Towards protecting the Great Barrier Reef from land-based pollution – a focus on nitrogen

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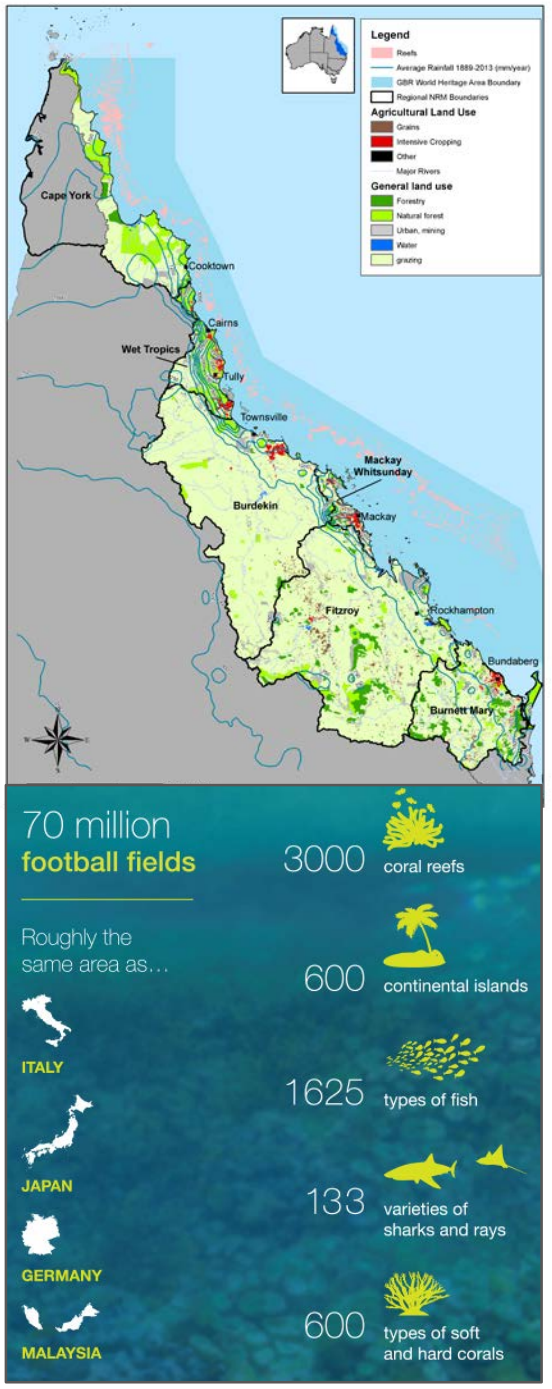
Australia's Great Barrier Reef

- World Heritage listed in 1981
- 344,400 km^2, 2,300 km long
- Value ~AU$5.5B yr^{-1}
- Ecosystem health impacted by agriculture
  - Sediments
  - Pesticides
  - Dissolved N

Catchments

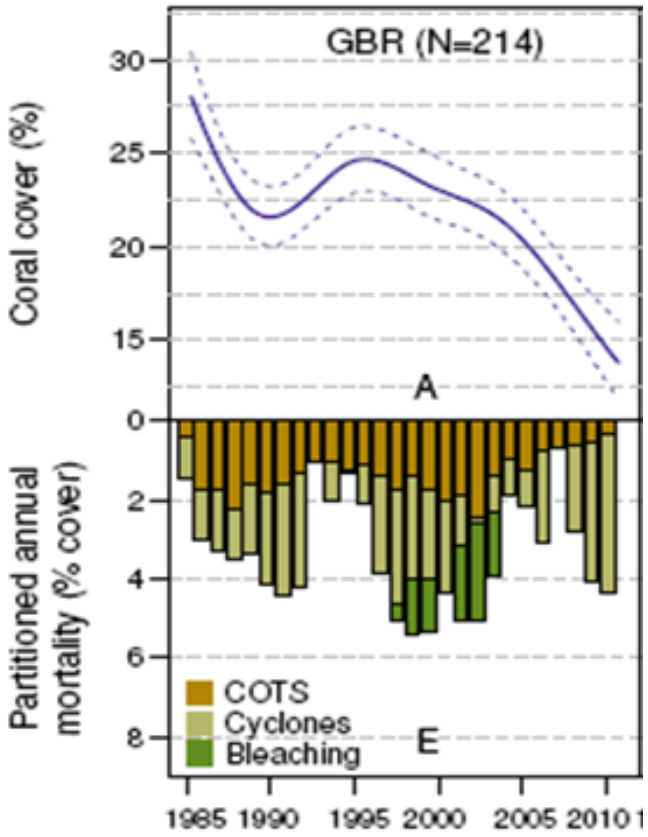
- 424,000 km^2
- Grazing, grains, intensive cropping



Great Barrier Reef Marine Park Authority

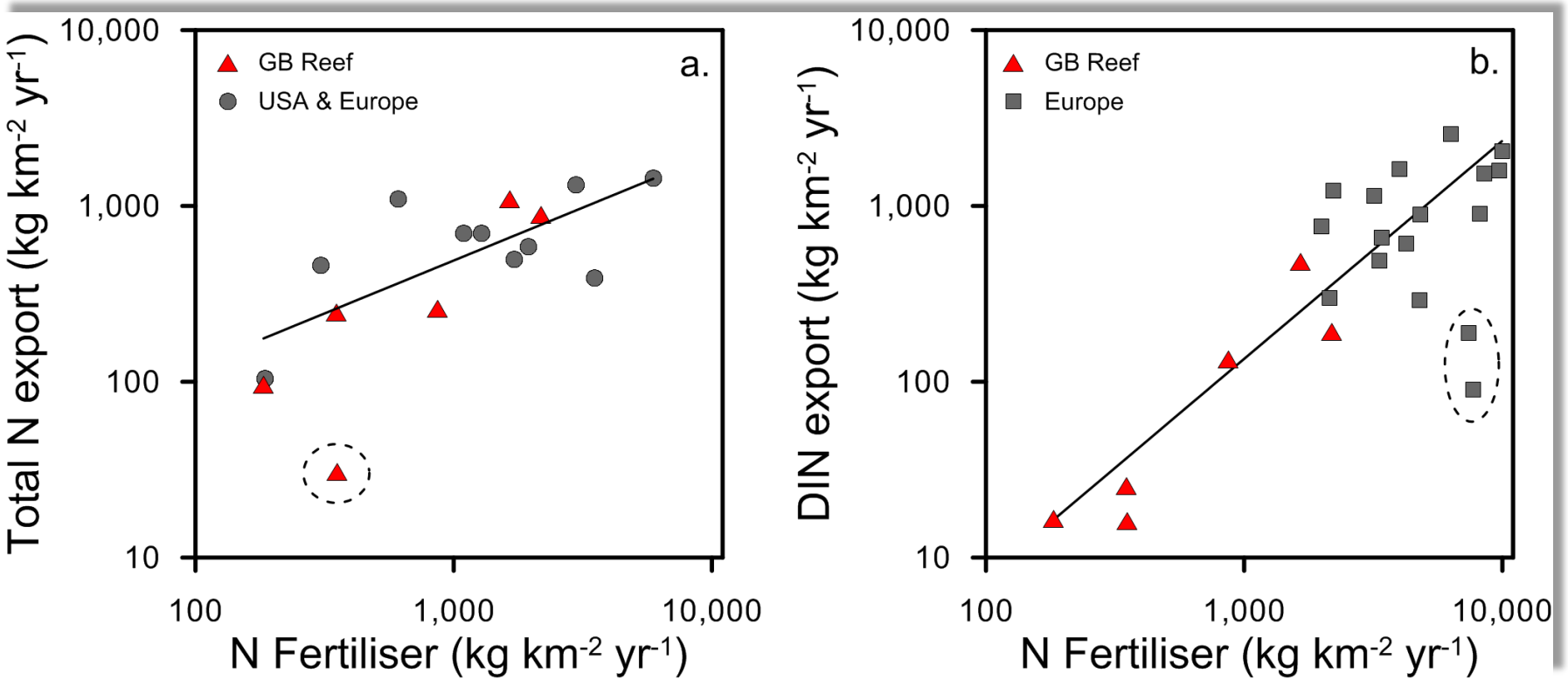
Reef under pressure: Coral cover decline 1985-2010

De'ath et al (2012)



- Marked coral cover declines in the central & southern reefs
- Cyclone disturbance and population outbreaks of crown-of-thorns starfish are the main causes of declines
- **Crown-of-thorns starfish outbreaks linked to increased nitrogen inputs**
  (Fabricius et al. 2010)

Nitrogen discharges from catchments linked to fertiliser – *similar to the northern hemisphere*



Thorburn et al (2013)

Policy responses for water quality

Reef Water Quality Protection Plan, 'Reef Plan'

- Target of 50% reduction in dissolved N by 2018
- Based on *Scientific Syntheses and Consensus Statements*: 2003, 2008, 2013, 2017 (*in prep*)
- AU$375M from 2008 to 2013
- Promoted voluntary uptake of Best Management Practices
- Complete uptake of BMPs unlikely to meet targets*

Reef 2050 Long-Term Sustainability Plan (2015)

- Response to UNESCO (2014) report
- Target of 80% reduction in dissolved N by 2025
- Set water quality in a broader framework
- Ecosystem resilience in the face of…changing climate
- AU$575M from 2015 to 2020
- Support for adoption of broader range of abatement measures

**Thorburn & Wilkinson (2013), Waters et al (2014)*

Programs on agricultural practice change:

Reef Rescue 2008-2013

- AU$200M program
- AU$146M in direct grants to farmers
- Abatement cost ~AU$150 / kg DIN*
- Questions over real efficacy
  - Accuracy of land management data

Reef Trust 2014 on

- AU$210M for supporting adoption of improved practices, through diverse activities, e.g.
  - Adopting controlled traffic
  - Trialing enhanced efficiency fertilisers
  - Wetland restoration

Rolfe & Windle (2016)

Complete uptake of BMPs is unlikely to meet targets – what next?

Some ideas*…

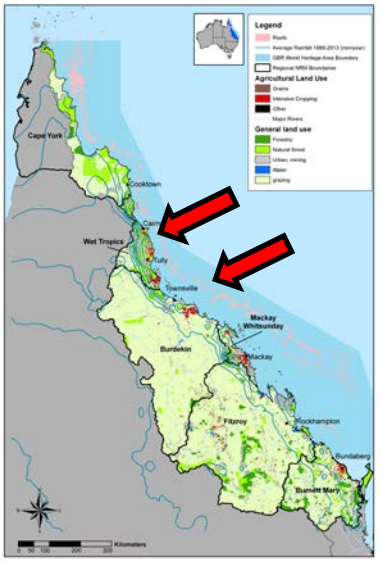
- Combining different policy instruments to increase change
  - Market based instruments, information systems, regulations
- Harmonization of multi-sectoral policies, e.g.
  - Drought assistance results in reduced ground cover and increased erosion
  - Supporting expansion of cropping in catchments increases N loading
- Changing land use through valuing other products
  - Carbon sequestration
  - Harvest of native fauna
  - Biofuels
  - Low N-input crops

Kroon et al (2016)

New initiatives in the ‘pipeline’

“Purchasing” reduced N fertiliser inputs

- Through reverse auctions
- Targeting sugarcane farmers in **two** regions
- Pilots 2014-2016
  - Abatement cost 30-40% that of directs grants
- Multiple auctions 2016-2018

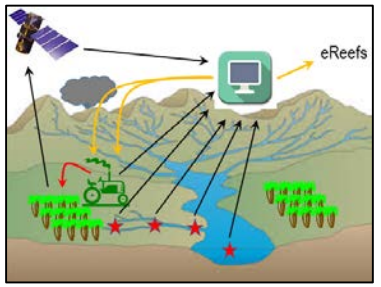


Farmers insuring against loss of yield with lower N

- Over-application of N is an “insurance” against yield loss
- Why not manage that risk commercially?
- Development & testing 2017-2019

Providing information systems to facilitate change

- Feedback on water quality and production impacts of management
- Create an action learning environment



Towards protecting the GBR from land-based pollution – *Despite strong government support it is unlikely water quality goals will be met*

Global Change Biology

Global Change Biology (2016) 22, 1985–2002, doi: 10.1111/gcb.13262

RESEARCH REVIEW

Towards protecting the Great Barrier Reef from land-based pollution

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Marine Pollution Bulletin 85 (2014) 33–41

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Viewpoint

Informing policy to protect coastal coral reefs: Insight from a global review of reducing agricultural pollution to coastal ecosystems

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Agriculture, Ecosystems and Environment 180 (2013) 4–20

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Water quality in agricultural lands draining to the Great Barrier Reef: A review of causes, management and priorities

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Agriculture, Ecosystems and Environment 180 (2013) 192–209

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Conceptual frameworks for estimating the water quality benefits of improved agricultural management practices in large catchments

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2013 Scientific Consensus Statement

Chapter 5

The water quality and economic benefits of agricultural management practices