5

Tropical North Queensland

5.1 On 5 and 6 July 2012, the Committee held a public hearing in Townsville and visited various sites in Townsville and north of Cairns. The focus of the visit was to consider the vulnerability of marine coral reef ecosystems and terrestrial wet tropical ecosystems to climate change, as highlighted in submissions presented to the inquiry.

5.2 Tropical North Queensland is home to both the Great Barrier Reef World Heritage Area, and the Wet Tropics of Queensland World Heritage Area. The Great Barrier Reef Marine Park covers an area of approximately 344 400 square kilometres along 2300 kilometres of Queensland's coastline, from the tip of Cape York south to Bundaberg.[1] Many different habitat types exist within this area, including coral reefs, seagrass meadows, tidal wetlands, open waters and islands.[2] Climate change has been identified as the greatest threat facing the Great Barrier Reef ecosystem.[3]

5.3 The Wet Tropics of Queensland World Heritage Area covers some 8944 square kilometres, spanning over 450 kilometres along the north-east coast of Australia, from just south of Cooktown to just north of Townsville.[4] The 'wet tropics' is the most biodiverse terrestrial region of Australia.[5] The main vegetation type is wet tropical rainforests, fringed by sclerophyll forests, woodlands, swamps and mangrove forests; there are

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1 The Marine Park makes up over 99 per cent of the World Heritage Area. Great Barrier Reef Marine Park Authority (GBRMPA), 'Great Barrier Reef outlook report 2009', *Exhibit 23 to Submission 28*, pp. 3, 135.

2 GBRMPA, *Submission 28*, p. [1].

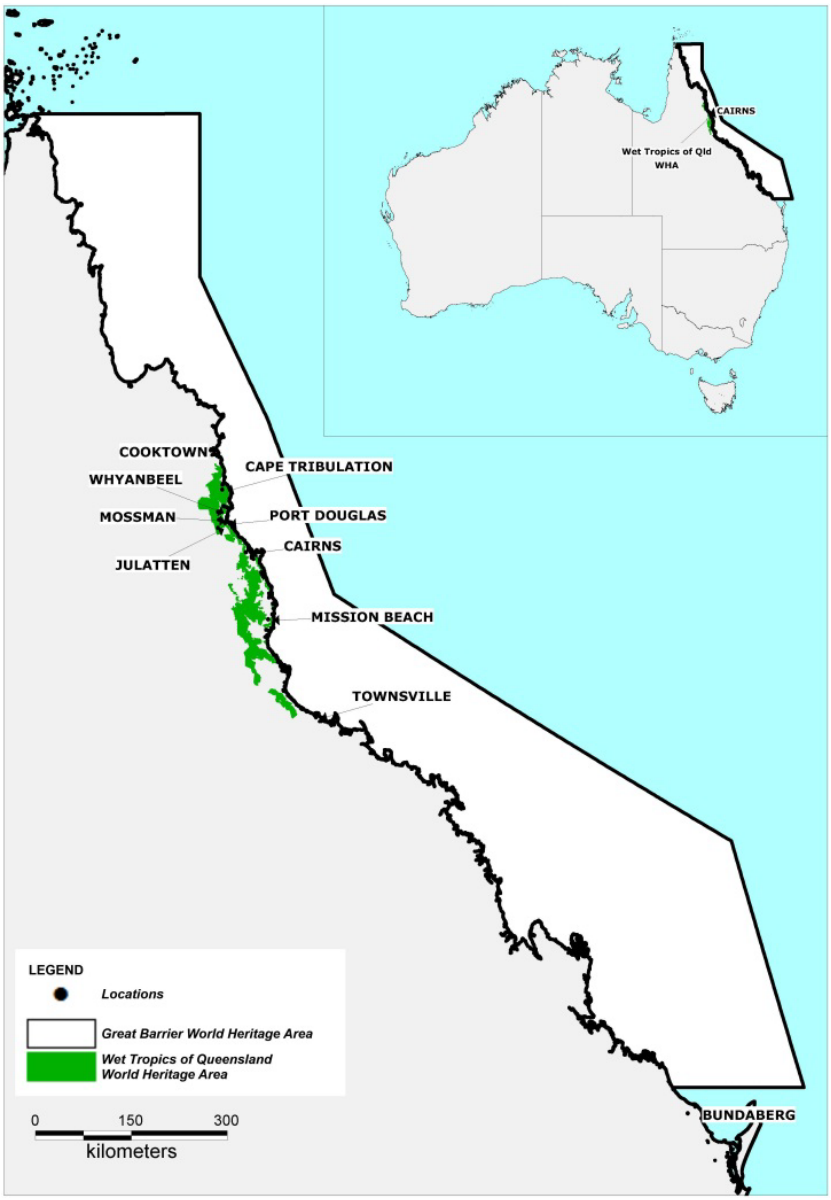
3 GBRMPA, 'Great Barrier Reef outlook report 2009', *Exhibit 23 to Submission 28*, p. 172.

4 United Nations Educational, Scientific and Cultural Organization (UNESCO), 'Wet Tropics of Queensland', <http://whc.unesco.org/en/list/486> viewed 31 July 2012.

5 Wet Tropics Management Authority (WTMA), *Submission 2*, p. 1.

also several endemic species including the lemuroid ringtail possum.[6] Climate change is predicted to result in changes in species abundance and distribution, increased vulnerability to pests and weeds,[7] and high levels of extinction in the wet tropics of Queensland.[8]

Figure 5.1 Location of the Wet Tropics of Queensland World Heritage Area and the Great Barrier Reef World Heritage Area



Source *Parliamentary Library © Commonwealth of Australia 2012*

6 UNESCO, 'Wet tropics of Queensland', <http://whc.unesco.org/en/list/486> viewed 31 July 2012.

7 WTMA, 'Climate change in the wet tropics—Impacts and responses: state of the wet tropics report 2007-08', *Exhibit 3 to Submission 2*, p. 10; WTMA, *Submission 2*, pp. 5-6.

8 R Garnaut, *The Garnaut climate change review: final report*, Cambridge University Press, Port Melbourne, 2008, p. 142.

5.4 The two-day inspection and public hearing program provided the Committee with an overview of the major climate change issues potentially affecting the biodiversity of local and international coral reef and wet tropical ecosystems. The key issues identified by the Committee during the site inspections included the impacts of invasive species, ocean acidification, increasing temperatures, and increasing intensity of extreme weather events.

Committee activities

5.5 The Committee's visit to Tropical North Queensland included inspections and briefings at Reef HQ Great Barrier Reef Aquarium in Townsville (Reef HQ), and in wet tropics areas north of Cairns. These activities provided an insight into the distinct ecosystem types existing in close proximity to each other, and the common challenges faced in the region due to climate change.

Reef HQ Great Barrier Reef Aquarium

5.6 Reef HQ in Townsville is the National Reef Education Centre for the Great Barrier Reef Marine Park Authority (GBRMPA),[9] and houses the world's largest coral reef aquarium. The Great Barrier Reef is home to approximately 1500 species of fish, 400 species of hard coral, one third of the world's soft corals, and six of the seven species of sea turtle.[10] Reef HQ's 2.5 million litre tank displays a coral reef exhibit with approximately 150 species of fish and 120 species of coral found on the Great Barrier Reef.

5.7 On 5 July 2012, the Committee inspected Reef HQ's research and community awareness projects, and gained an insight into how Reef HQ's interactive aquarium setting engages the community on the challenges faced by the Great Barrier Reef. At the time of the Committee's visit there were 28 living exhibitions showing reef supporting ecosystems and the biodiversity of the region. The Committee met with Mr Fred Nucifora, the Director of Reef HQ, and received briefings on the threats to biodiversity in reef ecosystems due to climate change; the research projects being undertaken at Reef HQ by Australian Institute of Marine Science (AIMS)

9 GBRMPA was established in 1975 as a federal government statutory authority responsible for managing and protecting the Great Barrier Reef Marine Park.

10 C Reid, J Marshall, D Logan and D Kleine, *Coral reefs and climate change*, CoralWatch, The University of Queensland, Brisbane, 2009, p. 83.

and James Cook University researchers; the *Great Barrier Reef Marine Park Zoning Plan 2003*; and GBRMPA's Reef Guardian program.

The wet tropics of Queensland

5.8 As noted earlier, the wet tropics of Queensland is the most biodiverse terrestrial region of Australia.[11] The Committee visited the Daintree Rainforest Observatory (DRO), which lies about 140 kilometres north of Cairns in the Cape Tribulation region. Whilst travelling through the wet tropics, and once at the DRO, the Committee received briefings from the following organisations:

- Wet Tropics Management Authority (WTMA), represented by:
  - ⇒ Dr Steve Goosem, Principal Scientist; and
  - ⇒ Mr Andrew Maclean, Executive Director; and
- James Cook University (JCU), represented by:
  - ⇒ Mr Peter Byrnes, Site Manager, Daintree Rainforest Observatory;
  - ⇒ Dr Susan Laurance, Senior Lecturer, School of Marine and Tropical Biology;
  - ⇒ Mr Bradley Smith, Research Strategy and Special Projects Manager, Division of Research and Innovation; and
  - ⇒ Mr Andrew Thompson, Research Worker/Canopy Crane Operator.

5.9 Some of the briefings throughout the day focused on local rainforest connectivity projects, research projects measuring the effects of climate change on species abundance and adaptability, and long-term baseline data collection necessary for measuring changes over time.

5.10 During the inspections, the Committee received the following documents:

- *Cairns to Daintree field trip map*, WTMA, July 2012.
- *Port Douglas to Daintree Rainforest Observatory*, trip notes, Dr Steve Goosem, July 2012.

Issues explored in Tropical North Queensland

5.11 Throughout its Queensland site inspection program, the Committee gathered evidence on how invasive species, ocean acidification, increasing temperatures and extreme weather events are posing threats to the biodiversity of Australia's reefal and wet tropical ecosystems. The Committee also gathered evidence on sustainable management practices,

11 WTMA, *Submission 2*, p. 1.

research and connectivity programs, and education and community awareness projects supported in the area.

Invasive species and species decline

5.12 During the course of the inquiry, the Committee has heard about the risks invasive species pose to biodiversity. In Western Australia and Sydney, for example, the Committee heard about phytophthora dieback and myrtle rust as emerging threats to biodiversity.[12] In Tropical North Queensland, the Committee was advised that over 200 plant species in the wet tropics are at risk of being infected by myrtle rust. The Committee heard that, as a windborne pathogen, there is little possibility of preventing the spread of the disease once it has taken hold.

5.13 The spread of invasive weeds also presents threats to biodiversity in the wet tropics. Outbreaks of weeds, such as miconia and Koster's curse, have been observed in the Whyanbeel area just north of Mossman.[13] These weeds are subject to eradication, as part of a nationally coordinated program managed by the Queensland Government. They are considered weeds because of their potential to damage the native and agricultural lands in Tropical North Queensland, and infest tropical areas of other states.[14]

5.14 The predicted increase in the frequency and intensity of cyclones will assist in spreading invasive weeds in hard to reach places such as rainforested hillsides. High winds, heavy rains and flooding associated with cyclone activity create disturbances that make ecosystems more susceptible to invasion, while also helping to spread the seed of invasive species. The spread of invasive weeds, particularly into inaccessible locations, will make management of these species difficult and expensive.

5.15 Species decline is an additional challenge to biodiversity in wet tropics areas. During the Daintree Rainforest Observatory (DRO) site inspection, the Committee heard that the world is currently experiencing the sixth mass extinction, and that 25 per cent of species in the Australian wet tropics are projected to become extinct.

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12 House of Representatives Standing Committee on Climate Change, Environment and the Arts (CCEA Committee), *Case studies on biodiversity conservation: volume 1*, May 2012, pp. 11-12, 58. There is controversy surrounding the correct scientific classification for myrtle rust in Australia, therefore only the common name has been included.

13 See figure 5.1 above, p. 56.

14 Department of Agriculture, Fisheries and Forestry (DAFF), 'National eradication programs—Exotic weeds', <http://www.daff.gov.au/animal-plant-health/pests-diseases-weeds/weeds/eradication> viewed 24 October 2012.

5.16 The Committee has previously heard about the potential for loss of species adapted to living in high altitudes in alpine regions, due to increased temperatures.[15] The Committee heard about a similar phenomenon in the high altitude regions of the wet tropics, affecting the threatened lemuroid ringtail possum (*Hemibelideus lemuroides*). An endemic possum in the wet tropics, lemuroids are very sensitive to high temperatures and poorly adapted for regulating their body temperature. In the 1980s, lemuroids were commonly found living above 1000 metres on the Carbine Tableland. Since then, there has been a significant decline in lemuroid numbers in the area. Furthermore, since 1999, lemuroids have been observed living at higher altitudes of above 1200 metres. The Committee was advised that this population decline and range shift has been partly attributed to the extreme, extended heat wave experienced in the region in the summer of 2005.

Committee comment

5.17 The Committee understands that the spread of myrtle rust is of concern in the wet tropics. At an earlier site visit to the Australian Botanic Garden at Mount Annan, the Committee heard about the rapid spread of myrtle rust along the east coast of Australia.[16] The full impacts of myrtle rust on the resilience of the wet tropics ecosystem are unknown, and there is little way of preventing its spread. The Committee acknowledges some views expressed about the spread of myrtle rust and possible ways to reduce its impact, including identification of the vulnerabilities of different parts of the forest to myrtle rust, and localised quarantine over important areas.[17]

5.18 There are numerous national management plans for invasive species,[18] setting targets for reducing the impacts of invasive species on various ecosystems.[19] The Committee recognises these plans and targets as useful tools in the management of invasive species, and acknowledges the importance of cooperation between all levels of government towards a

15 CCEA Committee, *Case studies on biodiversity conservation: volume 1*, May 2012, p. 38.

16 CCEA Committee, *Case studies on biodiversity conservation: volume 1*, May 2012, pp. 58-9.

17 Mr Andrew Maclean, WTMA, *Transcript of evidence*, 5 July 2012, p. 27; CCEA Committee, *Case studies on biodiversity conservation: volume 1*, May 2012, pp. 58-9.

18 See DAFF, *Submission 73*, pp. 2, 9, which lists: Australia's Biodiversity Conservation Strategy 2010-30; Caring for Our Country; the Clean Energy Futures Package; Australian Weeds Strategy; and the Australian Pest Animal Strategy as examples.

19 See, for example, Natural Resource Management Ministerial Council 2010, *Australia's biodiversity conservation strategy 2010-30*, Department of Sustainability, Environment, Water, Population and Communities, Canberra, p. 46.

national quarantine system which may limit the spread of diseases and invasive weeds in the future.[20]

5.19 Should the high levels of projected species extinction in the wet tropics and worldwide be realised, the effects on the biodiversity of the wet tropics region would be significant. Increased temperatures, extreme weather events and changes in rainfall patterns contribute to the loss of rainforests. In these circumstances, species like the lemuroid ringtail possum are forced to move to higher altitudes to survive. Those species already living at those higher altitudes, however, will have nowhere to go. Policies currently being pursued to combat projected species extinctions include minimising climate change, protecting tropical forests and increasing habitat connectivity—issues the Committee explores later in this chapter.

Climate change threats to biodiversity

5.20 Ocean acidification has been identified as a serious threat to the biodiversity of coral reef ecosystems. The coral reef exhibition at Reef HQ, containing thousands of reef creatures, is exposed to the same weather elements which occur in natural reefs. During its inspection, the Committee heard about the detrimental impacts of a more acidic ocean on corals. As levels of atmospheric carbon dioxide increase, the amount of carbon dioxide absorbed by the ocean also increases, causing the ocean to become more acidic.[21] This affects the ability of coral reefs to grow, which could in turn reduce the capacity of the Great Barrier Reef to repair itself after natural disturbances, including damage from cyclones and storms, or human induced disturbances, including damage from marine vessels and visitors.

5.21 Coral bleaching is another threat to reef ecosystems that can inhibit coral reproduction and lead to mortality. Put broadly, coral bleaching can occur as a result of sea temperature increases, and the ability of corals to recover from such events depends upon the length and severity of the temperature increase and the resilience of the reef. When waters are more acidic, corals have been found to bleach at lower temperatures,[22] demonstrating that the combined effect of ocean acidification and coral bleaching can be greater than the effect of each phenomenon alone.

5.22 In a survey of the Great Barrier Reef, carried out by AIMS scientists and published in 2009, a 14.2 per cent decrease in coral growth since 1990 was

20 CCEA Committee, *Case studies on biodiversity conservation: volume 1*, May 2012, p. 58.

21 C Reid, J Marshall, D Logan and D Kleine, *Coral reefs and climate change*, CoralWatch, The University of Queensland, Brisbane, 2009, p. 68.

22 Dr S Ward, *Submission 63*, p. [4].

observed, with the rate of decline being influenced by increased sea surface temperatures and ocean acidification.[23] The Committee also heard that the strength and frequency of cyclones is expected to intensify, in part due to a warming ocean, which would put added pressure on coral growth through increased damage to coral cover.

5.23 The Committee was interested to see the research facilities Reef HQ provides to local researchers. Reef HQ has previously supported researchers from The University of Queensland, who were assessing the factors affecting the vulnerability of coral reefs to ocean acidification. At the time of the Committee's visit, Reef HQ was supporting researchers from JCU, who were conducting experiments on the impacts of ocean acidification on coral strength.

5.24 The Committee heard that increased temperatures and changes in hydrological patterns are also posing a threat to the biodiversity of wet tropical ecosystems. During briefings given at the DRO, the Committee was informed that current climate change research in tropical forests is focused on the effects of increased temperatures, droughts and storms, and how they interact with land use.

5.25 Thornton Peak is an upland refugial area of the wet tropics, with fern forests at the summit that rely on cloud stripping to contribute large amounts of water to the forest system and the upper catchments. The rainforests capture water directly from the clouds and then release the water slowly, which maintains stream flows in the dry season. The Committee understands that cloud stripping contributes up to 70 per cent of the total water input into the forest system in the dry season and 10 to 20 per cent in the wet season. The Committee heard that an increase in average temperature by one degree Celsius would likely raise the cloud base by 100 metres, reducing the level of cloud stripping and causing significant stress to the ecosystem.[24]

Committee comment

5.26 Throughout its visit to Tropical North Queensland, the Committee heard about the current and future effects of increased temperatures and increased levels of atmospheric carbon dioxide on the local ecosystems. The Committee was pleased to hear about the research being supported by Reef HQ, investigating the impacts of ocean acidification on reef

23 AIMS, 'Declining coral growth on the Great Barrier Reef', <http://www.aims.gov.au/docs/research/climate-change/declining-coral-growth.html> viewed 7 August 2012, citing G De'ath, J Lough and K Fabricius, 'Declining coral calcification on the Great Barrier Reef', *Science*, vol. 323, 2009.

24 Dr S Goosem, 'Port Douglas to Daintree Rainforest Observatory', trip notes, July 2012, pp. 3, 5.

ecosystems. The partnerships between the local universities and Reef HQ appear mutually beneficial for improving the understanding of the effects of climate change from a scientific perspective, and for engaging and educating the community on what individuals can do to combat the effects of climate change on Australia's biodiversity.

5.27 The adverse impacts of ocean acidification, increased temperatures, and changes in hydrological patterns discussed above reinforce the need to build resilience into ecosystems to help them withstand changes in climate.

Sustainable management of reef and rainforest

5.28 The Committee's visit to Reef HQ highlighted the importance of sustainable management practices to the protection of the Great Barrier Reef and the wet tropical rainforests of Queensland.

Sustainability at Reef HQ

5.29 Reef HQ demonstrates sustainable management through its coral propagation program, the results of which are displayed in the aquarium. The coral propagation program was explained to the Committee as operating in a similar way to that of growing new plants from mature ones in a garden; the donor mother colony is left in place in the research facility, with the fragments taken from it placed in the right conditions for them to grow. Traditionally, in order to carry out research, corals would be collected from the reef and translocation would sometimes kill the coral. The Committee was informed about the long-term goal of requiring little to no collection of coral from the Great Barrier Reef in order to carry out the coral propagation program. This would mean that the corals appearing in the displays at Reef HQ could be regenerated through the coral propagation program, with no adverse effect on the Great Barrier Reef.

5.30 The Committee heard that the sustainable use of resources at Reef HQ aims to reduce energy consumption. Aspects of the air conditioning and chilled water system, and the pump and filtration system design, are contributing to lower energy consumption. A lighting replacement program aims to transition to the use of energy efficient LED lighting, and improvements have been made to building insulation and building management systems for monitoring and control. The aquarium features a 153 kilowatt roof mounted array of photovoltaic solar panels, with an initial offset of 15 to 20 per cent in annual energy use, and a 260 tonne

reduction in annual greenhouse gas emissions expected.[25] The Committee heard that the aim is to reduce its energy use by 50 per cent of 2006 levels by the end of 2012.

Figure 5.2 Members inspecting Reef HQ's coral propagation program

Photograph courtesy of committee secretariat

Rainforest management

Land use

5.31 Black Mountain Corridor is a strip of rainforest along the top of the Macalister Range that connects the northern and southern rainforest sections of the wet tropics. The Committee heard that the Julatten area—a strip of agricultural lands and rural residential subdivisions—has separated the Black Mountain Corridor from the Mount Lewis and Carbine Tableland northern section of the wet tropics. The Committee was informed about the progress and success of local management groups in re-establishing this connection, for example, through a tree-planting scheme that has been operating for the past six years, supported by the local community. The Committee understands that there is a long history of community-based rainforest tree-planting organisations also operating north of the Daintree River.

5.32 Another area of the rainforest that has suffered due to changing land use arrangements is north of the Daintree River in the Daintree region, home to around 100 threatened species. Much of the lowlands in this region

25 Reef HQ, 'Energy management', <http://www.reefhq.com.au/education-at-reef-hq-aquarium/reef-research-and-internships/energy-management> viewed 8 August 2012.

were subdivided for development in the 1980s. Many of the subdivisions were targeted for buy-back as part of the mid-1990s local, state and federal government Daintree Rescue Program. The Committee heard about the ongoing restoration projects, including wildlife corridors and rainforest connectivity revegetation projects, to repair and link these subdivisions to the rainforest once again. These projects are aimed at making the rainforest more resilient, increasing wildlife habitat and decreasing invasive weed encroachment.

Road design

5.33 The Committee noted that the narrow, winding Cape Tribulation Road has been designed with large speed bumps in order to slow traffic and reduce wildlife roadkill. These traffic calming devices are designed to help protect wildlife such as cassowaries from further decline, after the significant loss of population further south in the Mission Beach area due to three cyclones in recent years.[26] The Committee heard that the Mission Beach area could benefit from more speed bumps to better protect local cassowaries, given that the area is fragmented and therefore more at risk of local extinction should further disturbances such as cyclones contribute to species decline.

5.34 The narrowness of the road allows for vegetation to grow close to it, the rainforest canopy to grow over the top of it, and rainforest fauna to move over it, contributing to rainforest connectivity from the lowlands through to the Thornton Peak uplands. Minimising disruption to the connectivity of the rainforest allows for resilience to be increased, which in turn strengthens its capacity to withstand climate changes.

Committee comment

5.35 The Committee commends the progress being made by Reef HQ toward the goal of requiring no collection of coral from the Great Barrier Reef for research or display purposes, and sees this as an important goal for research institutions in order to maintain as little human disruption to the structure of the reef as possible.

5.36 The Committee also commends Reef HQ's efforts towards the sustainable use of resources through the adoption of reduced energy use targets. The exhibitions and research being supported by Reef HQ are contributing to the publicly available information on the reef and the sustainable management of reef resources.

5.37 The Committee heard about the history of land use in the region, leading to the fragmentation of the rainforest. This highlighted the need for

26 See figure 5.1 above, p. 56.

regional planning for landscape resilience in the wet tropics of Queensland. The Committee also heard about the reasons for maintaining the Daintree Ferry; slowing traffic in the area; and incorporating connectivity measures into the road designs, and sees all of these as positive ways of promoting resilience in the ecosystem and promoting sustainable practices in the local human community. The Committee was informed of various road design features that assist with biodiversity conservation and sees merit in such measures being implemented in other areas of ecological significance.

5.38 The Committee heard repeatedly about the importance of building resilience into ecosystems to assist them to better withstand climate changes, and was interested to hear about the variety of connectivity projects in the Wet Tropics of Queensland World Heritage Area and Daintree region involving the local community working toward this goal. Government buy-back initiatives and community projects are making an important contribution towards reconnecting the rainforest, thereby increasing wildlife habitat and decreasing invasive weed encroachment. Such initiatives are intended to help protect the region from climate change impacts.

Research and training facilities and projects

5.39 Research conducted at Reef HQ involves collaboration between local universities and GBRMPA. The Reef HQ turtle hospital opened in August 2009, and is supported by the JCU School of Veterinary and Biomedical Science. One of the aims of the hospital is to enhance community engagement by raising awareness of these threatened species and encouraging changes in behaviour to ensure a sustainable future for turtles.[27] The facility allows visitors to see the turtles up close, and learn about their conditions and how they are being rehabilitated. In 2010-11, the hospital cared for 57 turtles, and had over 23 900 visitors.[28]

27 GBRMPA, *Annual report 2010-11*, GBRMPA, Townsville, 2011, p. 72.

28 GBRMPA, *Annual report 2010-11*, GBRMPA, Townsville, 2011, p. 72.

Figure 5.3 Members inspecting the turtle hospital at Reef HQ

Photograph courtesy of committee secretariat

5.40 The wet tropics of Queensland occupies 0.26 per cent of Australia's landmass, yet supports large proportions of its native plant and animal species, including 40 per cent of its bird species, 30 per cent of its marsupial species and 65 per cent of its fern species.[29] The Terrestrial Ecosystem Research Network's Rainforest Supersite in Far North Queensland comprises two sectors, the first being the lowland Daintree Rainforest Observatory (DRO) in the Cape Tribulation region. The second is the upland Robson Creek site, located northeast of Atherton. The locations of these two sites enable monitoring across a range of altitudes, temperature variations, and rainfall patterns.

5.41 The DRO opened in 1998, established with funding from the Australian Research Council. The Committee heard that further funding to develop the site as an educational and research centre had been provided by the federal government, increasing the amount of accommodation for students and the number of laboratories. Federal government funding had also been secured for remote sensing devices and equipment able to automatically monitor the environment through a wireless sensor network. The data collected through the network will be made available electronically to researchers offsite, making valuable information easily accessible.

29 WTMA, *Annual report and state of the wet tropics report 2010-2011*, WTMA, Cairns, 2011, p. 60.

5.42 The Committee inspected the complex mesophyll vine forest at the DRO site, viewing some of the 170 dendrometer bands placed at chest-height around the tree trunks. Dendrometer bands are used to collect and establish baseline data through measuring stem incremental growth, litter trap and leaf area index.[30] One of the purposes of collecting the data is 'to report on the risks and threats to lowland rainforest canopy trees under changing rainfall and temperature scenarios'.[31]

5.43 The Committee also inspected the canopy crane at the DRO. Identification tags are placed on all trees with a diameter at chest height of greater than 10 centimetres, within the arc of the crane; some 680 trees are closely monitored through the use of the canopy crane.[32] Access is made available to researchers from across the globe to carry out canopy-related research that can be shared. The DRO also provides access to the weather data that has been collected for over 10 years from the tower of the crane and in the clearing adjacent to the rainforest.

Figure 5.4 Committee members in the canopy crane with crane operator (left); and an example of the identification tags placed on trees around the DRO site (right)

Photographs courtesy of committee secretariat

5.44 The Committee heard about four main areas of climate change research currently being undertaken in tropical forests, namely:

30 JCU, 'Current research—JCU', <http://www.jcu.edu.au/canopycrane/informationfor/JCUPRD_047095.html> viewed 7 August 2012.

31 JCU, 'Current research—JCU', <http://www.jcu.edu.au/canopycrane/informationfor/JCUPRD_047095.html> viewed 7 August 2012.

32 JCU, 'Researchers—JCU', <http://www.jcu.edu.au/canopycrane/informationfor/JCUPRD_046932.html> viewed 7 August 2012.

- examining changes in long-term plot data—to be conducted at the DRO site through long-term altitudinal gradient monitoring;
- remote sensing of drought and fire patterns—the DRO will set up remote sensor towers to measure various environmental factors;
- modelling of species distribution; and
- studying the ability of individuals to adapt to changes in the environment. In situ experiments can study the impacts of climate change on tropical rainforests, where sections of the rainforest can be manipulated to simulate drought conditions to see how species will respond.

Committee comment

5.45 The DRO operates as a scientific and educational facility; one of many similar sites around the world. The Committee was impressed by the extent of collaboration and knowledge-sharing between research institutions, and by the proposal for data collected on-site to be made accessible to researchers off-site. This will allow researchers to incorporate the data more readily into projects measuring the impacts of climate changes on biodiversity in the region.

5.46 The importance of collecting essential baseline data, useful for measuring the effects of climate change on our ecosystems, was a common theme that arose during the public hearing in Townsville and at the site inspections in the wet tropics. The Committee considers this an increasingly important focus for research funding bodies.

Education and community awareness projects

5.47 Reef HQ has a formal education program for school students, which saw 11 945 students participate in 2010-11.[33] Reef HQ also has an educational videoconferencing program that reached 5855 students nationally and internationally during 2010-11, a figure the Committee heard had increased in 2011-12.[34] The Committee was informed that the videoconferencing program consists of sea-diving conferences connecting to classrooms all over the world, including in places like New York City and Canada, where school children can talk to scuba divers in the coral reef exhibition about the effects of climate change on reef ecosystems. At the time of the Committee's visit, this program was being used at the World Expo 2012 in South Korea, where the reef divers were connecting daily to people in the Australian pavilion.

33 GBRMPA, *Annual report 2010-11*, GBRMPA, Townsville, 2011, p. 72.

34 GBRMPA, *Annual report 2010-11*, GBRMPA, Townsville, 2011, p. 73.

5.48 The Committee heard that visitor numbers to Reef HQ had increased markedly in 2011-12, up from 121 731 in 2010-11.[35] The rise in memberships and the growing Townsville population is said to have contributed to the significant increase.

5.49 During its visit to Reef HQ, the Committee was briefed on the *Great Barrier Reef Marine Park Zoning Plan 2003* and heard about the increase in the highly protected, marine national park (green) zones from 4.5 per cent to 33 per cent of the Great Barrier Reef Marine Park.[36] This rezoning was prompted by the recognition in the mid-1990s that existing levels of protection were inadequate to protect the biodiversity and therefore maintain the resilience of the Great Barrier Reef. The zoning plan was developed in consultation with the community in order to protect a minimum of 20 per cent of each of the 70 identified major habitat types in the Great Barrier Reef region. A notable positive change that has resulted from the rezoning is the recovery of fish populations.[37]

5.50 The Committee also heard about GBRMPA's Reef Guardian program, which commenced in 2003 with 25 schools committed to the protection and conservation of the Great Barrier Reef. The number of participating schools across the Great Barrier Reef catchment has increased to 285, with over 113 000 children focused on managing resources, conducting projects in school and in the community, and educating the wider community. This program encourages people in the community to be environmentally active and work together as Reef Guardians.[38]

5.51 The Reef Guardian program has since been extended to councils, farmers, fishers and graziers, in order to spread the conservation and protection efforts to more parts of the community through various mechanisms.

Committee comment

5.52 The Reef Guardian program has grown rapidly and, with the expansion to other parts of the community, it is an effective way of educating and encouraging community engagement and participation in caring for the biodiversity of the Great Barrier Reef ecosystem. The Committee sees the value in extending the Reef Guardian program to other Australian reefs, and also adapting the concept to other areas and ecosystem types, as was

35 GBRMPA, *Annual report 2010-11*, GBRMPA, Townsville, 2011, p. 71.

36 GBRMPA, 'Great Barrier Reef outlook report 2009', *Exhibit 23 to Submission 28*, p. 126.

37 GBRMPA, 'Great Barrier Reef outlook report 2009', *Exhibit 23 to Submission 28*, p. 126.

38 GBRMPA, 'Reef Guardians', <http://www.gbrmpa.gov.au/our-partners/reef-guardians> viewed 6 August 2012; GBRMPA, 'Great Barrier Reef outlook report 2009', *Exhibit 23 to Submission 28*, p. 103.

canvassed by the Wet Tropics Management Authority at the public hearing in Townsville.[39]

Concluding remarks

5.53 Among the issues arising across the Committee's consideration of reef and wet tropical ecosystems, the most significant is the impacts of increased temperatures. The Committee was also interested to hear about the issue of invasive species expansion into the wet tropics, having heard about similar issues during previous site inspections.

5.54 The Committee was encouraged by the cooperative relationships displayed between researchers and management groups, and the acknowledgments between management groups of the reef and the wet tropics of the successful measures used in both areas to understand and build resilience to the effects of climate change. The Committee was particularly impressed with the Reef Guardian program, acknowledged by other management groups as a good mechanism for enhancing community engagement. In light of its success, there may be merit in this and similar programs being extended to other ecosystems.

5.55 The Committee would like to thank Ms Olivia McKenna and Mr Fred Nucifora for facilitating the Committee's visit to Reef HQ. The Committee would also like to thank Dr Steve Goosem, Mr Andrew Maclean and Mr Bradley Smith for facilitating the Committee's visit to the DRO, and all others who assisted the Committee during its site inspections in Tropical North Queensland.

Mr Tony Zappia MP
Chair
November 2012

39 Mr Maclean, WTMA, *Transcript of evidence*, 5 July 2012, p. 29.