The importance of the Reef and actions industry can take to better protect it

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1. Values of the Great Barrier Reef

The Great Barrier Reef (the Reef) is the world's largest coral reef system, extending over 2000 km along the Queensland coast. It is home to over 3000 individual reefs and other important habitats, making it one of the most complex and ecologically valuable natural systems on earth.

The Great Barrier Reef Marine Park Authority's Representative Areas Program identified over 70 distinct bioregions in the Reef, each of which have distinct biological and geophysical traits. This has illustrated the high level of biodiversity in the region which is one of the reasons why the Reef was listed as a World Heritage Area in 1981. Examples of this outstanding biodiversity include:

- 1500 species of fish;
- 360 species of hard corals;
- One-third of the world's soft coral species;
- 4000 species of molluscs (eg. Shellfish);
- 1500 species of sponge;
- 800 species of echinoderms (starfish, urchins etc);
- 500 species of seaweed;
- 23 species of marine mammals; and
- 6 species of marine turtles.

Many of these species are endemic to the Reef, and there are many thousands of species that have yet to be properly identified.

Whilst the Reef is best known for its coral reefs, these comprise only 6 percent of the total area within the Great Barrier Reef Marine Park (the Marine Park). Most of the area of the Marine Park is comprised of soft sediment habitats lying in between coral reefs, between the coast and the barrier reefs, and benthic habitats of the continental slope. Although these areas contain a wide variety of habitats and high biodiversity, much is still unknown about their ecology and current condition.

Several habitat types such as deep-water seagrass beds have only recently been discovered. Nevertheless, it is clear that all habitat types, whether coral reefs or lesser-known habitats, are important components of the Reef ecosystem. Seabed communities such as sponge gardens, seagrass beds and rocky shoals create a network of habitats that connect different parts of the Reef together. This ecological network and its component habitats are important to many marine species, including commercially-important

species.

The Great Barrier Reef is made up of many different habitats, all of which are essential for the healthy functioning of the Reef ecosystem.

Recent studies identified 40 individual non-reef bioregions in inter-reefal, lagoonal and continental slope regions, and 30 reefal bioregions. Extensive surveys of hundreds of reefs over the last 20 years have shown that corals, fishes, sponges and macroalgae show a marked change in species composition moving from sheltered inshore fringing reefs to the exposed shelf-edge reefs of the outer barrier. Inshore reefs are often characterised by a relatively high abundance of corals such as Galaxea, Montipora and Goniopora, compared to mid-shelf reefs that have more plate-forming Acropora species, and outer-shelf reefs that are frequently dominated by digitate or sub-massive Acropora species.

Soft corals are commonly found throughout the Reef, however they have received relatively little scientific attention compared to hard corals

Although they are usually less abundant than hard corals, soft corals are important and visually spectacular members of the reef community

This highlights just some of the ecological diversity of the Reef.

In terms of cultural values and diversity, the reefs, islands and the surrounding areas in the Reef include many features of cultural and archaeological importance such as shell middens, fish traps, rock paintings, artefact quarries and story sites. Some of these sites, such as the fish traps adjacent to the Haven in Hinchinbrook Channel, have been listed on

the register of the National Estate and are believed to have been in use for hundreds, if not thousands, of years.

The traditional hunting of dugongs and turtles and associations with land and sea country are of cultural importance to Australia's indigenous peoples. These traditional hunting rights are protected under the Australian Government's *Native Title Act 1993*.

Within the Reef there is significant non-indigenous heritage with more than 30 historic shipwrecks, numerous relics from World War II, and a number of historical ruins and lighthouses on the cays and islands. The Reef was listed on the Register of the National Estate in 1991 and the Australian government has obligations to conserve and protect the Reef under the Australian Heritage Council Act 2003 and the Environment Protection and Biodiversity Conservation Act 1999.

From a socio-economic perspective, relevant industry sectors within the Marine Park and the catchments adjacent to the World Heritage Area contribute around $6 billion annually to the Australian economy (Access Economics 2007). They are all reliant on the healthy natural resource of the reef and its catchment.

The tourism industry alone, which in 2003 employed almost 48,000 people, is expected to grow by 51% by 2020. Access to the Reef's unique natural resources was internationally recognised by its winning the World Travel and Tourism Councils Destination Award in 2007. Key agricultural sectors such as beef, sugarcane, and horticulture collectively employed 26,470 people. Mining and mineral processing employed 14,398 people (Productivity Commission Report, 2003).

2. Water quality

Anthropogenic (human) impacts such as primary industries (agriculture, aquaculture), urban and industrial development, tourism and recreation are having the greatest effect on the ecological integrity of sensitive near shore and receiving environments (Haynes 2001, Williams 2001).

Examples of the affects that poor water quality can have are:

- Inhibited coral recovery rates after disturbances (Birrell et al. 2005);
- Inhibited fertilisation rates, embryo formation (Koop et al. 2001), larval settlement and recruitment (Smith et al. 2005) in some corals, as well as causing direct coral mortality; and
- Coral colonies with less dense and weakened skeletons, which make colonies more susceptible to damage from catastrophic events (Wilkinson 1996).

Increased nutrient availability has been shown to:

- Promote phytoplankton growth. This results in increasing numbers of filter feeding organisms, which compete with coral for space (Smith et al. 1981), while also lowering light availability which affects photosynthetic rates of corals and seagrass (Waycott et al. 2005);
- Promote macroalgae blooms, which may overgrow coral structures, out-

competing the coral for space and shading corals (Smith et al. 1981), seagrass and other benthic habitats;
- Alter the ecology and nutrient dynamics of reef surfaces (Anthony 2000); and
- Enhance the frequency and severity of Crown-of-Thorn Starfish outbreaks (Brodie et al 2005).

Research undertaken by the Cooperative Research Centre for Reef Research on water quality and reef health has compared reef systems adjacent to the Wet Tropics, where contributing catchments support intense agricultural activity, with other reef systems adjacent to the relatively undisturbed catchments north of Princess Charlotte Bay. This research indicates:

- Significantly higher levels of most major water quality parameters (e.g. nutrients) in the Wet Tropics region;
- Dramatically lower coral cover and diversity and increased area of abundant algae in the Wet Tropics region;
- Apparent imbalances between previous reef development and the current potential for reef growth (based on the absence of live corals and reduced coral recruitment); and
- The recent disproportionate loss of exceptionally large, ancient coral colonies (indicating recent conditions at least temporarily worse than over past several centuries).

The study also found that the ability of reefs to recover from any disturbance, including natural disturbances such as cyclones, is significantly less in the Wet Tropics region. These results indicate the nature of changes, which are likely to have occurred as a result of poor water quality and provide clear evidence of recent, serious ecosystem decline due to terrestrial runoff from two major Queensland embayments, immediately adjacent to the Reef (Fabricius and De'ath 2004).

Of particular concern is the apparent lack of recovery on many of these reefs. For example, a current study of reefs adjacent to intensive agricultural land-use, not only found corals to be less abundant and less diverse, but to have had higher recent mortality and lower number and growth rates of coral recruits in comparison with reefs subject to minimal runoff (Fabricius and De'ath 2004). Recruitment of new corals is essential for the recovery of reefs after disturbance. Over thirteen years of monitoring has shown unambiguously that chlorophyll concentrations (an indicator of eutrophic conditions), in the inshore Reef lagoon adjacent to fertilised catchments and areas of higher population density, are twice those recorded in the inshore Reef lagoon adjacent to the northern Cape York catchment, where there is minimal fertiliser use (Brodie et al 2007).

Research undertaken in the last two years (Jupiter et al 2007) investigated historic nutrient and sediment levels by sampling coral cores in the Mackay Whitsundays area. This research has shown that in recent decades, and corresponding to the intensification of agricultural activities in the adjacent catchment, corals have experienced a 10-16 times increase in nitrogen levels during flood events, and that there has been a 4 times increase in the level of nitrogen in the ambient water quality. This reinforces that this is already a changed system, and supports earlier research that identified a water quality gradient and

consequent declines in coral biodiversity in the same area (Fabricius et al. 2005). These changes to the biodiversity of corals and potentially other species reduce the health and resilience of the Reef.

3. Climate change

A healthy Reef will be more resilient to the impacts of climate change. Measurements from mass coral bleaching events in 1998 and 2002 indicate the extent of damage to corals in the northern Reef as 50% and 60% of coral bleached respectively. It is estimated that with increased ocean temperatures, the coral bleaching threshold in the northern parts of the Reef will be exceeded regularly over the next 100 years. Recovery from, and adaptation to, this rate of change will be challenging for an ecosystem under stress from declining water quality (GBRMPA 2007).

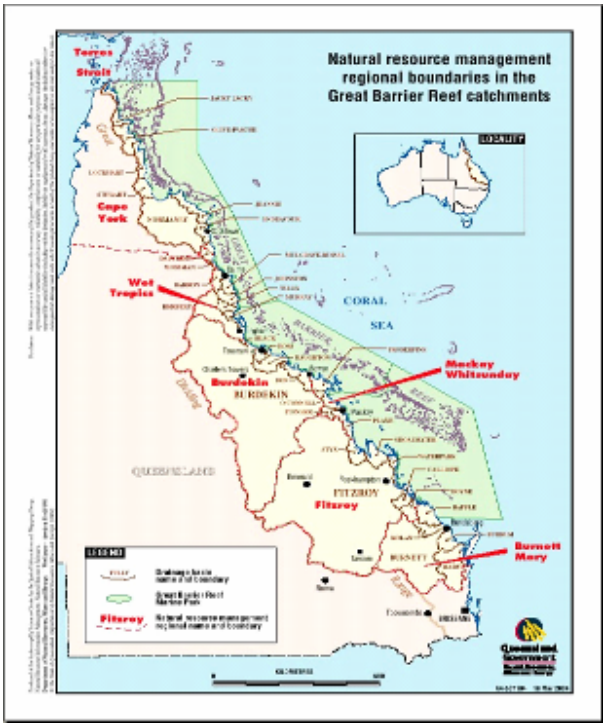
We have an obligation to ensure that the long term health of the Reef is sustained and that identified pressures such as land use intensification, decline in water quality and climate change are managed and reversed.

4. The Reef Water Quality Protection Plan

The Reef Water Quality Protection Plan (Reef Plan) was launched in 2003 and provides a framework of strategies and actions designed to improve the quality of water entering the Reef. The goal of the Reef Plan is to halt and reverse the decline in water quality entering the Reef within 10 years. It has two objectives:

1. Reduce the load of pollutants from diffuse sources in the water entering the Reef; and
2. Rehabilitate and conserve areas of the Reef catchment that have a role in removing water borne pollutants.

The Reef Plan contains nine strategies and 65 actions to achieve these objectives, and focuses on agricultural production in catchments flowing towards the Great Barrier Reef. (See map below.)



The intent of the Reef Plan is for all levels of Government, Industry and Great Barrier Reef catchment communities to work together and build upon existing policies, plans and initiatives to address the significant challenge of water quality decline.

More information about the Reef Plan can be found at www.reefplan.qld.gov.au

5. Agriculture in Reef catchments

The balance of evidence is now showing that the economic realities of agricultural production and continued urban growth are adversely impacting on water quality and the subsequent health of the Reef. Water quality decline has been identified as a major threat, with sediments, nutrients and agricultural chemicals emanating from diffuse land based sources identified as key pollutants.

Within reef catchments, rangeland grazing remains the spatially dominant land use, with the key issues being cover and poor land condition linked with erosive potential and sediment loss. Having said this, it is the intensively farmed commodities with close proximity to the coast (such as sugar and horticultural production) that remain a key focus area for action, particularly in terms of reducing nutrient and agricultural chemical loss to waterways.

Sugar is the largest of the intensively farmed industries in Reef catchments, with a value of $1075M (GVP 06/07) (DPI&F *Prospects* 2007), and an approximate area of 400,000 hectares within Queensland.

Irrigated Sugar Cane Production within the Lower Burdekin

The horticulture industry, comprising fruit and vegetable production, is worth $1785M (GVP 06/07) state wide (DPI&F *Prospects* 2007). Bananas remain one of the larger horticulture production sectors in GBR catchments with approximately 9,500 hectares cropped in North Queensland.

Banana Production within the Wet Tropics

6. Nutrient Management

The rationale for improving nutrient management is well understood as it can improve soil health, productive capacity and profitability, while minimising environmental impact.

Over the past 10 years, the management of nutrients within key agricultural sectors has improved significantly. Nutrient use in sugarcane and banana production systems has reduced by approximately 20% in applied N & P and 40% in applied N respectively (Incitec Pivot reported in Wrigley 2005). This reduction has come about through a number of successful strategies including:

- Voluntary, self management and participatory approaches;
- Tailored research and development;
- Improved economic assessments; and
- Dedicated education and extension services targeted at the translation and uptake of improved practices and technologies.

These strategies have been supported by the development of industry specific codes of practice, a clear definition of accepted Best Management Practices, development and implementation of systems approaches to agricultural enterprise management (e.g. Farm Management Systems), industry initiatives such as the Fertcare Program, and the development of tailored commodity specific nutrient management programs such as BSES's Six Easy Steps for sugarcane.

The continued application of this style of industry led, voluntary and self managed approaches has the real potential to deliver further improvements through improved

farming practices and nutrient loss reduction.

7. Emerging Planning and Policy

Two pertinent actions under Reef Plan require the development of Water Quality Improvement Plans (WQIPs), and the identification of Nutrient Management Zones (NMZs) and associated policy options to implement within these NMZs.

WQIPs are currently being developed for the Tully, Townsville, Burdekin, Mackay Whitsunday and Burnett Mary catchments. They are funded by the Australian Governments *Coastal Catchments Initiative* and are developed consistent with the Framework for Marine and Estuarine Water Quality Protection. WQIPs have three key components:

- Identify the Environmental Values of water bodies and the Water Quality Objectives that will protect identified values;
- Identify current status of pollutant loads; and
- Identify and commit to a set of management measures and control actions to reduce pollutant loads to receiving waters in order to protect water quality.

The designation of Nutrient Management Zones (NMZ) was supported by the completion of a Technical Report funded by the Australian Government (Brodie 2007). Ten NMZ's were defined, with the highest priority areas identified as the Wet Tropics, Mackay Whtisunday and the Burdekin regions. Five key criteria were used to assess and define NMZs:

- Fertilised land use;
- Potential for N & P loss;
- Likelihood of pollutants reaching the coast;
- Extent of transport within the GBR; and
- Number and proximity of sensitive near-shore receiving environs within the influence area of discharge (e.g.reef, seagrass meadows).

Policy options for managing nutrients within NMZs were identified in a Policy Discussion Paper prepared by the Queensland Department of Primary Industries and Fisheries (DPI&F), with the assistance of other agencies and industry. The paper recommended that the emphasis remain on proven industry-led, self management styled voluntary approaches to elicit desired improvements within key agricultural sectors. Fundamental to the success of this approach is the allowance of a 'grace period' for the uptake of improved management practices and innovation.

The paper also proposed that tailored monitoring and evaluation frameworks would operate in partnership with WQIPs where they exist, and will monitor the rate of uptake of good practices and resource condition trends to assess progress and compliance with agreed targets.

However, should this approach prove ineffectual, consideration was also given to implementing more stringent, potentially regulatory control mechanisms in order to

achieve compliance with defined targets.

7. Key messages for the Fertiliser Industry and its constituents

Governments, Industry and the community alike, are yet to see the universal adoption of accepted commodity specific management practices and the establishment of new industry norms that will ensure that adverse impacts on receiving environments are minimised and that the long term health of the Great Barrier Reef will be sustained.

Key stakeholders such as fertiliser and agricultural industry sectors are uniquely positioned to assist landholders in actioning management options and practices that can benefit the environment (minimise pollutant loss), without compromising enterprise viability.

The value of the Great Barrier Reef and the sustainable development of its catchments are of sufficient importance to warrant significant investment into actions targeting identified risks. Currently the emphasis is on self management approaches, coupled with better education, extension services and incentives designed to maximise the adoption of best management practices for water quality improvement. Governments will review progress on this preferred approach to measure its effectiveness and to assess if it is achieving the goal of the Reef Plan.

The preferred approach is to support accepted and endorsed industry specific best management practices (such as Fertcare) and Farm Management Systems, with the emphasis remaining on industry led, voluntary self management approaches.

Complimenting this approach should be industry investment targeted at the development of new and emerging technologies and alternate products, as well as continued research into the use, transport and fate of nutrients and pesticides, and their impact on ecological health.

A concerted partnership with all stakeholders in the nutrient supply chain is essential if this substantive challenge is to be met. The ability for partners to demonstrably show positive performance in this regard, may also negate the need for Governments to consider more interventionist, potentially regulatory control mechanisms.

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