Ecosystem-based Adaptation in Marine and Coastal Areas
GEO4: Environmental decline goes way beyond Climate change

climate change is quite convenient for politicians both at a popular level but also at a political level

a long-term issue - so decisive action is always posited for some time in the future, at a time that can always be made yet more distant

someone else can always be blamed: EU used to blame the US, the US would blame China and India, and developing countries would blame the entire developed west.

"it's very easy to pass responsibility for failure somewhere else… and in the process of doing that, one is able to keep one's own credibility and record, with the appearance of being much more progressive and constructive."

Certainly more convenient than tackling the issues that underpin everything else, the size of the human population and our unsustainable consumption of the Earth's resources.
Climate change is a threat to:

- Ocean currents
- ENSO
- Sea level rise
- Rainfall
- River flows
- Lake levels
- Thermal structure
- Storm Severity
- Storm frequency
- Acidification

Impacts on:

- Species composition
- Production & yield
- Distribution
- Diseases
- Coral bleaching
- Calcification

Safety & efficiency
- Infrastructure

Loss/damage to assets
- Risk to health & life
- Displacement & conflict

Adaptation & mitigation costs
- Market impacts
- Water allocation

Effects on:

- Production
- Ecology
- Fishing & Aquaculture operations
- Communities
- Livelihoods
- Wider society & Economy
Since IPCC…Scale of impacts is worsening

IPCC: SLR between 18-60 cm before end of century

No integration of ice sheets information

Current predictions are for a max between 1-2m
Human response: an even bigger threat

infrastructure, coastal zones, and water supply and flood protection account for the bulk of the adaptation costs estimated at 75-100 B/y
Ecosystem-based adaptation

What is lost when corals die?

**PEOPLE LOSE**

Ecosystems provide important services that need to be maintained to help us adapt to climate change

Ecosystem-based adaptation as an important option in response to climate change
Ecosystem-based adaptation is the use of sustainable ecosystem management to support societal adaptation (CBD 2009).

Ecosystem-based adaptation aims to:

Conserve biodiversity and make ecosystems more resistant and resilient in the face of climate change so that they can continue to provide the full suite of natural services.

Preserve and restore natural ecosystems that can provide cost-effective protection against some of the threats that result from climate change.
What is Ecosystem-based Adaptation?

EBA should be integrated into an overall adaptation strategy and a broader sustainable development strategy.
Coastal ecosystems play an important role in coastal protection as they dissipate wave energy, reduce erosion and trap sediments.
Sustaining local livelihoods and contributing to local economies

Figure 1: The biodiversity of the Wakatobi Islands underpins local livelihoods
Marine angiosperms (including saltmarsh, mangrove and seagrass) contribute some 46% of total organic carbon buried into marine sediments, or some 111 Mt carbon per year.
Providing refugia

- high cover
- high diversity
- low disease
- broad size range

- strong recovery
- good substrate
- good water quality
- good herbivores
Contributing to social resilience

- recognition of tenure and responsibility
- good governance
- contributing to developing solutions

- local knowledge and participation
- alternative livelihoods
- learning new skills
Effective management is at the heart of resilience
Coastal Resilience –
 adapting to rising seas and coastal hazards
2020s SLR with 20% annual chance flood

2020 A2 mean with 5-year Flood
Coastal wetlands – vulnerability and risk

Wetlands Lost

2080s Med SLR

- Lost
- Potentially present
Coastal wetlands – Protection Potential

Shoreline Protection Potential

- Low
- Yellow
- Orange
- Red
- High
Using Decision Support Tools to Plan and Adapt

Outreach to:
- Indonesia
- Solomons
- PNG
- Mexico
- Bahamas
- Caribbean
Regulatory Approaches

- Standard buffers/setbacks;
- Rolling easements/setbacks;
- Allowing retreat

Priority areas for protection based on current conditions;
  - Priority areas for conservation
  - Bulkhead-free zones

Priority areas for protection based on future conditions;
  - Upland buffer areas.

Incentives for risk sharing strategies (Insurance)
Engaging local communities in the Choiseul province of the Solomon Islands planning their local land and resource management in response to climate impacts.
•at today’s level of ~387ppm, allowing a lag-time of 10 years for sea temperatures to respond, most reefs world-wide are committed to an irreversible decline.

•Mass bleaching will in future become annual, In addition, ocean acidification will cause reduction of coral growth and calcification.

•If CO2 levels are allowed to reach 450ppm (by 2030-2040 at the current rates), reefs will be in rapid and terminal decline world-wide from multiple synergies arising from mass bleaching, ocean acidification, and other environmental impacts.

•Reefs will cease to be large-scale nursery grounds for fish and will cease to have most of their current value to humanity. There will be knock-on effects to ecosystems associated with reefs, and to other pelagic and benthic ecosystems.
Resilience: A Strategy to Cope
Spread Risk

Manage for uncertainty

fore-reef

shallow patch
Secure Sources of Seed

Protect refugia
Maintain Connectivity

Link with refuges – recovery
(a) reducing the harvest of herbivorous fish to sustainable levels
(b) maintaining an effective trophic pyramid by protecting sharks and other top predators,
(c) managing all aspects of water quality
(d) minimising any other direct anthropogenic impacts and stressors.
Resilience in Practice:
Kimbe Bay, Papua New Guinea
Aim: Design a resilient network of MPAs

TNC Resilience Model

- **Representation and Replication**
  - Habitat Types Multiples ➔ Risk Spreading

- **Critical Areas**
  - Refugia ➔ Secure Sources of Seed
  - Spawning Aggregations ➔

- **Connectivity**
  - Transport ➔ Replenishment

- **Effective Management**
  - Threat Abatement ➔ Strong Recruitment
  - Adaptive Strategies ➔ Enhanced Recovery

RESILIENCE
Projected thermal stress by 2100
(accumulated DHWs)

Degree heating week (DHW) is a measure of frequency and intensity of thermal stress.
DNA parentage analysis

(n=400)

Restorf Island

Cape Huessner

Kimbe Island

Wulai Island

42%

10%

5%

6%

(Planes et al 2008)
Stepping stones across the Pacific
Developing guidance for EbA

Incorporate ecosystem-based adaptation principles into marine and coastal sectoral development.

Nature’s infrastructure should be considered first.

Multiple stressors trade-offs and synergies is central to adaptation planning.

Stakeholders should be involved in strategy development.

Adaptive management is imperative.

Government and the private sector can provide incentives for “climate smart” development.

Environmental, ecological, social and economic changes should be measured and mapped.

A regional approach is needed.