Managing for Resilience
Great Barrier Reef case study

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“Conservation is not rocket science; it is far more complex.”

- Rocket flight obeys laws, predictable, so most reach their target, if not reasons are obvious.
- Conservation actions; large uncertainties in the linked socioecological systems, interacting non-linear elements, little central control.
- “Wicked, complex problems”

**Solution:**
Clear, outcome focused objectives, incorporate creativity (beyond experts), focus on patterns, scenarios, trade-offs, risk-based experiments & shared responsibility.
Outlook focused management

Figure 6.7 Projected vulnerabilities of components of the Reef ecosystem to climate change

Vulnerability differs for a number of ecosystem components and depends on total atmospheric carbon dioxide concentrations. Changes in sea temperatures, ocean pH and sea level are indicative only, based on the latest climate projections.

Source: Adapted from values presented in Gattuso et al. 2015 and Hoegh-Guldberg et al. 2018.
Human Wellbeing

Environment

Habitat

Species

Outstanding Universal Value

Exposure

Resistance & Recovery

Sensitivity

Temperature

Air / Sea

Sea Level

Fishing

Nutrients

Light

Sediment

Storms

Wind / Waves

Predation

Human Damage

Salinity

ENSO

Connectivity

Recruitment

Growth

Mortality

Resilience Budget:

Impacts \leq \text{Resistance + Recovery}

Aesthetics

Heritage

Recreation

Enjoyment

Sustainable Use

Livelihoods

Nutrition

Culture

Tourism

Protection

Knowledge

Medicines

Now (Health)

Resilience threshold

GBRMP  WHA


Resilience

Guidance for Resilience-Based Management

“Targeted investments”

www.gbrmpa.gov.au
Reef 2050 Integrated Monitoring and Reporting Program

Vision

To become a knowledge system that enables resilience-based management of the Great Barrier Reef and its catchment, and provides managers with a comprehensive understanding of how the Reef 2050 Plan is progressing.

- **Catchment**
  - Agriculture: Land management, Pollutant run-off
  - Catchment: Pollutant loads, Ground cover, Wetlands
  - Urban and industrial lands: Land management, Pollutant run-off
  - Public land: Land management, Pollutant run-off
  - Estuarine habitats: Mangroves, Saltmarshes

- **Marine**
  - (In-shore) Seagrasses: Habitat, Health, Processes
  - Marine physical & chemical environment: Water quality, Waves, Noise, Temperature, Light
  - Coral reefs: Health, processes and classification at Reef-wide medium and local scales
  - Megafauna: Great whales, Dolphins, Dugongs, Seabirds
  - Fish & fisheries: Recreational, Aboriginal & Torres Strait Islander Customary, Commercial, Aquaculture
  - Islands: Values-based monitoring framework for island national parks

- **Aboriginal & Torres Strait Islander heritage**
  - Country health - people's health, Heritage and knowledge, Culture and community, Education, Empowerment and economics

- **Human dimensions**
  - Aspirations, capacity and stewardship, Community vitality, Culture and heritage, Governance, Economic values
Knowledge for management

System understanding

Evaluate Reef 2050
RIMREP Prototype – “First Stop Shop”

Program Design

Prototype - Reef Knowledge System

Reference User Network (RUN)

Tools

- Reporting
- Data and publications
- Asset and activities
- Interactive maps
- Guidance
Reporting – Reef2050, Outlook, Report Cards

Ecosystem Health - EHT5 and EHT3

Healthy ecosystems sustain a diverse range of species and habitats, and maintain ecological integrity and resilience. Healthy ecosystems can offer users a wide range of opportunities that do not adversely affect the ecological integrity of their natural systems. Impacts on Great Barrier Reef ecosystems are compounding over space and time, and the cumulative effect of these impacts is reducing their resilience and ability to recover from disturbances. The loss of resilience is especially concerning given the importance of protecting ecosystems from climate change impacts.

A healthy ecosystem and community benefits do not have to be mutually exclusive, and with the Traditional Owners, is a fundamental component Traditional Owner values.

A healthy ecosystem is best described by its resilience to pressures. Resilience is the ability of species and habitats to cope with change or exposure and remain in a desirable functioning state.

It includes the ability to absorb impacts and continue functioning, and recover, reorganise or build capacity to learn and adapt in between.
Users can search for data and publications topic and key words or using the spatial search.
Users can view the spatial index of monitoring programs in the GBR.

Collation and representation of Monitoring Site Parameters

- Site Location
- What is being monitored?
- When monitoring has occurred?
- Frequency of sampling?
- Who is doing sampling?
- Program name?
- Parameters sampled
- Contact person
- Hyperlink to the monitoring data
- Data availability and data sharing agreements
Access to interactive maps of Reef data that is essential to Reef 2050 delivery.

2020: Reef wide maps of the seafloor, habitat and coral types to guide actions. Cairns region is already complete.
3D Habitat Maps for the Great Barrier Reef

Coral Type - Slope

-derived data:
- Satellite Image mosaic
- Water Depth
- Wave climate
- Geomorphic
- Bottom type (reef top)
- Coral type (slope)

Resilience Network: “Where and When” decisions
COTS > FMP > Species > Restoration
BUILD A RESILIENCE NETWORK

ENHANCE COMPLIANCE

CONTROL CROWN-OF-THORNS STARFISH

PROTECT KEYSTONE SPECIES

FACILITATE RESTORATION

ACCELERATE CLIMATE CHANGE ACTIONS

FOSTER PARTNERSHIPS FOR LOCAL ACTION

DEVELOP DECISION-SUPPORT SYSTEMS

BUILD AWARENESS AND SUPPORT

ADAPT POLICY AND LEGISLATION

IMPROVING THE CAPACITY OF CORALS AND CORAL REEFS TO RESIST AND RECOVER FROM DISTURBANCE.
Plan

Actions

Monitor

Diagnosis

Prognosis

Decision support tools
Resilience Network 1.0:
33% no-take MPA network
Dynamic exposure mapping can be used to guide management action investments. Kininmonth et al. (in review)
Resilience Network 1.0 > 2.0

**Representation and Replication**

- Habitat Types
- Multiples
- Risk Spreading

<table>
<thead>
<tr>
<th>Disturbance History</th>
<th>Recovery Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (low)</td>
<td>0 (low)</td>
</tr>
<tr>
<td>1 (high)</td>
<td>1 (high)</td>
</tr>
</tbody>
</table>

- Low Disturbance
  - Low Recovery
  - High Recovery
- High Disturbance
  - Low Recovery
  - High Recovery

Principles for building resilience into MPA design
The Reef Resilience (R2) Toolkit – The Nature Conservancy
www.reefresilience.org
RBM in action
Coral cover on high priority reefs > target levels

~150,000 COTS 2019 = 1.5 km² adult coral!

1,000,000’s larvae - critical to support recovery.
Build a resilience network

Enhance compliance

Control crown-of-thorns starfish

Protect keystone species

Facilitate restoration

Image © newlyswissed.com
Outstanding Universal Value

A Healthy Reef for Future Generations