National Environmental Research Program

Project 2.2

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Mangrove, freshwater and coastal wetlands

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AUSTRALIA

MangroveWatch

RELEVANCE OF WORK

Values of wetlands

- Tidal and freshwater wetlands important for habitat and fishery production
- Provide a range of ecosystem services and cultural uses
- Provide coastal protection against storm surges/sea level rise

Status of wetlands

- Previously they were poorly documented
- Little information on condition, extent, status.
- Long-term management requires this knowledge
- Many threats exist and need to be understood and managed

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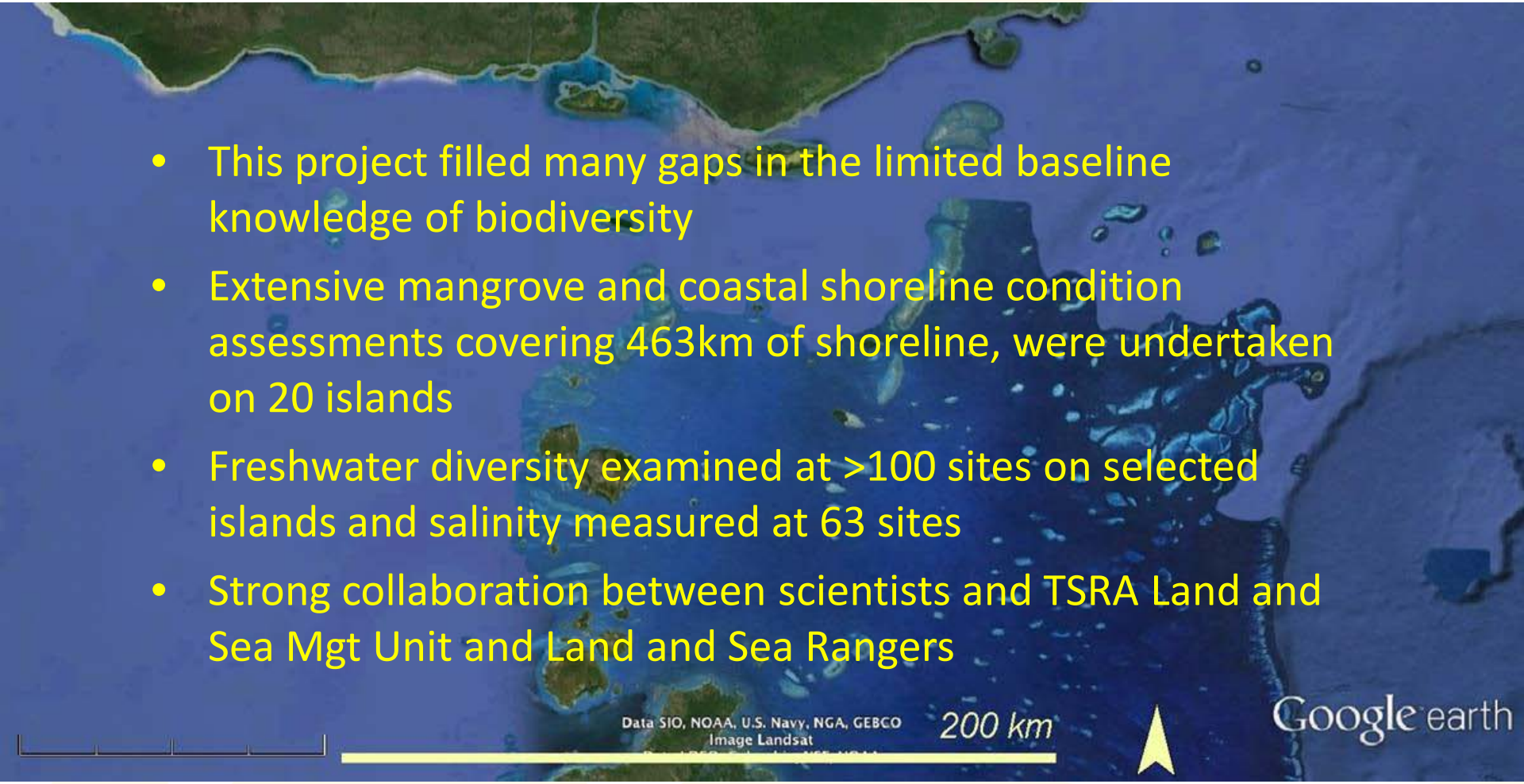
Project Overview



- This project filled many gaps in the limited baseline knowledge of biodiversity
- Extensive mangrove and coastal shoreline condition assessments covering 463km of shoreline, were undertaken on 20 islands
- Freshwater diversity examined at >100 sites on selected islands and salinity measured at 63 sites
- Strong collaboration between scientists and TSRA Land and Sea Mgt Unit and Land and Sea Rangers

Collaboration

- TSRA Land and Sea Management Unit staff worked with scientists to devise the field work plan and schedules
- TSRA Land and Sea Management Unit staff organised all island access, permissions and ranger availability
- Greatly increased ranger capability
  - Every single day of field work, across 20 islands, was conducted with rangers present – they loved it – as did the scientists!
  - Knowledge-sharing, greater understanding of values and threats to wetlands

Working With Rangers – Training/Knowledge Sharing

In the classroom

In the field

In boats

Presenting to schools

Working With Rangers – Inland Wetlands

Working With Rangers – Fish Surveys

Catching freshwater crabs

Juvenile barra

Cast netting

Small fish

Working With Rangers – Mangrove Wetlands

Surveys conducted by boat, helicopter and on foot
Rangers present every step of the way

Damien Burrows
TropWATER - JCU

5 Key Messages

Key Message #1

- Wetland are extensive on some islands, especially for mangroves, and biodiversity is high. Most of this was undocumented to date.
  - 31,390ha of wetland, 83% tidal (mangrove/salt marsh) so this was the main focus
  - Most wetlands are on Boigu and Saibai
  - 35 mangrove species present (out of 45 for Australia), half of the known world total
  - Tripled the known aquatic biodiversity for most islands
  - Documented 2 mangrove species new to Australia, 3 new to Torres Strait
  - 49 species of fish found in fresh and brackish waters, 18 of them new records for Torres Straits
  - New records for freshwater crabs, turtles and snakes
  - Various invasive species impacting wetlands (fish, deer and pigs)

Long-neck turtle – Saibai, Badu, Horn islands

Boigu senior ranger Nelson Gibuma standing next to the only Sonneratia ovata tree known in Australia

Climbing perch – from SE Asia via PNG. Found Saibai and Boigu islands

Key Message #2

- Mangrove Biomass and Carbon Standing Stocks are High
  - 31 forest plots across 5 islands (Boigu, Saibai, Iama, Gebar, Zagai)
  - Averaging 315tC/ha

Key Message #3

- Shoreline wetland condition assessed on 20 islands, covering 463km of shoreline
  - All georeferenced archival aerial video footage
  - Footage can be viewed by others, analysed for other purposes, compared with in the future
  - Extensive archival baseline of wetlands

Video surveys conducted by boat, helicopter and on foot
Rangers always present and working with us

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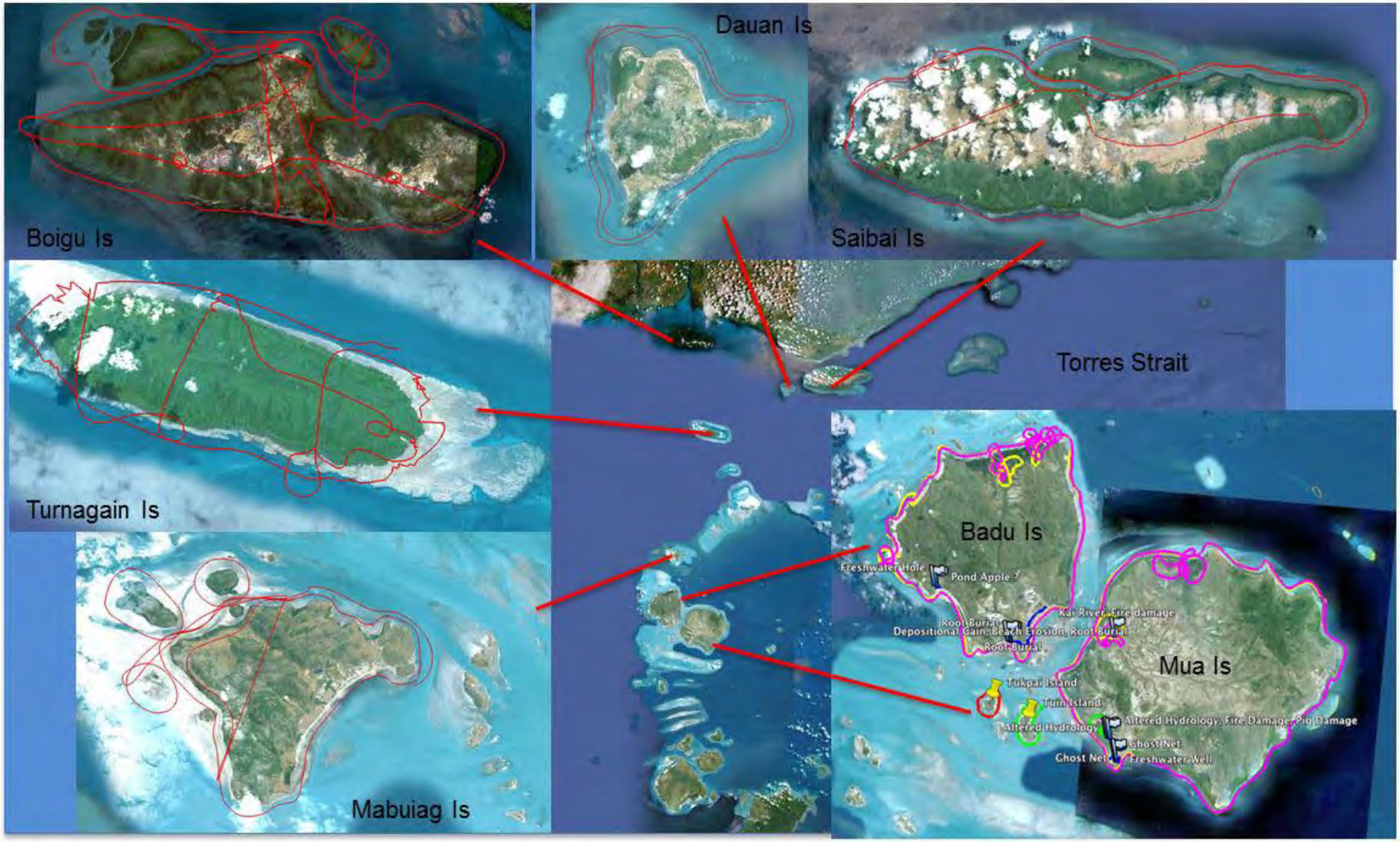
Shoreline Surveys

20 islands surveyed
463km of shoreline recorded

NERP JCU TropWATER Mangrove & Freshwater Aerial Video Surveys 2011-1013

Boigu Island
Duaun Island
Saibai Island
Turnagain Island
Darnley Island
Gabba Island
Tudu Island
Cap Island
Zagai Island
Mabuiag Island
Yam Island
Murray Islands
Badu Island
Sassie Island
Sue Island
Moa Island
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
200 km
Google earth

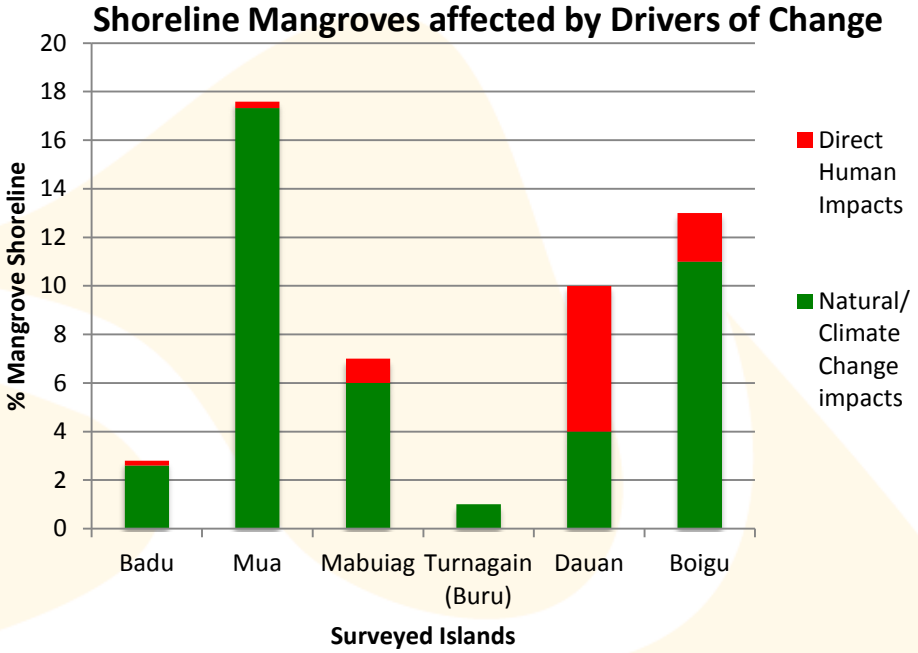
Shoreline Surveys in Torres Strait



Shoreline video survey tracks *(Red/Pink line)* of 7 central and northern Islands.

Key Message #4

- Drivers of change and thus the management responses vary from island to island



Mangrove dieback due to root burial from sand deposition caused by storm waves or storm surge, North-east Mua Is.

Key Message #5

- Wetlands acts as sentinels for climate change/sea level rise
  - Provide a real indicator of effect
  - Salinity in freshwater wetlands (63 sites)
  - Mangrove condition along shorelines (463km

Key issue of concern in Torres Strait

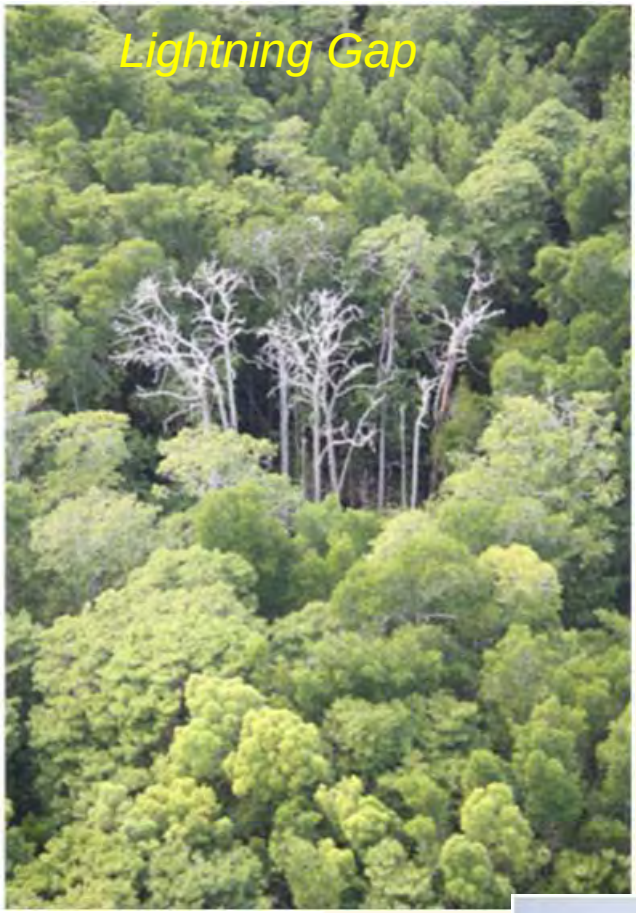
People are worried about climate change/sea level rise:

Sea level rise predictions validate these concerns:

- high rates predicted, at ~8 mm / year, i.e., 2 times the global average!
- most communities are close to the sea
- some communities have no place of retreat

Vulnerable, low-lying communities need to be extra vigilant!

Figure 4.1. Inundation experienced at Iama during king tides. Source: Iama Island Council.



HOW ARE WETLANDS RESPONDING?

Mangroves vulnerable

Occupy a narrow tidal position – small changes cause widespread death

More frequent and severe storms

Increased lightning and wind disturbance

Sea Level Rise

Loss of seaward mangrove extent and mangrove encroachment into saline/freshwater wetlands – *already occurring?*

Sea Level Rise and the Torres Strait Islands

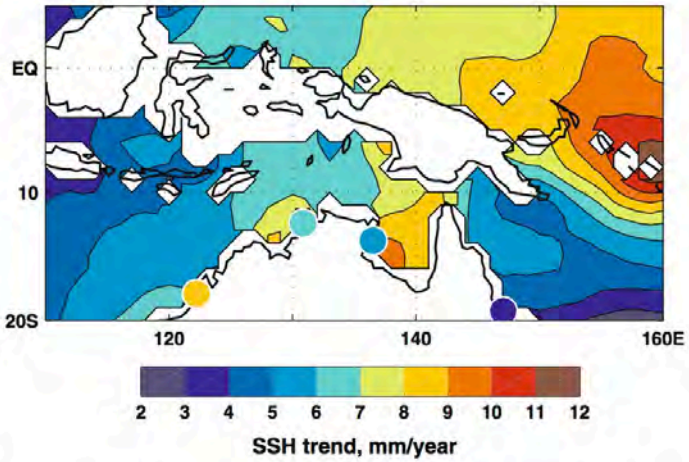


Fig. 7 Sea level trends in the region estimated from satellite altimeter data from January 1993 to December 2007. Sea level trends from tide gauge data from the National Tidal Centre are indicated by the *coloured dots*. The sea level data have been corrected for vertical land motion associated with glacial isostatic adjustment but not for changes in atmospheric pressure

Local Rate is ~8 mm/yr
= 0.8 m in 100 years

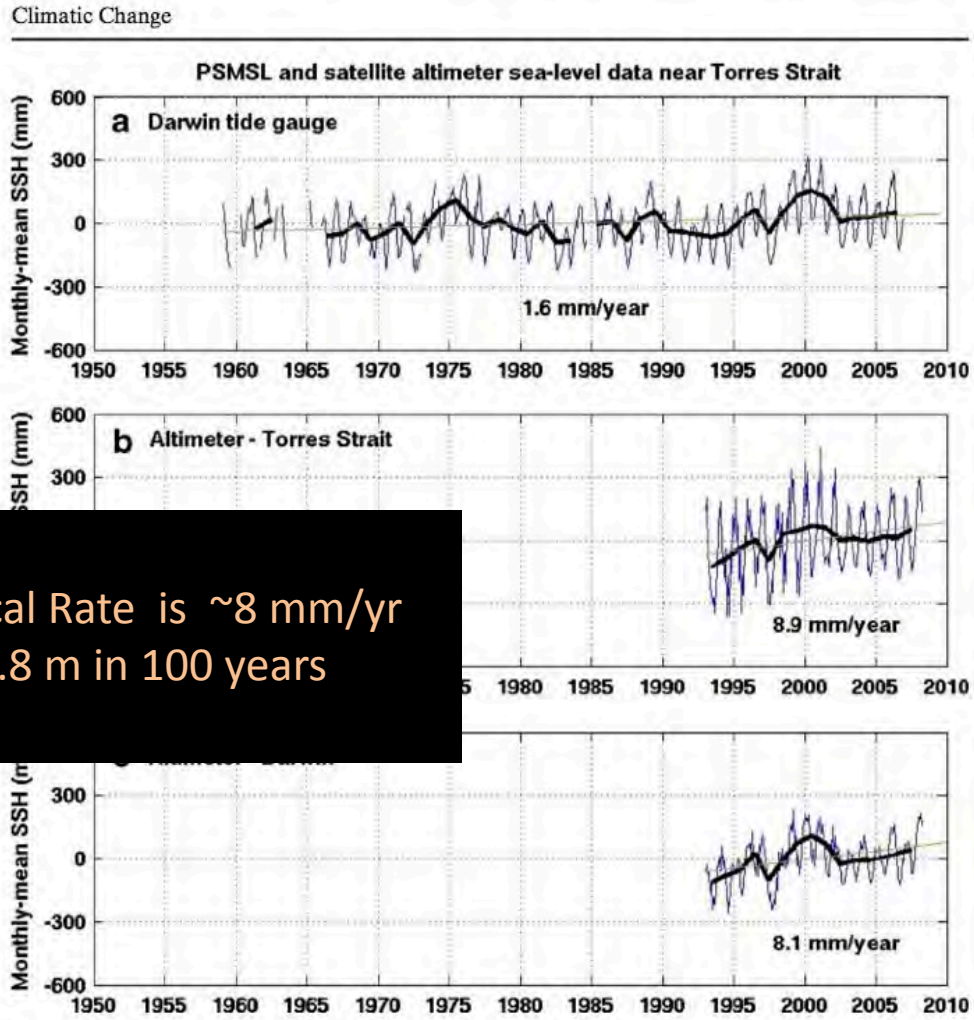


Fig. 8 Monthly averaged sea levels as measured by a tide gauge at Darwin (**a**), and as measured by satellite altimeter in Torres Strait (**b**) near Darwin (**c**)

Green et al., 2009

Boigu Island – a large Mangrove island

Boigu Island – a large Mangrove island

Area around 20-30 km^2

Boigu Island – a large Mangrove island

Parnell et al., 2011

Boigu Island – a large Mangrove island

Figure 5.3a: Inundation at HAT (Highest Astronomical Tide).

Parnell et al., 2011

Boigu Island – a large Mangrove island

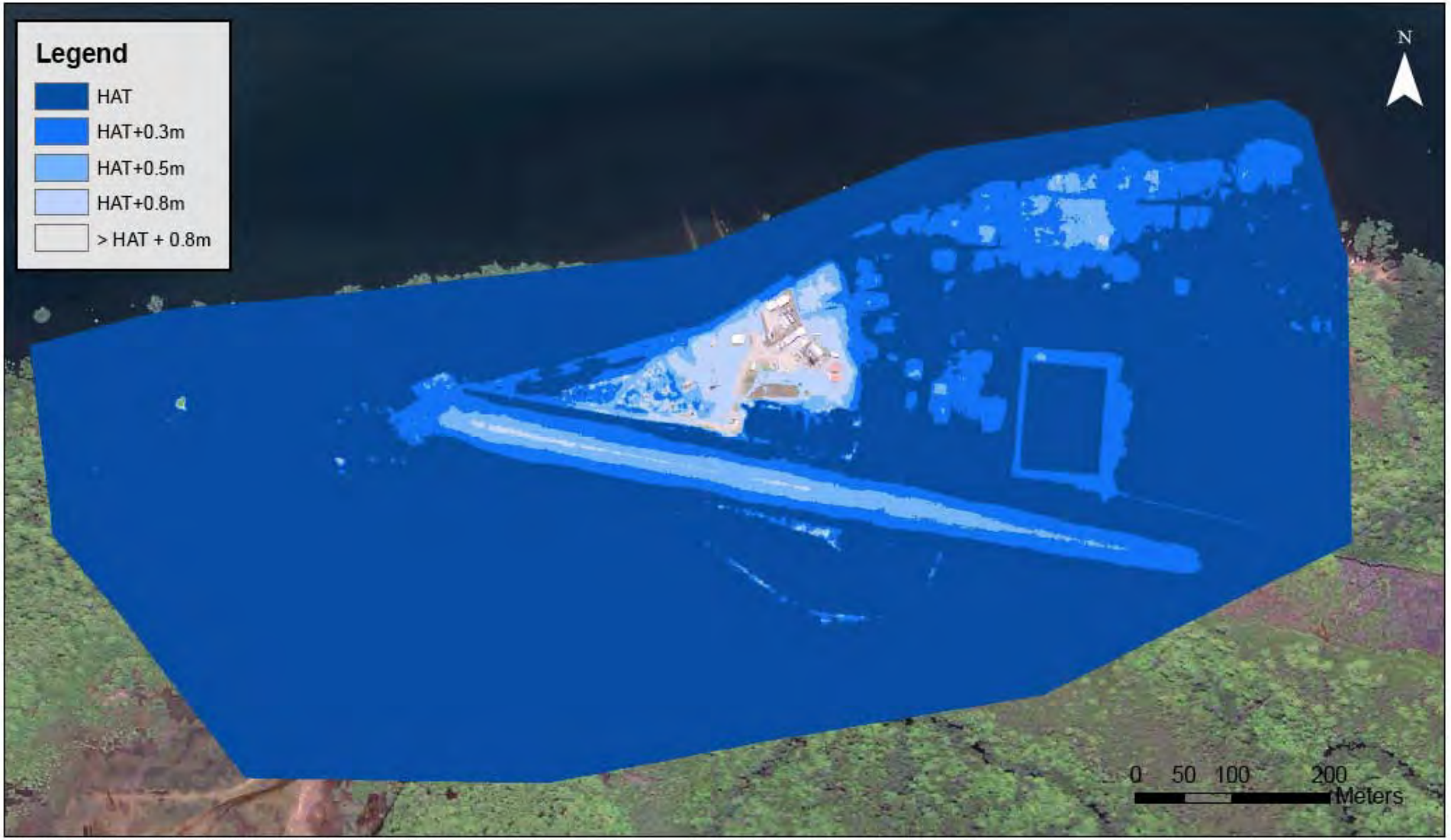
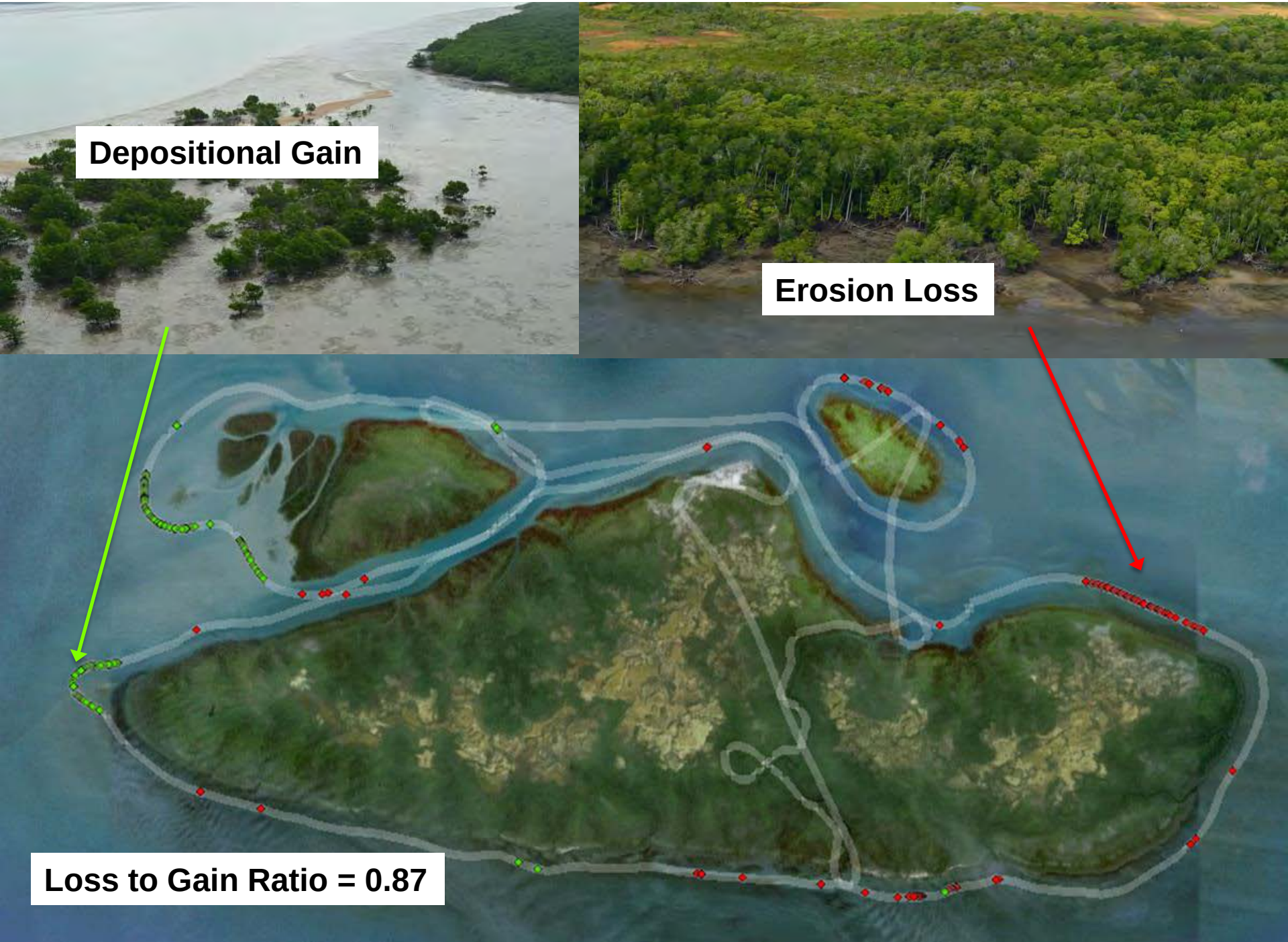


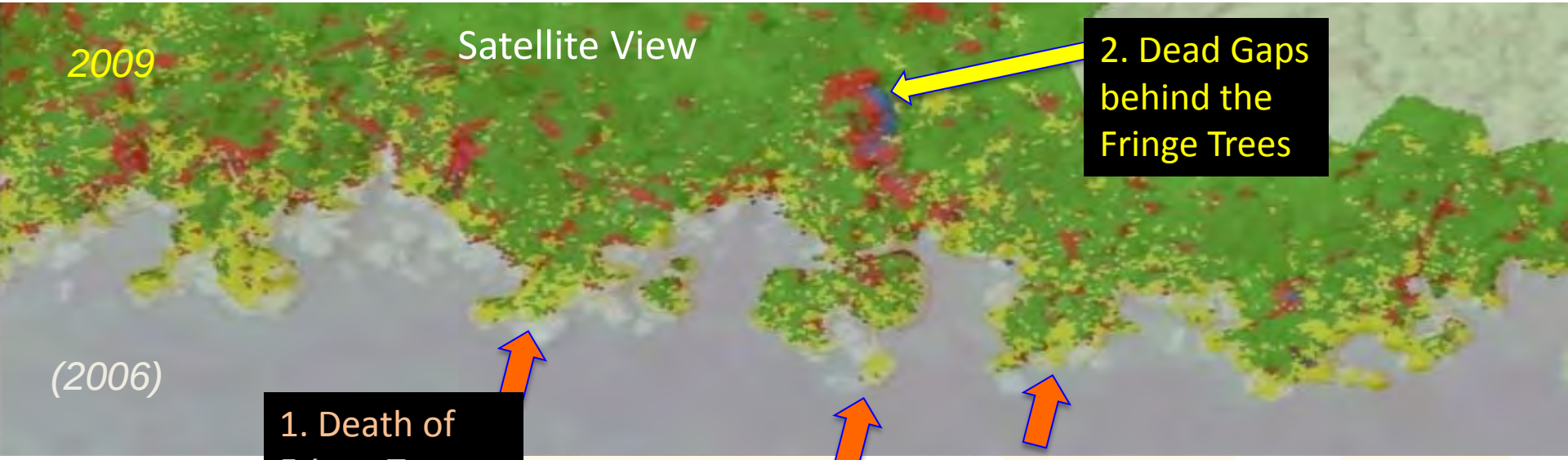
Figure 5.3d: Inundation at HAT with 0.8m sea level rise.

Parnell et al., 2011

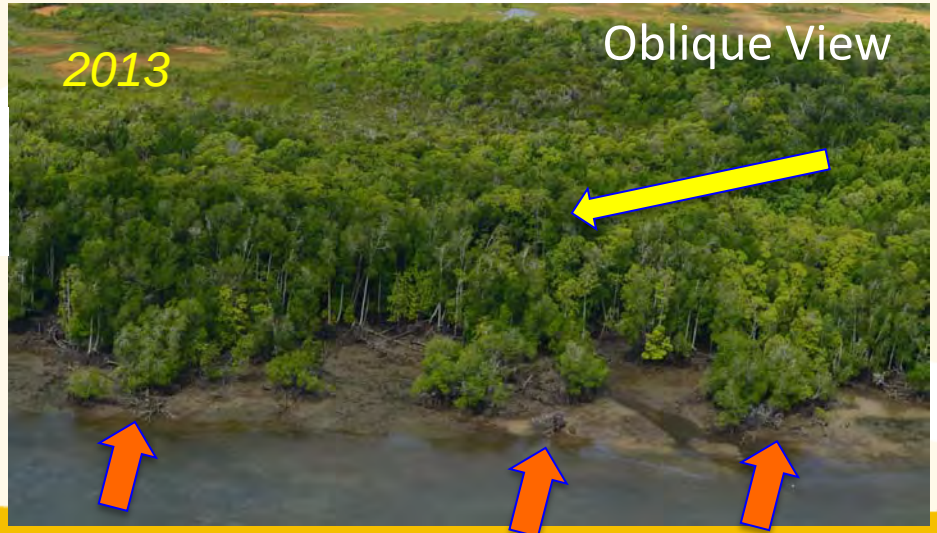
Are mangroves responding to sea level rise?


Depositional Gain
Erosion Loss
Loss to Gain Ratio = 0.87

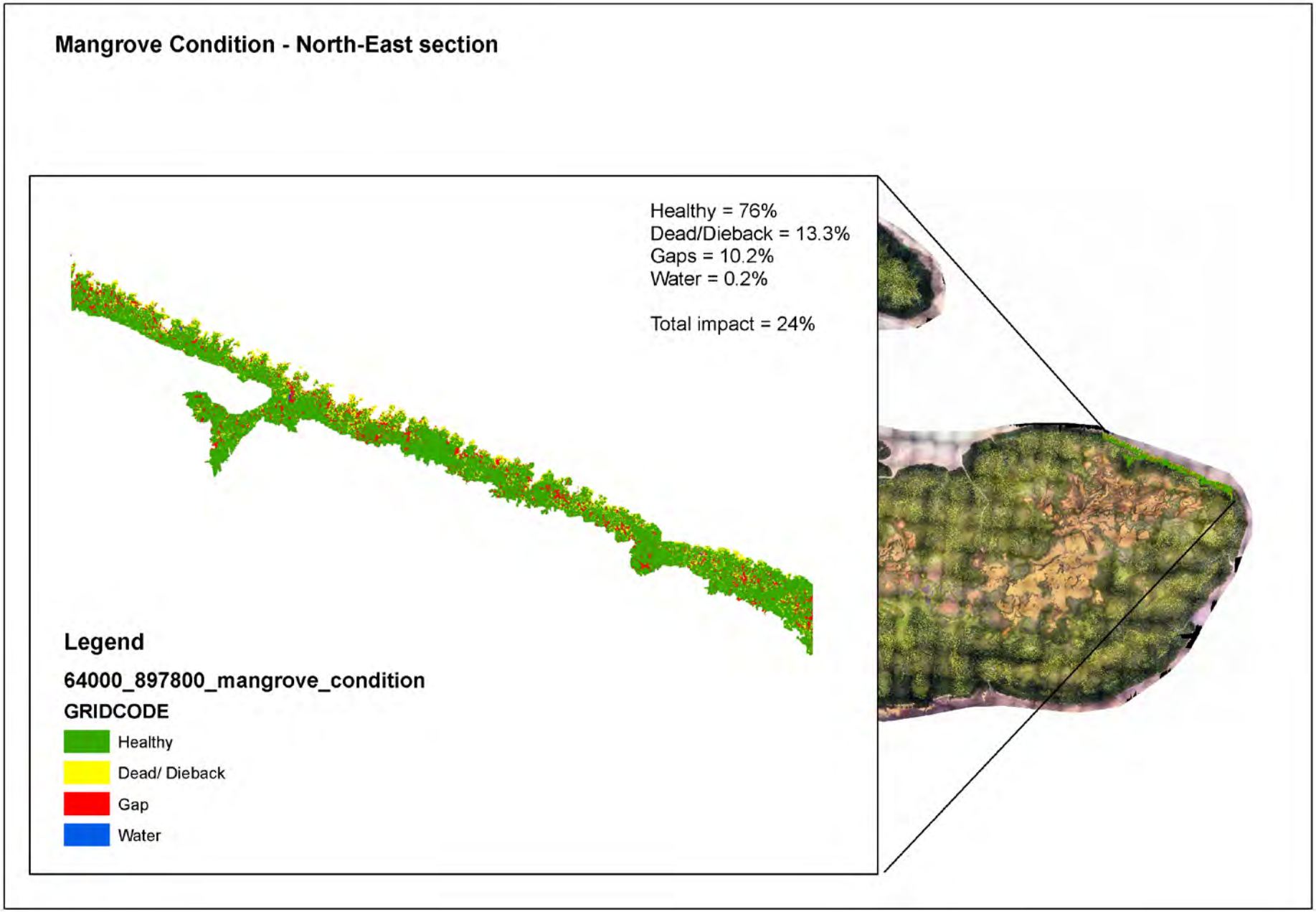
Likely Responses of Mangroves to Sea Level Rise



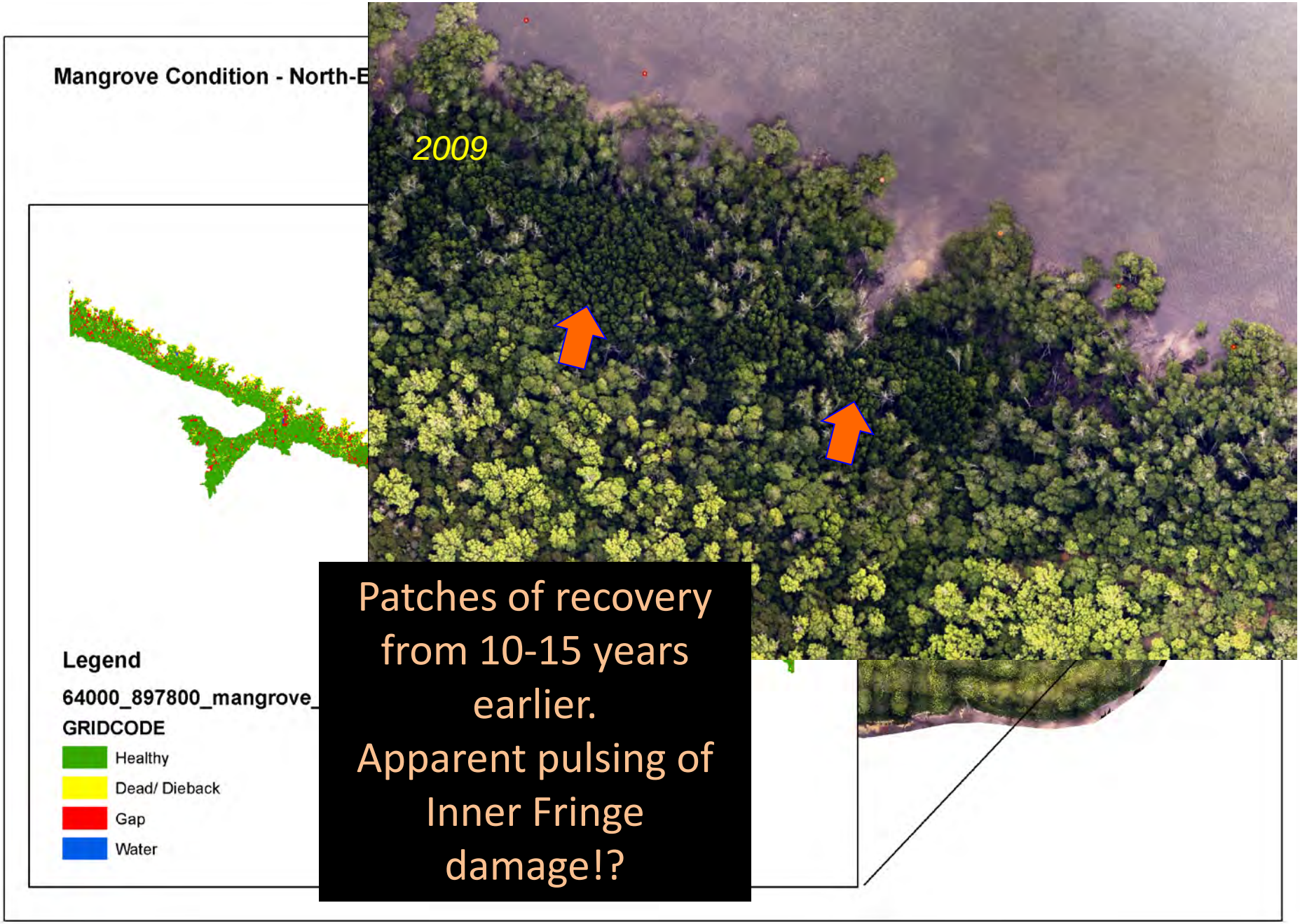
Processes of Change!



Boigu Island Mangrove Inner Fringe Condition - Example



Boigu Island Mangrove Inner Fringe Condition - Example



Torres Strait Islands and Sea Level Rise

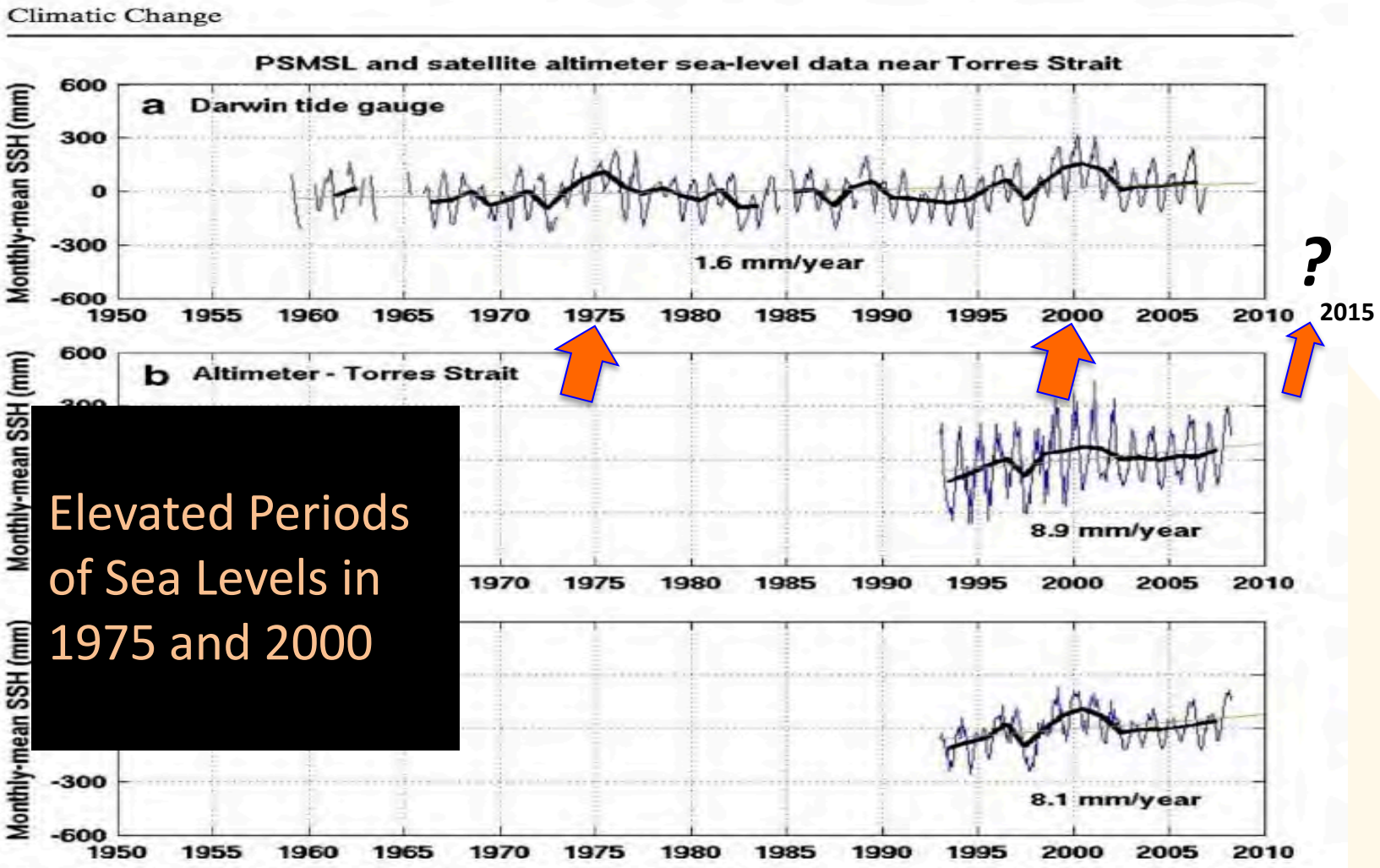


Fig. 8 Monthly averaged sea levels as measured by a tide gauge at Darwin (**a**), and as measured by satellite altimeter in Torres Strait (**b**) near Darwin (**c**)

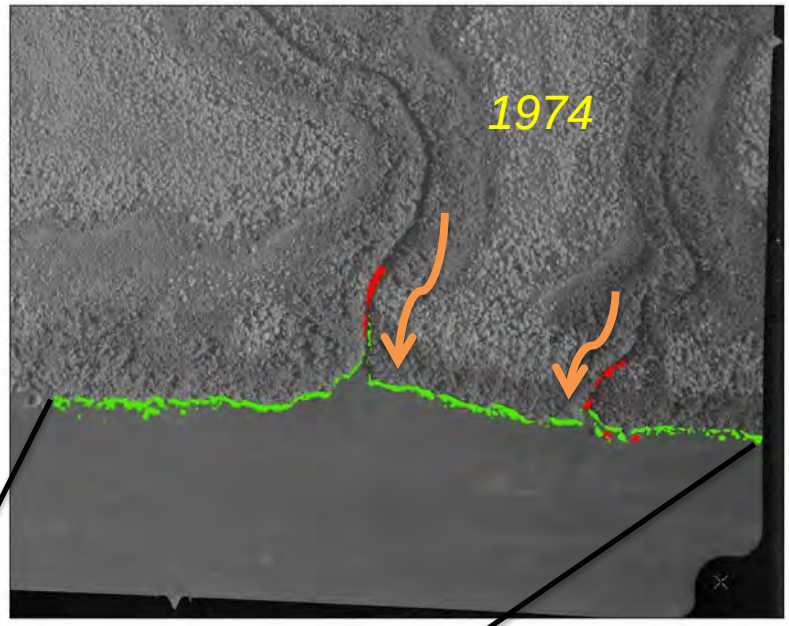
Green et al., 2009

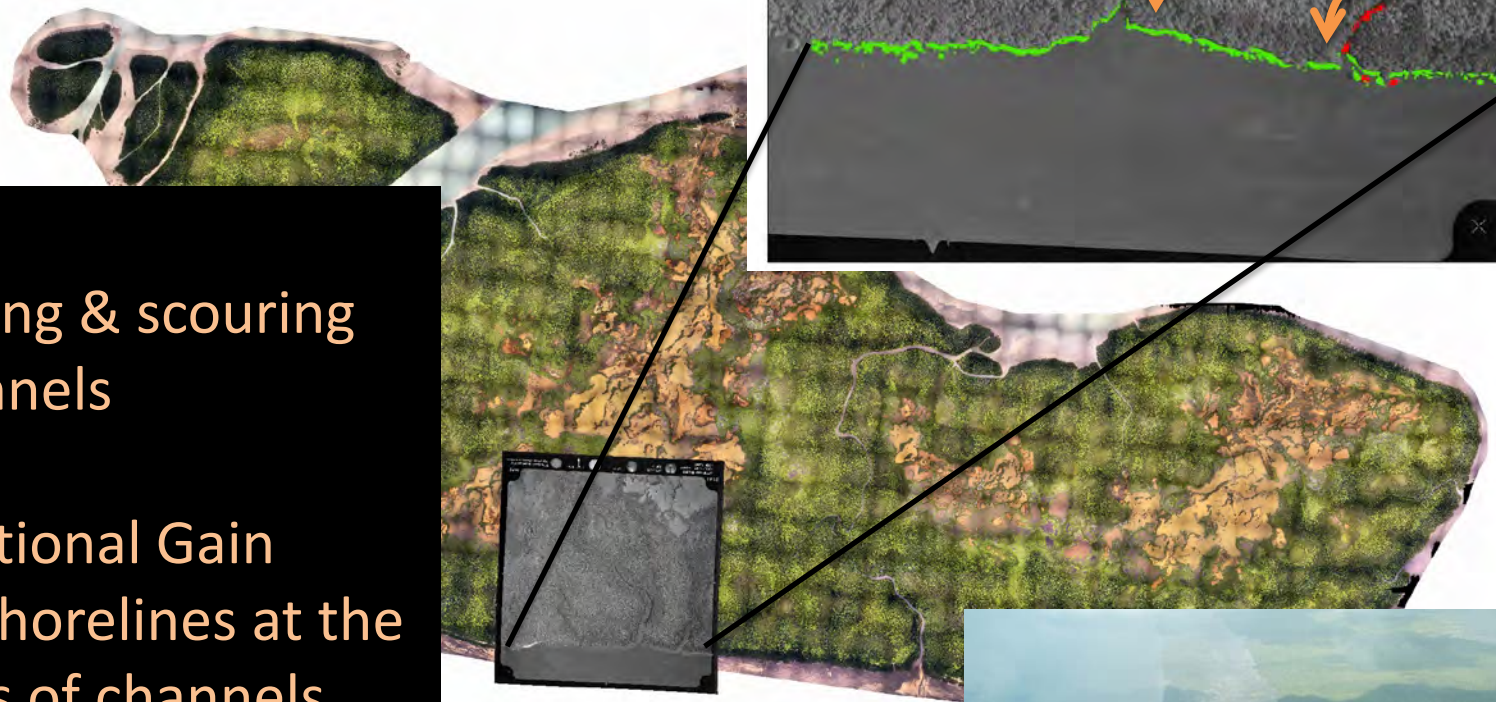
Boigu Island Shoreline Change 1974 – 2009

Example

Shoreline Expansion = 1.64 Ha
Shoreline Retreat = 0.25 Ha
Nett Change = +1.4 Ha
Mean distance change = 12m (*RMS = 2.43m)*

2009





Widening & scouring of channels

Depositional Gain along shorelines at the mouths of channels

The Response of Mangroves to Sea Level Rise

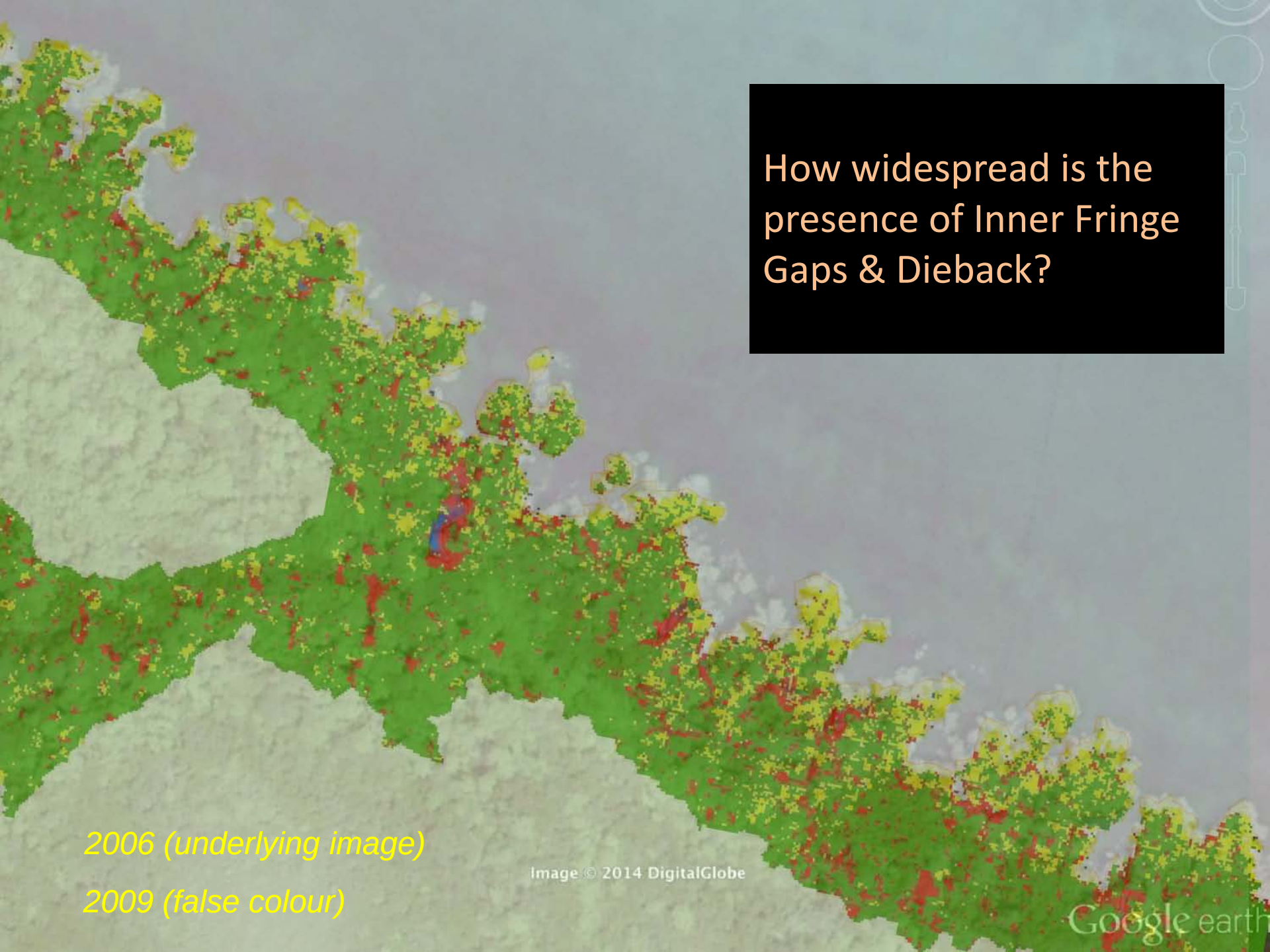
Review of Expectations

Shoreline retreat – loss of low intertidal fringe trees, front edge dieback

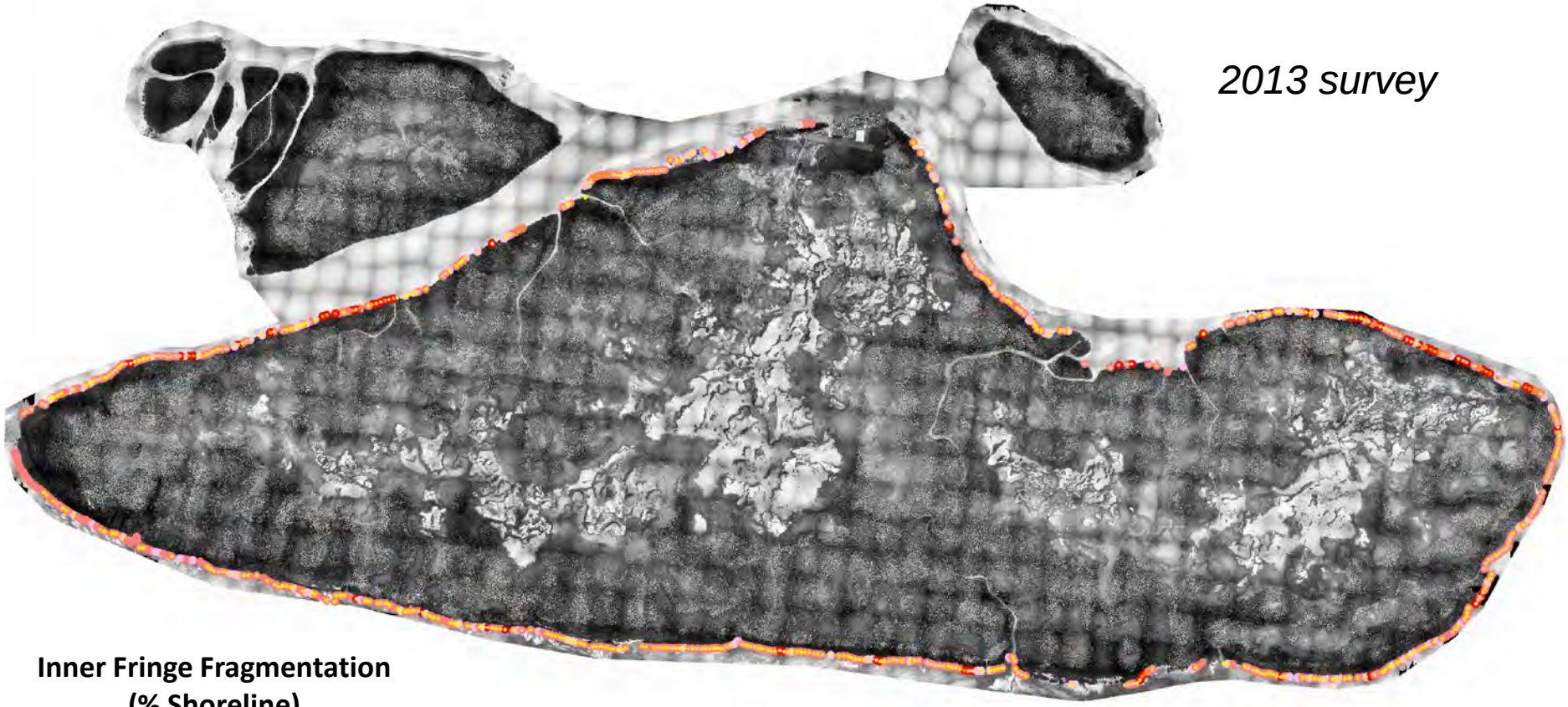
Landward expansion – encroachment of mangroves into supra-tidal zone

Channel expansion – channel widening, scouring, greater inundation water

Inner fringe dieback – loss of inner fringe patches, gaps behind the fringe

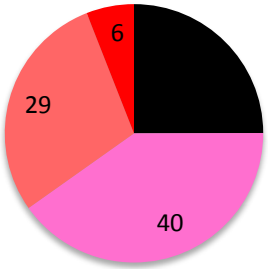

How widespread is the presence of Inner Fringe Gaps & Dieback?
2006 (underlying image)
2009 (false colour)
Image © 2014 DigitalGlobe
Google earth

Boigu Island Mangrove Inner Fringe Condition



2013 survey

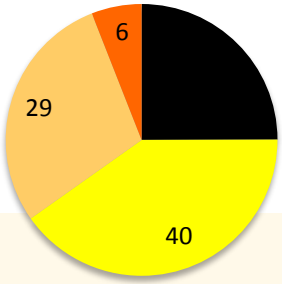
Inner Fringe Fragmentation (% Shoreline)



Legend

- High density gaps
- Moderate density gaps
- Low density gaps

Inner Fringe Dieback (% Shoreline)

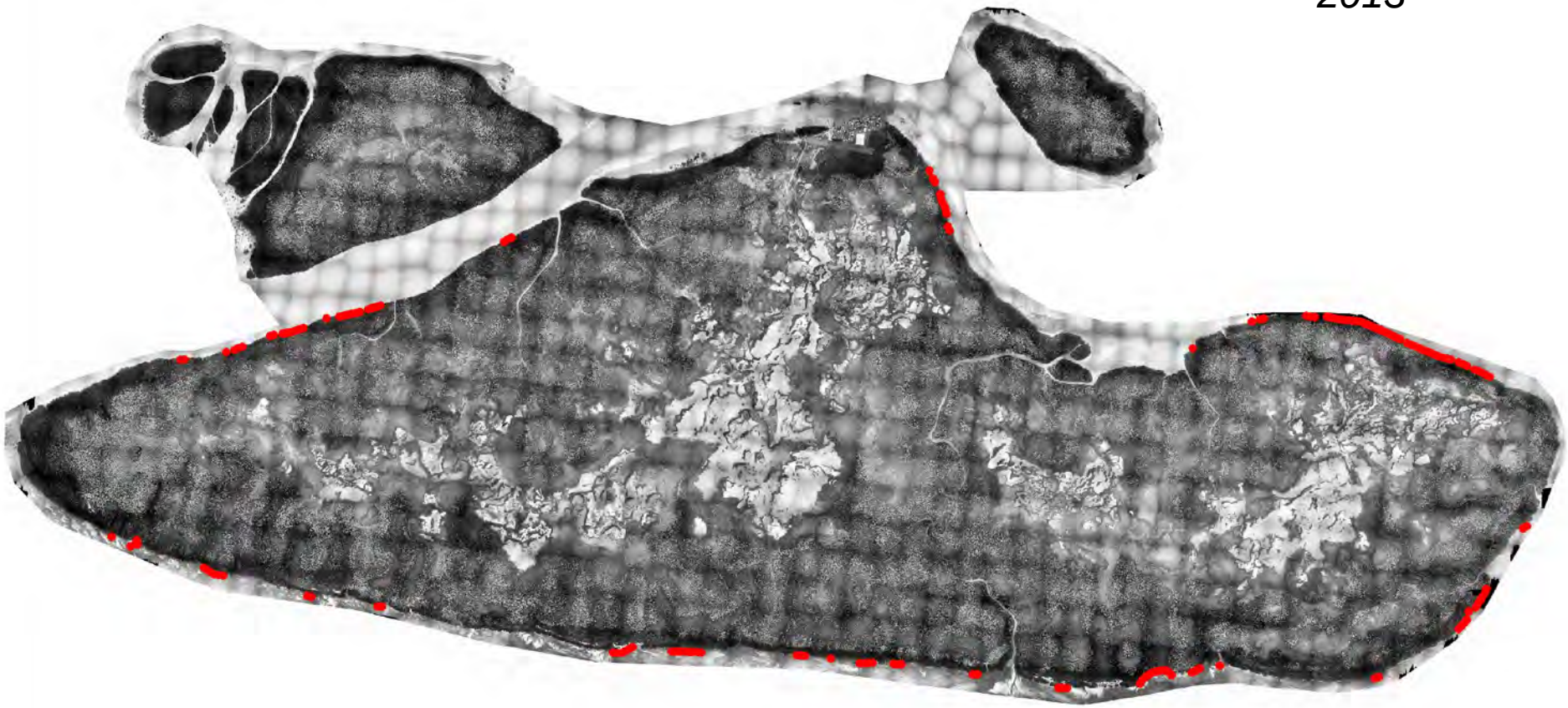


Legend

- High density dieback
- Moderate density dieback
- Low density dieback

Boigu Island Potential Shoreline Retreat

2013



Legend

Potential Shoreline Retreat

Potential Shoreline Retreat = 7.9 Km (22%)

Badu Island

Acknowledgements

Staff of the Torres Strait Regional Authority, Land and Sea Management Unit Rangers, elders, PBC and Council staff on the islands we visited

TropWATER
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THANK YOU

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