any such expansion will target existing cleared land. Annandale *et al* (2003) identified an estimated 86,000 hectares of cleared potentially suitable land for plantation development within a 200km radius of Cairns.

Native forests on private land have increased in importance since the cessation of rainforest logging following World Heritage listing, but the extent and nature of the private resource is poorly understood and its scattered distribution can complicate effective marketing on behalf of the land holder.

Farm forestry has the potential to become a true primary industry but is not viewed by many landholders as a viable enterprise due to past taxation impediments, failure of similar previous Government schemes due to inadequate long-term resourcing, concerns over timber resource security due to conservation and habitat values of plantings, and the medium to long-term time frame required before harvesting generates a return on the initial investment. Broadly speaking, farm forestry includes any trees on farm land which are managed to produce saleable products such as timber, oil, tannin, charcoal etc. The carbon credits that may stem from these plantations are seen as having future potential.

Utilisation of timber and other forest products in the region's Crown native forests is also managed by DPI Forestry. Following classification of the WTWHA, the extent of the region's natural environment that is subject to commercial forestry operations has been significantly reduced. The increasing importance placed on the non-timber values of the region's native forests is placing pressure on timber supplies, resulting in an increased demand for large-scale softwood and hardwood plantations

6.4.2 Management response

Commercial forestry on Crown land within the WTWHA is prohibited and the State is currently in the process of converting all of the 480,889 hectares of state forests and timber reserves in the WTWHA to national parks. Native forests on Crown land outside the WTWHA are assessed and managed for multiple uses, such as water catchments, wood production, grazing, ecotourism, recreation and minor forest products such as honey and firewood. The QPWS, a division of the EPA, plays a key role in this. It is the responsibility of QPWS to independently set and monitor environmental and resource management standards. These standards have to be met for all the activities that take place on Crown land.

Anyone intending to harvest timber from native forests on private land needs to check first with both their local government and NR&M to ascertain their legal obligations in relation to the proposed timber harvesting. Currently there is no formal code of practice for private forests. However, the Queensland Government has approved the development of a 'Queensland Forest Practices System' (QFPS). This system will cover both native forests and plantations.

The Community Rainforest Reforestation Program (CRRP) played a significant role in establishing farm forestry timber reserves in the region between 1992 and 2000. Existing organisations such as Private Forestry North Queensland, the North Queensland Timber Cooperative, Australian Forest Growers and the recently formed Network for Sustainable and Diversified Agriculture assist in integration, planning and management of private forestry activities.

The networks and connectivity they offer private forestry complement Landcare groups and together they could run extension and education programs to determine and achieve production forest actions outlined in this Regional Plan.

Traditional Owners have identified that they want to have increased participation in forestry initiatives in the region through agroforestry projects. The National Indigenous Forestry Strategy under development also outlines a number of key objectives for increased participation of Indigenous people in forestry. The Department of State Development has supported workshops to investigate opportunities for Traditional Owners in agroforestry.

Box 38. Commercial agroforestry production systems: Making a commercial case for NRM in the Wet Tropics

It is often argued that, in primary industries, natural resource protection and economic development are incompatible. CSIRO Agroecologist Mark Smith explains that a new generation of the right primary industries could help rehabilitate ecosystem services on agricultural land.

Sustainability solutions may actually come from finding innovative ways of enabling commercial agriculture to harness the economic benefits of Natural Resource Management (NRM). The challenge for landholders and natural resource managers is then to ensure that the 'right' land uses are put in the 'right' parts of the landscape.

An example might be to retain sugar on highly-productive prime agricultural land, while high-value tropical timbers and fibre crops would be supplied from more marginal land to ensure protection of soils, habitat and waterways. Taking these steps could mean substantial progress is made towards regional NRM targets while long-term economic gains are achieved for agriculture and regional communities.

What is needed is a scheme that ties together development of farm forestry and diversification of the regional sugar industry, linking the creation of new value chains for primary industries with rehabilitation of ecosystem services on agricultural lands.

Known as Commercial Agroforestry Production Systems or CAPS, the scheme could give farmers and landholders new choices about how to improve NRM, with their decisions driven by the prospect of commercial returns from investment in landscape diversification.

A network of entrepreneurs, industry, government and researchers, led by Mark Smith and Sonya Maley of TBL Vision, are trying to ascertain whether there are commercial drivers for sustainability that could help to achieve NRM targets in Far North Queensland. The Cairns Regional Economic Development Corporation, a Bioindustries cluster, is providing development and promotional assistance under its charter to foster entrepreneurship in bio industries.

A case study has been designed to test whether the CAPS scheme will deliver against the goals of the NRM Plan and the need for economic revival in regional agriculture. It has three goals and builds on ongoing financial and market assessments of the scheme:

- to test approaches to allocation of land in diversified landscapes;
- to assess the potential impact of CAPS on progress towards regional NRM targets; and
- to assist community and industry stakeholders in development of a strategic plan for CAPS, including the design of incentive schemes and new business models needed to underpin implementation.

Results from the case study and other work will be used to plan future investment in CAPS and to plan future management actions that link commercial innovation and ecosystem services.

CAPS is a prototype rural industries concept for transformation of agricultural landscapes in the Wet Tropics to more sustainable states, based on the idea that new value-adding industries could provide sound economic and business incentives for diversification of agriculture and expansion of farm forestry. Allocation of land to new uses under CAPS would combine economic returns and ecological benefits, including provision of habitat for wildlife and protection of water quality.

Under the scheme a sugar-fibre-timber system, built on the strengths of the current sugar industry, could emerge from CAPS. Sugar mills would become the eco-efficient hubs of rural industrial clusters integrating processing of sugar, fibre and timber. Industrial clustering in this way would enable integration of processing infrastructure and connection of value chains, meaning that more value from agriculture is retained locally. Rather than limiting itself to the export of raw sugar, the regional sugar industry would be the heart of a new manufacturing sector exporting high-value engineered building materials and fibre-timber composites. Sugar would remain at the centre of the system, but dependence on world sugar markets would be reduced.

Box 39. Aboriginal agroforestry initiatives Ma:Mu bush tucker garden

In many parts of the tropical world, agroforestry provides Indigenous people with the means to raise the standard of living, generate income, satisfy cultural needs for traditional foods and medicines and to improve their social status and community aspirations (Bristow et al. 2003). In the Wet Tropics Region many Traditional Owners recognise agroforesty projects have the potential to protect and maintain species of cultural significance, provide economic, social and cultural benefits for Aboriginal people and support the continued use of these resources for future generations.

A joint project between Ma:Mu Aboriginal Corporation, James Cook University, the Rainforest CRC, Tropical North Queensland TAFE, Coles Indigenous Australian Foods and WTMA have worked towards the development of the Ma:Mu Bush Tucker garden in Innisfail. The aim of the project is to develop traditional bush food species, including Davidson Plum, Johnstone River Apple, Red Bottlenut, Lemon Aspen, Lilly Pilly, Quandongs, Figs and Tamarinds.

Outcomes include: Continued use of resources; improved economic outcomes through employment and business development opportunities; cultural revitalisation and education, and skills development in conservation; improved NRM outcomes through the propagation of plant species for revegetation projects; and maintenance of ICPR of Aboriginal people.

Says James Epong (quoted in Rainforest Aboriginal News 2002): "We are preserving our culture through a process of educating the children and the wider community on bush tucker. Ma:Mu people and the wider community can visit the gardens with Elders and reflect on culture and life. All trees are used for day to day living whether it be bush tucker, making spears, boomerangs, canoes and weaving basket materials."

Alfie McCarthy with blue quandong, cherry satinash, lemon aspen and lilly pilly. (Photo: Brian Cassey, The Courier Mail)

(From left) Professor Roger Leakey, Ma:Mu Chair Victor Maund and students Francis Bull and William Niehsner in the Bush Tucker Garden. (Photo: The Cairns Post)

6.5 Mineral and Extractive Resources

6.5.1 Status and Threats

Mineral Resources

The Wet Tropics NRM Region includes historic tin and gold mining areas, although many of these areas are now within the WTWHA, where applications for new exploration and mining tenures are not accepted. Tin and gold base metal mineralisation is known to exist in the Herberton area, and various exploration and mining tenures are current. Other mineral deposits are known to exist in the region, but are currently not commercially viable. Most of the mining activity occurred at least 10 years ago, and in many cases more than 20 years ago. In the majority of the areas where activities such as dredging occurred, remediation by mining companies and natural regeneration has now reduced the sediment loss. Although there has been significant catchment disturbance and impacts in the past, NR&M operates an Abandoned Mine Land Program.

Extractive resources

Extractive resources include naturally occurring deposits of rock, sand, gravel and soils that are sourced using various quarrying and extraction techniques, and then processed to provide construction materials. The extractive industry

Surveyor pit and waste dump at Mt Garnet. (Photo © Pure Photography)

Box 40. Managing mining in the Wet Tropics

By Mike Frankcombe, Kagara Zinc, Mt Garnet

Mining – as opposed to quarrying and extraction – is a relatively small industry in the Wet Tropics. Activities are largely concentrated in the Upper Herbert catchment, around Mt Garnet, for copper, lead and zinc. Gold exploration is also occurring although there are no active gold mines in the catchment. Up until the early 80's the area was extensively mined for tin with numerous derelict tin mines still in existence in the Upper Herbert catchment.

Mining is a regulated activity under both the *Mineral Resources Act 1989* and *Environmental Protection Act 1994*. Nevertheless, current activities and old mine sites are considered a source of sediments and other mining waste (e.g. tailings, sulphidic mine wastes and acid drainage). Best practice environmental management in mining demands a continuing, integrated process through all phases of a resource project from the initial exploration to construction, operation and closure. For it to be successful it requires careful planning and commitment from all levels and groups within a mining company. It is based on a comprehensive and integrated approach to recognising, and avoiding or minimising, environmental impacts. Key elements include:

- Mine planning
- Environmental Impact Assessment
- Community Consultation and Involvement
- Environmental Management Systems
- Environmental Risk Management
- Cleaner Production
- Workforce Environmental Awareness
- Water Management
- Tailings Containment
- Energy Efficiency
- Atmospheric Emissions
- Dust Control
- Noise, Vibration and Airblast Control
- Hazardous Materials Management, Storage and Disposal
- Cyanide Management
- Managing Sulphidic Waste and Acid Drainage
- Environmental Monitoring and Performance
- Environmental Auditing
- Contaminated Sites
- Rehabilitation and Revegetation
- Mine Decommissioning

For more information, see *An Overview of Best Practice Environmental Management in Mining* by Environment Australia. Available at <http://www.deh.gov.au/industry/industry-performance/minerals/booklets/overview/>

produces natural sand and gravel from river terraces, floodplains, waterways and crushed aggregates from hardrock. These extractive materials play a critical role in our lives, as they are the basic raw materials needed to build and maintain highways, roads, rail lines, homes, schools, factories and other buildings.

The Wet Tropics NRM Region is experiencing high population growth and associated development pressure. High population growth tends to create urban sprawl thus constraining the available locations for existing and new quarry operations. Population pressure, together with environmental pressures, is causing difficulties for the extractive industry's ability to supply the quarry materials required for construction of new housing developments and associated community and transport infrastructure.

The Queensland Government has recently released a *Draft State Planning Policy for Protection of Extractive Resources*. This State Planning Policy (SPP) aims to maintain the long-term availability of extractive resources whilst minimising the adverse environmental effects of extractive industry. The SPP identifies Key Resource Areas (KRA) that are of State or regional significance. Of the nine KRAs identified in the Wet Tropics Region only one is an alluvial sand resource, the other eight are hard rock quarries.

6.5.2 Management Response

Current mining practice is strictly regulated under the *Mineral Resources Act* and *Environmental Protection Act* (see Box 40), while NR&M operates its Abandoned Mine Land Program. This program addresses issues relating to abandoned mine sites on a statewide risk-based priority basis. Any issues with abandoned mine sites in the Wet Tropics should be passed on to NR&M for assessment within this program.

There are several facets to the removal of quarry materials. The first is a requirement under the *Water Act* to obtain an allocation of riverine quarry material – a Quarry Allocation Notice. NR&M examines a river system's flow and how sediments are mobilised through the system. An Average Material Transport Rate is developed based on the river system's yield of sand and NR&M determines the allocation of riverine quarry material.

The second facet is the arrangements under the *Integrated Planning Act* (IPA). The removal of riverine quarry material is assessable under IPA, which requires a development permit along with the quarry allocation notice. NR&M is the assessment manager of the physical development permit. The primary concurrence agent is the EPA, and together they assess the conditions and constraints to the removal of quarry material such as buffer zones required, depth of quarry and equipment type etc.

NR&M is the responsible agency for all freshwater systems and EPA the agency for tidal and estuarine systems. DPI&F is effectively a 'third party' advice agency to these types of activities unless the works are to be undertaken within a declared fish habitat area (FHA) or involve the disturbance of marine plants. In this instance, DPI&F becomes a full concurrence agency.

Outside of the planning/approval arena, DPI&F does have provision under the *Fisheries Act* to enforce a 'notice to restore' (Sections 124, 125) where an activity is or has been detrimental to the fishery and/or fisheries habitat. Additional fishery approvals are also required where activities / works affect fish passage (e.g. a waterway barrier).

The extraction of quarry hardrock causes complete disturbance of localised sites. However, the area of disturbance is minimised through quarry design and site approval conditions. Other impacts, such as noise, blasting and vibration, and dust are assessed according to the relevant planning scheme (under IPA) and Environmental Protection Policy (under the *Environmental Protection Act*).

6.6 Urban land

6.6.1 Status and threats

The Wet Tropics NRM Region has a population of about 220,000 persons, over half of whom (120,000 persons) reside in Cairns City. The next most populous LGAs are Johnstone (19,383), Mareeba (18,417) and Hinchinbrook (14,700). These shires include the major population centres of Innisfail, Mareeba and Ingham respectively. Census data indicate that most of the population growth has occurred since the early 1970s, when tourism emerged as the region's primary industry (see Figure 7). Hence, while the region may once have been 'essentially rural in outlook', it appears that the view for most of us is now urban.

A further 8,700 hectares of land is needed to accommodate the projected urban population growth in the Wet Tropics Region, producing inevitable pressures on land values, housing affordability, supply and distribution of energy, construction of transport corridors and increased demand for high quality water supplies for domestic, agricultural and industrial use. The *World Resources (Urban Environment) Report*, published by the United Nations, found that urban areas affect the environment in three ways:

- The conversion of land to urban uses;
- The extraction and depletion of natural resources; and
- The disposal of urban wastes.

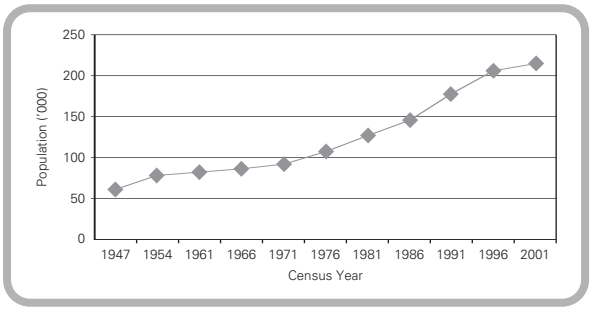


Figure 7. Wet Tropics Region population (1947–2001) (Source: WTMA, 2002, from Australian Bureau of Statistics Censuses of Population and Housing, 1947–2001).

Box 41. The issue of storm tides and marine inundation

By A/ Prof Jon Nott, JCU, Cairns

Coastal lands less then 5m above mean sea level or Australian Height Datum (AHD) along the wet tropical coast of Queensland may be subject to marine inundation during severe tropical cyclones. Marine inundation includes storm tide (surge plus tide) and also wave set-up, wave run-up and wave action. Marine inundation includes the effects of waves on top of the storm tide. Sandy sections of coast are likely to be severely eroded up to the 5 m contour (AHD) level during severe tropical cyclones due to wave action on top of the storm tide. Queensland has not experienced severe cyclones (category 4 and 5) since 1918 (Innisfail cyclone) and there are no recent bench marks from which to gauge the impact of these severe cyclones on the Queensland coast. Wave action during recent category 5 cyclones in Western Australia has eroded the coast to the level of the marine inundation or wave run-up. It is very likely that the same impacts would occur in Queensland during the same intensity cyclones.

To date coastal development zones, and demarcation of erosion prone areas, do not consider the impacts of erosion during a severe, or 1 in 100 year, cyclone event. Erosion prone areas that consider the effects of marine inundation and waves on the sandy coast need to be developed and incorporated into planning policies for the wet tropical coast, and indeed the entire Queensland coast.

The problems associated with urban encroachment on valuable agricultural lands are outlined in the section on cultivated and other improved lands, while the impacts on biodiversity have been discussed earlier, for instance the local extinction of endangered cassowaries in Cairns. It is worth noting that the natural resources of urban ecosystems have a multitude of values and benefits for urban-dwellers. Some of these include: providing habitat for plants and animals that would otherwise be absent; increasing aesthetic appeal; providing open space for recreation; and ecosystem services such as improving air and water quality and reducing noise. However, inappropriate development of ecologically and visually sensitive landscapes (for example coasts and

Cairns was the fastest growing regional Queensland city in 2003 – outstripping Townsville, Toowoomba, Mackay and Hervey Bay. It grew by nearly 3000 people compared with 1000 people for each of the previous three years.

– The Cairns Post, 11 June 2004

hillslopes) can have adverse effects on amenity and safety (see Box 41). Even where these areas are preserved and managed appropriately; recreational activities and other direct interactions (for example spreading of weeds) can have adverse impacts.

With their dense agglomerations of people and economic activity (including manufacturing, services and commerce), cities and large towns generally require more natural resources than the local area can supply. These essential supplies range from such basics as food, fuel and water to building materials such as wood, sand, gravel and stone to minerals such as aluminum and steel. This is something not readily understood by many urban-dwellers who are often separated from direct experiences that lead to an acquaintance or understanding of natural resources. The concentration of solid wastes in urban areas is also much higher than in surrounding areas.

Solid waste

The essential principles for managing solid waste are to avoid or reduce the need for waste generating materials where possible, reduce waste production by recycling and to dispose of the minimal waste stream with minimal impacts. In recent years there has been substantial progress in reducing the impacts of solid waste disposal in the Wet Tropics, mainly through attention to the disposal issue. This is a result of the work of the Local Area Waste Management Advisory Committee, the response of local governments to the landfill audit by AGC Woodward Clyde and the regulatory work of the EPA. These projects assessed the performance of existing landfills, upgraded or closed some and assessed the requirements for additional landfill capacity and investigated potential landfill options.

As a result of this work, the characteristics and volume of organic wastes produced in the region, the operations of existing organic waste processing systems and the capacity of existing markets is known. There are numerous recycling facilities for metals, glass, paper and organic waste in the region. The Douglas Shire Joint Venture for the management of municipal and industry waste is a good example of this work. Furthermore there have been investigations of costs, opportunities and constraints for a range of organic waste treatment options, such as bio-digestion, composting and waste to energy processes, although the economic size and location of the region have been obstacles.

In addition to the continuation of this work, there remain significant issues and opportunities for improving the whole solid waste system. Most of the projects would involve the 'reduce, recycle, re-use' end of this system. It is at this end that urban-dwellers can make a difference. All people, regardless of where they live, are resource users. **Urban-dwellers can reduce the size of their 'ecological footprint' (see Box 42) by being responsible with their use of natural resources, by consuming less and using less.**

6.6.2 Management response

Management of urban lands is primarily the responsibility of local government. This is primarily achieved through the *Integrated Planning Act 1997*, which is Queensland's principal planning legislation. The Act, the overarching purpose of which is 'ecological sustainability', establishes a framework for local government planning schemes and the Integrated Development Assessment System (IDAS) for assessing development applications. The majority of State planning and licencing approval processes (e.g. licensing of 'environmentally relevant activities' under the *Environmental Protection Act*), have been 'rolled in' to the *Integrated Planning Act* to integrate assessment of all aspects of development.

At a higher level the FNQ Regional Plan informs and instructs the IPA schemes. The FNQ Regional Plan seeks to achieve sustainable urban development that is efficient and compact, maintain a high quality living environment, utilise land resources efficiently and effectively and in harmony with the natural setting.

The FNQ Regional Structure Plan within the FNQ Regional Plan establishes, in general terms, the preferred broad-scale physical arrangements for the region over the next twenty (20) years, primarily in relation to urban settlement and regional infrastructure. It provides a broad planning framework designed to ensure future growth and development is accommodated in an efficient and effective manner commensurate with the need to protect key economic, social and environmental values. The plan reflects short (0–10 years), medium (10–15 years) and long term (15–20+ years) development opportunities need to be provided within the city of Cairns, on the northern tablelands and in the Cairns southern corridor, in a timely, efficient sequence. The preferred development sequence will in effect, provide for sustainable urban growth by protecting environmental areas and natural resources on the coast, provide for sustainable economic and employment opportunities in all new areas.

Box 42. Ecological Footprint

An **ecological footprint** is the measure of the amount of productive land area it takes to sustain one human or group of humans, say in a family or city. It is based on their use of energy, food, water, building material and other consumables. It is a way of determining relative consumption. Researchers William Rees and Mathis Wackernagel developed the technique in the early 1990s. They found that developed nations like Germany, Canada and the United States had ecological footprints up to three times as large as the area of productive land available to them. Similarly, the ecological footprint of a city like London is now the size of Spain. It takes that much land to support it. Per person, 1.7 ha is presently the accepted ecological benchmark for global sustainability. This will be reduced to 1.2 ha with the anticipated global population of 10 billion for the year 2050. You can estimate your own ecological footprint at http://www.ecologicalfootprint.com/.

The development industry (including private developers, architects, builders and planners) also has a key role to play in reducing the ecological footprint of urban land. North Queensland has its own chapter of the Australian Green Development Forum (AGDF-NQ). A balanced, non-profit coalition of members from development industries, government organisations and community groups, the aim of AGDF is 'to inspire urban developers, governments and industry bodies to work in partnership to achieve economically viable, sustainable developments.'

6.7 Land Resource targets

This chapter outlines some of the management actions that are needed to achieve the goal for land resources in the Wet Tropics. Implementing these and complementary actions described in other chapters (particularly for water and biodiversity) is expected to result in changes in the condition of the region's land resource. The specific resource condition targets for land (see below) should be read in conjunction with these assets because of this overlap.

As reported earlier, FNQ NRM Ltd commissioned Neil Sing (DPI&F) to develop a suite of management action targets for the major regional agricultural industries in the Wet Tropics (see also section 6.7.1). Management action targets for most of the major primary industry land uses were determined using a survey and industry group discussion process. Some smaller industries such as mangoes were not covered because of limited time and potentially limited environmental impacts. Agri-political groups associated with these industries assisted to determine current adoption rates and targets for the adoption of a defined set of best management practices (BMP). Considerable use was also made of BSES Ltd and DPI&F staff expertise to document best management practice in each industry.

The standard form of Sustainable Land Use MATS used here is:

"X% of farmers adopt best management practice Y in the specified region".

The practices, selected for their relevance to resource outcomes, are currently successfully used by at least some farmers (the baseline) in the region and industry

Box 43. Grazing Targets

By Neil Sing, DPI&F.

The beef industry is the biggest agricultural industry in the area under the jurisdiction of FNQ NRM Ltd in terms of land under production (excluding forestry) and second in terms of the number of producers. The structure of the industry makes it also the most difficult to access. In the drier areas of the Upper Herbert Catchment there are large, viable properties run by full-time beef producers. In other coastal and Tableland areas similar types of producer can be found but the part time producer is more common. These producers are less likely to live on the property and on the whole could be regarded like all part-time farmers as less interested in farming, although many are very competent. They are also less likely to belong to any industry organisation such as Agforce or organised group that can be used as a vehicle for identifying targets.

In recognition of this, targets for the beef industry were developed in two separate processes. One was concerned with just the Upper Herbert targets and the other with the wet areas on the coast. The methodology to determine the targets was different in each area, as were the issues.

Wet Area Targets

Approaches were made to Agforce who identified five locations as potential areas for which targets should be developed. These were Daintree, Herbert, Tablelands, Tully and Innisfail. Meetings were arranged through Agforce for the Daintree, Tully and Innisfail areas. The catchment coordinator arranged a meeting of producers in the Herbert and a marketing group of beef producers was used on the Tablelands. Just over 60 producers were involved in the process throughout the region although a group of 70 producers was addressed on the topic at a Landmark agribusiness function.

Land condition can be described in both dry and wet areas according to whether they are in A, B or C condition with prescribed criteria used to judge each level. On the wet coast, lack of groundcover or pasture density is generally not an issue, although over grazing can lead to a greater component of production weeds. Land condition was not used as a target on the wet coast for this reason and sediment loss was regarded as unlikely. This conclusion is supported by work done by Malanda Landcare group. Sheet erosion is possible under conditions of extreme overgrazing and this is recognised in the actions developed.

In most industries BMP is seen as the area where targets should be developed. In the wet coast beef industry BMP was not seen as having much potential for environmental impact, although this does depend on how wide a view is taken of BMP. If this extends to management of riparian areas then BMP is relevant but is possibly the limit. The other important BMP in wet area beef production is rotational grazing to manage pasture production and condition but this suffers from a measurement problem in identifying how much is enough or too little.

Beef producers saw weeds as a major issue but riparian issues were those that received the most attention. Riparian issues are also the area where there is the greatest doubt by farmers about the value of trees for riparian purposes.

Peter Wheatley's farm at South Mission Beach. (Photo: Geoff McDonald)

groups defined a realistic and achievable target level of adoption for the next five years (in all cases much above the baseline).

Management practice targets were prepared with industry groups in the seven cane growing districts in the Wet Tropics, namely Tableland, Mossman, Mulgrave, Babinda, Innisfail, Tully and Herbert. The targeted levels of achievement vary slightly between the districts reflecting local conditions. The targets shown here are for the Mulgrave area which was the most comprehensive and the results strongly influenced the decisions at other mill areas.

There are difficulties defining and documenting these BMPs. Not all industries are able to do this for every aspect and also a BMP can be adopted in parts or to a degree. A BMP may be still in its infancy and not all experts have agreed that a particular BMP is just that. Some may well turn out to be but are so leading edge that only 2–3% of farmers are trying out these practices. BMPs are a significant issue because they are usually very environmentally friendly practices and adoption would have a great benefit.

Determining the level and degree of adoption is perhaps the hardest issue. A soil test or leaf tissue analysis can be used as an example. you could take a soil test once a year from your farm, on every soil type, or on every block. On every block is the best option but both methods are using soil tests. With leaf tests for papaws doing it once is good, twice even better but three times may be just wasting money. It might be said that doing a soil test is best done on every block but this black and white approach does not recognise that there are farmers who are making progress towards using better practices. It is important to recognise these shades of grey of adoption not only for evaluation purposes but also to identify actions to move farmers along this path of adoption of the practice to a greater degree of sophistication.

To achieve improvements, many of the management actions will have to be undertaken voluntarily. As Sing (2004) points out, this process will be driven by the potential availability of funds to carry out improvement activities. Land managers will therefore be looking to groups like FNQ NRM Ltd for support in these endeavors. Other actions are the responsibility of natural resource managers, such as the State and local governments, and are policy-driven and/or required by legislation. As such, they should be considered core business.

6.8 Land Resource targets and actions

Management Action Target (MAT)	*Type of MAT*[27]	*Management Actions*	*Links Targets*[28]	*Potential Partners*
Resource Condition Target (RCT): L1. Maintain the sustainable productive capacity of land resources and reduce the loss of soil in Wet Tropics catchments by 2015.				
L1.1 Collate and calibrate targets for soil loss rates for different erosion and sediment management strategies by 2005. (See also W3).	RA	**L1.1.1** Review classification, condition and soil loss of soil types in the Wet Tropics based on NR&M soil suitability studies. **L1.1.2** Continue existing research programs on soil loss and sediment management strategies for all industries. **L1.1.3** Classify, map and identify the erosion rating of soils in the region. **L1.1.4** Identify appropriate soil erosion control practice for the soils of the tropics. **L1.1.5** Identify key sediment loss areas and industries. **L1.1.6** Increase technical support for soil conservation and management, and actively encourage the continued use of soil erosion structures (in conjunction with farming management systems approach including conservation cropping and conservation tillage practices in the region) in high priority areas. See W3.1, W3.2, W3.3, W3.4, W3.7, W3.8, W3.9.	B1, B3, B8, CB1, L2, W3, W6, L4, L7, L8.	NR&M, DPI&F, CSIRO, ACTFR, RWQPP Partners.

[27] Types of Management Action Targets: CB- Capacity Building, OGW- On-Ground Works, P- Planning, RA- Resource Assessment & Monitoring

[28] Some actions relate to many more condition targets than indicated here.

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
L1.2 Land managers adopt priority Best Management Practices by 2010 in each major industry in the Wet Tropics: • cane • banana • papaya • cropping; peanuts, potato and maize • dairy • wet area grazing • extensive grazing • forestry	OGW	L1.2.1 Identify and document Best Management Practices that are essential to the long term viability of industries in the region. L1.2.2 Investigate critical priority best practices that are essential to meet all obligations of other RCTs i.e. • Water Quality – reef water quality plan targets for industries, sediment, nutrient and pesticides; • Riparian; • Wetlands; • Weeds; • Native vegetation – Incorporate net gain principles for native vegetation in BMPs, for agriculture, infrastructure, mining and extractive industries; • Acid sulphate soils; • Salinity; and • Water Quantity. L1.2.3 Initiate extension program in conjunction with industry landholders in the use of BMP in all critical industry areas. L1.2.4 Facilitate the initiation of incentive programs aiding landholders in the implementation of priority practices. L1.2.5 Continual improvement of Priority Best Management Practices by on going monitoring of effectiveness.	B4, B8, B8, C2, CB1, L1, L2, L4, L6, L7, ME1, W3, W6.	Industry Organisations, RWQPP Partners, NR&M, DPI&F, Research Organisations.
L1.3 Banana industry refine extension programs to improve land and water management practices by 2008, in addition to specific audited adoption targets (defined p.84).	OGW	L1.3.1 Work with banana industry to actively encourage adoption of BMP identified in L1.2.	B1, B6, B8, CB1, L1, L2, W3, W6, L4, L6, L7.	Industry Organisations, NR&M, DPI&F.
L1.4 Wet Area grazing refine extension programs to improve land and water management practices by 2008, in addition to specific audited adoption targets (defined p.86).	OGW	L1.4.1 Extension of recommended grazing activities to beef producers in the wet by (includes management of pastures especially risks from over grazing, and appropriate use of fertilisers and chemicals). L1.4.2 Information is made available on the sources of funds for financing off stream watering points, in paddock shade and shelterbelts. L1.4.3 Program to identify acid sulphate released by drains and consequent remediation.	B1, B3, B6 -B9, B19, CB1, L3, L4, L7, L8, W1 - W3.	Industry Organisations, NR&M, DPI&F.
L1.5 Dairy farming industry refine extension programs to improve land and water management practices by 2008, in addition to specific audited adoption targets (defined p.84).	OGW	L1.5.1 A set of water use (and fertiliser) scheduling tools is defined for use by dairy farmers. L1.5.2 Increased awareness of the role of pasture management rotations in preventing the overgrazing of riparian areas. L1.5.3 Information is made available on the sources of funds for financing off stream watering points, in paddock shade and shelterbelts. L1.5.4 A forum is held to facilitate the exchange of information on management options for riparian zones at the property and catchment scale.	B1, B3, B4, B5, B6, B7, B8, B9, B19, CB1, L3, W1, W2, W3.	Industry Organisations, NR&M, DPI&F.
L1.6 Sugar cane industry – refine extension programs to improve land and water management practices by 2008, in addition to specific audited adoption targets (defined p.86).	OGW	L1.6.1 Growers are encouraged to control sediment losses by using spray out fallow or cover crops rather than cultivated fallows. L1.6.2 High-risk locations for sediment loss in the area to be identified, financial requirements for implementation assessed and soil conservation layouts installed where appropriate. L1.6.3 Develop guidelines for sediment and nutrient loss management techniques. L1.6.4 Growers are encouraged to maintain grassed headlands. L1.6.5 Growers to be made aware of effective riparian management techniques that to allow natural regeneration of native vegetation.	B1, B3, B4, B5, B7, B8, B9, B19, CB1, L3, L4, L7, L8, ME1, W1, W2, W3.	Industry Organisations, NR&M, DPI&F.

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
		L1.6.6 Priority locations for joining areas of riparian vegetation on major rivers and streams in the area are identified and a program of rehabilitation of these areas is implemented. **L1.6.7** A program of converting all major drains to have sloping sides and grassed is introduced. **L1.6.8** Work with cane industry to actively encourage adoption of practices to adoption of BMP as identified in L1.2. **L1.6.9** Promote practices that improve soil health and to reverse soil fertility decline. **L1.6.10** Introduce a program to identify acid sulphate released by drains and consequent remediation.		
L1.7 Papaya industry meet audited adoption targets (defined p84) by 2008.	OGW	**L1.7.1** Work with Papaya industry to actively encourage adoption of BMP as identified in L1.2.	B1, B6, B7, B8, CB1, L1, L2, W3, W6, L4, L6, L7.	Industry Organisations, NR&M, DPI&F.
L1.8 Peanuts, potato and maize growers meet specific audited adoption targets (defined p85) by 2008.	OGW	**L1.8.1** Work with cropping industry to actively encourage adoption of BMP as identified in L1.2.	B1, B6, B7, B8, CB1, L1, L2, W3, W6, L4, L6, L7.	Industry Organisations, NR&M, DPI&F.
L1.9 Extensive rangelands graziers meet specific audited adoption targets (defined p86) by 2008.	OGW	**L1.9.1** Implement the Savanna Plan	B1, B6, B7, B8, CB1, L1, L2, W3, W6, L4, L6, L7.	Industry Organisations, NR&M, DPI&F.
L1.10 All industry BMPs reviewed to incorporate net gain principles for native vegetation by 2007.	OGW	**L1.10.1** Incorporate net gain principles for native vegetation in BMPs, for agriculture, infrastructure, mining and extractive industries. **L1.10.2** Develop new extension techniques and target rural residential and part-time land managers. **L1.10.3** Extension program to implement Property Management Plans via sub-catchment approach incorporating industry BMPs.	B1, B6, B7, B8, CB1, L1, L2, W3, W6, L4, L6, L7.	Industry Organisations, NR&M, DPI&F.
L1.11 Local government regulate new, significant drainage works by 2008.	P	**L1.11.1** Local government amend their planning schemes to include drainage as a material change of use in both rural and urban areas, requiring code assessment (some local governments have already done so).	B1, B6, B7, B8, CB1, L1, L2, W3, W6, L4, L6, L7.	Local Govt, DLGP, LGAQ.
RCT L2. All good quality agricultural land will be retained for productive agricultural use commensurate with the broader regional economic, environmental and social priorities of the region by 2014.				
L2.1 Conduct land use investigations that consider future use of cane land for a range of uses and consider economic, social and environmental impacts by 2007.	RA	**L2.1.1** Investigate the potential for sugar industry restructuring programs to assist achieve land resource, water quality and biodiversity outcomes in line with *State Planning Policy 1/92: Development and the Conservation of Agricultural Land*. **L2.1.2** Review the land suitability framework for the Wet Tropical coast to incorporate changes in community attitudes towards what areas are suitable for sugar cane cultivation from agricultural and environmental perspective.	L1	Industry Organisations, Research Organisations, NR&M, DPI&F, DLGP.
L2.2 All local governments will develop and implement plans for appropriate rural residential and lifestyle development while protecting GQAL by 2010.	RA	**L2.2.1** Complete regional mapping of areas of GQAL and make readily available to the agriculture industry and land use and resource planning and management authorities. **L2.2.2** Incorporate procedures in local government planning schemes to manage rural subdivisions and family transfers to prevent fragmentation of agricultural land holdings. **L2.2.3** Develop and/or maintain incentives for landholders to retain GQAL in productive agricultural use.	L1.	Local Govt, NR&M, DLGP.

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
		L2.2.4 Develop additional support strategies that will assist local government to implement *State Planning Policy 1/92: Development and the Conservation of Agricultural Land* through regional and local land use planning and decision-making processes.		
RCT L3. 30% reduction in waste production in critical rural industries by 2010.				
L3.1 The regions industries have suitable waste management practices by 2008.	OGW	L3.1.1 Support and facilitate the development and implementation of specific industry waste management strategies relevant to the region's industries, with priority given to tourism, agricultural and marine industries. E.g. Green Globe accreditation. L3.1.2 Trial base information on environmentally friendly waste disposal methods where problems exist (eg disposal of agricultural plastics) for inclusion into BMP. L3.1.3 All growers are made aware of ways of disposing of waste materials in an environmentally friendly manner. L3.1.4 All growers are encouraged to utilise organic waste.	B8, L1.	Industry Groups, NR&M, DPI&F.
L3.2 Identify and implement suitable agricultural liquid waste management and reduction by 2008.	OGW	L3.2.1 All growers are encouraged to manage waste water in such a way that avoids direct discharge into watercourses.	B8, L1.	Industry Groups, NR&M, DPI&F.
RCT L4. No new risk of acid sulphate soil exposure by 2007 and disturbed acid sulphate soils rehabilitated by 2014.				
L4.1 No new development, drainage or other activities will occur in acid sulphate soil areas in the Wet Tropics unless maximum mitigation measures are incorporated by 2007.	OGW	L4.1.1 Support the implementation of *State Planning Policy 2/02: Planning and Managing Development involving Acid Sulphate Soils*, provide assistance in the form of data and information, mapping, codes of practice, guidelines for activities located within coastal and foreshore areas and the like in order to best achieve the desired outcomes of the State Planning Policy. L4.1.2 All wetlands or low-lying areas with disturbed acid sulphate soils rehabilitated to improve water quality of downstream environment. L4.1.3 Complete the mapping, assessment and monitoring the condition, of actual or potential acid sulphate soils, with priority given to coastal areas of known potential. L4.1.4 Raise industry and community awareness of the environmental, social and economic implications of disturbing potential acid sulphate soils (PASS). L4.1.5 Facilitate rehabilitation and management of areas of actual acid sulphate soils, on a priority site basis.	B7, B8, B9, L1, W3, W4.	NR&M, DPI&F.
RCT L5. No area of the Wet Tropics will have dryland salinisation outbreaks.				
L5.1 Determine the areas under threat of salinisation occurring in the Wet Tropics Region and manage appropriately by 2006.	RA	L5.1.1 Undertake a salinity hazard and risk assessment of the region. L5.1.2 Raise industry and community awareness of the environmental, social and economic implications of dryland salinity and disseminate information for avoidance.	W3, L1, CB1.	NR&M, DPI&F, Industry Organisations, Community Groups.
RCT L6. 100% control of outbreaks of new agricultural pest plants and animals from 2004 and impact of agricultural pests contained by 2009 and reduced by 2014.				
L6.1 Strategic control of pest plants and animal outbreaks from 2004.	OGW	L6.1.1 Implement strategic pest plant and animal control programs where public investment is warranted. L6.1.2 Further develop and implement non-lethal methods of control of problem native animals.	B5, L1, W1, W2, W5.	Landcare and Catchment Groups, NR&M, DPI&F.

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
L6.2 Coordinated weed control in all shires using shire pest management plans and involving all stakeholders is implemented with targeted information available for property managers including best practice weed management covering machinery and stock crate movement by 2005.	CB	L6.2.1 In conjunction with DPI&F, stakeholders, and landholders, guidelines for the management of cattle and weeds in riparian areas in wet regions of the Wet Tropics developed and distributed by 2008. L6.2.2 Regional Pest Management Officer to develop the capacity of individual shires and through them associated stakeholders, to coordinate their pest management efforts across shire boundaries thus enhancing the use of resources, staff, equipment and databases. L6.2.3 Regional Pest Management Officer to work with councils, agencies and other stakeholders to develop and implement targeted community awareness and education programs. Refer B5.1.	B5, L5, L1, W1, W2, W5, CB1, ME1.	Local Govt, NR&M, DPI&F.
RCT L7. Extensive rangelands – 70% of the pasture landscapes to be in A and B condition by 2017.				
L7.1 All landholders have information on pasture condition by 2005.	CB	L7.1.1 Comprehensive assessments of pasture composition and structure (cover) by land systems in the region. This should include desirable grass species, the level of pasture deterioration and degradation; and the long-term sustainable carrying capacity. L7.1.2 Evaluate the effectiveness of the *Leucaena Network Code of Conduct* and adapt and improve code if necessary.	B5, B6, B7, W1, W2, W3, W4, W6, L1 - L5.	DPI&F, Industry Groups, Landcare groups.
L7.2 All landholders are aware of best practice environmental management by 2007.	CB	L7.2.1 Targeted GLM+ adoption rates achieved through management actions detailed in table 6.7.1 (see p100). L7.2.2 Encourage, promote and provide advice on best practice management, in conjunction with property planning. L7.2.3 Promote the use of *Leucaena Network Code of Conduct* to minimize the risk of commercial leucaena adding to existing weed problems. L7.2.4 Undertake educational campaign for pastoralists on Aboriginal issues and interests for country. L7.2.5 Support and resource Traditional Owners to develop agreements with pastoralists regarding access and use of country.	B16, W1, W2, W3, W4, W6, L1, L2, L3, L5.	DPI&F, Industry Groups, Landcare groups.
L7.3 All leaseholders have property management plans by 2011.	RA	L7.3.1 Develop support materials to guide pastoralists in the preparation of property resource management plans and to meet their obligations under the *State Rural Leasehold Land Strategy*. L7.3.2 Develop criteria for property management plans for pastoralists on leasehold land regarding recognition of Traditional Owners rights and aspirations.	L1, L2, L3, L4, L5, B1, B4, B5 B6, B19, B21, W2, W3, W4, W6.	DPI&F, Industry Groups, Landcare groups.
L7.4 Landholders fence priority wetlands and waterways and/or provide alternative water points by 2011.	OGW	L7.4.1 Key frontage and riparian areas identified (through property and regional planning) and fenced to regulate stock control and allow regular wet season spelling and fire. L7.4.2 Key wetlands and waterholes identified and maintained by fencing, regulating stocking pressures and providing off site watering points. L7.4.3 Construct fencing for riparian areas so that wet season spelling can be adopted, and pull cattle out while pasture cover is still high.	L1, L2, L3, L4, L5, B1, B4, B5 B6, B21, B23, W2, W3, W4, W6.	DPI&F, Industry Groups, Landcare groups.
RCT L8. Productive forest area increased and improved by 2014.				
L8.1 The region has a production forest strategy including farm forestry by 2007.	P	L8.1.1 Undertake an audit including assessing existing plantations and growth figures. L8.1.2 Identify lands suitable for developing broad hectare timber plantations and small-scale native timber resources that require no clearing of native vegetation. L8.1.3 Determine and promote potential opportunities for the development of value-adding processes for the region's timber products. L8.1.4 Investigate species/ site /end use suitability across the region.	L6, B6, B19.	DPI&F, Industry Groups, NR&M.

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
		L8.1.5 Investigate incentive schemes to encourage farm forestry where significant environmental gains are achievable. L8.1.6 Assist negotiations with stakeholders and State govt to provide longer term certainty of harvesting rights.		
L8.2 All landholders in the region have access to forest development information by 2007.	CB	L8.2.1 Facilitate the availability of seedlings of suitable native species from nurseries in the region. L8.2.2 Conversion of farm headlands (and marginal areas) to commercial forestry where appropriate. L8.2.3 Provide forestry extension services and supporting farm forestry across the region, through active participation with individuals, grower groups and land care, catchment and other NRM groups. L8.2.4 Actively seek interested farmers to develop tree planting programs with them. L8.2.5 Promote the conversion of marginal agricultural and grazing lands (steep slopes, erosion prone areas, wind exposure areas and poorer soils) to commercial forestry. L8.2.6 Investigate opportunities and support Traditional Owner participation in the forestry sector. L8.2.7 Encourage the adoption of Codes of Practice for forestry activities (on private and State lands) incorporating environmental, social, cultural and economic considerations (e.g. develop methods of low impact harvesting). L8.2.8 Encourage certification (eco-labelling) of forest products.	B6, B19, CB1, L6.	DPI&F, Industry Groups, Landcare Groups.
RCT L9. The availability of all existing extractive resources is maintained commensurate with the broader economic, environmental, and social priorities of the region from 2004.				
L9.1 From 2004 the principles of the Draft State Planning Policy for Protection of Extractive Resources are adopted.	CB	L9.1.1 Raise community awareness of the importance of protecting extractive resources. L9.1.2 Develop and/or maintain incentives for landholders to retain extractive resources. L9.1.3 Develop additional support strategies that will assist State and local government to implement the State Planning Policy for Protection of Extractive Resources, when finalised, through regional and local land use planning and decision-making processes. L9.1.4 Support the implementation of the final State Planning Policy for Protection of Extractive Resources, provide assistance in the form of data and information, mapping, codes of practice and the like in order to best achieve the desired outcomes of the State Planning Policy.	L1, W3.	Local Govt, NR&M.
L9.2 No mining activity to have detrimental offsite impact by 2014.	OGW	L9.2.1 Strategy for Upper Herbert relic mine sites developed and progressively implemented.	L1, L2, L3, L4, L5, L7, B1, B4, B5, W3.	NR&M.
RCT L10. Urban Lands – No solid waste disposal site is causing detrimental impacts by 2015.				
L10.1 For all existing and new landfill sites, local government develop integrated management plans to meet legislative and management requirements, including post-closure management by 2010.	P	L10.1.1 Complete the Local Area Waste Management Advisory Committee program. L10.1.2 Investigate opportunities to develop gas to energy and waste to energy conversion processes for regional landfill sites. L10.1.3 Establish regional recycling targets and monitor and report on performances in meeting these targets.	L2, L8, W3, W4, C1.	Local Govt, NR&M.

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
L10.2 Reduction by 25% in the per capita volume of solid waste to landfill by 2015.	OGW	**L10.2.1** Develop regional guidelines and arrangements with construction and demolition industries for improved management and recycling of construction and demolition wastes projects. **L10.2.2** Encourage and facilitate home composting through appropriate incentives and accessibility to composting units. **L10.2.3** Reduce the volume of organic wastes going to landfill, and develop viable processes and markets for the treatment and re-use of organic wastes. **L10.2.4** Support the establishment of effective material separation and recovery facilities that minimise source separation and collection of recyclable materials. **L10.2.5** Facilitate and provide support to commercial recycling industries to establish viable industries and product markets within the region to use wastes. **L10.2.6** Develop or extend community based recycling operations. **L10.2.7** Review charging regimes for disposal of wastes to landfills in order to reflect the true long term costs of operating, maintaining and remediating landfill sites.	L2, L8, W3, W4, C1, CB1, ME1.	Local Govt, Community Groups.
L10.3 The region's industries have environmentally friendly waste management practices by 2011.	CB	**L10.3.1** Support and facilitate the development and implementation of specific industry waste management strategies relevant to the region's industries, with priority given to tourism, agricultural and marine industries, e.g. Green Globe accreditation.	L2, L8, W3, W4, C1, C2, CB1.	Industry Groups.

6.8.1 Detailed management actions – Priority Best Practice for agriculture

Key management practices and adoption rate targets for industries in the Wet Tropics NRM region (Sing 2004) for bananas, dairy, peanuts, potatoes& maize, papaya, cane industries and extensive rangelands to be achieved by 2008.

Banana Industry

Banana Industry – 100% of banana growers are made aware of the role silt traps, timbered riparian areas, contours and grassed drains, grassed inter rows and headlands play in reducing the loss of sediment and nutrients from farm blocks (no benchmark, capacity building target).

90% of banana growers use cultivation for land preparation only timed for May–Oct period and use herbicide for crop eradication (benchmark is 82%).

90% of growers are carrying out a soil test in each block /cycle with the subsequent application of major (incl. P) and minor nutrients using advice received.

75% of growers use where N application rates based on crop development, monitoring of N levels using leaf analysis 1–2 per crop cycle, with rate targets set at achieving between 250–300kg per ha per year (adjusted according to monitoring) mix of application methods (fertigation and broadcast) depending on season, specific trash placement.

80% of banana growers use herbicide in such a way that is integrated with trash placement with headlands and interrows managed by slashing and application timed to avoid risk of wash by rain (benchmark 75%).

80% of banana growers have at least 70% of their feasible internal drains wide, shallow and grassed (benchmark is 75%) with remainder of drains being managed using best practice management of box drains.

80% of banana growers use clean planting material sourced from tissue culture, fallow with specific non-host cover crops, and chemical applications are based on monitoring.

75% of banana growers use chemicals for the control of soil insects applied strategically as part of an integrated program, time application to avoid risk of high rainfall, product solubility considered and targeted application used.

80% of banana growers are using monitoring equipment in one place to guide irrigation practices for the whole farm.

Dairy Industry

100% of farmers make a self-assessment of their effluent management system using a quantifiable self-assessment process developed for the situation and compatible with existing quality assurance systems.

100% of farmers have effluent systems that meet local industry agreed standards to minimize impacts on surface and groundwater. These standards/targets to include:

- Effluent disposed of into either a pond, pump and sump or if into an adjacent paddock under specific conditions.
- All farms have effluent flowing from the dairy yard to the point of collection through a pipe or impermeable open drain (benchmark 86%).

50% of farms to have effluent filtered through a solids trap before entering pond system by 2008 (benchmark 16%).

All farms with relevant systems have the capacity to store at least one day's effluent.

100% of farms with ponds have a system designed so that it rarely overflows (benchmark 70%).

80% of farmers who have ponds ensure that they are impermeable (benchmark 59%).

100% of farmers with ponds pump out their effluent ponds before the start of the wet season to ensure they never overflow (benchmark 48%).

100% of farmers manage their effluent in such a way to ensure that it does not enter directly or indirectly into a watercourse (multiple benchmarks).

75% of farmers use either a soil test or move the distribution system frequently to avoid over supply of nutrients (benchmark 45%).

Irrigation

50% of farmers with irrigation have an effective method of scheduling and monitoring irrigation applications (benchmark 14%).

100% of farms have on-farm audits of the efficiency of their irrigation systems.

Nutrients

Dairy farmers to have nutrient management strategies that minimize nutrient losses and include the following as targets:

- 85% of farmers use soil samples at least every 2 years form various soil types on the property to determine nutrient requirements (benchmark 66%).
- 70% of farmers apply N fertilisers every month when rainfall is adequate (benchmark 46%).
- 80% of farmers apply N levels dependent on records, anticipated stocking rate, temperature and rainfall pattern, chance of leaching losses, outside advice and economic conditions (benchmark 52%).
- 80% of farmers apply lime as required based on a soil test (benchmark 61%).
- 100% of farmers using winter pastures establish those pastures using mulch striking with either spray out or mowing of existing pasture (benchmark 70%).
- 75% of farmers renovating tropical pastures do so using multiple N applications and grazing management (benchmark 59%).

Chemicals

100% of farmers holding a current agricultural and veterinary chemical users certificate.

100% of farmers are aware of storage and disposal (including local government guidelines) of chemical containers in accordance with quality assurance and legal requirements.

Weeds

80% of farmers have a regular weed control program involving weedicide use, stocking rate, rotation management and fertiliser application (benchmark 55%).

Peanuts, Potatoes and Maize

60% of farmers have water management control systems in place including contour banks, silt traps, maintained (slashed) waterways (drains) and headlands and vegetated riparian areas.

Improve the efficiency of irrigation systems used on all types of crops on the Tablelands including:

- 60% of farmers are using a sophisticated system of scheduling and recording of irrigation.
- Audits carried out on 60% of farm irrigation systems.

60% of farmers growing peanuts are using soil testing in a strategic manner to determine nutrient requirements.

80% of farmers growing potatoes adopt an integrated pest management plan for pest control.

The need for farmers growing peanuts to adopt an integrated pest management plan for pest control is investigated.

Papaya Industry

60% of land managed by papaya growers will have a nutrient management program in place, which requires landowners to comply with 50% or more of the following points:

- soil test performed prior to planting
- tissue test/s performed during the crop cycle
- record kept of all soil/tissue tests allowing comparison
- genuine effort to apply fertiliser more frequently
- use of weather forecasts to assist in managing timing and rate of fertiliser application
- record kept of all fertiliser applications including at minimum, rate, blend and date of application

60% of land managed by papaya growers will have a sediment management strategy in place, which requires landowners to comply with 50% or more of the following points:

- amount of bare ground during the wet season, especially in the months of February and March, is minimized
- inter-rows are slashed rather than sprayed out
- majority of drains are wide, shallow and grassed

- fallow cropping incorporated into crop cycle
- follow best practice for crop removal
- riparian areas are managed and allowed to rehabilitate naturally

Cane Industry

85% of farmers in all catchment areas apply N fertiliser as per the recommendations (incl. accounting for filter mud).

50% of farmers use soil tests in every crop cycle as a method of assessing cane nutrient requirements (benchmark 43%).

80% of farmers apply N fertiliser either underground or on the surface as close to the stool as possible and applied when there is the least risk of loss (benchmark for Mulgrave at this level but need to confirm).

80% of fallow area uses either a spray out fallow, or a legume/break crop (incl. direct drilling) with a green cane trash blanket (i.e. not cultivated) (benchmark 65%).

30 % of farmers prepare ground for plant crops using strategic or zonal tillage and controlled traffic zones (benchmark 24%).

45% of farmers retain inter-row trash through minimum tillage planting of replant crop (benchmark 30%).

60% of farmers use a range of chemicals for weed control that enables a reduction in the use of diuron and atrazine (benchmark 27%).

60% of farmers maintain a vegetated (incl. trees) riparian zone to intercept nutrients at depth and from overland flows (benchmark 49%) to apply to specified streams and rivers.

45% of farmers retain a trash component at all times in the crop cycle (benchmark 25%).

55% of farmers have a system of farming where the normal practice is to not burn the trash (benchmark 38%).

Extensive Rangelands

Ground cover

15 additional landholders managing stock numbers according to soil and climatic constraints, setting sensible stocking rates and maintaining an average ground cover greater than 50% at break of season.

Mapping and inventory

15 additional landholders engaging in GLM+ and using a satellite image/air photo and property planning kit to map paddocks, infrastructure, land types and land condition.

Property land condition information could be collated to add greater integrity to the Regional Land Condition Assessment (DPI&F 2003/2004). This would be subject to landholder agreement.

Riparian and wetland

Area and condition of frontage/wetlands/waterholes identified through GLM+ on 15 additional properties. This will provide a focus for future rehabilitation or management interventions. The GLM+ on-property process will be used to identify at-risk frontage and wetland areas. Options to fence, regulate stocking pressure, wet season spell and burn will be tested i.e. affordability, feasibility and profitability. This may include wetland rehabilitation i.e. repair drainage points to improve functionality of these systems.

Pasture monitoring and stocking decisions

15 additional landholders monitoring and recording pasture yield at 1st Muster (April/May) and adjusting stock numbers according to available feed. This will include break of season yield and ground cover measurements to check if stocking decisions were correct.

Wet season spelling

15 additional landholders participating in GLM+ to map paddocks, land types and land condition. Each property will use this information to plan and initiate a systematic wet season spelling program. Waters and fencing projects to initiate wet season spelling will be tested on each property through the GLM+ on property process i.e. affordability, feasibility and profitability.

***Note** – Wet Season Spelling means destocking for sufficient time over the wet season to maximize the amount of ripe seed of desirable perennial grasses on the ground. A wet season spelling program needs to be combined with sensible stocking rates to maintain good land condition.*

Fire and woodland management

15 additional landholders participating in GLM+ to map paddocks, land types and land condition. Each property will use this information to plan and implement a burning program depending on land types, timber thickening and patch grazing in each paddock. Waters and fencing projects to implement a burning program will be tested on each property through the GLM+ on property process i.e. affordability, feasibility and profitability.

***Note** – Fire needs to be used on a case by case basis and may not be suitable to control thickening on some land types.*

Weeds

15 additional landholders participating in GLM+ to map paddocks, land types and land condition. Each property will use this information to map weed infestations and assess the impact of weeds on land condition. Weed Management Plans will be developed and initiated depending on scale of infestation and affordability.

7.0 Water resources

7.1 Goals

Water in the Wet Tropics rivers and streams will be managed on an holistic basis and will be used efficiently to support domestic, agricultural and industrial uses, allocated equitably between users and provide sufficient water for ecological processes and environmental values.

The Aboriginal cultural values for water will be maintained, protected and recognised in planning, use and management activities.

Water discharging into the Great Barrier Reef will meet the Reef Water Quality Protection Plan goal, namely: "to halt and reverse the decline in the quality of water entering the Reef, within ten years."

7.1.1 Water: An overview of the asset and the services it provides

Rainfall and run-off[29]

Average rainfall in the Wet Tropics is generally very high but with distinct wet and dry seasons. On average, more than 2000 mm per annum falls on most parts of the region and up to 4000 mm on the coast. Precipitation on the coastal ranges is much higher again (6000 mm+) with a further 30% collected through the process of 'cloud stripping' (i.e., the trapping of cloud water droplets by montane forests). East-west rainfall gradients are very high and on the western Tablelands annual rainfall is in the range 800 to 1000 mm falling to less than 700 in the drier districts of the Upper Herbert River catchment (see Appendix K).

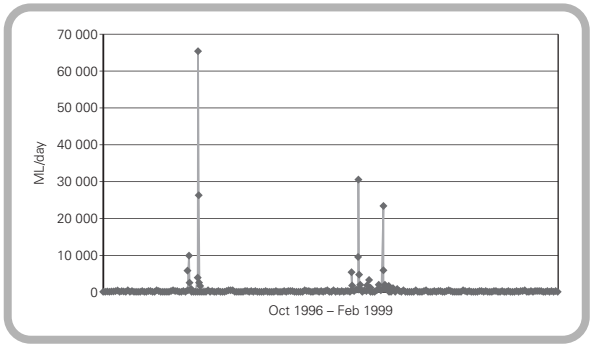


Figure 8. Wet Tropics Rivers are highly variable: Daily flow information (ML/day) at the Bilwon Gauging Station (Barron R) 1996–1999, and Barron River Gorge flood 1998.

There are two major impacts of this climatic pattern on both natural processes and human systems. The first is that runoff can be high during short periods resulting in flooding of streams and rivers. The second is that there are periods during the year when water can be in short supply as waterways have low flow and/or groundwater levels are lowered.

Table 9 presents the rainfall and annual discharges for the major catchments in the region together with current allocations. The highest recorded streamflow in the region was 4.56 megalitres per second recorded at Myola on the Barron River in March 1977. While these figures show potential still exists within the region for water resources development, such development will likely have significant environmental implications and be limited by the need to provide appropriate allowances for instream water needs.

The current annual regional use is estimated to be in excess of 300,000 ML per annum. However, streamflow records show that while the region is the wettest in the country, streamflow is also very seasonal. During the dry season streamflows in many watercourses are very low requiring preservation of flows for environmental purposes. Most runoff occurs

Table 9. Rainfall, runoff and water allocations for major catchments in the region.

River	*Total Area Ha*	*Rainfall (mm/yr)*	*Runoff (mm/yr)*	*Total runoff (000Ml/yr)*	*Allocated (000Ml/yr)*
Daintree River	216198	2384	1196	2586	5
Mossman River	48863	1852	779	381	
Barron River	225954	1311	449	1015	261
Mulgrave - Russell River	204278	3141	1809	3695	15
Johnstone River	240513	3217	1862	4478	17
Tully River	173136	2739	1455	2519	24
Murray River	117840	2239	1097	1293	
Herbert River	1021530	1194	357	3647	115

(NLWRA 2001.)

[29] The water resources of the region have been largely described in the Wet Tropics Overview documents published by QDPI 1995 as well as the FNQ Regional Plan Supporting Technical Document – Water Management (February 2000) and is largely reproduced here.

during the summer months when monsoonal influences dominate rainfall patterns. At other times, stream base flow is provided by groundwater flow systems. For this reason water storage is required to maintain continuity of supply for all uses and the dry season low flows in most streams are such that these need to be preserved for environmental purposes.

The lower-lying areas of the region are subject to flood inundation. While these areas include the towns of Innisfail and Ingham and some urban areas to the north of Cairns, in general they are used for agricultural purposes. Major flooding can also affect the regional road and rail network.

Ecosystem services provided by water

The Wet Tropic's high rainfall is its defining feature. Water in streams, wetlands and aquifers is absolutely essential to support the productive agricultural sector, for urban purposes and as a critical driver in the World Heritage listed forested stream ecology. Maintaining water in the Wet Tropics in good condition is essential for industry, lifestyle and the marine ecosystems of the rivers and adjacent Great Barrier Reef (see Table 10).

Clean water is essential for human health, the integrity of aquatic ecosystems and as an input into many economic activities. The quality of water is characterised by chemical (nutrients and heavy metals in particular), physical (sediments), and biological attributes (species richness and composition). Altered water quality changes the structure and function of ecosystems within rivers and wetlands and affects the marine ecosystems of the Great Barrier Reef region.

Traditionally, the term 'water resources' has been associated with the need for adequate provision of urban, industrial and rural water supply without due regard for the maintenance of flows for environmental values such as ecology, recreation and aesthetics.

Within the catchment areas of Wet Tropics rivers, are a wealth of creeks, streams, coastal wetlands and lagoons. Tinaroo Falls Dam and Lake Morris in the Barron River catchment provide water supply to Cairns and the Atherton Tablelands. The marine environment of Far North Queensland consists of the Great Barrier Reef system and estuaries. Trinity Inlet and Mourilyan Harbour are estuaries used for major port operations.

Table 10. Ecosystem goods and services provided by the region's water

Cities and towns	Water supply, waste removal and assimilation, recreation and aesthetic
Agriculture and grazing	Irrigation and stock water
Fisheries	Fish habitat for freshwater species, food and breeding habitat for barramundi and other species
Services	Hydro electricity from Kareeya and Barron Gorge and run of the river small hydros
Recreation and tourism	Recreational swimming, canoeing and rafting, aesthetic landscapes

The tremendous biodiversity supported by inland aquatic ecosystems in the Wet Tropics has already been discussed.

Since European settlement, most of our watercourses, and, therefore, the water quality of these systems have been subject to human development inputs including point source discharges (e.g. sewage, industrial waste) and diffuse (non-point) sources resulting from land clearing and development, agricultural, urban stormwater and recreation activities.

7.2 Water quantity

7.2.1 Water supply values

Major water storages used for urban or irrigation supply in the region are on the Barron River (Tinaroo Falls Dam, Copperlode Dam, Kuranda Weir), Tully River (Koombooloomba Dam) and Herbert River (Wild River Weir). However, water regulation (water storages and water harvesting) in the region is an exception rather than the rule, and total storage capacity is only a small proportion of annual stream runoff.

7.2.2 Aboriginal values for water

Healthy waterways have always been a valued resource for Aboriginal people of the Wet Tropics because their lifestyle and religious customs and beliefs are closely associated with the waterways. For example major rivers in the region such as the Barron River are believed to have been created by mythological snakes, while standing waters, like the Crater Lakes on the Tableland, are said to be occupied by totemic snakes known as 'yamani'. Various natural resources that are important to Aboriginal people are dependent on good water quality and reliable water flows. For example, clean and healthy waterways are essential for the healthy fish populations and the health of Aboriginal people.

The stream flow of rivers and creeks in the rainforest and the reliability of supply is important for Aboriginal groups to utilise poisonous plants as food resources. The time involved in processing these foods means that a reliable and continuous water supply is essential for leaching out the toxins. This use of poisonous plants is one of the distinctive cultural traits of Aboriginal people in the region and these resources are at risk from lower and reduced water flow rates.

7.2.3 Status and threats

The condition of a region's rivers and waterways is the net result of accumulated human impacts of land use and river changes. The Wet Tropics rivers and

Box 44. Traditional Owner concerns about declining health of rivers

During Plan workshops, Traditional Owners voiced their concerns about the impacts of chemicals from agricultural practices on the fish stocks in areas where they have fished for thousands of years. People were concerned about the impacts on their health from eating fish that have been affected by chemicals. One person noticed ulcers on prawns in fishing areas their family has used for thousands of years.

wetlands are by global, even Australian standards in good condition. Historical land use change, especially forest clearing had a significant impact on soil erosion, channel condition and discharges of sediments into the adjacent coastal areas. Some of those effects are still working their way through the system but there have been substantial changes in management systems in recent years: waste water treatment plants have been upgraded, most canefields have trash blankets, water on construction sites is better controlled, Water Resource Plans are assuring environmental flows, and steep forest land is mostly protected to name a few. However there is still work to be done, most of it continuing this good work.

Water Supplies

Currently, several areas in the Barron, Upper Johnstone, Upper Herbert, Murray Rivers and Behana Creek are fully allocated at low flows. Conditional allocations at higher flows allow water harvesting. Indeed a baseflow (50% of the 1 in 4 year annual low flow) surplus exists on the Lower Mulgrave River, the Russell River and major tributaries, the South Johnstone River, Liverpool Creek and major tributaries, the Tully River and major right bank tributaries and the Lower Herbert River.

Two areas are currently fully committed as groundwater resources and these are the Atherton subartesian management area and the Cairns Northern Beaches subartesian area, where substantial investigations have been undertaken.

Whilst the aquifer systems of the region do play an important role in the provision of both agricultural and urban water supplies, accurate data on yields is not available in many cases. This data is essential to allow the development of suitable planning strategies in relation to ensuring safe future water supplies. The level of resourcing to gather the necessary data remains a significant issue.

A large number of irrigators and small urban centres rely on natural stream flows for water supply. Over much of the region these streams are considered to be fully committed (by NR&M) during the dry periods of the year. Further assessments are required to be carried out over all catchments in the region to determine the level of commitment. In the Atherton - Eacham area heavy reliance is placed on the Atherton basalt aquifer for irrigation, domestic and urban supplies. Preliminary assessments on sustainable yield from this aquifer have been carried out by NR&M, however more detailed assessments are required to confirm the sustainable yield.

Over the past five years there has been considerable effort by NR&M to prepare development management strategies for catchments in consultation with users. These strategies are based on hydrological assessments of catchments and aquifers together with an assessment of all water needs both consumptive and non-consumptive. These strategies are encapsulated in the Water Resource Plan (WRP) under the *Water Act 2000*.

Main water supply issues in the Wet Tropics Region[30]

Barron River

The *Barron River Water Resource Plan* recognised the major role of the Barron River catchment and Tinaroo Falls Dam in the provision of water for agriculture, urban, recreation and ecological purposes. The Barron catchment is now managed as one system providing for the existing and future demands in the catchment including the Mareeba Dimbulah water supply scheme, Cairns City, the towns of Yungaburra, Atherton, Mareeba, Kuranda and potential new urban developments identified in the FNQ Regional Plan Regional Growth Management Framework (RGMF) at Myola and Koah.

Cairns City is supplied from a combination of sources including Copperlode Falls Dam in the Freshwater Creek catchment; and Behana Creek in the Mulgrave River catchment. The Behana Creek supply has recently been upgraded by duplicating the gravity pipeline to the Cairns City. While potentially this enables the city to double its extraction rate from Behana Creek limitations exist during low flows in Behana Creek to preserve instream environment values. There has been agreement that Cairns should focus on the lower Barron River for its next water supply augmentation. The key objective here is focus on the Barron catchment, where significant development has already occurred, and preserve for as long as possible other catchments of the region.

Mareeba Dimbulah Water Supply Scheme

Supplies available from the Mareeba Dimbulah Water Supply Scheme (formerly known as the Mareeba Dimbulah irrigation area or MDIA) are currently fully committed following responses from both sugar and horticulture expansion. However NR&M has identified efficiency gains through the establishment of a new water management system which will increase available supplies in the scheme by an estimated 30,000 ML. The sugar mill on the Tablelands, expansion of horticultural industries and possibly water for power generation will take projected water demands beyond the ability of existing infrastructure to supply (including projected

[30] From Far North Queensland, 2000: Regional Plan Supporting Technical Document : Water Management

efficiency gains). Accordingly further augmentation of existing supplies will be required.

Daintree/Mossman

Mossman and Port Douglas obtain their supply from Rex Creek, a tributary of the Mossman River. The ability of Rex Creek to continue to meet increasing demand has been questioned and it is understood Douglas Shire Council is examining augmentation options including the Mossman River.

Daintree currently obtains supply from run-of-river flows from Martins Creek. While Council is duplicating the gravity main to supply Daintree, the ability of Martins Creek to deliver the required volumes needs to be addressed.

Johnstone catchment

Towns within the Johnstone Shire can be serviced from existing sources of supply within the timeframe of FNQ Regional Plan. Longer-term strategies need to be developed which will enable future needs to be planned. However in the Eacham Shire, problems already exist with Malanda's water supply. Malanda obtains its supply from the North Johnstone River upstream of Malanda Falls. The North Johnstone Catchment is fully committed and thus additional supplies for Malanda will have to be addressed by either the provision of storage or seek a supply from another nearby catchment.

Russell/Mulgrave system

This area contains relatively small urban areas within an area whose predominant land use is sugar cane growing. The RGMF expects these centres to continue to develop slowly through controlled expansion. The ability of existing supply sources for small towns in the Russell/Mulgrave Catchment to continue to meet demands will depend on issues to preserve low flows. While it is expected that existing sources of supply and infrastructure will meet current and future demands within the FNQ Regional Plan timeframe, most of the supplies are obtained from World Heritage Areas. As there are limited economical options outside World Heritage Areas, the existing supplies and entitlements should be secured through negotiations with WTMA and NR&M.

Upper Herbert

The major urban centres of the upper Herbert include Herberton, Ravenshoe and Mount Garnet. Existing water supply infrastructures are expected to be able to meet future urban demands within the timeframe of FNQ Regional Plan. Expansion of irrigated agriculture along the upper Herbert and the recent drought have resulted in a review of the ability of the upper Herbert to meet the water requirements for irrigation. New management strategies and/or on-stream storage may be required to meet future agricultural demand in this area.

Tully/Murray

Tully is the major urban and service centre for surrounding districts but most of the population growth is focused on the Mission Beach area and Cardwell which continue to develop as urban centres and tourist nodes. While no issue is seen with Tully's water supply infrastructure, augmentation of Cardwell's existing supply needs to be planned.

7.2.4 Management response

The challenge remains for the community to address the increasing water needs of a growing urban population, expansion of irrigated agriculture and demands from industry, in a sustainable manner. The issue of non-consumptive needs is also an important aspect which must be addressed as part of overall management in the region. These needs are difficult to quantify. However, a process has been identified as part of the WRP strategy to ensure these needs are adequately addressed.

Even in the Wet Tropics, finding additional water storages will be difficult due to the impact of impoundments on environmental resources and the alteration in environmental flows required. Further there is a need to use water efficiently in both rural and urban areas building on existing programs. As the *FNQ Regional Plan* noted:

> *Some 42% (approximately 650 800 hectares) of the FNQ region comprises World Heritage Area, where infrastructure development for major storage sites is restricted. Elsewhere, good storage sites are extremely limited. It is therefore considered appropriate that where good storage sites have been identified they should be preserved for future development. For example land use within the catchment and possible storage area should be managed to ensure the site can be developed in the future.*

The aquifer systems of the region will continue to play an important role in the provision of both agricultural and urban water supplies. Development of lands and management of land use particularly in recharge areas can have a significant impact on the ability of the aquifer to recharge and the quality of water in the aquifer. Use of septic systems for residences and location of dumps are two land uses which require careful consideration.

Water use efficiency

It is becoming well accepted within the community that water is a finite resource. Government initiatives such as the Waterwise campaign will play a major role in shaping future water demands within the region.

The financial incentives component of the Rural Water Use Efficiency (RWUE) Program have been successful in achieving sustainable use by providing 'seed funding' for the investments in irrigation efficiency. Farmers use the funding to support their own investment in improved irrigation infrastructure. The RWUE Program has identified sustainable use

Box 45. Irrigation efficiency and the North Johnstone and Lake Eacham Landcare

The North Johnstone and Lake Eacham Landcare Association (Eacham Landcare) has turned to the weather to improve fertiliser and irrigation efficiencies and restrict the pollution runoff into the Johnstone River and out to the Great Barrier Reef lagoon. Coordinator Helen Irwin explains.

Eacham Landcare is the only community group in the State to be chosen to implement the Queensland Government's Rural Water Use Efficiency (RWUE) Program.

This latest research project tests the concept of 'degree days' scheduling, using average daily temperatures to gauge the actual nitrogen needs of a crop.

This scheduling method indicates the amount of nitrogen fertiliser required to maintain productive pastures, instead of applying a set amount of fertiliser at set intervals of time.

Improving fertiliser efficiency reduces leaching and with the downstream effects of the Johnstone River which flows into the Great Barrier Reef lagoon at Innisfail.

Eacham Landcare worked with five local dairy properties to improve Distribution Uniformity (DU) and carry out on-going research into efficient water use through scheduling based on weather information.

The group has produced some significant results. Initially, soil moisture monitoring equipment was used to investigate the three types of irrigation system, solid set, traveller and pivot, used on the southern Atherton Tablelands, discovering that a low DU resulted in many farmers over-irrigating to compensate for their driest spots.

Scheduling irrigation based on evapotransporation rates has reduced water consumption on all five of the initial properties by as much as 40%, without reducing pasture growth.

The group successfully gained funds to purchase and install an automatic weather station on the old weather station site just outside Malanda.

Farmers can ring the Malanda Weather Station on 4095 5975 to obtain a range of rainfall, wind and temperature information or use weather and evapotransporation information published each week in the free Eacham Times newspaper to schedule their water use. The information is sponsored by Malanda Rural supplies.

Working with all irrigators in the catchment to improve efficient water and fertiliser use is now an on-going project for this Landcare group.

practices for each of its target rural industries, cotton, grains, horticulture, dairy and sugar. Programs are developed to build on the Waterwise initiative and implemented to achieve greater community understanding, acceptance and actions to minimise water use. The Cairns City Council is undertaking a 'least cost planning' study to determine the extent to which existing infrastructure can meet future needs.

7.3 Water quality

7.3.1 Status and threats

Water quality refers to the state of a water body or watercourse environment, usually in terms of parameters called water quality 'indicators'. Water quality indicators can include both physico-chemical parameters such as dissolved oxygen, pH, temperature and turbidity, microbiological indicators, such as bacteria counts and biological indicators such as species richness and composition. These latter indicators are used especially when assessing aquatic ecosystem values (see section on inland aquatic ecosystems p34).

Most water quality in Queensland is assessed according to the *Australian Water Quality Guidelines for Fresh and Marine Waters* (ANZECC 2000). The guidelines provide numerical concentration limits or statements for indicators that are recommended to protect a designated environmental value namely:

- aquatic ecosystems;
- recreational water quality and aesthetics;
- raw water for drinking water supply;
- agricultural water use; and
- industrial water use.

Table 11. Guideline values used for assessment of surface water quality

	Guideline for ecosystem protection	
Elevation	≤150m	>150m
EC (µS/cm)	250	250
TN (mg/L)	0.3	0.15
TP (mg/L)	0.01	0.01

From ANZECC and ARMCANZ (2000)

Table 12. Guideline values used for assessment of groundwater quality [a]

Rating	***EC (µS/cm)***	***Nitrate (mg/l)***
Generally suitable for sugar cane irrigation on most soil types, for stock watering and for drinking water.	≤1700	≤50
Generally suitable for sugar cane irrigation on most soil types and for stock but unsuitable for drinking water.	≤1700	51–400
May be suitable for sugar cane irrigation depending upon soil type, and for some stock, but unsuitable for drinking water.	1701–4300	≤400
Generally unsuitable for sugar cane irrigation on any soil type, for drinking or for stock watering.	>4300	–

[a] from ANZECC & ARMCANZ (2000) and NHMRC & ARMCANZ (1996): note that drinking water guidelines apply at the point of use (e.g.tap).

Table 13. Monitoring results for Wet Tropics catchment monitoring stations January 1997 to March 2003

Catchment	*Surface water [a] Number of sites rated*			*Groundwater [b] % bores rated*		
	Good	Moderate	Poor	Good	Moderate	Poor
Mossman				–	–	–
TP	1	1	1			
TN	2	1	–			
EC	3	–	–			
Barron				91	6	3
TP	–	1	11			
TN	1	1	9			
EC	10	2	–			
Mulgrave-Russell				83	9.5	7.5
TP	1	1	6			
TN	5	4	–			
EC	9	–	–			
Herbert				87	6	7
TP	–	4				
TN	–	2	2			
EC	4	–				

TP – Total Phosphorous, TN – Total Nitrogen, EC– Electrical Conductivity

[a] Good: <20% recording exceeded guidelines; Moderate 20–50% recordings exceeded guidelines; poor > 50% recordings exceeded guidelines.

[b] Good: generally suitable; Moderate Suitable for irrigation and stock but not for drinking water; Poor: generally unsuitable.

Source: Hunter et al *2003.*

EPA has prepared Draft Queensland Water Quality Guidelines for ecosystem protection, with a subset of these determined for the Wet Tropics. The data are derived from ANZECC 2000 guidelines referred to earlier.

Hunter *et al* reviewed water quality data for Wet Tropics catchments and reported on salinity, total nitrogen (TN) and total phosphorus (TP) levels. They found that salinity (EC) was generally good condition for protection of aquatic ecosystems at most sites in most catchments. However, the condition ratings for TN and TP were moderate or poor at many sites and were typically poorer at sites adjacent to agriculture than at sites upstream. A number of factors may have contributed to elevated nutrient levels in these areas, including soil erosion and fertiliser wash-off. With one exception, surface water EC at all sites was rated as suitable for irrigation of sugar cane on most soil types. The majority of groundwater sites were suitable for all purposes investigated with respect to EC and nitrate levels. Sites where groundwater was rated as unsuitable or marginal were often close to the coast, with elevated EC levels probably due to saltwater intrusion.

There is a critical need for other essential water values to be considered in water management such as:

- protection of biodiversity of both modified and pristine ecosystems;
- production of fish and shellfish for human consumption; and
- maintenance of recreational water quality and aesthetics for residents and tourists.

The management practices that influence water quality have been reviewed in the recent reports of the Productivity Commission, the Baker Report, in the Sustainable Condition report for this plan and in the environmental review accompanying the FNQ Regional Plan. The main resource management areas influencing water health are:

- Catchments – hill slope erosion, river sedimentation, flow regime changes, and non-point source pollution. This includes urban catchments and storm water runoff.
- Riparian zones – stream channels and their adjacent banks which are considered to be critical landscape elements for river health and water quality, as well as for ecosystem function and biodiversity.
- Wetlands and floodplains – the condition of the natural floodplain and associated fresh and salt water wetlands are essential components of river systems and condition their impacts on adjacent coastal and marine areas.
- Point source emissions of water – especially waste water treatment plants, aquaculture and industrial sources.

Table 14. Wet Tropics Catchment Land Use (%)

Catchment	*NP and reserves*	*Sugar*	*Grazing*	*Crops not Sugar*	*Forestry*
Daintree	60	2	4	0	32
Mossman	77	11	3	0	0
Barron	29	3	33	8	18
Russell-Mulgrave	73	14	5	1	0
Johnstone	55	15	21	4	0
Tully	71	13	6	3	2
Murray	64	13	7	2	6
Herbert	27	8	58	0	4

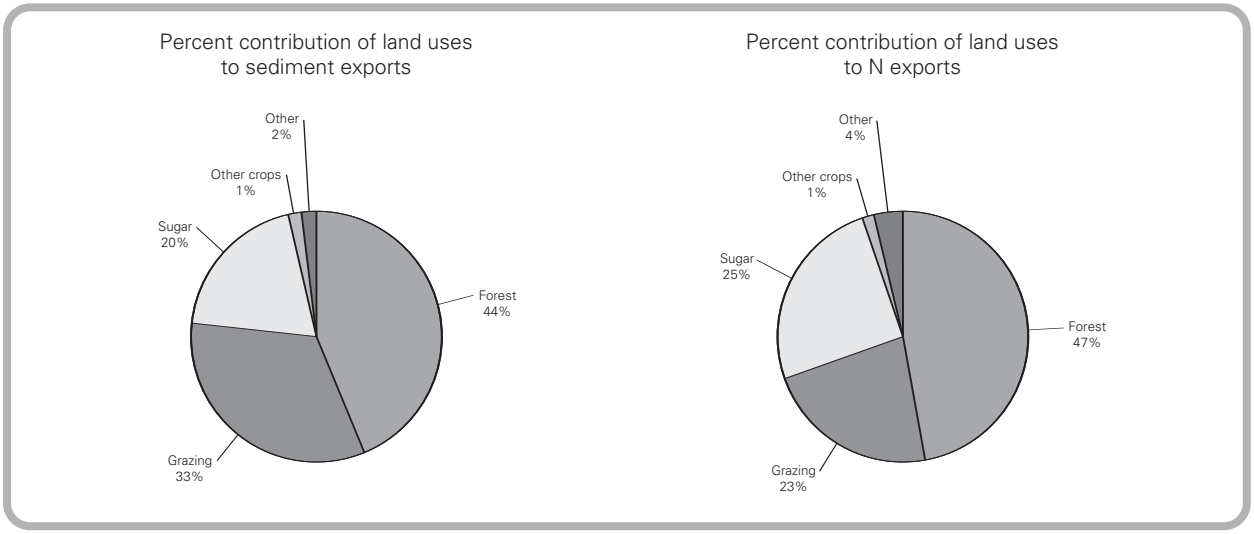


Figure 9. Percent contribution of land uses to sediment and nutrient exports from Wet Tropics catchments (Source: Brodie et al *2003).*

These activities have resulted in:
- increased nutrient concentrations;
- increased sediment concentration and suspended solids;
- low dissolved oxygen;
- toxins and contamination from chemicals;
- eutrophication (overgrowth of aquatic plants and algae), exotic weed;
- invasion, fauna kills and unsafe levels of pathogens in recreational areas;
- salinity changes;,
- acid sulphate toxicity; and
- pathogens.

Regional growth, urban and industrial expansion will place even higher demands on the environmental values of the region's water bodies. Such growth remains the biggest threat to the region's water quality in the future. If not managed correctly, it will result in further degradation of water quality.

There has been a substantial scientific effort and considerable public debate about water quality in the Wet Tropics and in particular the impacts on the GBR, notably Haynes (1999), NLWRA (2001), GBRMPA (2001), Furnas (2003), Productivity Commission (2003) and Baker (2003) Reports, and Hunter *et al* (2003). Brodie *et al* (2003) provide the latest assessment of water quality conditions in all Reef catchments including those in the Wet Tropics. They review and update water quality estimates for all catchments and provide quantitative estimates of a range of parameters including, nutrients, sediments and pesticides.

Table 14 and Figure 9 show land use distributions for each catchment and their relative contribution to pollution discharges. Almost half of the sediments and nutrients are modelled to come from forest areas where scope for reducing discharges is limited to improved infrastructure management and pest animal control. Most of the water quality improvements will thus need to be found in the intensively used agricultural and urban landscapes of the region.

The Reef Water Quality Protection Plan (p1) noted that:

"The Great Barrier Reef World Heritage Area is a nationally and internationally significant area with outstanding natural, social and economic values. Over the last 150 years the land catchment areas adjacent

Table 15. Risk factors for Wet Tropics catchments (Source: NLWRA, Reef Water Quality Protection Plan)

Catchment (north to south)	***Risk factors***				***Risk assessments Reef Water Quality Protection Plan***	
	Total area of cropland (ha)	*N fertiliser use (t/y)*	*Current N export (t/y)*	*Current sediment export (t/yr)*	*Biophysical risk*	*Risk from development pressures*
Daintree	4324	340	499	94,132	L	M
Mossman	5375	820	234	15,131	M	M
Barron	24855	1680	321	145,877	M	M
Russell-Mulgrave	30642	4720	1,441	222,425	MH	M
Johnstone	45697	7300	1,849	305,142	H	M
Tully	27702	2660	1,303	88,084	MH	M
Murray	17676	1290	420	17,098	M	M
Herbert	81722	9800	1,588	664,787	MH	M

***Biophysical risk**, summarising the magnitude of (potential) land-based pollutants from the catchment and their impact on coastal/marine ecosystems.*
***Development risk**, providing an assessment of future development pressures, which may result in increased pollution from the catchment to the reef.*

to the Reef have undergone extensive modification for urban infrastructure, agricultural production, tourism and mining. This modification has led to significant increases in pollutant loads in the rivers since the beginning of European settlement, such that now the major source of pollutants entering the Reef are the result of land use activities in the catchment areas.

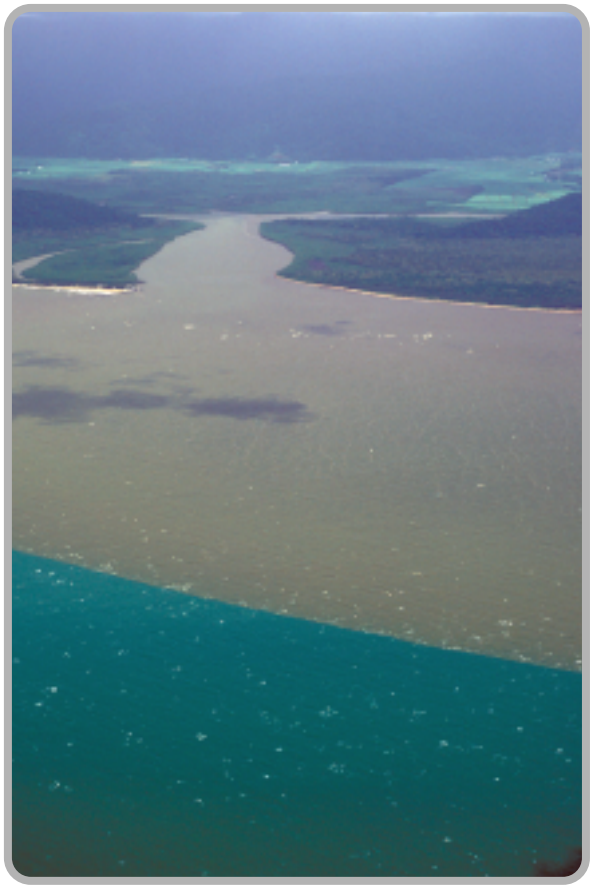
The balance of evidence is that sediment and nutrients from land-based sources are impacting the inner reefs and seagrass areas of the Reef. The vast majority of the 2900 reefs that make up the Great Barrier Reef are in good condition but some of the 450 inshore reefs are showing impacts consistent with a decline in water quality."

The Wet Tropics catchments are estimated to discharge 31% of the N to the GBR, an increase from an estimated 15% in 1850. Whilst nutrients are discharged in several forms and from natural as well as agricultural landscapes, Furnas (2003, p.199) notes that:

"Longitudinal sampling of nutrients in the Herbert and Tully Rivers shows that most of the nitrate exported from these two rivers comes from a floodplain source. A similar downstream nitrate increase occurs in the Johnstone River where there is extensive cultivation of sugarcane and bananas in the lower catchment. There is no obvious source for this additional nitrate. Agricultural fertilisers are almost certainly the source."

Further: "The net increase in nitrate discharge (ca. 1000t of nitrate-N p.a.) is similar to the estimated loss of fertiliser nitrogen to groundwater (15% of 9000 t of fertiliser N)" (Furnas 2003, p.197).

High loads of suspended solids/particulate matter associated can impact greatly on ecosystems, as it interferes with fish breeding, can smother habitats and prevent light penetration required for aquatic plant growth. Suspended solids also act as a carrier for nutrients and for toxicants such as heavy metals and pesticides.



Research shows that sediments in Wet Tropics streams and discharged to the Reef have increased by factors of from four to ten since 1850. (Photo: © GBRMPA)

Research noted above show that sediments entrained in Wet Tropics streams and discharged on to the Reef have increased by factors of from four to ten since 1850. Grazing is the greatest contributor to increased sediment problems, although riverbank erosion due to riparian zone degradation in cropping land is also a significant contributor.

Sediments from relic mine workings and diggings have long been considered one of the major sources of sediment in the Upper Herbert River catchment (Bartley *et al* 2003). Mining was conducted there using sluicing and dredging methods which speed up the natural erosion rate by several orders of magnitude, leaving mined areas extremely vulnerable to erosion and with tailing ponds that discharge fine sediments when overtopped.

7.3.2 Management response

The Reef Water Quality Protection Plan (RWQPP) identifies a number of risk criteria that enable prioritisation of high risk catchments. Reef catchments were assessed against the following criteria:

- Bio-physical risk – summarising the magnitude of (potential) land-based pollutants from the catchment and their impact on coastal/marine ecosystems;
- Social risk – encapsulating various factors of the capacity of a catchment community to change practices that (potentially) cause land-based pollution;
- Development risk – providing an assessment of future development pressures, which may result in increased pollution; and
- Risk to marine industries – assessing the economic impact of land-based pollution on industries which operate within the catchment impact area and rely on reef integrity for income and profit.

A full risk analysis assessment was undertaken for 35 reef catchments as part of the RWQPP. Four out of the top ten high risk catchments were located in the Wet Tropics NRM Region, namely:

- Herbert;
- Johnstone;
- Mulgrave-Russell; and
- Tully.

A number of actions will focus on these high risk catchments.

Box 46. Targeting landscape sustainability: catchment planning for landuse management

The Barron River Integrated Catchment Management Association (BRICMA) is working with the community to restore 'hydraulic neutrality' on cropping and grazing land to pre 1850 levels. Coordinator Helen Adams explains.

Hydraulic neutrality is the balance found in the original landscape before land clearing and development modified the natural system checks and balances such as forests, grasslands, wetlands and flood plains.

The secret is to conserve water where it falls, as high up in each catchment as possible. However, when water flows across property boundaries, the responsibility for its treatment changes.

BRICMA has developed a computer based Geographical Information System (GIS) framework which provides the basis for landscape planning at the local level by identifying each connecting sub catchment, from the river mouth to the smallest order gully, along every tributary and every flow path for water, as well as the source and responsibility of runoff water.

Also, the catchment framework can host monitoring sites or nodes where data is stored, to assess upstream changes in the sustainability of management practices over time.

This information is used to direct options for managing runoff water.

BRICMA believes land managers who adopt and practice soil and water conservation based on natural drainage systems deserve 'pollution credits' because they are providing ecosystem services for the catchment.

Additionally, extra services in the treatment of "travelling" water from up-stream neighbouring land, drains, roads like silt harvesting, velocity reduction deserve extra credits.

The catchment plan provides all necessary background information to develop property management plans for land managers working day to day at the fine, paddock scale level.

Management options for soil and water conservation based on drainage lines may include: paddock contouring; installation of silt traps or wetlands for runoff control and aquifer recharge (specifically positioned and sized); timber lines for wind and water breaks, and for stabilising slopes; riparian vegetation along waterways for biodiversity and filtering overland flow.

Outcomes for catchment/farm scale planning:

- Provides knowledge, ownership and responsibility for soil and water conservation and runoff;
- Produces management plans that consider the responsibility of landholders and neighbours in soil and water conservation;
- Provides the ability to monitor the success of land management changes at property/sub catchment scales;
- Provides the ability to store relevant data for specific sub catchments;
- Provides the ability to assess catchment health from lowest to highest order streams over time; and
- Assists strategic, long-term, sustainable land management based on natural systems (catchment) principles.

Erosion Problem in the lower Barron (Photo: Helen Adams)

While many waterways of the Wet Tropics are in good condition, six out of the eight river systems (75%) pose medium to high risk to the Reef from catchment impacts including nitrogen and sediment export from primary production together with development and construction pressures (RWQPP workshop background paper); discharges of sediment (and runoff) from grazing land are very sensitive to the level of ground cover. To illustrate the significance of this factor, Brodie *et al* (2003) model the effect of increasing the ground cover in the upper Herbert catchment from 60% to 70% (current cover may be considerably less than this). Their scenario modelling predicts much lower hillslope erosion on grazing land (33%) and a reduction of 17% in total sediment export (Brodie *et al* 2003, p60). The Upper Herbert catchment (1,165,000 ha) is an important contributor to sediment loads. These data clearly demonstrate the importance of about 40% cover at the end of the dry season as a critical target for reducing runoff and soil loss. Reduced groundcover reduces the frequency of fire, which in turn encourages tree thickening with further reductions in groundcover due to competition (Sharp & Whittaker 2003).

Maintenance of environmental flows

The lack of a holistic approach to river management when planning land and water developments has resulted in a decline in instream river environmental values and water quality in some areas of the Wet Tropics due to the disruption of natural flows.

The natural hydrological regime of a river is complex and features many elements which are crucial to the sustainability of aquatic processes and maintenance of water quality. Such elements include seasonal and annual patterns of flow, low flows, flood and flushing flows. If flows are low as a result of consumptive use, dilution and flushing are minimal and water quality may rapidly deteriorate. Barriers also allow build-up of nutrients and algae which can affect water quality standards needed to maintain natural ecological ecosystems and other values.

Of the 13 major water storages in Far North Queensland, eight are located within the Barron River catchment along with numerous other legal and unauthorised storages and off-takes. Effects of these water storages as noted during the Barron River ICM community consultation process include lack of flowing water in some areas and low water levels which have lead to algae build up in Tinaroo dam and some tributaries of the Barron River. Other potential effects include acid sulphate soils, particularly in the low-lying flood-prone areas. The Barron River faces a potentially serious threat to maintaining its environmental flow requirements due to continuing urban development in flood prone areas of its catchment and proposals for further water extraction.

Pesticides and heavy metals

The most commonly used herbicides in the sugar industry are atrazine and 2,4-D. Pesticides and herbicides used in sugar cane production and to a small extent in urban applications, have been found in the stream biota and waters of the Wet Tropics. Dieldrin and diuron were recently found in subtidal sediments at concentrations that may be hazardous to the fauna and flora of coastal ecosystems (Haynes *et al*. 2000a, 2000b). Lindane and dieldrin have been detected in dugongs collected along the Queensland coast. Atrazine, diuron, lindane, dieldrin, DDT, and DDE have been detected in subtidal sediments, particularly between Townsville and Daintree River. Apart from dieldrin and diuron, the concentrations of other pesticides in water and sediments are believed not to be toxic to aquatic animals.

Detailed studies examining pesticide persistence, interaction and mobility in the soil are ongoing. Some studies have examined the concentrations and loads leaving tropical sugarcane paddocks; and the pesticide residues in sediments and biota along the Queensland coast have been reported.

Repeated application of mill mud to paddocks, as a cost effective nutrient recycling process, has been found to produce concentrations of Cadmium and Zinc that were 3–5 times higher levels than where no mill mud was applied (Barry *et al*. 1998). Production of peanuts and other edible crops on land treated with mill mud may lead to higher concentrations of these metals entering the food chain.

Waste management

Untreated leachate from landfills and sewerage effluent from sewerage treatment plants poses a potentially serious threat to the quality of receiving waters in the Wet Tropics if current practices are left to continue.

Solid Waste

The Wet Tropics currently has 29 municipal landfills, scattered throughout the region. Of these landfills, 26 have been identified as being environmentally unacceptable due mainly to siting adjacent to mangroves and creeks, and/or lack of stormwater and leachate controls. Leachate is water that has become contaminated by chemicals from waste, it may contain a broad range of contaminants and the possible escape from wet landfills pose the greatest threat to water quality. Leachate management used at wet landfill sites varies dependent on site specific conditions.

Sewage

Sewage in high or medium density residential areas in the Wet Tropics is treated to basic secondary level only. Sewerage in rural and rural residential areas and some villages is treated via septic tank. Water quality studies undertaken on Trinity Inlet in Cairns indicate that increased levels of nitrogen and phosphorus input occur largely as a result of urban development activities, with sewage effluent discharge being a major source. Inlet monitoring has also indicated levels of bacteria which exceed water quality guidelines and which thus poses health threats to humans in contact with the areas surrounding the

discharge point. Water quality monitoring of the region's creeks and rivers also indicates an increased number of situations where levels of nutrients and pathogens exceeded guidelines at discharge points.

Since the implementation of the *Environmental Protection Act* and the completion of the initial FNQ Regional Plan there has been considerable progress in the management and quality of wastewater treatment in the Wet Tropics. The EPA has statutory responsibility for the licensing and monitoring of wastewater treatment plants, most of which are operated by local government, and for the endorsement of local water quality plans under the Act, (e.g. Douglas Shire WQIP).

The EPA has environmental performance criteria for wastewater treatment plants for the region that reflect the high environmental and economic values of the region's natural waterways and coastal waters. They also enforce standards for the planning, design and operation of sewerage collection, transport, treatment, disposal and re-use schemes, to comply with State environmental standards and regulations.

A significant and potentially growing threat to water quality arises from the on-site disposal of domestic sewage in smaller towns (especially coastal towns) and in low-density residential developments. While these are currently addressed by the Australian Standards for new developments, there are many pre-existing developments requiring attention. Local water quality plans are a promising approach to assessing these problems.

7.4 Water Resource targets

Water quantity

For water quantity, the Plan defers to the statutory powers of the water resource planning process in the Queensland *Water Act 2000*, which has a thorough process for determining sustainable water use, and includes provision for environmental flows. There are however supporting actions that need to be taken including commitment to water use efficiency in both rural and urban areas.

Catchment based water resource plans (WRP) and accompanying resource operations plans (ROP) under the Queensland *Water Act 2000* are the most effective instruments to achieve sustainable use and conservation of the region's water supplies. These plans:

- Protect river health and aquatic habitats by identifying environmental flow needs;
- Specify existing water entitlements and assess the capacity of the water resource to support these entitlements;
- Identify any further allocations which may become available without compromising environmental needs or without adversely affecting existing water users;
- Involve the community and industry in determining water management strategies and in identifying an appropriate balance between environmental and consumptive needs; and
- Identify catchment wide monitoring and reporting requirements.

Furthermore, Ropes provide water users and potential entrants to the water industry with a degree of certainty regarding the availability of water and strategies and priorities for release of additional water allocations.

A Water Resource Plan has been completed for the Barron River and this catchment is currently subject to the ROP process. The Barron Water Resource Plan defines the volume that can be sustainably allocated in the Barron and Upper Mitchell catchments

A Wet Tropics Water Resource Plan is under consideration from the Daintree River catchment to the Herbert River catchment. Completion of this plan will substantially address water allocation issues in the Wet Tropics consistent with the NRM principles underpinning this plan including provision for environmental flows. According to the FNQ Regional Plan, the priority order is: Johnstone Rivers; Herbert; Russell/Mulgrave; Tully/Murray; Mitchell; Daintree and Mossman.

Water quality

The quality of water in Wet Tropics Rivers has declined since 1850 in all Wet Tropics catchments contributing to degradation of the Great Barrier Reef and has the potential to continue doing so. The majority of the 2900 reefs of the GBR are in good condition, however 450 inshore reefs are impacted by water quality decline.

While there are cumulative impacts from all rivers discharging into the Reef lagoon, it is difficult to define an overall aggregate regional condition target given that impacts are substantially localised to adjacent coastal waters and fringing reefs. Therefore, condition targets are best defined on a catchment scale (or smaller), within a regional framework of maintaining the health of the Reef, as per the RWQPP. Targets set out in this section and throughout the Regional NRM Plan support the objectives of the RWQPP, namely:

- Reduce the load of pollutants from diffuse sources in water entering the reef; and
- Rehabilitate and conserve areas of the reef catchment that have a role in removing water borne pollutants.

A key component of the RWQPP is the implementation of a long-term water quality and ecosystem monitoring program in the lagoon to assess the effectiveness of the RWQPP in reversing the decline in water quality of runoff originating from catchments. One subprogram of the RWQPP monitoring program is river mouth monitoring which will be carried out in 15 reef catchments; nine of

Box 47. Douglas Shire Water Quality Improvement Plan

Michelle Henderson and Brian Roberts, Douglas Shire Council

At the end of 2002, the Commonwealth Government agreed to provide funding for the development of a "Water Quality Improvement Plan" for waterways in Douglas Shire as a basis for a longer-term strategy for achieving water quality targets for the Daintree, Saltwater, Mossman and Mowbray River catchments. An integral part of this process involved stakeholder consultation in order to determine environmental values, water quality issues and water quality objectives for the waters of the Douglas Shire, and to develop and assess alternative management strategies to improve water quality.

The Douglas Shire Council subsequently made a successful application to the Department of the Environment and Heritage for funding to develop a "Water Quality Improvement Program" within the Douglas Shire Catchments to help implement the plan. The funding package was part of the NHT priority for improving water quality entering the GBR Lagoon, and was provided under the Coastal Catchments Initiative. The Program comprises five "priority action" projects, namely:

- Adoption of Agricultural BMPs for Sediment & Nutrient Reduction in Douglas Shire;
- Determination & Demonstration of Agricultural BMPs in Saltwater Creek Catchment of Douglas Shire;
- Control of Point Source Discharges of Sediment and Nutrient in Douglas Shire;
- Protection and Restoration of Riparian and Wetland Areas in Douglas Shire; and
- Monitoring and Modelling of Sediment and Nutrient Flow Within and From Waters of Douglas Shire.

The total program is a complex set of 94 tasks being actioned by 11 partners over 2 years, which will be followed by a simpler ongoing Shire and community program in which a stream health index replaces laboratory analyses. The Environment and Heritage-funded program is limited to monitoring sediment and nutrients in the Shire's four major catchments, so Council has expanded its coverage. AIMS has been contracted to monitor water quality (including pesticides) and coral health on the Shire's inshore marine environment. Studies on groundwater, estuary sediment movement, benchmark pristine streams, seagrass beds and grazing management are currently being developed to augment the Water Quality Improvement Program.

The Douglas Shire appreciates all input and assistance from the community and landholders with this important work, which will enhance the Shire's reputation as "clean and green". It also provides an approach that could be adapted and applied across all Wet Tropics catchments to help halt and reverse the decline in water quality entering the Great Barrier Reef.

As a case study the Douglas Shire program can probably be considerably simplified for other catchments in the Wet Tropics according to the coordinator, Dr Brian Roberts. He believes that local authorities and catchment groups can make significant progress without the high level of funding required to include automatic stations and modelling. A preliminary report on the lessons learned from the Douglas Shire program is currently being prepared.

For more information, including contact information, see the Douglas Shire Council's website www.dsc.qld.gov.au. This website includes lessons and recommendations from the Douglas experience.

Photo: Douglas Shire Council

these are classed as category one river catchments. The category one catchments that lie within the Wet Tropics NRM region include the Barron, Johnstone, Tully and Herbert Rivers. It is envisaged that community partnerships will be established to carry out part of these activities.

Current knowledge about loads and ambient levels of water quality, the causes of water quality decline and consequent impacts are temporally and spatially patchy and subject to wide error bands. The premises for water quality targets for this plan are:

- There is strong justification for action to be taken to halt and reverse the decline in the quality of water in key freshwater reaches of the region's rivers and of water discharging into the Reef.
- Past effects and future threats of water quality decline due to sedimentation, pesticides and nutrient enrichment in the region's waterways vary across the region. Many streams in the Wet Tropics are in good condition. However, the water quality in some waterways in some seasons does not meet water quality standards for some uses.
- Targeting inputs or practices is the only practical option at present, given the limitations of existing information and emission models and the restrictive conditions under which load and ambient targets would be cost-effective.
- It is a high priority to create a systematic water quality-monitoring program to improve understanding of water quality at catchment through to field scales.

- Even with decisive action, some sources of pollution will take several decades to eliminate for example, persistent pesticides that are no longer in use. Another concern is the estimated 30 years supply of excess nitrogen stored in agricultural soils below plant root availability, as a result of fertilising practices.

Consequently, the overall approach to targets and actions is:

- To drive catchment-based change through Water Quality Improvement Plans (WQIP), in line with the Douglas Shire's WQIP in preparation now.
- Fully recognising the central role for high adoption rates of Best Management Practices within all industries (primary production, extraction/mining, roads and urban development activities), with the emphasis on continuous improvement in these BMPs. Most of these BMP management action targets are defined in the Land Resources chapter.
- Investment in the modelling and monitoring needed for improved accuracy in water quality management and in making better connections between management actions and responses in the resource condition; improvements in information flow and access arrangements.

7.4.1 Template – Defining preliminary 7 yr load targets based on the adoption of land use BMPs

Current loads: From model estimates

Load Target = Aggregate reduction of discharges from increased adoption of BMPs in each sector.

	Land use sector				
Land Use BMPs	*Cane*	*Grazing*	*Horticulture*	*Urban and Infrastructure*	*Natural Landscapes*
Number of treatment units					
Reduced Sediment with BMP (discharge per unit)					
Current adoption rate (%)					
Agreed adoption rate (% in year 7)					
Sediment load target reduction year 7					
Total Catchment Load Target					

Box 48. Water quality assessment for sustainable agriculture

A project assessing nutrient levels in runoff has lead to the development of on-farm infrastructure and a community-minded water quality awareness. Dave Green, from FNQ NRM Ltd, says monitoring will continue in the Tully-Murray and Granite Creek catchments to test the effectiveness of land management practices.

The project concept, as reported in ACTFR (2004), was initiated in February 2001 with NRM Wet Tropics leading the consultation between a number of landholder groups, specific interest groups such as SUNFISH, Wet Tropics catchment groups, and Federal and State Government departments. The project concept was previously initiated by the Tully banana growers local producer association which expressed a significant interest in determining the extent of nutrient and sediment losses from their farms during wet seasons.

The banana farmers provided financial support and submitted a successful proposal for funding to the Banana Sectional Group of the Queensland Fruit and Vegetable Growers, which was later incorporated into the NRM Board proposal for NHT funding.

This project consisted of a relatively intensive survey of paddock scale runoff after from banana and cane paddocks after rain events in tropical north Queensland. The study is considered unique and assesses the runoff from banana and cane paddocks, in watersheds within two distinct regions of north Queensland, in the Tully-Murray Rivers catchment and the Granite Creek catchment south-west of Mareeba on the Atherton Tablelands (including an urban drainage site in Mareeba).

There were three levels of farm investigation: primary sites with crump weirs installed to allow for continuous monitoring of discharge and meteorological data; secondary sites that were manually gauged and sampled less regularly than the primary sites; and random sites that were sampled opportunistically.

Runoff weir on a banana farm. (Photo: Cardwell Shire Catchment Management Association)

7.5 Water Resource targets and actions

Management Action Target (MAT)	*Type of MAT*[31]	*Management Actions*	*Links Targets*	*Potential Partners*
Resource condition target (RCT) W1. Instream environmental flow requirements will be met in all Wet Tropics Rivers by 2015.				
W1.1 Establish monitoring programs and report on environmental flow conditions within the region's waterways by 2007.	RA	**W1.1.1** Identify and facilitate the collection, collation and analysis of detailed catchment data required to support the WRP program in close collaboration with government departments. **W1.1.2** Where necessary establish monitoring of environmental flow conditions throughout the region.	W1, W2, B2, B3, B7, B8, B9, B16, B18, B19.	NR&M, DPI&F, Research Organisations
W1.2 Rehabilitate all structures negatively affecting environmental flows by 2015.	OGW	**W1.2.1** Identify structures impacting adversely on environmental flow regimes (criteria to be defined). **W1.2.2** Prioritise structures and commence a rehabilitation program for identified priority structures.	W1, W2, B2, B3, B7, B8, B9, B16, B18, B19.	NR&M, DPI&F, Research Organisations
RCT W2. Allocation of regional water resources including underground water will demonstrably not exceed sustainable levels by 2015.				
W2.1 Prior to completion of the WRP, establish interim water management processes in key catchments utilising the WRP framework, to facilitate improved water allocation and management decision-making.	P	**W2.1.1** Identify interim water management processes in key catchments (catchments listed in chapter earlier). **W2.1.2** Water entitlements developed in accordance with Water Resource Plans under *Water Act 2000*.	B2, B5, B7, B8, B9, B16, B18, B19, L5, W1.	NR&M.
W2.2 Prepare management plans for all significant groundwater resources in the region, including monitoring and reporting procedures, especially those in areas of saline intrusion by 2015 (See also Salinity section).	P	**W2.2.1** Water allocation plans developed in accordance with Water Resource Plans under *Water Act 2000*. **W2.2.2** Through the WRP process, establish mechanisms to identify, license and monitor all groundwater extraction operations, including rural and urban domestic supplies.	B2, B5, B7, B8, B9, B16, B18, B19, L5, W1.	NR&M.
W2.3 Implement programs to increase community understanding and adoption of efficient water use practices from 2008.	CB	**W2.3.1** Develop community, local government and industry education programs on water management and demand management issues at the regional and local levels. **W2.3.2** Develop and implement demand management strategies for irrigation systems, including improved on-farm water management practices, improved irrigation infrastructure efficiencies and attention to, groundwater extractions and off-takes from surface water sources outside of controlled areas (i.e. extend the Rural Water Use Efficiency program) **W2.3.3** Local government to develop demand management strategies for urban water supply including retrofitting rainwater tanks. **W2.3.4** Implement water metering for irrigation and domestic users, and encourage WRP to reward efficient irrigators. **W2.3.5** Seek to facilitate and encourage local government to require installation of rainwater tanks in new dwellings.	B2, B5, B7, B8, B9, B16, B18, B19, L4, W1.	Community Groups, Local Govt, Industry Groups.

[31] Types of Management Action Targets: CB- Capacity Building, OGW- On-Ground Works, P- Planning, RA- Resource Assessment & Monitoring.

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
RCT W3. Improve water quality by reducing sediment and nutrient loads in all Wet Tropics waterways ongoing.				
W3.1 Develop an integrated long-term water quality monitoring regime for each major catchment and adjacent marine waters to underpin delivery of the Reef Water Quality Protection Plan goals by 2006.	RA	**W3.1.1** Build on the existing FNQ NRM Ltd project in conjunction with partner agencies. **W3.1.2** Support the development of monitoring / measurement tools that enables farmers and land managers to assess and manage the impact on water quality of their operations at a property level. Some projects already underway through DPI&F. **W3.1.3** Participate with industries to define nutrient sensitive zones at sub-catchment scale where BMPs and nutrient management plans will be given highest priority.	B2, B5, B7, B8, B9, B16, B18, B19, W1, W2, L1, L3, L7.	RWQPP Partners, NR&M, Research Organisations Industry Groups, DPI&F, Traditional Owners.
W3.2 Set interim targets by July 2005 in all catchments for reduced sediment and nutrient discharges, and meet these targets through adoption of defined and agreed BMPs by 2011.	RA	**W3.2.1** Engage a technical panel, with landholders and industry representatives' involvement and input, to calibrate the effectiveness of management practices for each sector. **W3.2.2** Assist in the development of an upgraded Sediment and River Network Model (SedNet) modelling tool. **W3.2.3** Define benchmark (current) adoption rates for each management practice. **W3.2.4** With industry and local government assistance confirm adoption rate targets. Refer W3.7	B2, B5, B7, B8, B9, B16, B18, B19, L1, L3, L7, W1, W2.	RWQPP Partners, NR&M, Research Organisations Industry Groups, DPI&F.
W3.3 Establish in-stream water quality standards tailored for Wet Tropics conditions by 2011.	RA	**W3.3.1** Facilitate a research program on tropical water quality standards in conjunction with partner agencies.	B2, B5, B7, B8, B9, B16, B18, B19, W1, W2, L1, L7.	RWQPP Partners, NR&M, Research Organisations , DPI&F.
W3.4 Prepare Water Quality Improvement Plans (WQIP) for each Wet Tropics catchment by 2008 (N.B. Douglas Shire's WQIP in preparation now).	P	**W3.4.1** Incorporate whole-of-catchment and cumulative impact assessments in consideration of sewerage reticulation, treatment and disposal projects especially for larger urban areas and coastal towns.	B2, B5, B7, B8, B9, B16, B18, B19, W1, W2,	RWQPP Partners, NR&M, Research Organisations , DPI&F.
W3.5 Sewerage plants all meet tertiary standards by 2030.	OGW	**W3.5.1** Assist local government to prepare a schedule for the upgrading of sewage treatment facilities. **W3.5.2** Assist local government to commence upgrades of priority sewerage treatment plants.	B2, B5, B7, B8, B9, B16, B18, B19, W1, W2,	Local govt, Industry groups.
W3.6 Prepare targets for timing the introduction of sewage pump out at marinas.	RA	**W3.6.1** Develop and implement regional guidelines with statutory provisions where necessary, for the provision of wastewater services for marine facilities and provision of land based collection and treatment systems.	B2, B5, B7, B8, B9, B16, B18, B19, W1, W2,	Local govt, Industry groups.
W3.7 In co-operation with industry, increase the adoption of management practices that promote water quality improvements from 2004 (see also Land Targets L1, L3).	CB	**W3.7.1** Enhance the role of ICM groups for targeting and implementing on-ground works programs. **W3.7.2** Adopt the quadruple bottom line approach to design for infrastructure affecting waterways, including transport crossings and water impoundments and extraction. **W3.7.3** Prepare land and water management plans to develop sustainable water use and land management practices on irrigated lands. **W3.7.4** Negotiate with local government to integrate BMPs into planning scheme provisions. **W3.7.5** Review the environmental and social performance of existing septic tanks and unsewered urban and rural residential areas and develop strategies to alleviate these conditions on a priority basis. **W3.7.6** Assist sugar mills prepare BMP for the disposal of mill-mud.	B2, B3, B7, B8, B9, B16, B17, B19, B21, B15, CB1, L1, L3, L7, L8, ME1, W4, W5.	Industry groups, Catchment and Landcare groups, PI&F, Local Govt, NR&M.

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
		W3.7.7 Promote better nutrient management practices and assist fertiliser suppliers to develop more environmentally friendly products. **W3.7.8** Assist and support local government to develop urban stowmwater management plans and urban stormwater quality plans for urban drainage systems through best-practice guidelines and the like based on concepts of natural drainage, aesthetic, environmental, cultural and recreational considerations. **W3.7.9** Support local government approaches to obtain funding under National and State programs to assist in providing or upgrading stormwater management systems. **W3.7.10** Create and implement a system of verification to confirm that best practice is being applied. **W3.7.11** Trial a GIS based farm planning tool to produce farm and sub-catchment plans (including refining the role of sediment traps). **W3.7.12** Encourage and support individual landowners, community groups, organisations and local governments to construct artificial wetlands to ameliorate flooding, reduce the flow of water and water runoff and improve water quality. **W3.7.13** Assist State agencies prepare and implement rehabilitation plans for derelict tin mining sites in the Herbert river catchment.		
W3.8 Enhance priority riparian areas and wetlands from 2004.	OGW	**W3.8.1** Rehabilitate riparian zones by implementing priority elements of the NQ River Trust Strategy. **W3.8.2** Construct on-farm small wetlands and sediment traps (see also section on Wetlands).	B3, B7, B8, B9, B16, B19, L1, L7, W3, CB1, ME1.	River trusts, catchment and Landcare groups, Industry groups, DPI&F.
W3.9 30% of properties in the Upper Herbert extensive grazing area to have 40–50% groundcover at end of dry season by 2009.	OGW	**W3.9.1** Enhance the role of Landcare and ICM groups encouraging BMP. **W3.9.2** Assist the DPI&F extension program.	B2, B3, B7, B8, B9, B16, B18, B19, L7, W1, W2, CB1, ME1.	DPI&F, NR&M, Landcare and Catchment groups.
RCT W4. Meet Australian Water Quality guidelines for ambient levels of pesticides and heavy metals in tropical waterways, by 2015.				
W4.1 Establish in-stream water quality standards for pesticide and heavy metal concentrations, tailored for Wet Tropics conditions by 2011.	RA	**W4.1.1** Facilitate a research program to develop water quality standards for tropical conditions (see W3.2). **W4.1.2** Establish industry by industry monitoring of products used and associated BMPs for each industry to target reductions in levels of pesticides and heavy metals.	B8, B9, B9, B19, L1, L3 W4, W5, W3.	Research institutions Industry groups, NR&M, DPI&F.
W4.2 In conjunction with WQIPs (W3.4) meet new tropical water quality standards by 2015.	RA	**W4.2.1** Establish benchmark levels of pesticides and heavy metals, including benchmark levels of atropine and deuton.	B8, B9, B9, B19, L1, L3, W4, W5, W3.	Local Govt, Industry groups, NR&M, DPI&F.
W4.3 50% less atrazine and diuron released to the environment by 2008.	OGW	**W4.3.1** Create and implement a system of verification to confirm that best practice is being applied (e.g. through farm management systems program or other independent programs adopted by farmers). **W4.3.2** Establish take up of best management practices that reduce release of pesticides and heavy metals, with industry and local government (e.g. encourage better farm management practices through application procedures outlined in COMPASS for cane growers).	B8, B9, B19, CB1, ME1, W4, W5, W3,	Local Govt, Industry groups, NR&M, DPI&F

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
RCT W5. Aboriginal values for waterways are recognised and protected by 2008.				
W5.1 All NRM policy, planning and management arrangements recognise and protect Aboriginal values for waterways by 2008.	CB	**W5.1.1** Ensure adequate representation and participation of the region's Traditional Owners in water resource planning processes. **W5.1.2** Resource and support Traditional Owners to document their values for waterways, and methods for protecting and assessing ecosystem health of waterways. **W5.1.3** Resource and support Traditional Owner water quality monitoring projects in conjunction with broader water quality monitoring programs.	A2, A5, CB1, ME1, W1, W3, L1.	NR&M, Traditional Owners.

8.0 Caring for Country

Aboriginal Cultural and Natural Resource Management

8.1 Goals

The authority and custodial obligations and responsibilities that Traditional Owners[32] have for country[33] as defined under their traditional laws and customs, and their contemporary aspirations for land and sea management are recognised and reflected in NRM policy, planning and management processes.

These aspirations are fully identified in the Wet Tropics Aboriginal Cultural and Natural Resource Management Plan, which is a key supporting document to this Plan.

Introduction

Traditional Owner groups from the region retain strong and continuous connections to their land and sea country. They do not consider themselves as another stakeholder group. Rather, they regard themselves as the proper custodians of their traditional estates. These estates include land and sea resources, and the knowledge and practices associated with these.

There are at least 17 Traditional Owner groups within the Wet Tropics NRM Region including (but not limited to); Nywaigi, Warrgamay, Banjin, Girramay, Djiru, Ma:mu, Gulnay, Warungnu, Bar-Barrum, Jirrbal, Ngadjon-Jii, Muluridji, Yalanji, Djabugay, Gunggandji, Yidinji, Yirriganydji[34]. Within these groups there are a number of named clan groups. The names of these Traditional Owner groups also refer to the languages and dialects spoken by the members of these groups. According to the linguist R.M.W. Dixon (1976), Ngadjon-Jii, Ma:mu, Jirrbal, Djiru, Gulnay and Girramay people speak related dialects belonging to the larger 'Dyirbal' language group. While the area demonstrates some dialectal similarity it also includes a number of major regional linguistic divergences. As Dixon (1976, p.221) points out, not only do the Aboriginal groups of this region speak at least five distinctive languages, but also the boundaries between some of these languages, e.g. Yidinji and Ngadjon-Jii, constitute a "major linguistic discontinuity". This linguistic diversity reflects some of the cultural differences, notably totemic organization or systems of social classification (two or four-section systems), found in this region (Sharp 1938–39).

Notwithstanding these differences, anthropologists have noted that Aboriginal groups in the region share a number of cultural and social features, particularly relating to material culture traditions. Some of these traditions, such as specialised techniques for processing, often toxic, rainforest foods and trapping rainforest animal species, are unique to the Aboriginal cultures of the Wet Tropics (Tindale and Birdsell 1941; Harris 1978; Bottoms 1993). The unique and distinctive nature of Rainforest Aboriginal cultures is also reflected in customary environmental management practices. For example, archaeologists have noted that Rainforest Aboriginal cultures represent an outstanding example of hunter-gatherer use of tropical rainforest, where hunter-gatherers were uninfluenced by trade or exchange with agriculturalists or horticulturalists (Horsfall 2003). Also characteristic of Aboriginal use of the Wet Tropics is the practice of aboriculture and the use of fire to manipulate the environment to improve plant productivity (Hill 1988).

For Traditional Owner groups today, the Wet Tropics Region is imbued with cultural meaning. In this regard, the Wet Tropics is a series of 'living' Aboriginal cultural landscapes that have been shaped by management practices of their ancestors for thousands of years. They express their culture through their relationship with country and their groups, as well as through their beliefs and customs. The basis of this cultural expression is the belief in the Dreaming.

It is also important to acknowledge that there are many historical Aboriginal and Torres Strait Islander peoples who live within the region who are not Traditional Owners. Many of these people have been living in the region for many generations, and have historical connections to the Wet Tropics. Although it is the Traditional Owners who `speak for country', these people also have interests in land and sea management issues.

Aboriginal values for the region have important links with all other asset chapters in this Plan. This is highlighted in Figure 10.

Aboriginal Customary Law and authority for country

For Aboriginal people of the Wet Tropics, their traditional entitlement to their ancestral lands and waters derives from the charter of the 'Law'. Sometimes called '*Bama* or Murri Law', the Law is regarded as the source of customary beliefs and practices, jural protocols and procedures, and traditional interests and rights. For Traditional Owner groups, the Law is also acknowledged as the source of all life forms and natural phenomenon, which comprise their world.

[32] An Aboriginal person who has traditional or familial links, and/or connection to particular traditional lands and/or waters under traditional law, including rights, interests and responsibilities (Wet Tropics Regional Agreement 2004).

[33] 'Country' is a term used by Aboriginal people for their traditional lands, waters and airspace. It means place of origin, literally, culturally or spiritually. It refers to more than just geographical area: it is all of the values, places, resources, stories, and cultural obligations associated with that geographical area (Smyth 1994, Wet Tropics Regional Agreement 2004).

[34] These spellings are consistent with the Aboriginal Rainforest Council Regional Agreement spellings.

Figure 10. Relationship between caring for country and other assets identified in the Wet Tropics NRM Plan.

Aboriginal Law also refers to the creative epoch at the beginning of time when the activities of Dreaming or totemic beings shaped and gave meaning to the world. According to the laws and customs acknowledged by regional Aboriginal people, the topographic features of their traditional lands and waters were created by, or are the embodiment of, a number of ancestral and totemic figures. In the process of creation, these Dreamtime beings left behind potent essences of themselves in the landscape or in physical objects, places were named and the land and waters were charged with numinous import. Aboriginal people refer to these Dreaming-invested places as 'story-waters' or 'story-places'. For the Traditional Owners of the Wet Tropics, the physical features of the environment not only affirm the veracity of their Law, but they also stand as tangible proof of the enduring and systematic presence of ancestral and totemic beings on, and in, country. Thus, for Aboriginal people, the concept of the 'Law' is systematically related to country through the ordered existence of story-places, Dreaming tracks, and the cultural protocols which structure the peoples' activities on country and their subsequent engagement with the Law.

For Aboriginal people in the Wet Tropics, their traditional country is both a mythological landscape encoding the activities and physical forms of Dreaming or Story beings, and an ancestral space continuously occupied by the spiritual incarnation of deceased Aboriginal people, referred to as the 'spirits' or the 'old people'. Aboriginal people in a number of ways experience the presence of these ancestral beings. Traditional Owners often speak of being 'watched' or guided in their actions by their 'old people'. In this respect, the watchful and regulatory presence of the 'old people' throughout country serves to mediate Indigenous people's activities on country and their engagement with the Law in a systematic way. Aboriginal people speak of acting in a 'proper way' when on country. For them, this means observing a range of cultural protocols when occupying and using their traditional lands and waters. Observation of these rules may involve 'speaking to country', smoking places, being quiet, and/or leaving behind a portion of catch or food for the 'spirits' of the country.

The presence of totemic beings and the 'old people' ensures the sacred status of Aboriginal lands and waters. The old people and the Story beings are regarded as the intrinsic guardians of country and they not only guide Aboriginal people in the appropriate occupation and use of their lands and waters but they also act to punish and dispel non-sanctioned users of Aboriginal country. For Aboriginal people, the physical landscape, and in particular the story-places and story-waters associated with the Law, serves as evidence of the inalienable connection that exists between themselves, their ancestors, and the Law. It is this inalienable relationship that forms the basis and content of Aboriginal traditional ownership of the lands and waters of the Wet Tropics Region.

8.1.1 Overview of Aboriginal values and assets

Many, if not all, of the natural assets identified in this Plan have associated Aboriginal cultural values. For example, Double Island is said to be the totemic rainbow serpent, 'Kudyu-Kudyu' (McConnel 1935:54; Quinn 1991), while natural features in the Barron River Gorge and along the Redlynch Valley are identified as the body of the ancestral hero, Damarri (Bottoms, Lee Lon and Verevis 1995). In her report on the 'Aboriginal Cultural Values of the Wet tropics Bio-Region', Horsfall (2003) states that Aboriginal people of the region make no significant distinction between 'nature', its resources, the actions by which they are exploited, and the cultural system within which people live. For Aboriginal people, as Horsfall

Table 16. Aboriginal assets and their values in the Wet Tropics NRM region.

Assets	*Description*	*Values*
Cultural Landscapes Places, and Materials	• Story places & ceremony places • Waterways of significance • Conception, birth and burial places • Historical and occupation places • Walking tracks and campsites • Art sites & resource use places • Intangible cultural and spiritual places • Cultural artifacts and objects • Ancestral remains • Documentation of heritage	• Spiritual, ceremonial and cultural values • Historical values • Educational values • Economic values • Well-being
Aboriginal Knowledge of country	• Biodiversity knowledge • Land & sea management knowledge • Hunting & gathering techniques • Medicinal & nutritional knowledge • Aboriginal languages • Spiritual and cultural knowledge	• Spiritual and cultural values • Economic values • Historical values • Environmental values • Employment opportunities • Health and well-being
Aboriginal Cultural Practices	• Customary management of country • Religious, ceremonial and cultural practices • Hunting, gathering and fishing • Music, dance & artistic expressions • Oral cultural traditions	• Spiritual, ceremonial and cultural values • Historical values • Educational values • Environmental values • Economic values • Health and well-being
Cultural & Natural Resources	• Flora and fauna of cultural significance • Waterways (estuarine and freshwater) • Geological features	• Economic values (commercial and subsistence values) • Health and well-being • Ceremonial, cultural and spiritual values
Aboriginal peoples & organisations	• Elders (and their knowledge and skills), Traditional Owner Youth • Traditional Owner and Indigenous Organisations	• Social and cultural values • Economic values

observes, the environment is a humanised landscape. It is not seen as "something conceptually apart from humans, as something only to be exploited by them for a living". As this suggests, the Aboriginal concept of country and the values ascribed to it are not fixed for all time, but reflect the dynamic nature of human-environment interactions.

Therefore, the protection and management of the region's assets, as identified in the chapters of this Plan under the themes of biodiversity, climate, land, water and community, are important to the Traditional Owners in the region. The issues and priorities identified in this chapter relate to all of the key themes and asset areas. Aboriginal values and assets of the region that were identified in the workshops with Traditional Owners for the development of the Plan are identified in Table 16. These assets are not mutually exclusive and there is a great degree of overlap between each of the asset areas. An example is that knowledge of country underpins Aboriginal cultural practices and the management of cultural and natural resources.

Traditional Owner aspirations for cultural and natural Resource management

Traditional Owners of the region have a strong interest and aspirations to become involved in contemporary NRM activities in the region, and to maintain their traditional laws, customs, knowledge and practices for customary land and sea management. These aspirations can be achieved through: the development of equitable partnership arrangements with government and non-government agencies; and increased employment opportunities and involvement in planning and management arrangements. A key to this involvement is the role Aboriginal structures and organisations play in NRM activities.

One of the key differences regarding Aboriginal and non-Aboriginal approaches to NRM is that Aboriginal people adopt a much more holistic perspective than mainstream scientific approaches. For them, the natural and cultural values of the land and waters are interwoven and inseparable. For example, the protection and management of species of cultural significance includes the maintenance of creation stories, customary laws, use of and access to, as well as the traditional knowledge and practices in regards to use and management of the species. This is also linked to the reproduction of language, totemic systems and social identity. Understanding this holistic perspective is fundamental in the appreciation of Traditional Owners' NRM aspirations as identified in this Plan.

The social and economic disadvantages that face many Aboriginal people in the region today influence Aboriginal people's aspirations for NRM. In many of the catchments in the region Indigenous people have significantly higher unemployment rates, and lower income levels when compared with the total

population in 2001 (Fenton 2004). In workshops, many Traditional Owners talked extensively about opportunities for sustainable development initiatives on country that could be supported through the NRM process.

Aspirations for natural and cultural resource management identified in workshops by Traditional Owners include (amongst others):

- Recognition of customary rights and obligations for country;
- Recognition of status as Traditional Owners by the regional community;
- Employment and sustainable economic development opportunities on country;
- Strong, effective and well resourced Traditional Owner governance structures;
- Skills development and culturally appropriate training opportunities;
- Cultural revitalisation and self-determination;
- Conservation of culturally significant plants and animals;
- Increased access and use of country:
- Recognition and protection of Aboriginal values for country in policy, planning and management arrangements;
- Increased involvement in all levels of natural and cultural resource management; and
- The development of equitable partnerships and cooperative management arrangements for country with all NRM stakeholders.

Traditional Owners' natural and cultural resource management issues

Key issues for natural and cultural resource management were identified at workshops for the development of this Plan and the Aboriginal Cultural and Natural Resource Management Plan. They are identified in Figure 11.

'It is perhaps not so much how the capacity of Indigenous people can be developed to address NRM issues, but how innovative approaches to NRM and planning may be used to address serious issues of social and economic disadvantage for Indigenous people in the region'

– Mark Fenton, 2004

Recognition of country based approaches to managing resources

Current regional approaches to NRM do not adequately recognize cultural boundaries and the local authority of each Traditional Owner for their country and its resources. Aboriginal people of the region have used and managed the natural resources at a local country based scale for thousands of years. Today, they continue to view and manage resources at this scale. Given this, it is appropriate, therefore, to support the development of management plans at a country-based scale, which reflect both the cultural boundaries and the customary laws of each group for their country. Country-based planning will ensure that individual NRM projects are consistent with Traditional Owners' responsibilities to all cultural and natural values of country, and that NRM decisions are made at the culturally appropriate scale. Country-based NRM plans can be developed by each Traditional Owner group independently of, or in collaboration with, landholders and management agencies who have contemporary interests in the same country.

Current management arrangements

For Aboriginal people in the Wet Tropics, their customary interests and rights entail caring for country in a culturally and environmentally sustainable manner. The cultural responsibilities and obligations of Traditional Owners to care for country in this manner is evident in a range of activities. For example, Ngadjon-Jii people are members of a number of endangered species conservation groups, are involved in riparian revegetation projects in the Barron River catchment area, and regularly conduct Traditional Ecological Knowledge (TEK) tours at the Malanda Conservation Park, Malanda Falls National Park, Lake Eacham National Park and Wooroonooran National Park. Other Aboriginal groups in the region are similarly involved in the day-to-day care of their country.

While Aboriginal people are engaged in a range of informal NRM management practices in relation to their traditional lands and waters, many of which are conducted in conjunction with State Government agencies such as EPA and NR&M, co-management, on a more formal basis, appears elusive for many groups. The recent MoU between Ngadjon-Jii people, EPA and WTMA marks a welcomed step towards the recognition and implementation of a co-management strategy for the region's protected areas. Though the MoU falls somewhat short of the legally-binding cooperative management structures aspired to by many Aboriginal groups with native title claims over state land. While the legal reality of co-management seems years away, a number of Aboriginal groups in the region have opted to pursue their co-management aspirations through alternative routes. A good example of the creative responses of Indigenous people to this issue is the establishment of the 'Cardwell Indigenous Ranger Unit' (CIRU). Created through the joint efforts of Girringun Aboriginal Corporation and EPA, CIRU is

responsible for the management of protected areas, both marine and terrestrial, in the Cardwell area. In effect, Girringun has achieved a form of co-management minus a change in government policy or political willingness at the State level.

Girringun Aboriginal Corporation represents Traditional Owners at a sub-regional level in the southern part of the Wet Tropics Region. Traditional Owners are represented by various Traditional Owner and Aboriginal organisations at a local level, sub-regional level and at a region level. Local level Traditional Owner organisations include (but are not limited to) Djabugay Ranger Agency and the Kuku Yalanji Marine Resource Centre. Girringun Aboriginal Corporation operates at a sub-regional level in the southern part of the Wet Tropics NRM region.

The Aboriginal Rainforest Council (ARC), recently established as part of the Wet Tropics Regional Agreement under section 40 of the *Wet Tropics World Heritage Protection and Management Act 1993* (Qld),

Maintenance of Aboriginal knowledge and practices

- Transmission of cultural knowledge and practices to younger generations.
- Increased access to country, its resources and places of significance.
- Maintenance of Aboriginal languages.
- Maintenance of hunting and gathering practices.

Protection and management of land and sea country

- Negative impact of weeds and feral animals on cultural values.
- Protection and management of species of cultural significance.
- Negative impacts of agriculture (sediment and chemicals) on waterways and resources.
- Loss of Aboriginal knowledge systems.

Protection of intellectual and cultural property

- Control of information by Traditional Owners (ownership, access, storage).
- Threats to intellectual and cultural property rights from bioprospecting and tourism.
- The need to develop equitable benefit sharing agreements for the use if ICP.

Social and economic issues

- Lack of sustainable economic development opportunities on country.
- Concerns about issues affecting youth and cultural survival.
- High rates of unemployment and lack of employment opportunities on country.

Protection of places of significance and cultural material

- Protection and management of cultural landscapes, places and materials by Traditional Owners.
- Control of information by Traditional Owners.
- Minimisation of negative impacts on places of significance from development and other uses.

Capacity building and institutional change

- Lack of awareness and understanding of Aboriginal issues by NRM stakeholders.
- Lack of meaningful involvement in NRM planning and management activities at all levels.
- Need for training and capacity building in NRM.
- Lack of infrastructure, support and resources to undertake NRM projects.

Policy, legislation and management arrangements

- Lack of meaningful involvement in planning and management arrangements for country.
- Lack of recognition of rights and interests in legislation, policy and management arrangements.
- Confusion about management arrangements, legislation and policy.
- Inadequate permitting arrangements.

Figure 11. Cultural and Natural Resource Management Issues for Traditional Owners

Box 49. Case Study – Recognition of the Wet Tropics as a cultural landscape – A regional agreement for the Wet Tropics World Heritage Area

A review of Aboriginal involvement in the management of the WTWHA produced the report `*Which Way our Cultural Survival – The Review of Aboriginal Involvement in the Management of the Wet Tropics World Heritage Area (1998)*'. Subsequently, the Interim Negotiating Forum (INF) was established in order to negotiate a Wet Tropics World Heritage Area Regional Agreement and give effect to a range of review recommendations that aim to achieve more effective and meaningful participation of rainforest Aboriginal people in the management of the WTWHA. The resulting regional agreement is between Rainforest Aboriginal people and the WTMA, EPA, and NR&M, and the Department of the Environment and Heritage.

Key elements of the historic regional agreement include: support for the listing of the WTWHA on the new National Heritage List with the future aim of nominating of the cultural values for World Heritage Listing; the establishment of the Aboriginal Rainforest Council; and agreement to a number of principles, guidelines and protocols outlining arrangements for rainforest Aboriginal peoples participation in policy, planning, permitting and management.

Allison Halliday, Aboriginal Negotiating Team spokesperson said: "The regional agreement is a fantastic achievement. We are overjoyed that our hard work has finally paid off. This will be a new beginning for our mob. At last rainforest Aboriginal people will have a meaningful role in management of our country. It means a lot to us to have both State and Commonwealth Government agencies recognising Rainforest Aboriginal people and wanting to work more closely with us. We realise how significant this agreement will be when we look at our sons and daughters. It is their future we have secured. We dedicate our achievement to our Elders and to those we have lost in this long journey. This Agreement will advantage about 20,000 rainforest Aboriginal people, who feel that we have been disenfranchised by World Heritage management arrangements".

Allison Halliday, Aboriginal Negotiating Forum in Cairns on Monday 21 June 2004.

will become the peak advisory body for rainforest Aboriginal people in the Wet Tropics World Heritage Area for natural and cultural resource management issues. The ARC will facilitate the effective interaction between rainforest Aboriginal people and the WTMA, NR&M, EPA, and the Department of the Environment and Heritage, advising and reporting on land and cultural heritage management, policies and programs. There are also three Native Title Representative Bodies (NTRB) within the Wet Tropics NRM Region – Cape York Land Council, Central Queensland Land Council and North Queensland Land Council. NTRBs are recognised under the Australian Commonwealth Government's *Native Title Act 1993* (NTA). Their functions and powers involve support to native titleholders to make various applications under the NTA, including claimant, objection, future act and compensation applications. NTRBs also have a role in the negotiation of Indigenous Land Use Agreements (ILUAs). In addition there are two Deed of Grant in Trust (DOGIT) regions at Yarrabah and Wujul Wujul which have Shire Councils established under the *Local Government (Aboriginal Lands) Act 1978*. There are also three ATSIC Regional Councils, which are in place until 30 June 2005 in an advisory role. With the closure of ATSIC and the associated agency, Aboriginal and Torres Strait Islander Services (ATSIS), the Government is exploring ways to coordinate and deliver Indigenous services, within the framework of the Council of Australian Governments (COAG).

Within a number of Government agencies there are Indigenous units which support Traditional Owners e.g. WTMA's Aboriginal Resource Management Program (ARM), the Indigenous Engagement Unit (IEU) (EPA), and the Indigenous Policy and Liaison Unit (GBRMPA). They all play an important role in ensuring that Indigenous peoples' issues are recognised in planning and management activities undertaken by these and other government agencies. Program 7 of the Rainforest CRC, Aboriginal Collaboration and Capacity Building in Research, has undertaken a number of environmental and cultural research projects in conjunction with Rainforest Aboriginal people.

Furthermore, Traditional Owners are pursuing various avenues to achieve their aspirations and priorities for land and sea management through formal and informal mechanisms such as:

- The development of the Wet Tropics Aboriginal Cultural and Natural Resource Management Plan and input into the Wet Tropics Regional NRM Plan;
- The Wet Tropics Regional Agreement (see Box 49);
- Indigenous Land Use Agreements, Memorandum of Understanding and other agreements with NRM stakeholders;
- Involvement on Boards and Committees;
- Native title claims;
- Employment in land management agencies;
- Traditional Owner organizations, such as the Aboriginal Rainforest Council (ARC) and Girringun Aboriginal Corporation; and
- Building partnerships with government and non-government agencies.

Legislation and Policy

Traditional Owners' rights and interests for land and sea are recognised in policy, legislation and planning documents at an international, national, State and regional level.

International recognition includes: *The Convention on Biological Diversity 1992*, and the *Draft Declaration of the Universal Rights of Indigenous Peoples*.

National recognition includes: *The National Strategy for the Conservation of Australia's Biological Diversity*; *the Native Title Act 1993*; *Wet Tropics World Heritage Protection and Management Act 1993*; *the Environment Protection and Biodiversity Conservation Act 1999*.

Various regional planning documents recognize Indigenous interests such as the Cardwell-Hinchinbrook and Wet Tropical Coast Regional Coastal Management Plans, the FNQ Regional Plan and the Great Barrier Reef 25 Year Strategic Plan. Other legislation and planning instruments will be discussed in relevant areas of this chapter.

Box 50. What is native title?

Native title is the recognition in Australian law that Indigenous people had a system of law and ownership of their lands before European settlement. The native title of a particular group will depend on the traditional laws and customs of those people. The way native title is recognised and practised may vary from group to group, depending on what is claimed and what is negotiated between all of the people and organisations with an interest in that country. In Aboriginal customary law, people with rights to use land and natural resources also have responsibilities for caring for country. Thus, native title has a close relationship with management of natural resources.

Native title may exist in areas such as vacant Crown land, some national parks, forests and public reserves, some types of pastoral lease, some land held for Aboriginal communities, beaches, oceans, seas, reefs, lakes, rivers, creeks, swamps and other waters that are not privately owned. People who hold native title have a right to continue to practice their law and customs. This could include visiting to protect important places, making decisions about the future use of the land or waters, hunting, gathering and collecting bush medicines.

A number of commentators have pointed to the limits of native title, seen solely as a legal entity. Throughout the Wet Tropics Region, like the rest of Aboriginal Australia, Traditional Owners are working together with local government, community groups, and state agencies, to bring about the realization of what some have called 'social native title'. Going beyond the *Native Title Act*, social native title aims to broaden the 'recognition space' provided by Mabo and negotiate real outcomes that will benefit Indigenous people now and in the future. In the Wet Tropics Region, these negotiations are opening up new spaces for Aboriginal involvement in environmental management.

8.1.2 Key Themes for Caring for Country

The following key themes are addressed in this section, which address Traditional Owners' priorities for natural and cultural resource management.

- Increased access and use of country
- Places of cultural significance and cultural landscapes
- Aboriginal knowledge of country
- Resource use and cultural maintenance

8.1.3 Increased access and use of Country

Traditional Owners at the workshops conducted as part of the planning process highlighted the fact that an important part of caring for their traditional country and maintaining cultural landscape values is being able to have access to country, so that they can renew contact with places, manage places of cultural significance according to their laws and customs, and be able to actively manage resources. Figure 12 shows how these key issues relate to the maintenance of healthy Aboriginal cultures and healthy country. These issues need to be acknowledged in contemporary NRM processes.

In workshops, Muluridji, Ma:Mu, Djiru and Girramay Traditional Owners talked about the importance of taking the younger generation onto country and passing on knowledge. Some of the women from the Ma:mu workshops were very concerned about issues facing young Aboriginal people such as substance abuse, youth suicide and unemployment. They stressed the importance of developing cultural camps to take young people onto country to provide them with increased opportunities to learn about their culture and their country, to ensure they have a sense

Box 51. Case study – healthy country, healthy culture

Cultural revitalisation camps and visits to country can address a wide variety of social issues that are facing young Aboriginal people today and facilitate the transmission of Aboriginal knowledge systems and cultural practices for the management and use of country and its resources.

A good example of a program that has both NRM outcomes and substantial cultural benefits is that organised by Kuku Yalanji at Mossman Gorge through Bamaga Bubu Ngadimunku. Over the last few years, the elders have taken children on regular culture camps to the Daintree and Cape Tribulation. On the camps children are taught bush craft and about protecting the environment. Children are also taught stories of the ancestral beings, songs and dances, and they learn about kinship and customary law.

The aim of the program is to strengthen the children's self-confidence, cultural identity and knowledge of land and sea management. Programs like this ensure the transfer of cultural knowledge from one generation to the next.

(Source: Lennon et al. *2001, p. 107)*

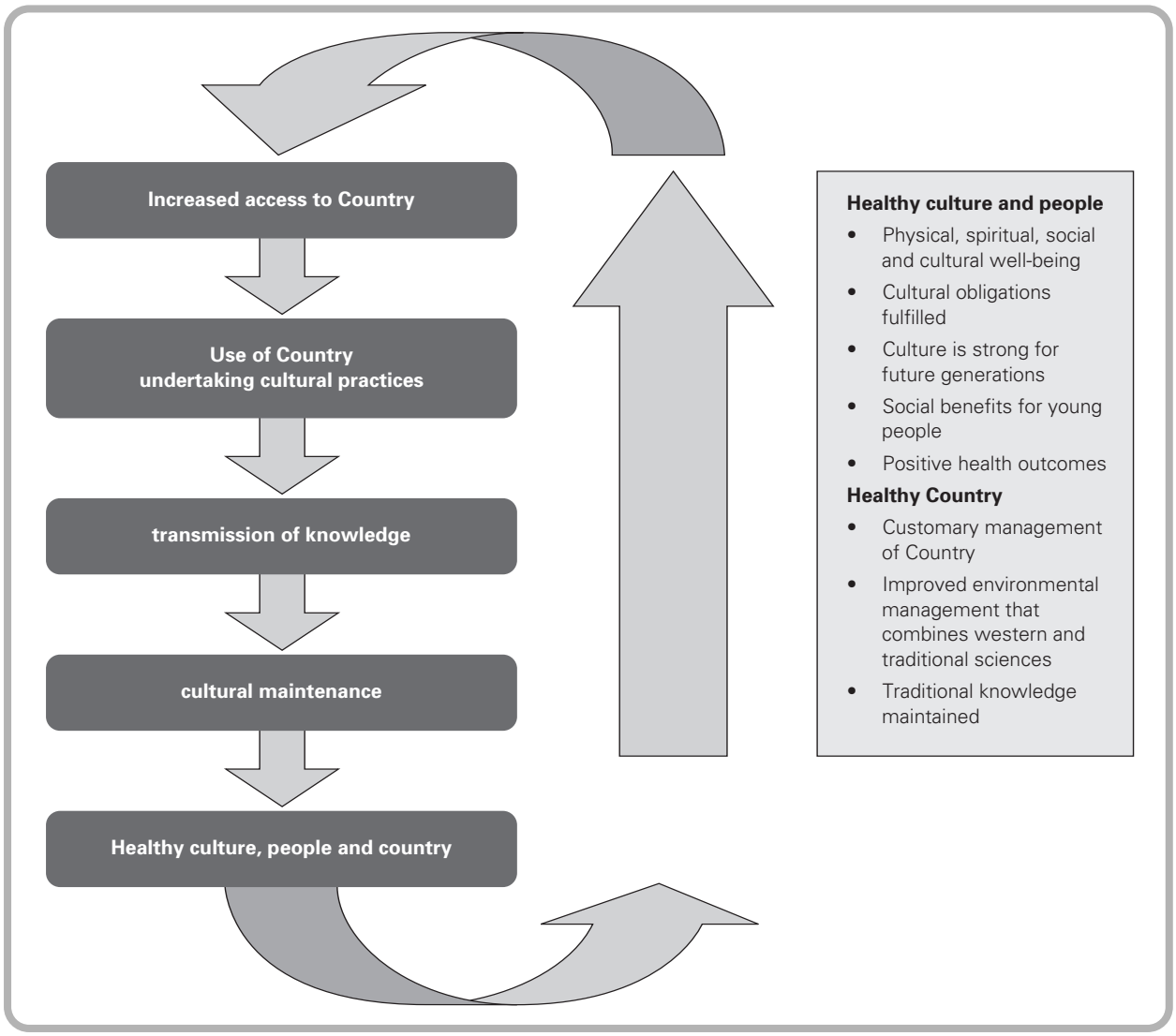


Figure 12. The relationship between cultural maintenance and healthy country.

of cultural identity and pride. These types of programs have been developed by KuKu Yalanji at Mossman Gorge (see Box 50).

Threats

Lack of recognition and understanding of Aboriginal values

There is a level of fear and uncertainty amongst the broader community about issues of access, native title and their implications. In many respects, this uncertainty stems from a lack of understanding of Aboriginal issues, and in particular, the importance of both access to and use of country for Traditional Owners.

Lack of resources and support

In the Wet Tropics Region many Traditional Owners live in urban or regional townships. Being able to take young people back to their traditional country is an essential part of learning about culture and looking after country. These activities require a level of support and resources, which are not currently or readily available.

Conflicting and inappropriate government policy

Many Aboriginal people have been physically alienated from their country through the granting of freehold and other tenures over these areas. For some Aboriginal people the declaration of their lands and waters as protected areas has effectively locked them out. Previous government policies which controlled Aboriginal occupation and movement, also served to restrict people's access to country.

Native title will only provide some Aboriginal people with legal rights to access their land and sea country in some areas. Native title is still subject to existing legislation and pursuing native title is a time consuming and complicated process with no guarantees of the types of outcomes that Traditional Owners are seeking. Further, the High Court has found that native title has been extinguished by freehold grants of land and other types of exclusive land tenures. The Court has decided that, in any event, all rights and interests held by tenure holders over non-indigenous tenures, including pastoral leases, will prevail over native title rights and interests in the event of a conflict.

Management Response

There are a variety of strategies that are being pursued by Traditional Owners to increase access and use of country. One of the key strategies used by Traditional Owners has been through the *Native Title Act*. As mentioned previously, potentially up to 98% of the WTWHA, is claimable under the provisions of the *Native Title Act*. To date, there are a number of native title claims that are at varying stages of mediation in the region. Outside of this western legislative approach to addressing access and use issues, Aboriginal people assert their prior ownership of the region under their own laws. There are other opportunities that are being pursued in conjunction with native title, such as the development of MoUs and other forms of negotiated agreements. For example the MoU between WTMA, EPA and Ngadjon-Jii incorporates access to places of significance such as burial sites by Ngadjon-Jii Traditional Owners (see Box 52)

There is also the potential for the new regional arrangements for NRM to support Traditional Owners in gaining increased access to their country, through funding on-ground NRM projects such as weed and pest animal management. These types of projects can achieve both NRM outcomes and substantial cultural outcomes for Traditional Owners, thereby helping achieve the quadruple bottom line.

Box 52. Case Study – Ngadjon-Jii Memorandum of Understanding

A Memorandum of Understanding (MoU) relating to Ngadjon land that falls within the boundaries of Wooroonooran National Park, including Mt Bartle Frere, the Topaz Road National Park and the Malanda Falls Conservation Park was signed in February 2003 between the Wet Tropics Management Authority, the Environmental Protection Agency and Ngadjon-Jii people. Under the MoU a restricted access area within the Wooroonooran NP known as Bulubu Burrguna or Top Camp, as it is known in the Ngadjon-Jii language, has been created, requiring visitors to seek permission from Ngadjon-Jii to enter the area. The MoU also contains provisions for support for Ngadjon-Jii employment, training and business opportunities, pest management strategies, as well as provisions for consultation with Ngadjon-Jii people about permits within the Parks.

Thomas Gertz, Ngadjon-Jii representative said his people were proud and pleased with the outcome of their negotiations with the conservation agencies. "The restricted access declaration will once again see our old people involved in the management of a very significant site within our traditional lands. We also look forward to once again looking after our country in a meaningful way being involved in management and decision making."

Dr Ross Pearson, Acting Executive Officer for the North Queensland Land Council, which represented Ngadjon-Jii People in their negotiations with EPA and WTMA, congratulated all parties on reaching the MoU. "The fact that Traditional Owners and government agencies can sit down together and agree on a way to best manage this country is reassuring and shows that the involvement of Traditional Owners leads to practical outcomes that benefit all".

Ngadjon-Jii elders, Clive Cook, EPA and Russell Watksinson WTMA at the MoU signing, Malanda February 2003 (Photo: Rodger Wilkinson).

8.1.4 Places of cultural significance and cultural landscapes

Places of cultural significance are both tangible and intangible features within the landscape, waterways and the sea that have special values for Aboriginal people (see Table 20). They are an important part of Aboriginal customary law, their developing traditions, history and current practices (Australian Heritage Commission 2002). These places often feature in Aboriginal creation stories. These stories serve to connect Aboriginal groups in the Wet Tropics Region to their traditional country. It is not just particular places that are important to Aboriginal people, but also the relationship between places that is important. For example, a coastal site may have been a traditional stopping place en route to a meeting place elsewhere and the land in between the two places may have significance as a traditional pathway or walking track. Often the connection between story places is such that there is not one particular place that has an independent value. Each place has a meaningful association with other places, connected by storylines and oral traditions.

Threats

Conflicting and inappropriate government policy

Various concerns about the *Aboriginal Cultural Heritage Act 2003* were raised during Plan workshops. These included; concerns about the protection of cultural landscape values and intangible cultural heritage values with the new legislation, the lack of recognition of Aboriginal ownership and control over their cultural heritage, and concerns about the reliability of database information and the control and management of this information by NR&M. Some of the information in the NR&M cultural heritage database has not been collected or approved by the Traditional Owners and does not represent the diverse range of cultural heritage values that Aboriginal people want to protect and manage.

Table 17. Some examples of types of culturally significant places

Occupation places	Hearths, fireplaces, stone artifacts, shell middens, artifact scatters, dwellings and campsites.
Stone quarries	Locations where materials for making artifacts were gathered for use and trade.
Carved and scarred trees	Trees may show scars from the removal of bark to make various artifacts including canoes, shields, and containers. Carved trees mark locations of cultural significance.
Art sites	These include drawings, engravings, stencils and paintings on rock faces that can have various functions.
Burial Places	Individual and collective
Ceremonial grounds	These places are important for Aboriginal people as meeting places or where ceremonies are performed. These can include Bora grounds.
Resource areas	These can include habitual areas of resource exploitation. Fish traps which are linear arrangements, or barriers of stone set across inlets and bays, or woven branches set across creeks or rivers.
Historical places	Contact sites between Europeans and Aboriginal people, historic cemeteries, massacre sites, missions, and burial sites.
Walking tracks	Traditional pathways of Aboriginal people (including trade routes).
Culturally significant places	Dreaming tracks, and story places.
Waterways of significance	Rivers and streams created and occupied by Dreaming beings.

Lack of information and monitoring

There are major information gaps relating to Aboriginal cultural landscapes and places. Traditional Owners need to be supported to document the cultural values of country, and to manage this information.

Physical threats

Many of the threats to regional biophysical assets identified in this Plan also threaten Aboriginal landscape values. Vegetation clearing, waterway and wetland modification, altered fire regimes, urban development, agriculture, pastoralism, tourism, mining, as well as weeds and pest animals, were identified in workshops as key threats to Aboriginal cultural values associated with Wet Tropics environment. For example, landscape fragmentation processes can break the connections between places of cultural significance, thus isolating culturally significant places from each other, and feral pigs can destroy culturally significant waterways.

Inappropriate management arrangements

Traditional Owners are concerned about their lack of involvement in the management of cultural heritage at all levels. The lack of appropriate consultation with Traditional Owners about projects and activities which impact on cultural heritage values was raised at workshops as well as concerns about the lack of employment opportunities and funding for Aboriginal people to manage places of cultural significance.

Lack of resources and support

The lack of resources and support to ensure the documentation, management and monitoring of places of cultural significance in culturally appropriate ways is a major impediment to the recognition and protection of cultural heritage values.

Use and access issues

Inappropriate use of, and access to, places of cultural significance by non-Aboriginal people, and lack of consultation about access to those places is an issue, as are restrictions on access to places of cultural significance by Traditional Owners to undertake cultural practices.

Lack of recognition and understanding of Aboriginal values

There is a general lack of awareness and understanding of Aboriginal cultural landscape issues and values by industry, government employees, community groups and the general public.

Management Response

Current legislation includes the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Cth), which provides overriding protection to all Indigenous sites and places. The Queensland *Aboriginal Cultural Heritage Act 2003* is administered by NR&M. It provides blanket protection of Aboriginal cultural heritage, which under the Act, includes areas, objects and archaeology. It establishes a cultural heritage *Duty of Care Guidelines*, and a register and database for cultural heritage. Cultural heritage bodies are established under the legislation. The cultural heritage body for the Wet Tropics Region is yet to be determined. As mentioned above, Traditional Owners have expressed various concerns about the *Aboriginal Cultural Heritage Act 2003*.

The *Integrated Planning Act* (IPA) requires valued features, including places of cultural heritage significance, be incorporated into any planning schemes. Recognition and protection of Aboriginal values in IPA schemes is a significant issue for Traditional Owners.

An innovative approach to the protection of Aboriginal values in planning, policy and management arrangements has been the development of cultural landscape mapping programs and databases by Indigenous people. Cultural landscape

mapping can be used to document (amongst other things) place names (in Indigenous languages), places of significance (or culturally sensitive zones), ethno-ecological knowledge, the location of food and medicinal plants, historical events, creation stories, and language boundaries. Systems can be built into GIS databases to ensure that protocols for storage, use and access of information, as defined under traditional laws and customs, are respected and recognised. For example, Traditional Owners in the Burdekin Dry Tropics are currently developing a landscape mapping project that also incorporates training and skills development in GIS and other capacity building components for Traditional Owners.

It is important that with the development of any cultural landscape mapping system that Aboriginal people have the ownership and control of information. Appropriate agreements and protocols for the protection of intellectual and cultural property need to be developed to facilitate this.

The development of a comprehensive cultural landscape mapping system in the Wet Tropics NRM Region can help to ensure that all NRM activities protect Aboriginal values and achieve the quadruple bottom line. Furthermore, this could greatly assist in the progression of the re-listing of the Wet Tropics World Heritage Area for its Aboriginal cultural values, and assist in the development of a culturally appropriate monitoring and evaluation strategy for the Aboriginal Plan and the Regional NRM Plan.

8.1.5 Aboriginal knowledge of Country

Traditional Owners of the region have a diverse and complex knowledge about the Wet Tropics Region. This knowledge has been the basis for the management of the environment for thousands of years. Archaeological evidence demonstrates Aboriginal occupation of the region from 6,000 years ago to the present. The absence of dates indicating earlier occupation is function of preservation factors and the relative paucity of research effort. As Horsfall (2003) observes, it is considered that Aboriginal people have lived in the Wet Tropics area for as long as they have lived elsewhere in the continent. This view about the antiquity of Aboriginal occupation is reflected in local narratives about the creation of landforms in the region. For example, Ngadjon-Jii and Yidindji people have stories about the formation of Lake Eacham which "provide a plausible account of a volcanic eruption" (Dixon 1991, p.41). As scientists have proven, the crater lakes on the Atherton Tablelands were formed by volcanic eruptions around 12,000 years ago. Other Aboriginal groups in the region possess stories about how the coastline was once out near the edge of the Great Barrier Reef, but the sea then rose until the shore reached its present position (Dixon 1977). Some scientists have interpreted these stories as describing the post-glacial sea level rise. As these two examples illustrate, it is not uncommon to find that Aboriginal environmental knowledge is readily supported by scientific knowledge. As this suggests, Indigenous knowledge is a vital component in understanding the environmental history of the region. Drawing upon these histories enables us to learn the lessons of the past and initiate ethically responsible actions for the future.

While Indigenous and scientific knowledge about the environment may, at times, complement each other, it is important to realize that the two knowledge systems are quite different in terms of their ethics and methods. While scientific knowledge is presented as abstract, objective and value-free, Indigenous ways of knowing can be regarded as embodied, personal, and morally and ethically bound. For Aboriginal people, knowing the world is very much a practical activity, based upon a different set of cause-effect relationships than those recognized by science. Unlike scientific knowledge, Indigenous ways of knowing are not necessarily structured as separate or singular systems of knowledge. This is because knowledge is not shared equally by members of a group or a society. Differences in gender, age and ritual status affect and inform the kind of knowledge possessed by an individual. As the recognition of these differences suggests, in Aboriginal societies with a strong oral, as opposed to, written tradition, knowledge and its transmission is linked to power. Knowledge in these contexts is not freely given or sought without due consideration of the cultural and social obligations and responsibilities associated with the transmission of knowledge.

These knowledge systems are a significant regional asset for both Traditional Owners and for the regional community because they can contribute to a better understanding and management of the environment. The preservation and revitalization of this knowledge is critical, as is the support for resourcing of projects that record knowledge in a culturally appropriate manner by Traditional Owners, as well as programs that support the transmission of knowledge on country.

Smyth (2002) identified some of the Aboriginal environmental knowledge systems of the Wet Tropics Region:

- Belief systems about the origins of the land and sea, the geographic features and species.
- Understanding of the inter-relatedness of the components of ecosystems.
- Knowledge of and names for a wide range of species and their seasonal patterns of growth;
- Knowledge of impacts on country by European settlement and related land use practices.
- Knowledge and practices relating to the use of natural resources (including nutritional and medicinal qualities of resources).
- Knowledge of the historical distribution of species, breeding patterns, life-cycles and food requirements.
- Knowledge rights, responsibilities and practices relating to the practical and ceremonial management of country and its biodiversity.
- Knowledge of affiliations of particular groups of Aboriginal people with particular country and kinship between people, country and flora and fauna species.

- Knowledge and use of languages, which are specific to particular groups of people and their country, and which contain and allow the transmission of aspects of cultural and natural heritage and related practices.

Management and control of knowledge in Aboriginal cultures is based on codes of conduct which determine who has the right to speak for country and pass knowledge on to others. There are also various protocols that inform access and use of particular places. Certain types of information can be restricted to a small group of people. In particular, knowledge about law, ceremony and spiritual beliefs may be restricted to certain elders who are responsible for this information and certain places. One of the key issues identified in Plan workshops relates to Traditional Owner control and management of their cultural heritage.

Threats

The loss of Aboriginal knowledge has a number of serious implications, which include the further erosion of the spiritual and social well-being of Aboriginal people now and in the future. Furthermore, the potential management benefits of Aboriginal land and sea knowledge and expertise will be lost to government and community land and sea management agencies.

Lack of information

There is a major gap in the documentation of Aboriginal knowledge in the region by Traditional Owners. Culturally appropriate documentation of Aboriginal knowledge (with appropriate intellectual cultural property rights [ICPR] protocols regarding development, storage, use and access of knowledge) through print, electronic and digital media, as well as interactive databases, can play an important role in ensuring that cultural knowledge is passed on to future generations.

Lack of recognition of Aboriginal knowledge of country

Western scientific knowledge and approaches to NRM are given greater priority than Aboriginal knowledge systems in current NRM planning, policy and management despite the fact that Aboriginal knowledge systems have been applied and utilised in the region for many thousands of years. The tension between scientific and Aboriginal knowledge reflects larger issues of power and control over resources.

Inappropriate use of Aboriginal knowledge systems

Traditional Owners are concerned about ensuring the appropriate use of their knowledge in research and NRM activities, and stressed the need for appropriate recognition and protection of ICPR. Some examples raised include the increasing pressure from commercial bioprospecting organisations, and government and research institutions that are interested in ways they can utilise ICPR for economic gain.

Inappropriate Government Policy

Current policy and legislation focuses on individual authorship and ownership and does not adequately recognise and protect Aboriginal ICPR. Aboriginal ICPR is usually based on group rights. Under Aboriginal customary law, knowledge is collectively owned by the descendents of a particular group (Janke 1998).

The Queensland *Biodiscovery Bill 2004* does not adequately recognise ICPR of Aboriginal people. It lacks appropriate triggers to ensure that companies consult with the Aboriginal people in regards to bioprospecting ventures, as well as mechanisms for the development of benefit sharing arrangement for the use of Aboriginal ICPR by bioprospecting companies (Davis 2002).

Management Response

In international conventions, declarations and agreements there is strong recognition of the need to preserve Aboriginal knowledge systems, and their importance in environmental management such as the *International Convention on Biological Diversity* (see Box 54).

At a national level, the Department of the Environment and Heritage in their *Reconciliation Action Plan* recognizes the importance of Aboriginal people collating and applying their knowledge systems to address contemporary environment issues, as does the *National Strategy for the Conservation of*

Box 53. The loss of ecological knowledge and Aboriginal languages

The loss of Aboriginal ecological knowledge and the viability of local languages are, among other things, linked to environmental change. As people are removed from country, and habitat is reduced and species decline, some to the point of local extinction, Aboriginal knowledge and ways of speaking about the environment, fauna and flora, are affected in a number of adverse ways. As linguists and anthropologists have observed, Aboriginal languages, like Aboriginal Law, are embedded in the landscape. Individuals are not only given the name of totemic species but are also named after a place, often associated with an ancestor. In this way, language, people, fauna and flora, and the environment are interlinked to create a humanized landscape. As such, environmental change has the potential to transform the nature of this inter-connectedness, in some cases, bringing about the loss of knowledge and language.

The erosion of language viability in the Wet Tropics Region is a serious concern for both Aboriginal people and linguists alike (see Dixon 1972). In their '*Language Atlas of the Pacific*', Wurm and Hattori (1981) identify a number of local dialects and regional languages as having serious sustainability issues, with some bordering on 'extinction'. While a number of Aboriginal groups in the region, for example, Djabugay people, have embarked upon a program of language revitalization, other groups require support, assistance and skills to bring about similar changes.

Australia's Biological Diversity (see Box 54). This recognition is yet to be appropriately implemented through State and Commonwealth legislative processes and translated into substantive research programs, funding and action at a local level.

8.1.6 Resource use and cultural maintenance

Hunting, gathering and fishing practices and the use of resources for other purposes are an important part of caring for country. These practices are crucial in maintaining links to country, re-affirming cultural identity and are central to the well-being of Aboriginal people. Natural resources are used for many purposes such as food, medicines, artifacts and implements.

Much of the focus of non-Aboriginal people on Aboriginal resource use in the region has been on the hunting of species such as turtles and dugongs. These species have deep cultural significance for coastal Traditional Owner groups. However, there are many other natural resources that are culturally significant for Aboriginal people. For example, plant species that are unique to the Wet Tropics Region are used to make cultural artifacts such as bicornual-shaped baskets.

Each Traditional Owner group has customary laws and protocols regarding hunting animals and utilising plant resources, to ensure that resources are conserved and maintained. These customary laws continue to provide the basis for the management of resources today. Smyth (1998) outlined some practices in relation to customary management of country. These include: conducting ceremonies (songs, dances, story telling and other rituals) with the purpose of nurturing the welling being of particular places, species and habitats; control of entry into estates by outsiders; – restricting resource use to clan members and others by agreement; seasonal exploitation of resources; restriction on the harvesting of particular species based on age, gender, reproductive conditions, health, fat content of individual animals; restrictions on resource use and distribution by clan members and others based on age, gender, initiation status, marital status and other factors; restrictions on the use of particular animals and plants of totemic significance to individual clans. Each clan usually identified closely with at least one natural element (usually animal or plant), the use of which was often highly restricted or prohibited.

Threats

Lack of recognition and understanding of Aboriginal values

Aboriginal hunting is a contentious issue, and is often perceived to have a major impact on species when there is little scientific basis for this perception (Caughley & Sinclair 1994, Altman & Allen 1992). In reality, understanding of the ecological dimensions of subsistence wildlife use in Australia is very limited and knowledge of whether or not subsistence use is

Box 54. International Convention on Biological Diversity and National Strategy for the Conservation of Biological Diversity

Article 8(j) of the International Convention on Biological Diversity states that each Contracting Party shall:

Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of Indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of benefits arising from the utilisation of such knowledge, innovations and practices.

Article 1.8.2 of the National Strategy for Conservation of Biological Diversity states that:

Ensure that the use of traditional biological knowledge in the scientific, commercial and public domains proceeds only with the cooperation and control of the Traditional Owners of that knowledge and ensure that the use and collection of such knowledge results in social and economic benefits to the Traditional Owners. This will include:

a) Encouraging and supporting the development and use of collaborative agreements safeguarding the use of traditional knowledge of biological diversity, taking into account existing intellectual property rights; and

b) Establishing a royalty payments system from commercial development of products resulting, at least in part, from the use of traditional knowledge.

Such arrangements should take into account relevant work in international forums such as the United Nations Commission on Human Rights. They should also take into account Australian obligations under the Convention on Biological Diversity.

Box 55. Case study: Community based management of resources, KuKu Yalanji Marine Resource Committee

During the 1990s a decrease in turtle and dugong numbers in the southern GBR became a major concern to environmental groups and governments. To manage turtles and dugong, governments decided that Indigenous people using the marine park and inshore waters and resources should be restricted and monitored. Forcing a permit system on Traditional Owners' activities caused tensions between hunters and government. Because of these concerns, the Kuku Yalanji of Mossman established a Marine Resource Committee for the management of traditional hunting permits issued by QPWS and GBRMPA.

Community-based management can prove to be effective because it provides the means for monitoring at a grassroots level and vests control in the hands of the Traditional Owners via a management mechanism that is locally driven. Not only do Traditional Owners regulate who, if and where people can hunt, their role also has a major influence on illegal hunting and the education of both Aboriginal and non-Aboriginal communities.

(Source: Hunter and Williams 1998)

adversely affecting wildlife populations is inconclusive in most cases (Davies *et al*. 1999). Many non-Aboriginal people do not understand the role that hunting has in cultural maintenance, caring for country, and social well-being. There is also a lack of recognition of the legal rights that Traditional Owners have to hunt and use resources. There is also controversy about what constitutes `traditional hunting'. The Australian Law Reform Commission found that a determination on whether an activity is traditional should focus on the purpose of the activity rather than on the method, so that the incorporation of new materials and hunting methods would not prevent an activity from being classed as 'traditional'.

Traditional Owners raised many concerns about the survival of species such as turtle and dugong, and many groups identified that they are not hunting these species currently because of these concerns. They identified that they want to be actively involved in research and management of species such as turtle and dugong to ensure their future survival.

Conflicting and inappropriate government policy

Under the *Native Title Act* and common law native title Traditional Owners do not need a permit if they are exercising their native title rights. However, this is not properly recognised by government agencies in the region.

Unregulated hunting

Traditional Owners are concerned about the illegal use of flora and fauna species on their country by non-Aboriginal people. They are also concerned about other Indigenous people using resources without permission. These unrestricted and unregulated practices can create negative public perceptions of hunting and reflect negatively on Traditional Owners.

Management Response

There are many international and national conventions, strategies and inquiry reports, both binding and non-binding, that recognise Indigenous peoples' rights and responsibilities to use resources. The *National Strategy for the Conservation of Australia's Biological Diversity* recognises the importance of hunting and gathering for Aboriginal people. Under the *Native Title Act* s211, native titleholders can exercise their rights to hunt and fish for personal, domestic or non-commercial needs without obtaining a permit or license. The Yanner case (1999) extended these rights to include hunting and fishing by modern adaptive methods in accordance with traditional law and customs. The 1999 High Court case of Yanner v Eaton (201 CLR 351), sometimes known as the 'crocodile case', upheld Indigenous people's native title right to hunt, gather and collect fauna and flora, without fear of prosecution under State nature conservation legislation. The Yanner decision certainly casts new light on the way governments and environmental management agencies deal with the conservation of protected species. For Aboriginal people, the Yanner decision and other native title judgements have brought about long-overdue recognition of their traditional laws and customs and provided some legal certainty regarding the exercise of these.

Contemporary approaches to management need to be community driven and based on traditional laws and customs such as the Kuku Yalanji example of community based management of hunting of turtle and dugong (see Box 55). The Indigenous Policy and Liaison Unit at GBRMPA is currently developing Traditional Use of Marine Resources Agreements (TUMRA) which are effectively MoUs with Traditional Owners in the region. Currently, a MoU is being developed between Djiru, Girrimay, Bandjin, Warrgamay, Nywaigi and GBRMPA.

'The huge biological diversity found in the north Queensland rainforests is reflected in the detailed vocabulary of the languages of the region, but these languages are at least as severely endangered as the biological species in the region.'

– Commonwealth Government, 2001

Box 56. Who to contact

The Aboriginal Rainforest Council (ARC) and Girringun Aboriginal Corporation can assist you to identify the correct Traditional Owners that you need to consult with regarding NRM projects. The Indigenous Project Officers with FNQ NRM Ltd can also assist in this process. To ensure that any existing legal rights and interests are not adversely affected and the relevant groups are involved, the appropriate Native Title Representative Body should be contacted because they have responsibility for native title issues.

There are a number of protocols, including a 'consultation and meeting protocol', Aboriginal cultural heritage and mapping protocols, and scientific and educational permitting protocol that were developed as part of the regional agreement for the WTWHA that can be used to assist all NRM stakeholders to develop effective partnerships with Traditional Owners (contact ARC regarding these).

Traditional Owners have identified a number of ways which they want to be involved in NRM projects, ranging from project design, advice and liaison on cultural matters, or participation in project management and on ground activities.

The resources needed to facilitate the involvement of Traditional Owners in projects needs to be considered in project planning for items such as reimbursement of travel costs and time. People often rely on the goodwill of Traditional Owners who are invariably under-resourced.

8.2 Caring for Country targets and actions

The following resource condition targets and management actions were developed in conjunction with Traditional Owners during and extensive consultation strategy that involved numerous workshops over a seven-month period. They are taken from the Wet Tropics Aboriginal Cultural and Natural Resource Management Plan.

Management Action Target (MAT)	*Type of MAT*[35]	*Management Actions*	*Links Targets*	*Potential Partners*
Resource Condition Target (RCT) A1. All Traditional Owners groups have strong and effective governance structures and support networks by 2010.				
A1.1 Resource Aboriginal Land and Sea Management organisations at a regional, sub-regional and local level by 2007.	CB	**A1.1.1** Support and resource the ARC as the regional Traditional Owner organisation for natural and cultural heritage issues in the WTWHA. **A1.1.2** Continue to support and resource the operations of the Girringun Aboriginal Corporation. **A1.1.3** Support and resource local Traditional Owner Cultural and Natural Resource management organisations.	A1-A5, B7, B15, B16, B21, B19, CB1, ME1, W6.	WTMA, DEH, GBRMPA DSD, NR&M, Aus Govt, State Govt, ICC, DATSIP.
RCT A2. Aboriginal cultural landscapes and culturally significant places are protected and managed to the satisfaction of each Traditional Owner group in the Wet Tropics by 2014.				
A2.1 Complete a cultural landscape mapping program to document the range of natural and cultural heritage values at local and regional level by Traditional Owners by 2007.	CB	**A2.1.1** Develop a regional cultural landscape mapping framework and project outline allowing for each Traditional Owner group to develop mapping on country. **A2.1.2** Identify infrastructure, skills, and training required to develop, implement and manage cultural landscape mapping databases and information. **A2.1.3** Develop and implement information sessions and training packages on the development and management of cultural landscape databases. **A2.1.4** Develop intellectual and cultural property protocols for collection, use, access and storage of information at local, sub-regional and regional levels. **A2.1.5** Develop agreements and MoUs with relevant government agencies and NRM stakeholders regarding the use of the cultural landscape database.	A1-A5, B3, B6, B17, B21, B23, W6.	ARC, Girringun, Traditional Owner Groups, DEH, WTMA, Research Organisations .
A2.2 Develop and implement country based management plans, community based management plans and TUMRAs for land and sea country for Traditional Owner groups to commence in 2005.	CB	**A2.2.1** Undertake a needs analysis with Traditional Owners to identify Traditional Owner groups who want to undertake country based planning. **A2.2.2** Develop a framework for country-based planning models and methodologies (in consultation with Traditional Owners). **A2.2.3** Prioritise Traditional Owner groups to undertake country based planning in the initial phase of funding. **A2.2.4** Assist Traditional Owner groups to develop Community and Country Based Management Plans and TUMRAs.	A1-A5, B3, B6, B15, B19, B21, W6, CB1.	ARC, Girringun, Research Organisations, DSD, NR&M, GBRMPA, WTMA, DEH, ICC, DATSIP, Aus Govt, State Govt.
A2.3 Increase involvement of Traditional Owners in managing cultural landscapes and places of cultural significance by 2009.	RA	**A2.3.1** Assist Traditional Owners to negotiate voluntary access agreements with landholders in the region to protect and actively manage areas of cultural significance. **A2.3.2** Develop and implement legally-binding agreements and cooperative management arrangements between Traditional Owners and relevant stakeholders for the management of land and sea country. **A2.3.3** Resource the regional Cultural Heritage Body to effectively administer the *Aboriginal Cultural Heritage Act 2003* in conjunction with NR&M. **A2.3.4** Implement the provisions of the Wet Tropics World Heritage Area Regional Agreement relating to employment and training, participation in decision-making, and the principles, guidelines and protocols for cultural heritage management. **A2.3.5** Support Traditional Owners to undertake training in cultural heritage management.	A1-A5, B3, B6, B15, B19, B21, W6, L7.	ARC, Girringun, Research Organisations, DSD, NR&M, GBRMPA, WTMA, DEH.

[35] Types of Management Action Targets: CB- Capacity Building, OGW- On-Ground Works, P- Planning, RA- Resource Assessment & Monitoring.

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
A2.4 Develop a monitoring and evaluation regime to determine changes in the protection and management of Aboriginal cultural landscapes and culturally significant places by 2006.	RA	**A2.4.1** Develop cultural indicators through consultation with Traditional Owner groups. **A2.4.2** Monitor and evaluate trends in effective management of country based upon cultural values and indicators as determined by each Traditional Owner group. **A2.4.3** Develop a qualitative survey tool to monitor and evaluate effective protection and management of cultural landscapes and places in accordance with the cultural values that each group has for their country.	A1-A5, B3, B6, B15, B19, B21, CB1, ME1, W6, L7.	ARC, Girringun, Research Organisations, DSD, NR&M, GBRMPA, WTMA, Traditional Owners.
A2.5 Explicit protection of all Aboriginal cultural landscapes and culturally significant places in policy, planning and management arrangements by 2008.	RA	**A2.5.1** Identify threatened places of significance and develop management plans for high priority areas (according to Aboriginal ICPR). **A2.5.2** Develop agreements between NTRBs, Girringun Aboriginal Corporation and ARC regarding roles and responsibilities for NRM and cultural heritage. **A2.5.3** Develop partnership agreements between FNQ NRM Ltd and ARC and Girringun Aboriginal Corporation. **A2.5.4** Support a process whereby Traditional Owners negotiate with landholders the return of cultural property. **A2.5.5** Develop and implement an ongoing educational campaign for all NRM stakeholders regarding the *Aboriginal Cultural Heritage Act 2003*. **A2.5.6** Develop models and culturally appropriate mechanisms to ensure that places of cultural significance and cultural landscape values are protected in all local government planning schemes. **A2.5.7** Develop culturally appropriate signage on country as determined by Traditional Owners.	A1-A5, B3, B6, B15, B19, B21, CB1, ME1, W6, L7.	ARC, Girringun, Research Organisations, DSD, NR&M, GBRMPA, WTMA, Traditional Owners.
A2.6 Support a process to re-list the Wet Tropics World Heritage Area as a World Heritage Cultural Landscape by 2009.	RA	**A2.6.1** Undertake research required for the submission to meet criteria for the WTWHA to be listed on the National Heritage Listing (which is required as the first step before advancement to the World Heritage Listing as a Cultural Landscapes). **A2.6.2** Develop submission to meet criteria for the WTWHA to be re-nominated as a World Heritage Cultural Landscapes.	A1-A5, B6, B21, CB1, ME1, W6.	WTMA, ARC, Girringun, Research Organisations, Traditional Owners, DEH, NR&M.
RCT A3. Traditional Owners have access to their traditional land and sea country for cultural maintenance and to revitalise customary management practices through working collaboratively and developing agreements with landholders and other NRM stakeholders by 2014.				
A3.1 Each Traditional Owner group to have agreements with relevant stakeholders regarding access to, and use of country by 2010.	RA	**A3.1.1** Develop further, and implement the provisions of current MoUs, MAs, CMAs and ILUASs (such as Kuku Yalanji ILUA and Ndadjon MoU). **A3.1.2** Support Traditional Owners to purchase land through the initiatives such as (but not limited to) the Indigenous Land Corporation. **A3.1.3** Develop and implement an educational campaign for landholders and NRM stakeholders about native title and access issues. **A3.1.4** Support a process of negotiation between Traditional Owners and relevant stakeholders to reach agreements regarding access to, and use of country.	A1-A5, B3, B6, B7, B15, B19, B21, CB1, ME1, L7.	ARC, Girringun, Research Organisations, DSD, NR&M, GBRMPA, WTMA, Traditional Owners, NTRB, NNTT.

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
RCT A4. Aboriginal knowledge systems and customary management practices for land and sea country are protected and conserved to the satisfaction of each Traditional Owner group in the Wet Tropics by 2009.				
A4.1 Develop and implement programs and projects that document knowledge and facilitate the transmission of cultural knowledge and practices by 2007.	RA	**A4.1.1** Record knowledge of country and develop educational materials (books, databases, videos) with appropriate ICPR protection. **A4.1.2** Develop and implement cultural programs to bring elders and young people together on country to facilitate the transmission of knowledge and cultural practices.	A1, A2, A3, B3, B6, B7, B9, B15, B19, B21, CB1, W6.	ARC, Girringun, Research Organisations, DSD, NR&M, GBRMPA, WTMA, Traditional Owners, DEH.
A4.2 Develop mechanisms for the protection of Aboriginal intellectual and cultural property to commence 2005.	RA	**A4.2.1** Develop legal frameworks and policy that recognises and protects Aboriginal ICPR. **A4.2.2** Develop protocols and guidelines for the protection of Aboriginal ICPR in research and all NRM activities. **A4.2.3** Develop and implement culturally appropriate benefit sharing arrangements for the use of Traditional Owners ICPR in biodiscovery, research, tourism and for other uses.	A3, B3, B15.	ARC, Girringun, Research Organisations, DSD, NR&M, GBRMPA, WTMA, Traditional Owners.
A4.3 Support the revitalisation of customary land and sea management techniques by each Traditional Owner group for their country to commence in 2005.	CB	**A4.3.1** Include customary management techniques of country by Traditional Owners in planning and management of natural and cultural resources in the region. **A4.3.2** Assist Traditional Owners to undertake customary management of their land and sea country. **A4.3.3** Increase the awareness of NRM stakeholders through cultural awareness training programs in regards to the importance of Aboriginal customary management techniques for land and sea country.	A1-A5, B3, B6, B9, B15, B16, B19, B21, CB1, L7, W6.	ARC, Girringun, Research Organisations, DSD, NR&M, GBRMPA, WTMA, Traditional Owners.
RCT A5. Traditional Owner groups are fully involved at all levels in natural and cultural resource planning and management by 2010.				
A5.1 All Traditional Owner groups are engaged in sustainable industries on their land and sea country by 2014.	CB	**A5.1.1** Develop and implement an awareness raising strategy for Traditional Owners about opportunities in the bush tucker industry. **A5.1.2** Undertake a scoping study on opportunities, constraints and challenges for Aboriginal people in the bush-tucker industry. **A5.1.3** Develop business plans for bush tucker initiatives. Develop bush tucker initiatives and projects in the region. **A5.1.4** Develop a regional Aboriginal tourism strategy to assist Traditional Owners to develop business plans and marketing strategies. **A5.1.5** Develop and implement tourism-training programs. **A5.1.6** Establish Aboriginal cultural tourism initiatives in the region. **A5.1.7** Traditional Owner organisations are supported and recognised as key delivery organisations for the management of both cultural and natural resource management in the region.	A3, A4, B3, B19, B21, L6, B15, CB1, W1, W6.	ARC, Girringun, Research Organisations, DSD, NR&M, GBRMPA, WTMA, Traditional Owners, DATSIP, ICC, DAFF, DEWR.
A5.2 Achieve proportional (to regional population statistics) staffing of Aboriginal people in NRM and Cultural Heritage Management by 2009.	CB	**A5.2.1** Review current opportunities and practices for Indigenous employment in government and non-government NRM agencies in the region. **A5.2.2** Implement the provisions of the Wet Tropics Regional Agreement in relation to employment and training of Aboriginal people. **A5.2.3** Promote the employment of Aboriginal people (in a variety of ways such as consultants, advisors, full-time, part-time etc) in natural and cultural resource management.	A1-A5, B3, B7, B15, B21, CB1, ME1, W6.	ARC, Girringun, DSD, NR&M, GBRMPA, WTMA, DSD, DPI&F.

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
A5.3 Develop and implement culturally appropriate mechanisms to ensure that Traditional Owners values and interests are incorporated into policy, planning and management to commence 2005.	RA	**A5.3.4** Ensure culturally appropriate representation of Traditional Owners on all NRM decision-making structures, advisory committees and boards at regional and local level. **A5.3.5** Develop mechanisms for the issuing, monitoring and assessment of permits for scientific, tourism and commercial purposes that are culturally appropriate for Traditional Owners. **A5.3.6** Promote and support the uptake of the protocols and guidelines in the Wet Tropics regional agreements by stakeholders currently not party to the agreement such as FNQ NRM Ltd, local government and community NRM organisations. **A5.3.7** Implement the provisions of the Wet Tropics World Heritage Area regional agreement regarding employment and training.	A1-A5, B7, B15, B16, B21, B19, W6, CB1, ME1.	ARC, Girringun, Research Organisations, DSD, NR&M, GBRMPA, WTMA, Aus Govt, State Govt
A5.4 Develop and implement culturally appropriate training packages for Traditional Owners in cultural and natural resource management to commence in 2005.	CB	**A5.4.1** Identify key gaps in skills and knowledge for natural and cultural resource management by Traditional Owners. **A5.4.2** Support Aboriginal rangers (both community rangers and within government agencies) to undertake accredited training in law enforcement for protecting and managing land and sea country.	A1-A5, B15, B19, B21, CB1, W6.	TAFE, JCU, ARC, Girringun, Research Organisations, DSD, NR&M, GBRMPA, WTMA, DEWR, DATSIP, ICC, State Govt.
RCT A6. All NRM stakeholders have the capacity to work effectively with Traditional Owners on issues affecting land and sea country by 2011.				
A6.1 Develop and implement cultural education programs and educational material for NRM stakeholders about Traditional Owners interests for NRM to commence in 2007.	CB	**A6.1.1** Develop a cross-cultural training program/package (as an economic enterprise). **A6.1.2** Develop and distribute a user-friendly guide for NRM stakeholders regarding engagement protocols, and the protection of cultural values in NRM activities.	A1-A5, B6, B15, B21, W6, L7.	ARC, Girringun, Research Organisations, DSD, NR&M, GBRMPA, WTMA, Traditional Owners.

9.0 Community

9.1 Goal

A community that is knowledgeable and informed of natural and cultural resource management issues and which actively participates in the sustainable management of natural and cultural resources in the region.

9.1.1 Community: an overview of the asset and the service it provides

For the purpose of this Plan, 'community' is defined as everyone who lives and works in the Wet Tropics Region, those who visit it and those who have some other (external) connection to it. Like all NRM regions in Australia, this community is made up of multiple interests and individuals who have varying preferences for the protection and use of natural and cultural resources (see Box 57). It is the challenge of FNQ NRM Ltd to facilitate through negotiation and participatory frameworks an approach to natural and cultural resource management that will allow all sectors and people within the community to achieve their aspirations for the management of natural and cultural resources in the region.

To achieve sustainable NRM, all people in the community need to actively participate in NRM through actions and decisions in their businesses, industries, jobs, professions, day-to-day lives and through the 'on the ground' implementation of NRM activities.

The quality of individual and community life and the major industries of the region are all dependent upon the regions natural assets. Tourism, agriculture, fishing, forestry and the ancillary industries that support them rely on the maintenance of a sustainable and healthy environment.

At the same time the climate, quality of life and natural assets of the region are attracting population growth and along with this growth there is increasing pressure on the environment, infrastructure and services of the region.

By 2021 the population of the Wet Tropics NRM region is projected to increase from 216,000 to 311,101 persons. The interface of community and NRM needs to be considered in the context of future social and economic trends within the region, resource use and pressures as described in the Background Report (McDonald & Weston 2004) as well as the social and demographic profiles of communities within the region as described in the Capacity Building Report (Fenton 2004). The capacity of community to participate in NRM will be substantially influenced by these factors.

Communication and the meaningful engagement of the regional community in NRM is one of the largest challenges facing the FNQ NRM Board.

9.1.2 Status and threats

Differences in awareness, knowledge and beliefs about natural processes and the way potential threats to natural and cultural assets are understood and conceptualized make the management of our natural and cultural resources to achieve sustainable outcomes exceedingly complex and difficult. It is hoped that the current plan may contribute to achieving improvements in this area by strategic investment at a regional scale.

This means investing in people as well as technical solutions and ensuring that individuals and communities have the capacity to effectively implement specific and often technology-based 'on ground' management actions.

It also means supporting groups such as Traditional Owners who have not been adequately involved in the delivery of the first phase of NHT, can actively participate in the planning, implementation and monitoring of all projects on their traditional land and sea country, and to increase the awareness of all NRM stakeholders of the important role and custodial obligations that Traditional Owners have in the management of their country.

In the spirit of the old adage "prevention is the best cure," young people need to be provided with the opportunity to avoid the mistakes of the past. Primary and secondary school education is an ideal time and platform to instil a sense of connectedness between people and the natural world. For better or worse, the next generation will be impacted by the decisions and actions of this Plan. They should at least be provided with the capacity to understand and deal with their inheritance.

Like all regions, the Wet Tropics Region needs a skilled, knowledgeable, motivated and well-resourced community. It needs strong leadership and effective partnerships to engage the community in decision-making and the development and implementation of responses to their natural resource management issues.

The new framework for regional planning emphasises this need to build the capacity of the community to manage natural resources in a more sustainable manner. The National Natural Resource Management Capacity Building Framework and the Queensland guidelines for Integrating Capacity Building into Regional NRM Planning identify four key conceptual areas of specific importance to capacity building. They are:

Awareness: Individuals within the community being aware of regional NRM issues and understanding the link between these issues and the long-term viability of the community.

Information and knowledge: Natural resource managers and users able and willing to access the necessary information, data and science – biological, social and economic – to make sound NRM decisions.

Skills and Training: Natural resource managers and users equipped with, or having access to, the necessary technical, people management, project management and planning skills to participate in the development and implementation of sustainable NRM at the property, local and regional scales.

Facilitation and Support: Support systems in place to ensure the engagement and motivation of the community to build social capital and enable skilled NRM managers and users to exercise ownership over regional NRM decision making processes, and effectively implement actions arising from these processes.

Seven key capacity and capacity building requirements in the Wet Tropics Region were identified in the Capacity Building Condition Report (Capacity Building Report), including:
1. Community engagement in NRM;
2. Motivation to participate in NRM;
3. Awareness of NRM issues;
4. Skills and training;
5. Knowledge of NRM;
6. Facilitation and support; and
7. Institutional change.

Community engagement in NRM

An integral component of capacity building in plan development and implementation is community involvement and participation. Building capacity cannot be achieved through a 'top down' process of simply providing strategies to increase awareness, information to improve knowledge and training to develop skills. Capacity building is as much about process as it is about achieving outcomes and should occur throughout the process of plan development and plan implementation.

Capacity building requires and must be embedded in direct, active and meaningful involvement of the community in all aspects of NRM planning and implementation. The guidelines for developing a regional natural resource management plan in Queensland (2002) clearly articulate the importance of community ownership and involvement in NRM planning and indicate that without ownership and an opportunity for community to contribute to "defining the problems, setting targets and developing solutions" it will be unlikely that the Plan can be successfully implemented.

Community engagement involves communication with a large, diverse and widely distributed population which requires investment, a sophisticated strategy and a receptive interest. Furthermore interest in NRM is influenced by personal perceptions, the relative importance and impacts of the issues-of-the-day and social and economic factors. For example, over the 3 years leading up to the public consultation phase of the *Draft* Wet Tropics NRM Plan, the database mailing list barely exceeded 1% of the regional population.

A strategy to increase the level (quantity) and degree (quality) of community engagement will necessarily include mechanisms and incentives for ongoing involvement in NRM. While early research directed at informing on-ground capacity building targets and community engagement inducements is yet needed, an immediate strategy needs to be developed for region-wide promotion of the NRM Plan by mid-2005. Ultimately, the key challenge will be to effectively engage all individuals and entities in the Wet Tropics Region in NRM matters.

Box 57. Key participants in NRM in the Wet Tropics

Government

The Wet Tropics Management Authority and the Great Barrier Reef Marine Park Authority manage the region's World Heritage Areas, the state agencies including the Department of Natural Resources, Mines and Energy, the Environment Protection Agency, and Department of Primary Industries and Fisheries have NRM responsibilities. The Department of Local Government, Planning, Sport and Recreation and local governments, through their development and land use planning functions, also have a significant role in the management of natural resources.

Non-government organisations

The Wet Tropics community has a well-established record of participation in Landcare, Integrated Catchment Management, land rehabilitation and conservation organisations.

Aboriginal groups

There are various Aboriginal organisations that deal with natural and/or cultural resource management issues including Aboriginal Community Councils (Yarrabah and Wujal Wujal), as well as Traditional Owner Organisations at a local level such as Djabugay Ranger Agency, at a sub-regional level such as Girringun Aboriginal Corporation and a regional level such as the Aboriginal Rainforest Council. The Native Title Representative Bodies deal with native title issues.

Industry

Tourism associated with the reef and the rainforest is the primary industry in the region. Other major industries that depend on natural resources include cropping, horticulture and grazing, as well as fishing, forestry and to a lesser extent, mining. Peak lobby groups (e.g. CANEGROWERS, Growcom, Agforce) and research corporations (e.g. SRDC) support these industries. In other jurisdictions, companies wishing to promote an environmentally responsible image will often embrace opportunities to participate in NRM programs and projects.

Research and Educational Institutions

Major research and educational institutions with an interest in NRM in the region include James Cook University, the Rainforest CRC, CSIRO, secondary and primary schools.

Individuals

The consumption pattern of every person.

Motivation to participate in NRM

Motivation to participate in natural resource management activities has not been identified as one of the four components of capacity building within the National Natural Resource Management Capacity Building framework. However it is referred to in the context of this framework as an important component of capacity building. The importance of motivation in the context of capacity is emphasised by Fenton *et al* (2000, quoted in Capacity Building Report) who state that "farmers may have significant capacity to adopt sustainable practices, but on the other hand no motivation to do so...conversely, there maybe significant motivation amongst farmers for the adoption of sustainable practices, but they may have little or no capacity to implement these practices".

Reasons for participating in NRM activities are most likely to be a consequence of how the issue is perceived or understood and whether the issue is perceived as being of direct relevance or importance to the individual. If the individual believes the issue may impact on themselves or their community then there is a greater likelihood of individuals being motivated to take action. The Capacity Building Report suggests there is a need to make NRM issues more immediately relevant to individuals and to develop collective ownership of issues at the local community level.

Awareness of NRM issues

Awareness is one of the key areas identified in the National Natural Resource Management Capacity Building Framework where it is defined as "individuals within the community being aware of regional NRM issues, and understanding the link between these issues and the long-term viability of the community." Several themes were clearly identified when the topic of awareness was discussed during preparation of the Capacity Building Report. These included:

(a) community awareness of NRM issues;
(b) community awareness of management actions;
(c) the temporal change in NRM awareness;
(d) the awareness of NRM issues amongst new landholders; and
(e) the visibility of NRM issues.

Community engagement via long-term commitment to effective communication devices and vehicles, primary and secondary school education programs, enhanced NRM coordinator support to industry and community groups, supporting membership opportunities and partnerships, and value creation through the transformation of human resources in NRM activities will enhance the position of each of the above themes.

Knowledge of NRM

The second key area within the National Capacity Building Framework is that of information and knowledge. According to the framework, "natural resource managers and users (will be) able and willing to access the necessary information, data and science – biophysical, social and economic – to make sound NRM decisions". This appears to be a somewhat overly simplistic view, which suggests that simply providing data and information will lead to 'sound NRM decisions'. It is clear through consultation undertaken in the Wet Tropics Region that this is one of the more complex issues underpinning capacity and capacity building and is very much about the recognition, acceptability and use of knowledge embedded in the different NRM belief systems within the community.

Box 58. Conflicting Belief Systems

Given that a distinction can often be made between a belief system based on local knowledge and one based on external 'scientific' or 'expert' knowledge, it will often be the case that the knowledge embedded in these belief systems will often be incongruent. For natural resource management and planning this is an important issue that needs to be addressed. In some instances, resolving the belief conflict is of equal or more importance than the on-ground management action itself.

From Capacity Building Report, p67

Any attempt to resolve conflicting belief systems will require communication. Effective communication requires trust. Trust must be valued, protected and developed over time. Understanding that the power of knowledge expands exponentially when shared, as opposed to the outdated concept that knowledge is power and therefore must be horded, should naturally lead to enhanced communication initiatives. The broader and deeper the conversation, the more opportunity there is to integrate belief systems.

Skills and training

Skills and training represent the third component of the National Capacity Building Framework. The development of capacity in this context would ensure that "natural resource managers and users are equipped with or have access to, the necessary technical, people management, project management and planning skills to participate in the development and implementation of sustainable NRM at the property, local and regional scales."

There are two important dimensions to skills and training in NRM. Firstly, skills and any requirement for training may be relevant to specific on-ground management actions and to broader issues in relation to planning, project management and administration. Secondly, it is important to distinguish skills and abilities which are required by individual landholders and property managers for the purpose of achieving property level NRM objectives and the skills and abilities required by regional groups and other community based environmental and conservation organisations to achieve NRM objectives.

Though not included in the National Capacity Building Framework, understanding how NRM presents business opportunities beyond primary industries and community-based activities and the skill and training to incorporate natural capital conservation into business strategies needs to be developed and promoted.

Facilitation and support

The fourth area of capacity building under the National Capacity Building Framework is that of facilitation and support. The framework broadly defines this area of capacity as including "support systems in place to ensure the engagement and motivation of the community, build social capital and enable skilled managers and users to exercise ownership over regional NRM decision making processes and effectively implement actions arising from these processes."

The FNQ NRM Board community engagement strategies must include comprehensive and demonstrable communication procedures supporting farmers, farming enterprises, other primary producers and all businesses as solutions to NRM challenges rather than problems.

Just as the majority of negative human environmental impacts can be linked to population and consumptive patterns (demand), the ultimate driver for improved production practices will only result from modified demand. Thus, the farmer and other primary producers have new opportunities to attract facilitation and support via satisfaction of new market demands.

The challenge for the NRM Board is to facilitate a community engagement strategy that includes a catalyst for changing demand patterns.

While certain industries such as tourism and tertiary education and research can conceivably improve these prospects, the relative socio-economic disadvantage in some outlying local government areas increases the challenge.

Box 59. Perception of Support for Farmers and Farming

One of the most common perceptions reported by many farmers and landholders during the Plan consultation process was the belief that Government, Government agencies and departments and many other external groups and organisations no longer placed a value on farming. The belief was that many of these external groups and organisations, far from supporting farmers were more intent on the removal of farming and farming enterprises. Clearly if these attitudes are reasonably prevalent in many rural communities within the region, it may be increasingly difficult to expect the willing uptake of management actions to achieve resource condition targets.

Institutional change

Institutional change, while not identified as a component within the National Capacity Building Framework, is nevertheless an important objective of the extension of the NHT Program. Although the concept of institutional change in NRM has been identified, there is little agreement on its meaning, its conceptual definition and measurement. Institutional change should not be confused with organisational change. Institutions are defined as "underlying, durable pattern of rules and behaviours" (Connor & Dovers 2002, quoted in Capacity Building Report) and consist of "formal constraints (e.g. rules, laws, constitutions), informal constraints (e.g. norms of behavior, conventions, self imposed codes of conduct), and their enforcement characteristics."(North 1994, quoted in Capacity Building Report). To draw an analogy with a football game, the rules of the game are the institutions and the players are the different organisations.

Using this definition of institutions in the context of capacity building and NRM, the issue becomes one of identifying and describing the type of changes that may be required in order to meet core sustainability objectives within an NRM context. To again use the analogy, a focus on institutional change requires an examination of the extent to which the rules of the 'NRM game' need to be changed in order that the different players are able achieve the goals of NRM.

In some instances the Regional Body can only identify issues of institutional change that need to be addressed by Commonwealth and State organisations or will involve changes in normative beliefs systems over the long term.

However, in many instances the NRM Board has the opportunity to play a key role in changing community norms and belief systems, via the aforementioned strategies and mechanisms.

9.1.3 Management Response

Until recently, support for community involvement in natural resource management operated at two levels; a broad support network managed through agency / local government support staff, and at the grassroots level. Agencies provided a statewide network of Landcare, ICM, Bushcare and Coastcare facilitators to assist community groups through a wide range of services. As recently as late 2000, when the first *Wet Tropics Strategy for NRM* was released, this network consisted of a DNR Regional Program Extension Officer based in South Johnstone and an EPA Bushcare Facilitator based in Atherton plus a number of extension staff (various programs) in Mareeba, Atherton, Cairns, South Johnstone and Ingham. In addition to this, the Wet Tropics Tree Planting Scheme provided a number of technical staff and a small workforce throughout the local governments of the Wet Tropics Region. The Trinity Inlet Management Program employed a Program Coordinator based in

Cairns and the North Queensland River Trust Association had an officer based in Townsville. Coastcare programs in the region have played a significant role in foreshore and marine protection and conservation since 1996. Additional community support was available from the EPA Bushcare Support Officer in Atherton, Greening Australia Bushcare Support Officers in Mareeba and Malanda, the Cairns and Far North Environment Centre (CAFNEC).

While some of these services still exist, the picture has changed radically in recent years as government departments have withdrawn support and funding to grassroots groups has been reduced. The majority of Landcare and ICM groups in the region still have coordinators funded under the NHT program. However, funding for these positions has been uncertain and several groups have had periods without coordinators. Most conservation groups have not had access to funded coordinators. In the past, each community group has acted relatively independently with respect to project development and implementation, support staff and group activities and there has been no coordinated approach to further developing 'on-ground' community involvement and engagement in NRM in the region.

Meanwhile, the resounding and frequent message that the Board receives from community groups is "don't pull our coordinator," or "we will quit these efforts (NRM) if we don't have the continuing support of a funded person." These same and similar messages were recorded in the Capacity Building Report (Fenton 2004).

Aboriginal Peoples' Involvement in NRM

It is well known that Traditional Owners' priorities for natural and cultural resource management have not been adequately recognised and supported in NRM planning and management arrangements. At the *Wet Tropics Regional Environment and Natural Resource Management Forum for Traditional Owners* that was held in Cairns in 2002 to discuss Aboriginal involvement in the new regional arrangements and the extension of NHT it was identified that in the first phase of NHT, Aboriginal people in Queensland received less than 1% of funding outside of the Cape York region, despite having substantial rights and interests in land management (see Hill & Nursey-Bray 2002). The Forum identified the key factors leading to the current problems as: inadequate consultation methods; poor Indigenous representation in planning; and seriously defective regional structures. The Forum strongly emphasized the need for greater input and participation by Aboriginal people in decision-making, and the need for the equitable allocation of funds to manage country (Hill & Nursey-Bray 2002; see also Rainforest Aboriginal News 2002).

During the one-day workshops that were undertaken with Traditional Owners (September 2003 – February 2004) a number of key issues that have lead to poor outcomes in the delivery of NHT1 were highlighted. These need to be addressed to ensure meaningful involvement and participation in natural and cultural resource management. They include:

- Poor representation and involvement in NRM networks both at regional and community level;
- A lack of awareness and recognition by NRM stakeholders regarding Aboriginal peoples values and priorities for natural and cultural resource management;
- The lack of infrastructure and resources to effectively participate in natural and cultural resource management;
- Low skills base for natural and cultural resource management;
- A lack of understanding of NRM issues and management arrangements,
- Low literacy and numeracy skills, and
- Poor comprehension of bureaucratic and legal processes.

It is important to recognise that because of the diversity of different Traditional Owner groups, there is also a great diversity of approaches and beliefs about natural and cultural resource management.

The workshops highlighted the fact that many Traditional Owners were marginalised from accessing funding in the first round of NHT because, without appropriate support through established community NRM networks and Aboriginal organizations they were not aware of funding opportunities. If they were aware of funding opportunities many groups were unable to develop submissions for funding and complete application forms for NHT funding. This highlights the need for long-term resources and staffing for Traditional Owner organizations (such as ARC and Girringun Aboriginal Corporation) to support Traditional Owners, and the need for greater interaction between Traditional Owner Groups and community NRM groups such as Landcare, catchment and Bushcare groups.

During the consultation phase many Traditional Owners said that their custodial obligations and connections to country and their knowledge and holistic approaches to land and sea management (where nature and culture can not be separated) are not adequately recognised and respected by NRM stakeholders. In most western scientific approaches to environmental management, the natural and cultural heritage values are viewed and managed separately. This narrow view of NRM has, and continues to devalue and marginalise Aboriginal priorities. For example, in the first round of NHT, many of the priorities for Traditional Owners were viewed as cultural heritage, and not seen to have NRM outcomes.

Box 60. Community Development Employment Program (CDEP)

Many Aboriginal people are employed through the Community Development Employment Program (CDEP) schemes. CDEP schemes are managed by Aboriginal organisations and they provide work that is important to the Aboriginal community. Most of this work is part-time because CDEP scheme funding for wages, provided through ATSIC, is linked to the unemployment benefits that would otherwise be payable to each schemes authorised quota of participants. This level of funding is only adequate to employ CDEP participants on a part time basis, usually 2 days per week.

CDEP can provide good opportunities for Aboriginal people to become involved with NRM activities. However, employment opportunities for Aboriginal people must move beyond CDEP to a focus on long term permanent jobs for Aboriginal people.

9.1.4 Community Targets

There are two core issues associated with the development of targets in the context of community and capacity building for natural and cultural resource management.

Firstly it must be recognised that the development of capacity and capacity building within the community is an enabling action, where the focus is on achieving the biophysical resource condition targets that have been identified elsewhere in this NRM Plan. For the purpose of the NRM Plan, enabling capacity building within community is not an end in itself, but an action that is directed at achieving the resource condition targets that have been identified. In this sense, the community is not the resource for which targets must be established, but it is the 'mechanism' through which the natural resource condition targets will be achieved.

However, taking a long-term perspective a community with the capacity to adapt continually to the needs of natural and cultural resource management in changing circumstances could indeed be considered an asset.

This Plan makes a commitment to building capacity in each asset area, and in recognising the diverse values that NRM stakeholders and Traditional Owners have for natural resources. Improving water quality depends heavily upon improving landholder understanding of the issues involved and the capacity to implement more sustainable land management practices.

Other capacity and capacity building requirements focus on procedural and process issues. This includes, for example: issues associated with community and stakeholder involvement in decision making; procedures for integrating and including local and traditional knowledge with 'scientific knowledge'; developing community ownership of NRM targets; and management actions and the development of trust amongst key stakeholders and industry interest groups involved in NRM. It is these procedural issues that need to be embedded and integrated with management actions associated with the achievement of each of the resource condition targets.

Secondly, for meaningful and quantifiable targets to be identified there is a requirement that reasonable baseline information exists against which to define the target and monitor progress towards achieving targets. For all capacity related issues in the Wet Tropics, no baseline information exists against which targets may be established and quantified. For this reason one of the core actions that must be undertaken is capacity building research where one objective would be the development of quantitative baseline information from which capacity-based targets may be derived.

Although the 'matters for capacity building targets' have been identified (Fenton 2004), the lack of quantifiable data at this stage precludes the identification of quantifiable targets. In order to address this issue it is proposed that quantifiable targets be established through a capacity building assessment and research program in the first year (2005) for all capacity building actions.

Capacity Building Assessment and Research

This program would coordinate and develop research directed at informing on-ground capacity building activities in the Wet Tropics Region and the development and monitoring of capacity building targets. Capacity building research activities would be developed within the program.

Capacity Building Actions

This program would develop 'on-ground' community involvement and capacity building activities to support the implementation of the NRM plan and the achievement of resource condition targets. A significant objective of the capacity building activities would be the development of strategies to raise awareness, provide opportunities for skills and training, improve knowledge, facilitate and support management actions directed at addressing specific resource condition targets.

Capacity building activities would be developed which would be:

- Undertaken as short term management actions which would be monitored during and at a 5 year time period (2010); and
- Have specific quantifiable targets associated with each action which would be based on the development of key capacity building and social indicators developed within the first year (2005) through the capacity building research program.

Conservation Volunteers Australia (CVA) crew on the banks of the Barron River with Project Officer Jane Greer and Cr Len Curtis (Photo: Helen Adams)

Mount Garnet Landcare Group (Photo: Mount Garnet Landcare Group)

Box 61. Liverpool Creek Revegetation Project: A Partnership Approach to Integrated Catchment Management

An Envirofund project entitled revegetation and stabilisation of an avulsion in Liverpool Creek is a fine example of a partnership approach to achieving natural resource management among a land-owner (banana and cane farmer), an integrated catchment management group, a shire river improvement trust, the Cairns Regional Community Development and Employment ATSI Corporation (CDEP) and the Australian Government. Bob Stewart, Johnstone River Catchment Project Officer explains.

Noel and Marlene Bromell are riparian farmers in the mid-catchment of Liverpool Creek. The Creek has avulsed or broken its bank and formed a new stream through their property for a number of years. This problem was identified in the Liverpool Creek Management Plan and The Johnstone Shire River Improvement Trust (JSRIT) and Johnstone River Catchment Management Association (JRCMA) successfully applied for funds through the Australian Government Envirofund. Liverpool Creek is a self-contained catchment within the Johnstone Basin. JSRIT together with the JRCMA developed the river management action plan Liverpool Creek in 2000/01. The plan recommended the use of cheaper green engineering techniques such as weed removal and revegetation wherever practical, which allow the landholder and other non-specialised groups to do much if not all of the rehabilitation work. In the plan many different reaches and sites within reaches are identified – 46 sites in total. Some of the sites need to be rehabilitated sequentially but others can be tackled as stand alone projects. The landholders did much of the earthworks and early weed removal and the revegetation aspects have been done by a team from Cairns CDEP. The Johnstone Shire Revegetation Unit supplied the planting material. Report writing and financial acquittals will be done by CDEP and JRCMA. The wetter than average wet season in 2004 caused some problems with erosion of banks that were recently revegetated. This has been repaired and provided the trees can establish well before the next major rainfall event, we would expect the avulsion to be stabilised and further erosion problems minimised.

9.2 Community targets and actions

The following Management Actions would be undertaken by 2010, with specific Targets established for each action developed through capacity building assessment and research undertaken by 2005

Management Action Target (MAT)	*Type of MAT[36]*	*Management Actions*	*Links Targets*	*Potential Partners*
Resource Condition Target (RCT) CB1. A community that is actively engaged and adequately equipped to manage natural resources in a sustainable manner by 2014.				
CB1.1 Develop and implement a program to coordinate and develop research directed at informing on-ground capacity building targets by 2005 (See CB1.2).	P	CB1.1.1 Develop quantitative indicators of capacity for use in target setting, plan monitoring and evaluation using the five capacity components of (i) engagement, (ii) motivation, (iii) awareness, (iv) skills and training and (v) facilitation and support. CB1.1.2 Undertake quantitative assessments and establish baseline indicators of each of the five capacity components within the Wet Tropics Region and sub regions. CB1.1.3 On an ongoing basis undertake, initiate and promote where required programs of social and cultural research in relation to NRM in the Wet Tropics. CB1.1.4 On an ongoing basis identify opportunities to more effective integrate social and indigenous cultural issues into project proposals and other NRM activities in the Wet Tropics.		Research Institutions, OESR, ABS, Community Groups, NR&M.
CB1.2 Between 2004 and 2010 progressively implement a program of capacity building activities, with specific targets established for each action developed through capacity building assessment and research (CB1.1) undertaken by 2005.	CB	CB1.2.1 Increase the level of meaningful community involvement in the implementation of the NRM plan and on-ground management actions. CB1.2.2 Ensure greater representation of the community in NRM activities through targeted community involvement programs directed at the general community, Traditional Owners, specific interest groups, government and industry. CB1.2.3 Develop strategies to ensure greater inclusion and integration of local and Traditional Owner knowledge in the implementation of management actions identified in the plan. CB1.2.4 Develop mechanisms and strategies to ensure greater collaborative involvement of Traditional Owners, local community and industry groups and external government agencies in the implementation of management actions and NRM activities. CB1.2.5 Increase the level of participation of young people in NRM plan activities and on-ground actions. CB1.2.6 Increase the uptake of environmental programs and NRM information within the education sector. CB1.2.7 Provide funding and resources to key Traditional Owner organisations and catchment groups, so they are able to provide project administration and management support to other smaller community groups. CB1.2.8 Develop support for the contribution of volunteer participation in local environment and conservation groups. CB1.2.9 Develop and fund a network of coordinators operating at the local catchment scale. CB1.2.10 Develop capacity building programs that specifically target new landholders and which improve awareness and knowledge of environmental issues and on farm practices amongst new landholders. CB1.2.11 Increase the number of appropriate extension, field and/or conservation officers within catchments to provide skills and training in relation to sustainable farm management practices.		Aus Govt, State Govt, WTMA, GBRMPA, Research Institutions, Community Groups, NRM Bodies.

[36] Types of Management Action Targets: CB- Capacity Building, OGW- On-Ground Works, P- Planning, RA- Resource Assessment & Monitoring.

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
		CB1.2.12 Develop a community awareness program that highlights the positive changes that have taken place within many rural communities to address environmental and conservation issues. CB1.2.13 Develop a community awareness and education program which identifies and increases awareness of critical environmental issues within each catchment, including the priority 'matters for targets' as identified in the Regional NRM Plan.		

PART D
implementation

10.0 Implementation

10.1 Setting priorities

Introduction

The fundamental purpose of this Plan is to guide the choice of actions that might be taken to protect or rehabilitate the natural and cultural assets of the Wet Tropics NRM Region in the short to medium term. The question is "What's the best value for money in sustaining our assets?"

While all issues addressed in the Plan are significant, the "best" investments will:

- Benefit high valued assets that are providing important ecological, economic, social and cultural services for the community:
- Address serious threats to those assets or services; and
- Do so in a cost-effective way.

Therefore to answer the question above, the priority of each action can be calculated using the following equation:

priority of action = value of asset x threat x cost effectiveness of action

To carry out this calculation for each action presented in the Regional NRM Plan however would be an immense task and meaningless if the relative value placed on each of the components of the equation for each action was not standardised. To reduce the complexity of this task and because of the limited data available, the following two steps were taken to answer this equation:

- **Prioritise NRM Issues**: assets*threats using a multi-criteria analysis approach with the FNQ NRM Board and technical advisors.
- **Prioritise actions**: cost effectiveness of action – the best means of dealing with issues. Management Action costs are estimated and related to the technical effectiveness provided in the information from the condition reports and other documents.

Details of the priority setting process undertaken by the Board can be found at Appendix I.

10.2 Integration

The Board priority setting process dealt with individual issues in what is a complex NRM system. For program coherence and implementation these issues have been integrated into priority packages. Many of the assets and threats interact; for example, the threat of further vegetation clearing affects all of the regional assets and, in turn, can only be managed in an integrated way. Similarly, there are Traditional Owner interests, rights and responsibilities across each of the program areas and this must be recognised through appropriate and meaningful involvement of the Aboriginal community in implementation of NRM activities. There are a small number of common integrating themes amongst the issues that take account of priorities and combine actions into a set of highest priority programs for the Regional Investment Strategy:

1. **Reversing the decline in native vegetation and threatened species;**
2. **Maintaining healthy waterways and wetlands;**
3. **Controlling weeds and animal pests;**
4. **Using soils and water sustainably and productively;**
5. **Linking natural resource management to land development and the urban environment;**
6. **Improving the functionality of coastal and marine ecosystems;**
7. **Meeting Aboriginal aspirations for natural and cultural resource management; and**
8. **Enhancing community awareness and engagement in NRM.**

An overview of the programs is outlined below.

10.3 Priority Programs

Reversing the decline in native vegetation and threatened species

One of the principal aims of the Regional NRM Plan is to protect, enhance and reinstate vegetation in areas of critical habitat for threatened species, key wildlife corridors and riparian zones. Protection of natural vegetation is the first priority as it can take many decades (and many more resources) to enhance and reinstate vegetation to favourable ecological condition. The Vegetation Program will also entail necessary resource information gathering projects and capacity building elements.

The Regional NRM Plan includes a package of actions within an integrated landscape scale consideration of the needs for ecosystem and species conservation. Key actions include:

- Creating corridors linking critical habitat in areas identified as of the highest conservation value;
- Using Traditional Owner knowledge and fire regimes to protect the habitat of threatened and other sclerophyll-dependent species;
- Working with local governments to assist with the completion of biodiversity audits and the development of shire biodiversity plans in order to identify priority areas within planning schemes for the management of biodiversity;
- Contributing towards the development of a spatial biodiversity database for the preliminary identification of priority areas consistent with the principles of systematic conservation planning;
- Promoting the adoption of recommended management practice for ecological restoration/re-vegetation, including appropriate monitoring;

- Producing a code of practice for native forest timber harvesting on freehold land;
- Providing support to landholders wishing to protect and enhance remnant vegetation through a 'Bush Tender' auction process in priority biodiversity areas; and
- Promoting adoption of binding conservation agreements for target areas and areas receiving funding assistance through FNQ NRM Ltd.

The Regional NRM Plan provides a framework for protecting and restoring remaining natural vegetation and ecosystem function by identifying regional management and rehabilitation priorities, as well as significant waterways and wetlands. These are shown on the composite maps included at Appendices L-N. As explained earlier, the maps are based on existing policy documents, the most important of which were the Regional Coastal and Vegetation Management Plans, the Wet Tropics Conservation Strategy and the FNQ Regional Plan.

Maintaining healthy waterways and wetlands

An increased understanding of the importance of waterways and wetlands has translated into high levels of activity in waterway and wetland management in the region. Statutory bodies, private landowners, community groups and governments have undertaken projects to rehabilitate riparian vegetation, prevent or control stream bank erosion, fence streams and lakes to exclude stock, construct artificial wetlands and restore hydrological function.

In recent years, river improvement trusts have assumed a lead role in the management of waterways and have taken a more holistic approach to river management. Through the development and implementation of "river management plans" they address a wider set of objectives and use a wider range of methods to achieve outcomes, including greater attention to protection and vegetative restoration.

Catchment management groups have prepared management plans for most catchments in the region and in addition most catchments also have "catchment rehabilitation plans" identifying and prioritising riparian areas requiring rehabilitation.

The Regional NRM Plan includes a package of actions for waterways and wetlands within an integrated landscape scale consideration of the needs for biodiversity conservation and water quality protection. Not surprisingly then, the Healthy Waterway and Wetland program is very closely linked to the Vegetation and Sustainable Use programs. There are two essential aims:

1) that there will be no further loss of wetlands in the region and that priority riparian zones and wetlands are rehabilitated wherever possible; and
2) that water discharging into the Great Barrier Reef will meet the reef water quality protection plan goal, namely: "to halt and reverse the decline in the quality of water entering the Reef, within ten years."

Key actions include:

- Working with local governments to assist with the completion of biodiversity audits and the development of shire biodiversity plans in order to identify priorities areas within IPA schemes for the management of biodiversity;
- Working with the EPA to complete its regional wetland inventory and to manage wetlands of regional and national significance;
- Assisting designated catchment groups and river improvement trusts to implement their catchment and river management plans;
- Promoting the adoption of recommended management practice for ecological restoration/revegetation, including appropriate monitoring;
- Developing creative market based incentives for the protection and management of riverine and wetland ecosystems;
- Promoting adoption of binding conservation agreements for target areas and areas receiving funding assistance through FNQ NRM Ltd;
- Identifying a set of management practices and agreed adoption rates with measured improvement to water quality outcomes;
- Focusing action at local catchment level and promoting catchment-based change through water quality improvement plans;
- Investing in research to improve our understanding of water quality and the effectiveness of actions taken to achieve it; and
- Strengthening and coordinating monitoring for measuring ambient water quality in selected stream reaches and for discharges from the region's rivers to the Reef lagoon.

Controlling weeds and animal pests

Pest management is an integral component of the overall management of natural resources and a successful pest management strategy requires a high degree of coordination and cooperation between all stakeholders. The first principle of the Regional NRM Plan is to stop the introduction of new ecologically invasive species into the region. Hence, this program promotes community awareness and encourages responsible behaviour concerning plants and animals that have the potential to become weeds and pests. It advocates the provision of material support to landholders engaged in eradicating or implementing long-term control over weeds and pests as well as ongoing monitoring of weed and pest infestations.

The control of weeds and animal pests is basically the responsibility of the landowner. This includes farmers and residents as well as State agencies and local governments. The *FNQROC Regional Pest Management Plan* is an important source document for the Regional NRM Plan, which includes the following actions to control weeds and animal pests:

- Increasing the capacity of councils to coordinate their pest management efforts across the region;
- Increasing public awareness of weeds and animal pests through a regional 'Weedwatch' program;

- Providing cost efficiency of control prior to weeds becoming major infestations by supporting councils and landholders to eradicate FNQROC regional pest management plan category 1 weeds (i.e. those that have limited or incipient populations in the Wet Tropics) from their properties, especially in areas of biodiversity significance;
- Providing support to councils to strategically manage and raise awareness of weeds of national significance (WONS), e.g. hymenachne, pond apple and lantana;
- Preventing the spread of existing weeds and animal pests (e.g. tilapia) into neighboring regions; and
- Mitigating the impacts of feral pigs, especially in areas of biodiversity significance and adjacent to good quality agricultural land.

Using soils and water sustainably and productively

The approach of the Regional NRM Plan to the sustainable use of our land and water resources is to assess the current status of degradation in the environment, identify priority land management issues needing attention according to soil/land type and industry, and to develop and implement non-statutory solutions. The emphasis is on assisting landowners and managers from all the sectors: natural landscapes; agriculture; grazing and urban areas; to improve their land management practices. This approach is set within an adaptive management framework to achieve ongoing continual improvement of management practices.

Key activities are:
- Benchmarking current management practices;
- Identification of management practice across all sectors, including critical factors for each industry;
- Negotiating the level of adoption to be reached (where this is not already agreed);
- Providing technical advice and extension of best management practice/ farming systems management/ property management planning;
- Providing incentives for increasing adoption rates where public benefits accrue from management practices;
- Monitoring of effectiveness of management practices and continual improvement;
- Monitoring of management practice adoption rates;

Linking natural resource management to land development and the urban environment

The initial component of this program is to enhance the links between local governments into the NRM planning process and where necessary sponsor capacity building activities. This includes activities dealing with integration of the Plan with land use and corporate planning within local governments. This will link with the FNQ Regional Planning process ensuring sustainable management of the region's environment and natural resources, through focusing development of the region in line with the preferred settlement pattern outlined in the Regional Structure Plans within the FNQ Regional Plan. It means planning to ensure identification, protection and restoration of important natural values and processes in settled regions. Local governments will also be involved as partners in local environmental projects.

The second component of this program addresses climate change adaptation in the region. As reported earlier, the region's climate generates the necessary inputs for all other resources. The greatest threat to the climate of the region is that of enhanced climate change resulting from an increase in greenhouse gases in the atmosphere. Reducing the future impacts of climate change relies primarily on the reduction of greenhouse gas emissions, increases in carbon sinks and the development of clear adaptation strategies for each region. Changes will in many cases be complex and difficult to quantify. However, many of the steps can be initiated at a 'no regrets' level until more specific data is available.

Key actions are:
- Introducing a scheme to support local government sustainability initiatives;
- Assisting local government in their NRM planning activities; and
- Defining the roles and responsibilities of those agencies/organisations involved in climate change issues and engaging the private sector to stimulate green development.

Improving the functionality of coastal and marine ecosystems

The Regional NRM Plan includes a package of actions that, if implemented, will improve functionality of the coastal and marine environment. The overriding objective of the coastal program, however, is to engage the community in the conservation of marine resources and coastal lands.

To achieve this, the initial focus will be on the re-engagement of Coastcare groups in the regional NRM process, building on the previous 'coast and clean seas' and 'Coastcare' programs (delivered through NHT) that implemented a suite of capacity building activities and on-ground projects that were delivered by the community and industry. These previous programs built the capacity of coastal communities throughout the Wet Tropics to better understand and manage coastal assets.

While State and local governments are committed to the implementation of the Regional NRM Plan, they have limited resources for the direct engagement of community groups. Given the large number of statutory processes that govern activities in the coastal zone, community based activities must be carefully targeted to meet the objectives of the various statutory management plans.

Key activities are:
- Coastal vegetation protection and enhancement through the development of sub-regional revegetation plans to guide the activities of Coastcare groups;

- Protection of traditional owner sea country values and involvement of Traditional Owner groups in fisheries management;
- Progressive improvement in the connectivity of river systems and condition of wetlands and intertidal zones by supporting on-ground works in line with State Government priorities;
- Improving understanding and implementing management controls to improve the viability of sea birds, turtle and dugong populations; and
- Reducing impacts of ports and shipping through community awareness and education.

Meeting Aboriginal aspirations for natural and cultural resource management

One of the major priorities of this program is to increase the involvement of Traditional Owners in all aspects of NRM and to protect cultural values and assets of the region. This program has two major components that aim to build the capacity of Traditional Owners to engage in and undertake NRM whilst providing for significant on ground NRM outcomes.

Core components of the program are:
- Development of 8–10 country-based management plans for Traditional Owners; and
- On-ground approaches to managing country (grant scheme).

As mentioned earlier, there are Traditional Owner interests, rights and responsibilities across each of the program areas and this must be recognised through appropriate and meaningful involvement of the Aboriginal community in implementation of NRM activities.

Enhancing community awareness and engagement in NRM

The overall goal of the Regional NRM Plan in relation to community in the Wet Tropics is: "*A community that is knowledgeable and informed of natural and cultural resource management and conservation issues and which actively participates in the sustainable management and conservation of natural and cultural resources in the region.*"

Community is defined in the Regional NRM Plan as 'everyone who lives and works in the Wet Tropics region, those who visit it and those who have some other (external) connection to it'. The Plan identified seven key capacity and capacity building requirements for an actively engaged and aware community in the Wet Tropics, namely:
- Community engagement in NRM;
- Motivation to participate in NRM;
- Awareness of NRM issues;
- Skills and training;
- Knowledge of NRM;
- Facilitation and support; and
- Institutional change.

Recognising capacity building actions are embedded throughout all other program areas, the following actions are designed to complement and facilitate those targets and actions as well as address additional specific capacity building requirements.

- Develop strategies and mechanisms to ensure greater representation, participation and collaboration by all sectors of the community in decision making processes – e.g.: establishment and ongoing support for five advisory committees to support the Board; continued support for the FNQ NRM Ltd Membership Body; and develop tailored programs to involve specific interest or sectoral groups.
- Develop strategies and mechanisms to ensure greater participation and collaboration by all sectors of the community in implementing the NRM Plan and on ground management actions – e.g. support via a network of coordinators operating on both a local catchment scale and regional scale; continued access to support via the coordinator network to develop projects from additional funding sources including Envirofund opportunities to access skills and training; and support for volunteer contributions in local groups.
- Enhance opportunities for increased partnerships with Traditional Owners including integration of Aboriginal cultural and natural resource management.
- Tailored awareness raising and education programs e.g. targeting young people as future land managers via the education system and supporting existing education and extension programs; access to information, training and technical advice for new landholders and land managers; and collaboration with environmental and conservation groups to target urban communities and linkages with the land development process.
- Support for key Traditional Owner and catchment groups so they are better able to support smaller community groups.
- Data acquisition and management services to ensure access to relevant information to assist decision-making, directing investments and informing monitoring and evaluation.
- Research programs to direct and inform on-ground capacity building activities and approaches to improving institutional arrangements, the development of quantifiable targets for capacity building, and cultural, social and economic assessments to inform future investments.

10.4 Monitoring and evaluation strategy for adaptive management and reporting

Purpose of the monitoring and evaluation strategy

To provide a sound basis for investment, this Plan includes a strategy for ongoing monitoring and review to reflect new information and experiences, and to

ensure continuous development and improvement of the Plan over time. This monitoring and evaluation strategy identifies monitoring, evaluation and reporting arrangements linked to the achievement of regional targets. The strategy is consistent with the *National NRM Monitoring and Evaluation Framework* and the *National Framework for Natural Resource Management Standards and Targets*.

Monitoring, evaluation and reporting framework

The monitoring, evaluation and reporting framework is driven by the agreed objectives and priorities of the Plan, the needs of an adaptive management approach and accountability requirements. As presented in Table 18, there are four core components to the monitoring, evaluation and reporting framework:

- *Plan Monitoring* – assessment of progress of project investments and other actions (e.g. capacity building and institutional change, statutory resource allocation and management, management practices (BMPs), and on-ground works) towards significant milestones and management action targets.
- *Outcomes Monitoring* – overall assessment of progress towards effecting change that will lead to achievement of the region's resource condition targets.
- *Adaptive Management Evaluation* – comprehensive evaluation and review of progress and effectiveness of the Plan towards improving management processes and decision-making that provides feedback for modifying and improving Plan targets, actions and future investments.
- *Accountability Evaluation* – assessment of the overall achievements of the Plan towards set goals (in terms of achieving progress towards improving natural resource condition and improving regional capacity in the longer term) for the investment received.

Each of these core components has a different focus, time frame and reporting requirements. However they are linked through sharing the same data collated in the Plan and outcomes monitoring processes and by complementing one another in covering the full range of issues affecting Plan performance and outcomes. The components provide the basis for structuring a range of activities and identifying responsibilities for the strategy to operate.

Essential to the effectiveness of the monitoring and evaluation strategy is:

- Establishment of a Monitoring and Evaluation Steering Committee, which will involve a small group of people appointed by the regional NRM Board;
- Allocation of resources and identification of roles and responsibilities for monitoring, evaluation and reporting; and
- Establishment of a data linkage between outcomes and outputs for investment accountability, and the adaptive management evaluation processes.

The Regional NRM Plan's monitoring, evaluation and reporting framework outlines:

- how the Regional Body will assess progress toward agreed objectives, priorities and targets of the Plan;
- how it will evaluate and review the Plan and its implementation for adaptive management purposes; and
- how it will comply with investment accountability requirements.

Based on an adaptive management approach, monitoring, evaluation and reporting activities will provide a feedback loop for all partners to learn from experience (i.e. successes and failures in management and investment decisions) as well as improvements in knowledge or the availability of new methods or models. In turn, on the basis of this improved understanding and capacity, necessary adjustments will be made to priorities, targets and actions in the Plan and Regional Investment Strategy at progressive points along the way to support the achievement of long-term resource condition outcomes. This adaptive management cycle of planning, implementation, monitoring, evaluation, review and improvement is presented in Figure 13. It will be achieved through:

- Establishing, implementing and maintaining systems for monitoring, evaluating and reporting the region's assets against agreed targets and outcomes (see Table 20);
- Ensuring these systems build on previous work and existing monitoring systems undertaken by local, State and Federal Governments and other regional groups (see Table 19). This will include specific attention to the monitoring and evaluation of Aboriginal targets (see Box 61);
- Establishing agreed roles and responsibilities with all partners for achieving, monitoring, evaluating and reporting targets. This will include the role of the Aboriginal Rainforest Council (see Box 62);
- Development of tools by which the strategy would operate (Table 20);
- Benchmarking the condition of those assets/natural resources and periodically monitoring their condition;
- Integrating the monitoring systems outputs to evaluate the health of the assets and the overall health of the region;
- Establishing reporting arrangements for monitoring progress toward achieving targets including changes in management practices and land uses;
- Periodically reviewing and evaluating the Plan and its implementation in terms of its effectiveness and efficiency in achieving outcomes;
- Working to engage and openly communicate with all partners on monitoring and evaluation; and
- Making periodic adjustments to the Plan and its implementation, including the goals, targets and focus of investments.

Table 18. A Monitoring, evaluation and reporting framework for the Regional NRM Plan

Monitoring and evaluation component	*Performance or implementation result*	*Focus*	*Performance reporting requirements*	*Primary responsibility*	*Reporting target (examples)*
Plan Monitoring	Project investments	Progress in activities/projects against significant milestones.	6 monthly	Regional Body	JSC Regional Body
	Outputs	Resource assessment Planning Capacity building On ground works	Annually	Regional Body	JSC Regional Body
	Intermediate Outcomes	Management action targets: – Resource assessment & monitoring; – Statutory resource allocation and management; – Management practices; – Capacity building and institutional change; and – On ground works.	Annually	Regional Body	JSC Regional Body Regional community
Outcomes monitoring	Outcomes	Resource condition targets	Annually	State and Federal Governments and Regional Body	JSC Regional Body Regional community
Adaptive management evaluation	Process	Progress review of the Plan and investment strategy	Annually Trigger points set in plan, investment strategy.	Regional Body	Regional Body Regional community JSC
	Effectiveness	Evaluation of implementation of Plan and investment strategy in improving management processes and decision-making.	Every 2 years (starting 2 years from accreditation) Trigger points set in plan, investment strategy.	Regional Body	Regional Body Regional community JSC
Accountability evaluation	Return on investment	Evaluation of return on investment in terms of achieving progress towards improving natural resource condition:	Every 5–7 years	Regional Body & all stakeholders	Regional community State and Commonwealth agencies

Box 62. Monitoring and evaluation of Aboriginal targets

Current State and Commonwealth guidelines require Regional NRM Bodies to incorporate Indigenous values in their plans and to consult effectively with Indigenous peoples. However, there is no National, State or regional monitoring and evaluation framework that adequately outlines approaches that NRM bodies should undertake to ensure that Indigenous priorities and values are effectively monitored as part of these schemes.

There has been minimal emphasis on research and investigation into monitoring Aboriginal values, and in the development of cultural indicators to do this. Within the Wet Tropics Region the most substantial work to date has been a project funded through the Rainforest CRC on Aboriginal cultural indicators in the WTWHA. This project highlighted that appropriate cultural indicators differ between each Traditional Owner group and that further work is required to develop cultural indicators with each of the Traditional Owner groups in the region.

Key issues that need to be monitored for Traditional Owners as identified in this Plan and the Wet Tropics Aboriginal Cultural and Natural Resource Management Plan include (amongst others): measuring involvement; appropriate recognition and consultation in NRM; access and use of country; and the maintenance of cultural knowledge and practices.

It is important that the monitoring and evaluation strategy outlines the role of an endorsed Indigenous body in reviewing both the outcomes of this Plan and the operations of FNQ NRM Ltd.

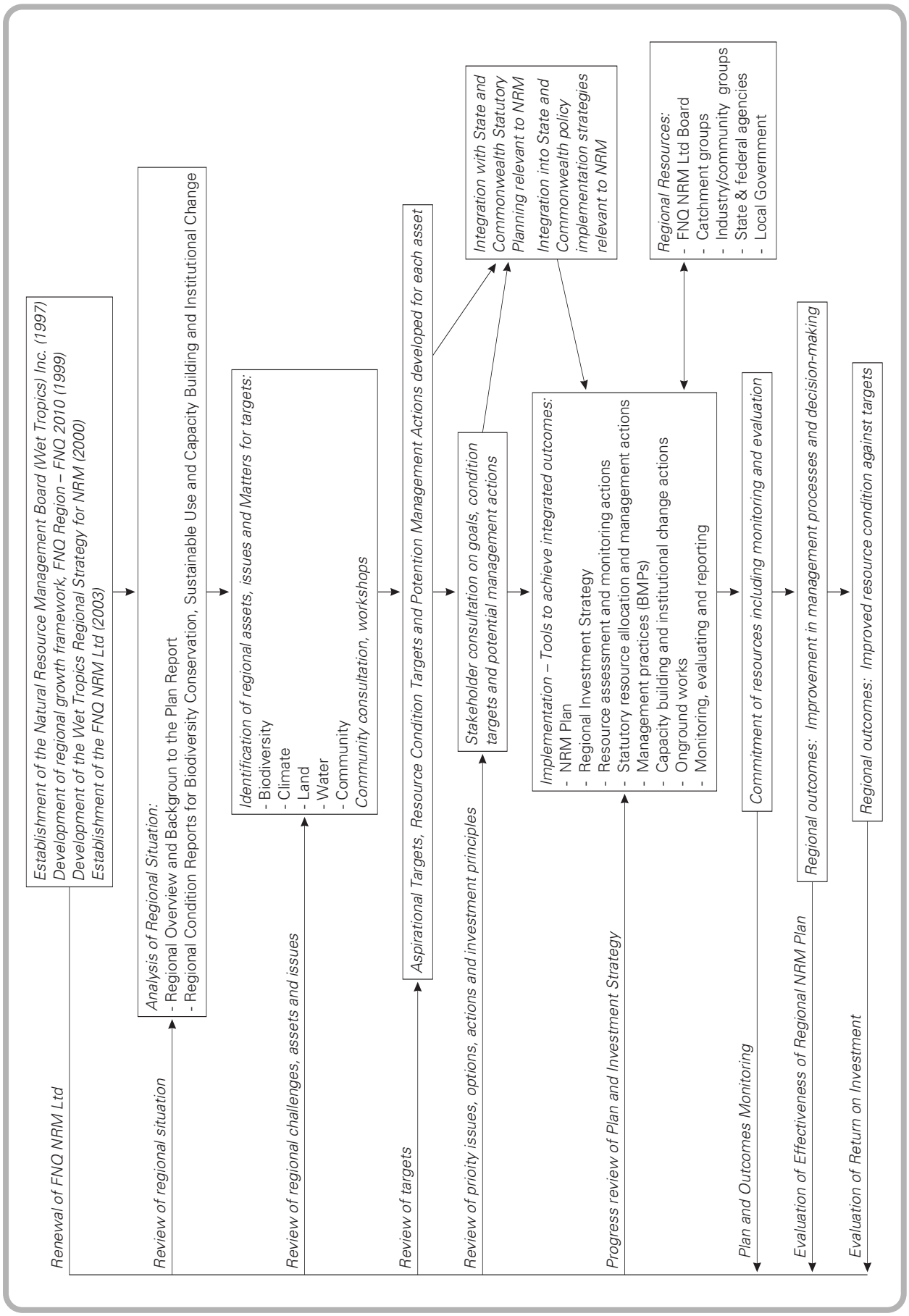


Figure 13 Wet Tropics NRM Plan monitoring and evaluation strategy for adaptive management

Table 19. Resource condition monitoring requirements and activities for assets

Asset	*Sub-assets*	*Monitoring requirements (examples)*	*State & Commonwealth activities*	*Regional activities*	*Gaps/issues*
Biodiversity	Terrestrial Ecosystems (Vegetation Communities)	Extent of vegetation communities	Queensland EPA Remnant Vegetation Mapping NR&M Statewide Landcover and Trees Study NR&M PestInfo and Annual Pest Assessments		
	Inland aquatic ecosystems (rivers & wetlands)	Extent of wetlands	NLWRA Australian Terrestrial Biodiversity Assessment 2002 NLWRA river condition assessment NR&M river assessments DPI&F stream ecology and water quality assessments nationally important wetlands		
	Coastal, estuary and marine ecosystems	Extent of seagrass meadows Extent of fish habitat areas	NLWRA estuary condition assessment Queensland DPI&F fish habitat areas DPI&F coastal wetland mapping	'Seagrass watch'	Current seagrass distributions are unknown
	Significant species and ecological communities	Extent of critical habitat Populations	Queensland EPA regional ecosystem conservation status CSIRO rare and threatened plants database EPA WILDNET EPA HERBRECS		
Climate		Air quality data Greenhouse gas emissions	BoM data EPA air quality monitoring and modelling NGGI Qld Treasury and AGO GG emissions data NR&M Statewide Landcover and trees study		
Land Resources	Cultivated and other improved land	Extent of GQAL BMP adoption rates	NLWRA Australian soil resource information system NR&M land resource survey assessments		
	Dry land pastures	% ground cover/bare ground on properties BMP adoption rates	NR&M Queensland land use mapping program NR&M 'Aussie Grass'	GLM+	Lack of detailed and comprehensive data on pasture condition
	Production Forests	Area of forested land	NR&M foliage projective cover NR&M Queensland land use mapping NR&M Statewide landcover and trees study		
	Mineral and extractive resources	Area of extractive resources	NR&M mining and extractive resources data		
	Urban land	Amount of solid waste	EPA reporting on state of waste and recycling		
Water Resources	Water quantity	Flow rate	NR&M groundwater/surface water data NR&M groundwater resource information (GWDB)		
	Water quality	Total N Nitrate Dissolved N Dissolved O	NLWRA soil erosion and sediment transport NR&M gauging station data EPA WQ monitoring data CSIRO/JCU sediment and nutrient exports to GBRWHA	'Catchment to Reef' WQIPs Local industry and	Inconsistent network of gauging stations for monitoring

Asset	*Sub-assets*	*Monitoring requirements (examples)*	*State & Commonwealth activities*	*Regional activities*	*Gaps/issues*
Water Resources		Total P Turbidity/ sediment Transparency Salinity		community monitoring (e.g. 'Waterwatch')	Poor coordination of monitoring by different bodies
Caring for country	Access and Use of Country				
	Places of Significance and Cultural Landscapes				
	Aboriginal Knowledge of Country Resource Use				
	Resource Use and cultural maintenance				
Community		Engagement Motivation Awareness Skills and training Facilitation and support			

Table 20. Monitoring and evaluation mechanisms and tools

M&E Tools	*Purpose*
Monitoring and evaluation steering committee	On behalf of the NRM Board, oversee the implementation of the Monitoring and Evaluation strategy. Establishing agreed roles and responsibilities and allocation of resources for monitoring and evaluation. Report to the Board on progress and emerging issues.
Monitoring and evaluation team	Assist with project commencement/selection. Selection of appropriate monitoring tools. Collation of baseline data in collaboration with project proponent. Auditing of projects. Monitoring project progress. Collation of final monitoring data in collaboration with project proponent. Advise on community/onground issues.
Project pro-forma	The pro-forma will link the project data to the target for accountability and regional evaluation. It will document all stages of the project and identify milestones and reporting responsibilities.
Toolkit of monitoring techniques:	Provide a range of monitoring techniques so that technique selection can fit project and group needs whilst providing accurate data for target and performance achievement.
Monitoring and evaluation database	Collation of all project data (initial, progress and final) through online reporting/access to M&E team or other proponents undertaking projects – possibly CAMS/NRM tracker. Provide data summaries for reporting to Agencies. Collation of project outcomes to demonstrate progress toward targets. Collate relevant information for use by community groups, regional bodies, state and federal governments as required.
Geographic Information System	For accurate location of projects within the region and for incorporation of project outcomes into other GIS layers i.e. vegetation, cadastral.

10.5 Monitoring and Evaluation Targets and Actions

Management Action Target (MAT)	*Type of MAT*	*Management Actions*	*Links Targets*	*Potential Partners*
Resource condition target (RCT) ME1. The Regional NRM Plan and its implementation comply with investor monitoring, evaluation and reporting requirements by 2006.				
ME1.1 Develop a strategy for continuous monitoring and periodic evaluation and reporting against resource condition and management action targets that complies with regional, State and Federal needs by 2005.	P	ME1.1.1 Establish a steering committee to oversee the development and implementation of the monitoring and evaluation strategy. ME1.1.2 Establish a framework for monitoring, evaluating and reporting the region's assets against agreed targets and outcomes. ME1.1.3 Develop appropriate performance criteria based on management actions. ME1.1.4 Identify and document agreed roles and responsibilities with all partners (including Federal, State and local government, industry groups, Indigenous people and other community groups) for achieving monitoring, evaluating and reporting targets and actions. ME1.1.5 Identify and commit resources for monitoring, evaluation and reporting. ME1.1.6 Identify and document previous work and current monitoring processes for assets undertaken in, or of relevance to, the region (e.g. by industry, Government or community). ME1.1.7 Assess issues and gaps in monitoring arrangements. ME1.1.8 Establish and maintain data sharing and assessment agreements with various agencies undertaking monitoring activities to address monitoring gaps and issues. ME1.1.9 Establish a data collection, management and retrieval system for the region with partners. ME1.1.10 Identify and coordinate plan investments based on regional priorities and action plans. ME1.1.11 Develop project pro-forma for each investment project that identifies links between on ground outcomes and resource condition targets.	CB1, ME2.	Aus Govt, State Govt, WTMA, GBRMPA, Research Institutions, Community Groups, NRM Bodies.
RCT ME2. The Regional NRM Plan is adapted in light of new knowledge and experience by 2010				
ME2.1 Adapt the Regional NRM Plan based on monitoring and evaluation outcomes to comply with investor reporting requirements and to support an adaptive management approach to NRM planning by 2006.	P	ME2.1.1 Report on Plan and outcomes monitoring as identified in M&E framework. ME2.1.2 Review annually progress against the Plan's goals, targets and actions and implement agreed adjustments on the basis of monitoring and evaluation findings, new research, or improved models or tools. ME2.1.3 Evaluate bi-annually (starting 2 years from accreditation) the effectiveness of the Plan and its implementation in improving management processes and decision-making at the regional level. ME2.1.4 Evaluate the effectiveness and efficiency of the NHT2 investment in regional NRM planning towards improving the region's natural resource assets and the enhancement of community capacity and complete a report to investors. ME2.1.5 Openly communicate and share knowledge with all partners relating to all monitoring, evaluation and related reporting outcomes.	CB1, ME1.	Aus Govt, State Govt, WTMA, GBRMPA, Research Institutions, Community Groups.

10.6 Roles and responsibilities of key NRM participants in delivering this plan

For regional NRM planning and management to work, it requires cooperation and commitment from landowners/managers, local and Traditional Owner groups, Government, research institutions and industry.

The roles and responsibilities of these key participants in NRM are briefly described below.

FNQ NRM Ltd

As the accredited Regional NRM Body for the Wet Tropics Region, FNQ NRM Ltd plays an important role in the regional model developed in Queensland and other jurisdictions for the delivery of programs such as NHT. Its role may include (after Productivity Commission 2003, p.232):

- Compiling information and undertaking ongoing monitoring of resource condition;
- Improving communication and information dissemination between land users and government; and
- Using local knowledge and information, together with other bodies such as industry associations, to set priorities and implement actions at the local level.

FNQ NRM Ltd is responsible for managing the implementation of the Regional NRM Plan, the funds it attracts and brokering other partners to take the necessary actions to achieve the Plan's goals and targets.

Community NRM and environmental groups

The Wet Tropics region is fortunate to have a strong community-based environment sector. These include:

- All major rivers in the region have community-based ICM groups that have undertaken assessment, strategy development and on ground works;
- Landcare groups and conservation organisations that work with local landowners to improve local management practices and assist with resource restoration projects and capacity building; and
- River improvement trusts (RITs) – statutory partnerships between local government and local resource management group that have prepared river and river reach management plans.
- Water authorities (water, drainage boards) whose main function is to supply water for stock watering and domestic purposes and to remove and dispose of excess water from agricultural lands.

There is an urgent need to revitalise these community-based NRM and environmental groups that have been so active in the Wet Tropics region in recent times. This includes the Landcare, Bushcare, Coastcare and Rivercare groups in their various forms and other groups who have done so much in the past but whose actions are stalled by the current round of revised policy implementation (NHT). These groups have a major role in the implementation of the Plan: designing and implementing community-based projects to implement the region's priorities identified here.

State Government agencies

Natural Resources and Mines

The Queensland Department of Natural Resources, Mines and Energy (NR&M) works closely with other government agencies, industry and the general community to develop and implement programs to achieve common goals for the management and maintenance of Queensland's natural resources.

NR&M's vision is *enhanced community benefit through sustainable natural resource management*.

The Department provides statewide policies on NRM, oversees the regional NRM program and has a core role in supporting the Regional NRM Body and the implementation of this Plan.

In addition, they manage resource allocation under legislation important for addressing key resource assets including:

- Land, including leasehold land;
- Regional vegetation management plans (RVMPs); and
- Water resource plans (WRPs).

Department of Primary Industries & Fisheries

The Department of Primary Industries and Fisheries (DPI&F) has a vision of *profitable primary industries for Queensland*, and supports strategic industry development at all stages of the industry lifecycle and throughout the entire value chain from production to consumption.

The department's mission is *to maximise the economic potential for Queensland primary industries on a sustainable basis*.

It delivers this through four major outputs: industry development, biosecurity, forestry and fisheries.

In achieving this, DPI&F strives to ensure Queensland's primary industries support sustainable production systems and use best practice in water management and water allocation, vegetation and pest management, and chemical use.

Environmental Protection Agency

The Environmental Protection Agency (EPA), which includes the Queensland Parks and Wildlife Service (QPWS), strives to protect Queensland's natural and cultural heritage, promote sustainable use of its natural capital and ensure a clean environment.

Key functions of the organisation are environmental planning, environmental policy, management of parks, forestry and wildlife, environmental operations,

sustainable industries, environmental and technical services, corporate affairs, and corporate development. It is the lead agency for:

- Licensing environmentally threatening industrial and waste management activities;
- Regional coastal management plans for the Wet Tropics and Cardwell Hinchinbrook regions; and
- Water quality improvement plans.

Department of Local Government, Planning, Sport and Recreation

DLGPS&R oversees the responsibilities of local governments for the built environment through three functional service areas: building codes Queensland, local government services and planning services. DLGPS&R is the lead agency for the Integrated Planning Act, which ensures local government planning schemes meet statutory requirements and incorporates state and regional interests. DLGPS&R also manages the FNQ Regional Planning project including coordination of implementation activities to progress the outcomes of the FNQ Regional Plan. Links will be maintained and strengthened between the NRM and FNQ regional planning processes.

Consistency across agencies

Individually the agencies have a major role in supporting the Regional NRM Body and the implementation of this Plan. All agencies will be supporting the technical work, assisting implementation of community-operated projects and making best use of their statutory instruments to allocate land and water to meet regional priorities. It is important that agencies cooperate to achieve whole of government outcomes for the region, given their past tendencies for fragmented and occasionally opposing policies and practices. To achieve maximum effectiveness of Plan implementation, it is important that government agencies have common policy and consistent practice.

For the core agencies (NR&M, EPA, DPI&F) in the first instance, FNQ NRM Ltd needs to work cooperatively with them to agree on the agency actions in the plan by:

- Tabling programs and budgets that relate to NRM in a single document and common format;
- Extending the current dialogue with agencies to identify gaps, overlaps and conflicts between policy and practice;
- Reviewing and reporting on agreed allocated tasks in the plan and the ongoing financial commitment they imply; and
- Within two years, concluding a program that integrates across agencies, NGOs and FNQ NRM Ltd.

Local governments

It is intended that NRM outcomes will be implemented in cooperation with local governments by incorporating objectives through their planning and works programs and assisting with obtaining NRM targets relating to a range of environmental and natural resource matters. This is likely to be done progressively over time as local government activities are reviewed and assistance is provided through NRM programs and initiatives to:

- Incorporate NRM objectives into local government planning schemes, policies, works programs and other planning and management mechanisms where appropriate;
- Assist local governments manage local infrastructure services including water supply, waste treatment, roads and recreation areas in accordance with the Plan;
- Support local conservation initiatives;
- Local government planning schemes need to be consistent with state policies including;
- State Planning Policy 1/92: Development and Conservation of Agricultural Land;
- State Planning Policy 2/02: Planning and Managing Development Involving Acid Sulphate Soils;
- State Planning Policy 1/03: Mitigating the Adverse Impact of Flood, Bushfire and Landslide;
- FNQ Regional Plan;
- State Coastal Management Plan – and the Wet Tropical Coast and Cardwell-Hinchinbrook Regional Coastal Management Plans; and
- Wet Tropics and Einasleigh Uplands Regional Vegetation Management Plans.

Where acid sulphate soils (ASS) may exist, for example, local planning and development assessment of land needs to reflect State Planning Policy 2/02 through mapping and assigning risk levels for development types on land identified in the mapping, and requiring soil tests to be undertaken, or refusing development on that land if it is likely to expose ASS. A similar process applies to State Planning Policy 1/92, where land suitability is mapped, and non-agricultural uses steered away from the agricultural lands wherever possible.

Industry Groups

Rural industries in the Wet Tropics Region have become more directly involved in NRM planning through this Regional NRM Plan (although their experience with the regional vegetation management and Reef Plan has made them wary). They have actively assisted this Plan through the process of defining the suite of BMPs and management actions that underpin its anticipated improvements to sustainable natural resource use and environmental outcomes (including the region's commitment to the RWQPP). Industry groups have a significant role in implementing essential programs, especially the increased adoption of BMPs. There will also be a need to revise those BMPs produced by/for the aquaculture, dairying, forestry, dryland grazing, horticulture and sugar industries.

Landholders

Individual landowners, who in the final analysis, must make changes to their farming and grazing systems for improvement in environmental outcomes to occur, are critical to the success of the Plan and many actions focus on assisting them make those changes. The funding provided through the Plan for technical support and for joint funding of on-ground works (such as riparian fencing or sediment traps that have significant public benefit), provides assistance for them to implement changes. The success of the Plan depends substantially on landowners' continuing willingness to adopt improved practices to assist in meeting the goals and resource condition targets of the Plan.

The Plan flags the intention of using incentive-based programs, directly funding landowners, perhaps on a competitive tender basis to implement works of high public benefit.

Traditional Owners

Traditional Owners of the region have strong interests in NRM, are interested in developing equitable partnerships with NRM stakeholders. They have been actively involved in the development of this Plan and the Wet Tropics Aboriginal Plan. Their substantial input into these Plans has been recognised at a both a state and national level. They should play a key role in the implementation of this Plan on various levels. Through the consultation phase Traditional Owners developed guiding protocols that need to be supported by all NRM stakeholders in the implementation of the Plan. These protocols are outlined at the beginning of this Plan.

There have been other significant processes that have been undertaken at the same time as this Plan, and the Aboriginal Plan such as the development of the Wet Tropics Regional Agreement between Rainforest Aboriginal people, NR&M, WTMA, EPA and the Department of the Environment and Heritage; as well as the formation of the ARC. The protocols developed as part of the Regional Agreement should ensure that Traditional Owners are meaningfully involved in NRM with these agencies. These protocols need to be supported and adopted by other key NRM participants such as FNQ NRM Ltd.

The Regional Agreement and the protocols developed strengthen the Aboriginal targets in this Plan and the ARC will assist all NRM participants in working with Traditional Owners. The impacts of NRM on native title and the role that the NTRBs have in native title issues needs to be recognised by NRM stakeholders.

Support and recognition of Traditional Owner organisations such as the ARC at a regional level, Girringun Aboriginal Corporation at a sub-regional level and Traditional Owners at a local level are crucial in the effective implementation of this Plan and the Aboriginal Plan and ensure that the quadruple bottom line is achieved in NRM activities.

Australian Government Agencies

Department of the Environment and Heritage

The Environment and Heritage portfolio's role is to achieve three major outcomes for the Australian Government:

1. The environment, especially those aspects that are matters of national environmental significance, is protected and conserved;
2. Australia benefits from meteorological and related sciences and services; and
3. Australia's interests in Antarctica are advanced.

The Department of the Environment and Heritage advises the Australian Government on policies and programs for the protection and conservation of the environment, including both natural and cultural heritage places. It administers environmental laws, including the EPBC Act and a range of other Acts and is responsible for Australia's participation in a number of international environmental agreements.

The Department manages a number of major programs. The most significant of those dealing with NRM come under the umbrella of the Natural Heritage Trust and the National Action Plan for Salininty and Water Quality. Both the Trust and National Action Plan are administered jointly with the Department of Agriculture, Fisheries and Forestry.

The Department of the Environment and Heritage works with Australian business organisations and industrial sectors, the community and other levels of government to protect Australia's atmosphere and to improve the environmental performance of Australian industry.

Department of Agriculture, Fisheries and Forestry

The Australian Government Department of Agriculture, Fisheries and Forestry has the dual roles of providing customer services to the agricultural, food, fisheries and forest industries, and addressing the challenges of natural resource management. It also helps build and promote the whole food and fibre chain from paddock to plate for domestic and international markets.

The Department's contribution to its customers is to help their industries become more competitive, profitable and sustainable.

Statutory Authorities

Wet Tropics Management Authority

The Wet Tropics Management Authority is a relatively small, policy-focused organisation responsible for managing the Wet Tropics according to Australia's obligations under the World Heritage Convention. It is not responsible for day-to-day management issues such as maintenance, permits, and enforcement activities, which are the responsibilities of the QPWS. However, it is responsible for the coordination of on-the-ground management to ensure the World Heritage

Area is properly protected. The Authority's main functions are:

- to develop and implement management plans, policies and programs; notably the Wet Tropics Management Plan;
- to administer funding arrangements;
- to promote research and monitor the state of the Wet Tropics;
- to enter into cooperative management agreements and other arrangements with land holders and Aboriginal people;
- to develop community education programs; and
- to promote the Wet Tropics locally, nationally, and internationally.

Great Barrier Reef Marine Park Authority (GBRMPA)

GBRMPA is responsible for the protection, wise use, understanding and enjoyment of the Great Barrier Reef World Heritage Area mainly through the management of the Great Barrier Reef Marine Park. While its responsibilities have been mostly in the marine environment, its role extends to its protection by controlling land based impacts and has been actively involved in assisting the preparation of this Plan.

The Australian Government is also jointly responsible for administering the *Reef Water Quality Protection Plan*.

The Science Community

Members of the science community from universities, state agencies and CSIRO have played a substantial role in preparing this Plan. The regional community needs their continued involvement because social, economic and even natural circumstances constantly change. The science community will provide the necessary monitoring methods and results and provide information for continually revising NRM practices this Plan has outlined.

10.6.1 Cross regional arrangements

It is recognised in the Bilateral Agreement that certain management actions, programs or areas of interest will span Regional NRM Plan areas. The multitude of boundaries that define administrative arrangements or describe natural features will also contribute to the need for cross regional arrangements.

Recent examples of a cross regional approach, on a multi-regional scale, include the 'Integrated Great Barrier Reef Water Quality Monitoring Program' and the proposed extension of the grazing land management project in savannah country.

It is however likely that many cross regional initiatives will involve a 'bilateral' approach, involving two neighbouring NRM Regions that have identified an area of dual interest. Where this occurs an MoU between the neighbouring regions will be developed. This document should clearly define:

- Rationale for a cross regional approach;
- Assets and threats (the issue);
- Relative benefits accruing to the parties;
- Cost sharing principles; and
- Reference to regional investment strategy.

Generic areas of dual interest

These areas will generally be created by the overlap between Regional NRM Plan area boundaries and administrative boundaries such as:

- Local Government Areas;
- Protected area boundaries (including WHA);
- Federal or State Government planning area boundaries (e.g. bioregions used for conservation planning and recognised under the Queensland Vegetation Management Act).

Defined areas of dual interest

These areas are of a more specific nature and have been identified as requiring special consideration in Regional NRM Planning and program implementation. The factors addressed by this approach include Traditional Owner country, portions of bioregions or regional ecosystems alienated by Regional NRM Plan boundaries and other State or Commonwealth planning boundaries and so on (see map 'overlapping areas of interest' at beginning of this document).

Defined areas: Cape York – Wet Tropics

- Traditional Owners – Yalanji; and
- Regional Ecosystem types beginning with the number 7 (i.e. Wet Tropics bioregion), north of the Regional NRM Plan area boundary.

Defined areas: Northern Gulf – Wet Tropics

- Traditional Owners – Bar-Barrum, Yalanji;
- Regional Ecosystem types beginning with the number 7 (i.e. Wet Tropics bioregion), in the Upper Mitchell catchment;
- Mareeba Dimbulah Water Supply Scheme; and
- Barron Water Resource Plan area.

Defined reas: Burdekin – Wet Tropics

- Traditional Owners – Warrgamay, Nywaigi, Warangu; and
- Regional Ecosystem types beginning with the number 7 (i.e. Wet Tropics bioregion), south of the Regional NRM Plan area boundary.

Abbreviations

ACTFR	Australian Centre for Tropical Freshwater Research
AFG	Australian Forest Growers
AGDF-NQ	Australian Green Development Forum-North Queensland
AGO	Australian Greenhouse Office
AHD	Australian Height Datum
AIMS	Australian Institute of Marine Science
ANCA	Australian Nature Conservation Agency
ANZECC	Australian and New Zealand Environment and Conservation Council
AQIS	Australian Quarantine Inspection Service
ARC	Aboriginal Rainforest Council
ARM	WTMA's Aboriginal Resource Management Program
ASS	Acid Sulphate Soil
ATSIC	Aboriginal and Torres Strait Islander Commission
ATSIS	Aboriginal and Torres Strait Islander Services
BMP	Best Management Practice
BOM	Bureau of Meteorology
BVG	Broad Vegetation Group
C4	Community for Cassowary and Coastal Conservation
CAFNEC	Cairns and Far North Environment Centre
CCC	Cairns City Council
CIRU	Cardwell Indigenous Ranger Unit
CMA	Cooperative Management Agreement
COAG	Council of Australian Governments
COTS	Crown-of-Thorns Starfish
CPA	Cairns Port Authority
CRC	Cooperative Research Centre
CRRP	Community Rainforest Restoration Program
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CVA	Conservation Volunteers Australia
CYPLUS	Cape York Peninsula Land Use Study
DAFF	Department of Agriculture, Fisheries and Forestry (Cth)
DATSIP	Department of Aboriginal and Torres Strait People
DCILGPS	Department of Communication, Information, Local Government, Planning and Sport (Qld, now DLGPS&R)
DEH	Department of Environment and Heritage (Qld, now EPA)
DEH	Australian Department of the Environment and Heritage
DES	Department of Emergency Services (Qld)
DET	Department of Employment and Training (Qld)
DEWR	Department of Employment and Workplace Relations (Cth)
DLGPS&R	Department of Local Government, Planning, Sport and Recreation (Qld)
DNR	Department of Natural Resources (Qld, now NR&M)
DOGIT	Deed of Grant in Trust
DPA	Dugong Protection Area
DPI&F	Department of Primary Industries and Fisheries (Qld)
DSD	Department of State Development (Qld)
DT	Department of Transport (Qld)
EC	Electrical Conductivity (a measure of salinity)
EIU	Einasleigh Uplands
EPA	Queensland Environmental Protection Agency
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ESD	Ecologically Sustainable Development
FHA	Fish Habitat Area
FNQ RPAC	Far North Queensland Regional Planning Advisory Committee
FNQROC	Far North Queensland Regional Organisation of Councils
GBR	Great Barrier Reef
GBRMPA	Great Barrier Reef Marine Park Authority
GBRWHA	Great Barrier Reef World Heritage Area
GHG	Greenhouse gas
GIS	Geographic Information System
GQAL	Good Quality Agricultural Land
IBRA	Interim Biogeographic Regionalisation of Australia
ICC	Indigenous Coordination Centre
ICM	Integrated Catchment Management
ICPR	Intellectual Cultural Property Rights
IDAS	Integrated Development Assessment System
IEU	Indigenous Engagement Unit (part of EPA)

IGA	Intergovernmental Agreement
ILUA	Indigenous Land Use Agreement
IMCRA	Interim Marine and Coastal Regionalisation for Australia
IMO	International Maritime Organisation
INF	Interim Negotiating Forum
IPA	*Integrated Planning Act 1997* (Qld)
IPCC	Inter-governmental Panel on Climate Change
IPCC	International Panel for Climate Change
ISO	International Standards Organisation
IUCN	International Union for Conservation of Nature (now World Conservation Union)
JCU	James Cook University
LGA	Local Government Authority
LGAQ	Local Government Association of Queensland Inc.
LIPS	Low Isles Preservation Society
MDWSS	Mareeba Dimbulah Water Supply Scheme (formerly MDIA – Mareeba Dimbulah Irrigation Area)
MoU	Memorandum of Understanding
NAP	National Action Plan for Salinity and Water Quality
NCA	*Nature Conservation Act 1992* (Qld)
NGGI	National Greenhouse Gas Inventory
NGO	Non government organisation
NGS	National Greenhouse Strategy
NHT	Natural Heritage Trust
NLWRA	National Land and Water Resources Audit
NNTT	National Native Title Tribunal
NOAA	National Oceanic and Atmospheric Administration (US)
NP	National Park
NR&M	Department of Natural Resources and Mines (Qld)
NRM	Natural Resource Management
NTA	*Native Title Act 1993*
NTRB	Native Title Representative Bodies
OECD	Organisation for Economic Cooperation and Development
OESR	Office of Economic and Statistical Research
PSSR	Particularly Sensitive Sea Area
QEP	Queensland Energy Policy
QFMA	Queensland Fisheries Management Authority
QFPS	Queensland Forest Practices System
QFRI	Queensland Forest Research Institute
QGS	Queensland Greenhouse Strategy
QIP	Queensland Implementation Plan
QPWS	Queensland Parks and Wildlife Service
RCG	Regional Coordination Group
RCMP	Regional Coastal Management Plan
RE	Regional Ecosystem
RGMF	Regional Growth Management Framework
RIS	Regional Investment Strategy
RIT	River Improvement Trust
ROP	Resource Operations Plan
RPAC	Regional Planning Advisory Committee
RVMP	Regional Vegetation Management Plan
RWQPP	Reef Water Quality Protection Plan
RWUE	Rural Water Use Efficiency
SES	State Emergency Service
SF	State Forest
SLATS	Statewide Landcover and Trees Study
SoE	State of Environment
SPP	State Planning Policy
TEK	Traditional Ecological Knowledge
TKMG	Tree Kangaroo and Mammal Group
TN	Total Nitrogen
TP	Total Phosphorous
TREAT	Trees for the Evelyn and Atherton Tableland
TUMRA	Traditional Use of Marine Resources Agreements
UNCLOS	United Nations Convention on the Law of the Sea
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USL	Unallocated State Land
VMA	*Vegetation Management Act 1999* (Qld)
WHA	World Heritage Area
WOG	Whole of Government
WONS	Weeds of National Significance
WPSQ	Wildlife Preservation Society of Queensland
WRP	Water Resource Plan
WTMA	Wet Tropics Management Authority
WTWHA	Wet Tropics World Heritage Area
WWF	Worldwide Fund for Nature

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APPENDIX A
Establishing the FNQ NRM Ltd Board

Background

The process to form an integrated regional NRM body started in the Wet Tropics in August 2001 with a regional forum hosted by the two pre-existing groups with substantial interest in regional NRM: Natural Resource Management Board (Wet Tropics) Inc (NRMB) and the North Queensland Afforestation Association (NQAA). The forum initiated discussion on how efforts to guide and support community participation in managing natural resources should be organised and delivered. The forum brought together representatives from over 160 community-based organisations and set in train the formation of the new community-based natural resources body for the area, now FNQ NRM Ltd, and the joint project with the Rainforest CRC to develop the new management plan.

A Joint Working Group (JWG) of the two partner organisations, government agencies and two Traditional Owners, managed the process of forming the new Board. The JWG ran a series of working sessions to develop a framework for the new regional body that would deliver both the best outcomes for the region and to enhance opportunities for the community to participate in managing the region's environment. In November 2002, the JWG launched the public consultation process to test the proposal to establish the new regional body. The JWG distributed an Information and Community Participation Guide to over 900 individuals and groups across the region and held information sessions in Mossman, Cairns, Atherton, Innisfail and Ingham in November and December to provide further clarification of the proposed arrangements.

Written responses from 32 groups and 24 individuals supported the proposed membership, role and selection process and carried the overall support of the community, key interest groups and government. The results were communicated back to the community in March 2003. Based on the results and further consultation with peak bodies, the framework was refined and endorsed in May 2003.

The recruitment process for the new Board commenced in July 2003 and was heavily promoted through a comprehensive media and direct mail campaign inviting applications for Board positions. Minnicon and Burke P/L Cairns administered the application process and prepared a shortlist of applicants to be interviewed by a four member independent selection panel. Selections were finalised in September 2003 with appointments ratified at the Board's first meeting in October.

The Board

The appointment of the nine-member FNQ NRM Ltd Board in October 2003 followed an extensive community consultation process spanning almost two years. The process to design the structure and mandate of both the new Board and Company (now FNQ NRM Ltd) involved inputs from over 900 groups and individuals.

The rigorous and independent selection process chose Board members (Directors) for their foresight, expertise and demonstrated ability to lead the region through the challenges and complexities of managing natural resources. While Directors were appointed on criteria that ensured representation of the seven key interest groups in the region – catchment/community, coastal and marine, industry, conservation, local government, indigenous, and world heritage – in reality no one Director represents a particular interest group.

Directors were also chosen for their skills and knowledge across a range of fields and for their ability and commitment to representing the whole community in decision-making. Each Director is involved in decisions for all areas of Board and regional body's operations. In this way, the Board as a whole takes responsibility for its decisions.

Members were also assessed on their broader organisational, financial and community skills and the final make-up of the Board has members from across the region. The Board comprises:

Chair:	Cr Mike Berwick, Mossman
Director Catchment & Community:	Caroline Coppo, Ingham
Director Coastal & Marine:	Chris Gloor, Cairns
Director Industry:	Bill Shannon, Mission Beach
Director Conservation:	Peter Stanton, Cairns
Director Local Government:	Cr Ray Byrnes, Yungaburra
Director Indigenous:	Troy Wyles-Whelan, Ingham
Director World Heritage:	Peter Valentine, Townsville
Director Upper Herbert:	Ken Atkinson, South West

The Board is committed to strong connections to the regional community and every Director provides a community contact point on all Board matters. Furthermore, in keeping with its commitment to being open and accessible, Board meetings are open to the public and minutes are available on the Board's website. The Board is forming a Membership Body to be the essential link between the community and the Board of FNQ NRM Ltd. This partnership will mean shared decision-making and outcomes that are in the region's best interests. This will be a significant milestone for the region and culminates the formation of the new regional organisation.

Role of the Regional Body and Board

Across Australia, the Boards of regional bodies such as FNQ NRM Ltd are the Australian and State Governments' primary mechanism to involve the community in making decisions about natural resources. The Board of FNQ NRM Ltd has a variety of obligations under this new approach:

- Finalise the Regional NRM Plan (the framework to define priorities and access a range of funds including the Natural Heritage Trust);
- Administer funding on behalf of the Government and make decisions about the allocation of resources (decisions about funding environmental projects will be based on the Plan);
- Drive implementation of the Regional Plan by exploring innovative partnerships and projects as a means of achieving objectives and accessing resources from a range of public and private sources;
- Provide opportunities and means for the community to be genuinely recognised and involved in making decisions and able to participate in managing natural resources;
- Work to unify the efforts and contributions of natural resource managers to provide more coordinated management, planning and allocation of resources; and
- Ensure that FNQ NRM Ltd is making progress in all its core tasks.

On a broader scale, the Board will also represent the region at a State and Federal level, providing independent advice to Government about managing natural resources and where necessary, lobbying on behalf of the region for funding or on policy matters.

Guiding the region to sustainability – the Board's Vision and Objectives

The Board's vision statement is:

To harness the energy and knowledge of the community to achieve in the longer term a harmonious partnership within the region between productive and environmental concerns in managing natural resources.

The Board of FNQ NRM Ltd is committed to:

- Working collaboratively with integrity, accountability and fairness to represent the interests of the whole community in decision-making and distribution of resources;
- Striving for balanced and achievable outcomes that meet the needs of the region and take into account social, economic and environmental considerations for the immediate and longer term future;
- Taking a fresh, innovative and holistic approach to developing regional goals, management options and solutions toward which the whole community can contribute;
- Being receptive and respectful to different views and realities;
- Being open, accessible and genuine in dealings with the community whose interests we work to represent;
- Remaining relevant and reflexive to needs of both the community and the environment;
- Establishing meaningful and productive partnerships with all sectors of the community including the region's Traditional Owners to achieve sound environmental outcomes;
- Recognising and embracing the community as a rich source of knowledge, experience and energy and the valuable contributions communities make to managing natural resources;
- Acknowledging the diversity of cultures that exist within the region, in particular, the significance of the natural environment to the region's Traditional Owners and their contribution, rights and aspirations in managing natural resources through customary land and sea management practices;
- Communicating at the frequency and in ways desired by the community to ensure an informed and involved community and transparency in all dealings;
- Working to bridge the gap in the understanding and appreciation of challenges in sustainable land management and production between the rural and urban communities; and
- Ensuring that at all levels of the company's dealings corporate governance, legislative and reporting requirements of a non-profit, company limited by guarantee is met.

The Board's next priority will be the plan's implementation and to guarantee community ownership of the many initiatives which will flow from it.

The Board is committed to working on behalf of the community to achieve this mandate.

APPENDIX B
Wet Tropics Plan consultation activities

Overall a high level of community information and participation supported the process. The period January 2002 – July 2004 included the following activities:

- A Statement of Planning Intent was prepared and released along with a community information brochure to initiate the process;
- Over 30 community workshops held between January 2002 and June 2003 to June 2004;
- Advisory groups that comprised over 230 individuals representing key government agencies, community groups and organisations involved in managing natural resources in the region;
- Through the Rainforest CRC a Regional NRM Science Panel was formed which met together at the outset of the process in February 2003 and since then individual members provided science input until June 2004;
- A Key Stakeholder Reference Group met three times from November 2002 until the formation of the Board in 2003;
- A series of two-part community information sessions were held in eight locations across the region during March and April 2004 (approximately twenty sessions). The sessions that were attended by almost six hundred community members. Attendees received a 'preliminary targets survey' which sought to gather community input on a range of targets and actions taken from existing NRM plans in the region. Over 140 responses were received and analysed;
- Based on community feedback a two-day water quality forum was held in May 2004. The forum, attended by industry, government, science and community representatives aimed to generate discussion on issues and impacts related to water quality and the setting of realistic water quality targets for the catchments of the Wet Tropics. This forum was highly supported with approximately 80 participants attending over the two days;
- A local government NRM Forum was held in July 2004 to further communicate the purpose of the Plan and provide assistance to incorporate targets into local government planning schemes;
- An NRM Forum involving peak industry bodies was held in July 2004 to develop and Industry Engagement Strategy and develop partnerships with peak industry bodies; and
- Further targeted consultation and negotiation was undertaken with these and other key stakeholders in finalising the Plan and developing an investment strategy.

Biodiversity conservation

The consultation process for biodiversity conservation focused on engaging groups actively involved in NHT Bushcare projects, community conservation interest groups, landcare and catchment group members as well as local government planners, environmental officers and councillors; interested individuals and those with technical expertise.

Over 250 people throughout the region have participated in setting targets and potential management actions for Biodiversity Conservation.

Input was gathered via individual meetings with key representatives and peak organisations, presentations at meetings and a series of facilitated community workshops around the region. This process also worked with the region's Traditional Owners to identify the links between setting targets for biodiversity and traditional ecological knowledge and management.

Sustainable Use

Industry specific consultation (Sustainable Use) commenced in November 2003 and involved over three hundred primary producers directly. Producers worked to develop industry specific (beef, bananas, cane, dairy etc) management actions and targets such as standards for best management practices, (see Sing 2004). Over 2200 producers were contacted as part of the awareness-raising for the process. Each was also invited to participate in a series of workshops held across the region that were tailored to suit each industry.

Capacity Building and Institutional Change

A Capacity Building and Institutional Change Working Group was established to advise the Board on social and economic issues in conserving and sustaining natural resources. The group also developed and initiated a research project into capacity and capacity building requirements in relation to managing natural resources in the Wet Tropics.

As part of the Community Participation and Information Strategy a range of print and electronic communication tools were developed to support the process (outlined in Appendix C).

In addition, a substantial media and advertising campaign was conducted within both print and electronic mass media and sector specific publications.

APPENDIX C
Supporting documents and communication tools

Wet Tropics Natural Resource Management Plan: Statement of Planning Intent. Cooperative Research Centre for Tropical Rainforest Ecology and Management. Cairns. 2002.

Community Information and Participation Guide, NRM Board (Wet Tropics) Inc, 2002.

New Wet Tropics Natural Resource Management Plan (brochure) – Cooperative Research Centre for Tropical Rainforest Ecology and Management. Cairns. 2003.

'Planning for Sustainable NRM in the Wet Tropics' (2003) – presented formally at the National Planning Congress of the Planning Institute of Australia in Adelaide in April 2003.

'Wet Tropics Regional NRM Plan: Sustainable Natural Resource Management in the Wet Tropics' (2003), *Queensland Planner*, June 2003.

Sustainable Use Brochure – *Management Action Targets for the Banana Industry* (Neil Sing, Targets Facilitator), 2003.

Sustainable Use Brochure – *Management Action Targets for the Cattle Industry* (Neil Sing, Targets Facilitator), 2003.

Bama Cultural and Natural Resource Management Plan for the Wet Tropics Region, Information Sheet No. 1, Cooperative Research Centre for Tropical Rainforest Ecology and Management, Cairns and Natural Resource Management Board (Wet Tropics), 2003.

Wet Tropics NRM Plan Community Information and Consultation Guide, FNQ NRM Ltd, 2004 (providing a context to consultation, historical background information, process outline and full consultation details).

Natural Resources in the Wet Tropics: Biodiversity Summary Document, FNQ NRM Ltd, 2004.

Natural Resources in the Wet Tropics: Sustainable Use Summary Document, FNQ NRM Ltd, 2004.

Natural Resources in the Wet Tropics: Developing the Aboriginal Cultural and Natural Resource Management (NRM) Plan, FNQ NRM Ltd, 2004.

Natural Resources in the Wet Tropics: Poster with Plan consultation calendar, 2004.

Natural Resources in the Wet Tropics: Fact Sheet Series, 2004 (series of backgrounders aimed at basic information on a range of subjects related to the Plan, managing natural resources in the region and the FNQ NRM Ltd Board).

Wet Tropics NRM Plan Consultation Feedback, 2004 – a report outlining the analysis of results and data collected during all phases of the consultation.

NRM News email newsletter – Consultation updates feature in each edition of this bi-monthly electronic newsletter forwarded to over 2000 contacts.

FNQ NRM Ltd Website – www.nrmboard.org.au – dedicated sections to Plan consultation.

Direct Mail Promotions – Each aspect of the consultation process was supported by a direct mail campaign, including distributing all publications, to over 2000 regional contacts.

Sustainable Land Use Management Action Targets, N Sing, June 2004.

APPENDIX D
Key Elements of an Integrated Natural Resource Management Plan

(adapted from Draft Guidelines, NR&M, 2003).

1	Executive Summary	A précis of the key components and findings.
2	Background to the Plan	Details of the Regional Group; summary of the planning process.
3	Linkages / Integration with other Relevant Planning Processes	The regional NRM plan will need to rely on many of the existing or developing plans for implementation, particularly where it needs to work through existing statutory mechanisms. Agreed arrangements with existing planning bodies should be specified in the Plan.
4	Regional Overview	Analysis of regional information on natural resource condition and trends, related cultural, social and economic issues and an outline of past and current natural resource activities to provide a qualitative and quantitative description of the natural resource management issues facing the region; their cause, extent and severity; and the impacts of these issues to use as a basis for setting objectives and targets.
5	Vision, Objective/Goals, Principles	What regional situation is desired at a future point in time (the vision); Objectives/goals to resolve particular NRM issues; and overarching principles on which the objectives/goals are based.
6	Targets	Targets may be: Aspirational[37] – the vision of the community for the desired condition of their natural resources in the longer term (fifty years). Achievable resource condition targets desired resource condition in the medium term (ten to twenty years) – targets may relate to absolute improvement in resource condition or decreases in the rate of degradation. Governments have specified a minimum set of 'parameters for targets' for resource condition required in all regions. Management action targets define targets for the short term (one to five years) needed to meet the resource condition targets, or to enable resource condition targets to be established.
7	Priority Actions for Regional Investment	Prioritised actions to address the range of natural resource management issues and meet the resource condition targets outlined in the Plan.
8	Monitoring and Evaluation	A detailed monitoring and evaluation process to identify who is accountable for commitments, financial management, and performance monitoring and reporting arrangements.
9	Reporting and Communication	A reporting structure for communication of the effectiveness of priority actions being implemented and the outcomes of the activities undertaken.
10	Reviewing the Plan	Requirements for ongoing review to reflect new information and ensure continuous development and improvement of the Plan over time.
11	Regional Investment Strategy	A business plan to attract external investment in priority actions that are identified in the regional NRM Plan. It outlines the funding required to implement an accredited plan and identifies the returns, if any, for the investment of the respective contributors.

[37] Note in this Plan we substitute the term Goal for the term Aspirational target.

APPENDIX E
Matters for targets and core indicators. National natural resource management outcomes

National Outcomes (Goals)

- The impact of salinity on land and water resources is avoided or reduced.
- Biodiversity and the extent, diversity and condition of native ecosystems are maintained or rehabilitated.
- Populations of significant species and ecological communities are maintained or rehabilitated.
- Ecosystem services and functions are maintained or rehabilitated.
- Surface and groundwater quality is maintained or enhanced.

Matters for Targets (Resource Condition)

- Land salinity.
- Soil condition.
- Native vegetation communities' integrity.
- Inland aquatic ecosystems integrity (rivers and wetlands).
- Estuarine, coastal and marine habitats integrity.
- Nutrients in aquatic environments.
- Turbidity/ suspended particulate matter in aquatic environments.
- Surface water salinity in freshwater environments.
- Significant native species and ecological communities.
- Ecologically significant invasive species.

Core Indicators

- Area of land threatened by shallow or rising water tables.
- Soil condition.
- Native vegetation extent and distribution.
- Native vegetation condition.
- River condition.
- Wetland ecosystem extent and distribution.
- Wetland ecosystem condition.
- Estuarine, coastal and marine habitat extent and distribution.
- Estuarine, coastal and marine habitats condition.
- Nitrogen in aquatic environments.
- Phosphorous in aquatic environments.
- Turbidity/suspended solids.
- Instream salinity.
- Selected significant species and ecological communities extent and conservation status.
- Selected ecologically significant invasive species extent and impact.

APPENDIX F
Draft guidelines for involving Aboriginal and Torres Strait Islander peoples

Draft Queensland Guidelines for involving Aboriginal and Torres Strait Islander peoples in the establishment of NRM Bodies, and development of the Regional NRM Plan and Investment Strategy

The major factors of the guidelines include:

- Aboriginal and Torres Strait Islander peoples are the traditional custodians of all lands and seas in Queensland. These customary rights are recognised through a number of international covenants.
- Aboriginal and Torres Strait Islander peoples have extensive interests in natural resource management. These interests include traditional custodians of land and seas; culture including cultural heritage; social interests; economic interests; and environmental interests.
- While areas and objects of cultural heritage are better known, other aspects of culture such as Aboriginal language, dance, art and lore relate directly to the land and/or the seas and any of these aspects may be important for people in relation to natural resource management and enhance NRM projects within the region.

(Source: NR&M, March 2003)

APPENDIX G
Matters of National Environmental Significance

World Heritage Areas

- Great Barrier Reef
- Wet Tropics of Queensland

Nationally listed threatened species

Table 21. Nationally listed threatened species

Common name	*Genus, species (subspecies, population)*	*EPBC Act conservation status*
Plants		
	Aponogeton bullosus	Endangered
	Aponogeton proliferus	Endangered
	Polyscias bellendenkerensis	Vulnerable
	Archontophoenix myolensis	Endangered
	Arenga australasica	Vulnerable
	Marsdenia araujacea	Presumed extinct
	Tylophora rupicola	Endangered
	Asplenium pellucidum	Vulnerable
	Asplenium wildii	Vulnerable
	Diplazium cordifolium	Endangered
	Canarium acutifolium var. acutifolium	Vulnerable
	Hexaspora pubescens	Vulnerable
	Cycas platyphylla	Vulnerable
	Cyperus cephalotes	Endangered
	Eleocharis retroflexa	Vulnerable
	Fimbristylis adjuncta	Endangered
Trailing sundew	*Drosera prolifera*	Vulnerable
Notched sundew	*Drosera schizandra*	Vulnerable
	Lastreopsis walleri	Vulnerable
	Eucryphia wilkiei	Vulnerable
	Actephila foetida	Vulnerable
	Chamaesyce carissoides	Vulnerable
	Sankowskya stipularis	Endangered
	Sauropus macranthus	Vulnerable
	Cajanus mareebensis	Endangered
	Dioclea hexandra	Vulnerable
	Tephrosia leveillei	Vulnerable
	Ctenopteris walleri	Vulnerable
	Grammitis reinwardtii	Vulnerable
	Hymenophyllum lobbii	Presumed extinct
	Hymenophyllum whitei	Presumed extinct
	Trichomanes exiguum	Presumed extinct
	Plectranthus gratus	Vulnerable
	Prostanthera albohirta	Presumed extinct
	Endiandra cooperana	Endangered

Blue tassel fern	*Huperzia dalhousieana*	Endangered
	Huperzia filiformis	Endangered
	Huperzia lockyeri	Vulnerable
	Huperzia marsupiiformis	Vulnerable
Layered tassel fern	*Huperzia phlegmarioides*	Vulnerable
Square tassel fern	*Huperzia prolifera*	Vulnerable
	Huperzia serrata	Presumed extinct
Rock tassel fern	*Huperzia squarrosa*	Endangered
	Lycopodium volubile	Presumed extinct
	Carronia pedicellata	Endangered
	Acacia guymeri	Vulnerable
	Acacia ramiflora	Vulnerable
	Musa fitzalanii	Presumed extinct
	Corymbia leptoloma	Vulnerable
Red-throated bloodwood	*Corymbia rhodops*	Vulnerable
	Homoranthus porteri	Vulnerable
	Ristantia gouldii	Vulnerable
	Syzygium hodgkinsoniae	Vulnerable
	Triplarina nitchaga	Vulnerable
	Xanthostemon formosus	Endangered
	Calochilus psednus	Endangered
	Crepidium lawleri	Endangered
Cypress orchid	*Dendrobium callitrophilum*	Vulnerable
	Dendrobium lithocola	Endangered
	Dendrobium mirbelianum	Endangered
	Dendrobium nindii	Endangered
	Dendrobium phalaenopsis	Vulnerable
	Diplocaulobium masonii	Presumed extinct
	Genoplesium tectum	Endangered
	Oberonia attenuata	Presumed extinct
	Phaius pictus	Vulnerable
	Phaius tancarvilleae	Endangered
	Vrydagzynea paludosa	Endangered
	Zeuxine polygonoides	Vulnerable
	Arthraxon hispidus	Vulnerable
	Centotheca philippinensis	Vulnerable
	Dichanthium setosum	Vulnerable
	Lemmaphyllum accedens	Presumed extinct
	Alloxylon flammeum	Vulnerable
	Grevillea glossadenia	Vulnerable
	Cyclophyllum costatum	Vulnerable
	Gardenia actinocarpa	Endangered
	Myrmecodia beccarii	Vulnerable
	Zieria obovata	Vulnerable
Orange tamarind	*Toechima pterocarpum*	Endangered
	Chingia australis	Endangered

	Plesioneuron tuberculatum	Endangered
	Phaleria biflora	Vulnerable
	Tmesipteris lanceolata	Presumed extinct
Animals		
Lake Eacham Rainbowfish	*Melanotaenia eachamensis*	Endangered
Armoured Frog, Armoured Mist Frog, Thornton Peak Tree Frog, Little Waterfall Frog*	*Litoria lorica*	Endangered
Torrent Tree Frog, Waterfall Frog*	*Litoria nannotis*	Endangered
Nyakala Frog, Waterfall Mist Frog*	*Litoria nyakalensis*	Endangered
Creek Frog, Common Mist Frog*	*Litoria rheocola*	Endangered
Day's Frog, Lace-eyed Tree Frog, Australian Lace-lid*	*Nyctimystes dayi*	Endangered
Sharp-nosed Torrent Frog, Sharp-nosed Day Frog*	*Taudactylus acutirostris*	Presumed extinct
Tinkling Frog*	*Taudactylus rheophilus*	Endangered
Magnificent Broodfrog*	*Pseudophryne covacevichae*	Vulnerable
Loggerhead Turtle*	*Caretta caretta*	Endangered
Green Turtle*	*Chelonia mydas*	Vulnerable
Hawksbill Turtle*	*Eretmochelys imbricata*	Vulnerable
Olive Ridley*	*Lepidochelys olivacea*	Vulnerable
Leatherback Turtle*	*Dermochelys coriacea*	Vulnerable
legless lizard	*Delma mitella*	Vulnerable
Yakka Skink	*Egernia rugosa*	Vulnerable
Buff-breasted Button-quail	*Turnix olivii*	Endangered
Masked Owl (northern)	*Tyto novaehollandiae kimberli*	Vulnerable
Red Goshawk	*Erythrotriorchis radiatus*	Vulnerable
Southern Cassowary (Australian)*	*Casuarius casuarius johnsonii*	Endangered
Star Finch (southern)	*Neochmia ruficauda ruficauda*	Endangered
Spotted-tailed Quoll (N Qld), Yarri**	*Dasyurus maculatus gracilis*	Endangered
Northern Bettong*	*Bettongia tropica*	Endangered
Mahogany Glider*	*Petaurus gracilis*	Endangered
Fluffy Glider, Yellow-bellied Glider (N subspecies)	*Petaurus australis unnamed subsp.*	Vulnerable
Ghost Bat	*Macroderma gigas*	Vulnerable
Greater Large-eared Horseshoe Bat*	*Rhinolophus philippinensis*	Endangered
Spectacled Flying-fox	*Pteropus conspicillatus*	Vulnerable
False Water-rat	*Xeromys myoides*	Vulnerable
Humpback Whale	*Megaptera novaeangliae*	Vulnerable

**Subject to a recovery plan*
***Subject to a draft recovery plan*

Nationally listed ecological communities

Mabi Forest (Complex Notophyll Vine Forest 5b) (Critically Endangered)

Migratory species

Listed migratory species include those listed under the conventions on the Conservation of Migratory Species of Wild Animals (the Bonn Convention) as well as the agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA); and the Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).

Seabirds, shorebirds (e.g. plovers and sandpipers) and waterfowl account for the majority of bird species. However there are also numerous terrestrial species of particular significance for the region. These include the buff-breasted paradise kingfisher (often used as an icon in the Wet Tropics), the metallic starling closely associated with rainforests, and numerous cuckoos including koels and channel-billed cuckoos that breed in the region.

Migratory species in our region also include marine mammals (e.g. dugong, whales and dolphins), marines reptiles (e.g. marine turtles, estuarine crocodile), as well as the great white and whale sharks (not commonly found in Wet Tropics waters). Some marine species are important components of tourism in the region. These include the dwarf minke and humpback whales, dugongs and marine turtles, in addition to the many waders and shorebirds for which the coastal areas are so well known.

An interesting additional group is butterflies, one of which undertakes mass long distance migration through the region (the brown awl) and others are noted for over-wintering aggregations including the blue tiger and various crow butterflies.

A list of migratory species can be found at <http://www.deh.gov.au/biodiversity/migratory/list.html>

APPENDIX H
Resource Condition Targets for all assets

RCT B1. No net loss of the area of native vegetation across the region by 2008[38]

RCT B2. Quality and extent of regional ecosystems currently with an 'endangered' or 'of concern' conservation status under the *Vegetation Management Act 1999* is maintained or improved by 2014.

RCT B3. Increase in the area, condition and integrity (i.e. net gain) of areas of 'regional biodiversity significance'[39] by 2014.

RCT B4. No new deliberate introductions of ecologically invasive species that threaten terrestrial ecosystems after 2006.

RCT B5. Eradication of category 1 pests under the FNQROC Regional Pest Management Strategy and strategic eradication or containment of other ecologically invasive species that threaten terrestrial ecosystems by 2014.

RCT B6. Terrestrial ecosystems being managed for key threatening processes (other than ecologically invasive species) by 2014.

RCT B7. All wetlands of particular biodiversity significance protected from active clearance (direct and by grazing) and managed for conservation purposes by 2014.

RCT B8. Quality and extent of riparian ecosystems maintained and improved by 2014.

RCT B9. Quality and extent of inland aquatic ecosystems maintained or improved by 2014.

RCT B10. No new deliberate introductions of ecologically invasive species that threaten inland aquatic ecosystems after 2006.

RCT B11. Eradication of category 1 pests under the FNQROC Regional Pest Management Strategy and strategic eradication or containment of other ecologically invasive species that threaten inland aquatic ecosystems by 2014.

RCT B12. Progressive improvement in condition of coastal, estuarine and marine ecosystems by 2014.

RCT B13. Reduce the impacts of commercial shipping and ports infrastructure on estuarine and marine ecosystems by 2014.

RCT B14. No further decline in coastal resources associated with land development by 2014.

RCT B15. Traditional Owner values and priorities for sea country are identified and protected by 2014.

RCT B16. Critical habitat of threatened species[40] protected and managed to allow recovery and long term viability by 2014.

RCT B17. Improved protection for significant coastal and marine species and the habitats that support them by 2014.

RCT B18. All ecological communities listed as 'critically endangered' under the EPBC Act protected and managed for conservation purposes by 2008.

RCT B19. No decline in the conservation status of any native species[41] or regional ecosystem by 2014.

RCT B20. The world heritage values of the Great Barrier Reef and Wet Tropics maintained by 2014.

RCT B21. All native species of Aboriginal cultural significance are protected and managed to the satisfaction of Traditional Owners by 2014.

RCT C1. Greenhouse emissions and air pollution levels are reduced to, or below, 1990 levels by 2012.

RCT C2. Natural resources managed for potential impacts of climate change by 2012.

RCT L1. Maintain the sustainable productive capacity of land resources and reduce the loss of soil in Wet Tropics catchments by 2015.

RCT L2. All good quality agricultural land will be retained for productive agricultural use commensurate with the broader regional economic, environmental and social priorities of the region by 2014.

RCT L3. 30% Reduction in waste production in critical rural industries by 2010.

RCT L4. No new risk of acid sulphate soil exposure by 2007 and disturbed acid sulphate soils rehabilitated by 2014.

RCT L5. No area of the Wet Tropics will have dryland salinisation outbreaks by 2008.

RCT L6. 100% control of outbreaks of new agricultural pest plants and animals from 2004 and impact of agricultural pests contained by 2009 and reduced by 2014.

RCT L7. Extensive rangelands – 70% of the pasture landscapes to be in A and B condition by 2017.

RCT L8. Productive forest area increased and improved by 2014.

38 As measured by SLATS (Statewide Landcover and Trees Study) data

39 Appendices L, M, N

40 See Biodiversity Report Appendix C

41 See Background Report Appendix C

RCT L9. The availability of all existing extractive resources is maintained commensurate with the broader economic, environmental and social priorities of the region from 2004.

RCT L10. Urban lands – No solid waste disposal site is causing detrimental impacts by 2015.

RCT W1. Instream environmental flow requirements will be met in all Wet Tropics rivers by 2015.

RCT W2. Allocation of regional water resources including underground water will demonstrably not exceed sustainable levels by 2015.

RCT W3. Improve water quality by reducing sediment and nutrient loads in all Wet Tropics waterways ongoing.

RCT W4. Meet Australian water quality guidelines for ambient levels of pesticides and heavy metals in tropical waterways by 2015.

RCT W5. Aboriginal values for waterways are recognised and protected by 2008.

RCT A1. All Traditional Owners groups have strong and effective governance structures and support networks by 2010.

RCT A2. Aboriginal cultural landscapes and culturally significant places are protected and managed to the satisfaction of each Traditional Owner group in the Wet Tropics by 2014.

RCT A3. Traditional Owners have access to their traditional land and sea country for cultural maintenance and to revitalise customary management practices through working collaboratively and developing agreements with landholders and other NRM stakeholders by 2014.

RCT A4. Aboriginal knowledge systems and customary management practices for land and sea country are protected and conserved to the satisfaction of each Traditional Owner group in the Wet Tropics by 2009.

RCT A5. Traditional Owner groups are fully involved at all levels in natural and cultural resource planning and management by 2010.

RCT A6. All NRM stakeholders have the capacity to work effectively with Traditional Owners on issues affecting land and sea country by 2011.

RCT CB1. A community that is actively engaged and adequately equipped to manage natural resources in a sustainable manner by 2014.

RCT ME1. The Regional NRM Plan and its implementation comply with investor monitoring, evaluation and reporting requirements by 2006.

RCT ME2. The Regional NRM Plan is adapted in light of new knowledge and experience by 2010.

APPENDIX I
FNQ NRM Board Priority Setting Process

Many inputs informed the Board's decisions on priorities including the regional overview and condition reports and other key documents especially the FNQ Regional Plan, Wet Tropics Conservation Strategy and the Productivity Commission report on the GBR Catchment. The Board sought advice from its science panel and from the community and industry during the draft plan consultation process. These determined the scope of NRM issues and potential management actions included in the Plan. The key issues for specific prioritisation were identified in the reports prepared for the Wet Tropics NRM planning project including the Capacity Building Report, and the Aboriginal Plan.

The assets are grouped into the five broad asset areas of: biodiversity, climate, land, water and community and 23 issues derived for the natural assets and 10 for the community assets. Whether or not community capacity is an end (an important outcome in its own right) or a means to sustainable natural resources management in the NRM plan, is a contentious issue for some. For the NHT, community capacity building and institutional change is an important outcome area and therefore it is included here for prioritisation.

Table 22. Threat criteria assessment guidelines

Threat Criteria	
Tractability	How easy is it for human intervention to resolve this problem? Would various management actions make a significant and permanent difference to the source or effects of the threat, or would they just make only marginal gains?
Urgency	Is the threat increasing at a rate that makes it urgent to intervene? Is this a particularly opportune time to intervene to deal with an emerging problem that will become much more difficult to resolve in future (e.g. a new weed)? Or does the trend indicate that waiting until later will make little difference?
Irreversibility	Is the effect of the threat irreversible, at least for all practical purposes? Or can the asset be restored at a later time? For example, soil erosion is largely irreversible in the long term.
Extent	Does the problem only occur in one small area or is it a widespread problem in the region? Extent may mean aerial extent (e.g. for weeds), length (e.g. length of wildlife corridors), number of landholders (e.g. adopting new management practices).

See: NR&M, 2004: Regional NRM Planning Guiding Information Products Module 5a.

Table 23. Guidelines for target setting in regional natural resource management planning – May 2004

Asset Criteria	
Biodiversity	The variety of life forms: the different plants, animals and micro-organisms, the genes they contain and the ecosystems they form. Usually considered at three levels: genetic, species and ecosystem diversity. Assets include regional ecosystems, waterways, wetlands, marine habitats, significant species and ecological communities. Aboriginal values need to be considered also, including knowledge systems and intellectual property, cultural resources, religious and spiritual significance of biodiversity.
Climate	Climate is one of the dominant driving forces behind the diversity found in the region and underpins economic activities. One of the major distinguishing characteristics is rainfall, although it varies greatly from year to year. Assets include equitable climate and clean air.
Community	Includes everyone who lives and works in the region, those who visit and invest in it. The community includes government and non-government institutions, community groups and organisations, industry groups, and Indigenous people. The community is responsible for managing the natural resources of the region in a sustainable manner and their skills and knowledge, attitudes and resources to manage the regions resources is an important asset.
Land	Agriculture and conservation are the major land uses in the Wet Tropics Region. Much of the accessible and arable land is privately owned; the more rugged parts of the region are predominantly protected areas and the drier areas leasehold tenures. A significant proportion of the region, especially in protected areas is claimable under the Native Title Act. Assets include arable land, native pastures, forests, urban lands, Aboriginal cultural landscapes, places and materials.
Water	The region drains to the Great Barrier Reef from six major coastal catchments, along with Trinity Inlet. Its climatic and geomorphologic conditions result in fast flowing streams with high discharge rates. Water is used mainly for agriculture, industry and domestic use. Assets include good quality water, water availability, waterways and wetlands, Aboriginal cultural values for waters.

Prioritising Issues

Each NRM problem is assessed in terms of its: tractability, urgency, irreversibility and extent, (Table 22) and its impact on the regional assets.

The evaluation process was a simple version of a multiple criteria analysis. Threat and asset criteria sets were collectively given equal weights but each criterion was weighted separately. The Board then scored each of the key issues against each of the criteria in terms of its threat characteristics and impact on each of the assets. For example addressing the issue of water quality decline was evaluated in terms of its tractability, urgency, irreversibility and extent then in terms of its impact on regional assets. The resulting weighted sum was used to rank the issues and assist the prioritisation and decision-making process.

The Board weighted the threats mostly equally – although some members saw the importance of dealing with high risk irreversible urgent threats as more important than the other criteria. Greater differences emerged amongst the asset criteria and how they were weighted. Most Board members weighted impacts on the land, water and biodiversity asset similarly and more highly than the climate and community assets. It should be noted that for all assets at least one Board member weighted them all equally. Figure 14 shows the Board weighting and ranking of the issues – and the range of scored values from maximum to minimum for each one. While Board members rated many issues similarly, they had highly variable scores for the importance of some issues – including water extraction, soil fertility decline, grazing pressure, aquatic pest plants and animals, and greenhouse gas emissions. These legitimate differences arise from the experience and values of the board members and the way they conceptualise the complex NRM business.

Table 24. Importance of criteria as scored by the Board

Threat Criteria		*Asset Criteria*	
Tractability	19.3%	Biodiversity	23.7%
Urgency	28.0%	Climate	12.7%
Irreversibility	28.7%	Community	13.0%
Extent	24.0%	Land	25.3%
	100.0%	Water	25.3%
			100.0%

Table 25. Priority threats to be addressed

Rank	*Issue*	*Priority*
1	Vegetation clearing	High Priority
2	Soil erosion	
3	Terrestrial pest plants and animals	
4	Waterway and wetland modification	
5	Terrestrial habitat fragmentation	
6	Inappropriate urban land development	
7	Lack of community engagement/ motivation to participate in NRM	
8	Water quality decline	
9	Greenhouse gas emissions	
10	Lack of awareness/knowledge of NRM	
11	Altered fire regimes	Medium Priority
12	Grazing pressure	
13	Aquatic pest plants and animals	
14	Conflicting/inappropriate government policy	
15	Urban and industrial pollution	
16	Loss/inappropriate use of Traditional Ecological Knowledge	
17	Lack of facilitation and support	
18	Conflicting belief systems	
19	Lack of information/monitoring	
20	Water extraction	
21	Lack of skills and training	Lower Priority
22	Overfishing and marine habitat modification	
23	Acid sulphate soils	
24	Soil fertility decline	
25	Diseases and pathogens	
26	Tourist and visitor impacts	
27	Soil acidification	
28	Lack of recognition and understanding of Aboriginal values	
29	Episodic climatic events	
30	Lack of access to Traditional Land and Sea country	
31	Aquaculture development	
32	Shipping and ship-sourced pollution	
33	Soil salinity	

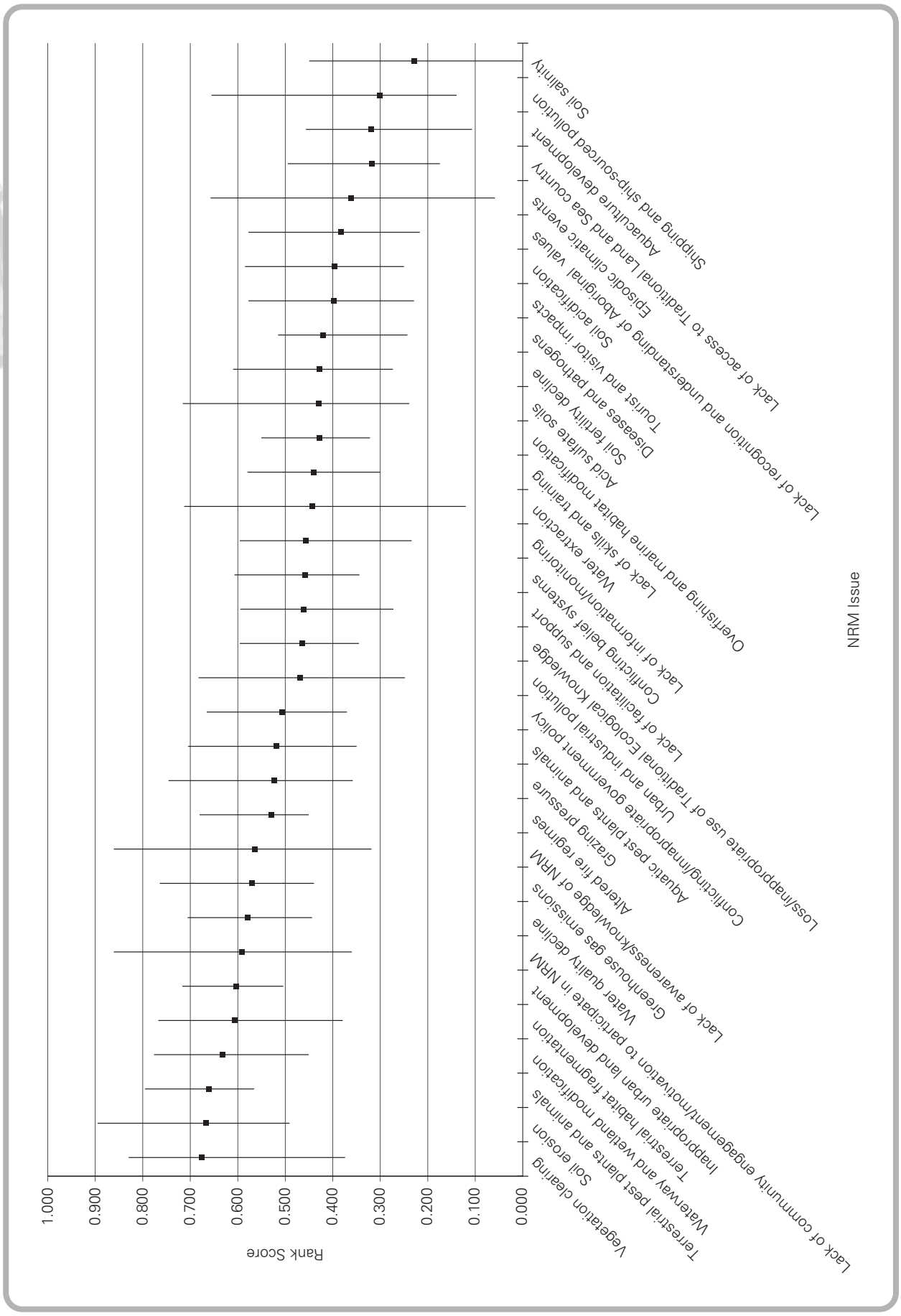
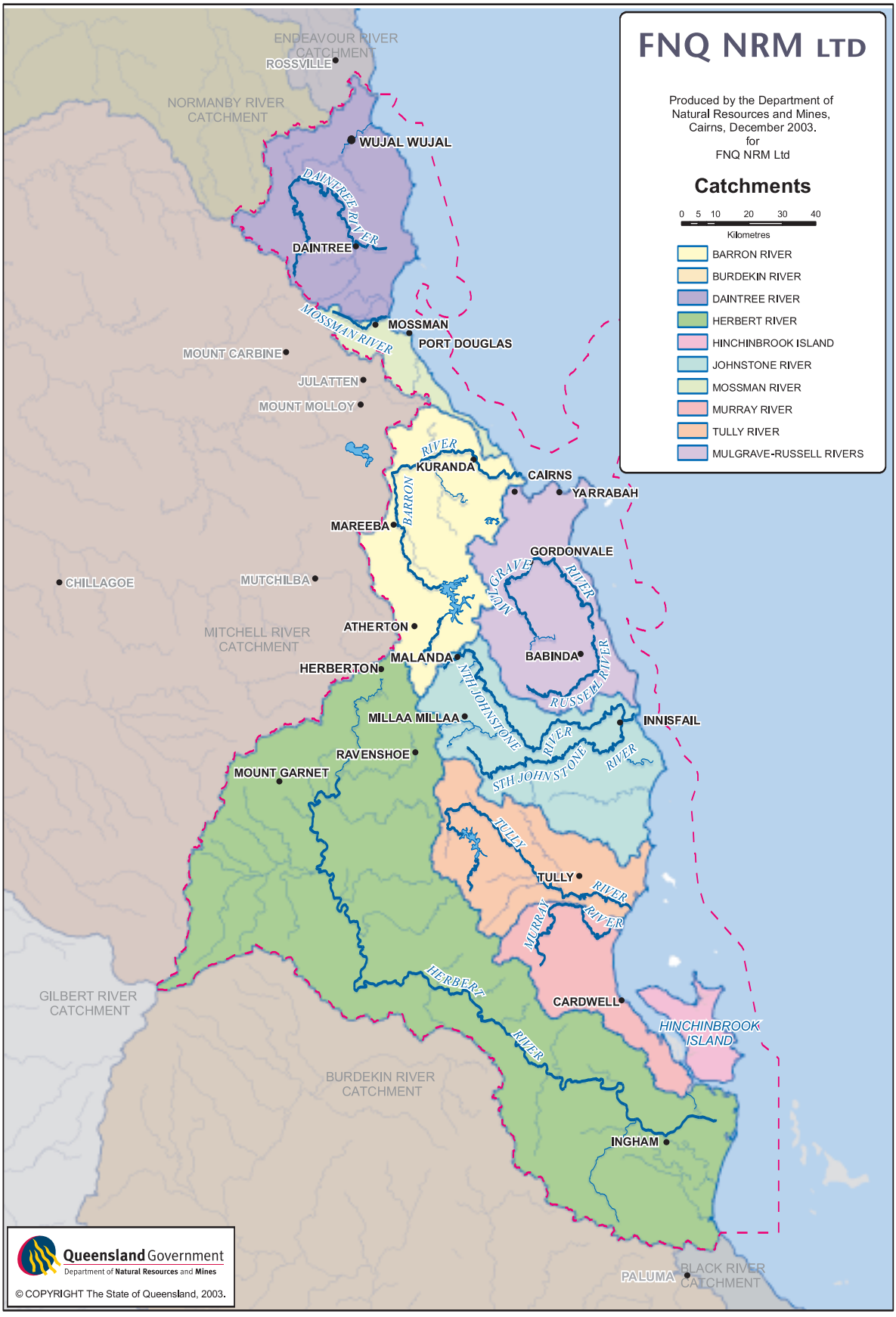
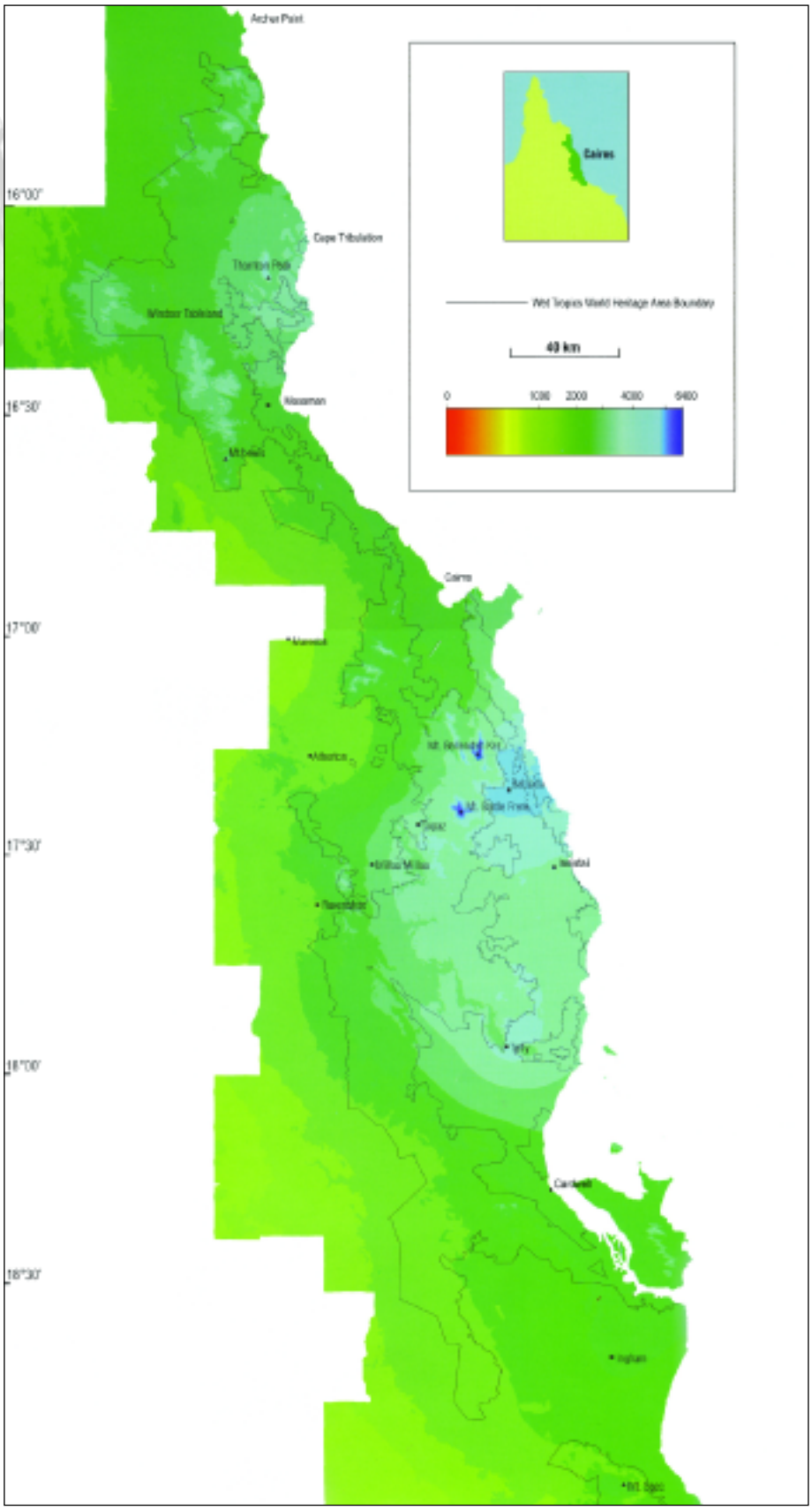


Figure 14. Board Weighting and Ranking of the Key NRM Issues for the Wet Tropics

APPENDIX J
Wet Tropics Catchment boundaries map

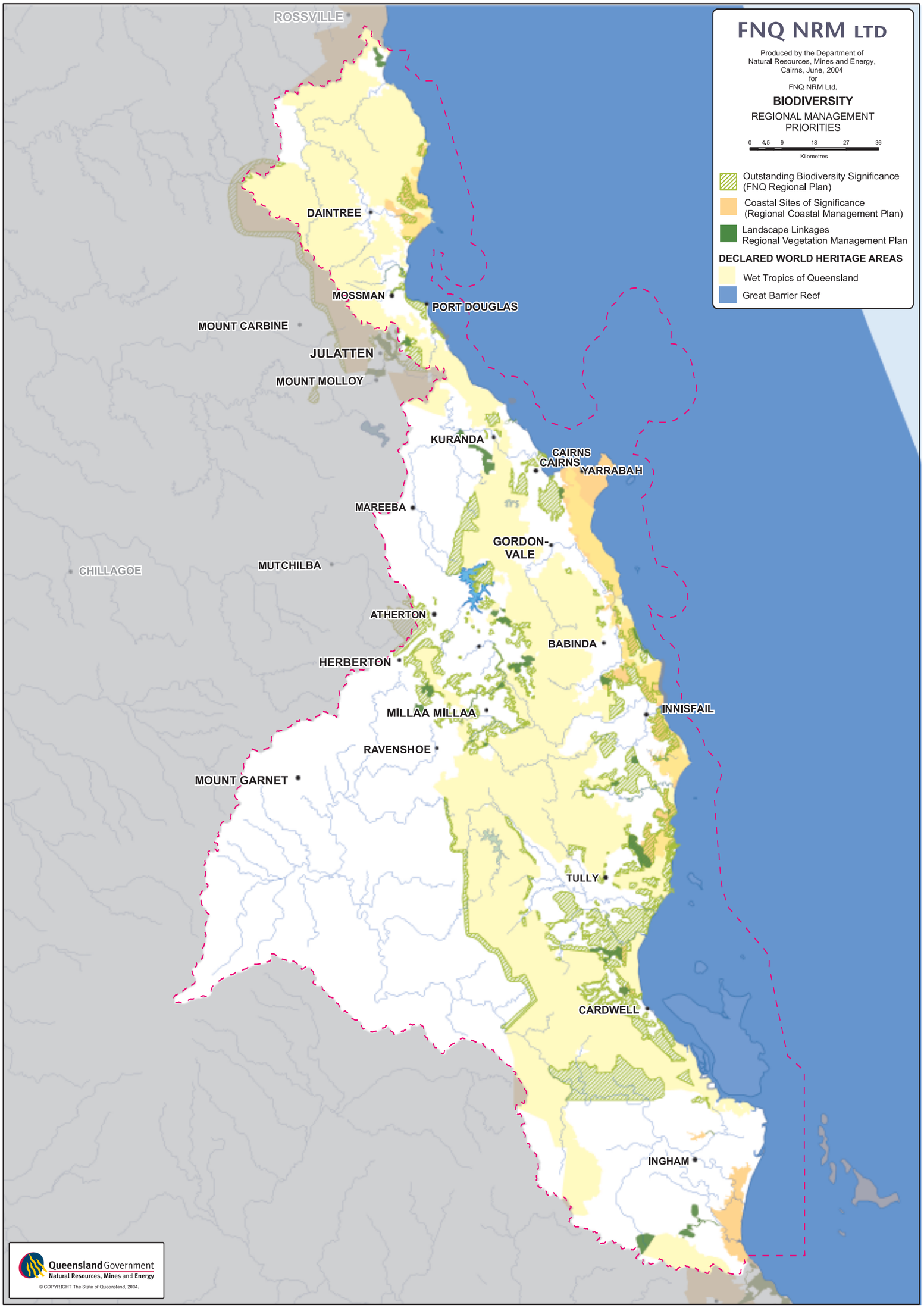


APPENDIX K
Rainfall Distribution chart

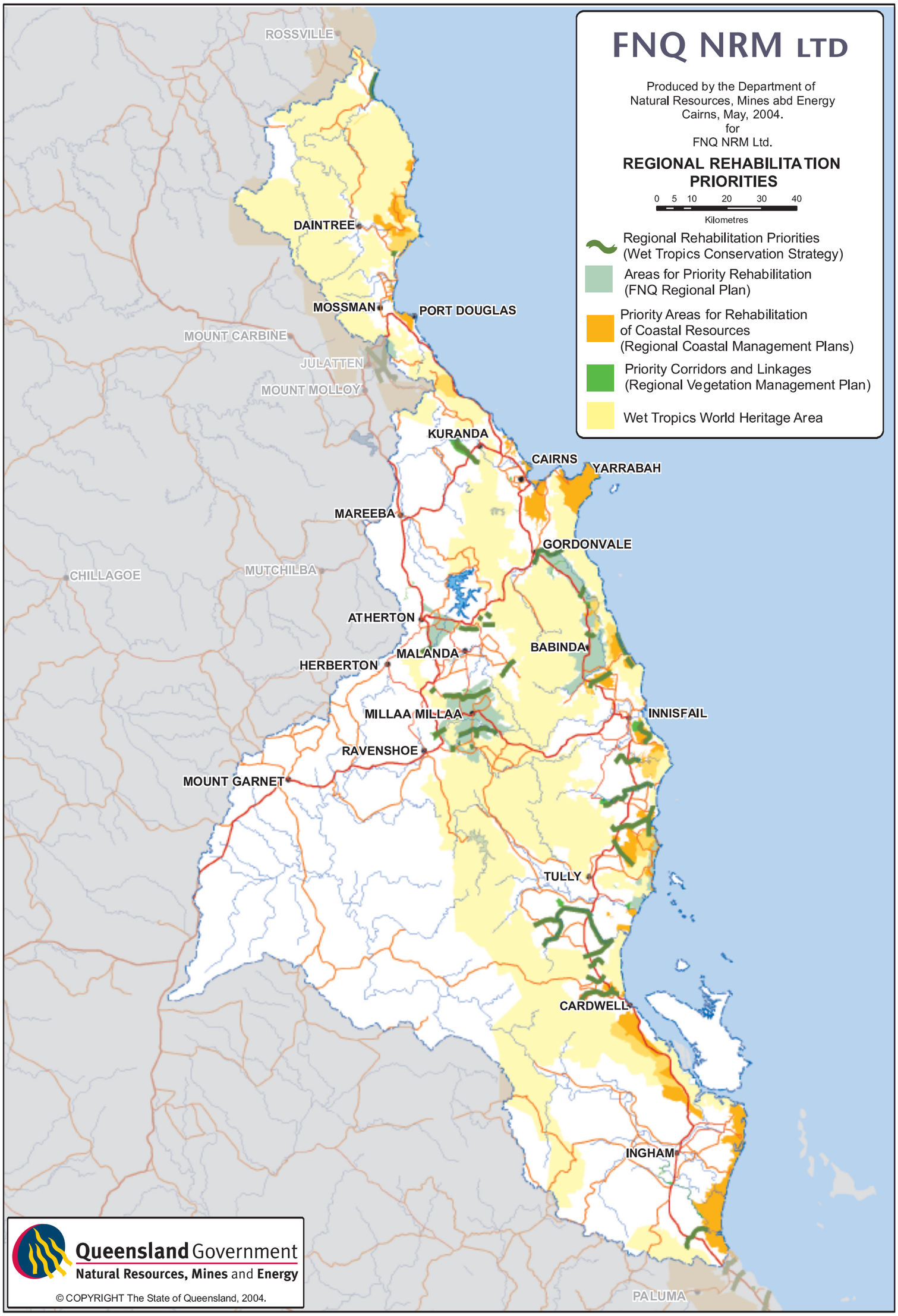


From: Turton et al, *1999*

APPENDIX L
Management Priorities map



APPENDIX M
Rehabilitation Priority Areas map



APPENDIX N
Significant Waterways and Wetlands map