Nitrogen management and the Great Barrier Reef

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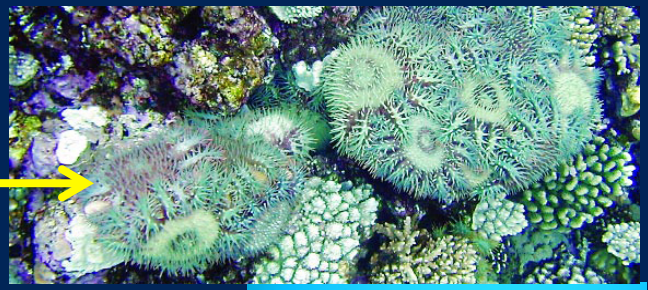
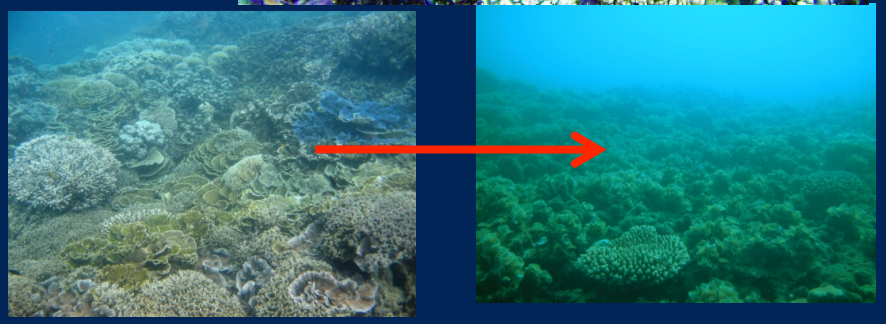
Status of the GBR

(from Brodie and Waterhouse 2012)

- Coral cover from about 40% fifty years ago to 28% in 1987 to 22% in 2004 to 14% currently and predicted to decline further.
- Dugong populations continue to decline
- Seagrass in trouble especially associated with both chronic stress (water quality) and extreme events – large cyclones and large floods
- Shark populations declining
- Crown of thorns starfish outbreaks started again for the 4th 'wave'.
- Increasing incidence of coral diseases
- Increasing water temperatures
- Declining calcification





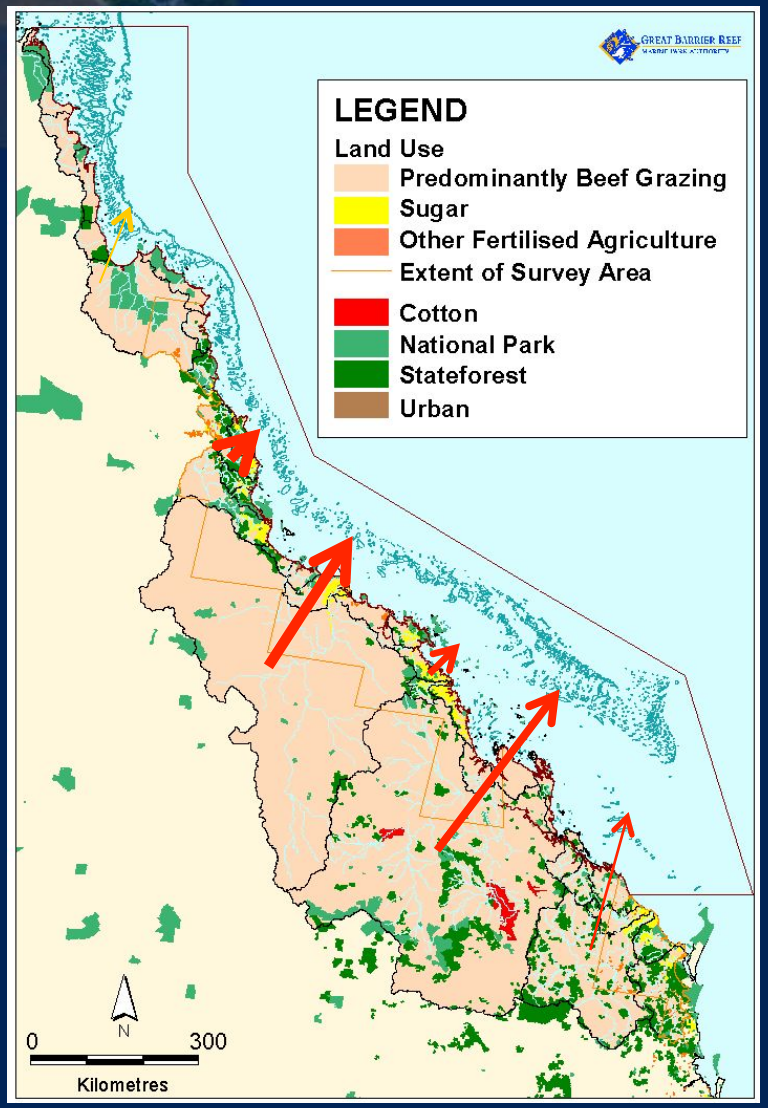
Status of GBRWHA and water quality

Scientific consensus statement on water quality in the Great Barrier Reef (Brodie et al 2013)

- The overarching consensus is ***that key GBR ecosystems are showing declining trends in condition due to continuing poor water quality, cumulative impacts of climate change and increasing intensity of extreme events.***

- **The decline of marine water quality associated with terrestrial runoff from the adjacent catchment is a major cause of the current poor state of many of the key marine ecosystems of the GBR.**
- **The greatest water quality risks to the GBR are from nitrogen discharge, associated with crown of thorns starfish outbreaks and their destructive effects on coral reefs, and fine sediment discharge which drives light reduction for seagrass ecosystems and inshore coral reefs. Pesticide inputs pose a risk to freshwater and some inshore and coastal habitats.**
- **Recent extreme weather– heavy rainfall, floods and tropical cyclones – have had severe impacts on marine water quality and GBR ecosystems. Climate change is predicted to increase the intensity of extreme weather events.**
- **The main source of excess nutrients, fine sediments and pesticides from GBR catchments is from diffuse source pollution from agriculture.**
- **The use of improved land and agricultural management practices is proven to reduce the runoff of suspended sediment, nutrients and pesticides at the paddock scale.**

Sediment, nutrient and pesticide loads to the GBR



- Sediment – 14 million tonnes (5 X natural) – sourced mainly from erosion in grazing lands.

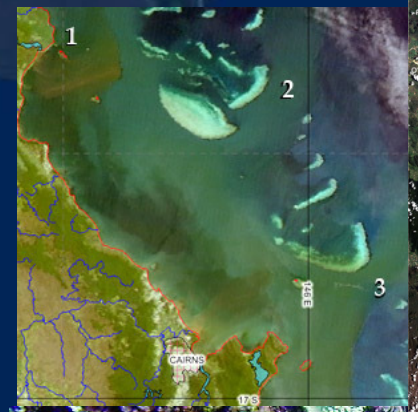
- Total Nitrogen – 66,000 tonnes (6 X natural) – PN loads mainly from erosion in grazing lands, nitrate from fertiliser use in sugarcane.

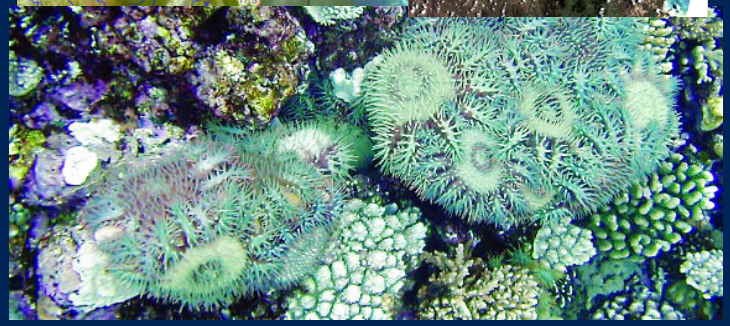
- Total Phosphorus – 14,000 tonnes (9 X natural) – PP loads also from grazing lands.

- PSII herbicides (e.g. atrazine) – 28 tonnes (no natural load) – from sugarcane, grains cropping and weed control in grazing lands.

- Loads from Kroon et al 20112 source information from Waterhouse et al. 2012

Nutrient (N and P) effects in the GBR





- Shifts in the dominance of macroalgae versus corals (De'ath and Fabricius 2010)
- Shifts in seagrass/macroalgal dominance
- Phytoplankton blooms (Brodie et al. 2010, 2011) – leading to:
- Crown of thorns starfish outbreaks (Brodie et al. 2005; Fabricius et al. 2010)
- Enhancement of coral bleaching (Wooldridge et al)
- More coral diseases

For more see: Brodie et al. 2012, 2013

Crown of thorns starfish (COTS)

- Three waves of outbreaks 1962 – 1975; 1978 – 1990; 1993 – 2005
- Now well understood to be linked to increased nutrient discharge from the land (Brodie et al. 2005; Fabricius et al. 2010)
- Removal of fish predators may also be linked.
- Largest cause of coral mortality on the GBR (Osborn et al. 2011; Hughes et al. 2011; De'ath et al. 2012)
- Fourth wave of outbreaks now confirmed to be starting off Cairns region (where all the other waves began) – started in 2009/2010
- We can now expect high coral mortality from COTS in the central GBR over the next 10 years.

Why is N management of importance for community and GBR health

- What are the targets for WQ improvement, and why, how are we tracking, what are the contributors to N at end of catchment.
- At least a 50 per cent reduction in anthropogenic end-of-catchment dissolved inorganic nitrogen loads in priority areas.
- At least a 20 per cent reduction in anthropogenic end-of-catchment loads of sediment and particulate nutrients in priority areas.
- But not ecologically based!

- What is the challenge for sugar production in relation to N at end of catchment, what are the key ecological challenges - what is the total risk assessment