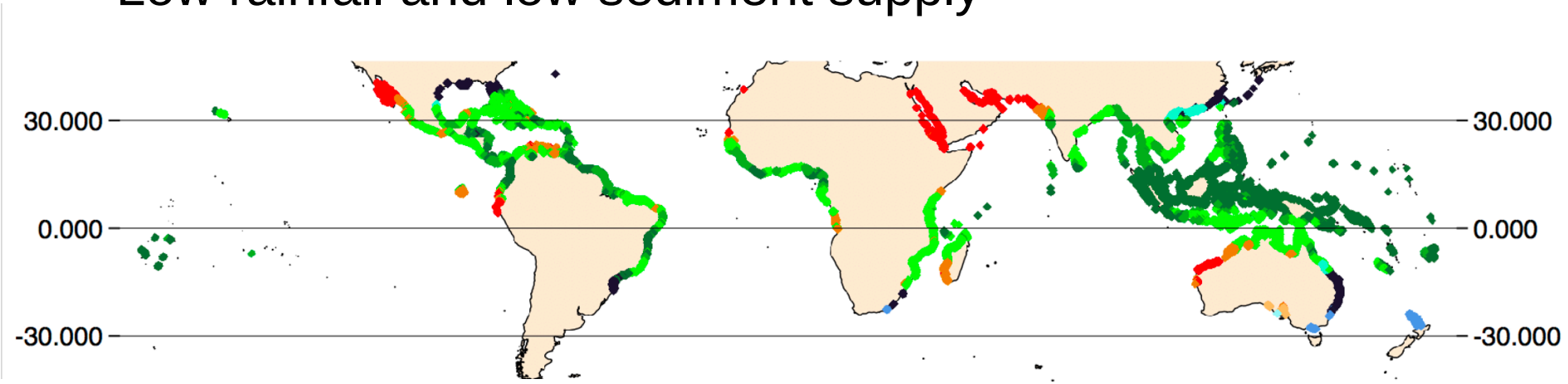
Fluctuating sea level and habitat change in Western Australia

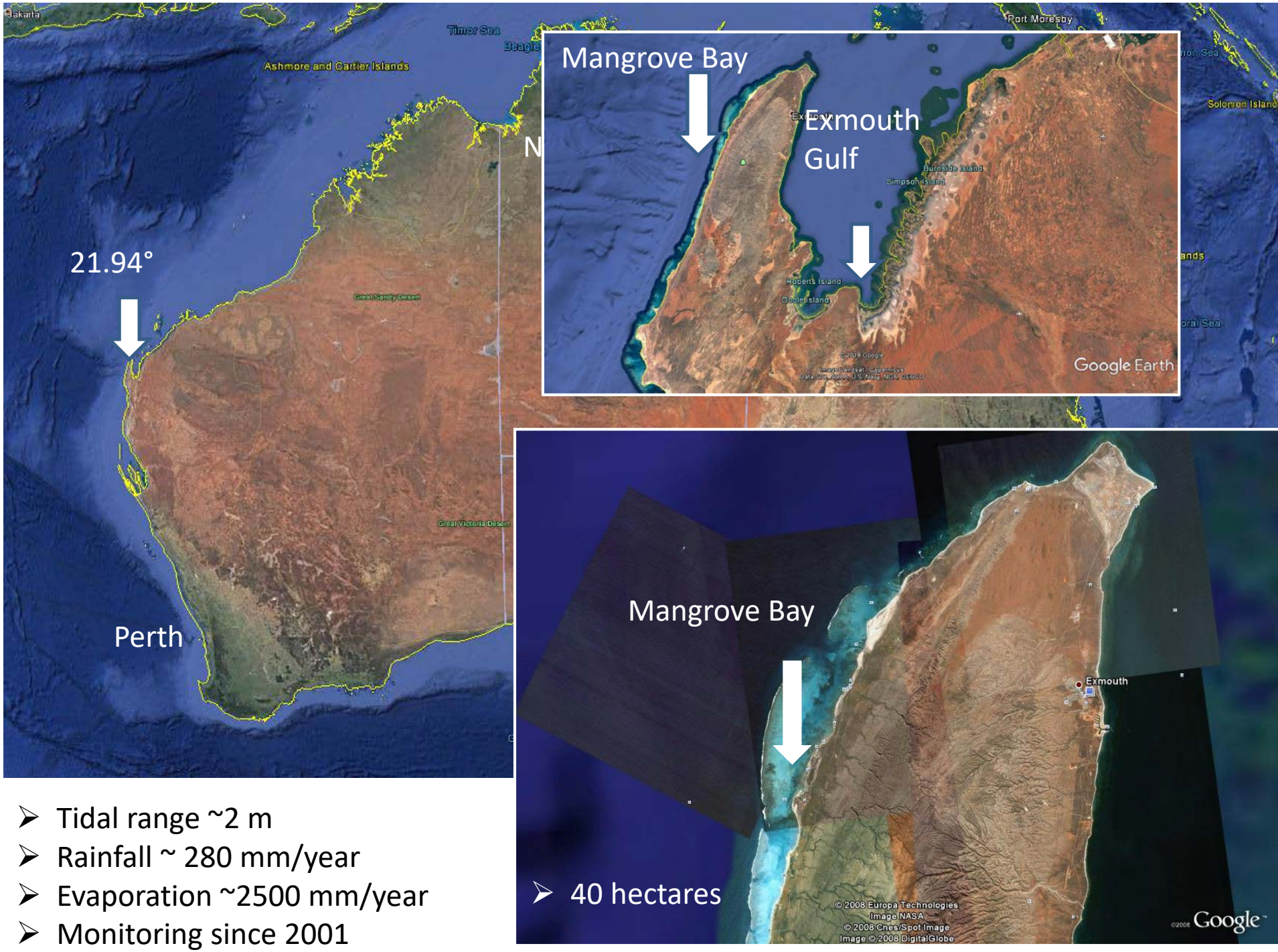
Catherine Lovelock, The University of Queensland
Ilka Feller, Smithsonian Institution
Marilyn Ball, Australian National University
Sharyn Hickey, University of Western Australia
Ruth Reef, Monash University

Arid zone mangroves

- Low rainfall and low sediment supply



- Short, *Avicennia*
- Low productivity
- Often the only “trees” in the landscape – productivity and diversity
- Vulnerable to climatic extremes (drought, storms)
- Adjacent to sabkha/salinas

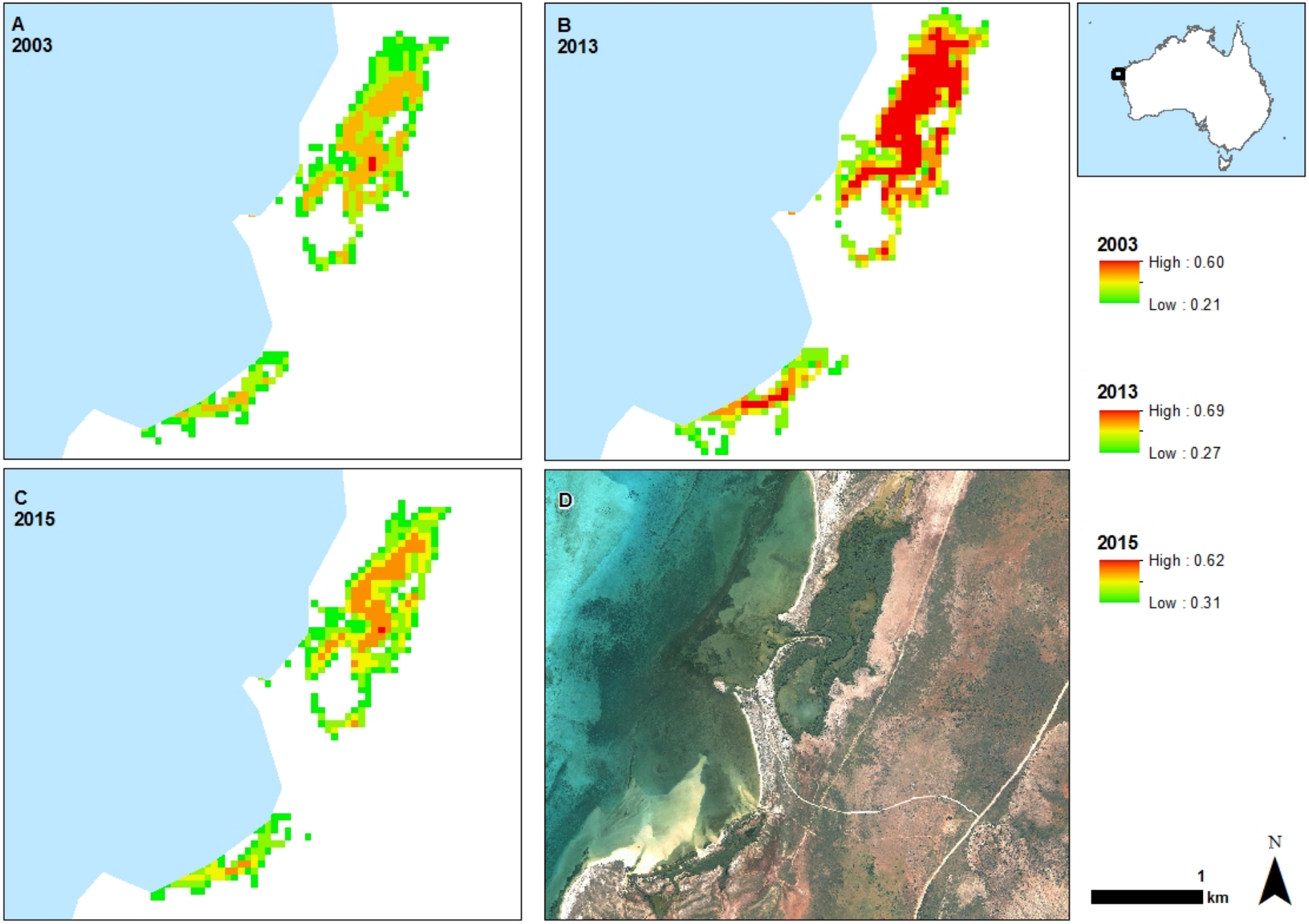


- Tidal range ~2 m
- Rainfall ~ 280 mm/year
- Evaporation ~2500 mm/year
- Monitoring since 2001

Dieback of the canopy observed in 2003 and again in 2016

Coincident with larger scale dieback across northern Australia

Photo-Norm Duke


A
2003
B
2013
C
2015
D
2003
High : 0.60
Low : 0.21
2013
High : 0.69
Low : 0.27
2015
High : 0.62
Low : 0.31
1
km
N

Climate cycles?

Regional sea level trends

AGU PUBLICATIONS

JGR

Journal of Geophysical Research: Oceans

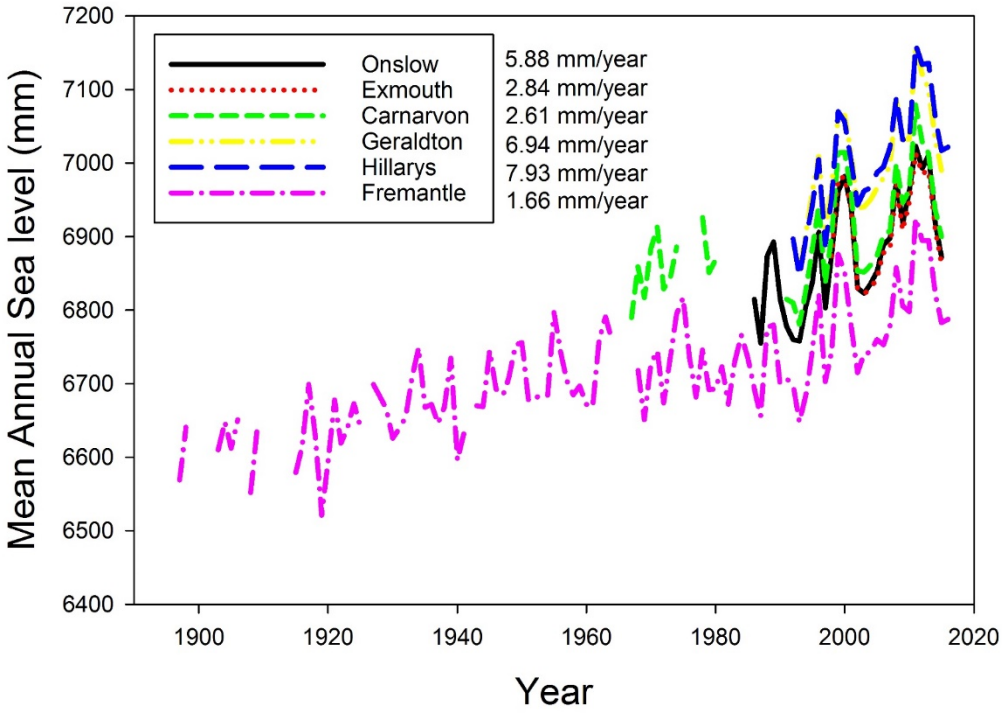
RESEARCH ARTICLE
10.1002/2015JC011139

PDO and ENSO modulations intensified decadal sea level variability in the tropical Pacific

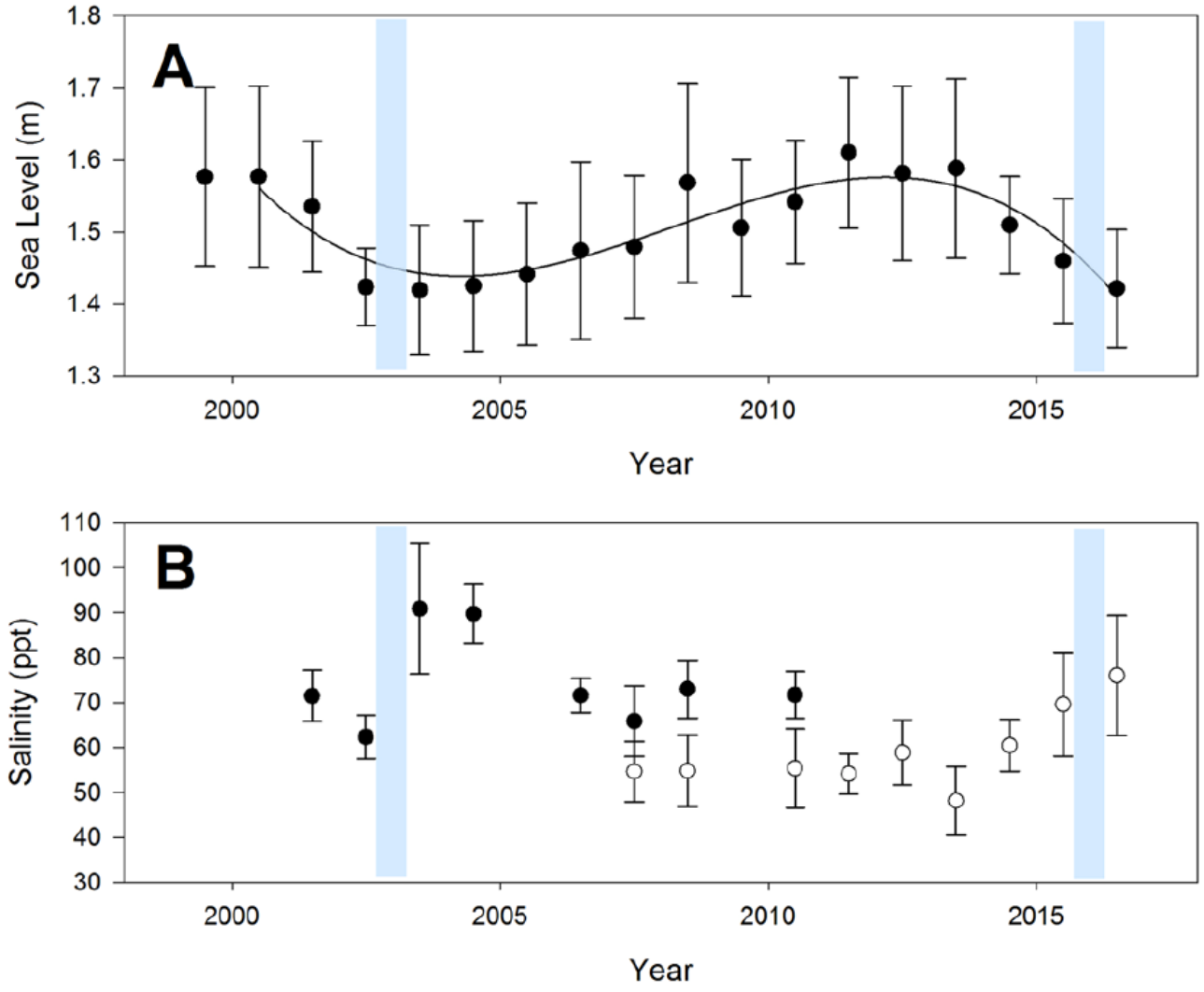
Jae-Hong Moon[1], Y. Tony Song[2], and HuiKyo Lee[2]

Key Points:

- El Niño/La Niña (ENSO) cycles are associated with variation in rainfall in many regions
- But also with variation in sea level

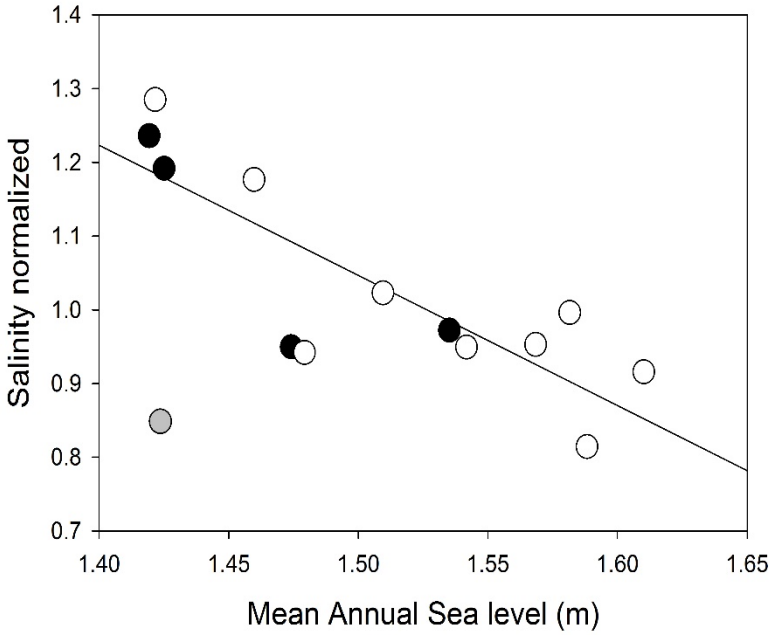


Sea level variation and soil salinity



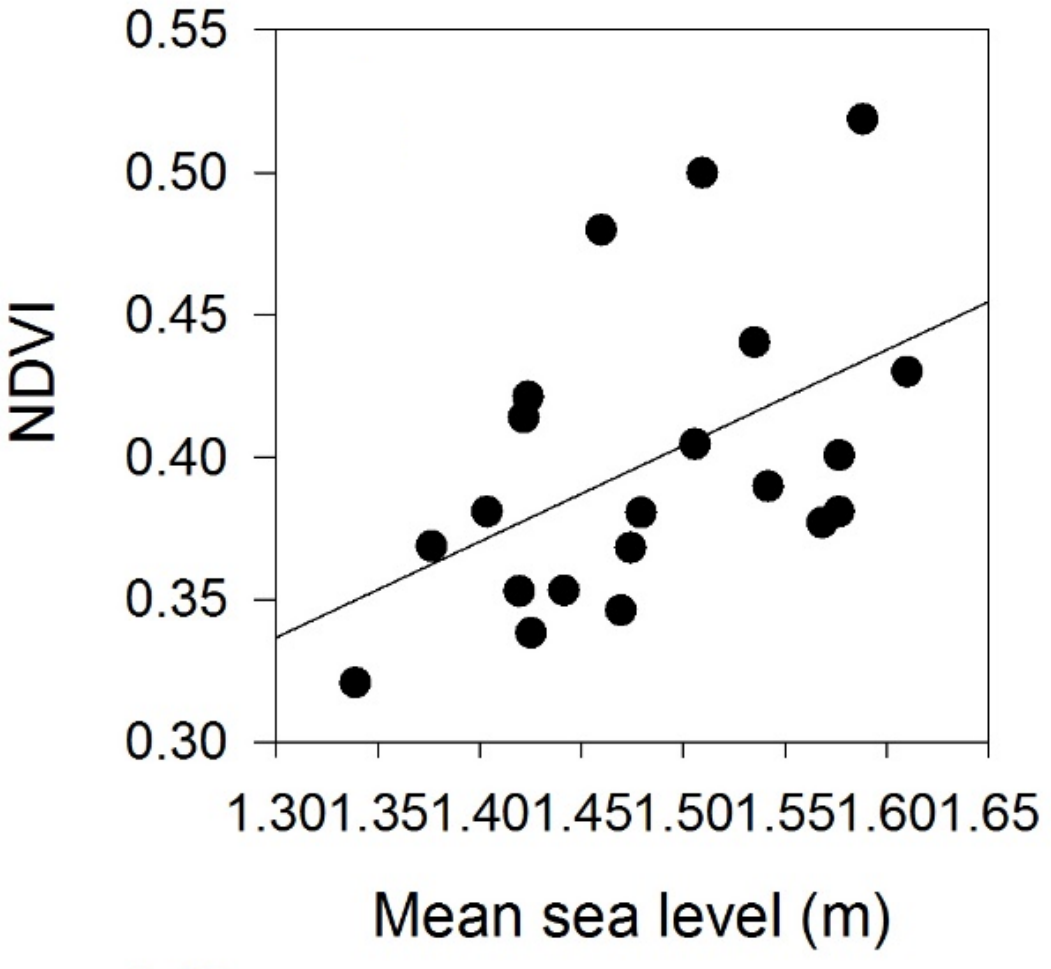
Declining “greenness” with lower sea levels

- Plot based



- Up to 30% higher salinity during low sea level events
- Other biogeochemical processes – oxidation of pyrite?

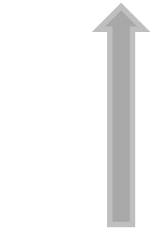
- Whole stand



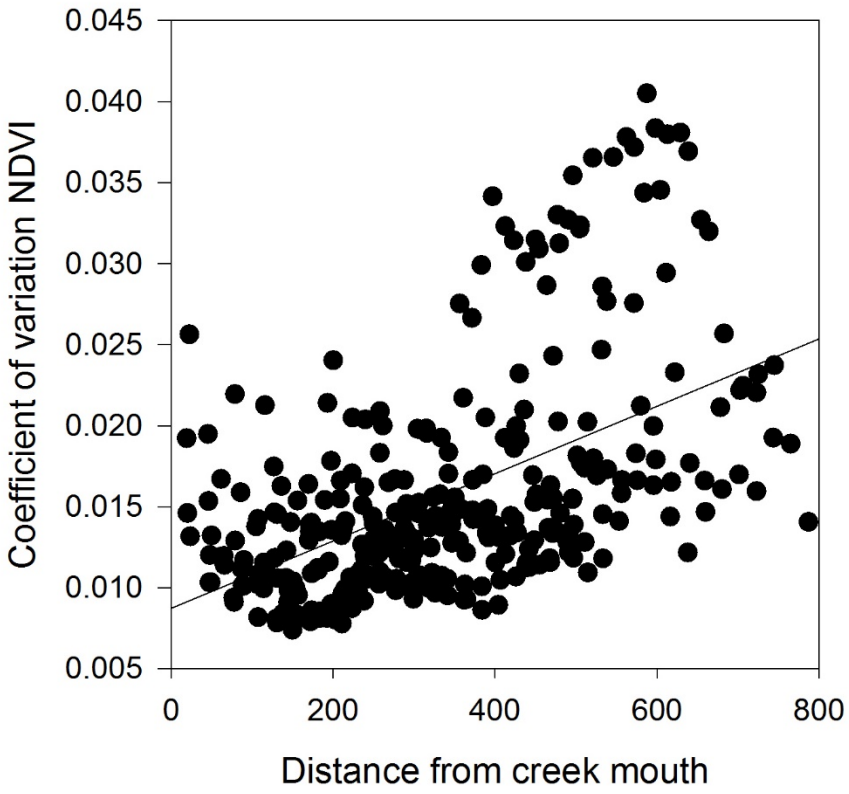
Importance of hydrology

- Trees far from creek mouth more affected than those close to the creek mouth

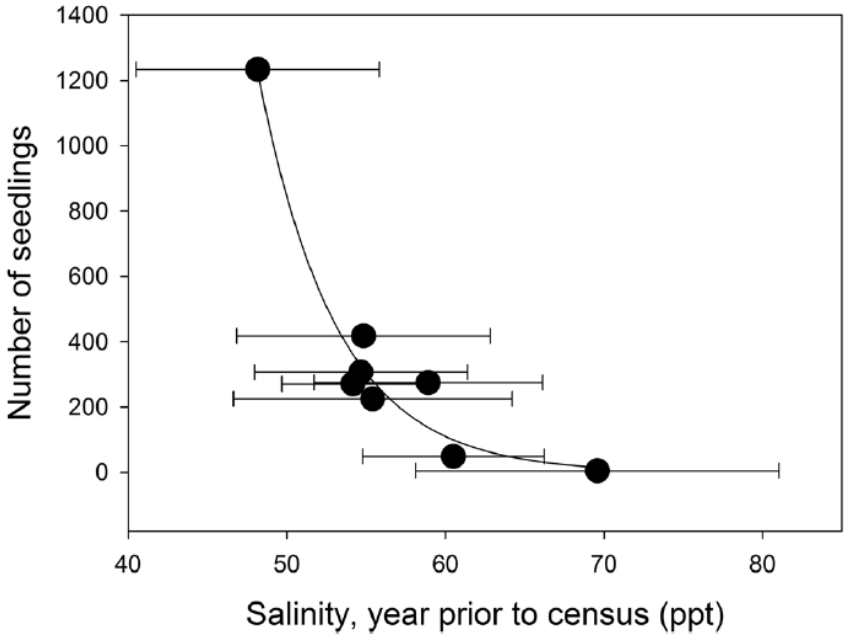
More variation in canopy



Less variation in canopy

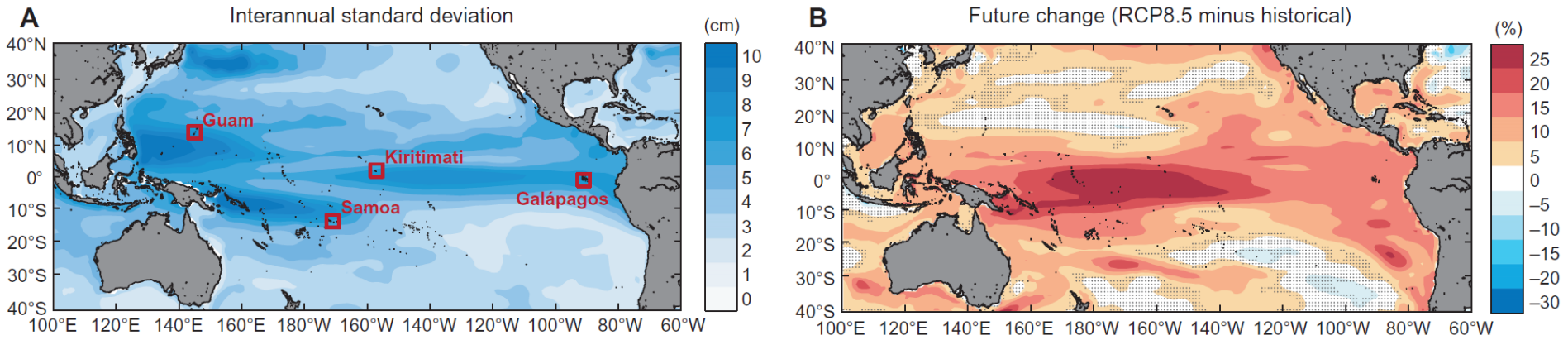


High salinity* limits reproduction and recruitment



* Potentially other linked soil conditions

Future trends in sea level variation



- "we find that climate change will enhance El Niño–related sea level extremes, especially in the tropical southwestern Pacific, where very low sea level events, locally known as **Taimasa**, are projected to double in occurrence"
- "throughout the tropical Pacific, prolonged interannual sea level inundations are also found to become more likely with greenhouse warming and increased frequency of extreme La Niña events"

Widlansky, Timmermann, Cai Sci. Adv. 2015;1:e1500560 25 September 2015

Conclusions

- Increasing sea level variation affects mangroves
- Arid systems more vulnerable: sea level lows and low rainfall/humidity occur simultaneously; balance with mangrove expansion in “wet” phase
- Questions - “cause of death”? - what will be the influence on the long term stability and distribution?

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