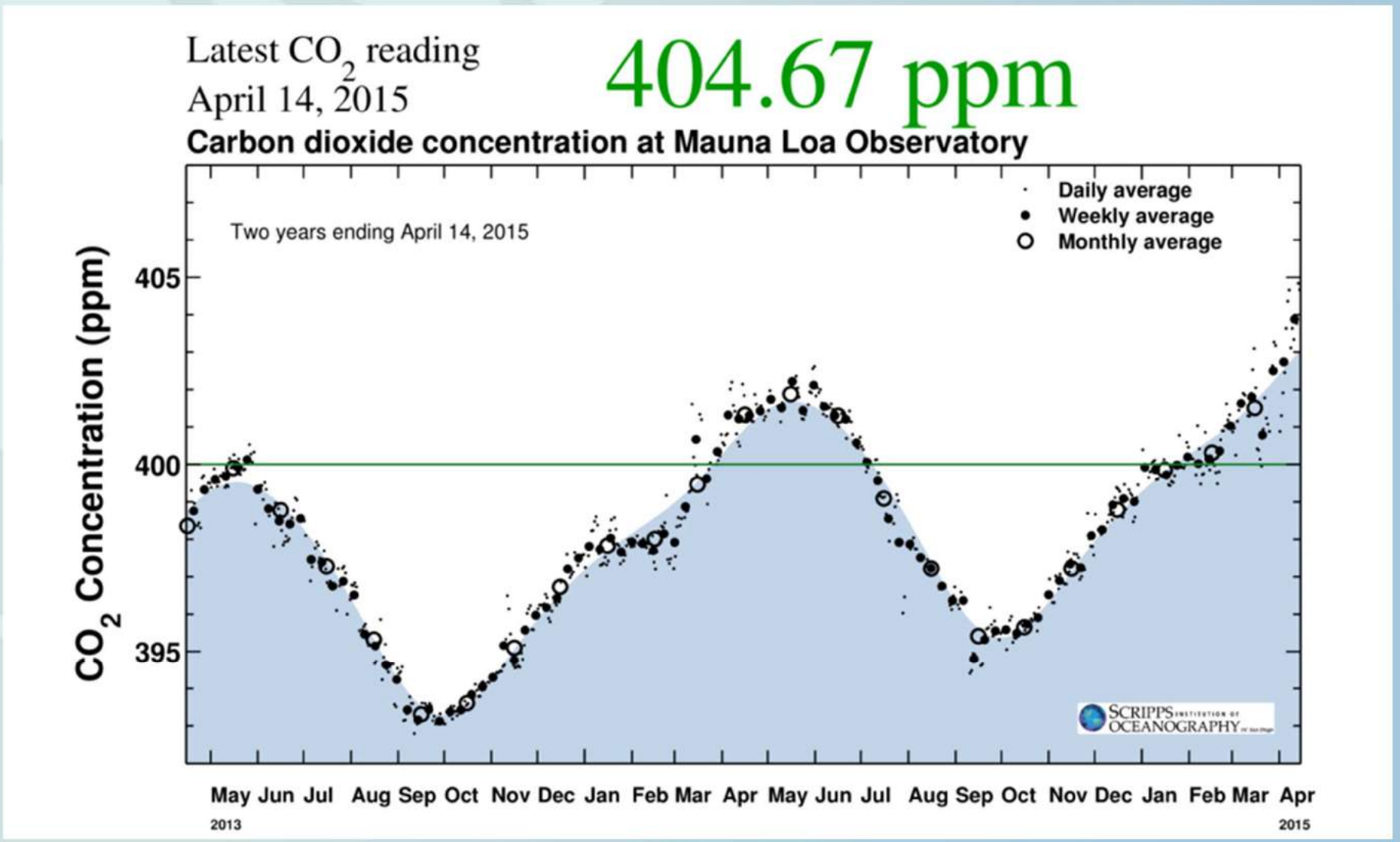
Ecosystem-based Adaptation to Climate Change in the Pacific Islands

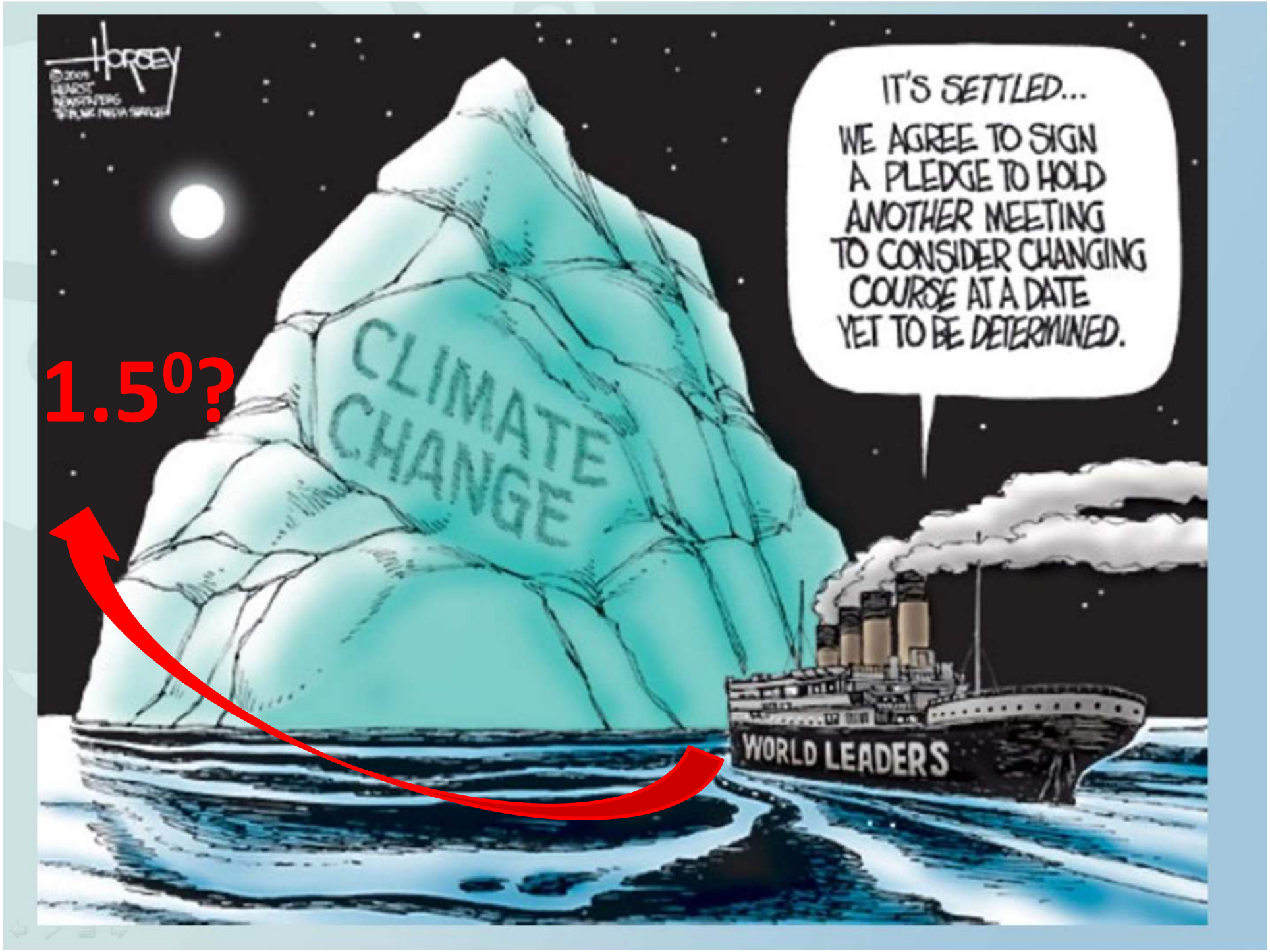
Stuart Chape
Director – Biodiversity and Ecosystem Management Division

Ecosystem Perspective on Climate Change

Ecosystem Services

CO_2 Threat


Latest CO_2 reading
April 14, 2015
404.67 ppm
Carbon dioxide concentration at Mauna Loa Observatory
Two years ending April 14, 2015
Daily average
Weekly average
Monthly average
CO_2 Concentration (ppm)
405
400
395
May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr
2013
2015
SCRIPPS INSTITUTION OF OCEANOGRAPHY


Horsey
IT'S SETTLED...
WE AGREE TO SIGN A PLEDGE TO HOLD ANOTHER MEETING TO CONSIDER CHANGING COURSE AT A DATE YET TO BE DETERMINED.
CLIMATE CHANGE
1.5⁰?
WORLD LEADERS

More than 1,000 new coal plants planned worldwide, figures show

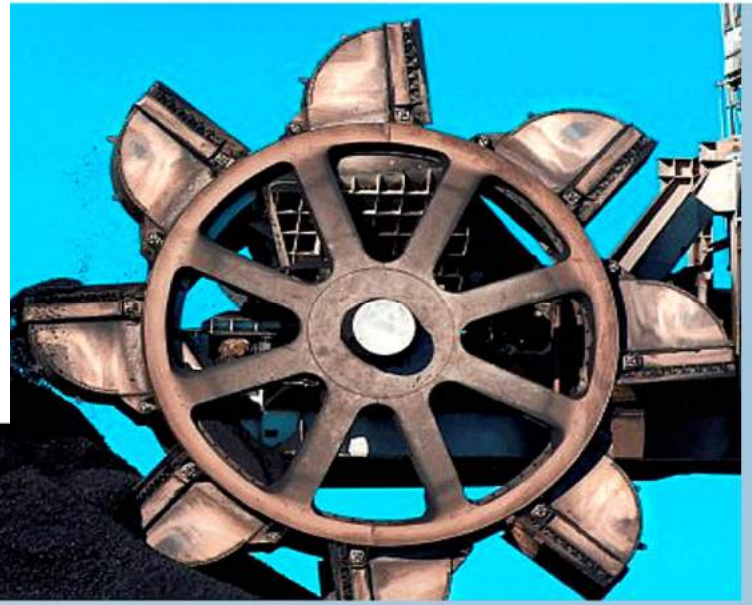
World Resources Institute identifies 1,200 coal plants in planning across 59 countries, with about three-quarters in China and India

Damian Carrington
The Guardian, Tuesday 20 November 2012

Germany To Open Six More Coal Power Stations In 2013

RWE's new lignite power station opened in Neurath in 2012

Germany's dash for coal continues apace. Following on the opening of two new coal stations in 2012, six more are due to open this year, with a combined capacity of 58 enough to provide 7% of Germany's electricity needs.



Australia approves controversial Carmichael coal mine

Carmichael project is worth some A$16bn and will dig up and transport about **60 million tonnes of coal a year for export**, mostly to India.....mine will cover an area **seven times the size of Sydney Harbour** and **produce 128.4 million tonnes of CO^2 per year**

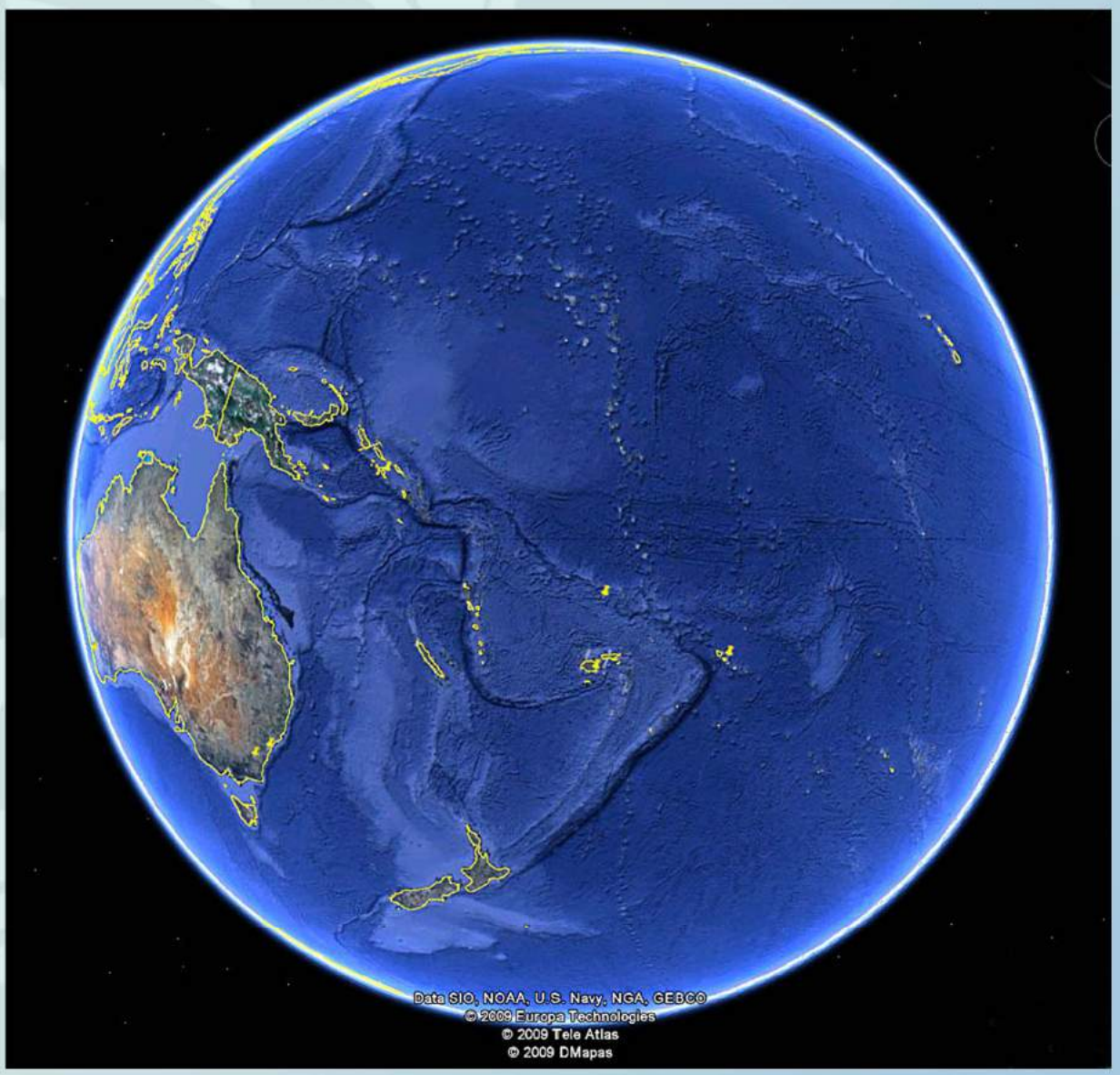
"We will be expanding our coal-based thermal power. That is our baseload power. All renewables are intermittent. Renewables have not provided baseload power for anyone in the world.

After all, solar works when the sun is shining, wind works when the wind is blowing, hydro works when there is water in the rivers. **You must have coal**."

India's Minister for Power, Coal and Renewable Energy

13/2/2016

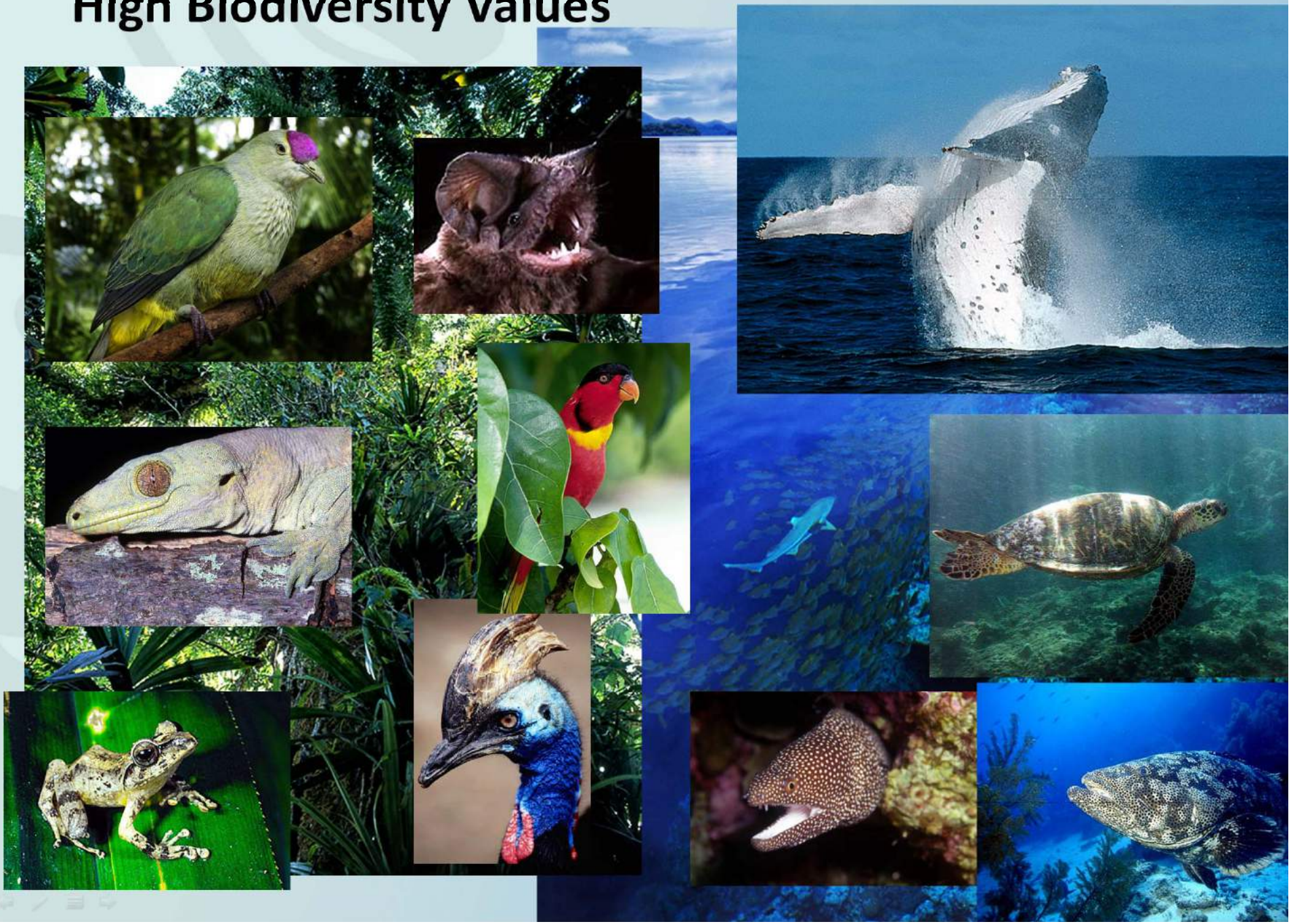
Pacific Islands Region: Ecosystem Approach Critical for Climate Change Adaptation



Pacific Islands Region

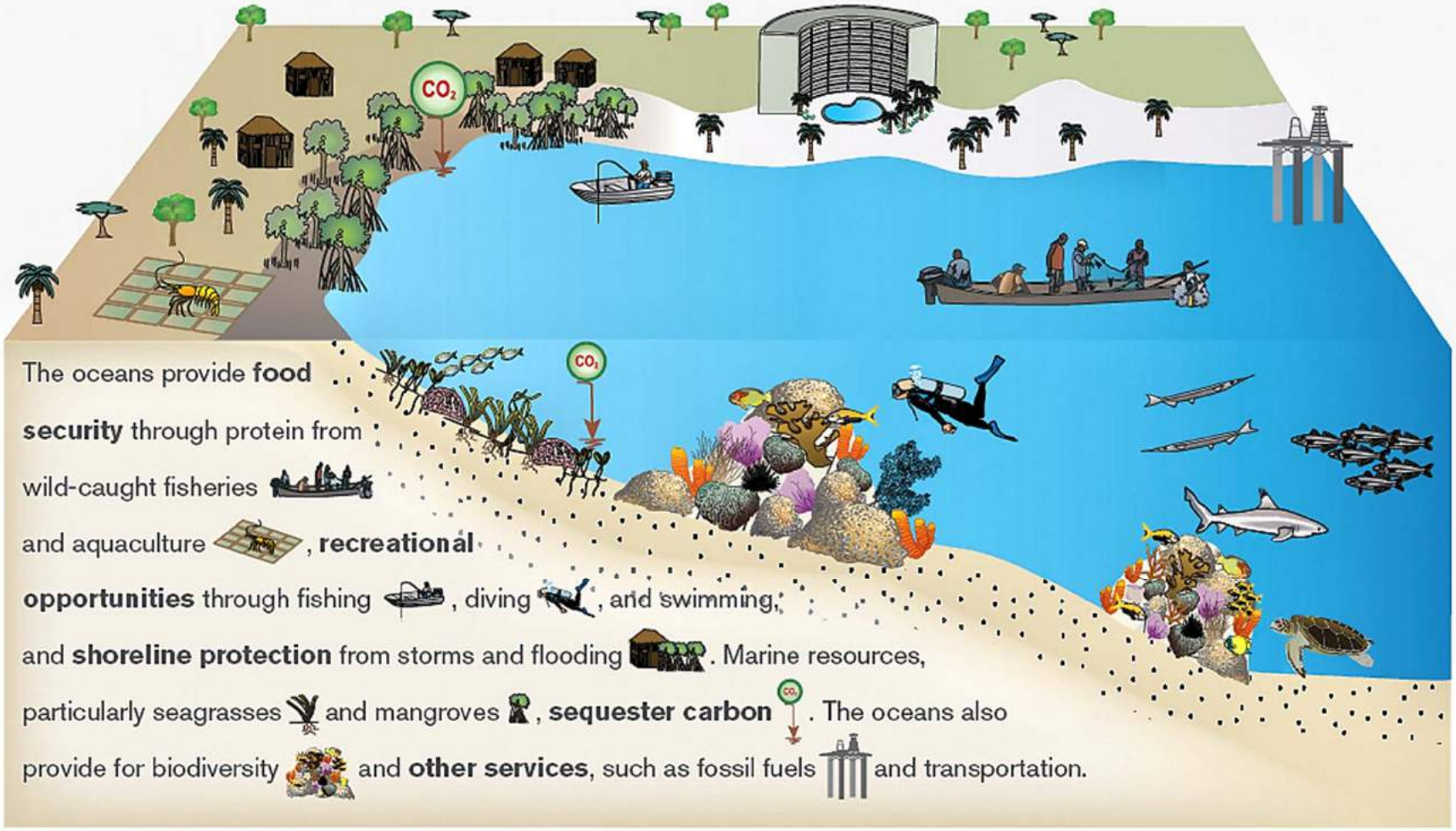
Island Ecosystem Diversity

High Biodiversity Values



Pacific island people reliant on natural resources

Ecosystem services even more important today



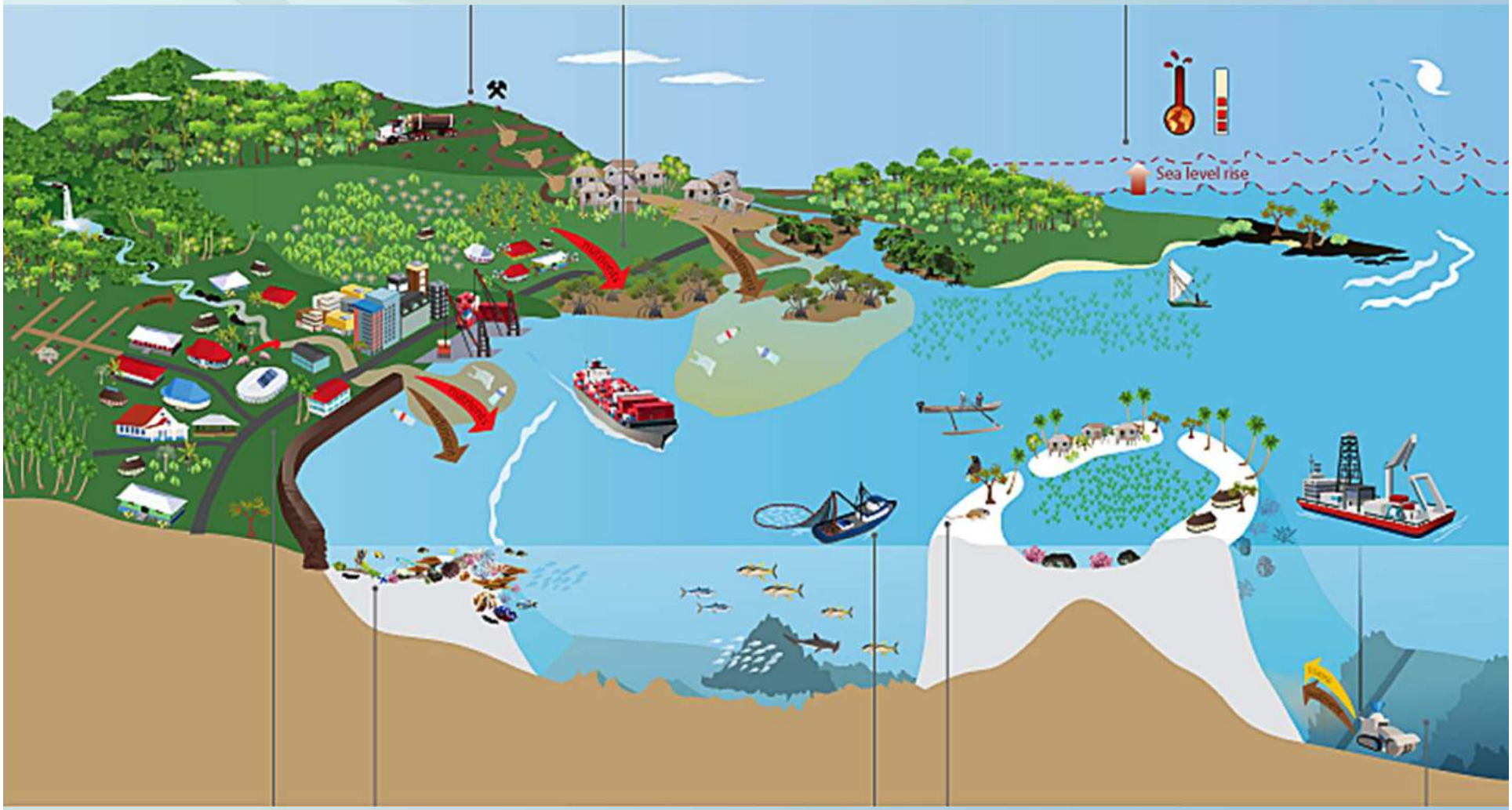
Conceptual diagram illustrating the ecosystem services provided by oceans and the ways in which humans depend on oceans.

Non-Climate Change Environmental Challenges

Non-Climate Change Development/Environment Issues

Mining and Logging

Pollution and Waste



Coastal Development

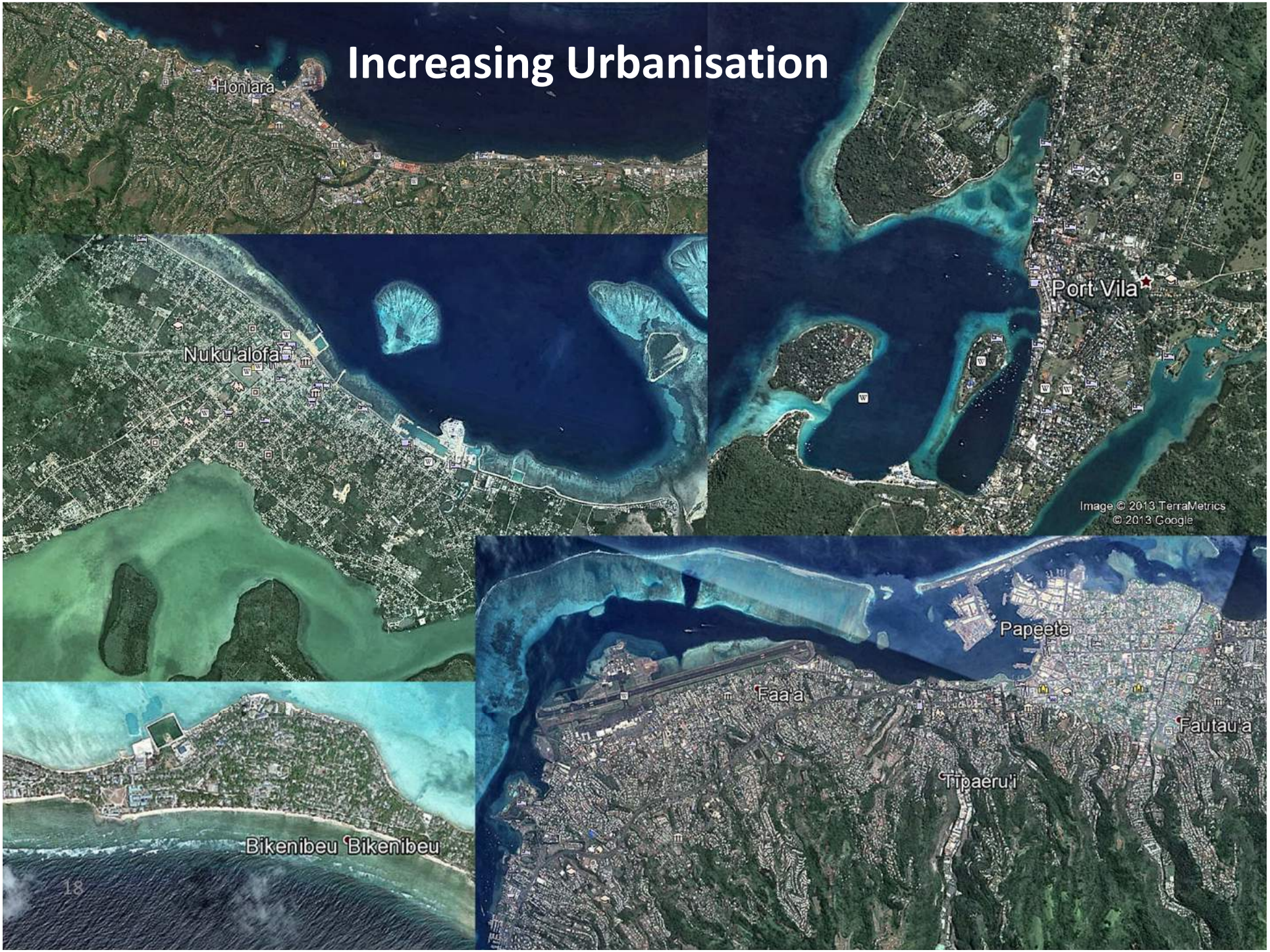
Unsustainable Fishing

Invasive Species

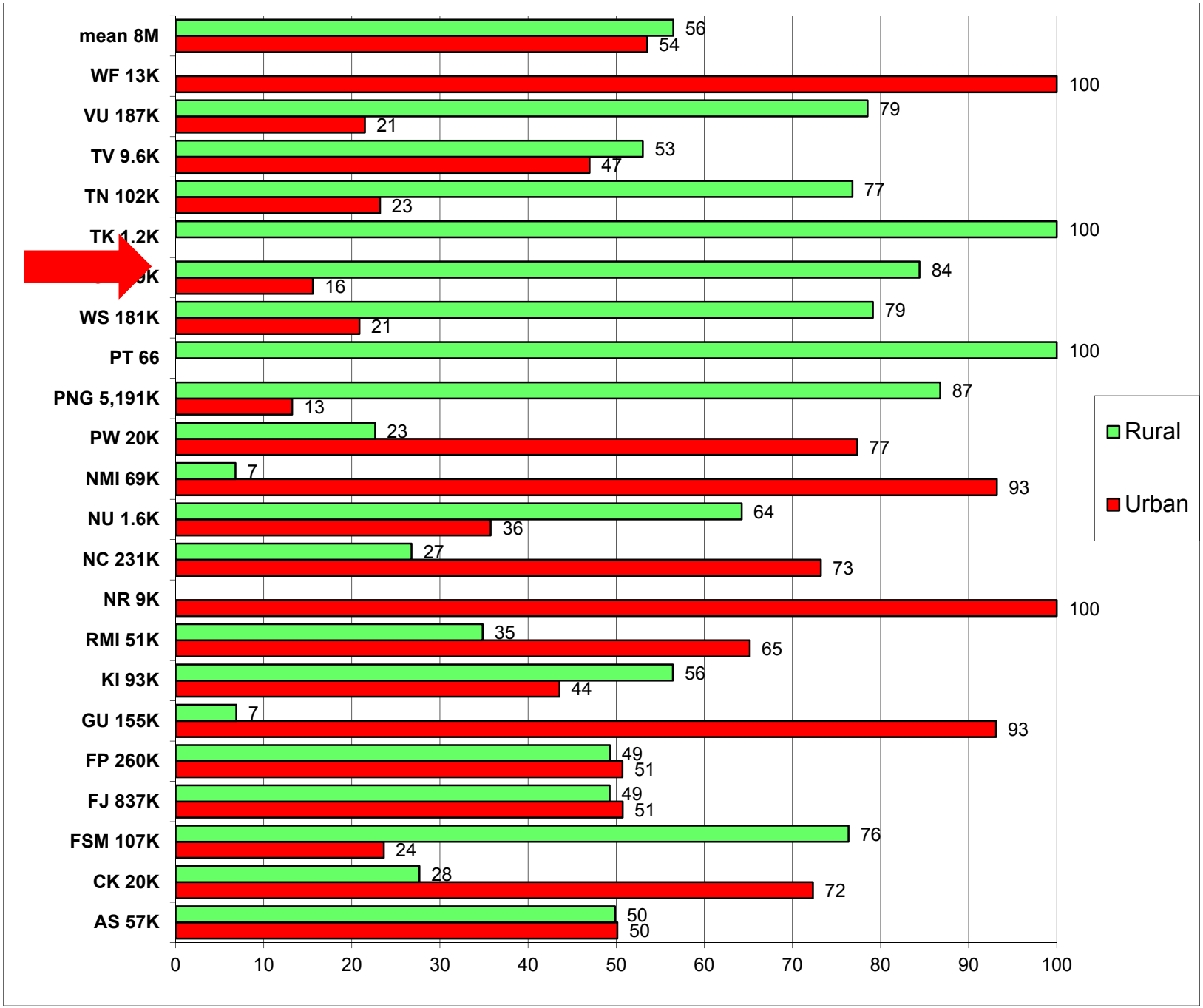
Emerging Uses

Pollution and Waste Management

Increasing Urbanisation



Nearly half of the region's population is now urban

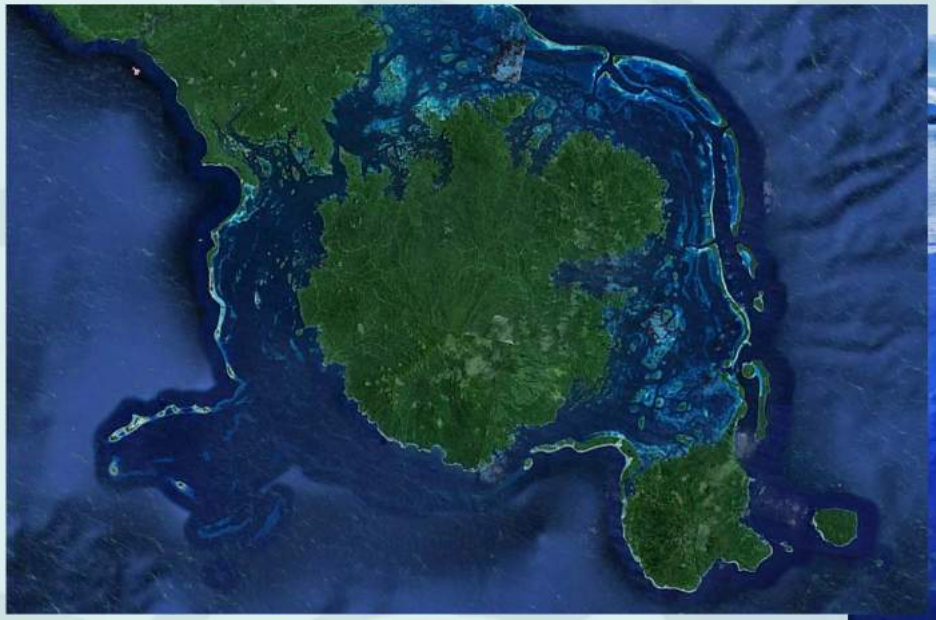


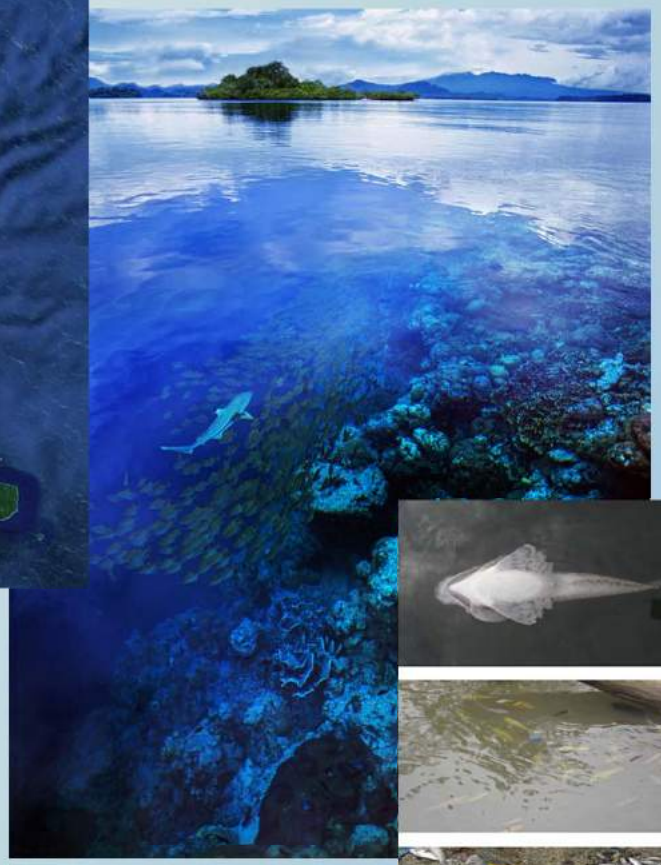
Governance/Natural Resource Management

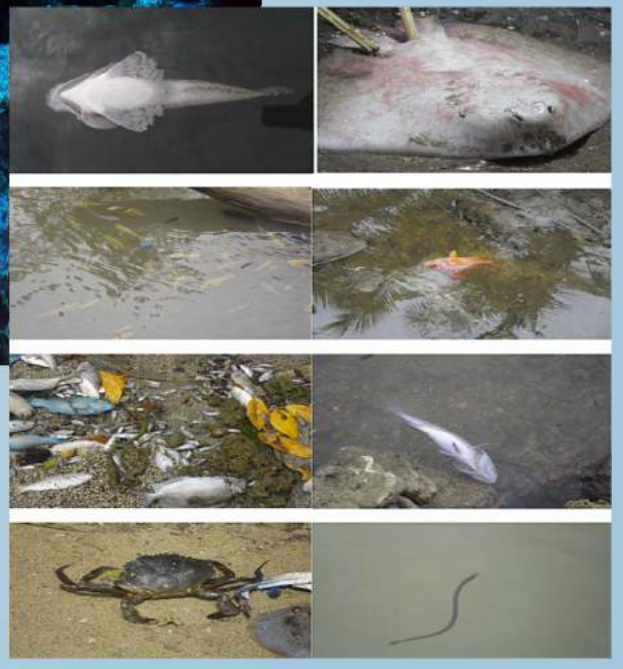
Marine ecosystem impacts

Damage to catchments and water supplies

Marovo Lagoon, Solomon Islands 2011

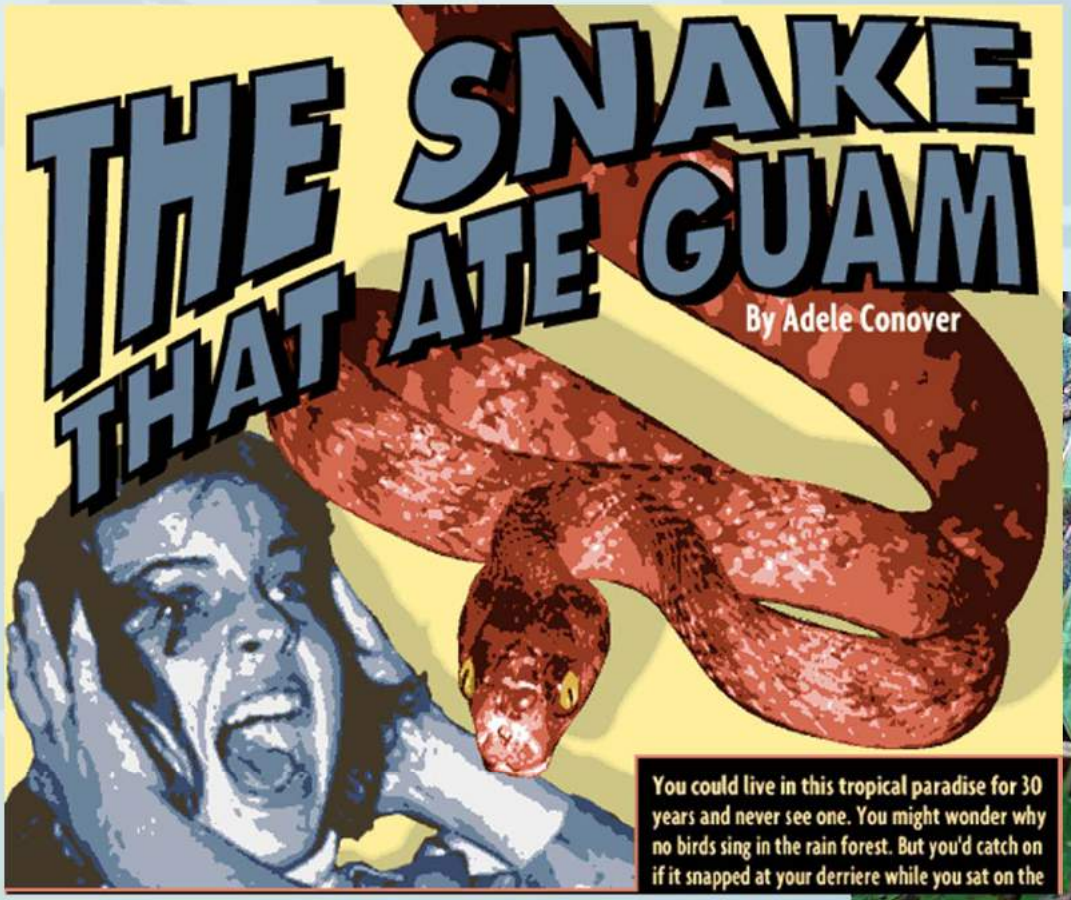






Algal bloom over 50-60 km^2, possibly caused by sedimentation from logging operations

Invasive Species

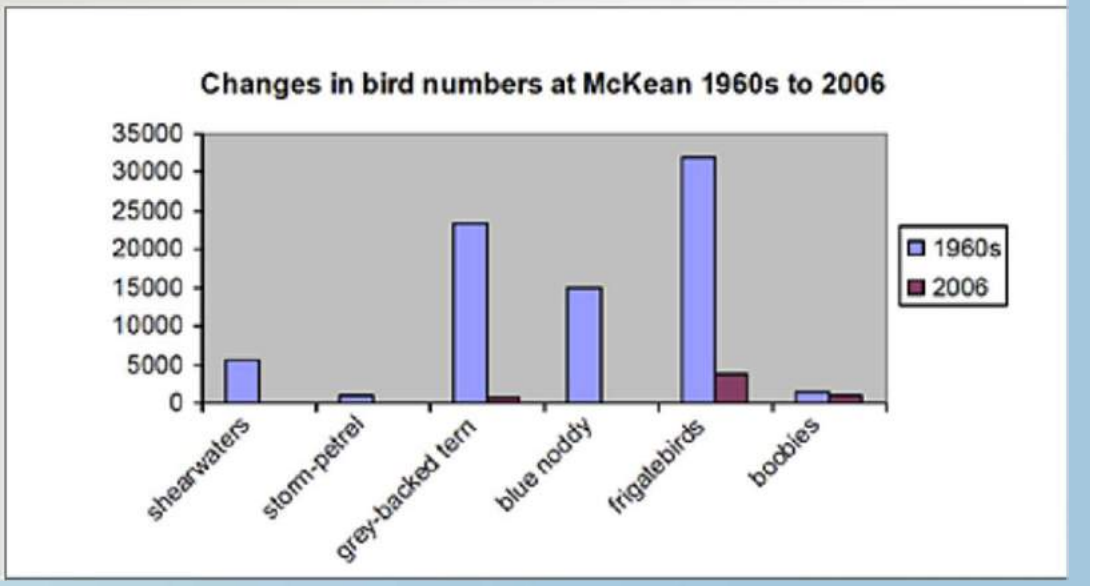


Invasive Species

THE MCKEAN DISASTER – WHAT HAPPENED?

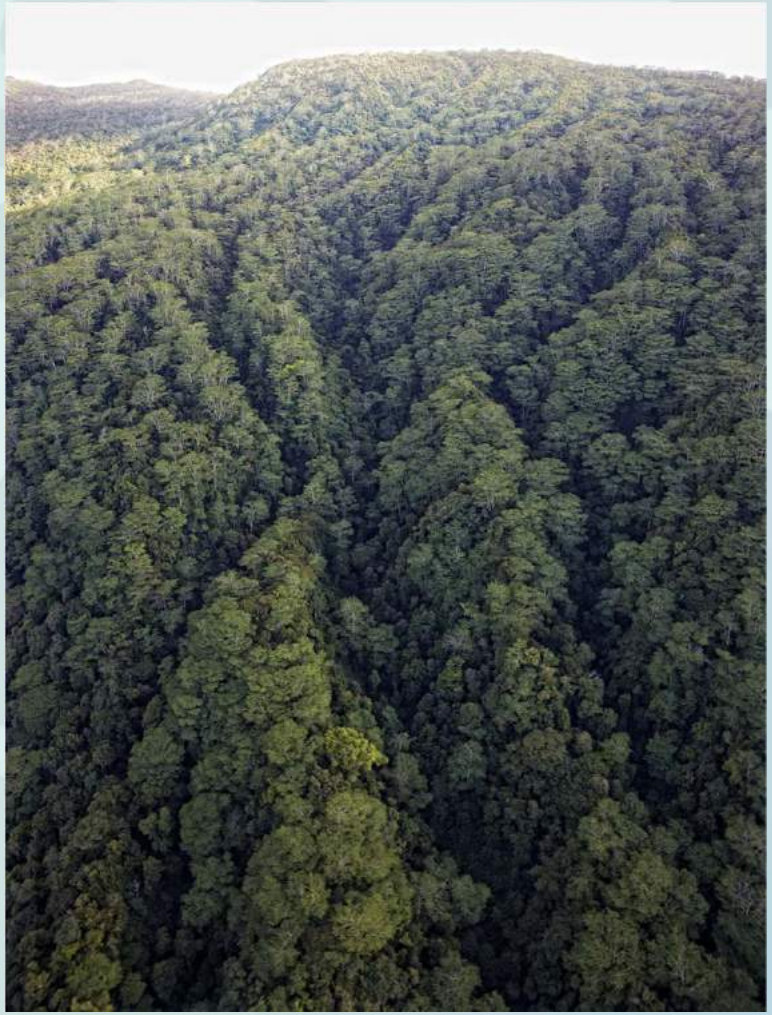
A fishing vessel was wrecked here in 2001–02 and allowed Asian rats (lower left) to invade and wipe out many seabirds.

Blue noddies, storm petrels and others declined from thousands of birds in the 1960s to very few in 2006 (see graph below).



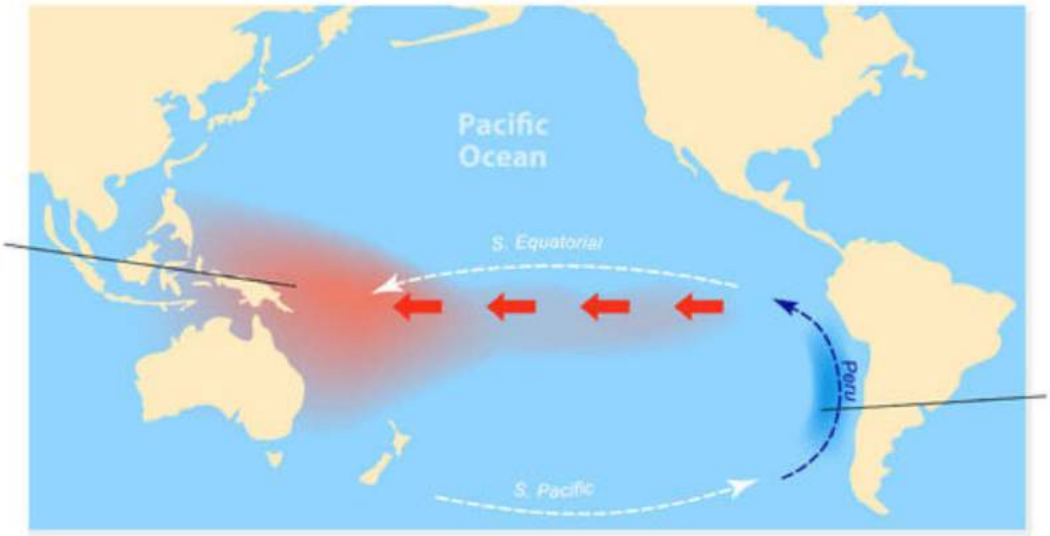
Natural Disasters

Invasive Species and Disasters



THE EL NIÑO PHENOMENON

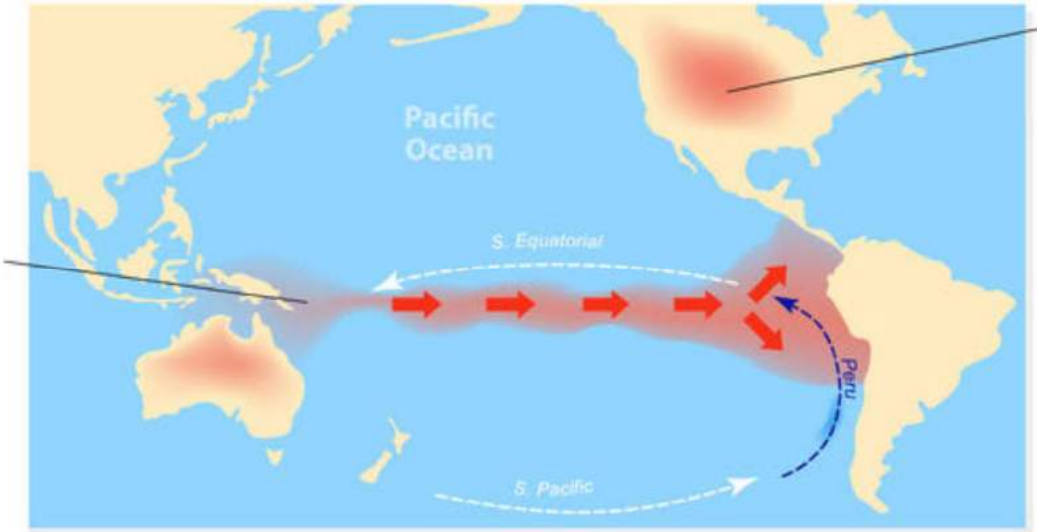
NORMAL YEAR



Equatorial winds gather warm water pool toward the west.

Cold water along South American coast.

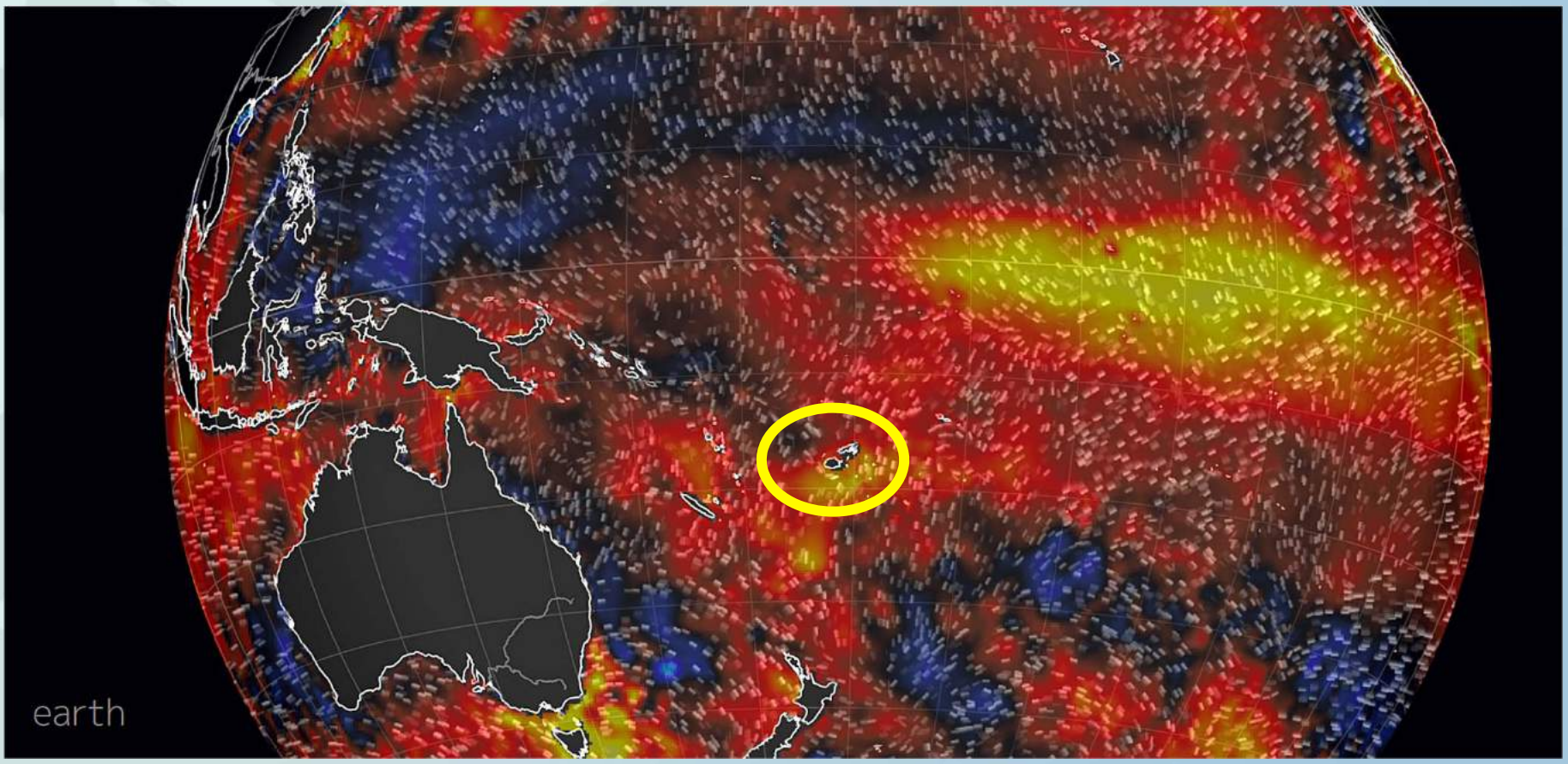
EL NIÑO YEAR



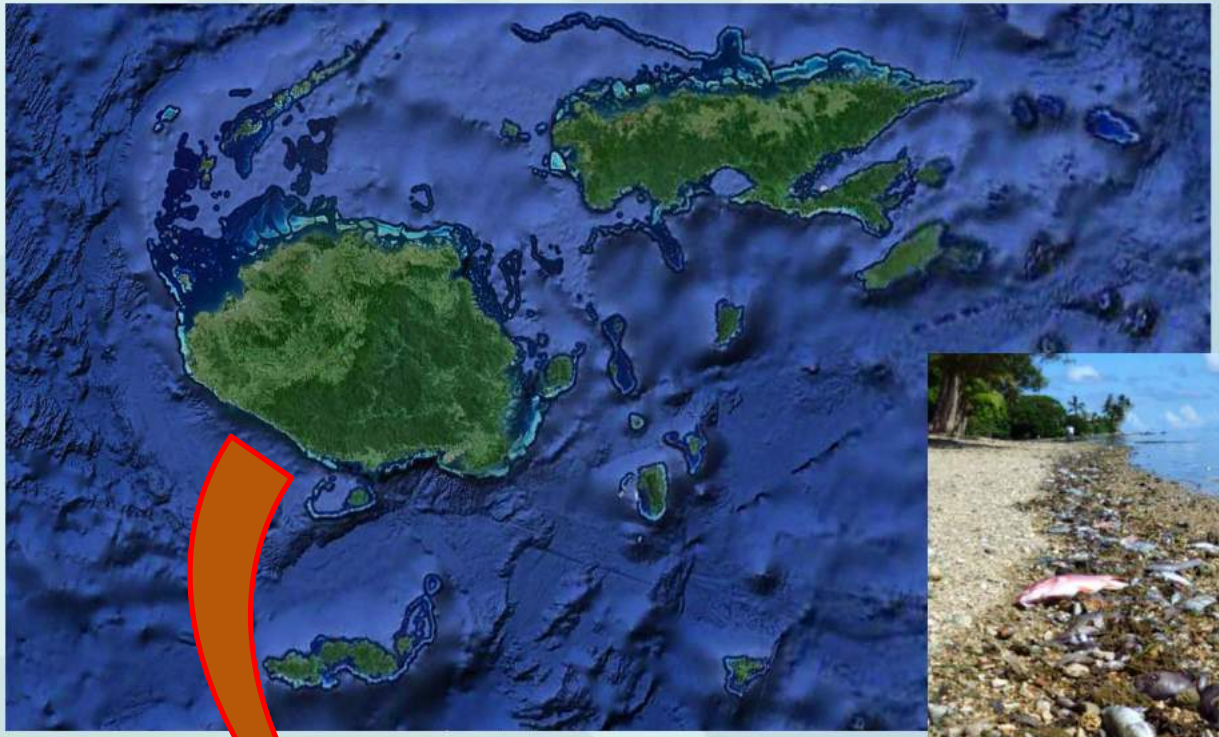
Warmer winter

Easterly winds weaken. Warm water to move eastward.

El Nino 2015-2016: SST

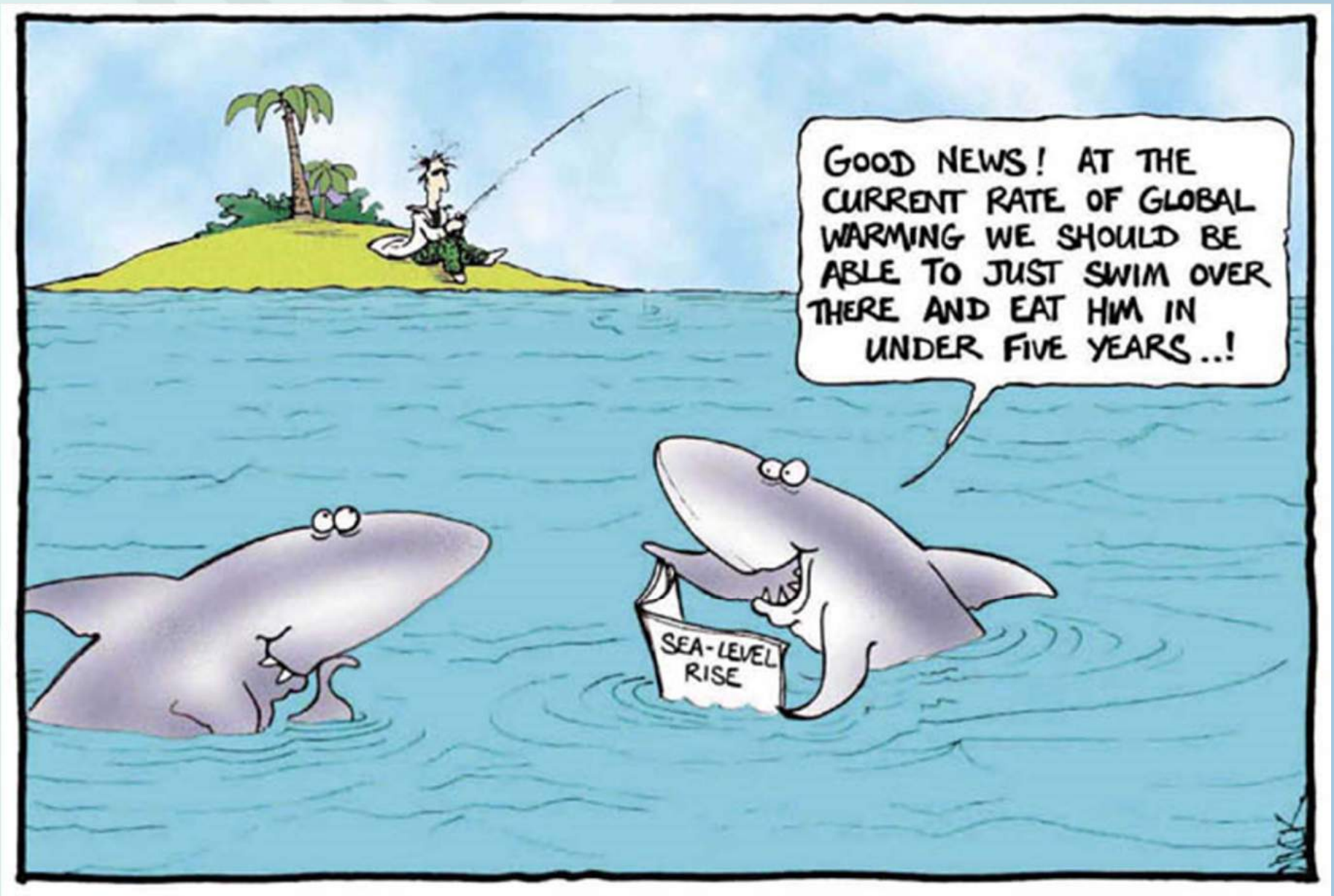


Fiji February 2016: Extreme Sea Temperatures

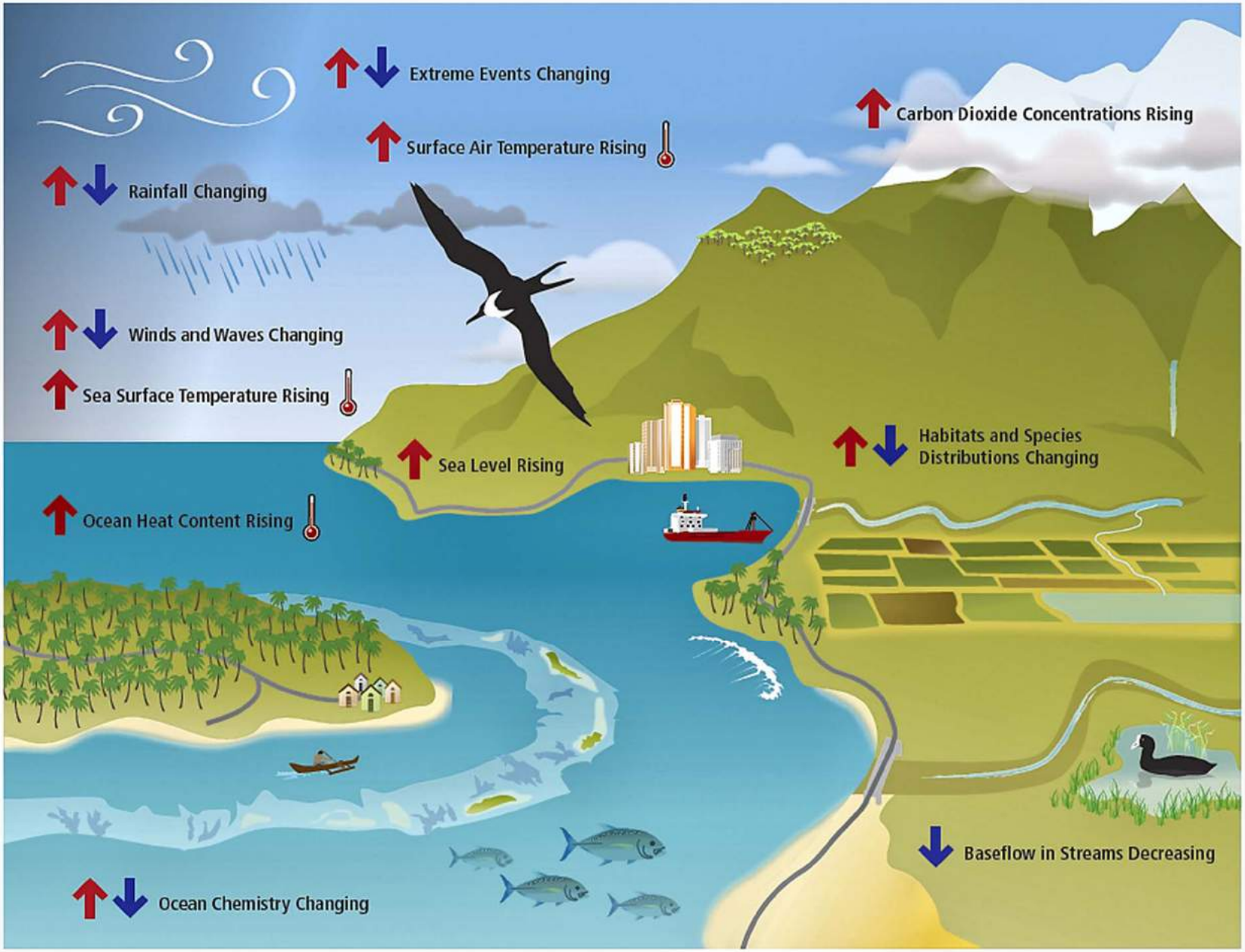


Major fish die-off

Climate Change Impacts



Climate Change in Pacific Islands Region

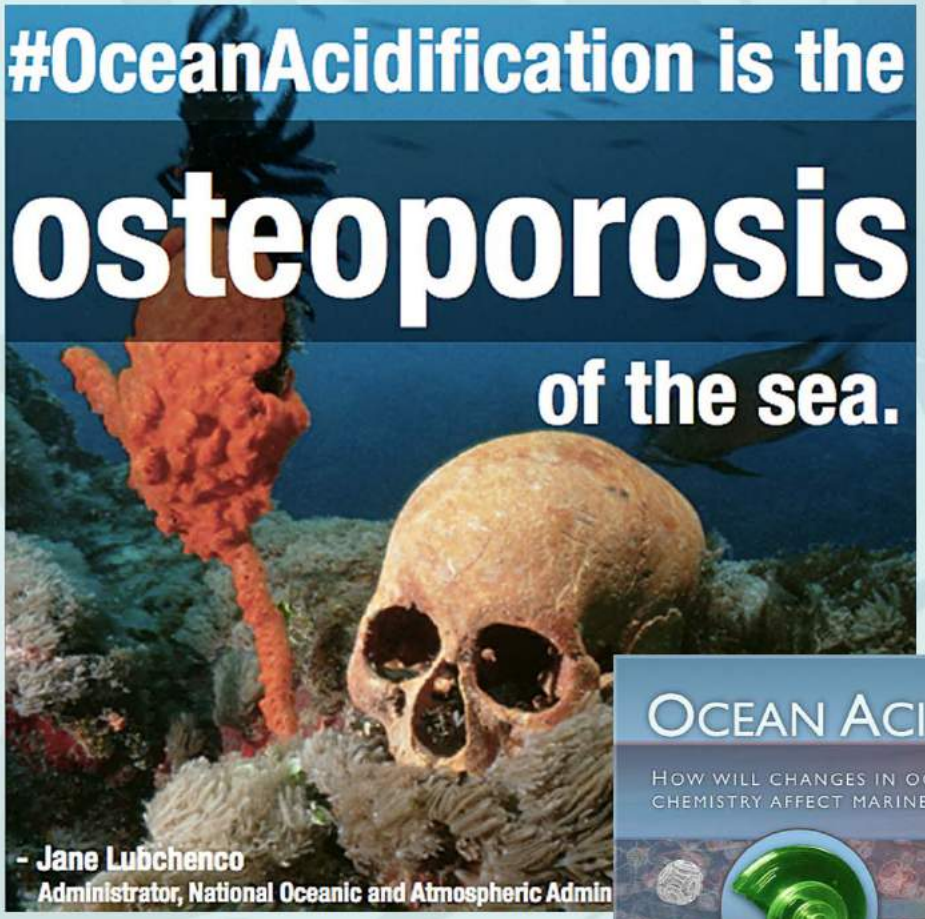


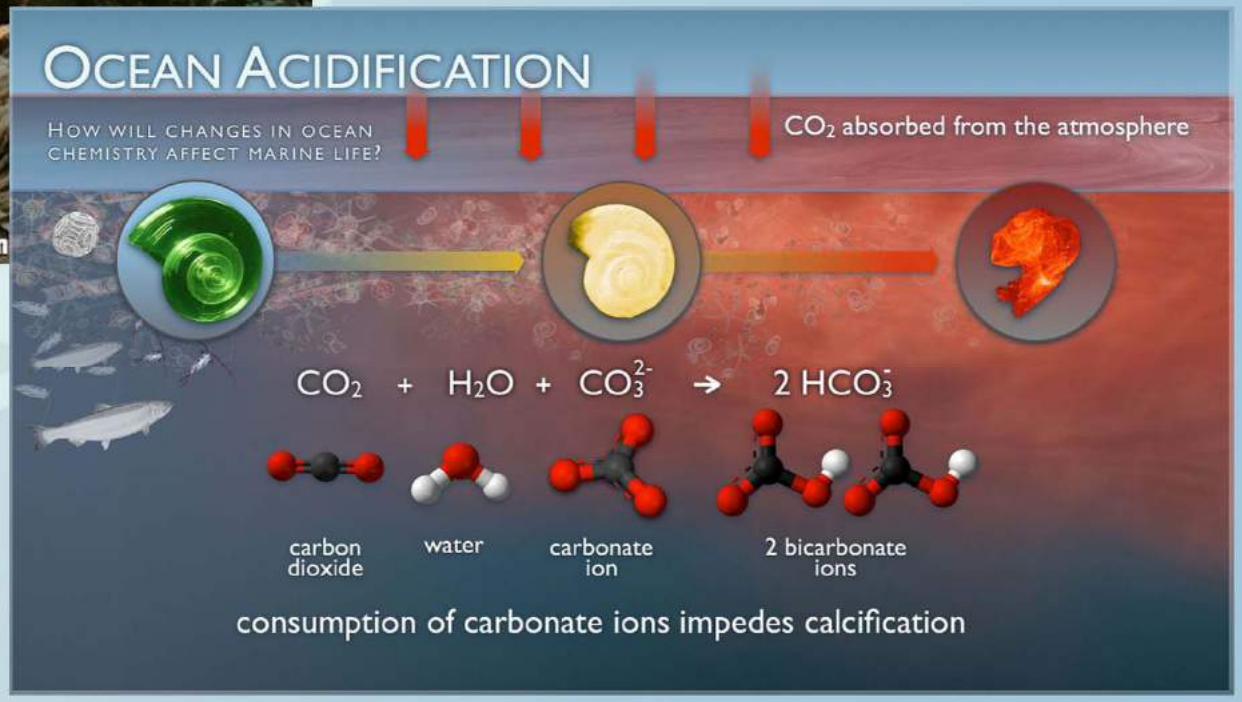
Climate Change Related Threats

Sea Level Rise

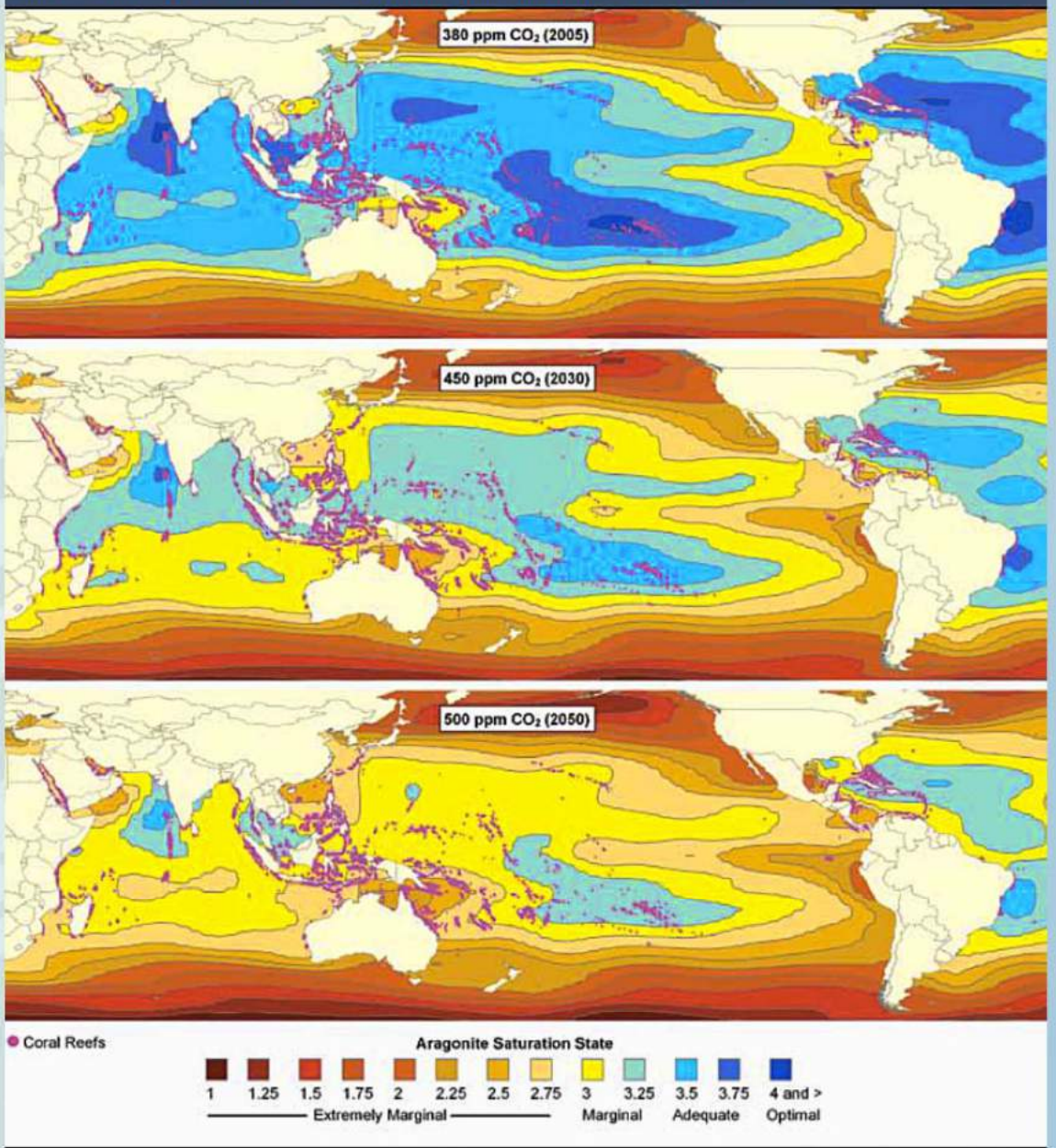
The Marshall Islands Are Disappearing

Ocean Acidification



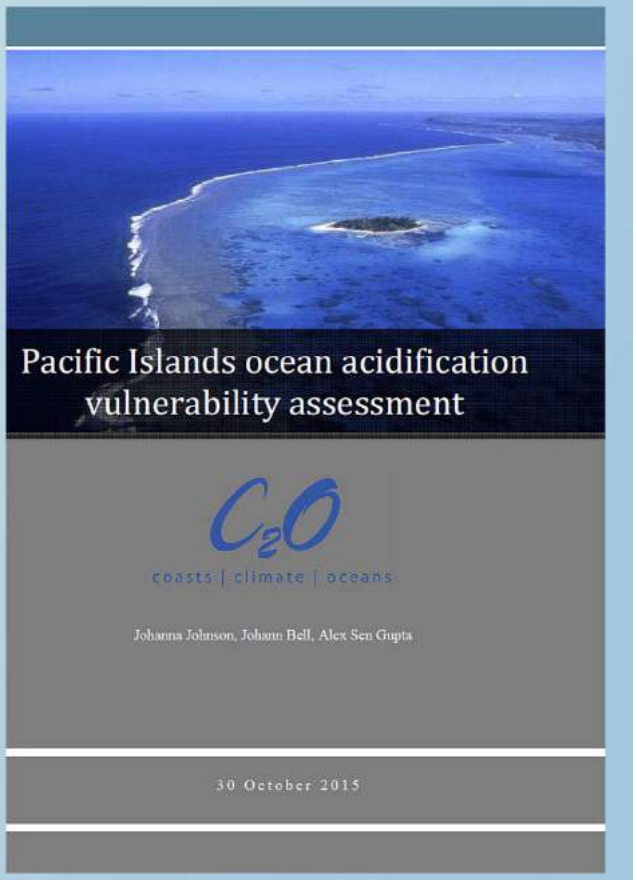


MAP 2.9. THREAT TO CORAL REEFS FROM OCEAN ACIDIFICATION IN THE PRESENT, 2030, AND 2050



Note: Estimated aragonite saturation state for CO_2 stabilization levels of 380 ppm, 450 ppm, and 500 ppm, which correspond approximately to the years 2005, 2030, and 2050 under the IPCC A1B (business-as-usual) emissions scenario. Source: Adapted from Cao and Caldeira, Geophysical Research Letters, 2008.

- **Declining ocean pH** - dramatic changes in aragonite saturation, with **implications for calcifying organisms, such as corals, some plankton, and shellfish**.
- Best available modelling suggests by **2050**, **only about 15% of coral reefs around the world will be in areas where aragonite levels are 'adequate' for sustainable coral growth**.
- Pacific island region will experience similar changes - **oceanic and coastal reef habitats are expected to be modified**.
- Subsequent **declines in fisheries productivity** of some target species (e.g. reef fish) and impacts on calcareous aquaculture commodities (e.g. pearl oysters)

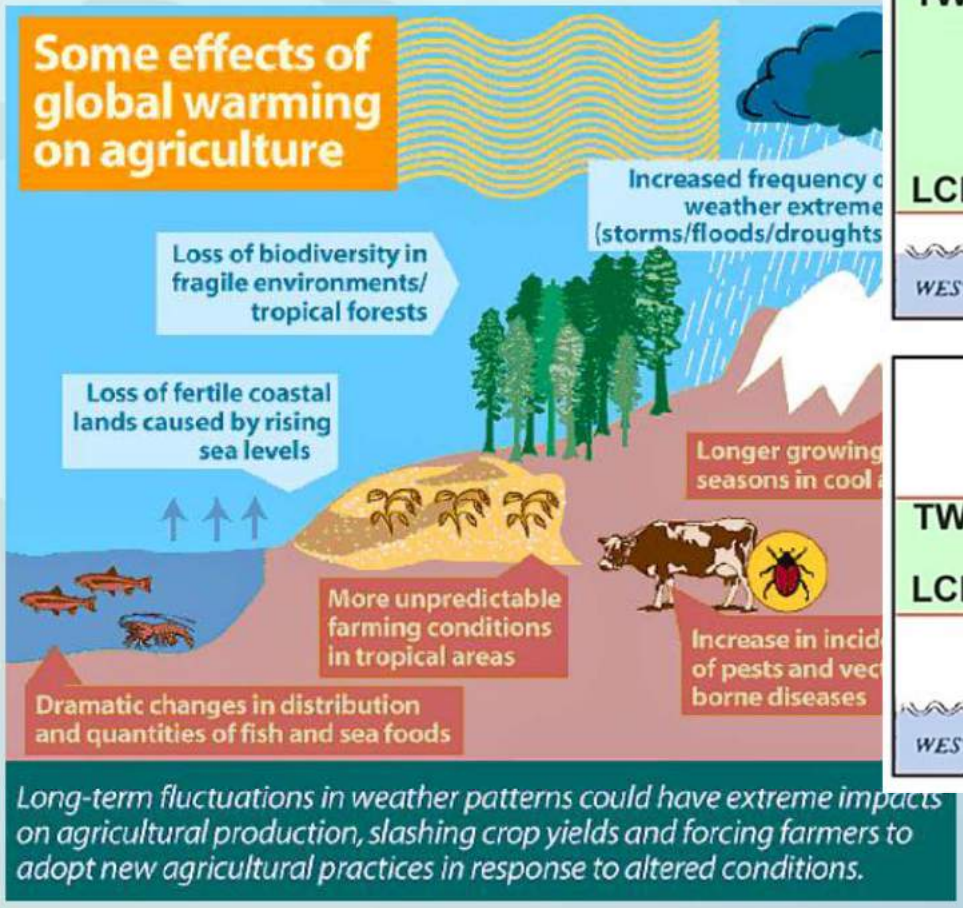


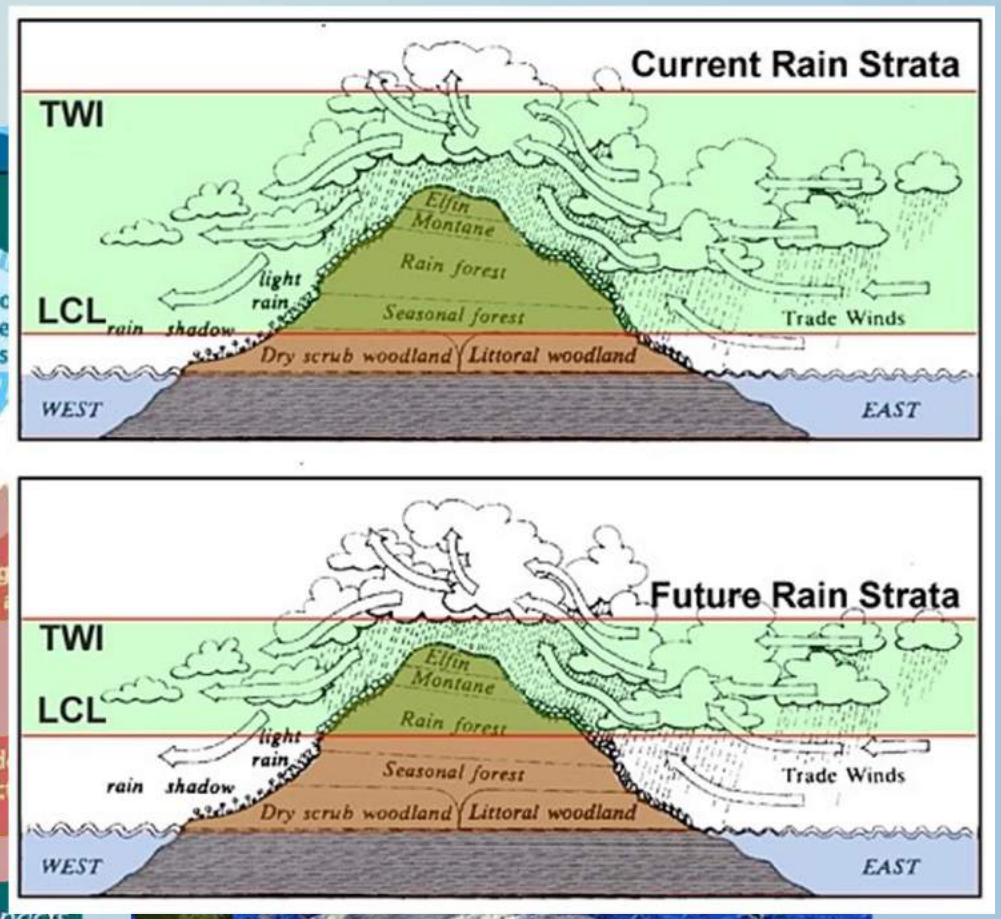
El Nino

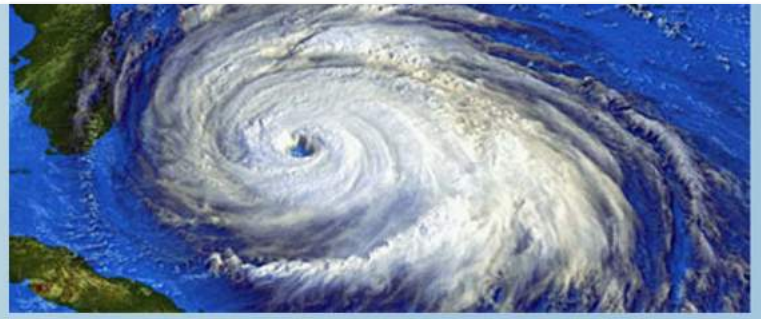
Ocean Acidification

?

Changing Rainfall Patterns and Weather Events







Increased Vulnerability to Wildfires

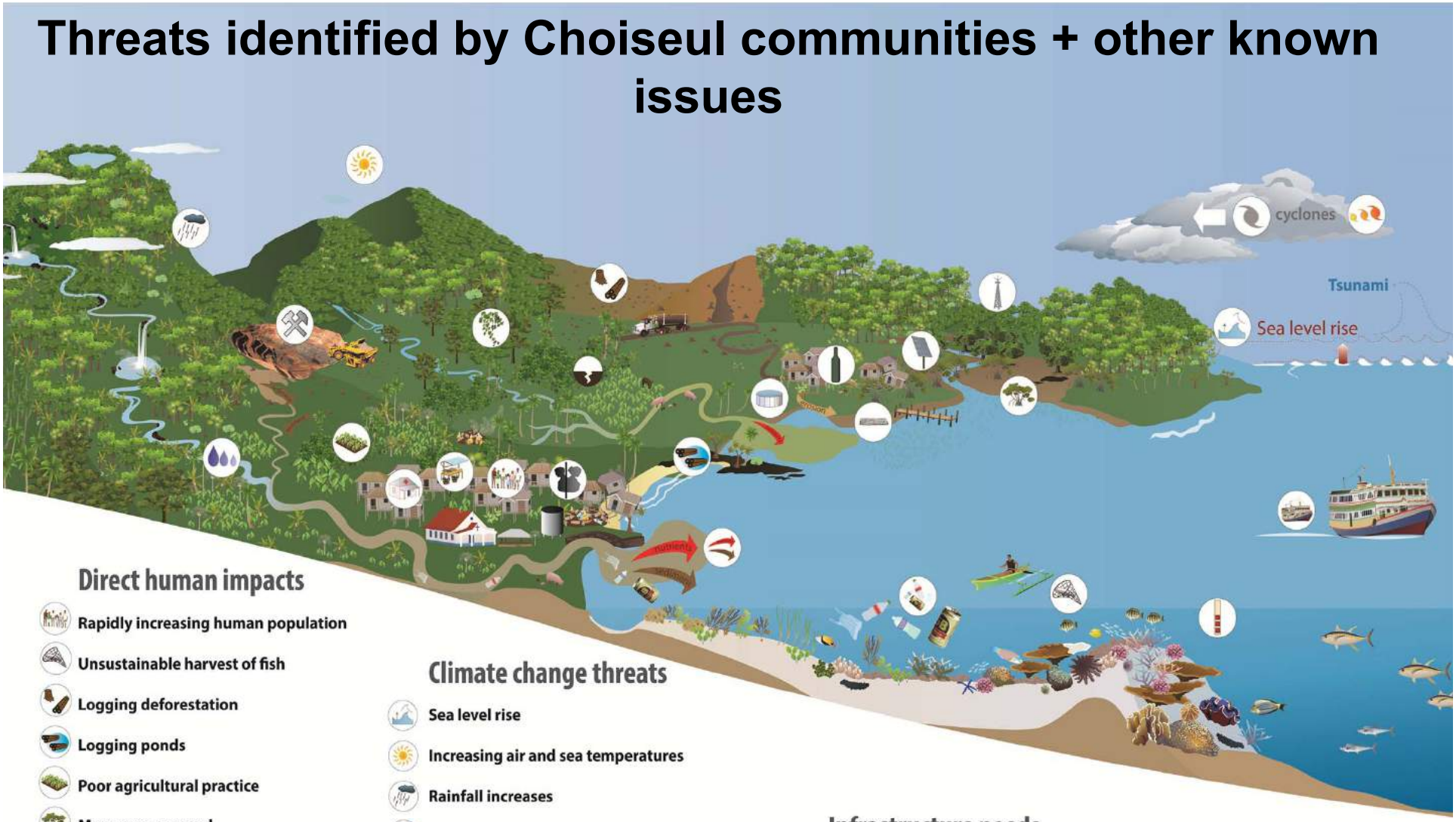
Lower Capacity for Resilience

Non-CC Impacts

Climate Change Impacts

Lower Capacity for Resilience

Threats identified by Choiseul communities + other known issues



Direct human impacts

- Rapidly increasing human population
- Unsustainable harvest of fish
- Logging deforestation
- Logging ponds
- Poor agricultural practice
- Mangrove removal
- Inappropriate coastal defences
- Proposed mining operations
- Invasive species
- Nutrient and sediment flow
- Inappropriate rubbish disposal

Climate change threats

- Sea level rise
- Increasing air and sea temperatures
- Rainfall increases
- More intense tropical cyclones
- Ocean acidification

Natural disasters

- Cyclones and tsunamis
- Drought
- Earthquake

Infrastructure needs

- Limited access to fresh water
- Lack of communication infrastructure
- Distance to markets
- Limited basic services
- Limited energy generation

Social challenges

- Reduced self reliance
- Cultural transition
- Gender inequities
- Foreign logging workers

Ecosystem-based Adaptation:

*By **taking into account the ecosystem services** on which people depend for their **livelihoods and social and economic security**, EbA **integrates sustainable use of biodiversity and ecosystem services in a comprehensive adaptation strategy*** (CBD 2009)

Need to fully integrate non-climate change issues

Benefits of Ecosystem-based Adaptation

- Aligns with and enhances **poverty alleviation** and **sustainable development strategies**
- **More accessible to rural and poor communities** – cost effective
- **Increases local engagement and action**, drives resource management to rural communities
- Enables **vulnerable communities** to **participate** directly in **resource management decisions**

Benefits of Ecosystem-based Adaptation

- **Precautionary** and addresses risk management – ensures that long-term **natural resources** that **provide resilience** are **not destroyed by short-term or emergency responses** to crisis
- **Provides** both **protective** and **provisioning services**
- Can **contribute** to **climate change mitigation**
- Builds on existing investments in **biodiversity conservation**

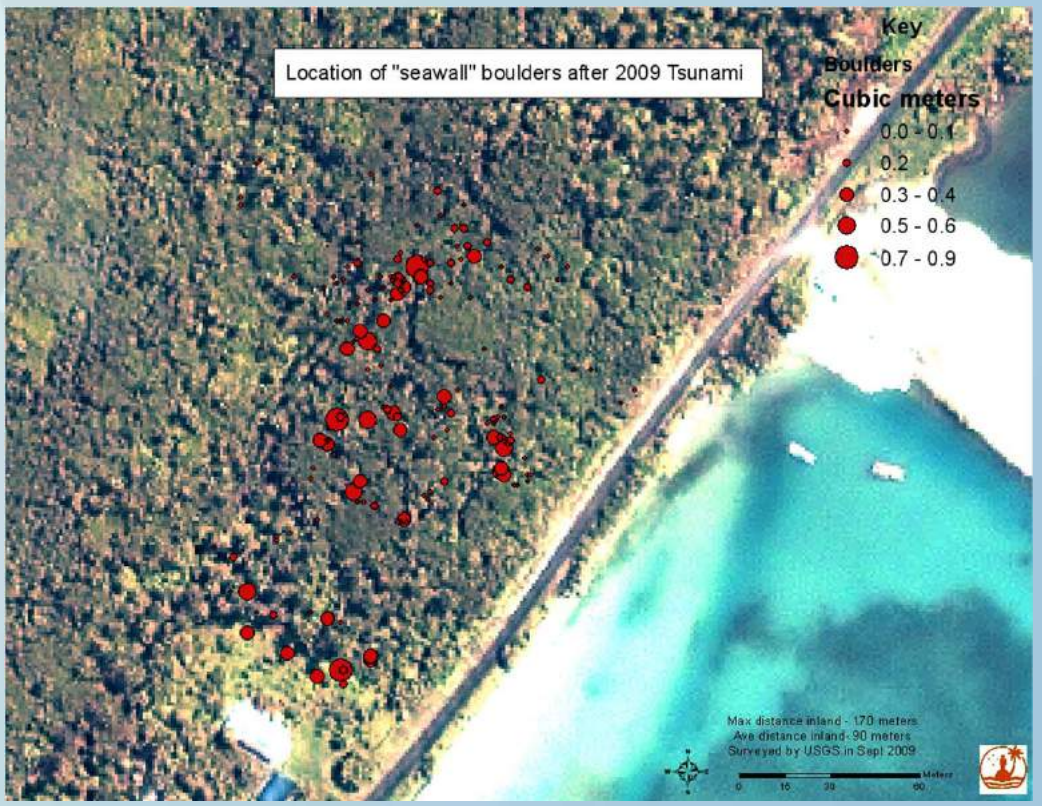

A comparative analysis of
ecosystem-based adaptation
and engineering options
for Lami Town, Fiji
Ecosystem-based adaptation and
climate change vulnerability
in Choiseul Province, Solomon Islands
Synthesis report
USAID
SPREP
Legal Frameworks for
Ecosystem-Based Adaptation
Climate Change in the Pacific
Ben Boer and Pe
Pacific Island Biodiversity, Ecos
and Climate Change Adaptati
Building on Nature's Resilienc
Terry Hills, Ashley Brooks, James Atherton, Maini
SPREP
PROE
Lami Town
Central
Business
District
N
1 mi
1 km
Protect river banks
Dredge rivers
River realignment
Increase drainage
Existing sea walls/
hard protection
Build sea walls
Replant stream buffer
Existing mangroves
Replant mangroves
Waterways
Main Road
Lami Town Boundary
Village without
adaptation
Most vulnerable to climate change impacts
No management of ecosystem services
Village with hard engineering
adaptation options
Effective in reducing potential damage
No management of ecosystem services
Village with ecosystem
based adaptation (EbA)
Natural buffers reduce climate change impacts
With secondary benefits from ecosystem services
UPSLOPE
Deforestation:
- causes greater landslide risk & higher flood levels
- results in biodiversity loss
Improved drainage:
- reduces landslide risk & groundwater recharge
- but can increase sediment flows to rivers and reefs
Intact & replanted forests:
- reduce landslide risk & less sediment flow to rivers & reefs
- provide building material, crops & firewood & store carbon
RIVERSIDE
Removal of riverside vegetation:
- causes reduced freshwater quality
- increases flooding risk
Artificial banks, dredging & river realignment:
- reduces flooding risk
- but can cause poor freshwater quality & loss of biodiversity
Intact & replanted riverside vegetation:
- reduces sediment flows & flooding risk
- protects freshwater supply & biodiversity
COASTAL
Removal of coastal vegetation & mangroves:
- causes erosion & coastal flooding
- degrades fish & crustacean habitat
Seawalls:
- reduce erosion in targeted areas
- but can cause erosion nearby & reduce fish & crustacean habitat
- heavy building material can be projected inland by tsunamis & storm surges
Intact & replanted coastal vegetation & mangroves:
- reduce coastal erosion & flooding
- provide building material, crops, firewood & store carbon
MARINE
Inappropriate watershed management:
- reduces water quality
- degrades health of fisheries and reefs
Increased aquaculture & access to fisheries technology:
- supplements declining fisheries
Integrated ridge to reef management:
- protects intact habitats & biodiversity
- supports healthy fisheries & reefs

Understand the Options

Understand the Implications

Avoid cheap and nasty ‘protection’ measures

What happens to seawalls in tsunamis and major storm events

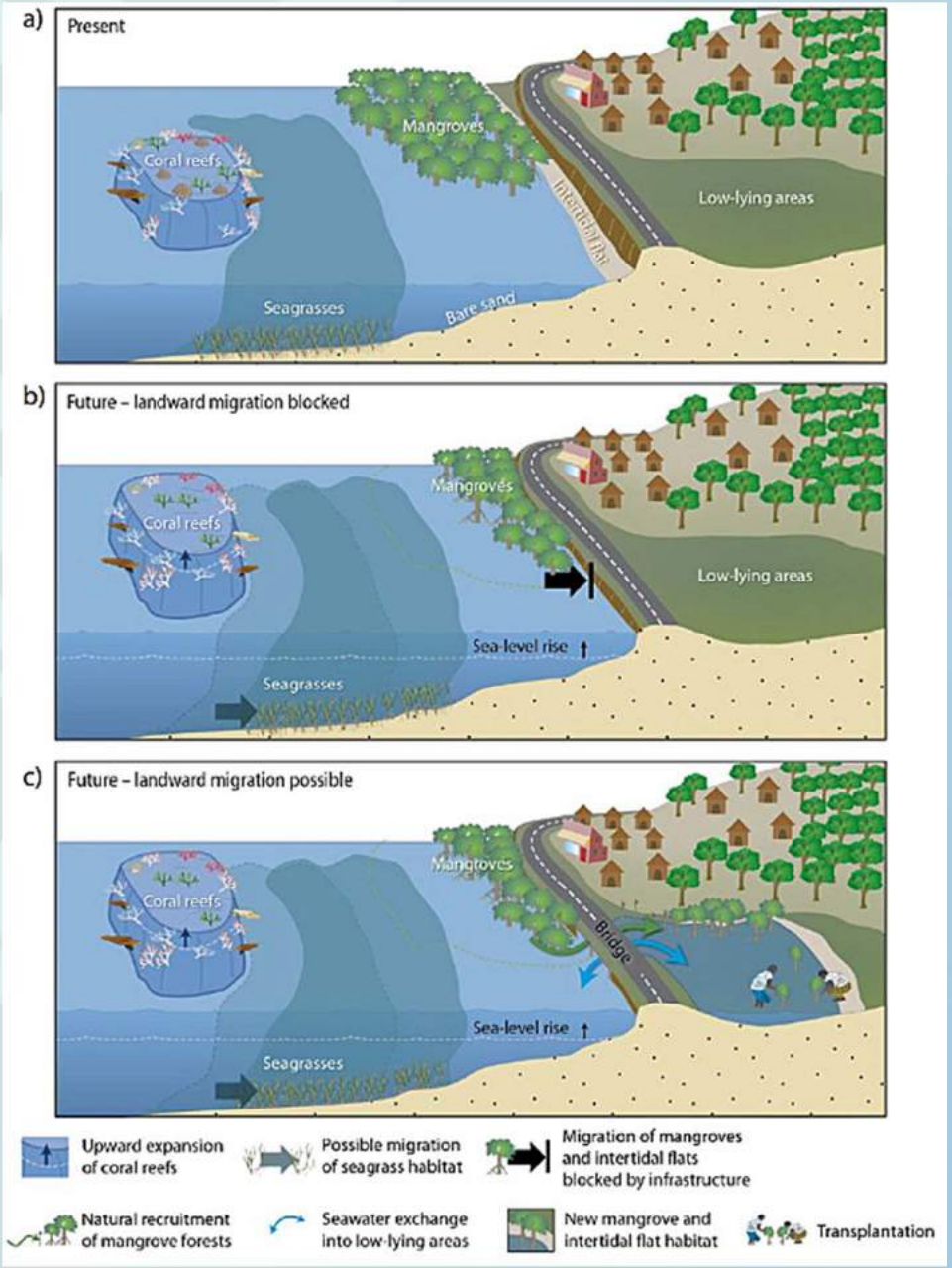


Understand Infrastructure Construction and Maintenance Costs

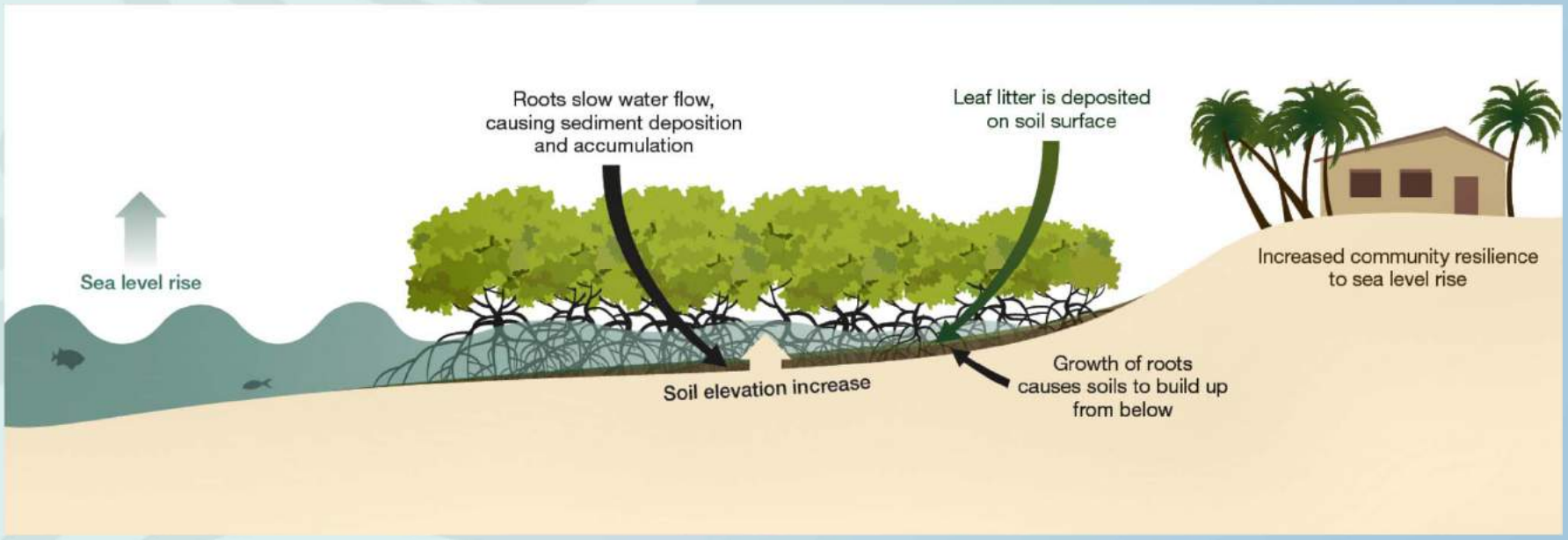
Maldives

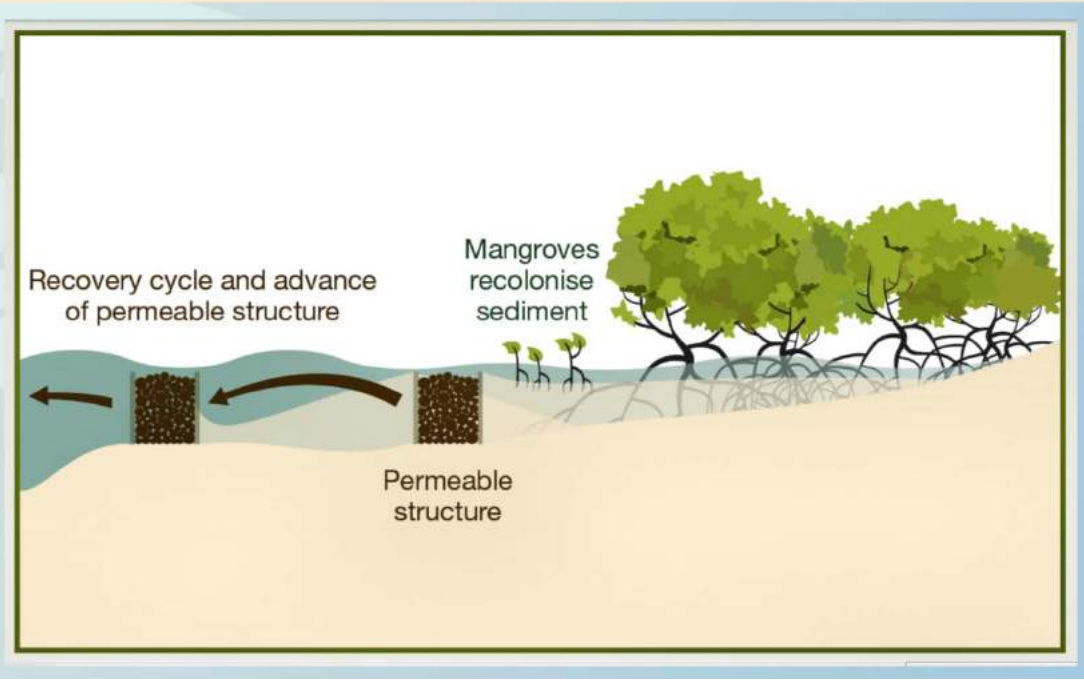
Sea wall around Malé cost $54 million, or $12.4 million per km.
Maldives has 2,002 km coastline – seawall $24.8 billion enterprise.
With current annual GDP, it would take more than three decades to raise the funds

Allow for Ecosystem Shift in Development Planning



Maintain and/or Restore Coastal Ecosystems

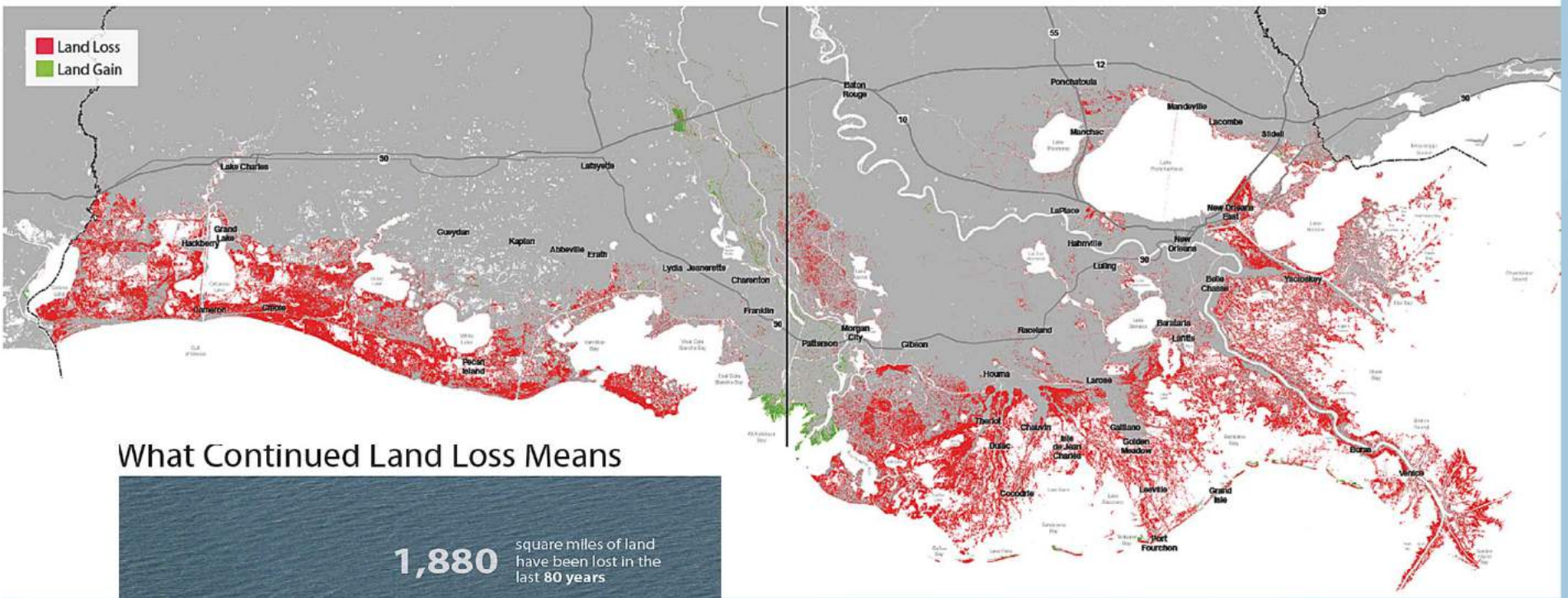




Louisiana, USA

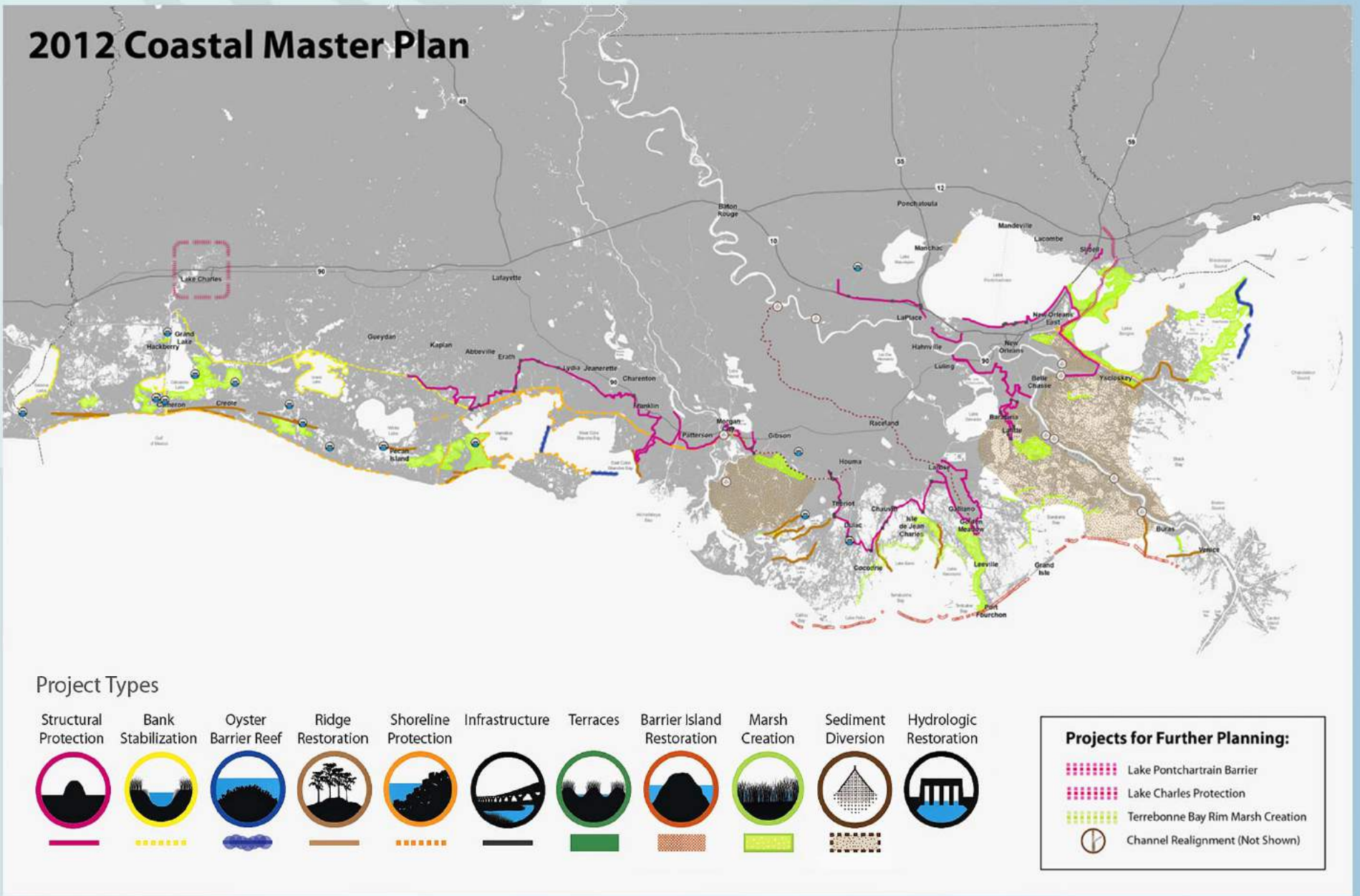
Louisiana is Experiencing a Coastal Crisis

Predicted Land Change over the Next 50 Years

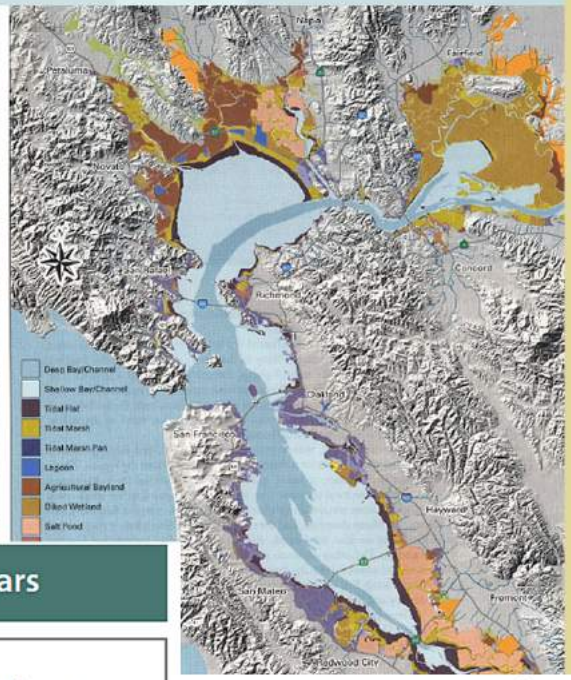


What Continued Land Loss Means

Louisiana, USA



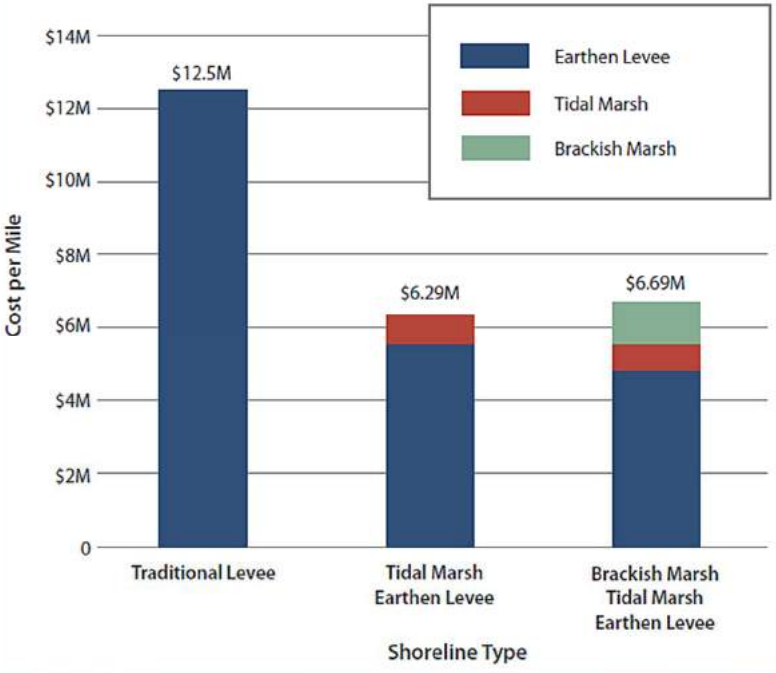
San Francisco Bay, USA

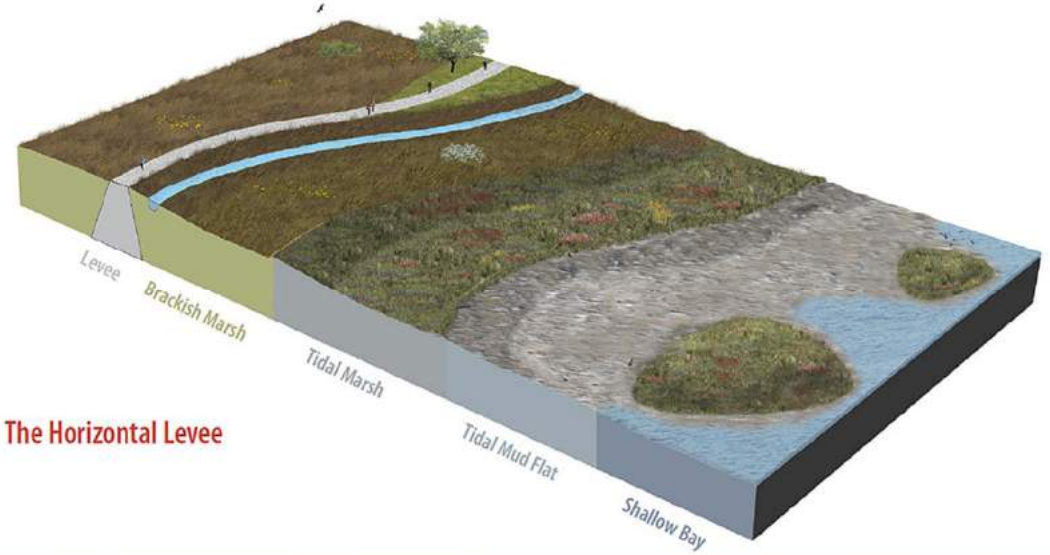


SAN FRANCISCO BAY AREA
SHORELINE AREAS
POTENTIALLY EXPOSED
TO SEA LEVEL RISE

Area potentially exposed to an approximate 16-inch sea level rise
Area potentially exposed to an approximate 55-inch sea level rise
No data

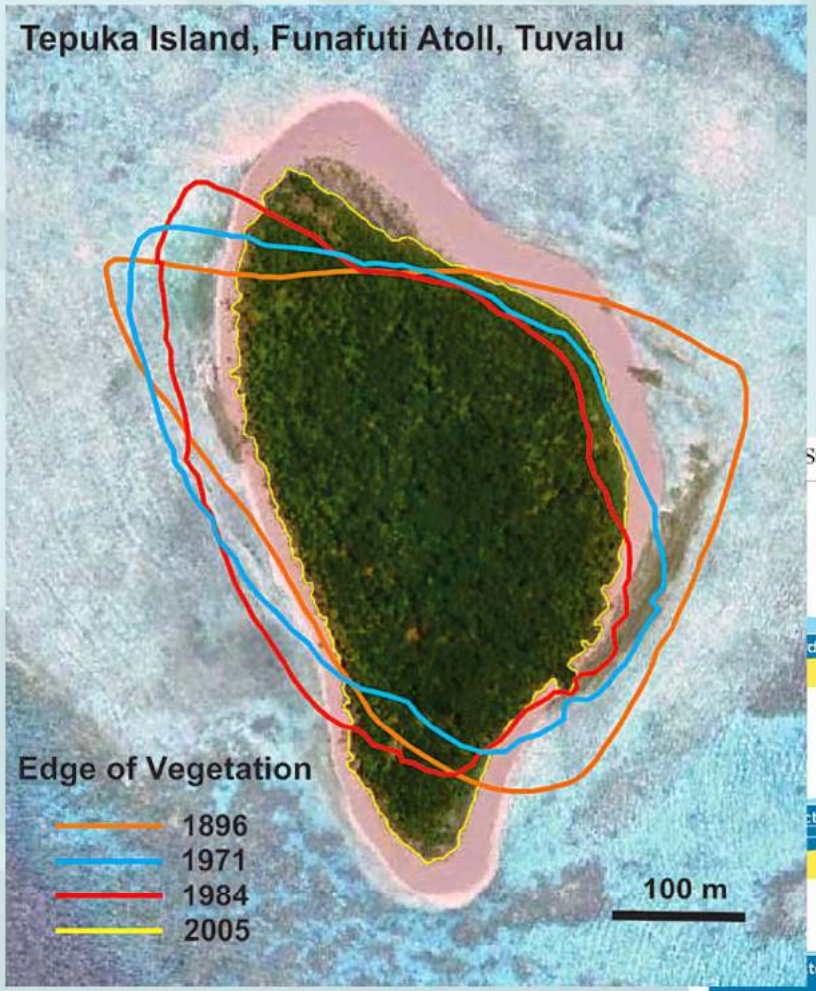
Levee Cost/Mile (In Millions) Over 50 Years

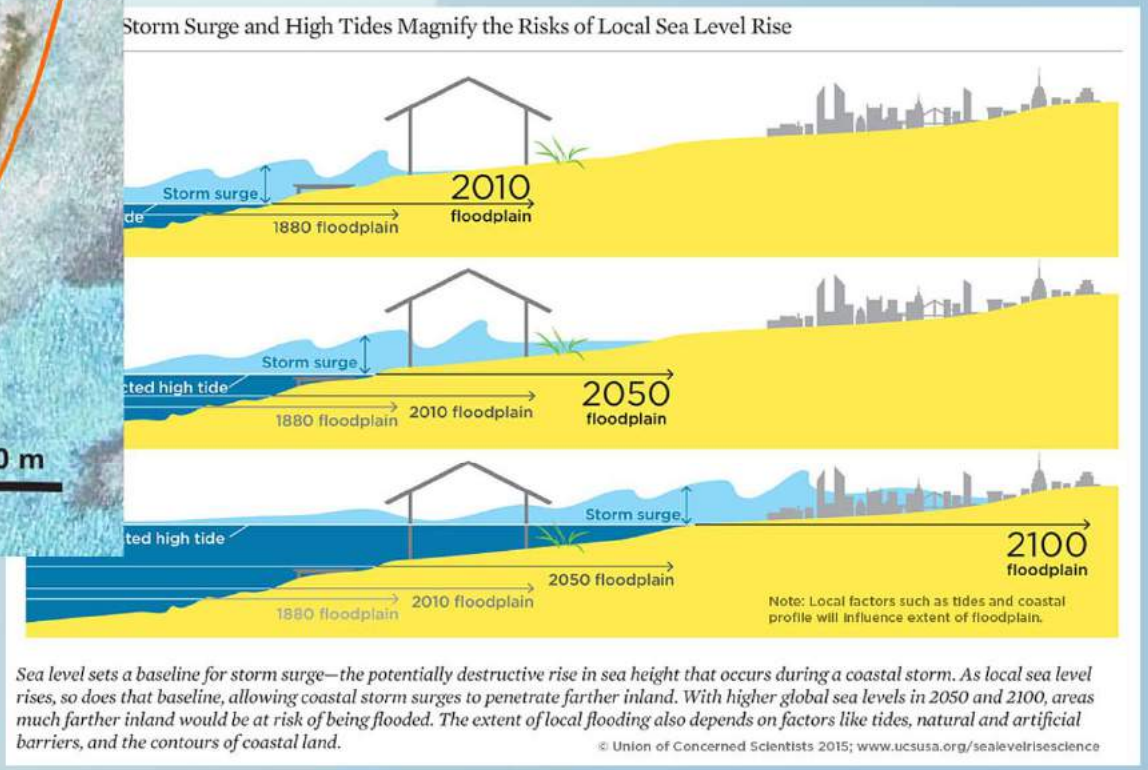




The Horizontal Levee

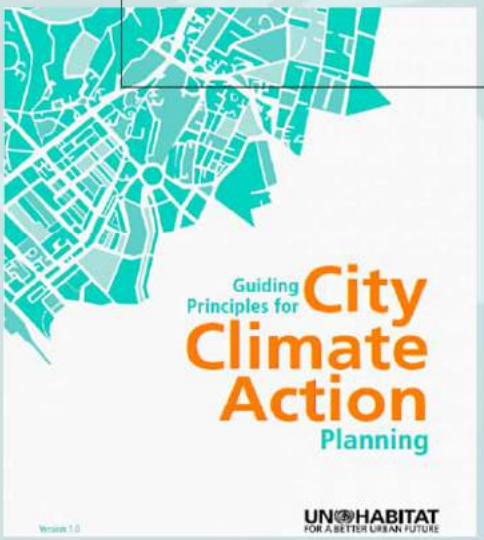
Apply Good Analytical Science to Underpin Decisions





Sea level sets a baseline for storm surge—the potentially destructive rise in sea height that occurs during a coastal storm. As local sea level rises, so does that baseline, allowing coastal storm surges to penetrate farther inland. With higher global sea levels in 2050 and 2100, areas much farther inland would be at risk of being flooded. The extent of local flooding also depends on factors like tides, natural and artificial barriers, and the contours of coastal land.

Apply Ecosystem/Environmental Approaches for Resilient Cities and Settlements



What Needs to Change

- **Integration** of **climate change adaptation options** with the **ecosystem approach**
- **Holistic** – all **adaptation options** reviewed in the context of **sustainability**: **livelihoods, ecosystem services protected**
- **Non-climate change issues receive equal weight** in government policy and its implementation
- Donors to fund holistic **national level approaches**
- Governments need to undertake **national scale long-term resilience-focused development planning**
- **Ecosystem and socio-economic resilience analysis and mapping (ESRAM)** completed to integrate CC and non-CC threats into **ecological and social vulnerability *and opportunity*** assessments as a basis for adaptation planning at national, provincial and community levels

Solomon Islands

National Climate Change Policy: ***"healthy and functioning ecosystems are crucial for the achievement of adaptation and mitigation objectives"***

Fiji

National Climate Change Policy: Adaptation Objective 5.5 *"support the* ***ecosystem-based approach throughout Fiji****, recognising that* ***ecosystem services****, such as food security, natural hazard mitigation and physical coastal buffer zones,* ***increase resilience****"*

Vanuatu

Climate Change and Disaster Risk Reduction Policy : *"**effective natural resource management** can minimize the threat of climate change to ecosystems whilst enhancing livelihoods resilience….*
***Embedding action and planning within an ecosystem**, strengthening all interrelated parts and components (social, biological, economic)"*

Landscape Scale that includes Community and Ecosystem Focus

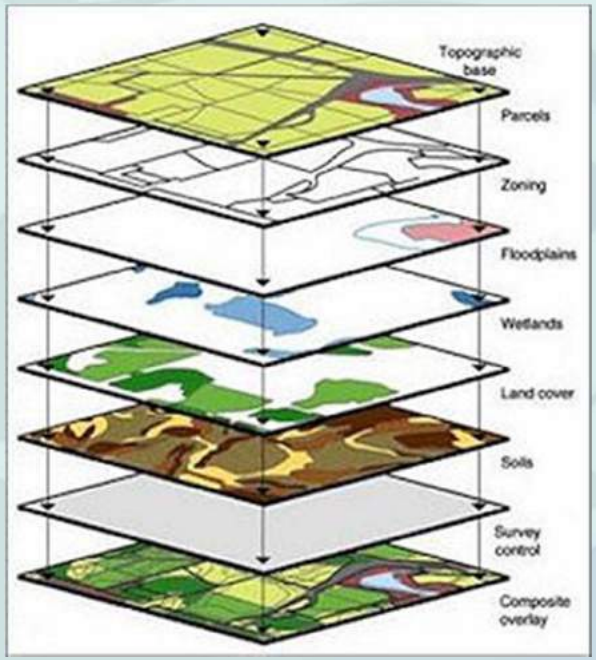
National policy implementation ⟷ **Sub-national policy implementation** ⟷ **Community engagement**

Country-wide integrated planning

Whole-of-island integrated planning, ridge to reef approach, watershed management, etc

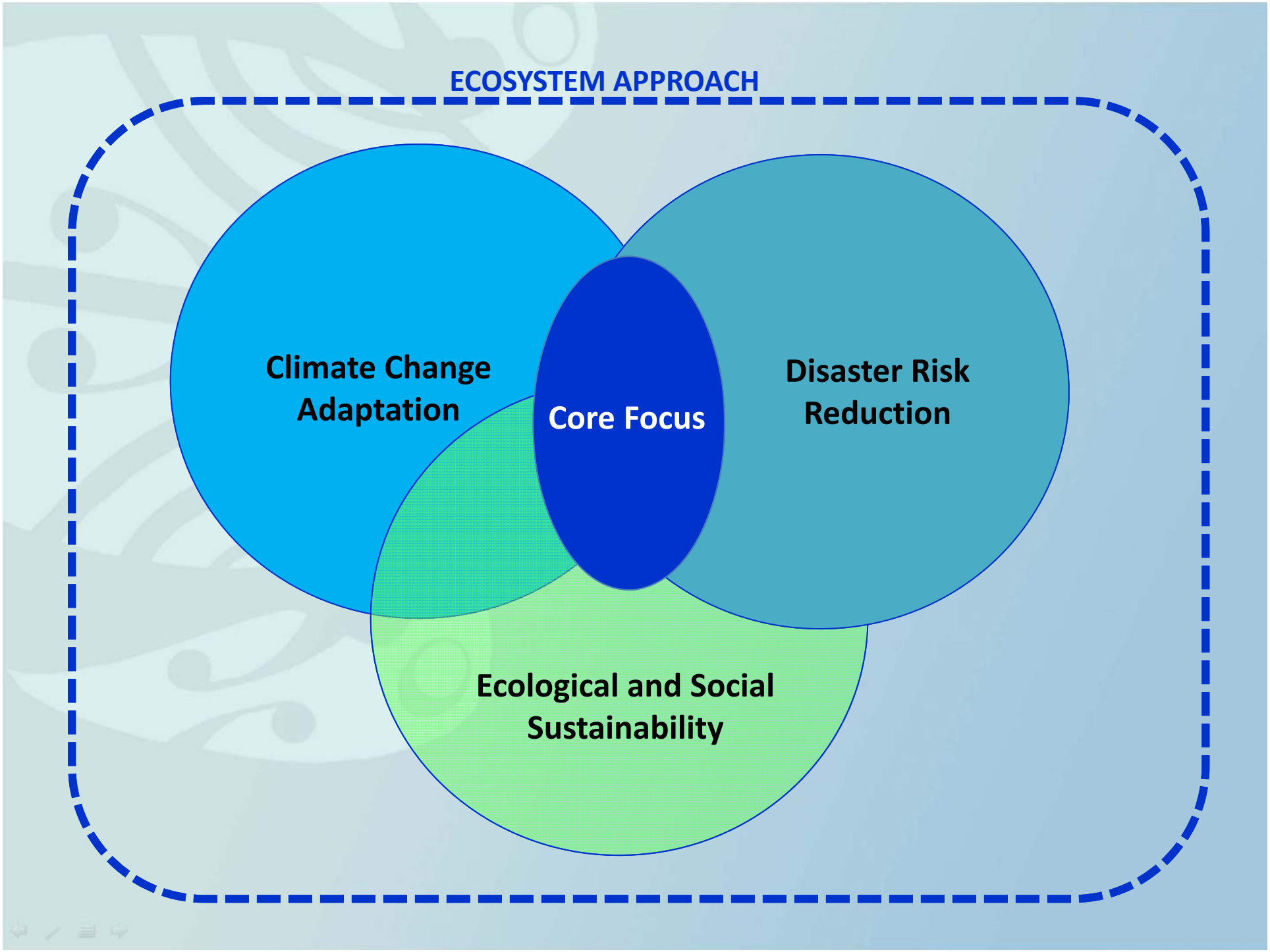
Undertake Ecosystem and socio-economic resilience analysis and mapping (ESRAM)

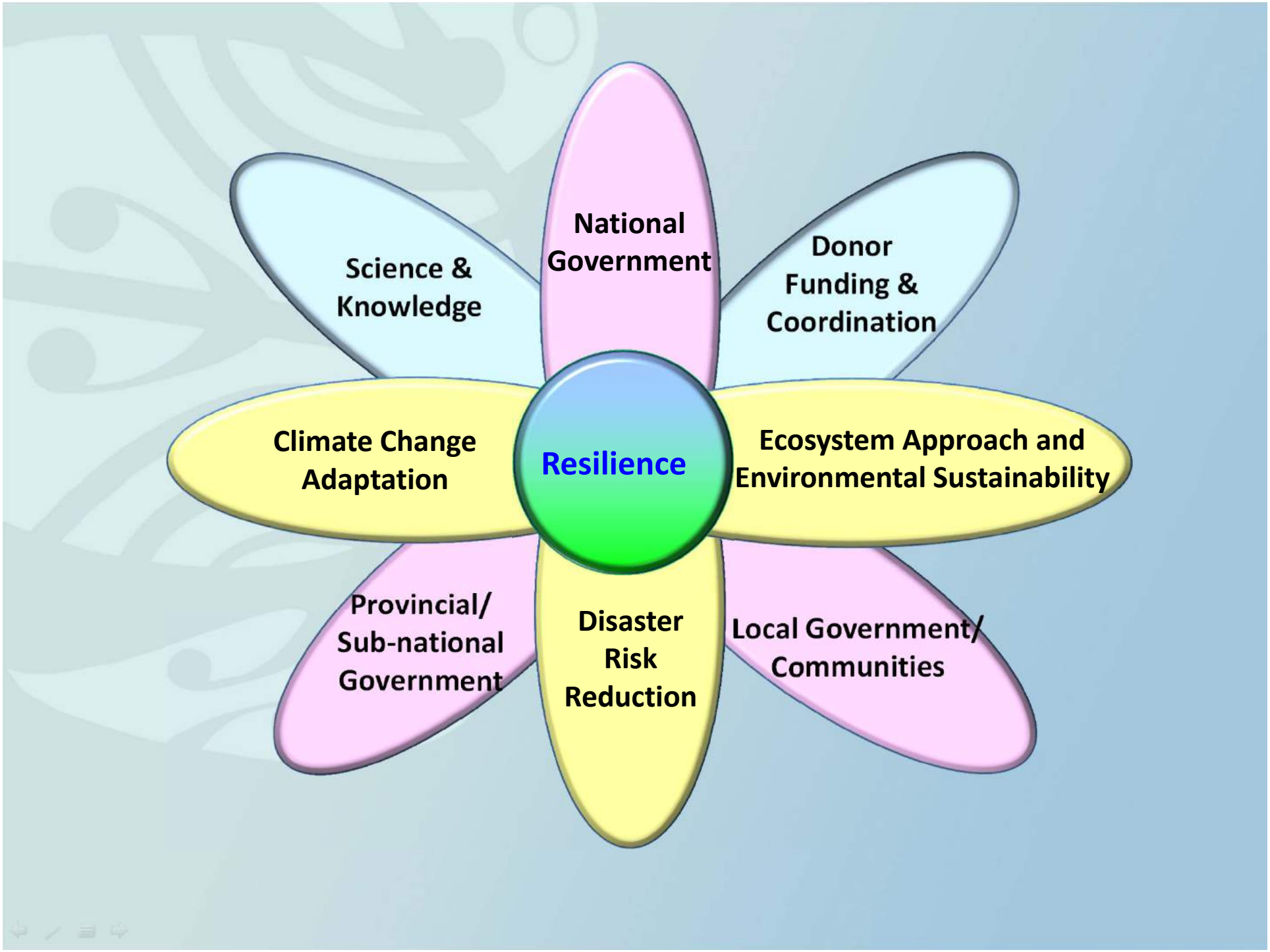
- ESRAM to integrate climate change and non-climate change threats into vulnerability assessments as a basis for adaptation planning at national, provincial and community levels



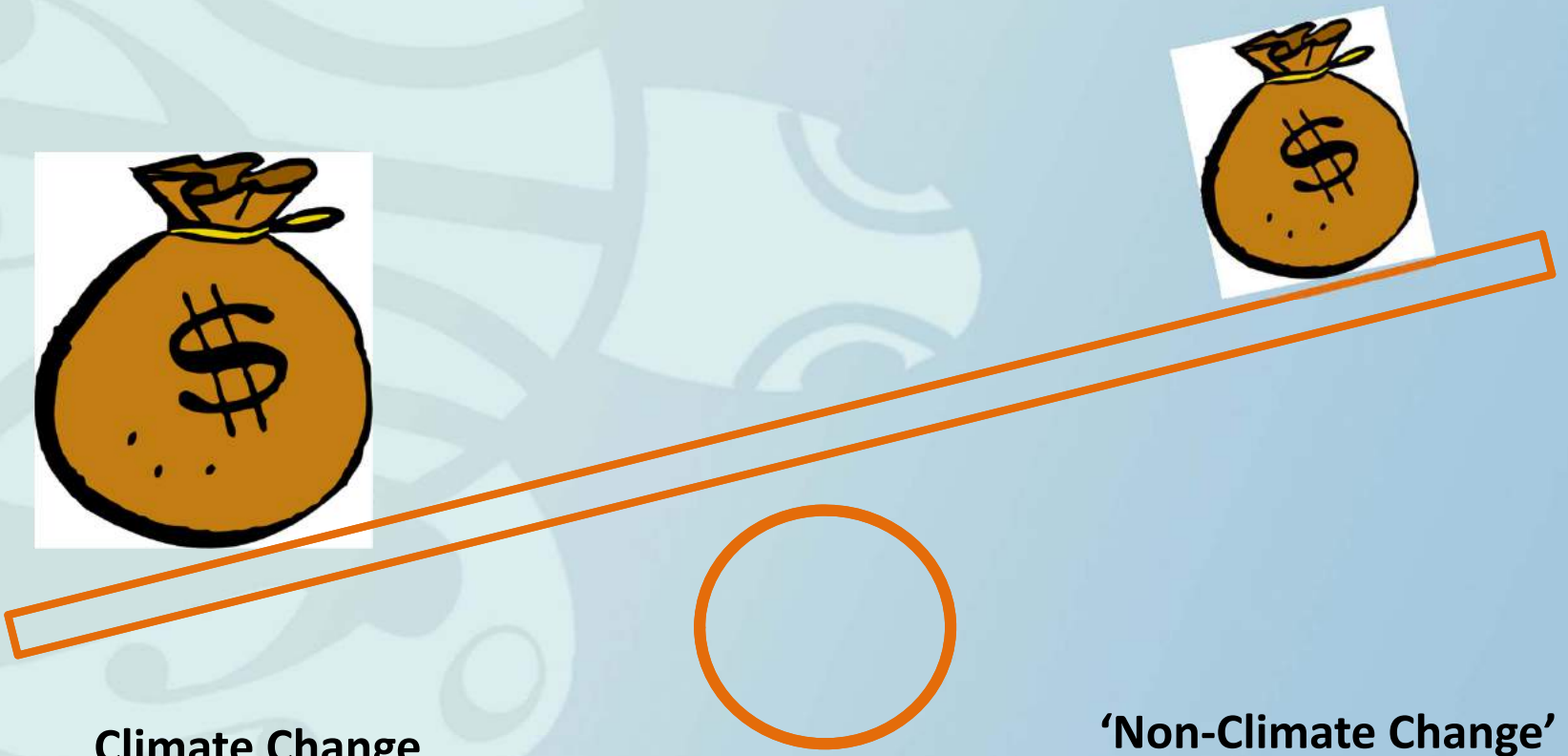
Ecosystem and Socio-economic Vulnerability and Opportunity Assessments (**ESVOA**)

More effective adaptation planning and implementation at all scales


ECOSYSTEM APPROACH
Climate Change Adaptation
Core Focus
Disaster Risk Reduction
Ecological and Social Sustainability


National Government
Donor Funding & Coordination
Ecosystem Approach and Environmental Sustainability
Local Government/ Communities
Disaster Risk Reduction
Provincial/ Sub-national Government
Climate Change Adaptation
Science & Knowledge
Resilience

Balanced Approach to Funding



Climate Change Sector

'Non-Climate Change' Environmental Issues

Balanced Approach to Funding and its Application

Integrated Approach:
Climate Change Adaptation + DRR + Environmental Sustainability + Ecosystem Protection and Management

Thank You!