State of the
Wet Tropics Report
2006 – 2007
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Terms and abbreviations

ACTFR  Australian Centre for Tropical Freshwater Research
APVMA  Australian Pesticides and Veterinary Medicines Authority
ARC  Aboriginal Rainforest Council
ARF  Australian Rainforest Foundation
Bioregion  Wet Tropics of Queensland biogeographic region
C4  Community for Coastal and Cassowary Conservation
CAFNEC  Cairns and Far North Environment Centre
CRC  Cooperative Research Centre
CSIRO  Commonwealth Scientific, Industry and Research Organisation
CSIRO TFRC  CSIRO Tropical Forests Research Centre
CVA  Conservation Volunteers Australia
DEW  Department of the Environment and Water Resources
DLGPSR  Department of Local Government, Planning, Sport and Recreation
DMR  Department of Main Roads
DNRW  Department of Natural Resources and Water
DPIF  Department of Primary Industries and Fisheries
EMP  Environmental Management Plan
EPA  Environmental Protection Agency
EPBC Act  Environment Protection and Biodiversity Conservation Act 1999
FNQ  Far North Queensland
FNQ NRM Ltd  Far North Queensland Natural Resource Management Limited
FNQ ROC  Far North Queensland Regional Organisation of Councils
FNQWS  Far North Queensland Water Strategy
FNQ 2025  Far North Queensland 2025 Statutory Regional Plan
ILUA  Indigenous Land Use Agreement
IUCN  World Conservation Union
JCU  James Cook University
MTSRF  Marine and Tropical Science Research Facility
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCA</td>
<td>Nature Conservation Act 1992</td>
</tr>
<tr>
<td>NHT</td>
<td>Natural Heritage Trust</td>
</tr>
<tr>
<td>QCCCE</td>
<td>Queensland Climate Change Centre of Excellence</td>
</tr>
<tr>
<td>Qld</td>
<td>Queensland</td>
</tr>
<tr>
<td>QPWS</td>
<td>Queensland Parks and Wildlife Service</td>
</tr>
<tr>
<td>Queensland Act</td>
<td>Wet Tropics World Heritage Protection and Management Act 1993</td>
</tr>
<tr>
<td>RAAC</td>
<td>Rainforest Aboriginal Advisory Committee</td>
</tr>
<tr>
<td>RE</td>
<td>Regional ecosystem</td>
</tr>
<tr>
<td>RRRRC</td>
<td>Reef and Rainforest Research Centre</td>
</tr>
<tr>
<td>SLATS</td>
<td>Statewide Landcover and Tree Study</td>
</tr>
<tr>
<td>TC</td>
<td>Tropical Cyclone</td>
</tr>
<tr>
<td>The Area</td>
<td>The Wet Tropics of Queensland World Heritage Area</td>
</tr>
<tr>
<td>The Authority</td>
<td>The Wet Tropics Management Authority</td>
</tr>
<tr>
<td>The Plan</td>
<td>The <em>Wet Tropics Management Plan 1998</em></td>
</tr>
<tr>
<td>TKMG</td>
<td>Tree Kangaroo and Mammal Group</td>
</tr>
<tr>
<td>TREAT</td>
<td>Trees for the Evelyn and Atherton Tablelands</td>
</tr>
<tr>
<td>UNESCO</td>
<td>United Nations Educational, Scientific and Cultural Organisation</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
</tr>
<tr>
<td>VMA</td>
<td><em>Vegetation Management Act 1999</em></td>
</tr>
<tr>
<td>WONS</td>
<td>Weeds of National Significance</td>
</tr>
<tr>
<td>WTMA</td>
<td>Wet Tropics Management Authority</td>
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<tr>
<td>WTQWHA</td>
<td>Wet Tropics of Queensland World Heritage Area</td>
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INTRODUCTION

1. Overview

1.1 World Heritage listing

The Wet Tropics of Queensland World Heritage Area (WTQWHA, the Area) was inscribed on the World Heritage list in 1988. Of the 192 World Heritage properties listed for their natural values, the Wet Tropics is one of only 22 to fulfil all four natural World Heritage criteria and the necessary conditions of integrity. Under the current criteria, the Wet Tropics of Queensland is considered to:

- contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance – Criteria (vii).

- be an outstanding example representing the major stages of Earth’s history, including the record of life, and significant ongoing geological processes in the development of landforms, or significant geomorphic or physiographic features – Criteria (viii).

- be an outstanding example representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals – Criteria (ix).

- contain the most important and significant 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 – Criteria (x).

In May 2007 the WTQWHA was also listed on the National Heritage List on the basis that it possesses outstanding heritage value to the nation because of:

- the place’s importance in the course, or pattern, of Australia’s natural or cultural history – Criteria (a).

- the place’s possession of uncommon, rare or endangered aspects of Australia’s natural or cultural history – Criteria (b).

- the place’s potential to yield information that will contribute to an understanding of Australia’s natural or cultural history – Criteria (c).

- the place’s importance in demonstrating the principal characteristics of (i) a class of Australia’s natural or cultural places; or (ii) a class of Australia’s natural or cultural environments – Criteria (d).

- the place’s importance in exhibiting particular aesthetic characteristics valued by a community or cultural group – Criteria (e).
1.2 Condition of the World Heritage Area

In 2003 the Wet Tropics Management Authority (the Authority, WTMA) produced a Periodic Report [1] for the United Nations Educational, Scientific and Cultural Organisation (UNESCO). The report concluded that the overall integrity of the Area had been maintained since listing. A wide range of management responses are still being undertaken to enhance the Area’s integrity and condition in the long-term:

- Natural processes are being relied on to gradually reinstate ecosystem composition, structure and function in previously logged forests. Many disturbed areas have significantly rehabilitated in the 19 years since World Heritage listing. The extent of cleared areas and vehicle tracks has been significantly reduced, as has the amount of internal habitat fragmentation within the Area. This has resulted in a general enhancement of the integrity of the Area.

- Systematic fire planning and management of the open forests and woodlands within the Area is progressing on a more rigorous and scientific basis than at listing. Further monitoring of ecologically appropriate fire regimes will gradually improve fire management in a range of vegetation communities.

- Rare and threatened species are afforded a higher level of protection than at listing. However, the implementation of species recovery plans and ecosystem repair activities are not being adequately resourced as yet.

- Since listing there has been a very significant increase in conversion of parcels of land to tenures that offer greater protection and are unencumbered by leases or other use rights.

- Significant advances and improvements in the design, construction and maintenance standards for infrastructure within the Area have occurred since listing.

**Key pressures**

Although many sound conservation activities, programs and policies are now in place, there remains a number of long standing key pressures that still prevail within the region and adversely affect the condition of the Area:

- Climate change is emerging as a major threat to the condition of the Area and the survival of a large proportion of the Area's unique biota. Temperature increases have the potential to dramatically limit the range of biota presently confined to cooler, higher altitude parts of the region. Climate change could also alter rainfall patterns, fire regimes and the frequency of extreme events such as cyclones and droughts.

- Regional population growth, urban sprawl and changing land uses outside the Area are causing increased demand for new water supplies, road upgrades, electricity supplies and waste disposal. It will be a significant
challenge to meet the growing demand for water while maintaining ecological systems, environmental water flows and water quality.

- Vegetation clearing and fragmentation of natural habitats outside the Area have the potential to adversely affect the ecological functioning of the Area by severing ecological connectivity, altering hydrological and fire regimes and increasing invasions by feral animal pests and environmental weeds.

- Invasive pests, such as diseases, plants and animals, are more prevalent now than at listing and their impact more pervasive.

- Internal fragmentation of large blocks of rainforest by cleared powerline corridors and road easements remains a threat within the Area.

- A large portion of the Area was dramatically affected by Tropical Cyclone Larry (TC Larry) on 20 March 2006. TC Larry caused significant damage to a 200km wide section of the Area between Cairns and Cardwell and inland to the Atherton Tablelands. In some areas the rainforest canopy has been largely destroyed and will take many years to recover. In the most devastated areas regeneration will be dominated by the germination of pioneer species and fast growing vines. Increased sunlight on the forest floor will also promote the growth of weeds in previously shaded areas. Many smaller, isolated rainforest patches and riparian vegetation strips are unlikely to recover without active rehabilitation and weed control.
1.3 Role of the World Heritage Area in the life of the community

Trends since World Heritage listing
Since listing there have been marked improvements in community awareness about the Area and the benefits it provides. Community participation in management of the Area has also prospered. In particular:

- Community attitudes surveys have shown a significant increase in support for the listing and the management of the Area.

- A wide range of educational materials about the Area are now readily available in formats such as booklets, CDs and websites. These include resources and activities developed specifically for use in schools as part of the Education Queensland school curriculum.

- Additional visitor facilities have been constructed to cater for the growing tourism industry. However, some presentation roads and management roads have been closed due to lack of funding for maintenance.

- There has been an increase in the participation of Aboriginal people and the broader community in management and conservation of the Area and surrounds.

Future activities
To further enhance the role of the Area in the life of the community, there is a need to:

- foster community participation and engagement in conservation of lands outside of the Area to enhance ecological connectivity and address the range of other threats to the Area

- undertake further economic, sociological and ecological research to demonstrate the benefits of the Area to the community

- promote Aboriginal participation in all aspects of World Heritage management

- seek additional funds and community contributions to maintain roads and visitor facilities.
2. Reporting framework

2.1 State of the Wet Tropics Report

Reporting on the state of the WTQWHA is an annual statutory requirement under section 63(1)(c) of Queensland’s *Wet Tropics World Heritage Protection and Management Act 1993* [2] and section 10 of the Commonwealth’s *Wet Tropics of Queensland World Heritage Area Conservation Act 1994* [3]. Section 63(1) of the Queensland Act states that the Authority must, within 3 months after the end of each financial year, give to the Minister and the Commonwealth a report on:

- the administration of the Queensland Act during the year
- financial statements for the year
- the state of the Area.

This annual State of Wet Tropics Report focuses primarily on management initiatives and responses to pressures during 2006-2007. Additional detail about the Authority’s activities can be found in the Annual Report 2006-2007. The Authority prepares a more comprehensive report on the conservation of the Area as part of its Periodic Report [1].
2.2 Periodic Report

Every six years the Authority is required to prepare a detailed Periodic Report on the state of conservation of the Area in accordance with Article 29 of the World Heritage Convention and the UNESCO World Heritage Centre’s *Operational Guidelines for the Implementation of the World Heritage Convention*. The Periodic Report serves four main purposes. It provides:

- an assessment of the application of the World Heritage Convention by the Authority
- an assessment as to whether the World Heritage values, as inscribed on the World Heritage List, are being maintained
- updated information about the Area and records the changing circumstances and state of conservation of the Area
- a mechanism for regional cooperation and exchange of information and experiences between different World Heritage properties.

The Authority prepared its first Periodic Report [1] in 2003, including a revision of the nomination dossier.
PART 2

The natural condition of the World Heritage Area

3. Tropical Cyclone Larry

Background

Tropical Cyclone Larry was the most powerful cyclone to hit Far North Queensland in many decades when it crossed the coast at Innisfail in March 2006. Strong winds from this unusually fast moving cyclone severely damaged both the natural and man-made environments of the coastal region between Cairns and Cardwell, including the Tablelands to the west.

Although cyclones are neither an unusual nor an unexpected event for the Wet Tropics, there were three features which set TC Larry apart:

- It was an extremely intense cyclone (category 4 to 5 with wind gusts over 285km/h).
- Its destructive winds penetrated far inland.
- The damage to rainforest areas was exacerbated due to previous severe damage by TC Winifred in 1984.

The destructive force of TC Larry can be gauged from the magnitude and extent of measured wind gusts. A wind gust of 293.7km/h (an Australian record) was measured about 10km outside of the cyclone’s eye on a cable car tower located 100m below the summit of Mt Bellenden Kerr [4]. Severe wind gusts persisted onto the Tablelands with gusts of 185km/h (category 3) recorded at the Ravenshoe wind farm [4].

Extensive expanses of natural forest within the Area suffered from severe branch pruning, a loss of canopy and a reduction in forest height through breakage of tree trunks. TC Larry also stripped trees of most of their leaves and fruit. Many hillsides, ridges and spurs displayed extensive leaf browning and subsequent leaf loss.

The rate of forest recovery has varied with the intensity of the damage; species composition; site conditions such as soil type, climate and elevation; and the extent of subsequent weed and native vine invasion. The potential for widespread invasion by *Miconia calvescens*, in particular, poses a major threat. Miconia has invaded and replaced large areas of rainforest in tropical islands such as Hawaii and Tahiti. In Tahiti this invasion accelerated dramatically after damage caused by cyclones.
After TC Larry  

Fifteen months later 

Garners Beach 

Henrietta Creek 

Liverpool Creek
TC Larry had a particularly devastating impact on fragmented landscapes surrounding the Area. Numerous narrow riparian strips of vegetation, many small remnant rainforest patches and a large number of rehabilitation plots remain severely damaged or destroyed.

The persistent rainfall following TC Larry rapidly stimulated the production of new leaf flushes. The loss of leaves from many trees and the increased light penetrating the damaged forests also stimulated many plants to flower and fruit. Many suppressed saplings and seedlings have undergone a growth spurt due to the increased light reaching the forest floor and the decreased competition for resources by the surrounding damaged trees. However, it will take many decades for large areas of damaged forest to achieve their previous height, biomass and structure. In the interim, these damaged forests are likely to be highly susceptible to further wind damage and other climatic stresses such as drought.

Figure 1. The path and category of Cyclone Larry.
Summary data

Infestations of miconia, siam weed and mikania vine are concentrated in the lowland rainforests around Innisfail which were the hardest hit by the cyclone. The widespread and massive disturbance caused by TC Larry and the subsequent movement of heavy equipment and vegetation debris during the clean-up operations provide ideal conditions for the rapid recruitment and spread of exotic species. These will require urgent ongoing attention and research over the coming years.

Management actions (2006-2007)

- A network of over 60 cassowary feeding stations was established by the Queensland Parks and Wildlife Service (QPWS) throughout cyclone affected coastal rainforests. The feeding stations are designed to feed starving cassowaries and to prevent cassowary interactions with people, cars and dogs in urban areas. By June 2007 about 50 feeding stations were still operating – 32 in the Tully/Mission Beach area and 18 in the Innisfail area. It is anticipated that many of these will be able to be closed down in the near future as food supplies recover.

- The QPWS Cassowary Rehabilitation Facility at Garners Beach was expanded to cope with sick and injured cassowaries. Since TC Larry 15 cassowaries (one adult, six sub-adults, and eight juveniles) have been taken into care. These figures include 13 birds at the Cassowary Rehabilitation Facility and two birds at Hartley’s Crocodile Adventures. Ten birds were released back into the wild with transmitters to track their movements.

- In September 2006 FNQ NRM Ltd held a ‘Lessons from Larry’ forum which identified the need to integrate environmental values into cyclone clean-up and recovery processes. FNQ NRM Ltd is now working with the Commonwealth, State and local governments to incorporate natural resource management into disaster management processes and funding arrangements (see 7.2 Community consultation).

- A research report by Dr Steve Turton and Dr Allan Dale in March 2007 [81] concluded that, while tropical cyclones were natural phenomena, it is critical to build landscape resilience to reduce the long-term ecological and social impacts of cyclones, particularly as global warming has the potential to increase the frequency and severity of cyclone impacts.

- Researchers, in collaboration with the Department of Natural Resources and Water (DNRW), have established a network of monitoring plots in cyclone affected areas and in ‘control’ areas to the south of the main impact area to address questions such as:
  - Do invasive species dominate regrowth of vegetation in heavily disturbed areas?
– Does proximity to existing weed infestations increase the invasion of weeds in heavily disturbed areas?

– Does the invasion of weeds in heavily disturbed areas alter the succession of rainforest habitat in the long-term?

• A concerted educational program and media campaign was launched during the clean-up and rebuilding operation to alert workers to the risk of spreading siam weed on vehicles and machinery.

• Tolga Bat Rescue and Research recorded a decrease in the number of spectacled flying foxes affected by tick paralysis and less orphans needed care. Due to the impacts of TC Larry in their mating season, many spectacled flying foxes were born up to five months later in the year.

• The Authority, in collaboration with the Department of Main Roads (DMR) and FNQ NRM Ltd, prepared ‘Keep the Trees, Please!’, a guide to cleaning up roads after a cyclone in the WTQWHA.

4. State of biodiversity

Biodiversity refers to the variety of plants, animals and micro-organisms in an area; the genetic differences among individuals; the communities, ecosystems and landscapes in which they occur and the variety of processes on which they depend. Descriptions of the state of biodiversity are a useful surrogate measure of the relative condition of the natural values for which the Area was listed.

Ecosystem diversity refers to the number of different habitat types or biological communities. Each community comprises an interdependent network of plants, animals and micro-organisms influenced by factors such as climate, soils and altitude.

Species diversity is the most commonly used measure of biodiversity. It refers to the number of species of plants, animals and micro-organisms in a given area.

Biodiversity has a number of distinguishing features:

• Biodiversity loss is irreversible. Once lost, a species is lost forever.

• Many species and their potential contributions to ecosystem function have yet to be discovered or understood.

• There are limits, or trigger points, to any ecological system’s ability to endure stress. If stressed beyond these limits, systems collapse or take a different form with losses or major changes to biodiversity.

• Disturbed ecosystems generally exhibit a lowered resilience to stresses such as climate change, cyclones, droughts, fires, pests and diseases.
The Wet Tropics has one of the highest levels of biological diversity of any region of Australia and is represented on ‘The Global 200 List’ [6] – a collection of the world’s 200 most outstanding, important and diverse terrestrial, freshwater and marine habitats. The World Conservation Monitoring Centre recognises 17 megadiverse countries which collectively harbour 75 percent of total global biological diversity [5].

4.1 Ecosystems at risk

*Background*

The Queensland Herbarium’s regional ecosystem framework forms the scientific basis of Queensland’s conservation planning, biodiversity management [7] and legislation and guidelines for vegetation management [8]. Regional ecosystems (REs) are communities of remnant vegetation that are consistently associated with a particular combination of geology, landform and soil within a bioregion. The Wet Tropics bioregion is divided into nine subregions (*Figure 2 and Figure 3*).

The Regional Ecosystem Description Database [9] lists the status of all regional ecosystems as gazetted under the *Vegetation Management Act 1999* (VMA) and their ‘biodiversity status’ as recognised by the Environmental Protection Agency (EPA). The conservation status of each regional ecosystem under the VMA is based on its current extent as a proportion of what once existed prior to clearing. The ‘biodiversity status’ of an RE also considers its condition, threats to the ecosystem and the rarity of the vegetation.
Under the VMA, regional ecosystems are classified as:

**Endangered**
- less than 10 percent of its pre-clearing extent remains in a bioregion, or
- 10-30 percent of its pre-clearing extent remains (if the area of remnant vegetation is less than 10,000ha).

**Of concern**
- 10-30 percent of its pre-clearing extent remains in the bioregion, or
- more than 30 percent of its pre-clearing extent remains (if the area of remnant vegetation is less than 10,000ha).
**Not of concern**

- more than 30 percent of its pre-clearing extent remains and the area of remnant vegetation is more than 10,000ha.

In addition to the VMA, regional ecosystems are now used for biodiversity planning and assessment throughout Queensland, including guidelines for clearing on leasehold lands under the *Land Act 1994* and the preparation of local government planning schemes.

There is also a more detailed source of information about ecosystems and vegetation for the Wet Tropics. Peter and David Stanton and the Authority have almost completed vegetation mapping at a scale of 1:50,000 for the entire Wet Tropics bioregion, funded by the Australian Government [13]. The Stantons interpreted over 4,000 aerial photographs and undertook numerous field trips to provide the primary mapping data for 53 map sheets and recommendations for conservation management of specific areas. The Authority digitised some 90,000 vegetation polygons, including a description of their condition and conservation values. The mapping data was also used by the Queensland Herbarium as the main data source for derivation of the certified Regional Ecosystem mapping for the bioregion.

**Summary data**

Although being Queensland’s third smallest bioregion, the Wet Tropics has a very high diversity of REs and a disproportionately large percentage have an ‘endangered’ or ‘of concern’ conservation status [9] (*Table 1* and *Table 2*). Most ‘endangered’ REs have attained their status due to agricultural land clearing outside of the Area and most also have naturally restricted distributions. REs classified as ‘of concern’ include once widespread types that have been extensively developed for agriculture, as well as some open forest systems that are rapidly changing structure and floristic composition due to altered fire regimes. However, a large proportion are designated as ‘of concern’ due to their naturally restricted distribution and small spatial extent of less than 10,000ha [10].

Although recent legislation and government policy has significantly increased the level of protection for ‘endangered’ and ‘of concern’ regional ecosystems, these initiatives have not improved their condition. Ecosystems still remain highly fragmented. Pressure on these areas is increasing due to...
surrounding land clearing and other threatening processes, particularly on the coastal lowlands.

Mabi forest (RE 7.8.3) on the Atherton Tablelands is recognised as an endangered ‘ecological community’ under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A draft Recovery Plan has been completed and restoration plantings have been initiated.

Of the 18 VMA endangered REs (Table 3), 15 occur on the coastal alluvial plain. Four are rainforests, eight open forest and woodlands (sclerophyll forests) and three are non-woody wetlands. Of the three upland endangered REs, two are rainforests (one on basalt, one on alluvia) and one is an open sclerophyll forest on basalt.

In the Wet Tropics many more REs are considered ‘endangered’ under the biodiversity status than under the VMA conservation status (Table 4). This demonstrates the importance of taking into account the condition and rarity of vegetation and the prevailing threats. It also indicates that many REs considered ‘endangered’ using the ‘biodiversity status’ are not as well protected under the VMA.

**Table 1.** Summary of the VMA conservation status of Queensland’s bioregional ecosystems

<table>
<thead>
<tr>
<th>Bioregion</th>
<th>Area ('000 ha)</th>
<th>No. Regional ecosystems</th>
<th>Endangered Ecosystems</th>
<th>Of concern Ecosystems</th>
</tr>
</thead>
<tbody>
<tr>
<td>New England Tableland</td>
<td>341</td>
<td>25</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Central Queensland Coast</td>
<td>1,151</td>
<td>75</td>
<td>9</td>
<td>43</td>
</tr>
<tr>
<td>Wet Tropics</td>
<td>1,850</td>
<td>185</td>
<td>18</td>
<td>134</td>
</tr>
<tr>
<td>Desert Uplands</td>
<td>6,882</td>
<td>77</td>
<td>2</td>
<td>26</td>
</tr>
<tr>
<td>Northwest Highlands</td>
<td>6,950</td>
<td>43</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Southeast Queensland</td>
<td>8,231</td>
<td>151</td>
<td>22</td>
<td>75</td>
</tr>
<tr>
<td>Cape York Peninsula</td>
<td>11,548</td>
<td>222</td>
<td>1</td>
<td>97</td>
</tr>
<tr>
<td>Einasleigh Uplands</td>
<td>12,808</td>
<td>142</td>
<td>0</td>
<td>36</td>
</tr>
<tr>
<td>Mulga Lands</td>
<td>19,097</td>
<td>65</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Gulf Plains</td>
<td>21,377</td>
<td>84</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>Mitchell Grass Downs</td>
<td>22,787</td>
<td>54</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Channel Country</td>
<td>24,594</td>
<td>56</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Brigalow Belt</td>
<td>35,158</td>
<td>172</td>
<td>26</td>
<td>55</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>172,774</strong></td>
<td><strong>1351</strong></td>
<td><strong>92</strong></td>
<td><strong>516</strong></td>
</tr>
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</table>
Table 2. Wet Tropics subregions and their level of representation within the WTQWHA

<table>
<thead>
<tr>
<th>Subregion</th>
<th>Area ('000 ha)</th>
<th>Area in WHA ('000 ha)</th>
<th>% representation in WHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herbert</td>
<td>220</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Tully</td>
<td>144</td>
<td>29</td>
<td>20</td>
</tr>
<tr>
<td>Innisfail</td>
<td>199</td>
<td>43</td>
<td>22</td>
</tr>
<tr>
<td>Atherton</td>
<td>168</td>
<td>38</td>
<td>23</td>
</tr>
<tr>
<td>Paluma/Seaview</td>
<td>247</td>
<td>100</td>
<td>40</td>
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<tr>
<td>Kirrama/Hinchinbrook</td>
<td>268</td>
<td>157</td>
<td>59</td>
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<tr>
<td>Bellenden Ker/Lamb</td>
<td>255</td>
<td>206</td>
<td>81</td>
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<td>Macalister</td>
<td>116</td>
<td>54</td>
<td>47</td>
</tr>
<tr>
<td>Daintree/Bloomfield</td>
<td>359</td>
<td>257</td>
<td>72</td>
</tr>
<tr>
<td>Total</td>
<td>1,976</td>
<td>894</td>
<td>45</td>
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</table>

Table 3. Subregional distribution of endangered, of concern and no concern regional ecosystems as per the VMA [9].

<table>
<thead>
<tr>
<th>Subregion</th>
<th>Endangered</th>
<th>Of concern</th>
<th>No concern</th>
<th>Number of REs in subregion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herbert</td>
<td>10</td>
<td>34</td>
<td>11</td>
<td>55</td>
</tr>
<tr>
<td>Tully</td>
<td>8</td>
<td>30</td>
<td>6</td>
<td>44</td>
</tr>
<tr>
<td>Innisfail</td>
<td>9</td>
<td>43</td>
<td>9</td>
<td>61</td>
</tr>
<tr>
<td>Atherton</td>
<td>3</td>
<td>28</td>
<td>12</td>
<td>43</td>
</tr>
<tr>
<td>Paluma/Seaview</td>
<td>0</td>
<td>30</td>
<td>13</td>
<td>43</td>
</tr>
<tr>
<td>Kirrama/Hinchinbrook</td>
<td>1</td>
<td>44</td>
<td>16</td>
<td>61</td>
</tr>
<tr>
<td>Bellenden Ker/Lamb</td>
<td>1</td>
<td>47</td>
<td>14</td>
<td>62</td>
</tr>
<tr>
<td>Macalister</td>
<td>2</td>
<td>34</td>
<td>7</td>
<td>43</td>
</tr>
<tr>
<td>Daintree/Bloomfield</td>
<td>7</td>
<td>70</td>
<td>21</td>
<td>98</td>
</tr>
</tbody>
</table>

Table 4. Conservation status of Wet Tropics regional ecosystems [9]

<table>
<thead>
<tr>
<th>Conservation status</th>
<th>VMA</th>
<th>EPA Biodiversity status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endangered</td>
<td>18</td>
<td>79</td>
</tr>
<tr>
<td>Of concern</td>
<td>134</td>
<td>87</td>
</tr>
<tr>
<td>Not of concern</td>
<td>33</td>
<td>19</td>
</tr>
<tr>
<td>Total</td>
<td>185</td>
<td>185</td>
</tr>
</tbody>
</table>
Management actions (2006-2007)

- The State Policy for Vegetation Management [11] details principles for vegetation management and how specified outcomes will be achieved. Applications to clear are also assessed against vegetation management codes [12]. In November 2006 four new regional vegetation management codes came into effect: 1) Brigalow Belt and New England Tablelands bioregions; 2) Coastal bioregions; 3) Southeast Queensland bioregion; and 4) Western bioregions. These codes replaced the 24 codes that had been in use since the introduction of the vegetation management framework in 2004. The Wet Tropics falls within the Coastal bioregions area.

- The Vegetation Management and Other Legislation Amendment Act 2004 phased out broad-scale clearing of remnant vegetation by December 2006. Vegetation in urban areas is protected on freehold land if it is ‘endangered’, and on leasehold land if it is ‘endangered’ or ‘of concern’.

- The Authority’s vegetation mapping program [13] is being finalised. Staff developed an innovative hierarchical vegetation framework to classify the 250 vegetation communities of the Wet Tropics vegetation mapping. This will allow the data to be used at different scales and complexities according to the user’s needs. A hierarchy of colours was also developed to suit mapping of the vegetation communities. The development of a web-based mapping program is underway to make the vegetation mapping readily accessible to planners, scientists and the general public.

4.2 Species at risk

Background

Each native plant and animal is a unique and valuable part of the region’s biodiversity. However, some species have declined in numbers to the extent that they are now threatened with extinction or are currently considered extinct.

State-listed rare and threatened species [14] are afforded statutory protection under the Nature Conservation Act 1992 (NCA) [15] while the EPBC Act lists those species considered threatened at a national level. Threatened species encompass the categories of ‘presumed extinct’, ‘endangered’ and ‘vulnerable’. A species is designated as ‘vulnerable’ when there is strong evidence that it faces a high risk of extinction in the medium term, and ‘endangered’ if it faces a very high risk of extinction in the near future. A species is classed as ‘presumed extinct’ if there is no reasonable
doubt that the last member of the species has died. Rare species are not presently considered threatened, but include species with small geographic ranges or low local abundances, patchily distributed within their ranges. Because of these attributes, rare species are at greater inherent risk of becoming threatened and, as a result, are often a primary focus of conservation planning and monitoring, even when no obvious threats to their survival are currently apparent.

Although the number of species considered ‘at risk’ is only a small part of the region’s overall biological diversity, a decline in these species threatens ecological processes and can point to a wider decline in biodiversity. While representing only one percent of the land area of Queensland, the Wet Tropics bioregion has the highest number of species considered to be ‘at risk’ of any bioregion in Queensland. Therefore, the WTQWHA is very important for the conservation of many of the listed species.

Threatened species lists have many purposes and can be utilised to:

- inform and influence conservation policies and legislation
- stimulate research and monitoring programs
- set priorities for the allocation of conservation resources and threat management
- inform decisions about development
- target geographical areas for conservation planning
- increase public awareness of human impacts on biodiversity
- monitor the status of biodiversity and report on the state of the environment.

Summary data

The tables below detail the species listed under the NCA and the EPBC Act and their conservation status.

Table 5a. Fauna: species diversity and numbers at risk.

<table>
<thead>
<tr>
<th>Status</th>
<th>Freshwater fish</th>
<th>Amphibians</th>
<th>Reptiles</th>
<th>Birds</th>
<th>Mammals</th>
<th>Insects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NCA</td>
<td>EPBC</td>
<td>NCA</td>
<td>EPBC</td>
<td>NCA</td>
<td>EPBC</td>
</tr>
<tr>
<td>Extinct</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Endangered</td>
<td>0</td>
<td>1</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Vulnerable</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Rare</td>
<td>0</td>
<td>-</td>
<td>11</td>
<td>-</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td>Common</td>
<td>0²</td>
<td>-</td>
<td>35</td>
<td>-</td>
<td>137</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>1</td>
<td>56</td>
<td>8</td>
<td>159</td>
<td>6</td>
</tr>
</tbody>
</table>
The only freshwater fish and insects recognised as wildlife under the NCA are those specifically listed as extinct, endangered, vulnerable, rare or common in the Nature Conservation (Wildlife) Regulation 1994.

Although there are no fish listed as common wildlife in the Wet Tropics, a detailed inventory has been undertaken by Pusey et al [16] who have identified 80 species.

Table 5b. Vascular plants (spore-bearing): species diversity and numbers at risk.

<table>
<thead>
<tr>
<th>Status</th>
<th>True ferns</th>
<th>Fern allies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>True ferns</td>
<td>Fern allies</td>
</tr>
<tr>
<td></td>
<td>NCA  EPBC</td>
<td>NCA  EPBC</td>
</tr>
<tr>
<td>Extinct</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Endangered</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Vulnerable</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Rare</td>
<td>28</td>
<td>-</td>
</tr>
<tr>
<td>Common</td>
<td>228</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>274</td>
<td>16</td>
</tr>
</tbody>
</table>

Table 5c. Vascular plants (seed-bearing): species diversity and numbers at risk.

<table>
<thead>
<tr>
<th>Status</th>
<th>Non-flowering plants</th>
<th>Flowering plants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cycads</td>
<td>Conifers</td>
</tr>
<tr>
<td></td>
<td>NCA  EPBC</td>
<td>NCA  EPBC</td>
</tr>
<tr>
<td>Extinct</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Endangered</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Vulnerable</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Rare</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Common</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>14</td>
</tr>
</tbody>
</table>

Table 5d. Non-vascular plants and fungi: species diversity and numbers at risk.

<table>
<thead>
<tr>
<th>Status</th>
<th>Bryophytes</th>
<th>Fungi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mosses</td>
<td>Liverworts</td>
</tr>
<tr>
<td></td>
<td>NCA  EPBC</td>
<td>NCA  EPBC</td>
</tr>
<tr>
<td>Extinct</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Endangered</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Vulnerable</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Rare</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Common</td>
<td>173</td>
<td>93</td>
</tr>
<tr>
<td>Total</td>
<td>173</td>
<td>93</td>
</tr>
</tbody>
</table>
Table 5e. Protista: species diversity and numbers at risk.

<table>
<thead>
<tr>
<th>Status</th>
<th>Green algae</th>
<th>Red algae</th>
<th>Brown algae</th>
<th>Slime molds</th>
<th>Blue-green algae</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NCA EPBC</td>
<td>NCA EPBC</td>
<td>NCA EPBC</td>
<td>NCA EPBC</td>
<td>NCA EPBC</td>
</tr>
<tr>
<td>Extinct</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>Endangered</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>Vulnerable</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>Rare</td>
<td>0 -</td>
<td>0 -</td>
<td>0 -</td>
<td>0 -</td>
<td>0 -</td>
</tr>
<tr>
<td>Common</td>
<td>60 89 -</td>
<td>25 -</td>
<td>1 -</td>
<td>41 -</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>60 0 89 25 1 41</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6a. Rare and threatened species listed in schedules of the NCA.

<table>
<thead>
<tr>
<th>Group</th>
<th>Rare &amp; threatened category</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extinct</td>
<td>Endangered</td>
</tr>
<tr>
<td>Wet Tropics animals</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Wet Tropics plants</td>
<td>20</td>
<td>39</td>
</tr>
<tr>
<td>Queensland animals</td>
<td>7</td>
<td>58</td>
</tr>
<tr>
<td>Queensland plants</td>
<td>27</td>
<td>151</td>
</tr>
<tr>
<td>Wet Tropics animals</td>
<td>0%</td>
<td>36%</td>
</tr>
<tr>
<td>as a percent of Queensland’s total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet Tropics plants</td>
<td>74%</td>
<td>26%</td>
</tr>
<tr>
<td>as a percent of Queensland’s total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6b. Wet Tropics species listed as threatened in schedules of the EPBC Act.

<table>
<thead>
<tr>
<th>Group</th>
<th>Threatened category</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extinct</td>
<td>Endangered</td>
</tr>
<tr>
<td>Animals</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Plants</td>
<td>13</td>
<td>24</td>
</tr>
</tbody>
</table>

Endangered animals (Table 6a) include seven frog species, seven mammals and seven birds. A further 26 vertebrate species and one invertebrate species are classified as vulnerable [14].

The high proportion of presumed extinct, endangered and vulnerable plants found in the Wet Tropics, compared to the rest of Queensland (Table 6a), reflects the
vulnerability, small population size and restricted distribution of many of the region’s locally endemic plants and the pattern and legacy of past forest clearing.

The decline and disappearance of the region’s frog populations has been catastrophic. Several regionally endemic, upland stream dwelling frogs have not been found for several years. The primary cause of these mass frog mortalities has been attributed to chytrid fungus disease which is widespread throughout the bioregion. A range of other amphibian diseases also appear to be affecting the region’s frogs (see 5.7 Pathogens).

Declines in the region’s adult cassowary population, estimated to be between 900 and 1200 birds, continue due to the cumulative effects of lowland habitat clearing and mortality caused by collisions with vehicles. Cassowary fatalities in the Mission Beach region and the Daintree lowlands are of particular concern. Stress, disease and dog attacks may also contribute to cassowary deaths. These factors were significantly heightened following the devastation caused to significant sections of cassowary habitat as a result of TC Larry.

Recovery plans are presently in place, or are being reviewed, for eight frog species [17] [18], the northern bettong [19], the mahogany glider [20], the southern cassowary [21] and cave-dwelling bats [22]. No systematic recovery planning for any plant species has been undertaken despite the high number of recent plant extinctions which have occurred in the Wet Tropics.

**Management actions (2006-2007)**

- Under the NCA all listed native wildlife is protected. In 2006-2007 EPA endorsed a policy to amend the NCA to incorporate new categories of protected species in Queensland. These new categories will be developed over the next five years. They will align the Queensland classification more closely with that of the World Conservation Union (IUCN) and will provide greater consistency in signifying level of risk. The new categories are: rare (which will be phased out by 2010), extinct in the wild, endangered, vulnerable, near-threatened and ‘of least concern’. Species listed as common will become listed as ‘of least concern’. Species currently listed as rare will be reassessed to determine which of the new categories most adequately describe their status.

- Revised recovery plans for the cassowary and mahogany glider have now been completed by QPWS and await endorsement. The Northern Bettong Recovery Plan is in the process of revision. Draft recovery plans have been prepared for the spotted-tailed quoll, spectacled flying fox and the filmy
fern *Chingia australis* but have yet to be endorsed. QPWS is in the process of compiling a draft Recovery Plan for the Wet Tropics population of the yellow-bellied glider.

- Wildlife Queensland visited Cardwell in May 2007 to expand the activities of its Queensland Glider Network into mahogany glider territory. Activities included the installation of timber nesting boxes, distribution by landholders of tube-stock of tree species preferred by mahogany gliders, talks to primary schools and distribution of a Mahogany Glider Education Kit.

- QPWS monitored populations of the endangered mahogany glider and northern bettong. There is significant concern over bettong numbers on Paluma Range and a need for additional investigation.

- In 2005-2006 the Australian Rainforest Foundation (ARF) commissioned a study to design a feasible north-south coastal cassowary corridor network between Cairns and Cardwell [23]. In 2006-2007 the report was used to inform a range of regional planning initiatives. These included mapping for the Department of the Environment and Water Resources (DEW) to help assess development referrals under the EPBC Act; and mapping of wildlife corridors for the Far North Queensland 2025 Statutory Regional Plan (FNQ 2025).

- Through the Marine and Tropical Science Research Facility (MTSRF), a research program was established to assess the condition of threatened species and look at ways to mitigate threats. The program decided to focus on cassowaries and arboreal mammals and the rare and threatened species and ecosystems of the coastal lowlands, particularly around...
the Tully, Murray and Hull River catchments. Climate change data will be factored into threat assessments.

- QPWS verified 31 cassowary deaths after TC Larry to June 2007. There were 15 deaths in the Innisfail area (one juvenile, six sub-adults, eight adults), 11 in Mission Beach (one chick, one juvenile, seven sub-adults, two adults) and five in the Tully area (two sub-adults, three adults). Causes of death were 18 vehicle strikes, 6 dog attacks, an injury sustained from a fight with another cassowary, one from malnutrition and five unknown cases. The number of cassowary deaths was substantially greater than in previous years, but it is uncertain how many deaths can be directly attributed to the impacts of the cyclone.

4.3 Land tenure within the World Heritage Area

Background

The WTQWHA includes within its 3,125km boundary about 740 separate parcels of land comprising a variety of land tenures including National Park, Forest Reserve, State Forest, Timber Reserve, Unallocated State Land, Leasehold and Freehold. A corresponding range of government agencies and private landholders have responsibilities for managing these tenures under a range of legislation. The Wet Tropics Management Plan 1998 (the Plan) [24] regulates activities in the Area across all tenures.

Summary data

Since November 2000 State Forests and Timber Reserves in the Wet Tropics have been progressively transferred to protected area tenures under the NCA. Areas affected by the tenure transfer process extend from Mt Windsor in the north to Townsville in the south. Parts of some Forest Reserves, such as Mount Windsor Forest Reserve, are located outside the Area’s boundary but were included in the transfer process due to their high conservation values.

The increase in National Parks within the Area since listing has been significant. At the time of listing (December 1988) only 14 percent of the Area was National Park compared to 64 percent at present (Table 7, Figure 4).
Table 7. Proportional trends in land tenure in the WTQWHA.

<table>
<thead>
<tr>
<th>Tenure</th>
<th>Percentage of WTQWHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Park</td>
<td>28</td>
</tr>
<tr>
<td>Forest Reserve</td>
<td></td>
</tr>
<tr>
<td>State Forest</td>
<td>38</td>
</tr>
<tr>
<td>Timber Reserve</td>
<td>8</td>
</tr>
<tr>
<td>Various reserves and dams</td>
<td>1</td>
</tr>
<tr>
<td>Unallocated State Land</td>
<td>7</td>
</tr>
<tr>
<td>Leasehold*</td>
<td>15</td>
</tr>
<tr>
<td>Freehold and similar</td>
<td>2</td>
</tr>
<tr>
<td>Others (rivers, roads, esplanades etc.)</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

*Leasehold includes leases over a variety of base tenures including National Park, Timber Reserve, Forest Reserve and State Forest. Where a lease has been issued over a base tenure, the area of the lease has been subtracted from the base tenure. If only base tenures are considered, the proportional representation of National Park is increased to 68.2%, Forest Reserve to 5.5% and Timber Reserve to 10.4%.

Figure 4. Relative proportions of different land tenure types within the WTQWHA.

Management actions (2006-2007)

- In June 2006 the Douglas Shire Council finalised its planning scheme. The scheme identified the areas in the coastal Daintree lowlands, outside the Area, that were important to conserve. The Queensland Government is providing a further $10M to compensate landowners not allowed to build, taking the Queensland Government’s commitment to the Daintree land
buy-back to $15M. Since 2004 the Queensland Government has spent $8.5M to buy 135 blocks.

- Indigenous Land Use Agreements (ILUAs) were signed with the Eastern Kuku Yalanji people in April 2007 to cooperatively manage their traditional lands in the Mossman, Daintree and Bloomfield River catchments. The agreements recognise the native title rights of the Kuku Yalanji people. They provide for Aboriginal land ownership and living areas, some grazing areas, conservation areas and public access to designated tourist sites. When final gazettal occurs, the agreements will result in a tenure reconfiguration incorporating: Aboriginal Freehold, Freehold, National Park, and various leases and reserves.

5. Pressures

There are a wide range of processes which may threaten the biodiversity and aesthetic values of the Wet Tropics. Direct threats to the WHA are the cause of environmental changes which directly reduce the capacity of ecosystems and species to survive. Underlying threats may create demands for resources or act as vectors for more direct threats to the Area’s values. The majority of threats to the Area originate outside its boundaries.

Table 8. Examples of underlying and direct threats to the WTQWHA.

<table>
<thead>
<tr>
<th>Underlying threats</th>
<th>Direct threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Climate change</td>
<td>• Vegetation clearing</td>
</tr>
<tr>
<td>• Regional population growth</td>
<td>• Infrastructure and habitat fragmentation</td>
</tr>
<tr>
<td>• Urban development and pollution</td>
<td>• Weeds</td>
</tr>
<tr>
<td>• Demand for community infrastructure (roads, water supplies and electricity)</td>
<td>• Feral animals</td>
</tr>
<tr>
<td>• Unsustainable farming practices</td>
<td>• Pathogens</td>
</tr>
<tr>
<td>• Unsustainable tourism and recreation</td>
<td>• Altered fire regimes</td>
</tr>
<tr>
<td></td>
<td>• Altered aquatic systems</td>
</tr>
</tbody>
</table>
The Organisation for Economic and Cooperative Development [25] promotes the use of markets and economic incentives to conserve biodiversity, pointing out that, in the long-term, it is more effective to deal with the underlying threats than focus solely on the direct threats.

### 5.1 Climate change

**Background**

It is now generally acknowledged that climate change and its associated impacts will become a major challenge of the 21st century. Climate change is defined in Article 1 (2) of the United Nations Framework Convention on Climate Change (UNFCCC), as ‘a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is, in addition to natural climate variability, observed over comparable periods of time’ [26]. The adverse effects of climate change, as defined in Article 1 (1) of the UNFCCC, are ‘changes in the physical environment or biota resulting from climate change which have significant deleterious effects on the composition, resilience or productivity of natural and managed ecosystems or on the operation of socioeconomic systems or on human health and welfare’ [26].

As climate warms, the preferred climatic conditions for a species are likely to shift to higher altitudes. A species’ survival may depend on both its ability to relocate and on the availability and accessibility of alternative areas with suitable habitat. Urban development, agriculture and infrastructure corridors, such as powerline clearings and highways, all act as barriers to prevent the movement of many species to more favourable areas. Those rainforest species that are dependent on canopy cover and will not cross open areas will be especially vulnerable to the effects of such landscape fragmentation. Computer simulations suggest one of the first consequences of climate change will be that cloud bands on tropical mountains will shift upwards by hundreds of metres during the dry season [27]. Upland sites of endemism, dependant upon the cloud environment, are likely to be particularly susceptible to climate change effects in the near future [28].

Keystone elements of the Area’s World Heritage values, such as biodiversity and locally endemic and spatially restricted species, are predicted to be under severe pressure over the coming decades due to both the escalating rate of climate change and the associated increase in frequency of severe climatic events such as cyclones, floods and droughts.

**Summary data**

The effects of climate change, particularly with respect to increases in extreme El Niño-like weather conditions, have been more evident since listing. The community’s awareness of climate change and its potential impacts has increased significantly over the past year. The Authority’s Conservation Strategy [29] outlines a range of management, policy, research and educational priorities relevant to this emerging issue.
Global warming has the potential to decrease the available habitat for many endemic species adapted to the cooler wet upland and montane rainforests [30]. The Rainforest Cooperative Research Centre (CRC) [31] identified seven frog species, five mammal species, three bird species and three skink species likely to lose over half their present core habitat with only a 1°C temperature increase. Increased carbon dioxide levels are predicted to reduce the nutritional value, increase the toughness and reduce the digestibility of foliage that many vertebrate and invertebrate animals rely on. Seasonal changes may affect plant reproduction cues and fire regimes and increase the vulnerability of ecosystems to invasion by feral animals, weeds and pathogens.

Based on current trends, it is predicted that by 2100 coastal north-east Queensland, including the Wet Tropics, will be warmer by 1.4 to 5.8°C. Rainfall may vary from plus four percent to minus ten percent per degree of warming, depending on location [32]. Current computer modelling simulations (Figure 5) predict the loss of up to 66 percent of all the Area’s locally endemic vertebrate species over the next 50 to 100 years as a consequence of the current trends in climate change [30]. The impacts of internal habitat fragmentation as barriers to movement and migration are expected to exacerbate this impact, as well as accelerating pest invasions and increasing the risk of fire.

**Figure 5.** Geographic pattern of species richness of regionally endemic rainforest vertebrates at varying temperature scenarios predicted to 2100 [30].
Management actions (2006-2007)

- The Queensland Climate Change Centre of Excellence (QCCCE) was established in 2007 as a specialist unit within the DNRW. The QCCCE will bring together the expertise of staff from DNRW, EPA and the Department of Primary Industry and Fisheries (DPIF).

- The Queensland Government released its ClimateSmart Adaptation 2007-2012 Strategy in June 2007. The strategy seeks to educate the community about climate change and encourage government and business to reduce greenhouse gas emissions and consider the potential impacts of climate change when making decisions. The strategy is being implemented by the QCCCE. It includes 62 actions, focusing on seven priority sectors – water planning and services; agriculture; human settlements; natural environment and landscapes; emergency services and human health; tourism, business and industry; and finance and insurance.

- The North Queensland Climate Alliance was formed to raise community awareness and reduce local greenhouse gas emissions. The Alliance is made up of numerous government agencies, research organisations, businesses and community groups. Several climate change workshops and public lectures were held by conservation groups, academics and government agencies.

- In 2006 a climate change research program was established within the MTSRF. The research program is working to refine predictive models to a regional level and use these models to provide a better idea of the impacts of climate change on:
  - Wet Tropics rainforest ecosystems
  - trees, soils and insects and their roles in ecosystems
  - threats to ecosystem processes
  - biodiversity of the rainforests.

- JCU in Townsville has established a Centre for Tropical Biodiversity and Climate Change Research which is focusing its efforts on climate change impacts on the biota of the Wet Tropics. In the past year researchers collated new data layers and began monitoring at 28 sites at a range of elevations and latitudes. Researchers also developed a new generation of species distribution maps and biodiversity maps using the Maxent model. The Centre is funded through the JCU Research Advancement Program and supported by MTSRF and the Queensland Government.
5.2 Regional growth and development

Background

The Wet Tropics is the most populated region in tropical Australia [33]. People are concentrated in Cairns, Townsville, smaller coastal towns, and the closely settled farming areas of the Atherton Tableland – all within 50km of the Area. The ‘urban sprawl’ is now spreading rapidly as Cairns and Townsville expand along the coast and other coastal townships such as Mission Beach are developed. Urban development is also occurring on the Tablelands in places such as the ‘villages’ of Kuranda and Yungaburra.

A number of the areas undergoing rapid urban development are identified in the Far North Queensland Regional Plan [37] as priority biodiversity areas. These include the Daintree-Cape Tribulation coastal strip, Mission Beach and Kuranda. The number of rural landholders on small holdings has increased greatly in the region, particularly in the ‘sea change’ and ‘tree change’ areas such as Mission Beach and the Atherton Tableland [34, 35].

Development associated with a rapidly increasing regional population is leading to subsequent increases in demand for energy supplies, telecommunication facilities, and the upgrading of transport corridors and water supplies.

Summary data

The FNQ region’s population at 30 June 2006 was 220,219. The population of the Far North Queensland (FNQ) region grew by 4,500 people in 2006, compared with an annual average of 3,700 between 2001 and 2006 [39]. By 2016 it is predicted that the FNQ population will increase to 263,890 people [38].
Cairns City had the largest annual population change of any local government area in Queensland outside south-east Queensland in the year to June 2004, growing by 2,800 people to 125,000 people [38]. The estimated resident population of Cairns City at 30 June 2006 was 136,558 people, an increase of 7,892 people or 6.1 percent over the year. This compares with an increase of 3,339 people or 2.7 percent in the year to June 2005 [83]. Projections indicate that by 2026 the population is expected to reach between 166,000 and 207,700 people [82].

Johnstone Shire’s population decreased by 507 people (2.6 percent) and Eacham Shire decreased by 93 people (1.5 percent) – the two greatest percentage decreases in population of Local Government Areas in Queensland to June 2006 [39].

Dwelling approvals in Cairns City numbered 1,574 in 2006 compared to 1,549 approvals in 2005 [82].

**Table 9.** Cairns City and its contribution to the total regional population.

<table>
<thead>
<tr>
<th></th>
<th>Population at 30 June</th>
<th>Share 2006</th>
<th>Average annual population change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cairns City</td>
<td>106,694</td>
<td>112,932</td>
<td>127,856</td>
</tr>
<tr>
<td>Balance of Region</td>
<td>85,299</td>
<td>88,730</td>
<td>92,363</td>
</tr>
<tr>
<td>Total</td>
<td>191,993</td>
<td>201,662</td>
<td>220,219</td>
</tr>
</tbody>
</table>

**Management actions (2006-2007)**

- The Department of Local Government, Planning, Sport and Recreation (DLGPSR) began to prepare the Far North Queensland 2025 Statutory Regional Plan (FNQ 2025). The Queensland Government allocated $3.7M to develop FNQ 2025 which will apply to the Wet Tropics region from Douglas Shire and Wujal Wujal Aboriginal Shire south to Cardwell Shire and west to Mareeba and Herberton Shires. FNQ 2025 aims to manage growth in the region and will limit urban development within a designated footprint. The draft Regional Plan is scheduled to be released in April 2008.

- The Authority and EPA worked with DLGPSR to identify biodiversity areas and corridors to improve connectivity between the major blocks of the Area. This data may be used to inform FNQ 2025.
5.3 Vegetation clearing

Background
Most of the region’s extensively cleared coastal lowlands are freehold agricultural and urban land. Similarly, the fertile soils and gentle terrain of the basalt tablelands led to widespread clearing of this landform from the time of European settlement. Consequently, as most of the well-drained coastal plain and fertile upland basalt plains have already been extensively cleared, even small amounts of additional clearing of these habitat types can have a relatively large impact on regional biodiversity. The richest, most fertile habitats were typically cleared first and most extensively. Many mammal and bird species prefer these fertile habitats [40] and their local populations can be rapidly depleted or even lost with any future clearing.

Clearing within the Area is strictly regulated, but clearing around the Area is an underlying threat to the Area’s integrity. Impacts include loss, fragmentation and degradation of habitat; severing of wildlife corridors; reduction in habitat refuges; increased demand for water, reduced water quality and changing water tables; and the introduction and spread of pest plants, animals and diseases. Re-establishing ecological connectivity between sections of the Area is important to enhance the Area’s integrity.

Summary data
The Statewide Landcover and Trees Study (SLATS) [41] monitors tree clearing in Queensland using satellite imagery. Rates of clearing are listed in Table 10 and Table 11.

Agricultural land fragmenting the rainforest

Photo: Steve Nowakowski
Table 10. Rate of bioregional forest conversion 1997 to 2004 (ha per year) by cause of clearing [41].

<table>
<thead>
<tr>
<th>Period</th>
<th>Pasture</th>
<th>Crops</th>
<th>Forestry</th>
<th>Infrastructure</th>
<th>Settlement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997-1999</td>
<td>448</td>
<td>723</td>
<td>-</td>
<td>78</td>
<td>27</td>
</tr>
<tr>
<td>2000-2001</td>
<td>733</td>
<td>67</td>
<td>69</td>
<td>108</td>
<td>30</td>
</tr>
<tr>
<td>2001-2003</td>
<td>683</td>
<td>188</td>
<td>131</td>
<td>56</td>
<td>21</td>
</tr>
<tr>
<td>2003-2004</td>
<td>529</td>
<td>1</td>
<td>381</td>
<td>16</td>
<td>63</td>
</tr>
</tbody>
</table>

Table 11. Rate of clearing from 1991 to 2004 for the Wet Tropics bioregion [41].

<table>
<thead>
<tr>
<th>Period</th>
<th>Rate of clearing (ha per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991-1995</td>
<td>3583</td>
</tr>
<tr>
<td>1997-1999</td>
<td>1275</td>
</tr>
<tr>
<td>2000-2001</td>
<td>1007</td>
</tr>
<tr>
<td>2001-2003</td>
<td>1069</td>
</tr>
<tr>
<td>2003-2004</td>
<td>991</td>
</tr>
</tbody>
</table>

It has been conservatively estimated that land clearing within the region for the period 1999-2001 resulted in the direct loss of habitat for 54,000 mammals per year and the loss or displacement of an estimated 29,000 birds per year in addition to the destruction of an estimated 350,800 open forest and woodland canopy trees, 383,600 rainforest canopy trees and 251,200 wetland canopy trees [40].

The Vegetation Management and Other Legislation Amendment Act 2004 was enacted to end broad-scale clearing, to halt clearing of endangered vegetation on all freehold lands (including urban areas) and to halt clearing of both endangered and ‘of concern’ regional ecosystems on all leasehold lands by 2006 (see 4.1 Ecosystems at risk).

The Wet Tropics Conservation Strategy [29] identified the regional rehabilitation priorities for landscape linkages, riparian zones and wetland areas. ‘Sustaining the Wet Tropics – A Regional Plan for Natural Resource Management 2004-2008’ [42] identified key natural resource management priorities within the region. Together with a Regional Investment Strategy, the Regional Plan forms the basis for allocation of

![Forest clearing](Photo: Steve Nowakowski)
Australian Government funding under the Natural Heritage Trust (NHT) and other investment in the region.

Prior to TC Larry the total area of new clearings within the Area since listing in December 1988 covered approximately 101ha. Of this, 85ha occurred on Freehold land prior to the commencement of the Wet Tropics Management Plan 1998. Most of the remaining 16ha was associated with the provision of community infrastructure.

**Management actions (2006-2007)**

- In November 2006 a new ‘Coastal bioregions vegetation management code’ [12] came into effect to assess applications for clearing vegetation (see 4.1 Ecosystems at risk).

- Under the Nature Assist program the Queensland Government requested competitive bids from landholders who wished to conserve their land in perpetuity under a Nature Refuge Agreement. In the first round of the program $1.85M was committed to 70 landholders throughout Queensland for protection of around 81,000ha. Fourteen of these landholders were in the Wet Tropics bioregion. A second round will be announced later in 2007.

- A range of community rehabilitation activities were undertaken throughout the Wet Tropics (See 7.5 Community conservation).

**5.4 Infrastructure**

Regional growth and development pressures result in demands for new or upgraded infrastructure such as roads, powerlines, water supplies and water storage. Significant environmental impacts are associated with such infrastructure, particularly where cleared corridors are required through rainforests. Impacts include:

- ecological fragmentation
- edge effects caused by increased levels of exposure to sun and wind
- changes to water cycles and local air temperatures
- invasion by exotic weeds and feral animals
- a loss of native ‘deep forest’ plant and animal species.
A range of agencies are responsible for operating and maintaining community infrastructure in the Area including QRail, QPWS, DMR, Telstra, Powerlink, Ergon Energy, Stanwell Corporation, North Queensland Water, the Defence Department and local governments. Under the *Wet Tropics Management Plan 1998*, a permit is required to undertake construction, maintenance or upgrades of infrastructure. Infrastructure agencies, together with the Authority, have developed Codes of Practice that are used as part of the conditions for these permits. So far Codes of Practice have been developed for road [46], electricity [47] and water infrastructure [48]. The Authority also requires that Environmental Management Plans (EMPs) be developed as an additional condition of some permits. EMPs set specific environmental management requirements and assist in compliance monitoring.

### 5.4.1 Roads

**Background**

Roads have a direct impact on the integrity of the Area. The presence of a road alters hydrology, fragments habitat and results in fauna being killed through collision with vehicles. Roads can isolate wildlife populations and disrupt seasonal movements and genetic interchange. Roads are also a source of stream pollution and increased sediment load and road culverts often result in the fragmentation of aquatic habitats and alter stream flow patterns. These fragmentary impacts are amplified by vehicular use which interferes with wildlife activities and behaviour. Impacts may include noise, vibration, movement, dust, emissions and lights.

**Summary data**

The *Wet Tropics Management Plan 1998* (the Plan) restricts the use of motorised vehicles to specified roads. The Area now has 1,217km of roads which provide motor vehicle access for public, private or management purposes. These roads are managed by a variety of agencies and private interests. About 6,535km of vehicle tracks in the Area, with a combined footprint of approximately 2,070ha, have been set aside for rehabilitation. The majority of these were unformed logging tracks previously used by the timber industry.
The growing commuter, freight and tourism transport needs of the region are increasing demand to upgrade main roads within the Area. In May 2006 the Authority’s Board recommended that the Wet Tropics Ministerial Council endorse the rezoning of a section of the Area to accommodate the proposed upgrade of the Kuranda Range Road to a four lane highway [49]. The Board determined that no other option offered the benefits and feasibility of the upgrade proposed by DMR. The proposed upgrade would enhance forest and stream connectivity, reduce road kills in the Area and, on completion, improve the integrity of the Area. In making its decision, the Board received assurances from the Queensland Government that, if the upgrade proceeded, there would be adequate resources to construct the road upgrade with the proposed environmental safeguards; the environmental values of the Myola area would be protected and the Smithfield to Kuranda powerline would be removed.

The tourism and recreation sectors are asking for improved maintenance of public roads where motor vehicle access is allowed under the Plan. Some of these roads have been closed for safety reasons since the Plan commenced.

MTSRF researchers, in partnership with DMR, have studied the impacts of roads on wildlife and ecosystem connectivity. They have designed and trialled a variety of ways to reduce the high level of road kills in the Area. Animal underpasses and overpasses have been developed to provide a means for animals to safely cross roads. Their main function is to reduce fragmentation for animals that rarely or never leave the canopy. The crossings include:

- purpose-built tunnels under roads and canopy bridges above roads
- traffic calming devices
- fencing to funnel wildlife away from roads and into culvert crossings
- retrofitted elevated dry passageways within large culverts under the road
- a range of newly designed cassowary awareness signage.

Management actions (2006-2007)

- In May 2007 the Federal Minister for Environment and Water Resources, under section 133 of the EPBC Act, gave approval for DMR to construct and operate the Kuranda Range Road upgrade between Smithfield and Kuranda subject to a set of 11 conditions [50]. These conditions include requirements to conserve 150ha of suitable cassowary habitat and to develop a national recovery plan for the endangered fern Diplazium pallidum. The Australian Government had requested that the Wet Tropics Ministerial Council defer its decision on the proposed rezoning amendment under the Wet Tropics Management Plan 1998 pending a decision under the EPBC Act. In light of the Minister for the Environment’s decision to approve the upgrade, it is expected that the Ministerial Council will soon make a decision on the rezoning of the Area to accommodate the road upgrade.
Fauna friendly road designs continued to be monitored and assessed in the Mission Beach and the Palmerston and Millaa Millaa areas. The tunnels under the East Evelyn Road recorded their first cassowary and tree-kangaroo crossings in the past year. A series of 45m long rope bridges strung across the Palmerston Highway in November 2005 recorded their first confirmed possum crossings in March 2007 – green ringtail possums and Herbert River ringtail possums.

A rope bridge strung across the Old Palmerston Highway now regularly has up to 30 possum crossings a night including lemuroid, green and Herbert River ringtails, coppery brushtail possums and striped possums.

DMR produced a draft ‘Fauna Sensitive Road Design Volume 2’ to incorporate a range of recent research findings.

5.4.2 Electricity supply

Background

Power transmission lines are less prevalent within the Area than roads. However, the clearings associated with them are typically wider and the fragmentation and edge effects are greater. Clearings associated with powerlines result in the invasion by weeds, especially tall exotic grasses and shrubs. These corridors also act as conduits for feral animals, wind and fire into the interior of the forest.

Summary data

Within the Area there are 222km of power transmission lines, 98km of power distribution lines, one substation (Chalumbin) and six electricity supply communication facilities. Electricity infrastructure also includes hydroelectric dams and equipment. Stanwell Corporation, Powerlink and Ergon Energy manage electricity generation, supply and distribution infrastructure and various ancillary facilities such as roads and buildings located within the Area.
No new powerline clearings have been established since the introduction of the *Wet Tropics Management Plan 1998*. The range of initiatives being employed to reduce the impacts of powerline maintenance is resulting in increased levels of tree cover across most powerline easements throughout the Area.

In 2005 the Australian Government approved the construction of a high voltage powerline from Tully to Innisfail, subject to a number of conditions. The construction of this powerline along a new coastal alignment will allow the eventual removal of 35km of a high voltage electricity powerline from Kareeeya to Innisfail which currently cuts through the Palmerston section of the Area. Rehabilitation of this powerline corridor will significantly improve the overall integrity of the affected area.

**Management actions (2006-2007)**

- Construction began on the Kareeeya to Tully powerline outside the Area. Planning was undertaken for the construction of the Innisfail to Edmonton powerline which is proposed to pass through the Area west of Eubenangee Swamp. Some preliminary planning was also done for revegetation of the World Heritage Area sections of the existing Kareeeya to Innisfail powerline which will be decommissioned. The Authority expects that permit applications will be received in the forthcoming year for these activities within the Area.

### 5.4.3 Water supply and storage

**Background**

Dams, weirs and culverts result in pressures on aquatic ecosystems through:

- changes in natural flow regimes as a result of water extraction and supply
- direct modification or destruction of important habitats
- barriers to the movement of plants and animals within rivers and between rivers and their floodplains
- decreased water quality and quantity
- increased colonisation by introduced and exotic animal and plant species.

Demand for water in the Wet Tropics region continues to increase as the population grows and agriculture uses more water for irrigation. Climate change has the potential to alter rainfall patterns and may also increase the pressures on water supplies in future.

**Summary data**

Water impoundments within the Area cover approximately 2,000ha. The major impoundments, all constructed prior to World Heritage listing, are Copperlode Dam, Paluma Dam and Koombooloomba Dam. Although Tinaroo Dam is located
outside of the Area, it significantly affects environmental water flows along the Barron River, sections of which flow through the Area.

Water storage and supply infrastructure located within the Area are managed by corporate entities such as North Queensland Water, Sun Water, and Cairns Water as well as by local governments. Eight local governments have 22 weirs and domestic water intakes within the Area, each with associated pipelines, access roads and powerlines. Water demands for agricultural, industrial and domestic uses continue to increase due to the diversification and intensification of agriculture, regional population growth and increased urbanisation. Use of groundwater resources on the Atherton Tableland is increasing as surface water resources become fully allocated. The effect of increased groundwater extraction on stream recharge, wetlands and other ecosystems dependant on groundwater is still uncertain.

Cairns City sources its domestic water from Copperlode Dam (Lake Morris), Behana Creek and six small streams in its southern rural area. Cairns Water services over 130,000 residents and 58,875 properties. Cairns consumes around 100 ML/day during the heaviest demand periods from September to November. The overall annual water consumption is about 29,000 ML/year. Copperlode Dam, the major source, has a total capacity of 45,000ML and provides around 80 ML/day on average and about 110 ML/day during high demand periods. However, it is likely that the rapidly growing population of Cairns will one day require more water than is currently available.

Weirs, dams, culverts and bridges affect nearly every coastal stream and river in the region. Such barriers to native fish movement result in reduced access to suitable habitat by aquatic organisms and reduced reproductive success.
Management actions (2006-2007)

- Preparation of the Far North Queensland Water Strategy (FNQWS) commenced in 2005 and is due to be finalised in 2007. The project is jointly sponsored by DNRW, SunWater and Cairns City Council. It encompasses the catchments of the Mulgrave, Barron and North Johnstone Rivers, and part of the Herbert, Walsh, Upper Mitchell, Mossman and Lower Daintree Rivers. It aims to address water supply issues identified in the FNQ 2010 Regional Plan by developing a strategy to provide for medium and long term water needs in the region. The Strategy will take into account urban growth, climate change and increased demand for water from agriculture and industry over the next 50 years. A draft plan will be available in August 2007.

- DPIF and JCU continued to develop effective and cost efficient designs to retrofit culverts and allow fish movements upstream.

5.5 Weeds

Background

Most weed invasions are closely associated with disturbances caused by human activity. Within the Area itself, the majority of weeds are associated with boundary edges and cleared corridors which act as conduits for weed dispersal.

Weeds generally compete vigorously with native plants for light, water, nutrients and pollinators. Weeds can affect animal biodiversity by eliminating or reducing food supplies, habitat and nesting sites. Although most pest plants do not invade undisturbed habitats, they often prevent native species regenerating in disturbed areas. Weeds also cause other flow-on effects. Some weeds are either more flammable or more fire retardant than the species they displace and can alter the
fire patterns of the communities they invade. This may subsequently affect native animals living in those communities.

As the principal land manager QPWS is responsible for the majority of weed control within the Area. Biosecurity Queensland has a regional coordinating role and also assists in the eradication and control of weeds, particularly the eradication of Class 1 weeds listed under the *Land Protection (Pest and Stock Route Management) Act 2002*. The North Australian Quarantine and Inspection Service is responsible for identifying new outbreaks of dangerous environmental weeds and preventing weeds from entering Australia. The Australian Government also provides funding for weed management through the Weeds of National Significance (WONS) program.

**Summary data**

Within the bioregion 508 exotic plant escapees have become established (naturalised) [52] which represents almost 39 percent of Queensland’s total. The rate of increase in exotic escapee plant species is alarming. Around 200 new weeds have been identified in the region over the past decade. Many of these are destined to become environmental, agricultural or urban weeds. Of major concern is the number of recent arrivals on the Northern Australian Quarantine Strategy’s Weeds Target List [53]. The list is a compilation of those species considered to pose the greatest potential threat to Australian rural industries and natural environment.

The Authority’s Conservation Strategy [29] has prioritised emerging, established and potentially invasive environmental weeds likely to threaten World Heritage values. Weeds have been prioritised according to their potential to invade, disrupt and transform a variety of Wet Tropics ecosystems. Some have already demonstrated their invasive potential in the region, whilst others are major weeds in other tropical areas and have the potential to spread here. The Strategy identifies 59 species and five plant groups as the focus for weed control programs within the region. The Authority and DNRW have also produced a weed identification guide for the Wet Tropics. DNRW has a wide range weed information sheets and control sheets on its website.

**Management actions (2006-2007)**

- Biosecurity Queensland was launched on 1 March 2007 as a new DPIF business group. It brings together the biosecurity resources and functions of DPIF, DNRW and EPA. Biosecurity Queensland will be responsible for animal and plant biosecurity, weeds and pest animals, research, animal welfare, chemical use and food safety.
In June 2007 QPWS convened a regional weed identification and hygiene workshop attended by 58 staff from QPWS, DNRW, local governments and the Authority. The workshop included practical field presentations and vehicle washdown demonstrations.

All local governments within the Wet Tropics bioregion have completed their Pest Management Plans. Quarterly meetings of the Far North Queensland Local Government Pest Plan Advisory Committee and the Far North Queensland Pest Advisory Forum are coordinated by DNRW.


DNRW continued to research Wet Tropics weeds at the South Johnstone Centre for Wet Tropics Agriculture. Research focused on:

- seed germination, viability and longevity of pond apple, harungana, hymenachne, sicklepod, hairy senna and siam weed
- seedling emergence of pond apple, harungana, sicklepod, hairy senna and siam weed
- the dispersal of pond apples by cassowaries, investigating gut passage times, germination rates and viability of seed after passing through cassowaries (joint project with CSIRO)
– base data about the size, mass of pond apple fruits and the number of seeds they contain

– environmentally friendly methods of chemical control of pond apple.

- In October 2006 DNRW, in conjunction with EPA, Douglas Shire, Mareeba Shire, CSIRO and local landholders, conducted the Melastome Taskforce Operation. The taskforce surveyed 179ha of dense rainforest to delimit and control Koster’s curse and two new miconia species [82]. These weeds are all from the Melastomataceae plant family which are dispersed by birds. The Taskforce aims to control existing populations of the target weeds, gather information on the distribution and genetic structure of the population and increase public awareness.

- There are two national weed eradication programs operating in the Wet Tropics – the National Siam Weed Eradication Program [68] and the National Four Tropical Weeds Eradication Program to eradicate Koster’s curse, limnocharis, mikania vine and several miconia species [69]. The only recorded infestations of these four weeds in Australia are currently in the Wet Tropics. This five year program commenced in 2004 and was managed and operated by DNRW until March 2007. It is now managed by Biosecurity Queensland. An external review of the program in September 2006 concluded that it has significantly reduced the area infested by these weeds and that eradication remains achievable.

- The current status and progress towards eradication of each weed species are:

  - Some progress was made reducing plant density in infestations of siam weed (*Chromolaena odorata*). However, infestations persist throughout the Wet Tropics – three sites in the Thuringowa/Townsville region, numerous sites at four creeks in Herberton Shire, numerous sites in the Tully/Innisfail region, three sites in Douglas Shire, and one in Cairns City.

  - Only one infestation of Koster’s curse (*Clidemia hirta*) is known at Julatten. In 2006-2007 an additional 467ha were surveyed and no more plants were found outside the known area. Although seedlings continue to emerge, seed banks are being exhausted. *Clidemia hirta* is on track to eradication.

  - Limnocharis (*Limnocharis flava*) is being eradicated. Only three of the 18 infestations recorded seedling emergence in the last year. Approximately 80 percent of infestations are in the monitoring stage (no emergence for one to four years) or eradication stage (no emergence in five years). Targeted surveys of accommodation facilities in Cairns were conducted and no more plants were found.

  - Treatment reduced the area infested by mikania (*Mikania micrantha*) from 48,400m² to the current area of 6m² for all infestations. However, the area of a new infestation has not yet been determined. Of 14 infestations,
two are defined as eradicated, and another six are in a monitoring phase. Infestations are in the Shires of Hinchinbrook, Johnstone, Cardwell and Mareeba.

– Of a total of 31 infestations of *Miconia calvescens* 10 are defined as eradicated and another seven have no emergence for one to four years.

– Only one infestation of each of *Miconia racemosa* and *Miconia nervosa* has been identified (one to two hectares). An additional 200ha were surveyed and no other plants were found.

• The ‘Defeating the Weed Menace’ program funded a strategic pond apple control program. The program was delivered by seven local governments in the Wet Tropics. The extended wet season this year and forest damage from TC Larry limited access and opportunities to control infestations. However, control works were undertaken at Wawu Dimbi in the Daintree River catchment; Warrina Lakes and sites west of the Bruce Highway in Johnstone Shire; Palm Creek, Macknade Creek and the Lower Herbert River; Yarrabah Aboriginal Community; and Brick Creek Pond near Cardwell. The area controlled was 214ha. The program also undertakes monitoring of pond apple sites and public education. Further funding for pond apple control was obtained through the Blueprint for the Bush program.

• The ‘Defeating the Weed Menace’ program funded a strategic hymenachne control program. The program was delivered by three local governments in the Wet Tropics. Control works and management planning were undertaken on the Annan River, on 12 properties in the Upper Murray region, and on private properties in the Johnstone Shire. An Envirofund project run by the Barron Catchment Care controlled hymenachne scattered along a 40km stretch of the Barron River.

• The QPWS Wet Tropics District worked to control a wide range of weeds throughout the district, particularly along roadsides and around visitor sites. Weeds sprayed included guinea grass, blue top, tobacco tree, glycine, devil fig, lantana, rats tail grass and Brazilian nightshade.

• The QPWS Savanna District worked to control a range of weeds with a focus on conserving mahogany glider habitat. These included sicklepod in the Henrietta section of Girringun NP; lantana along the Wallaman Falls and Mount Fox Roads, the Wet Tropics Great Walk, Broadwater State Forest Park and Abergowrie; and high biomass grasses at Jourama Falls and Bluewater Road in Paluma Range National Park.
• FNQ NRM Ltd and Conservation Volunteers Australia (CVA) collaborated on the Weedwatchers project to engage the community to identify and monitor weeds and raise public awareness about the impacts of weeds. Weedwatchers will support local government and landholders to manage weeds. A dedicated team of volunteers has been recruited for on-ground weed control and monitoring. Two new weed invasions (*Pueraria montana var lobata* and *Triplaris sp.*) were identified in the Skeleton Creek catchment and Cairns City Council will work to eradicate them.

• As the majority of environmental weeds are not listed under their species names on herbicide registration, an off-label permit was approved by the Australian Pesticides and Veterinary Medicines Authority (APVMA off-label permit number 7845) to assist local government and environmental groups manage these pest plants. Herbicides have been approved for use against a large variety of environmental weeds.

• FNQ NRM Ltd, DNRW and FNQ ROC collaborated to produce a guide to ‘Engaging schools in pest management education’. The guide contains posters, CD ROMs, activity sheets and information sheets.

• In April 2007 the University of Queensland, FNQ NRM Ltd, FNQ ROC, and Cook Shire’s Pest Animal and Weed Program produced a CD ROM, Regional Weeds of Priority, to help identify Wet Tropics weeds.

• In addition to the weeds mentioned above, local governments in the region undertook a number of ongoing programs of weed control, often in cooperation with DNRW or QPWS. The major focus of these programs varied. Tobacco weed was a concern in Eacham Shire; sicklepod, giant sensitive plant, panama rubber, *Thunbergia laurifolia* and several newly emerging ‘class one’ weed species were a focus for the Cairns City Council; hiptage and a range of new emerging weeds were a focus in Douglas Shire; and giant rats tail grass and rubber vine and other new invasive species were a focus in Mareeba Shire.

### 5.6 Pest animals

**Background**

Pest animal species can degrade ecosystems and species through predation, competition for food or breeding areas, changes to habitat, or the transmission of parasites and other disease organisms.

A range of government agencies are responsible for the control of pest animals in the Wet Tropics. As the principal land manager, QPWS is responsible for the majority of pest animal control in the Area. However, DNRW also assists in the eradication and control of feral animals under the Land Protection (Pest and Stock Route Management) Act 2002.
Summary data

The Rainforest CRC [54] assessed the status of exotic vertebrate animal species that have established feral populations in the Wet Tropics. The study found that the current major vertebrate pests were the pig, cat, cane toad, dog/dingo and tilapia. These species achieved a high ranking due to their current levels of ecological impacts and because of the current lack of feasible options to control them.

Although the number of vertebrate pest species (28) has remained stable for several years, their population numbers, distribution and ecological impacts are generally very poorly understood. Some populations have apparently increased markedly in recent years. It has been estimated that there are about 27,000 feral pigs in the region (J. Mitchell pers. comm.). Apart from the feral pig, no estimates of feral animal numbers, densities or distribution have been undertaken within the region.

Very little is known about the status of invertebrate pest species apart from those of importance to agriculture or those which pose a threat to human health. Invertebrate species such as the crazy ant, electric ant, European bee, papaya fruit fly, palm leaf beetle and spiralling white fly have all been recognised as potential threats to the integrity of the Area.

The Authority’s Conservation Strategy [29] has identified feral deer as a major emerging threat that needs to be tackled before it becomes established in the region. Research commissioned by the Authority found that feral deer are much more widespread in the Wet Tropics than first thought. Feral deer can degrade native vegetation communities and revegetation areas through browsing, grazing and trampling. They can compete with
native fauna for resources and lower the water quality of creek and river systems through erosion and faecal contamination.

Tilapia, an introduced fish, has become established in the Barron River, Lake Tinaroo, Lake Barrine, Herberton Weir, creeks and drains in the Cairns region and in farm dams. Tilapia are rapidly invading many of the region’s major rivers, streams and water storages, possibly aided by illegal movement and release by people. Two tilapia species have become established in the Wet Tropics – the Mozambique mouthbrooder (*Oreochromis mossambicus*) and the black mangrove cichlid (*Tilapia mariae*). Their rate of population increase is very rapid. For example, five *T. mariae* were released into a Port Douglas resort pond in 1989. Three years later over 1 million fish (18 tonnes) were destroyed [55]. It is illegal to possess, rear, sell or buy tilapia. It is also an offence to release tilapia into Queensland waterways or to use them as bait, live or dead. Penalties of up to $150,000 now apply.

Fish stocking has also been identified as a threat to native species in the Area. The translocation of large predatory native fish, such as barramundi and sooty grunter, outside their natural range is a particular concern. Translocating recreational fish species above natural barriers such as waterfalls may put the native aquatic species and the ecological processes of these streams at enormous risk. There is evidence that up to 36 native fish species (plus red-claw crayfish) have been translocated into the region’s waterways [56].

The World Conservation Union has listed the Indian myna bird as one of the world’s 200 worst invasive species. The presence of the aggressive Indian myna in an area signals a disastrous change to local native bird populations. Overseas, the Indian myna has pushed native birds towards extinction in Polynesia, Hawaii and Mauritius. However, the Indian myna prefers more open areas and does not appear to invade forested areas.

Two contained outbreaks of crazy ants occurred in Cairns City and Edmonton in recent years. In May 2006 DPIF confirmed the presence of an exotic tramp ant species, the electric ant (*Wasmannia auropunctata*) in Smithfield. Originally from South America electric ants are listed as one of the world’s worst 100 invasive species by the Invasive Species Specialist Group of the World Conservation Union. The ant is tiny (about 1.5mm) and light to golden brown in colour. It can cause painful, itchy persistent pimples on humans if bitten. There is no defined nest structure, but colonies can be found under rocks, in leaf litter, in tree forks, amongst fruit on the branch, in clumps of grass and in household debris. The ants are also capable of rafting together and moving along waterways.
Management actions (2006-2007)

Feral deer

- In cooperation with QPWS, DNRW and local governments, the Authority continued its feral deer education program. Populations of feral deer have now been identified in the Babinda, Palmerston, Bingil Bay, East Russell, Ithaca River and Tarzali areas. All feral rusa deer (*Cervus timorensis*), fallow deer (*Dama dama*) and sambar deer (*Cervus unicolor*) so far identified are believed to have escaped from deer farms. WTMA officers worked with Cairns City Council and landholders to install deer traps in the Babinda area.

- Cairns City Council declared feral deer as a pest under its Pest Management Plan.

Feral pigs

- In the Wet Tropics District QPWS continued its collaborative efforts to control pigs, particularly with Douglas Shire and Cairns City Council. Controls included trapping and shooting on-park. A cooperative ‘on ground’ program between QPWS, the Douglas Shire Council, Traditional Owners and private landowners continued in the Daintree area. A professional, accredited, full time trapper was employed to control pigs working across all tenures in the area including National Parks. More than 1,000 pigs were captured during the year, 203 on the protected area estate. A commitment for a new pig trapping project is in place with a local contractor to trap on-park. The contractor will operate 20 permanent traps at on-park hot spots from Innsiefail to Ingham in response to requests for assistance from neighbours. This program will complement existing on-park trapping already undertaken by district staff.

- In the Savanna District QPWS continued to control pigs on-park and provided pig traps to about 40 neighbours in the Ingham region.
• FNQ NRM Ltd initiated a $500,000 feral pig management program in the Tully River catchment. Funds were made available to purchase traps, pay for trapper’s wages and running costs, and to coordinate the program across a number of agencies. FNQNRM Ltd is planning on setting up similar projects in other strategic areas within their region.

• In July 2006, the ARF launched a feral pig trapping program in response to the habitat devastation in key cassowary areas following Cyclone Larry. Over 400 pigs were removed by NQ Feral Pig Management Solutions from a 600km² area. The program was funded $75,000 in 2006 and extended in cooperation with Cairns City Council in 2007 to include feral dog trapping in key cassowary habitat.

• DNRW undertook several feral pig biology and management research projects within the Wet Tropics including developing economic impact monitoring and ranking systems, research into the diet of feral pigs in rainforests and research to quantify the effectiveness of hunting as a control technique. Findings from this research are disseminated throughout the region by the Feral Pig Advisory Committee.

• The Invasive Animals CRC worked to develop PIGOUT, a commercial, shelf-stable pig bait. This product may be of considerable benefit in instances where large numbers of feral pigs have to be controlled quickly, such as in an exotic disease outbreak. The first generation of this product uses the poison 1080. However, the aim of long-term research is to develop more pig-specific toxins. This work is supported by Meat and Livestock Australia and is a collaborative effort with a range of state agencies across Australia with trials occurring simultaneously in four countries (Australia, New Zealand, America and Britain).

**Feral ants**

• The yellow crazy ant outbreak at Edmonton was subject to highly effective control measures during 2006-2007. DNRW was the lead agency for the control of this pest animal. Cairns City Council, CSIRO and other government agencies provided assistance when required. The use of a new tuna and jam food lure developed by CSIRO successfully attracted crazy ants when populations were low. Crazy ants were found at 272 food lures out of 51,000. A total of 18 separate infestations were treated from November 2006 to June 2007. These infestations covered an area of about 3415m². These figures show that the crazy ant infestation is much reduced.
Electric ants were declared under the *Plant Protection Act 1989*. The declaration established a pest quarantine area so that movement of the ants can be controlled. An emergency response team was mobilised from DNRW, EPA and DPIF to deal with the electric ant outbreak in Smithfield. The Electric Ant Control Centre was established to undertake a range of activities to combat electric ants, including surveillance and treatment; sample identification; movement controls to stop the spread of electric ants; community engagement; and research and development of new treatment methods. In February 2007 electric ants were also discovered at a Kewarra Beach property.

DNRW, EPA and DPIF identified properties needing treatment for the electric ant outbreak. The low toxicity bait used to treat affected areas consists of corn grit soaked with soybean oil and impregnated with hydramethylnon – a chemical which inhibits food digestion and starves the ants. From 1 July 2006 to 30 November 2006 electric ants were found in 592 samples over 251ha. The area surveyed was 3,585ha.

**Feral bees**

An incursion of Asian honey bees was detected in Portsmith in May 2007. DPIF found and destroyed five hives over the next month. None of the bees carried the varroa destructor mite – a threat to the local honey industry – or any other mite. Monitoring will continue for the next 12 months.

**Feral fish**

The Australian Centre for Tropical Freshwater Research (ACTFR) at JCU in Townsville coordinated a project to improve the management of tilapia and other pest fish in the wet and dry tropics. Ongoing funding has now been obtained from FNQ NRM Ltd, MTSRF, CSIRO and DPIF. The project aims to survey waterways for exotic species, research their impacts and investigate control methods.

Community education about the impacts of pest fish is also an important outcome. A website was created to provide information about the pest fish distribution and impacts [36] and a database now contains 1,200 study sites in the region. Some key findings were the presence of *Tilapia mariae* in Lake Barrine, mosquito fish in the Upper Herbert catchment, the absence of tilapia in the Tully River system (despite reports of their presence), and the absence of tilapia in the Wild River below Herberton Weir (where tilapia have been found).
• During the year the ACTFR project financed the Tilapia Terminators fishing competition at Aloomba State School and educated fishers at the Barra Bash at Lake Tinaroo.

• DPIF, in collaboration with QPWS, commenced a program to control *Tilapia mariae* in Lake Barrine and prevent its spread. DPIF proposes to remove a proportion of the reproductively viable tilapia population during periods of cool weather (referred to as a ‘fish-down’). In addition, DPIF propose to install several fish screens at the outfall stream which flows into the Mulgrave River.

• DPIF continued its education campaign to help people identify tilapia and distributed identification cards and brochures to many businesses, councils and schools in north Queensland.

**Feral birds**

• A 16 month pilot program to research and develop a ‘super-roost’ Indian myna bird trap is progressing with Australian Government funding of $130,000. This project is being administered by the ARF and will be completed in December 2007.

**Feral cattle**

• QPWS removed 398 head of feral cattle from the Herbert River Gorge, Girringun National Park, as part of an ongoing intensive control program to eradicate the estimated 900 animals.

• Construction of a fence began on a section of Girringun National Park to protect Stoney Creek (Wallaman Falls) from cattle from adjacent lands.

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**5.7 Pathogens**

**Background**

Little is known about the ecological impacts of introduced pathogens on native animals and plants, although they are likely to be significant. Recent studies suggest that infectious diseases in wildlife populations caused by parasites and pathogens are emerging at unusually high rates [57] [58]. The diversity of new infectious diseases afflicting wildlife, coupled with the increased frequency of outbreaks, has raised concern that infectious disease may play a strong and increasingly important role in species depletion and extinction [58] [59]. A major loss of biodiversity may occur when a new disease is introduced, resulting
in catastrophic depopulation. It is anticipated that recent, initially catastrophic, declines may be followed by chronic population depression and potential local extinction.

Forest dieback or root rot disease (*Phytophthora cinnamomi*) and frog chytrid fungus (*Batrachochytrium dendrobatidis*) are two water-borne pathogens that are known to have significant impacts on many of the region’s native species. These impacts can be exacerbated by human activities that assist in the spread of these pathogens such as soil and water disturbance and movement of infected soil by vehicles, humans and animals.

Widespread, small patches of rainforest dieback caused by outbreaks of *Phytophthora cinnamomi* were first recorded in the region during the 1970s. More recent outbreaks were found in the late 1990s and continue to the present day. The cause or trigger of these outbreaks is presently unknown, but appears to be correlated to past disturbances associated with the logging industry. The effects of *P. cinnamomi* on the region’s rainforests can vary from no visible impact to the slight loss of canopy leaves in susceptible species or to the death of all plants in virulent outbreaks. Where virulent outbreaks occur the anticipated consequences include:

- major disruptions to ecological community structure
- local extinctions of populations of some plant species
- less productive, more open, less diverse habitat for wildlife.

Frog chytrid fungus has been identified as a primary cause of massive mortality of stream-dwelling frogs in the region. Chytrid fungus causes chytridiomycosis, a highly infectious amphibian disease first discovered in dead and dying frogs in the Wet Tropics in 1993. The fungus is now known to be widespread across Australia and has been present since at least 1978. It infects the skin of frogs, disrupting the epidermal layers and causing increased shedding and eventual death. Worldwide, chytrid fungus is now credited with causing the extinction of up to 122 frog species – eight in Australia. The emergence of this disease radically changes our view of wildlife diseases because it is the...
first such disease to emerge in ‘pristine’ sites to infect a wide range of hosts and to cause declines, and possibly extinctions, in disparate regions across the world.

**Summary data**

The Authority’s vegetation mapping program [13] has identified over 200 small patches of dead rainforest in the Mount Lewis, Lamb Range and Tully Falls sections of the Area. Based on preliminary findings, approximately 14 percent (126,000ha) of the Area may be considered highly susceptible to rainforest dieback [60]. At least five species of phytophthora have been found at dieback sites: *P. cinnamomi, P. heveae, P. katsuurae, P. palmivora* and another unidentified species.

Chytrid fungus has been identified as a cause of death in many frog species in the Wet Tropics. Several species of locally endemic rainforest stream-dwelling frogs, which were once distributed widely and in high numbers throughout the Wet Tropics, vanished from altitudes above 300m within a very short period of time. Three species, the sharp-snouted day frog (*Taudactylus acutirostris*), the mountain mist frog (*Litoria nyakalensis*) and the armoured mist frog (*Litoria lorica*) only occurred at high altitudes and it is highly likely that they have now become extinct. A fourth species, the northern tinker frog (*Taudactylus rheophilus*), is the only specialised high altitude stream-dwelling frog to have been rediscovered. It was found at two mountaintop locations in late 1996. However, its current status is unknown.

Another four species, the common mist frog (*Litoria rheocola*), the waterfall frog (*Litoria nannotis*), the Australian lace-lid (*Nyctimystes dayi*) and the green-eyed tree frog (*Litoria genimaculata*) have suffered extensive declines and are no longer able to be located at high altitude habitats. However, they still persist at lower elevations.

A ‘Threat Abatement Plan for Infection of Amphibians with Chytrid Fungus Resulting in Chytridiomycosis’ was released in 2006 [61].

**Management actions (2006-2007)**

- Researchers at JCU, Sydney’s Taronga Zoo, the Frog Decline Reversal Project (Cairns Frog Hospital) and CSIRO’s Australian Animal Health Laboratory in East Geelong, Victoria, began to diagnose a group of new and emerging diseases causing high levels of cancer, malformations and deaths in frogs in the Wet Tropics. These diseases, unrelated to chytridiomycosis, have never been seen before and could threaten the long-term survival of the region’s native frogs.
• JCU researchers, QPWS and WTMA continued to monitor phytophthora dieback sites on a biennial basis. The sites are at Mount Bellenden Ker, Mount Bartle Frere, Mount Lewis and in the Koombooloomba/Tully Falls area. Preliminary results indicate some vegetation regrowth after dieback, despite the pathogen persisting in the soil. Long-term recovery remains uncertain.

• Research by JCU into chytrid fungus disease progressed under a $1.6M NHT grant. JCU scientists discovered that a commercially available disinfectant can kill chytrid fungus. Their findings were published in the February 2007 issue of ‘Diseases of Aquatic Organisms’. TriGene was the most effective disinfectant tested. TriGene and F10 are now preferred for use in the field as they are active at much lower concentrations and appear to have no record of environmental toxicity. The disinfectants are used to clean equipment that has been used when handling amphibians or that has been in contact with contaminated water bodies.

5.8 Altered fire regimes

Background

Most non-rainforest ecosystems in the Wet Tropics rely on particular fire regimes for their persistence in the landscape. Fire regimes are long-term fire patterns, defined by their frequency and intensity and the season in which they occur. Fire management in these non-rainforest ecosystems aims to create a mosaic of patches which have different fire histories. This approach is based upon the assumption that more diverse fire patterns act to maintain greater habitat biodiversity across the landscape over time. Because different taxa exhibit different responses to fires, patchy burning provides a range of habitats that enable the persistence of a diversity of non-rainforest biota within the Wet Tropics rainforest landscape.

Patch mosaic burning has also been linked to traditional burning by Aboriginal peoples. However, such practices have been severely disrupted throughout the Wet Tropics following European settlement. This disruption has been implicated in population declines in a range of species including the northern bettong and the yellow-bellied glider. There is still a need for further research into the relationship between fire management and biodiversity conservation in the Wet Tropics. Fire is
a very powerful management tool which dramatically modifies ecosystems, their component species and their associated ecological processes.

Importantly, there is likely to be a positive relationship between fire proneness and ecosystem resilience to fire. Rainforests are so sensitive to fire that almost any fire reduces their conservation values.

**Summary data**

The long-term persistence or stability of a number of the more restricted regional sclerophyll vegetation types is under threat due to the disruption of historical fire patterns in the last 50 years. It has been found that ecologically significant changes to the boundary between rainforest and open forest have taken place over this time. Large areas of wet sclerophyll forests, in particular, have converted to simple rainforest. Presently, wet sclerophyll forests occur as a discontinuous strip up to 4km wide along the western margin of the rainforest and occupy approximately 54,000ha. This represents only half the extent identified from air photos taken in the 1940s [51]. The narrow strip of wet sclerophyll forest is important for the conservation of two of the mammals restricted to the bioregion, the northern populations of endangered northern bettong (*Bettongia tropica*) and the vulnerable Wet Tropics population of the yellow-bellied glider (*Petaurus australis*). It is a matter of urgency to determine which biota are dependent upon wet sclerophyll forests and the level of threat to these species imposed by their progressive conversion to rainforest.

Conversely, inappropriate fire management and wildfires have also adversely affected rainforest areas which are not adapted to burning. Extreme examples are areas of fire-degraded hillslopes where rainforests have been converted to grasslands, particularly on the hillslopes around Cairns. Within the Area there are about 105ha of these fire-degraded hillslopes. Changes to sugar cane harvesting techniques and urban expansion have reduced the frequency of hillslope fires penetrating into rainforest communities.

Climate change has the potential to increase the risk of fire in rainforest communities. Weed invasions can also significantly alter fire regimes. Tall aggressive weeds such as guinea grass and molasses grass are changing the seasonality and intensity of fires when they dominate the ground cover.

The protected area estate has 22 aggregated park management units within the Area for fire and pest reporting. Regional ecosystem mapping, Wet Tropics vegetation mapping [13] and recommended fire regimes for each regional ecosystem are used to develop Statements of Fire Management Intent and Fire Management Strategies. All management units have approved Statements of Fire Management Intent that address the objectives for significant fauna, flora and
ecosystems. Four management units have approved Fire Management Strategies and a further ten are in preparation. Specific fire management plans and detailed monitoring programs are also a component of the Northern Bettong Recovery Plan process [19].

All planned burns are approved by a Fire Referral Group. When granting approval for a planned burn, the Referral Group must consider a range of factors including the aims of burn; the preferred fire regime; the suitability of tactics to be used; the size of the proposed burn in relation to the total area of each type of vegetation; adequacy of staff and resources; the risk to personnel, neighbours, infrastructure, cultural resources and ecological processes; the results of relevant previous burns; and monitoring programs.

**Management actions (2006-2007)**

- QPWS held an annual workshop to review the previous year’s fire program. Fire Strategies, Statements of Fire Management Intent and planned burns for the forthcoming year were amended and approved. Experts in the field of fire management and representatives from other agencies were invited to attend to present new research and participate in the review process.

- In 2006 more than 95 percent of fires on the QPWS estate in the Area were reported in ParkInfo, the EPA’s spatial fire and pest reporting system. ParkInfo records detailed information about the extent of each fire, when it occurred, its intensity, and its ecological impact.

- In 2006 QPWS planned 35 burns covering approximately 18,000ha within the World Heritage Area. Weather conditions allowed for 19 planned burns covering approximately 7,600ha. QPWS responded to 12 wildfires which burnt approximately 4,700ha.

### 5.9 Grazing

**Background**

The grazing of stock is generally incompatible with the goals of World Heritage management. Although the most significant problems created by grazing animals within the Area are those of feral cattle, the grazing of domestic herds is also causing serious problems in some areas. The potential impacts of grazing include:

- modifications to vegetation structure and floristic composition of the understorey and ground cover
- reduced habitat diversity
- trampling of vegetation
- compaction of soil
- soil erosion and consequent effects on water quality
nutrient enrichment of aquatic ecosystems through excrement

- introduction and spread of invasive weeds
- alteration of natural fire regimes
- impacts of fencing, access roads and other infrastructure.

Most grazing leases within the Area occur in sclerophyll forests. Overall, these areas tend to be lightly grazed. However, cattle tend to preferentially graze palatable species and greater impacts are likely around stock congregation points such as water courses even at conservative stocking rates. The extent and nature of grazing impacts can depend on stocking rates, frequency of fire to improve herbaceous growth, establishment of access trails throughout the forest, construction of fence lines, palatability of vegetation, sensitivity of fauna, and the presence or absence of natural barriers to stock movement.

**Summary data**

Many of the grazing authorities within the Area will not be renewed beyond their current expiry dates where they occur on land being transferred to the National Park estate under the State Forest transfer process. The Authority’s Board has also adopted a general policy to phase out grazing in the Area except where it can be demonstrated the grazing activity is beneficial to World Heritage management and no prudent and feasible management alternatives are available.

**Management actions (2006-2007)**

- The Authority updated its data about grazing leases from the Queensland Digital Cadastral Database (DCDB). A GIS grazing layer was created and title searches of grazing leases completed to compile a list of leaseholders. Grazing under formal tenure arrangements is presently occurring on 29 grazing properties that make up just under eight percent of the Area (Table 12).

**Table 12.** Number, type and areas of grazing authorities granted over parts of the WTQWHA.

<table>
<thead>
<tr>
<th>Type</th>
<th>No.</th>
<th>Area (ha)</th>
<th>Proportion of WHA (%)</th>
<th>Latest expiry date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupation licence</td>
<td>3</td>
<td>2,985.5</td>
<td>0.33</td>
<td>N/A</td>
</tr>
<tr>
<td>Pastoral Holding</td>
<td>6</td>
<td>11,783.1</td>
<td>1.32</td>
<td>2034</td>
</tr>
<tr>
<td>Special Lease</td>
<td>12</td>
<td>47,852.9</td>
<td>5.36</td>
<td>2037</td>
</tr>
<tr>
<td>Term Lease</td>
<td>5</td>
<td>4,485.9</td>
<td>0.50</td>
<td>2051</td>
</tr>
<tr>
<td>Stock grazing Permit</td>
<td>1</td>
<td>4.7</td>
<td>0.00</td>
<td>2007</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>29</td>
<td>67,112.1</td>
<td>7.51</td>
<td></td>
</tr>
</tbody>
</table>
PART 3

The role of the World Heritage Area in the life of the community

Under Article 5 of the World Heritage Convention, the Authority must endeavour to give the Area a function in the life of the community. The Authority’s policy document, Protection through Partnerships [62], states that the Authority aims to achieve the protection, conservation and presentation of the Area through effective partnerships with stakeholders at both the local and the national level. Stakeholders include a broad cross-section of the community such as landholders and neighbours of the Area, Rainforest Aboriginal communities, land management agencies, local governments, community conservation groups, researchers, the tourism industry, recreational users and domestic and international visitors.

The Area provides many benefits and essential services to the community. These benefits and essential services flow, in part, from partnerships between the Authority and the community. It is also intended, in a reciprocal way, that the community plays an active role in caring for the Area. This section reports on the socioeconomic and cultural benefits provided by the Area for the community and the role the community plays in conservation and management of the Area.

6 Benefits of the World Heritage Area

6.1 Community services

Background

The WTQWHA supports a variety of natural processes through which ecosystems sustain and fulfil human life. In economic terms, the natural capital of the Area’s resources provides ‘ecosystem goods and services’ which have a wide range of benefits for the Wet Tropics community. Benefits may be environmental, economic, cultural, spiritual, educational, recreational or medicinal. The most important of these goods and services are those which are essential for life such as clean water and soil fertility. There are
also numerous others services and products (Table 13) which enhance the quality of life in the Wet Tropics.

The spiritual and aesthetic qualities of the Area may be more highly valued by the local community than more tangible products and economic benefits. Results from a survey conducted by Bentrupperbaumer and Reser [63] showed that the local community views the Area as an integral and cherished part of their natural and cultural landscape, with ‘just knowing it is there’ rating as the most important benefit overall. The Area and its attributes are important to the community’s sense of place and identity.

Table 13. Ecosystem goods and services provided by the WTQWHA.

<table>
<thead>
<tr>
<th>Environmental values and processes</th>
<th>Environmental regulation</th>
<th>Community services</th>
<th>Community enrichment</th>
</tr>
</thead>
<tbody>
<tr>
<td>biodiversity</td>
<td>regulation of regional &amp; micro climates</td>
<td>food</td>
<td>tourism</td>
</tr>
<tr>
<td>habitats and refugia</td>
<td>flood mitigation</td>
<td>clean water supply</td>
<td>recreation and leisure activities</td>
</tr>
<tr>
<td>soil formation &amp; fertility carbon sequestration</td>
<td>water purification</td>
<td>energy (hydro, solar &amp; wind)</td>
<td>spiritual values and enjoyment</td>
</tr>
<tr>
<td>conversion of solar energy</td>
<td>erosion control</td>
<td>shade and shelter</td>
<td>natural values</td>
</tr>
<tr>
<td>biomass production</td>
<td>pest control</td>
<td>soils</td>
<td>scenic &amp; aesthetic values</td>
</tr>
<tr>
<td>pollination</td>
<td>groundwater recharge</td>
<td>pharmaceutical and biological products</td>
<td>cultural and historical values</td>
</tr>
<tr>
<td>nutrient recycling</td>
<td>waste treatment</td>
<td>horticultural products</td>
<td>awareness and education</td>
</tr>
<tr>
<td>nitrogen fixation</td>
<td>energy conversion</td>
<td>art and craft materials</td>
<td>scientific discovery</td>
</tr>
<tr>
<td>water cycles</td>
<td></td>
<td></td>
<td>sense of place and identity</td>
</tr>
<tr>
<td>genetic resources</td>
<td></td>
<td></td>
<td>maintaining options for the future</td>
</tr>
<tr>
<td>fire regimes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

While there has been extensive research on the natural values of the Area, there has been little research on the Area’s community benefits. To date, most socioeconomic research has focused primarily on tourism and community attitudes (see 6.3 Tourism and recreation and 7.1 Community education).

The CSIRO Tropical Forests Research Centre (TFRC) supports a variety of research on other socioeconomic benefits of the Wet Tropics rainforests. For instance:

- Cloud stripping in high altitude rainforests has been shown to contribute an additional 40 percent more water than that provided by the annual
rainfall [64]. This is particularly important for maintaining dry season water supplies to the community.

- Rainforest insects have been shown to provide some economic benefits through pollination and pest control [65].

**Management actions (2006-2007)**

- CSIRO researchers [66] continued to research the benefits of rainforest insects in agriculture. They found that the tropical rainforest can act as a reservoir of pollinators that can benefit crops, demonstrating the advantages of allowing rainforest vegetation to remain near crops, or be planted within crops, to improve visitation by beneficial insects.

- MTSRF researchers [67] studied the value of the cassowary in Mission Beach and concluded that cassowaries and the rainforest services they provide are highly valued by Mission Beach residents and visitors. However, this value is not incorporated into the exchange of land which forms part of cassowary habitat. They argue that where the market is failing to provide an optimal social good, government intervention may be justifiable.

- In February 2007 FNQ NRM Ltd and Biocarbon established a joint venture, Degrees Celcius, to attract investments in ecosystem services into the Wet Tropics region. Degrees Celcius will assist landholders who have reforested land to tap into the growing market for voluntary carbon trading. Validation and accreditation processes are being developed. It is hoped that Wet Tropics rainforests may be particularly valuable for carbon storage.

### 6.2 Rainforest Aboriginal people

**Background**

There are 18 Aboriginal tribal groups with traditional connections to land in and around the Area. Each tribal group has customary obligations to manage country. To Rainforest Aboriginal people, the Wet Tropics region is a series of living cultural landscapes which identifies Rainforest Aboriginal people’s place within their country and reinforces their ongoing customary laws and connection to country. The preamble of the *Wet Tropics*
World Heritage Protection and Management Act 1993 [2] acknowledges ‘the significant contribution Aboriginal people can make to the future management of cultural and natural heritage within the Area, particularly through joint management agreements.’

Reaching agreements about tenure, land use and management regimes has been the key focus for Rainforest Aboriginal people to maintain the vitality of their cultural values and to achieve social and economic benefits from their traditional lands. Table 14 below describes some of the cultural values which relate to Aboriginal land use within the Area.

**Table 14.** Some Rainforest Aboriginal cultural values relating to land use in the WTQWHA.

<table>
<thead>
<tr>
<th>Spiritual</th>
<th>Ecological</th>
<th>Social</th>
<th>Economic</th>
</tr>
</thead>
<tbody>
<tr>
<td>• creation stories</td>
<td>• bush tucker (animals and plants)</td>
<td>• language</td>
<td>• hunting and gathering</td>
</tr>
<tr>
<td>• sacred sites</td>
<td>• bush medicine</td>
<td>• living areas and camps</td>
<td>• tools</td>
</tr>
<tr>
<td>• burial grounds</td>
<td>• knowledge of ecological relationships</td>
<td>• walking tracks</td>
<td>• food preparation</td>
</tr>
<tr>
<td>• bora grounds</td>
<td>• fire management</td>
<td>• kinship systems</td>
<td>• shelter building</td>
</tr>
<tr>
<td>• ceremony</td>
<td>• seasonal calendar</td>
<td>• clans</td>
<td>• harvesting resources</td>
</tr>
<tr>
<td>• responsibility for country</td>
<td></td>
<td>• cultural identity</td>
<td>• art and craft</td>
</tr>
<tr>
<td>• totems</td>
<td></td>
<td>• traditional law</td>
<td></td>
</tr>
</tbody>
</table>

A variety of land management agreements may foster Aboriginal participation in conservation management. Mechanisms for determining Rainforest Aboriginal interests in tenure, land use and participation in management are provided under legislation such as the *Aboriginal Land Act 1991 (Qld)*, the *Native Title Act 1993 (Commonwealth)*, the *Land Act 1994 (Qld)* and the *Wet Tropics Management Plan 1998 (Qld)* [24]. At least 80 percent of the Area is potentially claimable under the *Native Title Act 1993*. Currently, 16 Native Title claims have been lodged with the National Native Title Tribunal, covering over 30 percent of the Area. The following claims have been completed:

- A Native Title consent determination was made in December 2004 for the Djabugay people, the traditional owners of Barron Gorge National Park, with the State of Queensland and the Cairns City Council. Other interest holders such as Skyrail, Powerlink, Ergon and the public who use the National Park for recreational purposes will still be able to exercise their interests.

- Two ILUAs were registered on 18 May 2006 between the Mandingalbay Yidinji people and Cairns City Council and Ergon Energy.
Management actions (2006-2007)

- The Eastern Kuku Yalanji ILUAs were signed in April 2007. The agreements resolve tenure and management arrangements and native title rights for about 230,000ha of National Parks, Unallocated State Land, Forest Reserves and some grazing leases. The major parties to the agreements were the Kuku Yalanji people (represented by the Cape York Land Council), EPA, DNRW, WTMA, local governments, grazing leaseholders, Ergon and Telstra. The Kuku Yalanji ILUAs comprise 15 separate ILUAs, a Conservation Agreement under the Nature Conservation Act and a Cooperative Management Agreement under the Wet Tropics Management Plan. A steering committee of Yalanji people, Cape York Land Council and government agencies will oversee the implementation of the ILUA. Agreed tenure changes are expected to take several years to complete. The Authority will work with the Kuku Yalanji people on Community Development Plans in the World Heritage Area.

- Two ILUAs were registered in 2006-2007 over lands within the Area – the Mandingalbay Yidinji/Telstra ILUA on 8 December 2006; and the Mandingalbay Yidinji/State of Queensland ILUA on 20 November 2006.

- The National Native Title Tribunal is finalising orders for consent determination for ILUAs with the Eastern KukuYalanji people (see above) and the Ngadjon Jii people regarding Wooroonooran National Park, Topaz Road National Park and Malanda Falls Conservation Park.

- Other native title claim mediation processes in the Wet Tropics in 2006-2007 included negotiations with Rainforest Aboriginal people for the following ILUA processes: Tableland Yidinji people; Badjuballa people; Combined Mandingalbay Yidinji – Gunggandji; Mandingalbay Yidinji people 2; Combined Dulabed and Malanbarra Yidinji; Ma:Mu people; Combined Gunggandji; Djiru people 2; Jirrbal people 2; Jirrbal People 3; Warrungu People 2; and Tableland Yidinji People 3. These mediation processes will seek to establish Aboriginal interests with regard to land use in and around the Area.

- ILUA negotiations between the Ma:Mu people and the State of Queensland are almost completed. The ILUA will provide opportunities for economic development by Ma:Mu people. The construction contract for the canopy walk provides for the employment of Ma:Mu people and QPWS has negotiated a contract with the Ma:Mu Aboriginal Corporation to purchase intellectual property for interpretive materials. QPWS has also completed a cultural heritage assessment and management plan for the canopy walk (see 6.3 Tourism and recreation).
6.3 Tourism and recreation

Background

Nature based tourism and recreation help to achieve local, national and international appreciation of the World Heritage Area. Tourism and recreation also provide enormous social and economic benefits for the region. There are over 200 visitor sites and 150 managed walks in and around the Area. These are managed primarily by QPWS and by local governments. Bentrupperbaumer and Reser [45] calculated that Wet Tropics visitor sites receive, in total, about five million visits per annum.

Visitor expenditure in the region, based on expenditure associated with commercial tours, hire cars, running costs for private vehicles and their flow-on effects, is now estimated to exceed $2B annually [70] and tourism contributes up to 35 to 40 percent of jobs and income in the region [42].

In 2002 a Wet Tropics visitor survey [63] was conducted at the ten major visitor sites: Mossman Gorge, Lake Barrine, the Crater, Barron Falls, Marrdja, Murray Falls, Henrietta Creek, Goldsborough Valley, Big Crystal Creek and Davies Creek. The heaviest visitation was at Mossman Gorge with 366,415 visitors in a year. The majority of visitors (72.5 percent) to the ten sites were independent travellers using private vehicles. When asked the main reason for visiting the Area, 56 percent of visitors listed nature based activities such as walking, sightseeing and swimming. Forty percent visited to relax and appreciate the environment. Only two percent listed educational activities as a reason.

In conjunction with the tourism industry, QPWS and the broader community, the Authority has developed a Nature Based Tourism Strategy [43] and a Walking Strategy [44] to provide the basis for tourism and walking management in the Area. The strategies aim to encourage a dynamic and sustainable nature based tourism industry in the Wet Tropics.

Motorised vehicle access within the Area for tourism and recreation is limited to public roads and presentation roads as designated on the zoning maps of the Wet Tropics Management Plan 1998. As a result, many old logging roads are
now unavailable for public vehicle access. The tourism industry and recreational users express concern about the closure of some presentation roads due to lack of resources for repairs and maintenance. Some recreational users wish to open additional roads for four wheel drive and trail bike use. There is evidence of unauthorised use of roads by trail bikes and other vehicles within the Area, as well as damage and vandalism to locked gates.

**Management actions (2006-2007)**

**Tourism research**

- The Authority commissioned research through the Rainforest CRC and James Cook University to calculate the economic values of tourism in the Area [71]. The gross economic value of tourism directly generated by visitation to the Area was $426M. This represents 21.8 percent of all tourism expenditure in the Wet Tropics region (about $2B). Visitors spent an average of 3.17 days in the Area during an overall stay of 7.36 nights. This valuation is conservative. The research did not attempt to calculate any flow-on economic benefits, nor did it include the expenditure of local residents.

- In November 2006 JCU, funded through the MTSRF, began undertaking visitor surveys in Tropical North Queensland to determine visitors’ travel activities, behaviours, motivations, expenditure and satisfaction [72]. Preliminary results indicate that the rainforest is the second to the reef as a motivation for visiting the Wet Tropics region (Table 15). Over 2000 surveys have been collected between the Daintree and Mission Beach, mostly at Cairns Airport. The most common rainforest destinations were the Daintree, Mossman Gorge, Kuranda and the Atherton Tablelands. Over 60 percent of visitors were aware that the rainforests were World Heritage listed. Visitors gave their rainforest experience a rating of over 8.4 out of 10 for satisfaction. The survey will continue for three more years and include the southern Wet Tropics and a special survey for Japanese visitors.
Table 15 Motivations for visiting the Wet Tropics region
(measured on a scale of 1 = not at all important, to 5 = very important).

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Mean (Rainforest survey)</th>
<th>Mean (Airport survey)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit the Great Barrier Reef</td>
<td>4.41</td>
<td>4.50</td>
</tr>
<tr>
<td>Visit the rainforest</td>
<td>4.33</td>
<td>3.98</td>
</tr>
<tr>
<td>Experience the natural environment</td>
<td>4.08</td>
<td>3.89</td>
</tr>
<tr>
<td>See Australian wildlife</td>
<td>3.98</td>
<td>3.81</td>
</tr>
<tr>
<td>Rest and relax</td>
<td>3.93</td>
<td>3.87</td>
</tr>
<tr>
<td>Snorkelling and diving</td>
<td>3.61</td>
<td>3.83</td>
</tr>
</tbody>
</table>

Facilities and walks

- QPWS continued major repairs of visitor facilities throughout the Area which were damaged by TC Larry. Over 95 percent of park facilities and walking tracks were open by 30 June 2007.

- QPWS began construction on the Ma:Mu Canopy walk near Crawford’s Lookout on the North Johnstone River. The walkway is located strategically at the entrance of the Woorooroonooran National Park. It is intended that the walkway will promote the use of the park’s other natural and cultural values including the Misty Mountains Trails, Henrietta Creek, the South Johnstone camp sites and the Tchupala Falls and Nandroya Falls walking tracks. The canopy walkway and other facilities will be completed by June 2008. The construction contract includes 400m of elevated canopy walk, a cantilevered lookout, a 31m tower, a reception building, toilets, a car park and the road intersection with the Palmerston Highway. The constructors are committed to employing local people, including Ma:Mu people (see 6.2 Rainforest Aboriginal people). Opportunities exist for ancillary tourism and business ventures on the 14ha of adjacent freehold land, currently held by QPWS. QPWS will be inviting expressions of interest in late 2007 to operate, maintain and promote the facility. Over 200,000 people are expected to visit the walk each year.

Goldsborough Valley clean up after TC Larry

Photo: QPWS
QPWS installed retaining walls to halt erosion at the Lake Eacham foreshore swimming area. Work also commenced to upgrade visitor facilities as part of a major upgrade of the carpark and day use facilities.

A bridge was built by QPWS to allow safe passage of walkers on the Douglas Track across the railway line.

**Roads**

- 326 permits were issued by QPWS for the use of selected Wet Tropics presentation restricted roads – Maple Creek Road, Shoteel Creek Road, Mt Lewis Road and the Mount Edith and Kauri Creek Road loop. The Culpa Road, designated as a presentation restricted road, remained closed throughout the year because bridges are in need of repair.

- QPWS undertook a range of road repairs and upgrades, partly funded by the $1.5M Smart State road project and the Cyclone Larry Natural Disaster Relief Arrangements. Roads maintained and upgraded included Mount Lewis Road, Clohesy River Road, Shoteel Creek Road, the Mount Edith and Kauri Creek Road loop, Black Mountain Road, the Bump Track and various roads in the Paluma District.

- QPWS undertook road stabilisation trials and monitoring at Davies Creek and Mount Windsor to investigate options for enhanced road sustainability and maintenance efficiencies.

- Numerous gates and signs were installed by QPWS on presentation restricted roads and management roads throughout the Wet Tropics. Many of these had been damaged by vandalism.

- QPWS also patrolled and monitored road use and behaviour on a range of roads. Over 30 people were fined for illegal use of the CREB Track while it was closed.

- Traffic counters were installed on a variety of roads in the southern Tablelands, Paluma district, Wallaman Falls, Jourama Falls and Broadwater.

**Information**

- Tourism Tropical North Queensland and Townsville Enterprise Limited continued to develop and market the Great Tropical Drives which cover a large area of far north Queensland. There are 14 major driving routes and another six routes to experience wildlife, nature, indigenous activities, adventure, heritage or food. A series of maps and brochures were produced and a website established [73].
• The Authority published a 16 page Wet Tropics World Heritage Magazine. Over 100,000 copies were printed for distribution throughout the World Heritage Area. This edition featured Wet Tropics wildlife and plants, the impacts of TC Larry and visitor information.

• JCU, funded through the MTSRF, worked with WTMA and the tourism industry to develop content for a Wet Tropics tour guide manual, based on the existing Daintree manual.

• QPWS produced nine visitor guides and 12 web pages for parks [74] within the Area.

Events

• Several annual community recreation events were held throughout the Area including:
  
  – The ‘Paluma Push’ Mountainbike Ride run by Townsville Rockwheelers Mountainbike Club from Paluma to Hidden Valley via Lake Paluma and Benham’s Track.

  – The ‘RRR’ Classic run by the Cairns Mountain Bike Club from the Tablelands to Port Douglas via the Bump Track.

  – The ‘Pyramid Race’ run by the Great Pyramid Race Association from Gordonvale to the top of Walsh’s Pyramid and back.

Walsh’s Pyramid

7 Community education and participation

7.1 Community education

Background

The Authority produces a range of publications about the Area for the regional community, schools and visitors to the Wet Tropics. Over the years these have included Wet Tropics scenic posters, wildlife posters, visitor centre display materials, brochures on World Heritage issues, cassowary education kits, a periodical Wet Tropics magazine, fact sheets, CDs, features in local newspapers and television awareness campaigns.
The Authority’s Wet Tropics website [75] was launched in late 1999 and continues to expand. It has become the primary means for the Authority to disseminate information for the public and land managers. The website contains a large amount of educational, tourist and management information, as well as up-to-date news features. It includes Rainforest Explorer, a collection of educational resources for children from Preparatory to Year 9. Also available as a CD-ROM, Rainforest Explorer contains a wealth of activities about the Area. All activities are suitable for use as part of the Queensland education curriculum.

In conjunction with the Authority, QPWS has produced over 50 Tropical Topics publications about Wet Tropics plants, animals and natural processes [76]. QPWS has published information sheets about the majority of National Parks and major walking tracks in the Wet Tropics.

The Authority supports a network of about 15 community visitor centres throughout the region which promote regional tourism and present the Area to visitors. Many of these visitor centres are run by volunteers. Authority staff have tailored World Heritage training courses to meet the needs of staff at the different visitor centres. The Authority also provides a range of educational materials to privately owned tourist attractions.

Each year the Authority honours exceptional individuals and organisations who do so much to help conserve and present the Area. The Cassowary Awards recognise dedicated individuals and organisations for their work in areas such as science, conservation, tourism, arts and Rainforest Aboriginal culture.

The Authority has funded several community attitudes surveys since World Heritage listing. The latest was conducted through the Rainforest CRC in 2002 [45]. The regional community survey comprised face-to-face interviews and mail-outs in the area between Townsville and Cooktown. Key findings of the survey included:

- Ninety-four percent of the regional community were aware of the World Heritage status of the Wet Tropics rainforests. Eighty-eight percent supported the World Heritage listing.

- Quality of life advantages were rated the most important personal benefits bestowed by the Area, with ‘just knowing it is there, that it exists’ (61 percent) followed by ‘providing a quality environment in which to live’ (59 percent).
The most important benefits bestowed by the Area on the regional community as a whole were given as ‘providing clean water and air’ (92 percent), ‘protection of rainforest plants and animals’ (89 percent) and ‘protection of scenic landscapes’ (88 percent).

‘Introduced animals, plants and pests’ were perceived as the most serious threats by residents (26.7 percent). Human activities, both outside (26.1 percent) and within (25.9 percent) the Area, were seen as posing the second and third most serious threats.

Forty-nine percent of community respondents visited the Area at least once a year.

Reasons for visiting the Area were diverse, but predominantly related to recreational activities (55.9 percent), or the seeking of a particular type of experience, either personal or social (37.8 percent).

Management actions (2006-2007)

The eighth annual Cassowary Awards were held at RainForeStation at Kuranda on 25 November 2006. Over 250 guests attended. Nine Cassowary Awards were presented by the Member for Barron River, Mr Steve Wettenhall. The evening also featured the Young Cassowary Awards for students and school classes throughout the region. Award recipients are listed in the Annual Report 2006-2007.

JCU, funded through the MTSRF and WTMA, began a Wet Tropics community attitudes survey. The survey will replicate the 2002 study completed by Bentrupperbaumer and Reser [45] and will identify changes in the past five years. Questions focused on community awareness and use of the Area, the advantages and disadvantages of living near the Area, and opinions about the Area’s management. By June 2007 over 3,000 surveys had been distributed to residents in communities between Port Douglas and Townsville and west to Ravenshoe. Preliminary results have been positive.
about the use and management of the Area. From 380 surveys returned so far, 93 percent of respondents were aware that the rainforests are World Heritage listed and 81 percent considered the Area to be very important or considerable important.

• The Authority formed a partnership with FNQ NRM Ltd to deliver teacher training and information about World Heritage rainforests and their management, including Rainforest Explorer. The K-12 (Kindergarten through Grade 12) Environmental Education Program conducted conferences and in-services for over 300 teachers in the Cairns, Innisfail and Tablelands districts and educators from Brisbane. The program provides teachers with information about natural resource management and aims to strengthen community participation in environmental education.

• The Authority continued to provide World Heritage educational materials for over 15 visitor centres throughout the region. Staff training was conducted at two visitor centres.

• The Wet Tropics website [75] was expanded to include new sections on research, media, maps and resources for students and teachers. Website use has increased over the past year. The site now attracts about 2,000 to 3,000 visits each day and from 4,000 to 6,000 page visits each day. Much of this can be attributed to schools using Rainforest Explorer. Other popular sections are Wet Tropics walks, news and issues, and animals and plants. The Authority answers numerous queries received through the website each week.

• The Authority sponsored and wrote four ‘News In Education’ pages for both The Cairns Post and The Townsville Bulletin to promote educational activities about the Area.

• The ‘Be Cass-o-wary’ campaign continued to raise community awareness about the endangered cassowary. The campaign includes yellow cassowary ‘take care’ bumper stickers, cassowary bookmarks and cassowary stickers for school children. QPWS continued to educate communities affected by TC Larry about the cassowary feeding program and how best to minimise cassowary interactions with people.

Cassowary cartoon stickers
• The ARF opened an interpretative centre and retail shop in Cairns with proceeds from sales going to rainforest protection.

• The ARF developed a web based cassowary education kit freely available to all schools in Australia.

7.2 Community consultation

Background

One of the main roles of the Authority is to consult with the community about management of the Area. There are three statutory advisory committees to the Board:

• the Community Consultative Committee

• the Rainforest Aboriginal Advisory Committee

• the Scientific Advisory Committee.

The Authority’s Board has also established a Conservation Sector Liaison Group, a Tourism Industry Liaison Group and a Cassowary Advisory Group. QPWS has established a regional Tourism Industry Forum which links to a statewide tourism forum.

The Authority and QPWS also undertake a broad range of formal and informal consultation to include community views on the management of the Area.

Management actions (2006-2007)

• The Authority continued to hold regular quarterly meetings of its statutory advisory committees and liaison groups. Members of these groups are listed in the Annual Report 2006-2007. Key issues raised for discussion during the past year included the FNQ 2025, cassowary conservation (particularly around Mission Beach), the impacts of TC Larry on wildlife conservation and tourism, electric ants, crazy ants, feral deer, fire management, road access and maintenance in the Area, funding for World Heritage management, tourism opportunities, and the potential impacts of climate change.

• QPWS held quarterly meetings of the Tourism Industry Forum. Key issues discussed included the implementation of Tourism in Protected Areas, Commercial Activity Permits, the Ma:Mu Canopy Walk and tourism in the Palmerston region.

• FNQ NRM Ltd held a ‘Lessons from Larry’ forum in September 2006 to consult with the community about how to improve post-cyclone recovery programs and how best to distribute funds from the Landcare for Larry appeal. About $200,000 was distributed as grants of up to $3,000 to farmers, landholders, traditional owners and community groups for revegetation and
rehabilitation works. A follow-up workshop was held in May 2007 to assess progress on the action plan (see 3 Tropical Cyclone Larry).

- DLGPSR began consultation with stakeholders about the development of FNQ 2025. FNQ 2025 will designate an urban footprint and regulate development in the Wet Tropics shires between Douglas Shire and Cardwell Shire, all of which contain large areas of the World Heritage Area.

- FNQ NRM Ltd and CSIRO began consultation with the Mission Beach community to develop a plan to trial market-based incentives to achieve a viable habitat network in the Mission Beach region.

- QPWS conducted public consultation regarding the management plans for Wooroonooran and Barron Gorge National Parks.

### 7.3 Aboriginal participation

**Background**

Under the *Wet Tropics World Heritage Protection and Management Act 1993* the Authority must perform its functions, as far as practicable, having regard to the tradition of Aboriginal people particularly concerned with the land and liaising and cooperating with Aboriginal people particularly concerned with the land.

The Master Plan for Queensland’s Parks System [77] acknowledges the rights and interests of indigenous peoples. It states that ‘responsibilities, interests and aspirations of the indigenous peoples will be respected in relation to their lands, and their roles in park management will be supported. The Parks system will be managed with a high level of cooperation between indigenous peoples and the Service in a manner appropriate to indigenous cultural heritage and the protection of natural and cultural values’.

A review of Aboriginal involvement in the management of the Area, entitled ‘Which Way Our Cultural Survival’ [78], was completed in 1998 for the Wet Tropics Ministerial Council. The Review presented a commentary on current approaches to Aboriginal involvement in the Area and provided a series of recommendations to help meet the needs and the aspirations of Rainforest Aboriginal people. An Interim Negotiating Forum was established to implement the recommendations of the review.

The Interim Negotiating Forum led to the signing of the Wet Tropics Regional Agreement [79] in April. 

*RAAC field trip*
2005 between the 18 Rainforest Aboriginal tribal groups and the Queensland and Australian Government World Heritage management agencies. The Regional Agreement reconfirms the obligations and commitment of these World Heritage management agencies to cooperatively manage the Area with Rainforest Aboriginal people. Key outcomes of the Wet Tropics Regional Agreement include:

- the establishment of the Aboriginal Rainforest Council (ARC), recognised by World Heritage management agencies as the peak organisation for land and cultural heritage matters in the Area
- the establishment of the Rainforest Aboriginal Advisory Committee as a statutory advisory committee to the Wet Tropics Board
- support to seek listing of the Area on the National Heritage List as a precursor to potential nomination of cultural values for World Heritage listing
- the appointment of a second Aboriginal Board Director of the Wet Tropics Management Authority
- the development of detailed protocols and guidelines outlining how Rainforest Aboriginal people are to be involved in the range of management activities
- support for improved training and employment opportunities for Rainforest Aboriginal people
- recognition and protection of intellectual and cultural property rights and involvement in research.

Implementation of the Regional Agreement is well underway with the establishment of the ARC in September 2004 and the Rainforest Aboriginal Advisory Committee (RAAC) in November 2004. The ARC functions as the peak body for Rainforest Aboriginal involvement in land and cultural heritage matters in the Area. The RAAC deals with issues specific to the Wet Tropics Management Authority.

**Management actions (2006-2007)**

**Employment**

- QPWS employed 31 indigenous staff who work in the Area. Another 31 indigenous people were employed on the Community Jobs Programs to help clean up after TC Larry [80].
- The Authority developed criteria for selection of Aboriginal Board directors and supported the one current Aboriginal director.
- The Authority created two permanent, indigenous identified positions for Aboriginal Project Officers (formerly contract positions). The role of the Project Officers is to engage with Rainforest Aboriginal people and facilitate their participation in World Heritage management.
The Queensland and Australian Governments both provided funding of $150,000 to support ARC operations. The Authority provided $18,500 to support capacity building and administrative operations at the ARC.

Aboriginal people continued their active land management through community ranger groups such as those based at Mossman Gorge (Kuku Yalanji), Kuranda (Djabugay), Clump Mountain (Djiru and Ma:Mu) and Girringun (Girramay and others) and Yarrabah Community.

Consultation

The annual Wet Tropics Regional Agreement Workshop was held at Mungalli Falls on 14-17 June 2007 to discuss the implementation of the agreement and Rainforest Aboriginal participation in management of the Area. Participants agreed to 15 amendments to the Regional Agreement. The workshop was organised by the Authority and the ARC.

At a workshop in November 2006, Wet Tropics Traditional Owners determined the best ways to build their capacity to record, map and manage cultural heritage information. These included accredited training in different methods and technologies to record and map cultural heritage; and provision of computer systems and web-based mapping software in their local communities. The workshop was part of the Cultural Heritage Mapping Project for the Wet Tropics region, a $1M project funded to 2008 through the NHT and managed by the ARC and FNQ NRM Ltd. The project will provide support for nomination of the Area for National Heritage Listing and re-nomination of the World Heritage Area for its cultural landscape values.

The Authority held quarterly meetings of the RAAC to advise the WTMA Board. The Authority also supported RAAC delegates to attend the National Native Title Conference in Cairns on 6-8 June 2007.

Seventeen Wet Tropics Traditional Owner groups completed country-based plans for natural resource management funded by FNQ NRM Ltd.

The ARC consulted with Rainforest Aboriginal people and provided advice about World Heritage management for the Authority’s Board, EPA and DNRMW.

QPWS and WTMA developed operational working groups for National Parks to promote cooperative management with Traditional Owners.

The ARC, WTMA, FNQ NRM Ltd, Girringun and Burdekin Solutions Ltd completed negotiations for a Regional Partnership Agreement with the Indigenous Coordination Centre to implement the Wet Tropics Regional Agreement and the Aboriginal Natural and Cultural Resource Management Plan. The agreement is now awaiting endorsement by all parties.
Rainforest Aboriginal people were consulted about numerous Indigenous Land Use Agreements, National Park planning processes and park interpretive signs and information.

7.4 Landholders and neighbours

Background

The Area includes 127 freehold blocks or parts thereof (two percent of the Area) and about 202 leases (8.9 percent of the Area, mainly due to large grazing leases). Neighbouring land is managed for a multitude of purposes including conservation, timber production, grazing, sugar cane and other agriculture, tourism and private residences. There are more than 2,500 individual blocks of land neighbouring the Area’s 3,125km boundary and many more in the surrounding lands. Many of the major threats to World Heritage values occur along the boundaries. The assistance of landholders and neighbours is vital for the retention and rehabilitation of habitat and wildlife corridors outside the Area; fire management; weed and feral animal control; and care of water quality and flows. Healthy ecological management of their properties can also benefit landholders.

Management actions 2006-2007

- Nine new Nature Refuges, covering 492ha, were gazetted in the Wet Tropics in the past year. Six of these properties adjoin the World Heritage Area or National Parks. Two other properties form part of vegetation corridors connecting large tracts of rainforest. There are now 62 declared Nature Refuges in the Wet Tropics covering 7,060ha. There are also 6,632ha of the Taravale/Mount Zero Nature Refuge (60,308ha) within the Wet Tropics bioregion.

- Following TC Larry, QPWS managed about 90 workers as part of a labour market work program to assist with protected area repair and neighbour assistance activities. A $600,000 grant scheme was established to assist neighbours of protected areas to repair boundary fencing and access where damage had occurred from falling trees. Other Nature Refuge properties within the region were also assisted to clear cyclone debris.
Several pig trapping programs assisted neighbours of protected areas and the World Heritage Area to control pig numbers and the impacts on their crops and wetlands (see 5.6 Pest animals).

7.5 Conservation activities

Background
The Wet Tropics community plays an enormously important role in conservation management. People contribute local knowledge and expertise, and provide labour and enthusiasm through their employment and volunteer activities. The Wet Tropics community supports a rich array of groups active in natural resource management and environmental issues. The extensive network of groups includes:

- Australian Rainforest Foundation (ARF)
- BatReach
- Birds Australia
- Cairns and Far North Environment Centre (CAFNEC)
- Catchment Management groups
- Coastcare groups
- Community for Coastal and Cassowary Conservation (C4)
- Conservation Volunteers Australia (CVA)
- Daintree Cassowary Care
- Environmental Defender’s Office (EDO)
- Frog Decline Reversal Project (Cairns Frog Hospital)
- Greening Australia
- Integrated Catchment Management groups
- Kuranda Conservation
- Kuranda EnviroCare
- Landcare groups
- Wildlife Preservation Society Queensland (WPSQ) branches
- Rainforest Rescue (including Daintree Rainforest Foundation)
- Tolga Bat Rescue and Research
- Tree Kangaroo and Mammal Group (TKMG)
- TreeForce
• Trees for the Evelyn and Atherton Tablelands (TREAT)
• Wet Tropics Volunteers
• Wildlife Rescue groups

Queensland Government and local government land managers often rely on assistance from this immense resource of community knowledge and support. It is extremely important to maintain the capacity of community groups to continue to operate in an era of reduced and uncertain funding. In addition to achieving on-ground outcomes, community conservation creates a culture of caring for the environment and a heightened awareness and appreciation within the general public of the values of the Area.

Management actions (2006-2007)

Land acquisition

• In April 2005 the ARF received $5M dollars from the Australian Government for a range of conservation initiatives in the Daintree. The three year program includes land acquisition and stewardship payments. In 2006-2007 the ARF purchased 14 blocks of land in the Daintree taking the total land holdings to 163 hectares over 26 titles valued at $4,130,000.

• In 2005 the ARF received $1M from the Australian Government for cassowary conservation initiatives in the Cape Tribulation to Cardwell area coastal corridor. These initiatives include land acquisition, sponsorship, stewardship payments, research and fund raising. In 2006-2007 the ARF purchased 60ha of critical cassowary habitat at El Arish to provide a linkage with a nearby National Park.

• Daintree Rainforest Foundation and Rainforest Rescue raised funds for the purchase of their ninth private property in a Daintree rainforest residential precinct. Volunteers cleared up weeds and rubbish on the 2.12ha lot at Cape Tribulation and will revegetate the property with local rainforest trees. A joint fundraising dinner held in Port Douglas on 10 June 2007, together with preceding fundraising efforts, raised $50,000 towards the purchase of a tenth property.

• The EPA acquired a further 36 blocks in the Daintree as part of round two of Daintree Revisited funding. A total of 151 blocks covering 204.4ha have now been purchased at a cost of $6.98M (including four blocks purchased by Douglas Shire Council).

Wildlife care

• The ARF formally took over the day to day management of the QPWS Garners Beach Cassowary Hospital.

• CAFNEC and numerous volunteers undertook the annual census of the spectacled flying fox in the Wet Tropics under a contract with QPWS.
• The Frog Decline Reversal Project (Cairns Frog Hospital) was funded by the Australian Government to investigate new frog diseases, with the help of CSIRO, JCU and the Registry of Wildlife Pathology. A range of new fungal and bacterial diseases have appeared in the wake of TC Larry and been exacerbated by the continued wet weather since the cyclone.

• Kuranda EnviroCare reported cassowary sightings by the public to QPWS so that temporary signs could be erected to warn motorists to slow down.

• The local Mission Beach community assisted QPWS to maintain up to 61 supplementary feeding stations in areas affected by TC Larry. QPWS spent $6,000 per week on fruit supplies, servicing feed stations and the husbandry of animals in care at the QPWS Garners Beach Cassowary Rehabilitation Facility. About 1000kg of fruit was purchased weekly. This was supplemented by approximately 100kg of fruit per week donated by community members and local businesses who also helped in the preparation of the food (see 3 Tropical Cyclone Larry).

• Tolga Bat Rescue and Research addressed over 1,100 students from Wet Tropics primary schools, as well as numerous tertiary students visiting and volunteering at the hospital. A visitor centre is underway at the hospital with funds from the Australian Geographic Society and the Wet Tropics Management Authority. Tolga Bat Rescue and research is also leading a campaign for wildlife friendly fencing funded by the World Wildlife Fund.

Revegetation and weed control

• Catchment management groups, funded through FNQ NRM Ltd, continued rehabilitation of riparian vegetation and weed control activities. These included repairing cyclone damaged sites and hymenachne control on the Barron River; weed control and revegetation of a floodplain and river banks along the Mulgrave River; water monitoring in the Mulgrave River; tree planting on cyclone damaged water courses in the Russell River catchment; repairing rainforest edges damaged by TC Larry on private properties neighbouring the Area near Bramston Beach; water quality monitoring and riparian revegetation in the Johnstone River catchment; and tree planting in mahogany glider habitat and wetland rehabilitation in the Lower Herbert River catchment.
• In March and April 2007 C4 planted about 4,000 trees on a Mt Edna property to provide another link in the north-south wildlife corridor. C4 also increased the variety of plants in its nursery to over 200 species. Trees were used by QPWS, Biotropica and ARF as well as many local people trying to re-establish their gardens after TC Larry. C4 now aims to produce about 15,000 plants a year.

• CVA managed the on-ground works and community engagement for the Barron River Green corridor project. In the first year of the project 33,000 trees have been planted and maintained. The Green Corridor is a community partnership project to revegetate and remediate the Barron River from the upper catchment to the mouth, involving volunteers to create a green corridor of restored riverine ecosystems. It is an initiative of the Barron River Catchment Management Association and was launched in November 2005 with funding from the Cairns Port Authority. FNQ NRM Ltd funded a part-time project coordinator.

• CVA facilitated over 2,600 volunteer days in the Wet Tropics region during the past year. It worked to eradicate pond apple, thunbergia and other weeds in the Wet Tropics. CVA began managing the Weedwatchers education program which also focuses on eradication of emerging new weed species. CVA also worked with QPWS, Cardwell Shire Council, BHP Billiton, Shell and Boral on conservation projects in the region.

• In May 2007 the Daintree Cassowary Care Group, with assistance from Douglas Shire Council, planted 450 trees on a block in Cow Bay. The land had been illegally cleared and was subsequently bought by Douglas Shire Council after it was discovered that a fern, previously believed to be extinct, was growing there. The Cassowary Care Group also continued to revegetate the Jindalba site. Over 25ha have now been revegetated and less than a hectare remains cleared on the 60ha block.

• Both Kuranda Envirocare and Kuranda Conservation continued to rehabilitate the Kuranda Envirolink Wildlife Corridor, adding a further 2ha to the 10ha of revegetation already planted. Over 3,000 trees were raised and planted. The Kuranda community also helped to revegetate Barron River riparian zones as part of the Barron River Green Corridor Project. The project aims to revegetate the whole length of the river over the next
10-20 years. Much of this revegetation adjoins the World Heritage Area and provides connectivity for cassowaries and other wildlife.

- QPWS distributed 23,655 seedlings for replanting on and off protected area estate as part of the ongoing operation of the QPWS Restoration Services Nursery at Lake Eacham.

- QPWS completed a weed control and rehabilitation program at Eubenangee Swamp.

- TREAT and QPWS continued to replant the Peterson Creek corridor near Yungaburra. Over 1,500 trees were planted and much debris removed after damage by TC Larry – about 30 percent of the 2006 plantings were destroyed. Para grass was cleared on the stream bank in preparation for further planting. Revegetation began in 1998 and to date some 50,000 trees have been planted. The project links the isolated Lake Eacham area with the Curtain Fig State Forest and Yungaburra National Park.

- TreeForce has continued rehabilitation planting of native trees along Freshwater Creek in Cairns.

7.6 Research

Background

Research into World Heritage values and threatening processes is integral to effective conservation management. Research is needed to help us better understand how ecosystems and species behave and interact. It can identify threatening processes and help find biological and technological solutions for them. Research also helps us to understand how the Area benefits the community and how the community can best assist in management of the Area. To this end it is important that research projects reflect the needs and desires of the community and that the community plays a role in research.

In 2006 the Marine and Tropical Science Research Facility (MTSRF) was established by the Australian government with funding of $40M over four years. The national research hub for rainforest research is located at the Cairns campus.
of JCU. The MTSRF provides research funding for areas not currently supported through existing grant programs and supports research with a strong ‘public good’ focus. The MTSRF developed a Research Investment Strategy in 2005-2006 to guide investment in research over the life of the program. The Reef and Rainforest Research Centre (RRRC) is an incorporated body which administers the MTSRF research program.

The Rainforest CRC, JCU and the CSIRO TFRC have been the primary research organisations in the Wet Tropics bioregion. Research projects may involve affiliations between these research bodies as well as with other universities and CRCs for issues such as weeds, vertebrate pests, tourism and the reef. Government agencies such as QPWS, DNRMW, DMR, DPIF and the Authority may help fund or conduct research programs individually or within the MTSRF, as well as participating as research user groups on RRRC committees.

Management actions (2006-2007)

- The RRRC completed the first year of its research program, funded under the MTSRF. A range of research projects began investigating the various roles of the community in Wet Tropics conservation and how to identify and measure the social benefits of the Wet Tropics rainforests and World Heritage Area. These included research projects to:
  - build capacity for Traditional Owner participation in natural resource management and management of the Area
  - improve understanding about the perceptions and motivations of tourists and the local community who use the Wet Tropics rainforests (see 6.3 Tourism and recreation)
  - profile land management practices on private lands and develop tools to help landholders and managers identify the socioeconomic benefits of forest restoration
  - develop a toolkit and indicators for community groups to monitor and evaluate reforestation and restoration projects
  - develop water quality monitoring systems and define associated ecosystem services
  - develop indicators of social resilience in relation to water quality at a range of scales – from the Great Barrier Reef to local catchments and communities in the Wet Tropics
  - provide indicators for the key ecosystem services and biodiversity assets of the Wet Tropics for regional environmental reporting (including the State of the Wet Tropics Report).

- As part of the ‘Rainforest to Reef Conservation Research Initiative’ Earthwatch ran information days and gave talks about climate change, wetlands, rainforests as a resource and sustainable communities. Earthwatch
also provided volunteers to assist research in rainforest biodiversity and climate change; seed dispersal; cockatoos, kangaroos and bettongs; and life in the forest canopy.

- JCU sponsored the construction of an energy efficient building for the Australian Tropical Forests Institute adjoining JCU. It is anticipated that the building will host a range of research organisations including the JCU/CSIRO Tropical Landscapes Joint Venture, the Australian Tropical Herbarium, the Centre for Tropical Agritech Research and the Cairns section of the MTSRF.
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