

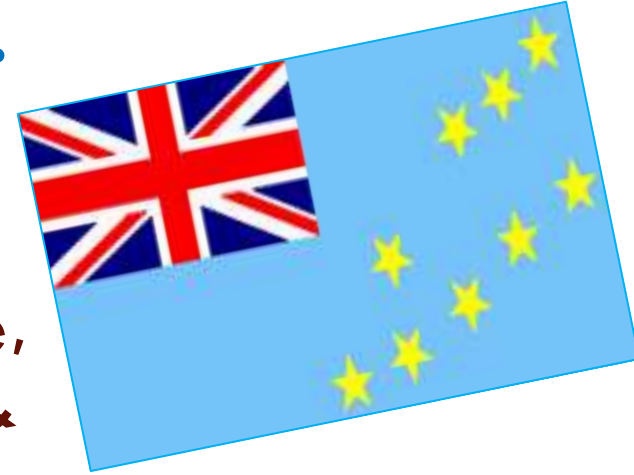


The trade-offs of adaptation and response in coastal settlements of Tuvalu and other atoll nations.

Soseala Tinilau (TIN)

Director of Environment

**Ministry of Public Works, Infrastructure,
Environment, Labour, Meteorology &
Disaster**



#NZAI19 CONFERENCE
November 27-28, 2019
Auckland, New Zealand



OUTLINE

- Short Summary – Tuvalu
- Atoll Islands
- Climate Change Related Coastal Impacts
- Way Forward to Counter Sea Level Rise (SLR)
- Success stories?
- Poor planning
- Adaptation Trade-Offs
- Acknowledgement







TUVALU SUMMARY

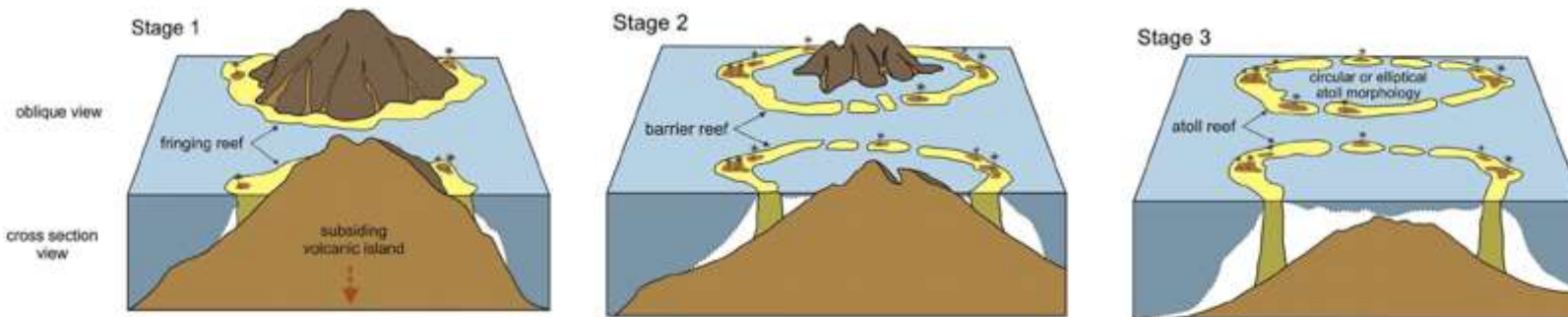
Capital: Funafuti	Biggest Island: Vaitupu
Land Area (km ²): 26	Sea Area/EEZ (km ²): 900,000
Population: 11,510 (2018) > 59% resided on Funafuti	Annual Growth (%): 1.2 (2018)
Average Density (inhabitants/km ²): 384 (2018)	Rural (outer island) Population (% of total population): 41
GDP (US\$ m): 43 (2018)	GDP per capita (US\$ m): 3,702 (2018)
GDP Real Growth (% per annum): 2.5 (avg. 2001-2018)	GDP per capita position: 120th (2018)
Religion: Christianity (> 91% are Protestant Christians - EKT)	Other Religions: SDA, JW, MUSLIM, BAHA'I, GOSPEL, BAPTIST, OTHODOX

Sources: World Bank, General Statistics Division, Government of Tuvalu



ATOLL ISLANDS

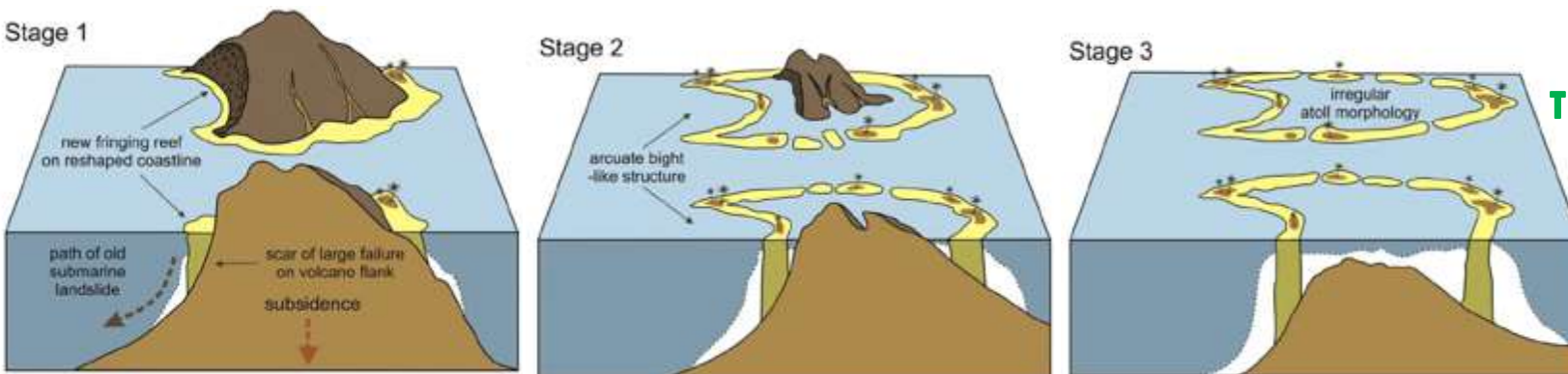
Atolls are ring-shaped coral reefs that partly or wholly surround a lagoon; atoll islands – located on reef or patch reefs within lagoon.



Nukuoro Atoll
Caroline Islands
FSM



Notably, many atolls exhibit major arcuate 'bight-like' structures (ABLS) in their plan form



Mururoa Atoll
Tuamotu Archipelago
French Polynesia





ATOLL ISLANDS



Source: Google Earth, NAPA II Project

Atoll islands are:

- Wave built accumulations of bioclastic sediment-skeletal sands and/or coral rubble sourced from adjacent reef or lagoon;
- Geologically very young having accumulated in the last few thousand years;
- **Small size and low elevation (<4m above sea-level);**
- Shallow soils, limited terrestrial biota, no surface water;

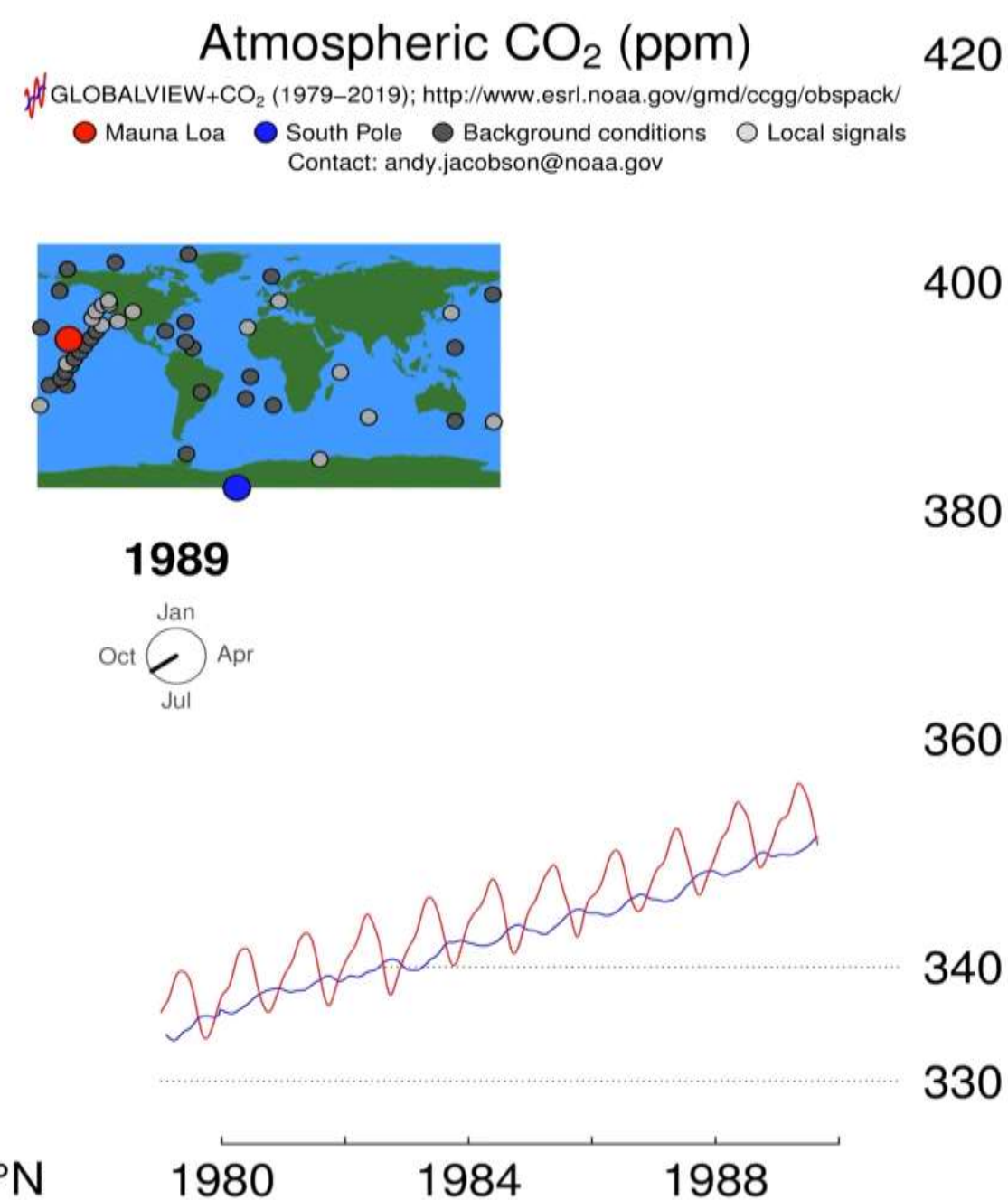
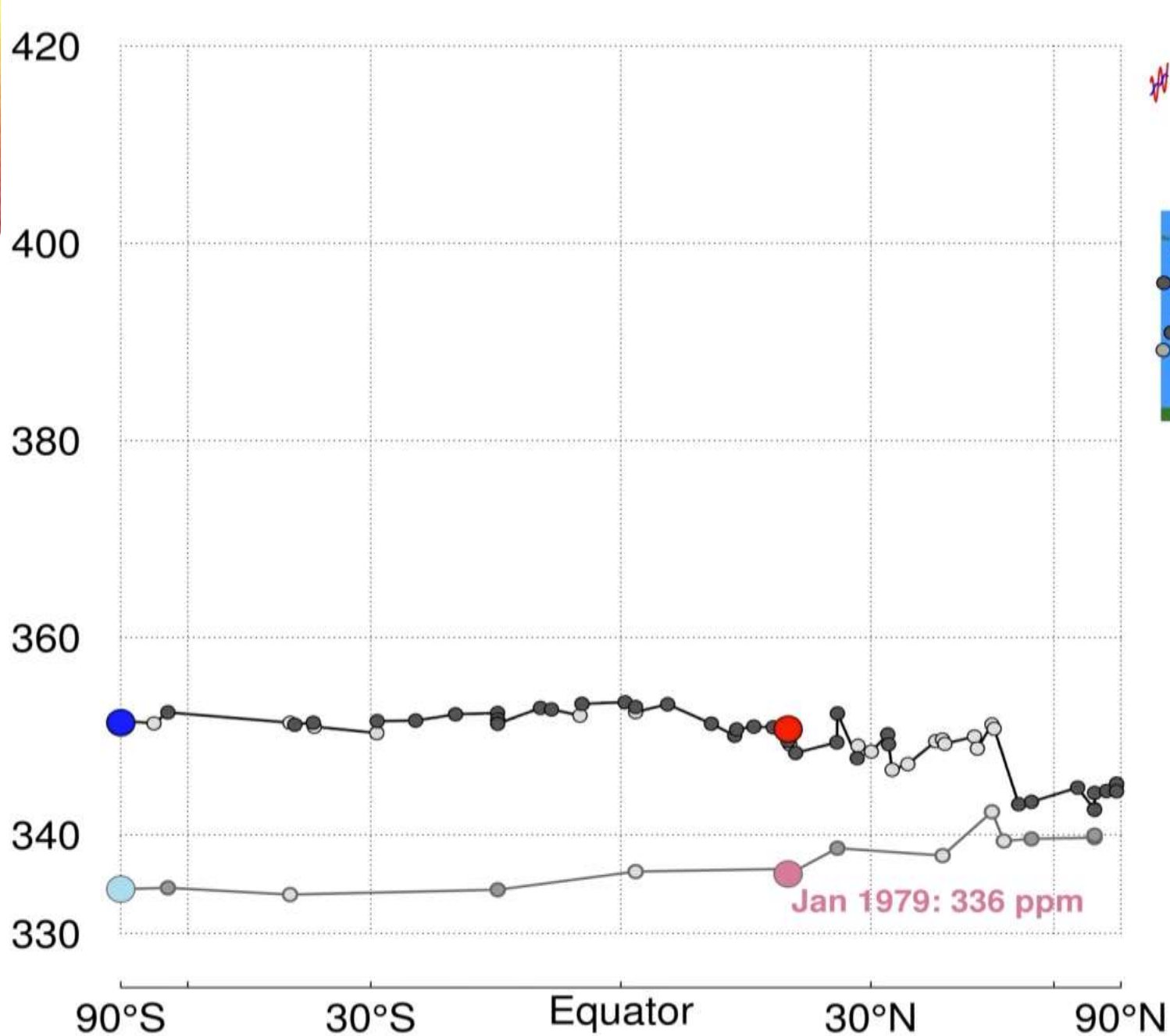


ATOLL ISLANDS

“All countries in the Pacific will be the first nations to face extinction as a result of global warming. **Rising sea levels** could wipe them off the map in a matter of decades.” Pres. Hilda Heine and Patrick Verkooijen: 11 April 2019:
<https://www.washingtonpost.com/opinions>

Hilda Heine – President of the RMI & Chair of the Climate Vulnerable Forum.

Patrick Verkooijen – Chief Executive of the Global Center on Adaptation and Managing Partner of the Climate Vulnerable Forum.





CC RELATED COASTAL IMPACTS

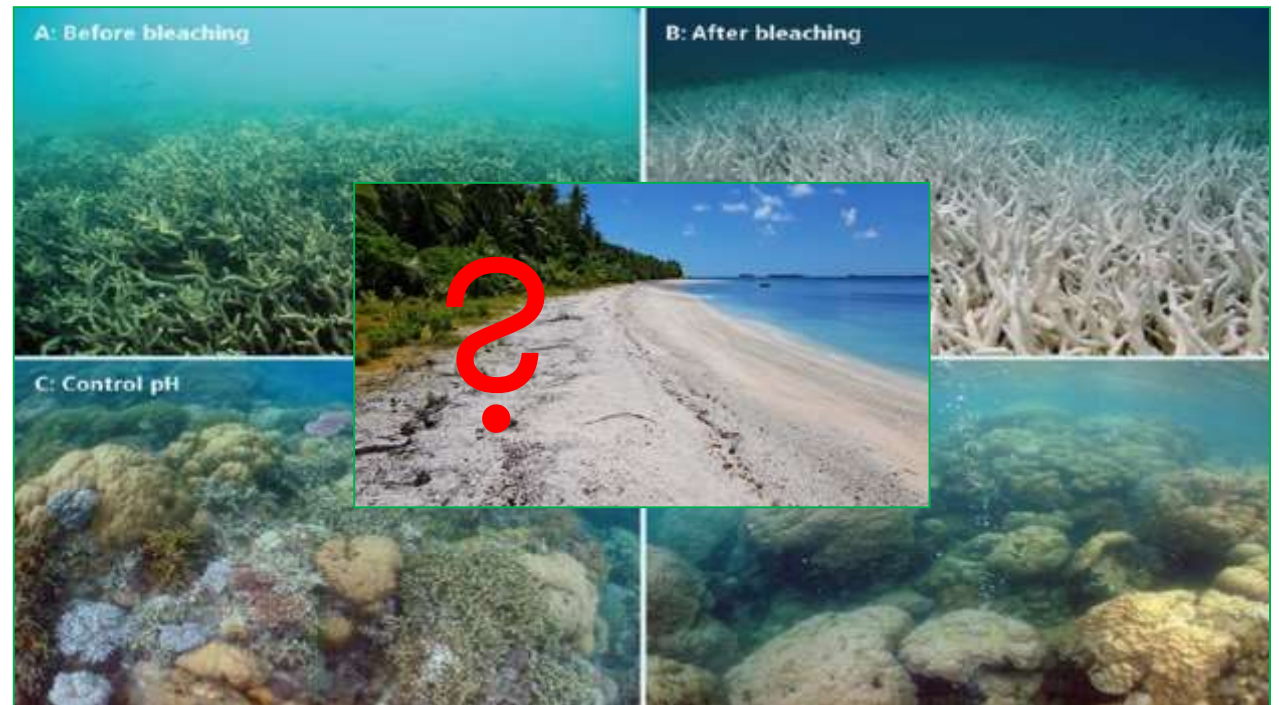
2. Change to coral reef productivity and structure

1. Sea Level Rise



Source: Nelly 2015

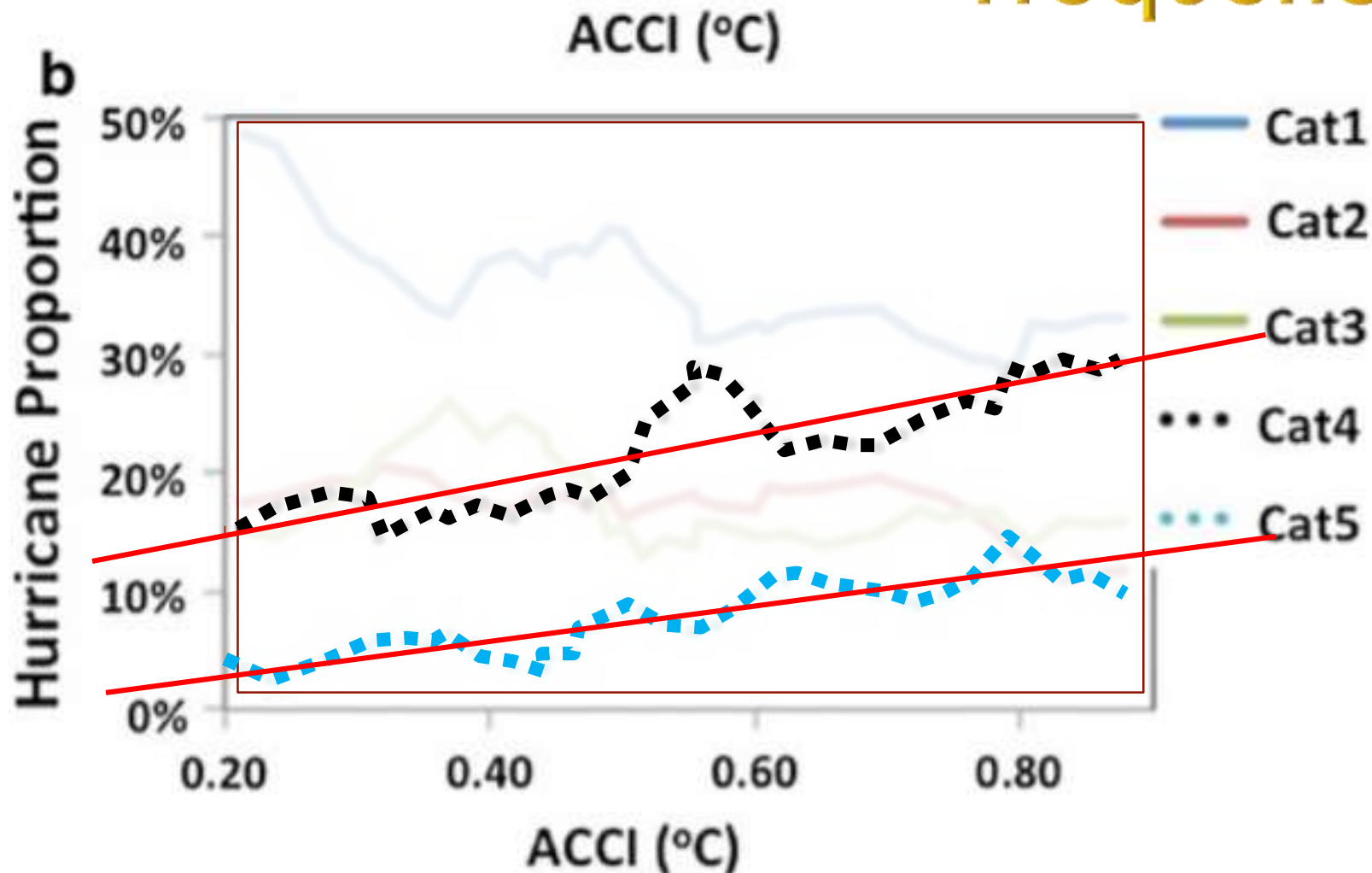
- It is useful to think of shoreline adaptation and coastal adaptation as **different**. (CA is about the entire island, shoreline is the active beach).





COASTAL IMPACTS

3. Change in Tropical Storm Frequency / Intensity



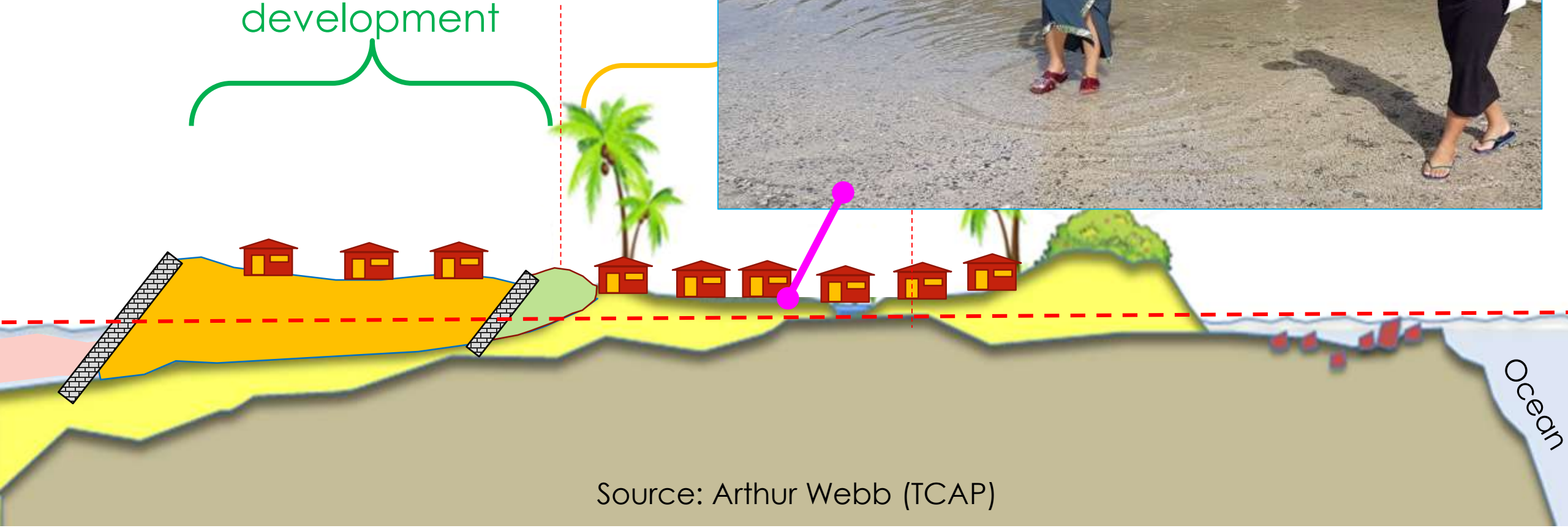
Since 1975 there has been a substantial and observable regional and global increase in the proportion of Cat 4–5 hurricanes of 25–30 % per C of anthropogenic global warming” (G.Holland & C.L.Bruye`re, 2014)



WAY FORWARD

Safe for long
term
settlement /
development

Exposed
flood



Source: Arthur Webb (TCAP)



WAY FORWARD TO COUNTER SLR

1. Tuvalu Coastal Adaptation Project (TCAP) - \$36m



Total lagoon area = 23, 033 Ha

TCAP Reclamation = 7.24 Ha

Length of lagoon shoreline protected = 780 m





WAY FORWARD TO COUNTER SLR

2. Funafuti Recreational Area ($\geq \$30\text{m}$)





WAY FORWARD TO COUNTER SLR

3. Seawalls & beaches for Nukufetau (~\$7m)



- Old damaged seawall buried
- Construction new seawalls and groynes using 2,0202.5 m³ geobags.
- ~20,000 m³ beach nourishment.
- Recycled coral armour used to repair seawalls.

Address: - Erosion concerns
- Improve the community
immunity
to flooding.



WAY FORWARD TO COUNTER SLR

4. “Artificial Island”

20/11/2019

Tuvalu PM looks to Japan for help with 'artificial island' plan | RNZ News



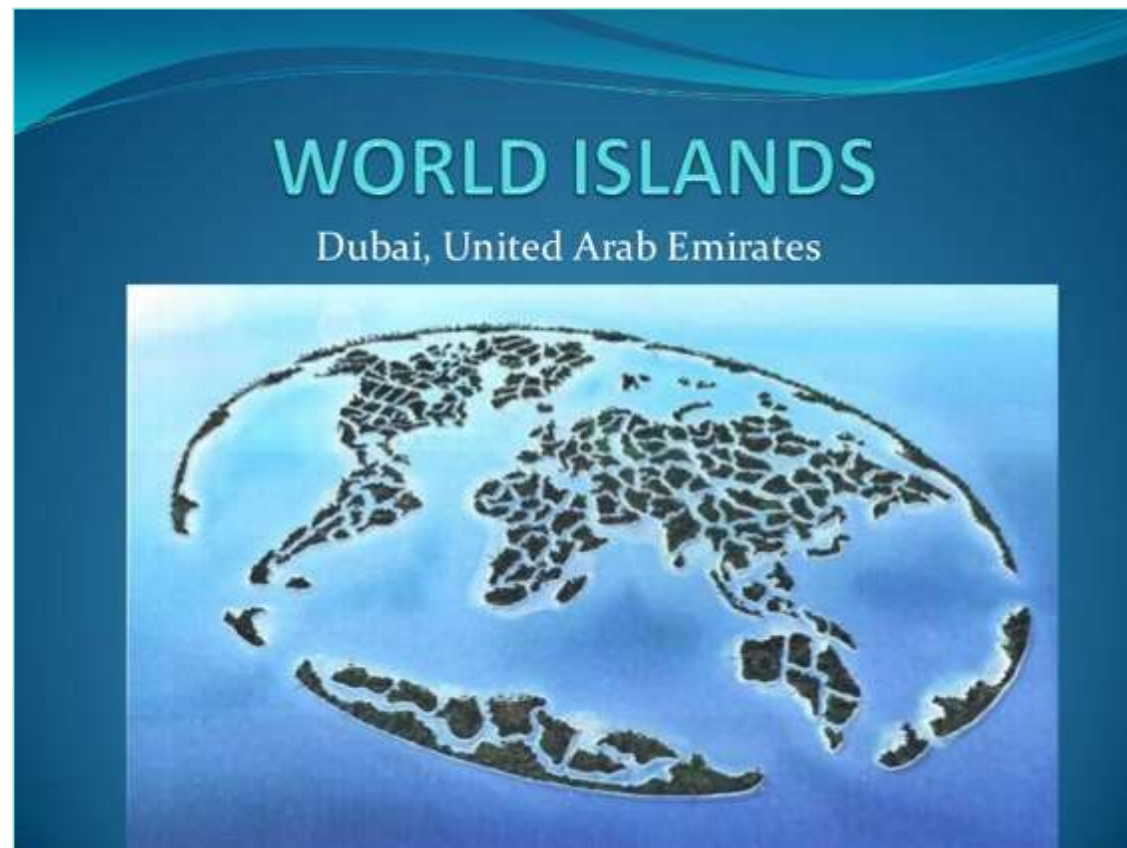
[PACIFIC \(/INTERNATIONAL/PACIFIC-NEWS\)](#) / [TUVALU \(/TAGS/TUVALU\)](#)

Tuvalu PM looks to Japan for help with 'artificial island' plan

4:23 pm on 25 October 2019

Tuvalu's prime minister says his country is looking to Japan for assistance in creating an "artificial island".

- Dredging the lagoon
- Reclaimed area ~ 16 km²
- Cost ~ **US\$ 280 million**

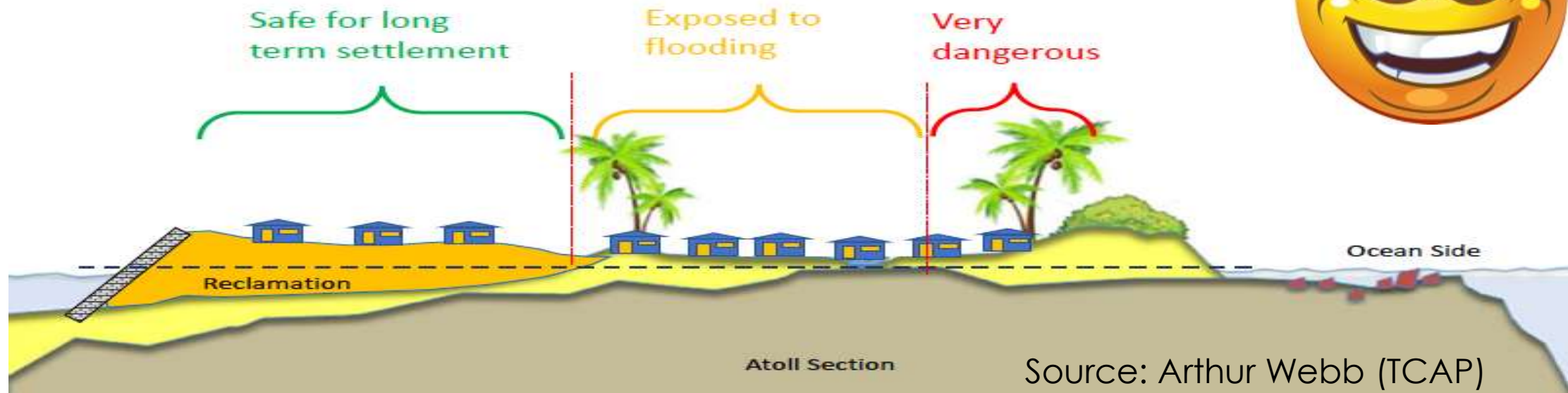
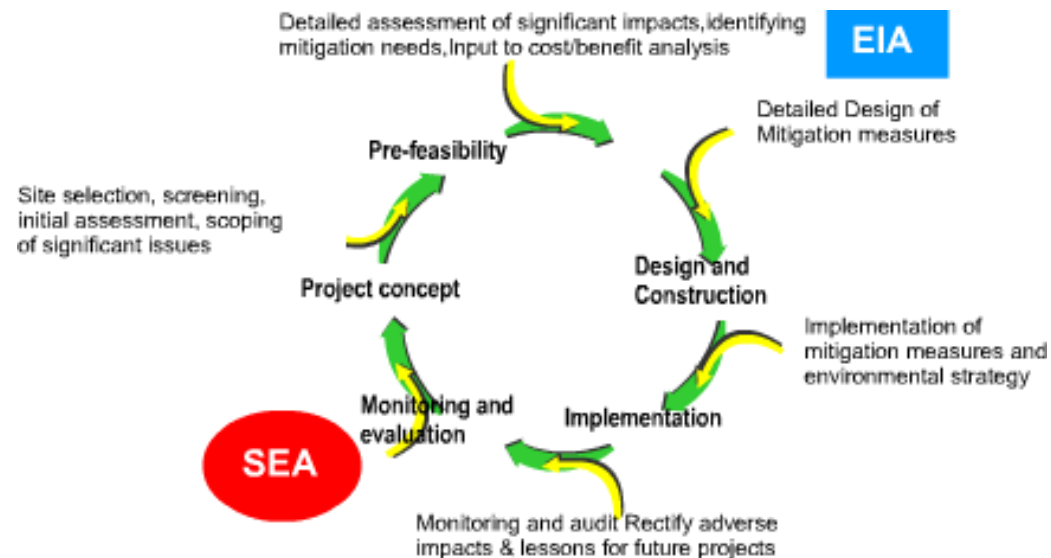




WAY FORWARD TO COUNTER SLR



www.f MakeAGIF.com



Source: Arthur Webb (TCAP)





Hulhumale Island , Maldives

<https://www.newscientist.com/article/2125198-on-front-line-ofclimate- change-as-maldives-fights-rising-seas/>



POOR PLANNING = MORE HARM?

Nukufetau seawall



Source: NAPA II Project



Source: Hilary Boyes (VSA)



POOR PLANNING = MORE HARM?

Do we really know what will happen to lagoons, currents, corals, fish, etc. with reclamation and dredging?



**► CASE STUDY:
TUVALU**

As the world's fourth-smallest country and standing at less than 4.5 metres above sea level, Tuvalu is one of the many Pacific Island nations being negatively impacted by the effects of climate change. Changes in tidal movements and weather conditions currently pose concerns regarding flooding and erosion, and rising sea levels threaten to engulf Tuvalu's islands and atolls in the future.

In past years, Tuvalu has also battled with sanitation and environmental issues caused by man-made leaches spread across the Fakaofu atoll.

Ural Pacific was contracted by writhe including the Government of Tuvalu and the New Zealand Ministry of Foreign Affairs and Trade to address these concerns through the delivery of a range of land reclamation and coastal protection works.

EQUIPMENT
A 1000 TON DREDGE
A 1000 TON ACCUMULATOR
A BARGE
SUPPORT EQUIPMENT
INCLUDING EXCAVATORS,
DOZERS AND TRUCKS

**365,000m³
OF SAND DREDGED**

Negative
costs in the
lagoon???



Will coastal adaptation
do more harm than
good in the long run?

Will this new reclaimed
land really keep us safe
and healthy?

Funafuti Recreational Area



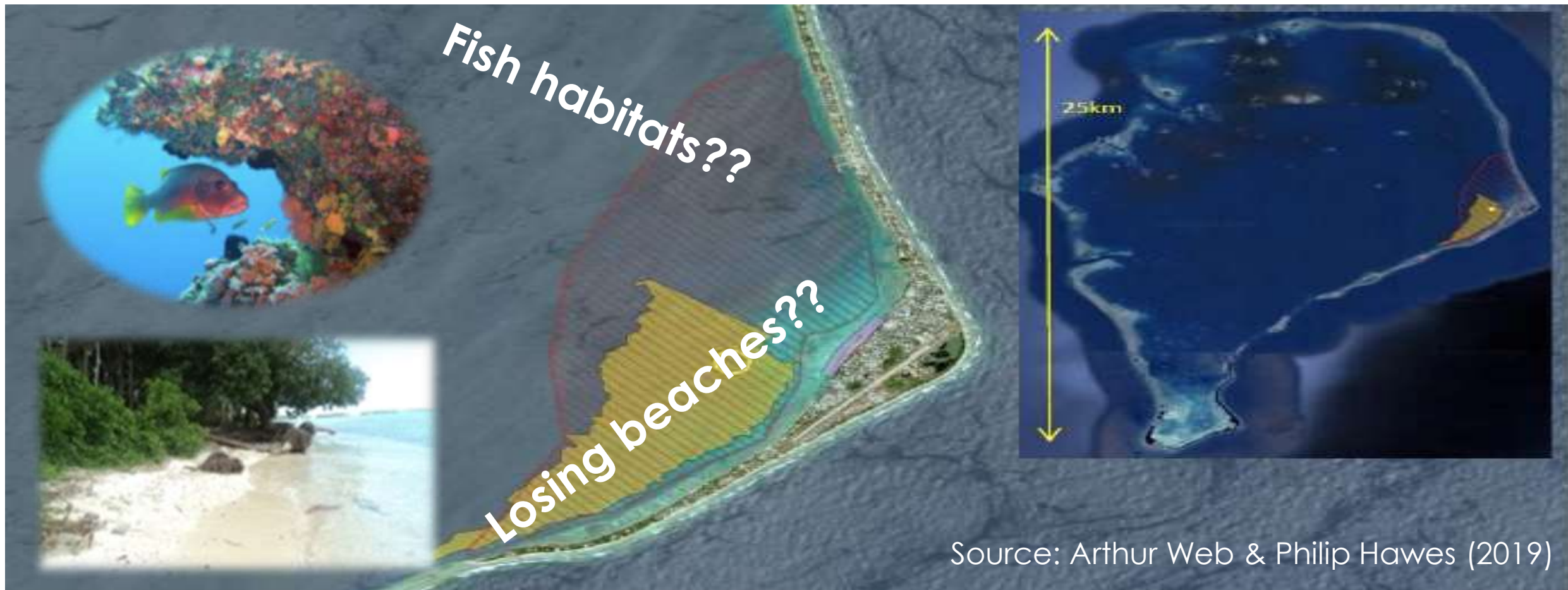
Subsidence





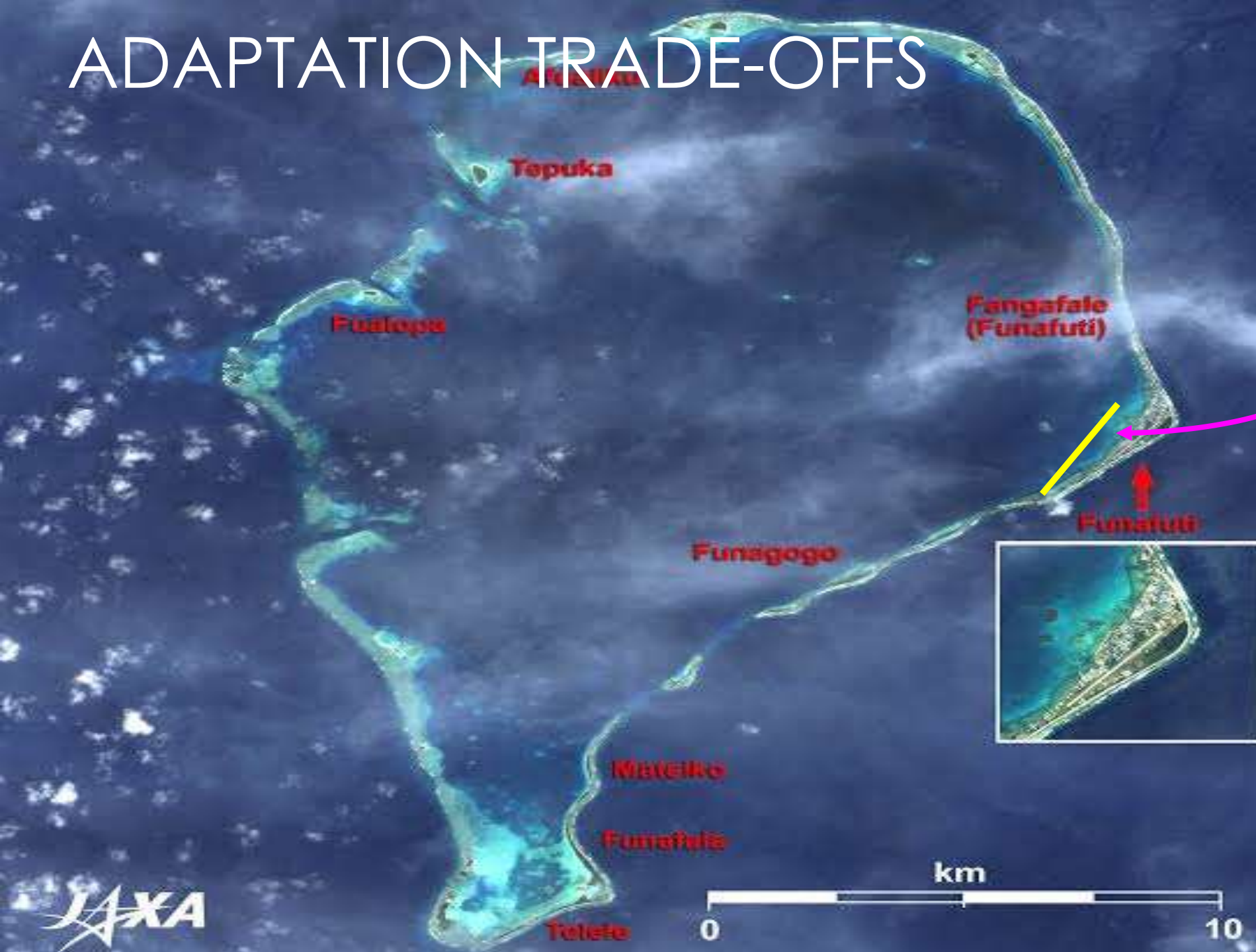
ADAPTATION TRADE-OFFS

We have to make decisions based on what we know, but so many unknowns.



Source: Arthur Web & Philip Hawes (2019)

ADAPTATION TRADE-OFFS





WHAT NEXT?

Atoll islands may be sustained provided:

- They are ***surrounded by healthy and productive reefs***;
- The ***sediment pathways between reefs and islands are not obstructed***;
- They are given time to adjust (***'naturally adapt'***) to the new and ongoing changes in climate, sea level and other drivers: and
- The adaptations are **well planned**



Source: RNZ.CO.NZ



WHAT NEXT?



If we do not fix the cause with global warming then what next - do we just continue to reclaim to counter the rising tides until we have no sand left in the lagoon?



ACKNOWLEDGEMENT

OMIP

11 November 19

11 November 2019

3 Boat
Harbors

TCAP





Thank You