Ecosystem services provided by mangroves: retention of dissolved nutrients.

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September, 2008

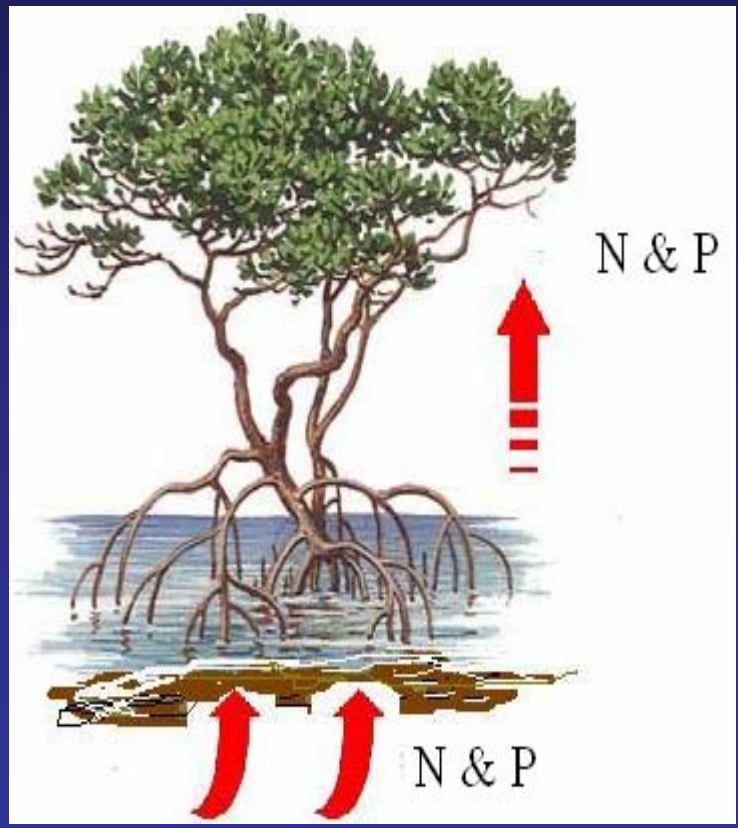
WHY ARE MANGROVES IMPORTANT?

- 1. Nursery grounds
- 2. They help control floods, storm surges, and coastal erosion
- 3. Natural biological filters of pathogens, heavy metals and pollutants

4. Mangroves are "sinks" of nutrients

Mangroves absorb nutrients directly from the soil and accumulate them as biomass

(Robertson and Alongi,1992)



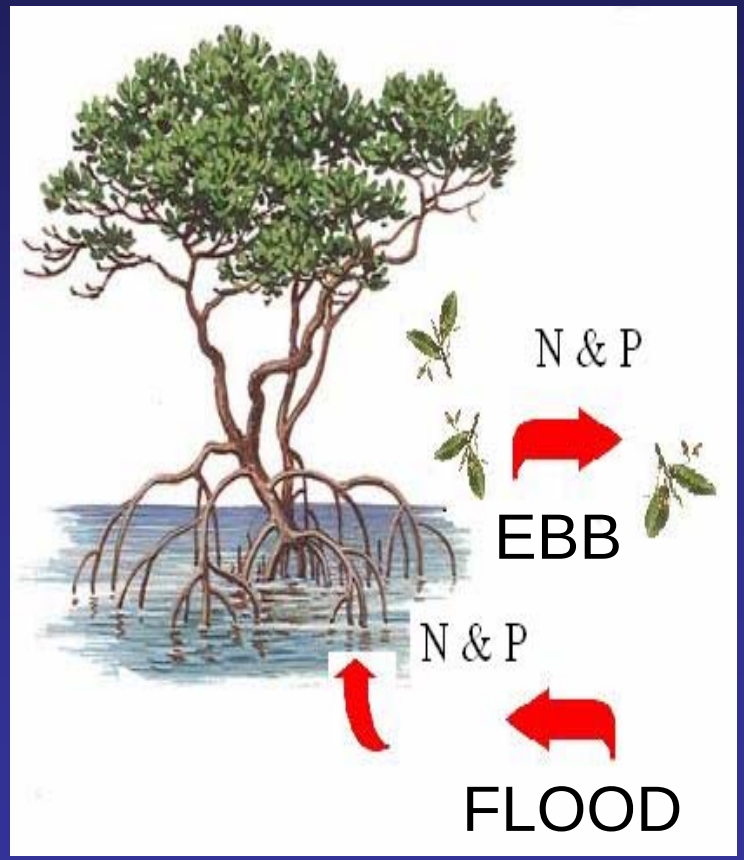
5. Mangroves are sinks/sources of nutrients through tidal exchange

- Import: *improve water quality*

(Alongi and Mckinnon 2004)

- Export; *support coastal food webs*

(Dittmar et al. 2006, Lee, 1999):



Factors determining the role of mangroves as sources or sinks

1) Geomorphological setting

2) Rainfall

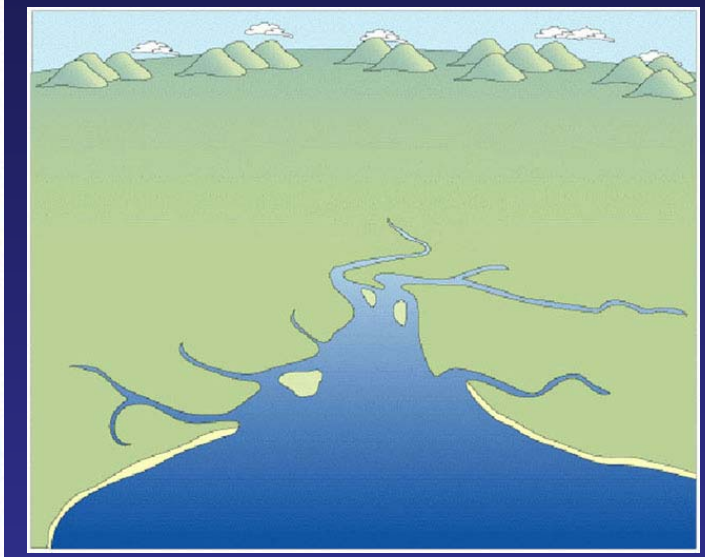
1) Geomorphological setting

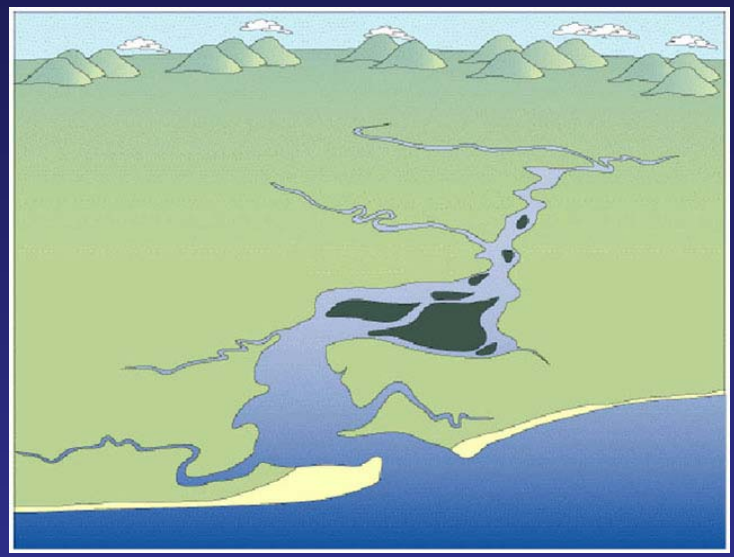
The physical forces acting on a shoreline will not only shape it, but will continuously control processes

Five settings: (Thom 1982)

1. river dominated
2. tide dominated
3. wave-dominated
4. composite river wave-dominated
5. drowned bedrock valley

The most important and contrasting (Wolanksi, 1992):





A) Tidal:

Little export, and even with overall import of materials (i.e. a ***sink***)

B) Riverine:

Nutrient influx and strong outwelling (i.e. ***source***).

(Woodroffe, 1992)

Figs. Modified from Ozcoast, 2008

GOAL #1. Assess whether mangrove forest are sinks or sources of dissolved nutrients through tidal exchange as predicted by literature

HYPHOTESIS #1:

Riverine mangroves act as sources of nutrients and tidal mangroves as sinks

2) Rainfall

- Seasonal plant growth is followed by greater absorption of nutrients
- Increase the strength of the forest as a sink?

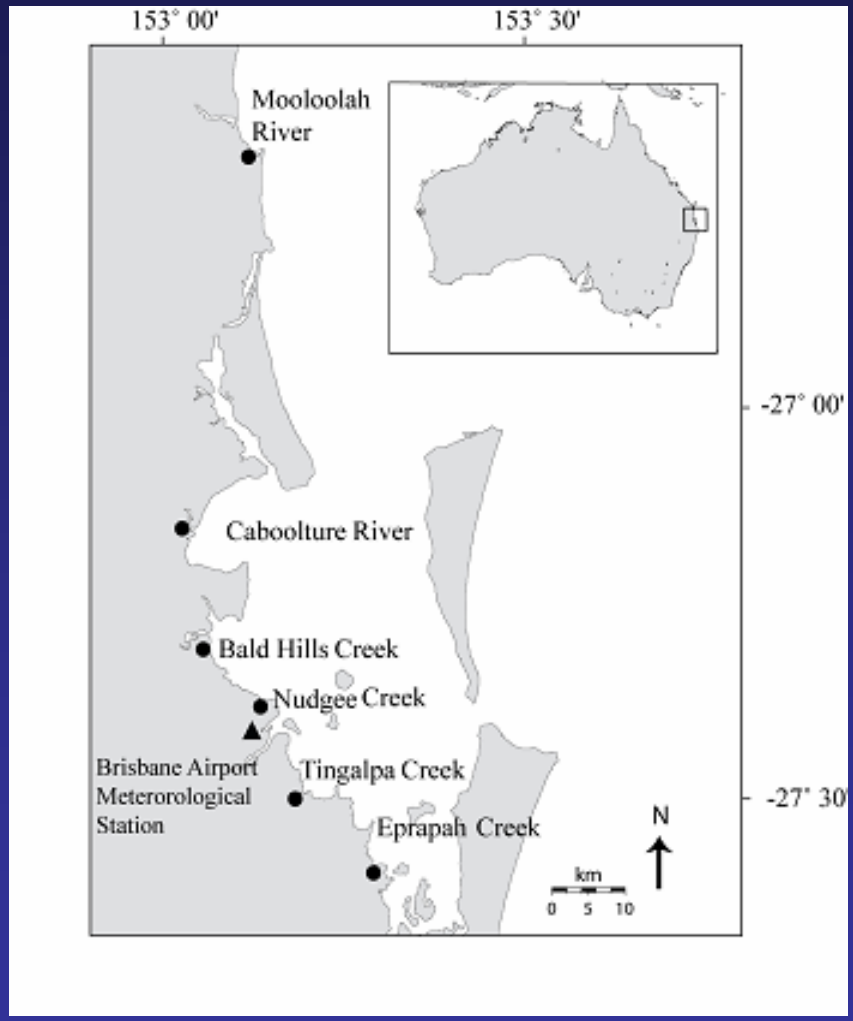
GOAL #2:

Assess whether the mangroves ecological service as a nutrient sinks is enhanced by rain

HYPOTHESIS #2:

Rain will enhance the role of mangrove forest as sinks of nutrients

Study sites:



- SE, Qld.
- Mesotidal
- *Avicennia sp.* dominant

- Subtropical; rainfall in summer (annual 996 mm)

  2007: 249 mm
  2008: 371 mm

Mooloolah River

(River-wave dominated)

Caboolture River

(River-tide dominated delta)

Tingalpa Creek

(River-tide dominated delta)

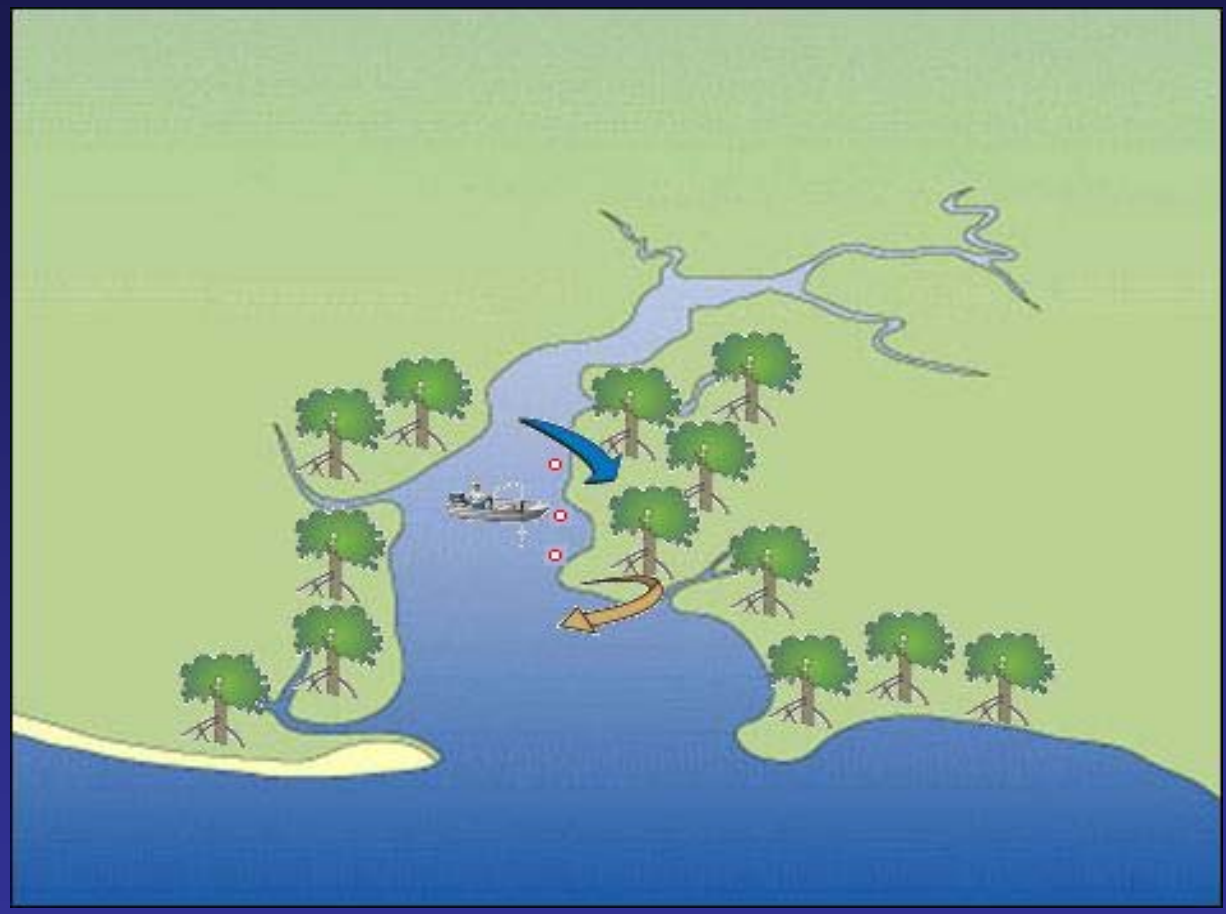
Geomorphological classification from Australian Estuarine Database, Geoscience Australia

Bald Hills Creek
(Tide-tide dominated estuary)

Eprapah Creek
(Tide-tide flat/creek)

Nudgee Creek
(Tide-tide flat/creek)

Sampling strategy



6 sites x 3 tidal cycles x 2 years = **36 tidal cycles**

3 points x 6 sites x 18 cycles x flood/ebb samples = **324 nutrient samples**

(Modified from Ozcoast, 2008)

High tide

Flood

Ebb

Net balance (NOx, P, NH_3) = [flood] - [ebb]

We waited…and waited..

Nutrient analysis

NOx (NO3 +NO2) & P

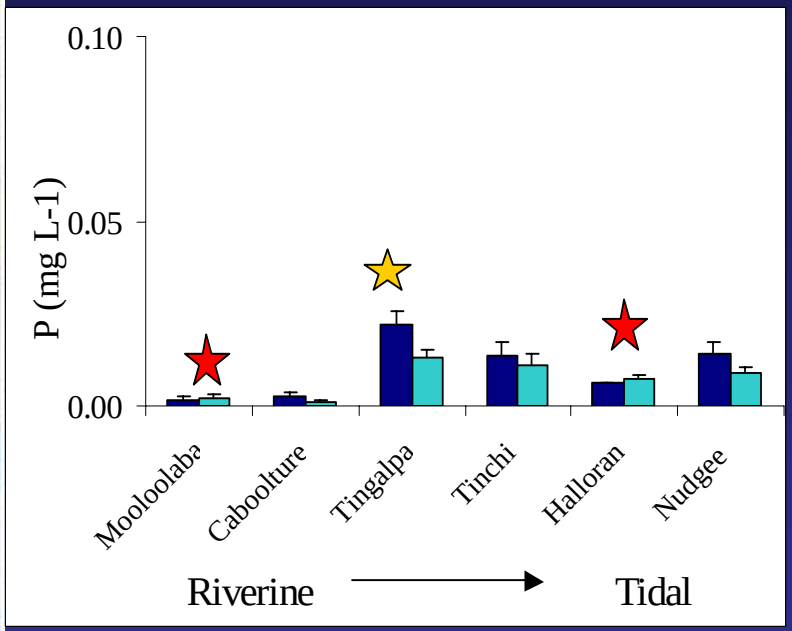
NH_4+

Colorimetric analysis (SEAL Nutrient Analyser AQ-2)

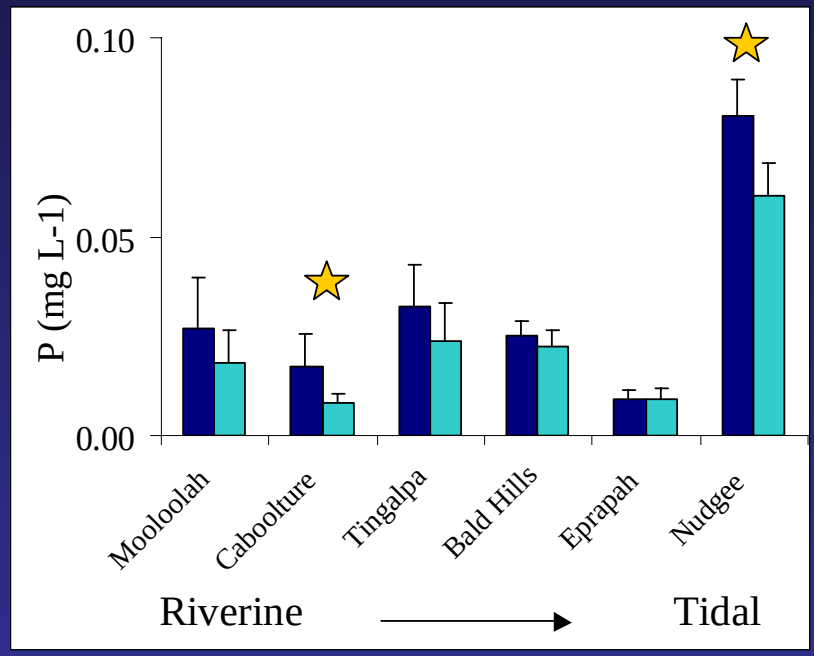
Fluorometric analysis

PHOSPHOROURS

- DRY YEAR



- WET YEAR



Riverine sinks P (p=0.01)

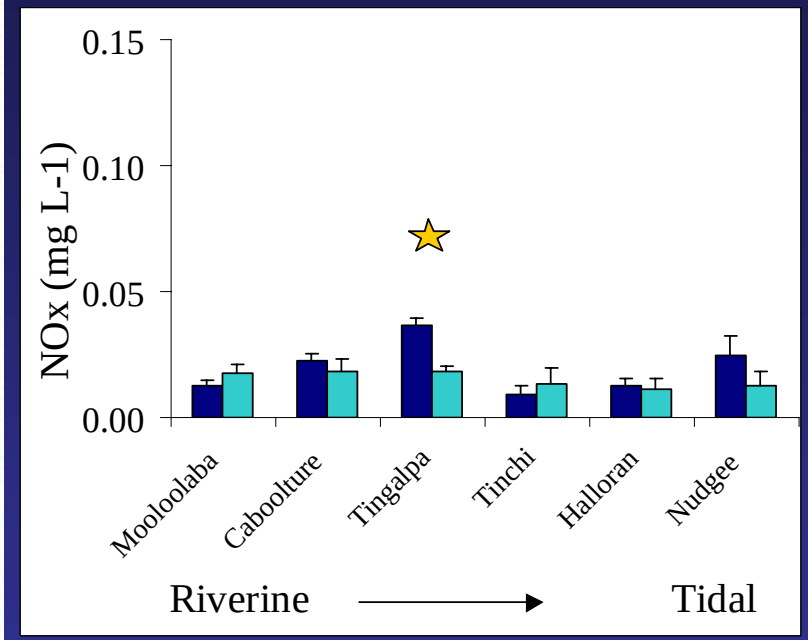
Tidal sinks P (p=0.05)

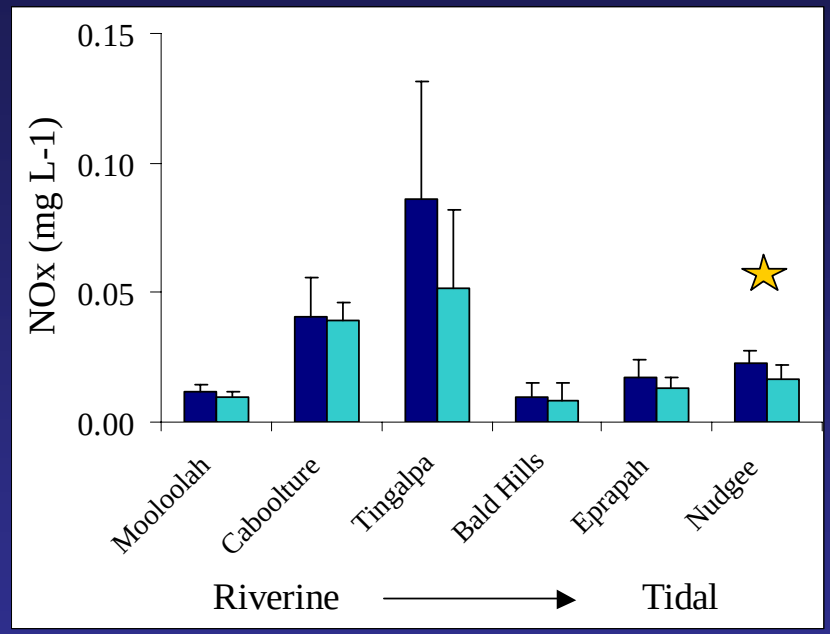
source

sink

NITROGEN (NOx)

- DRY YEAR
- WET YEAR





★ Riverine sink N (p< 0.01)

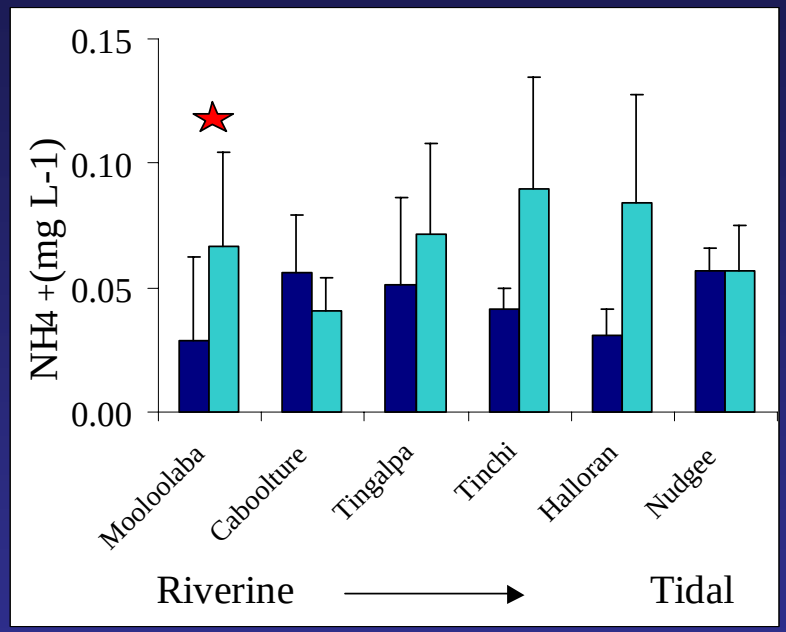
★ Riverine sink N (p= 0.02)

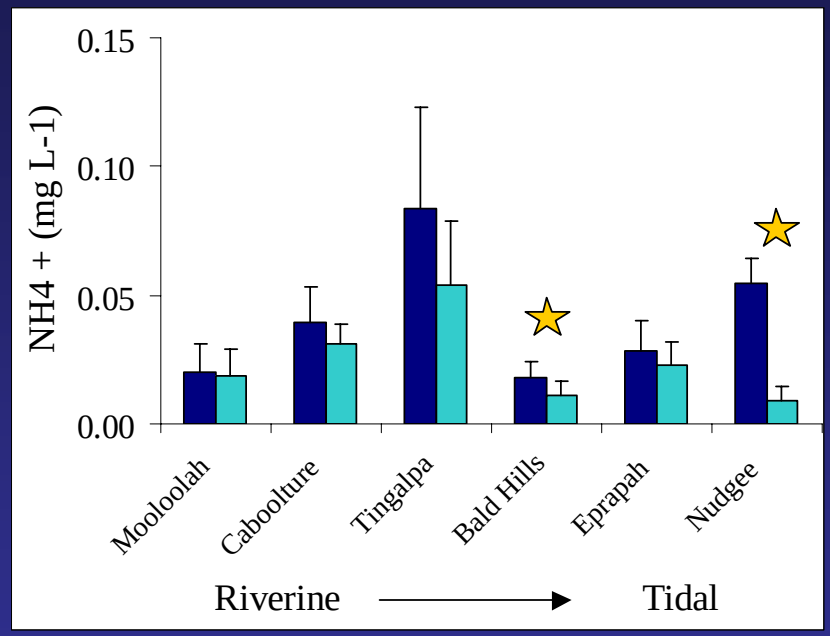
★ Tidal sink N (p<0.05)

★ Tidal sink N (p<0.01)

AMMONIA

- DRY YEAR
- WET YEAR





★ Riverine sink NH4 (p< 0.05)

★ Tidal sink NH4 (p<0.05)

Table 2. Net import/export average

DRY

WET

	Nutrients (mg/L)		
	P	NOx	NH3
2007			
River	0.003 ± 0.005	0.006 ± 0.012	- 0.014 ± 0.027
Tide	0.002 ± 0.003	0.003 ± 0.008	- 0.034 ± 0.030
2008			
River	0.009 ± 0.01	0.013 ± 0.021	0.013 ± 0.021
Tide	0.008 ± 0.011	0.004 ± 0.007	0.019 ± 0.021

HIPHOTESIS #1:
Riverine mangroves in SE Qld act as sources of nutrients and tidal mangroves as sinks

Mangrove forests in SE Queensland usually act as ***sinks*** of dissolved nutrients, especially N.

Riverine forest receive more N than tidal ones and are stronger N sinks.

HIPOTHESIS #2:
Rain will enhance the role of mangrove forest as sinks of nutrients

During periods of rainfall, the function of mangrove forests as sinks of nutrient is enhanced

SO????

- Mangroves in SE Qld are key sites for nutrient absorption (especially N).
  → improve water quality

- Mangrove forest with different geomorphological setting provide different ecological services.

- This information should aid in the decision making process for sustainable management in the region.

THANK YOU

- CMS
- CONACYT MEXICO

- Dr. Catherine Lovelock

- All my great field assistants!: Jock, Alistair, Aldrie, Esteban, Tim, Helen, Claire, Rodrigo, Christian, Kim,