

Introduction

Chapter 2

“Improvement of Great Barrier Reef water quality will increase the likelihood that these tropical marine ecosystems will survive.”

Photo courtesy of Great Barrier Reef Marine Park Authority



2.1 The Great Barrier Reef

The Great Barrier Reef is renowned internationally for its ecological importance and beauty. It is the largest and best known coral reef ecosystem in the world, extending over 2300 kilometres along the Queensland coast and covering an area of 350,000 square kilometres (Figure 2.1). It includes over 2900 reefs as well as extensive seagrass meadows, mangrove forests and soft bottom habitats. The biodiversity of the region is important for the continued survival of many species. It is a World Heritage Area, and is protected within the Great Barrier Reef Marine Park in recognition of its diverse, unique and universal values. The reef is also critical for the prosperity of Australia, annually contributing over \$6 billion to the Australian economy (GBRMPA, 2009).

The Great Barrier Reef is home to thousands of species, including coral and other invertebrates, bony fish, sharks, rays, marine mammals, marine turtles, sea snakes and seabirds, as well as a wide variety of other animals, algae and other marine plants (GBRMPA, 2009). It provides an important habitat for species of conservation concern such as dugongs, whales, dolphins, sharks and marine turtles. It is this biodiversity that builds such a remarkable ecosystem and supports human use (such as tourism and commercial and recreational fisheries) of the Great Barrier Reef.

The Great Barrier Reef remains one of the most healthy and well managed coral reef ecosystems in the world (GBRMPA, 2009). However, there is no room for complacency as the future health and resilience of the reef remains under threat from a range of factors including climate change, catchment pollutants and coastal development. As with coral reefs worldwide, the Great Barrier Reef is threatened by increasing seawater temperatures and altered water chemistry caused by global climate change. Maintenance, and where necessary, improvement of Great Barrier Reef water quality will increase the likelihood that these tropical marine ecosystems will survive the additional stresses imposed by a changing climate, including elevated seawater temperatures, increasing seawater acidity and increased tropical monsoonal storm activity and flood runoff.

2.2 Threats from land management

Although the Great Barrier Reef region is relatively sparsely populated, extensive land modification (such as clearing) has occurred over the past 200 years since European settlement (Furnas, 2003; Hutchings and Haynes, 2005). The Great Barrier Reef receives runoff from 35 major catchments which drain 424,000 square kilometres of coastal Queensland. These catchments are spread from the Cape York region in the north, to the Burnett Mary region in the south. Climate and soil characteristics vary across the catchments. Grazing is the dominant agricultural land use. Sugarcane and horticultural crops dominate in the high rainfall and coastal irrigation areas. Large sections of summer and winter rain-fed grain crops and irrigated cotton are prevalent in the inland areas of the Fitzroy region.

The quality of water flowing into the reef lagoon from the land has deteriorated dramatically over the past 150 years

(Furnas, 2003). Flood events in the wet season deliver pollutants from the adjacent catchments onto the Great Barrier Reef well in excess of natural levels. This has contributed to reduced resilience and has made the Great Barrier Reef more vulnerable to other pressures such as climate change.

In response to this threat, in 2003, the Queensland and Australian Governments established the Reef Water Quality Protection Plan (Reef Plan), to halt and reverse the decline in water quality. Reef Plan is focused on the significant threat of diffuse source pollution from agriculture in catchments adjacent to the reef. This is considered the single biggest manageable threat to the reef in terms of water quality. Neither Reef Plan nor this report address point sources of pollution such as sewage treatment plants or mines, or urban diffuse pollution such as stormwater runoff. They are managed through different mechanisms.

Recent science has further highlighted the links between expanding catchment development, intensification of agricultural production and declining water quality in the Great Barrier Reef lagoon. Long term monitoring and modelling have demonstrated that concentrations of nutrients are much higher in northern Queensland rivers adjacent to intensive agriculture than the relatively pristine rivers in Cape York (Mitchell et al., 2001); that sediment and nutrient exports have increased to the Great Barrier Reef over the last 200 years (Furnas, 2003); and that flood events are critical in transporting these pollutants to the marine environment (Devlin et al., 2001). Monitoring has also shown that pesticides are being transported into river systems and the Great Barrier Reef at harmful concentrations during flood events (GBRMPA, 2009; Lewis et al., 2009).

The significant number of reef, seagrass and mangrove ecosystems that exist in coastal or nearshore locations are directly exposed to catchment water pollution influences (Furnas and Brodie, 1996; Furnas, 2003). The highest risk area for degraded water quality, the inshore waters, make up approximately eight per cent of the Great Barrier Reef Marine Park and are near the coast (up to 20 kilometres offshore). This area not only has significant ecological communities, as described above, it is also the area of the Great Barrier Reef most used by recreational visitors and commercial tourism operations and it has significant commercial fisheries resources. Degradation of inshore reefs between Port Douglas and the Whitsundays has been associated with increased terrestrial runoff of pollutants in the region (Udy et al., 1999; van Woesik et al., 1999; Fabricius and De'ath, 2004; Fabricius et al., 2005; Devantier et al., 2006). Damage to both inshore and outer-shelf reefs of the central Great Barrier Reef from crown-of-thorns starfish outbreaks has been attributed to increased nutrient concentrations in inshore waters from terrestrial runoff (Brodie et al., 2005).

Based on the latest scientific consensus, the Australian and Queensland Governments reaffirmed their commitment in 2009 to an updated Reef Water Quality Protection Plan (Reef Plan 2009), which is designed to accelerate actions to improve the quality of water flowing from paddocks to the reef.

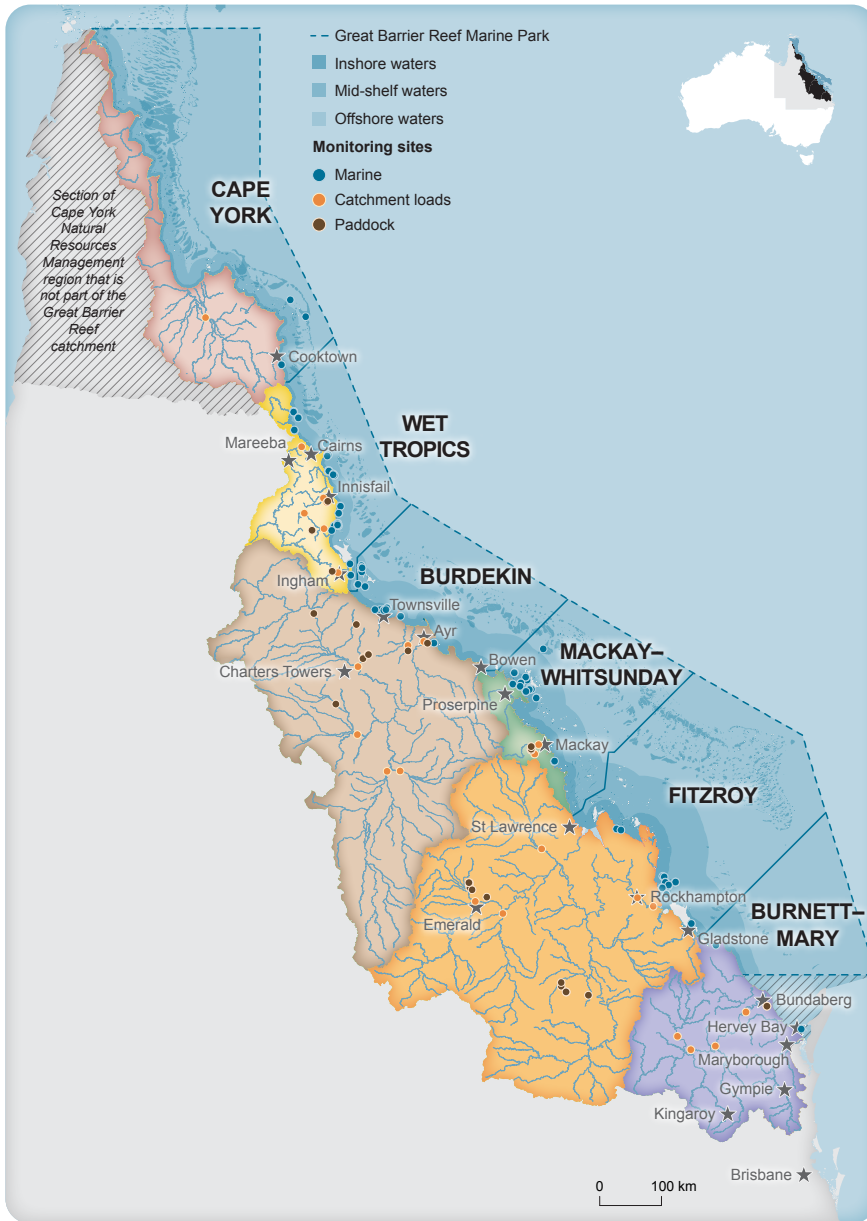


Figure 2.1 – The Great Barrier Reef showing regions, Paddock to Reef program monitoring sites and marine park.

2.3 About this report

This report provides a measure of the status of key indicators for the Great Barrier Reef and its adjacent catchments for the period immediately preceding Reef Plan 2009. It therefore does not include the effects of Cyclone Yasi and the more recent flood events which will be presented in subsequent reports. It is based on historical data and trends and takes into account the influence of a variable annual climate. Figure 2.2 outlines the report structure.

This report presents the current understanding of 2008–2009 conditions. This is the baseline from which the progress towards Reef Plan goals and targets will be measured. The intention of the Paddock to Reef program, however, is to continuously improve the accuracy and precision of monitoring and modelling.

Appendix 1 describes the approaches to the continuous improvement of the Paddock to Reef program. Consequently, this will also lead to an improved estimate of the baseline in future years. For example, current load estimates rely heavily on the currently available catchment water quality model, Sednet/ANNEX. While this model provides a relatively robust estimate of catchment loads, there is significant scope for improvement. A more sophisticated model, Source Catchments, will be used for subsequent reports. Rather than compare two different models, the new Source Catchments model will be hindcast to recalibrate the baseline based on the improved model. This will allow for annual comparison and a more accurate baseline.

1	Executive summary	<ul style="list-style-type: none"> Summary of the report including key results
2	Introduction	<ul style="list-style-type: none"> Purpose of the baseline Threats from land management How the results are presented
3	Management overview	<ul style="list-style-type: none"> Implementing reef water quality initiatives and actions
4	Methods	<ul style="list-style-type: none"> Description of the methods used
5	Great Barrier Reef region	<p>Baseline results:</p> <ul style="list-style-type: none"> Improved land management <ul style="list-style-type: none"> adoption of improved land management practices understanding the effectiveness of practices. Catchment indicators <ul style="list-style-type: none"> riparian extent wetland extent groundcover in grazing lands. Catchment loads entering the reef for key pollutants including: <ul style="list-style-type: none"> sediments nitrogen phosphorus pesticides. Great Barrier Reef water quality and ecosystem health <ul style="list-style-type: none"> water quality seagrass coral.
6	Cape York region	
7	Wet Tropics region	
8	Burdekin region	
9	Mackay Whitsunday region	
10	Fitzroy region	
11	Burnett Mary region	
12	Conclusion	<ul style="list-style-type: none"> Overall conclusions Improving the program
13	Appendices	

Figure 2.2 – Structure of the report.

2.3.1 How are the results presented?

This document provides context to the baseline estimates by explaining historical trends to demonstrate the connection between the paddock and the reef (Figure 2.3). These trends are important as they demonstrate variability over time, and are integral in the assessment and interpretation of how paddock to reef indicators change.

Description of indicators

Management practice adoption

This report presents the management practice adoption information as at 2008–2009 for the sugarcane, grazing, horticulture and grains agricultural industry sectors using an ABCD management practices framework. This information is derived from a range of datasets of varying comprehensiveness.

Under this framework, the management practices for sugarcane, horticulture and grains are defined as:

- A – Cutting-edge practices that require further validation of environmental, social and economic costs and benefits
- B – Currently promoted practices often referred to as best management practice
- C – Common practices often referred to as code of practice
- D – Practices that are superseded or unacceptable by industry and community standards.

For grazing, this report presents data on ABCD management practices, as distinct from ABCD land condition. However, these are management practices that impact on land condition:

- A – Practices likely to maintain land in very good condition or improve land in lesser condition
- B – Practices likely to maintain land in good condition or improve land in lesser condition
- C – Practices that may maintain land in fair condition or gradually improve land in poor condition
- D – Practices likely to degrade land to poor condition.

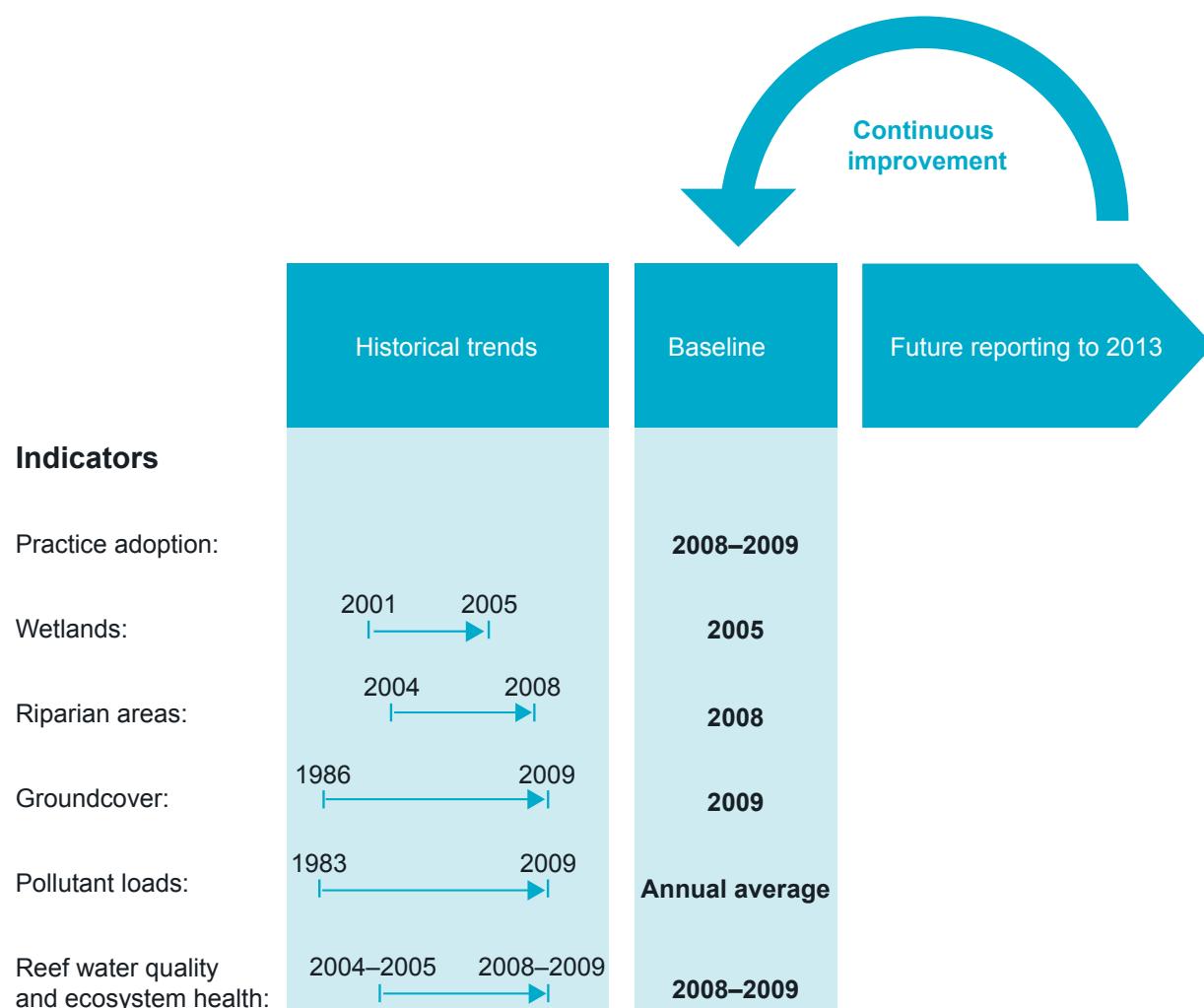


Figure 2.3 – How the baseline results are presented for each indicator.

Catchment indicators

This report presents information on catchment attributes that play a role in water quality leaving the paddock and entering the reef such as wetlands, riparian areas and groundcover.

The wetlands baseline information identifies the extent of vegetated freshwater swamps (palustrine wetlands) and mangroves/salt flats (estuarine wetlands) as at 2005 and indicates the loss of these wetlands historically and between 2001 and 2005. Extent information for the 2009 baseline year is still being prepared and will be made available in subsequent reports. New techniques are currently being tested to further report on wetland condition and extent.

The riparian baseline information reports the extent of riparian areas in a condition susceptible to erosion (non-forested with low groundcover) as at 2008 and the loss of riparian vegetation between 2004 and 2008. Extent information for the 2009 baseline is still being prepared and will be made available in subsequent reports.

This baseline information for groundcover presents the average late dry season groundcover as at 2009 and the historical average for the 1986 to 2009 period. The area with groundcover below the target of 50 per cent and below 30 per cent is also presented.

Catchment loads

Catchment loads are presented as the annual average total load at the end of the catchment for key pollutants calculated from monitoring and modelling data between 1983 and 2009. The total load includes the natural load and the anthropogenic load (the load due to human activity). The key pollutants presented graphically are total suspended solids, total nitrogen, dissolved nitrogen, total phosphorus, dissolved phosphorus and photosystem inhibiting (PSII) pesticides.

Great Barrier Reef water quality and ecosystem health

This report presents information on water quality, seagrass and corals for the Great Barrier Reef. Water quality includes suspended sediments, chlorophyll *a* (a surrogate measure for nutrients) and pesticides. Seagrass health includes an assessment of abundance, reproduction, nutrient status and light availability. Coral health includes an assessment of hard coral and macroalgae cover and trends in cover, juvenile density and recruitment.