



GBR Water Quality – what do we know and what more needs to be done?

Session 1: The Reef and its ecosystems – how are they shaping up?

Panel Discussion: Moving towards ecological targets for the GBR

Joint Reef Rescue / NERP Conference

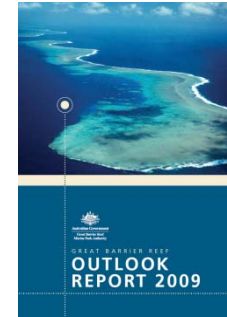
9 May 2013

Convenor: John Bennett, DEHP



Context – Reef Plan

OUTLOOK REPORT2 2014



CLIMATE
CHANGE

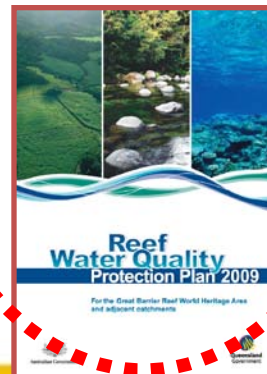
COASTAL
DEVELOPMENT

CATCHMENT
RUNOFF

DIRECT
USE

OTHER

REEF PLAN3



Context – Reef Plan Issues



Priority reef pollutants:

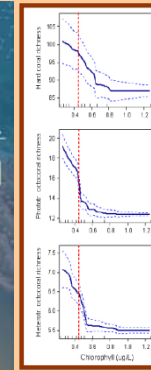
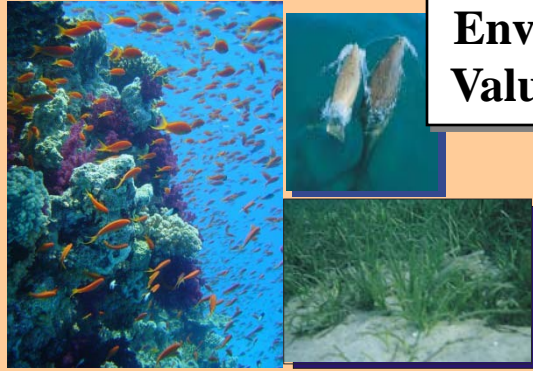
- Sediments (fines?)
- Nutrients (DIN, others?)
- Pesticides (PSII herbicides)

Endpoints:

- Corals
- Seagrasses
- Others?

WQ Management Framework (NWQMS, EPP Water, WQIPs)

**Environmental
Values & Goals**



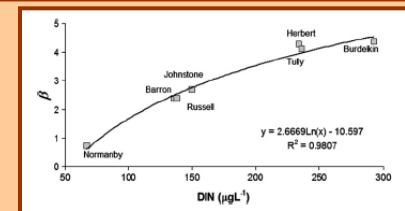
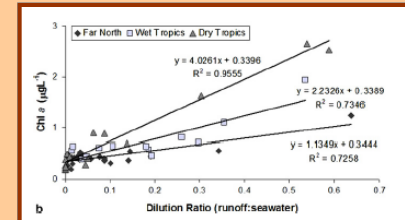
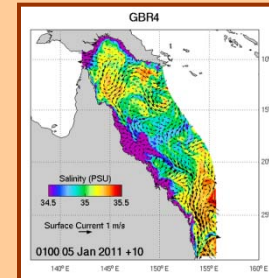
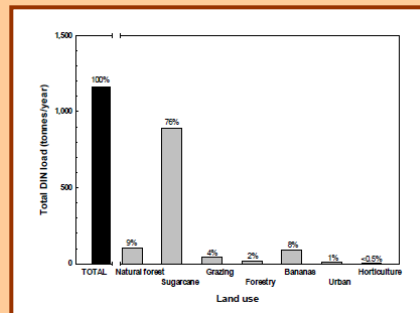
**Water Quality
Targets**

Compare and consider
socio-economic
impacts



**Predict WQ
Concentrations**

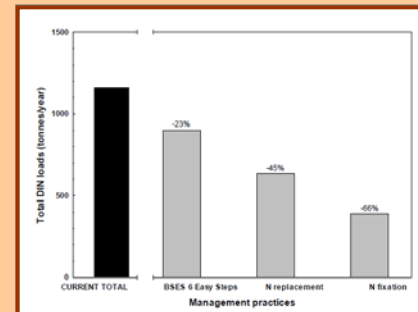
**Determine
Relative Loads**



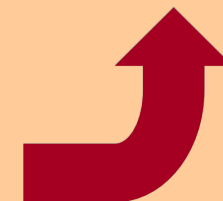
**Devise & Evaluate
Management
Options (BMPs)**

**Paddock &
Catchment**

Models



**Receiving
Water
Models**

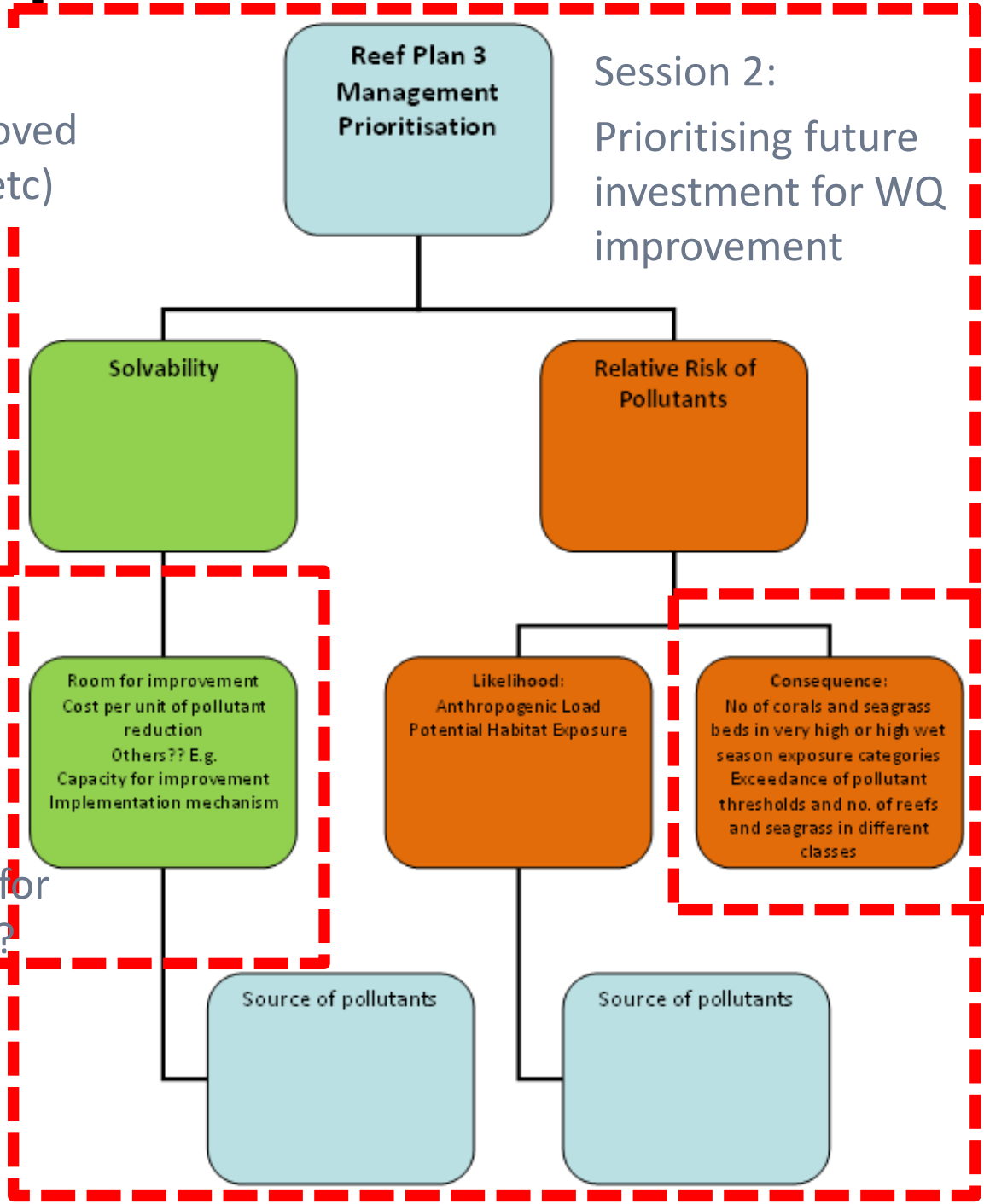


Sessions 4-7:
Adopting improved
practices (RR, etc)

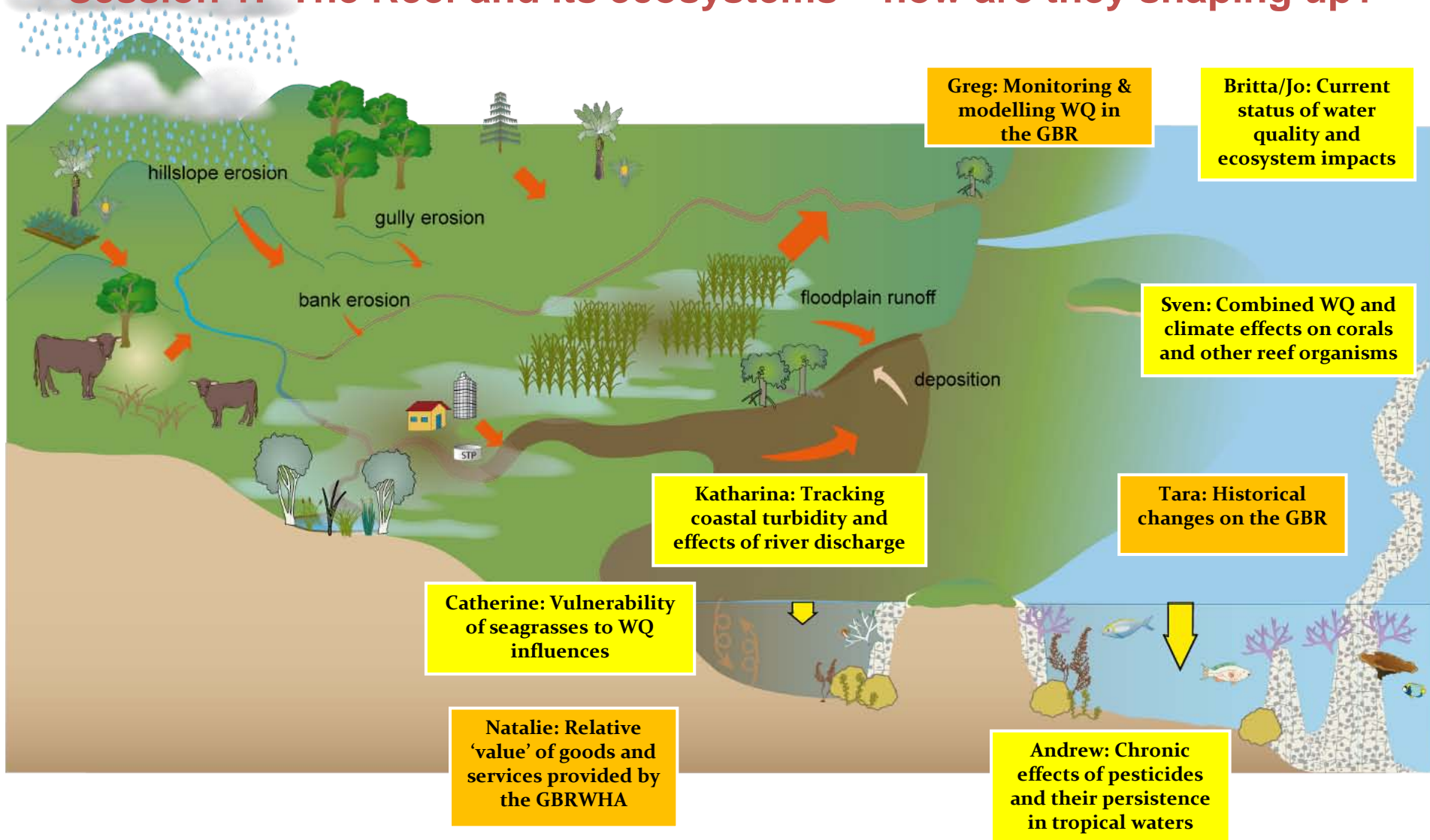
Session 2:
Prioritising future
investment for WQ
improvement

Session 3:
How are we
tracking in
management
practice
improvements for
Reef outcomes?

Session 1:
The Reef and its
ecosystems –
how are they
shaping up?



Session 1: The Reef and its ecosystems – how are they shaping up?



Panel Discussion: Moving towards ecological targets for the GBR.
What ecosystem benefits can we expect from reduced loads of nutrients, sediments and pesticides?



Panel Discussion: Moving towards ecological targets for the GBR.

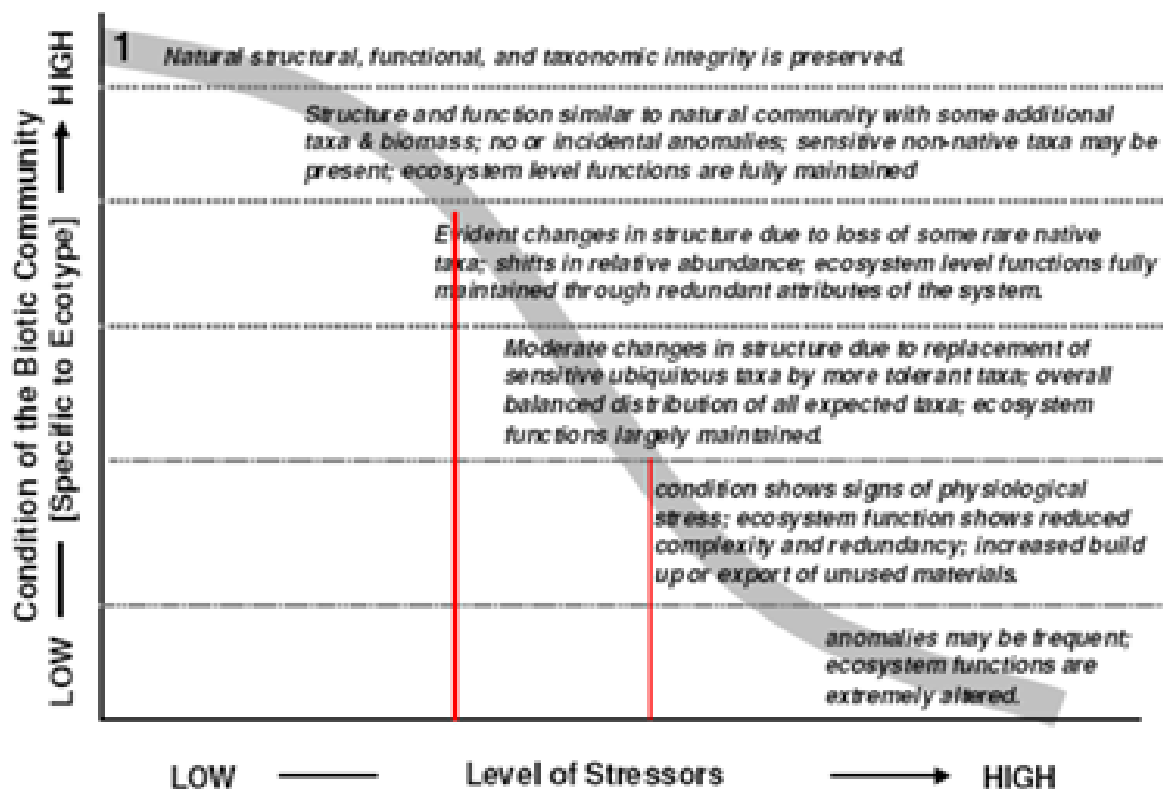


FIGURE 1-1. Conceptual model of the Biological Condition Gradient.

What ecosystem benefits can we expect from reduced loads of nutrients, sediments and pesticides?



Panel Discussion

Panel Discussion: Moving towards ecological targets for the GBR.

- Can we describe different “states / conditions” in terms of ecosystem structure, function, integrity, etc?
- Does existing monitoring allow us to describe the current state / conditions based on these terms?

What ecosystem benefits can we expect from reduced loads of nutrients, sediments and pesticides?

- Can we relate improvements in WQ to expected improvements in ecosystem state / condition?
- If so, can we establish ecological targets for the GBR?

How do we include socio-economic consequences?

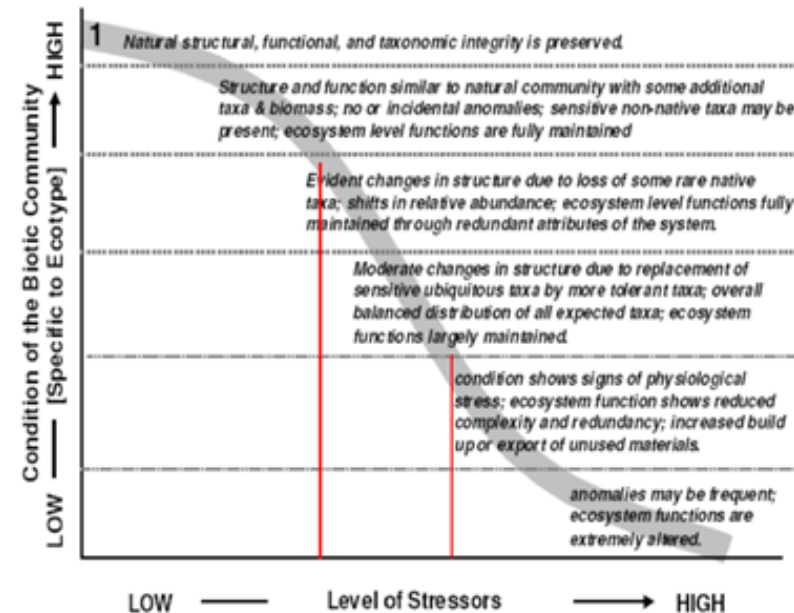


FIGURE 1-1. Conceptual model of the Biological Condition Gradient.



De'ath and Fabricius re sediments and nutrients

a) Macroalgal cover: *In coastal reefs of all regions other than Cape York, macroalgal cover would approximately halve if water clarity and chlorophyll were to be simultaneously improved. Water clarity has a greater effect on macroalgal cover than changes in chlorophyll. Benefits are also great for inner shelf reefs of the Mackay Whitsundays and Fitzroy reefs. Due to the natural north-south gradient in macroalgal cover, macroalgal cover would still be higher in the southern three regions than the northern regions after water quality improvements were implemented. Values in Cape York would remain similar to present values.*

b) Hard coral richness: *The simultaneous improvement of water clarity and chlorophyll would have greatest benefits in the southern regions. Coral richness on coastal reefs in the Burnett Mary, Fitzroy and Wet Tropics would increase by 44 – 47% compared to present-day values, and in the Mackay Whitsundays and Burdekin by ~30%. Changes in water clarity would have slightly greater benefits for coral richness than changes in chlorophyll. On inner shelf reefs, hard coral richness would still increase by about 20 – 25% in the Fitzroy and Mackay Regions, and 4 – 11% in the northern regions.*

c) Richness of phototrophic octocorals: *The simultaneous improvement of water clarity and chlorophyll concentrations would increase the richness of phototrophic octocorals on coastal reefs in all regions except Cape York by 63 – 84% compared to present-day values. On inner shelf reefs, the benefits would still be substantial (44 – 51%) in the Fitzroy and Mackay Whitsundays region, and 5 – 15% further north. Changes in chlorophyll will have a far greater effect on coral richness than changes in water clarity.*

d) Richness of heterotrophic octocorals: *A reduction in chlorophyll would lead to gains in the richness of heterotrophic octocorals, while increased water clarity would lead to slight losses of heterotrophic taxa. The simultaneous improvement of chlorophyll and water clarity would lead to 13 – 34% gains in the southern three regions (greater gains inner shelf than on coastal reefs), and small changes (ranging from 6% gains to 9% losses) on coastal and inner shelf reefs of the three northern regions.*



Panel Discussion: Moving towards ecological targets for the GBR.

- **Can we describe different “states / conditions” in terms of ecosystem structure, function, integrity, etc?**
- A: I suggest we have begun to look at the key ecosystems in terms of resilience/vulnerability/recovery. However, this is limited to coral reefs and seagrass meadows. We are still learning how various community types are recovering after different types of disturbance and in different environmental settings, eg affected by land runoff
- **Does existing monitoring allow us to describe the current state / conditions based on these terms?**
- A: I would argue the MMP does deliver this for coral reefs and seagrass meadows. However, our ability to delineate the effect of multiple and cumulative disturbances/pressures is still limited and is focus of current and future research. This means that we still have limited ability to unambiguously connect individual catchments/landuses to a reef response.



Panel Discussion: Moving towards ecological targets for the GBR.

What ecosystem benefits can we expect from reduced loads of nutrients, sediments and pesticides?

- **Can we relate improvements in WQ to expected improvements in ecosystem state / condition?**
- A: Our next step needs to be to properly calculate end of catchment loads and link to GBR responses. We have now a few years of marine condition data, but less loads data.
- We need to forecast what further load reductions are expected in the future-based on socio-economic forecasts and forecast of management practices changes.
- We need to estimate what effect the increase in extreme weather will have. Extreme events will set back the system regardless of best practice adoption (this could be another question: what do catchment researchers think?). Should improved land management practices focus on reducing loads under extreme events?



Panel Discussion: Moving towards ecological targets for the GBR.

What ecosystem benefits can we expect from reduced loads of nutrients, sediments and pesticides?

- **If so, can we establish ecological targets for the GBR?**
- A: Probably not yet, see above re multiple and cumulative stressors. But we should start to define the ecosystem values/objectives for the GBR, eg what is a “healthy” reef/seagrass meadow? This needs to be a long-term definition based on resilience/recovery as GBR systems fluctuate over time in response to disturbance. But the updating of water quality targets should be the first step.



Panel Discussion: Moving towards ecological targets for the GBR.

What ecosystem benefits can we expect from reduced loads of nutrients, sediments and pesticides?

- **Q: Have the current GBR water quality guidelines been useful and would they need to be more stringent in a climate change future, eg if water temperatures further increase and pH decreases**
- **A: recent research and monitoring has confirmed the current guidelines as true trigger points of ecosystem change. More data will allow for an update soon and the guidelines are a good benchmark for reporting.**



Panel Discussion: Moving towards ecological targets for the GBR.

How do we include socio-economic consequences?

- Do the perceptions of residents and tourists (re condition of the reef and its ecosystems) seem to correlate with scientific evidence?
- If trying to set goals for improvements in water quality --- should those goals be set by scientists, residents or tourists? How might goals differ, and what potential conflicts might these differences generate (which may need to be considered when implementing policy)?

THANK YOU



National Environmental
Research Program

CONTACT

Name:	John Bennett
Organisation:	DEHP
Phone:	07-33305657
Email:	john.bennett@ehp.qld.gov.au