Australian Government
Great Barrier Reef Marine Park Authority

Queensland Government

Managing for Resilience
Great Barrier Reef case study

Dr Roger Beeden – Director, Reef Knowledge Team
Great Barrier Reef Marine Park Authority
2nd December 2019

Traditional artwork by Patricia Galvin.

Conservation Letters
A journal of the Society for Conservation Biology
Volume 7, Issue 3, pages 271–277, May/June 2014

POLICY PERSPECTIVE

Conservation in a Wicked Complex World; Challenges and Solutions

Edward T. Game[1,2], Erik Meijaard[2,3,4], Douglas Sheil[4,5,6], & Eve McDonald-Madden[2,7]

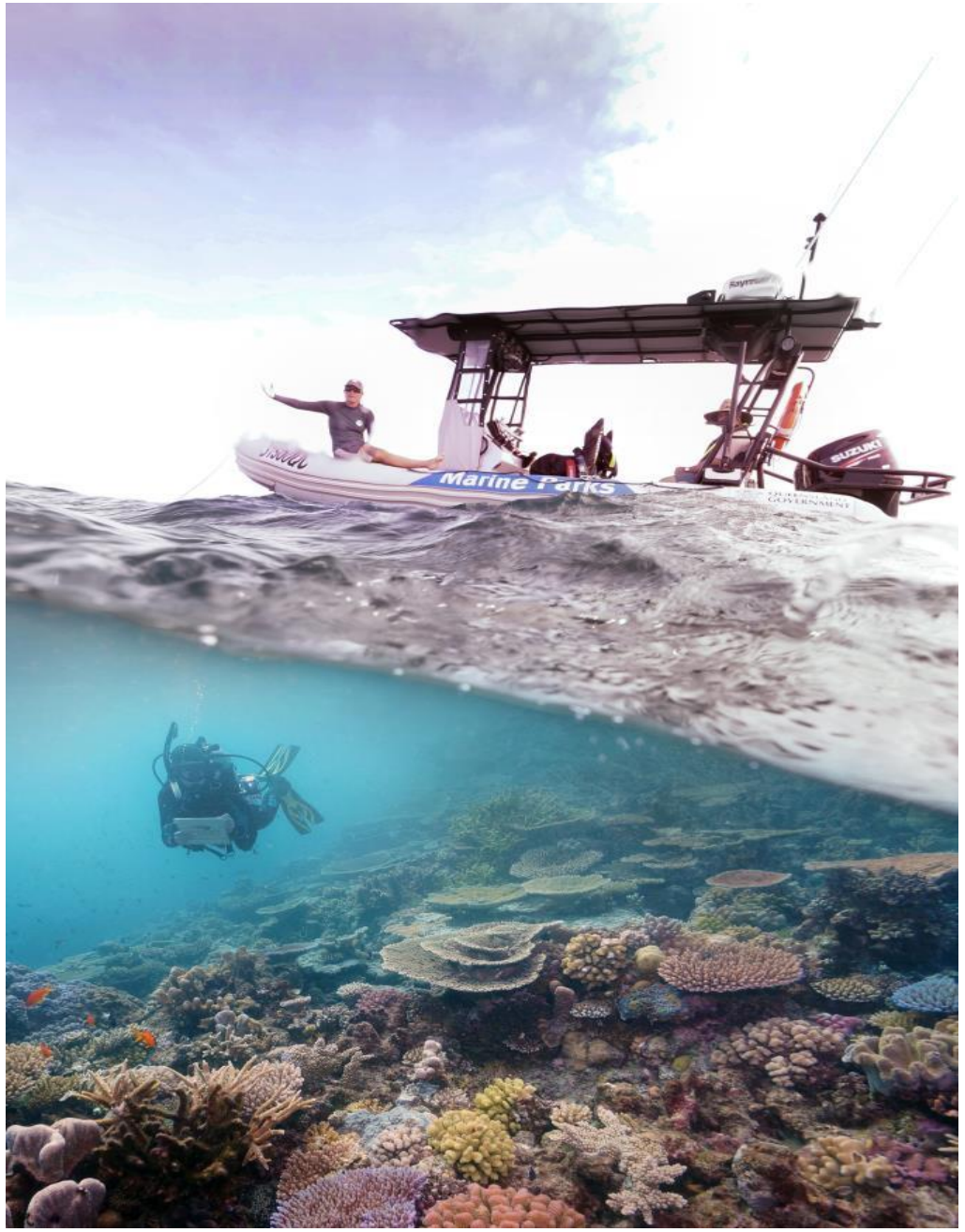
"Conservation is not rocket science;

it is far more complex."

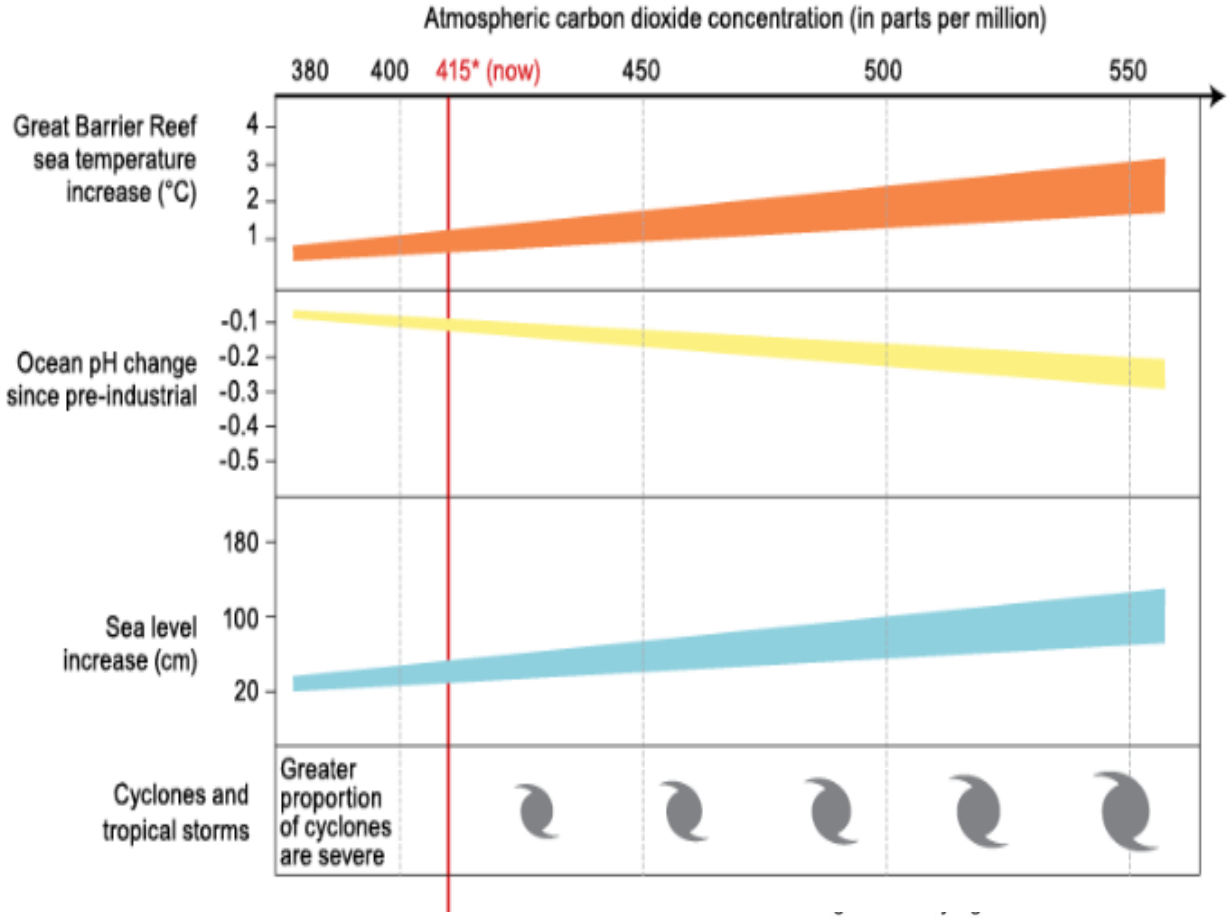
- Rocket flight obeys laws, predictable, so most reach their target, if not reasons are obvious.
- Conservation actions; large uncertainties in the linked socioecological systems, interacting non-linear elements, little central control.
- "Wicked, complex problems"

Solution:

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



Outlook focused management



* For the first time since human existence, the planet's atmosphere has reached 415ppm

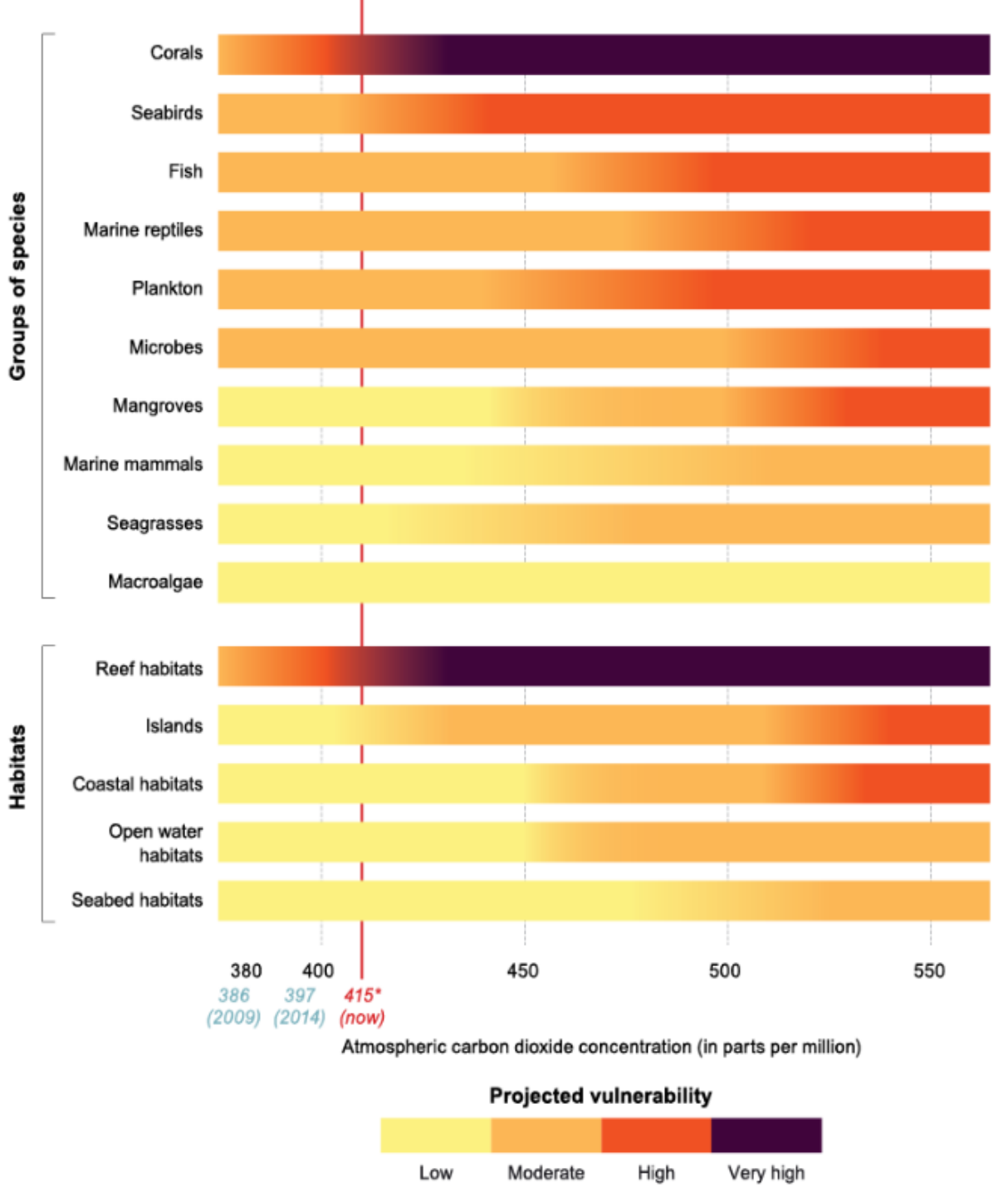
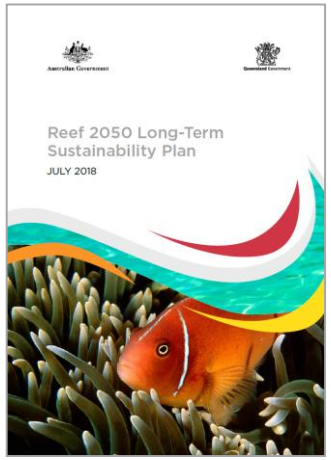
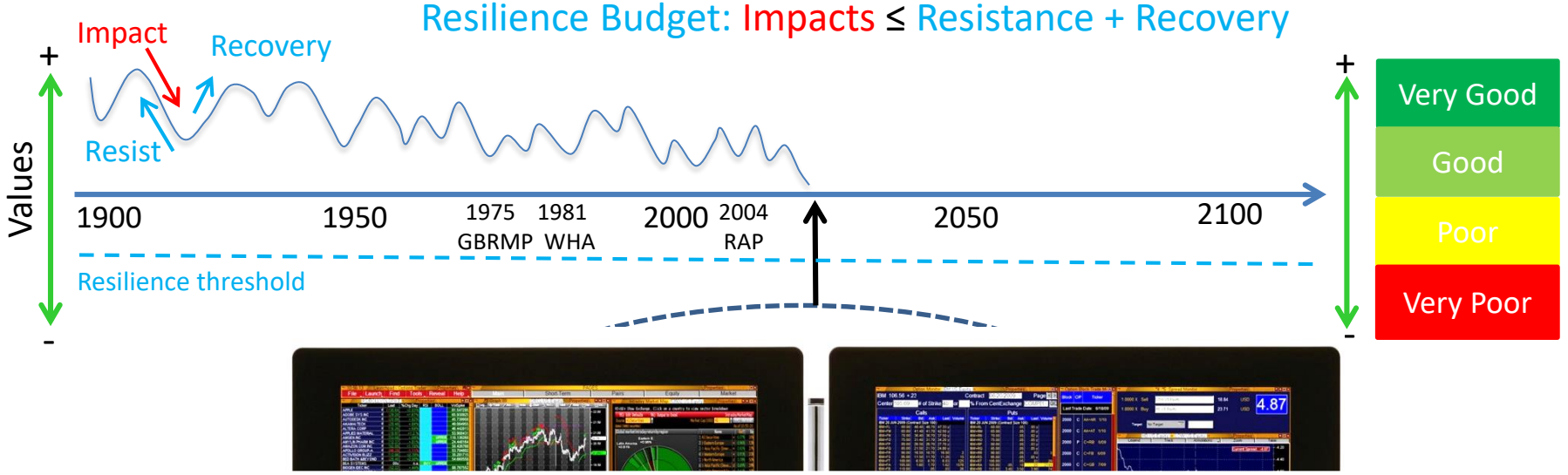


Figure 6.7 Projected vulnerabilities of components of the Reef ecosystem to climate change
Vulnerability differs for a number of ecosystem components and depends on total atmospheric carbon dioxide concentrations. Changes in sea temperatures, ocean pH and sea level are indicative only, based on the latest climate projections.
Source: Adapted from values presented in Gattuso *et al.* 2015[1159] and Hoegh-Guldberg *et al.* 2018[487]





Guidance for Resilience-Based Management

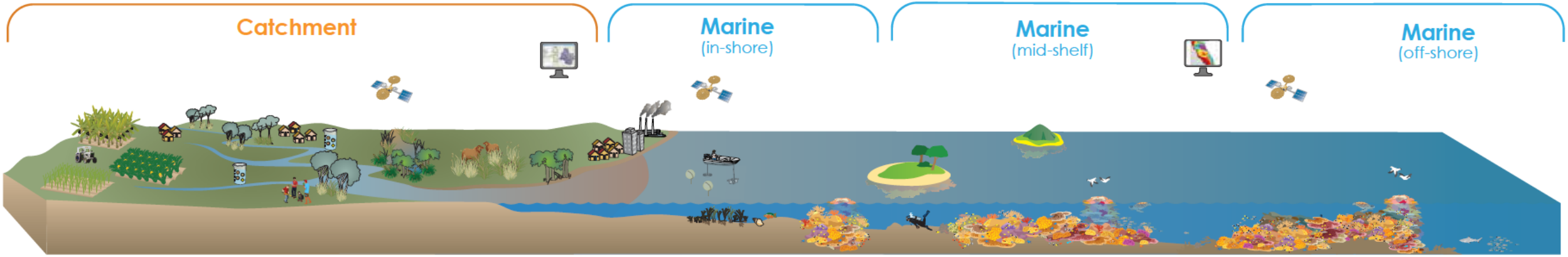
"Targeted investments"

www.gbrmpa.gov.au

Now (Health)

Reef 2050 Integrated Monitoring and Reporting Program

Vision



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

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

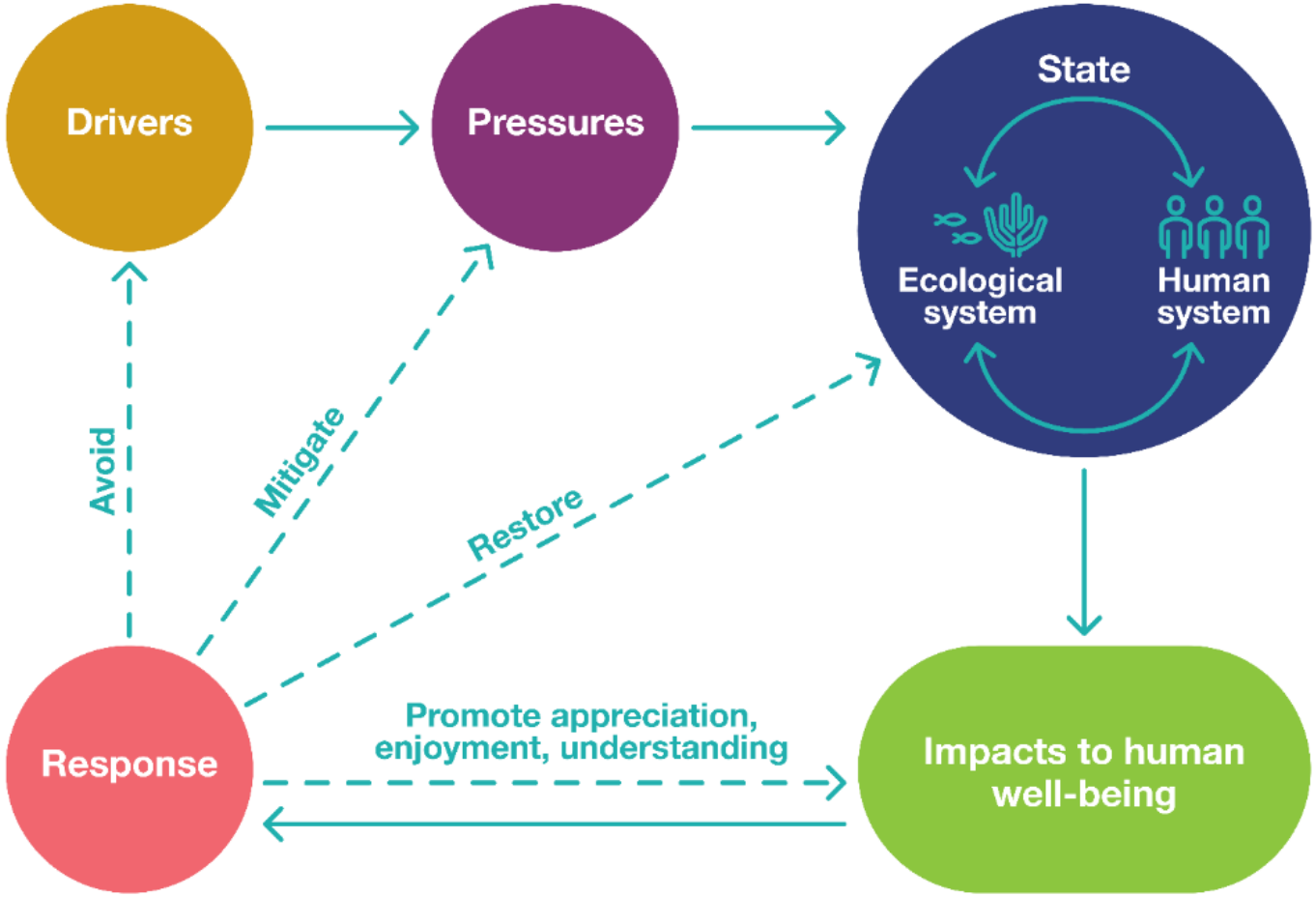
Fish & fisheries • Recreational • Aboriginal & Torres Strait Islander Customary • Commercial • Aquaculture

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 Themes

- Coral reefs
- Seagrass
- Megafauna
- Islands & Microbes
- Human dimensions
- Indigenous heritage
- Fisheries
- Physice-chem
- Catchment & estuaries
- Information from other sources

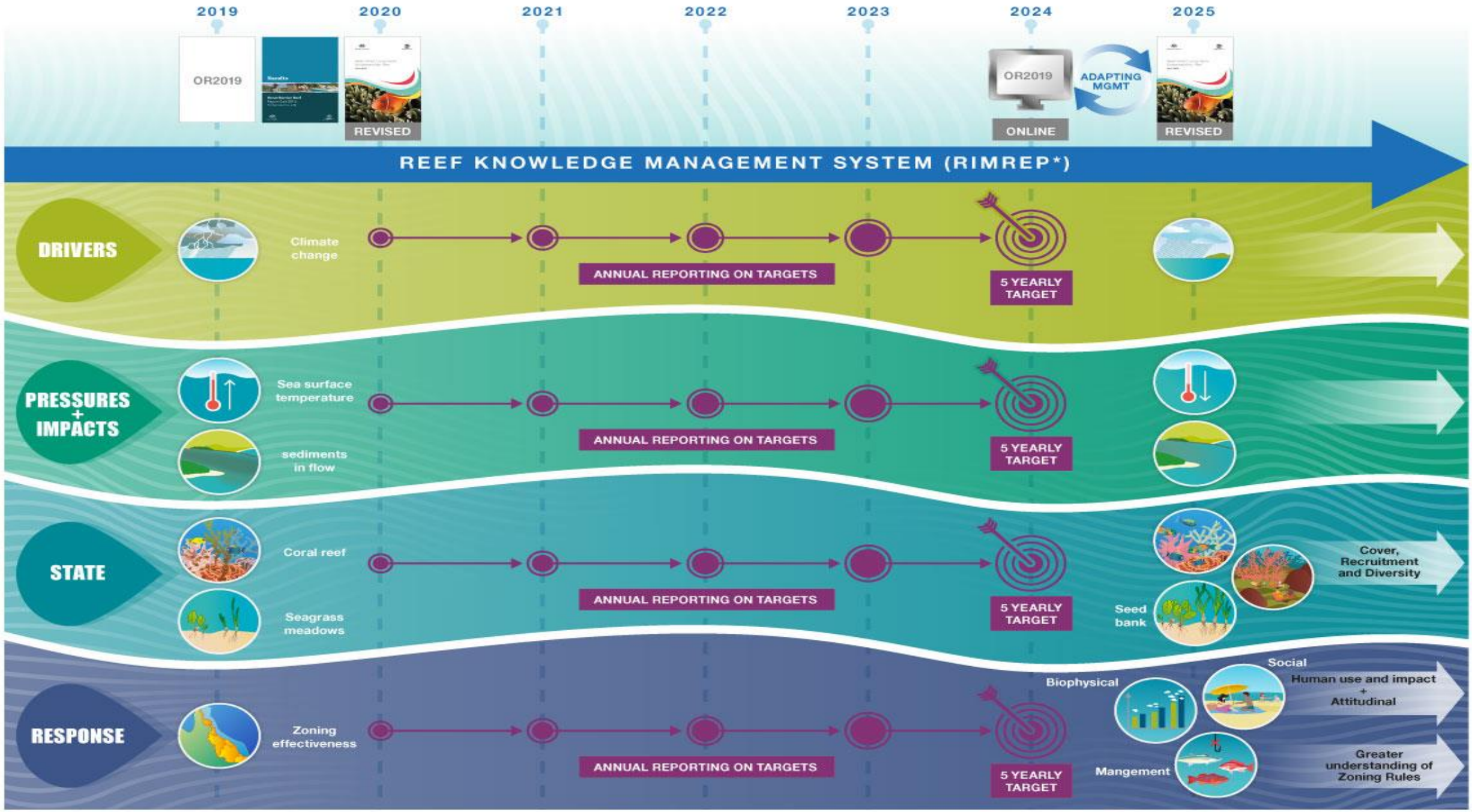
Drivers & Activities

Pressures

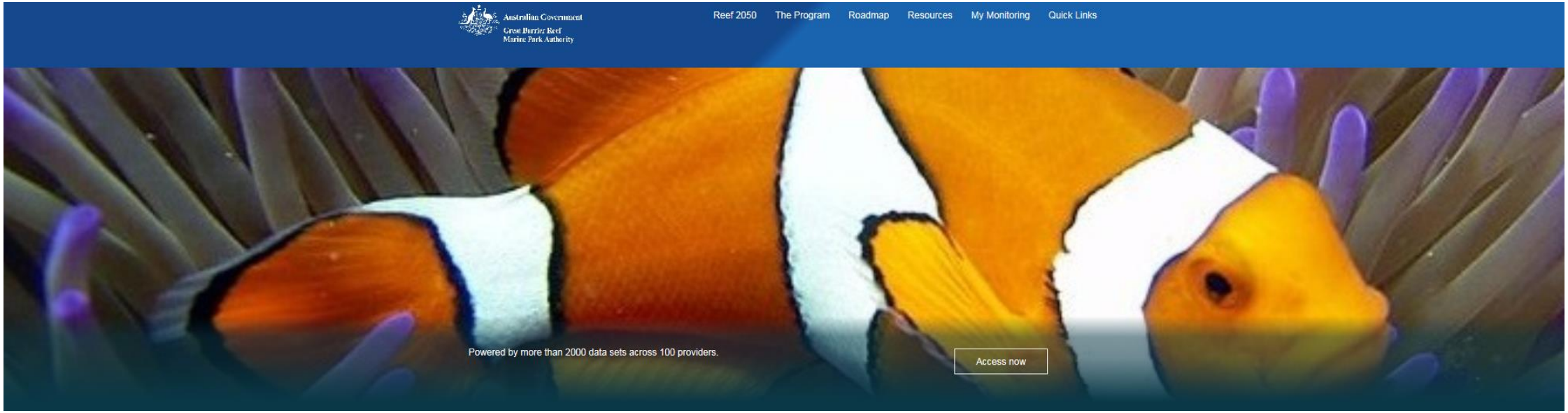
State

Impact

Response


2019
2020
2021
2022
2023
2024
2025
OR2019
REVISED
OR2019
ONLINE
ADAPTING MGMT
REVISED
REEF KNOWLEDGE MANAGEMENT SYSTEM (RIMREP*)
DRIVERS
Climate change
ANNUAL REPORTING ON TARGETS
5 YEARLY TARGET
PRESSURES + IMPACTS
Sea surface temperature
sediments in flow
ANNUAL REPORTING ON TARGETS
5 YEARLY TARGET
STATE
Coral reef
Seagrass meadows
ANNUAL REPORTING ON TARGETS
5 YEARLY TARGET
Seed bank
Cover, Recruitment and Diversity
RESPONSE
Zoning effectiveness
ANNUAL REPORTING ON TARGETS
5 YEARLY TARGET
Biophysical
Social
Human use and impact + Attitudinal
Mangement
Greater understanding of Zoning Rules

RIMREP Prototype – “First Stop Shop”



Program Design

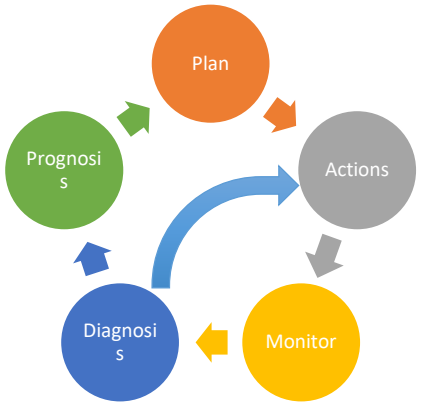
Prototype - Reef Knowledge System

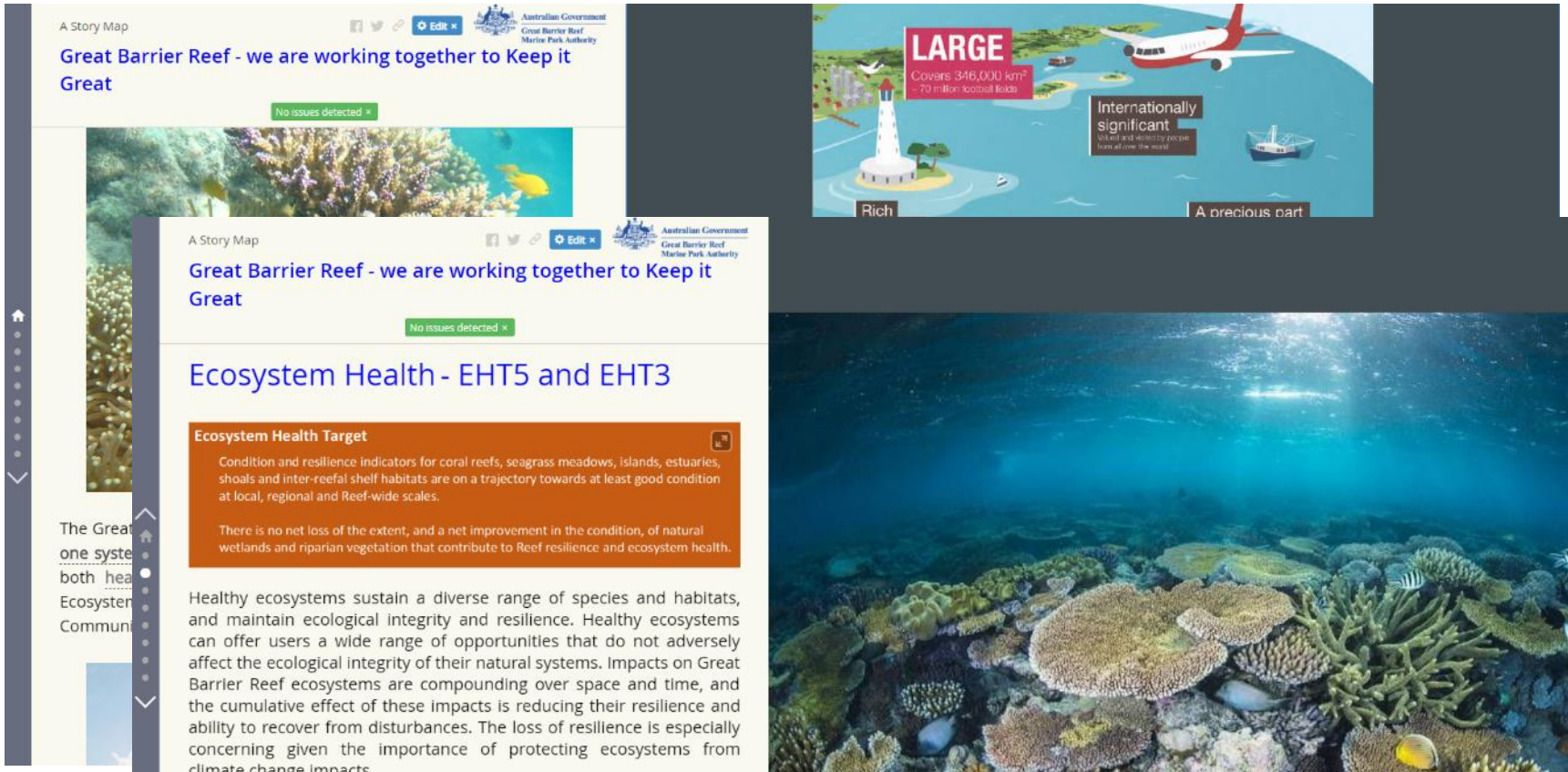
Reference User Network (RUN)

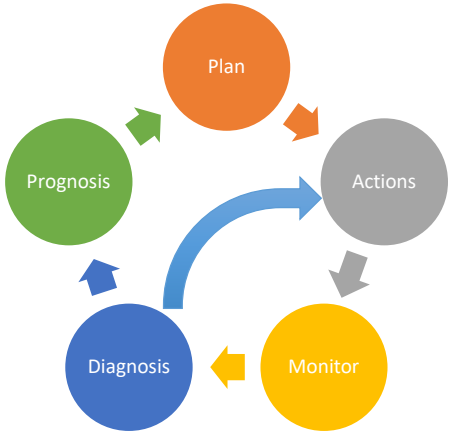
Tools

- Reporting
- Data and publications
- Asset and activities
- Interactive maps
- Guidance

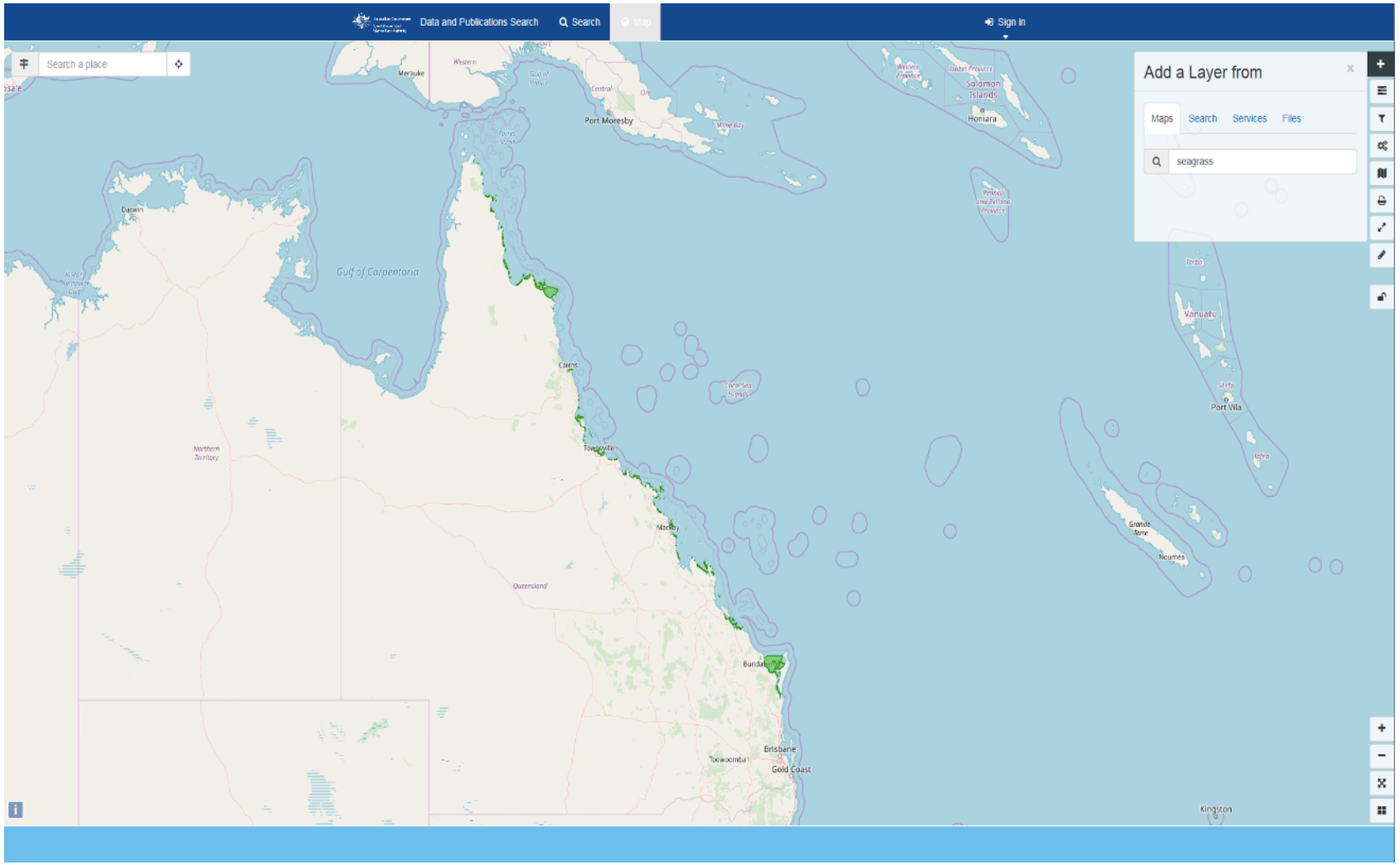
Reporting – Reef2050, Outlook, Report Cards





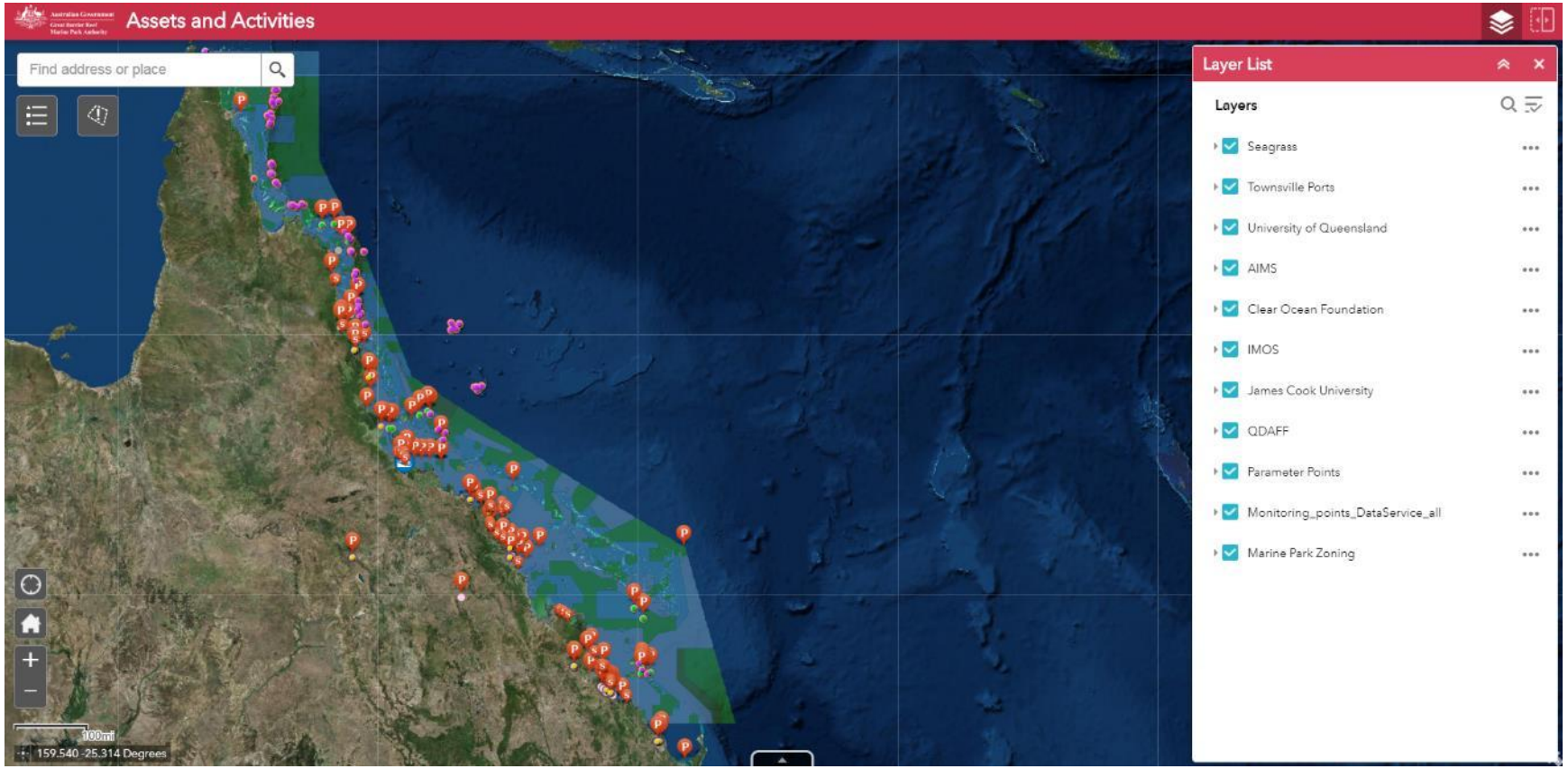


Users can search for data and publications topic and key words or using the spatial search.



Asset and activities

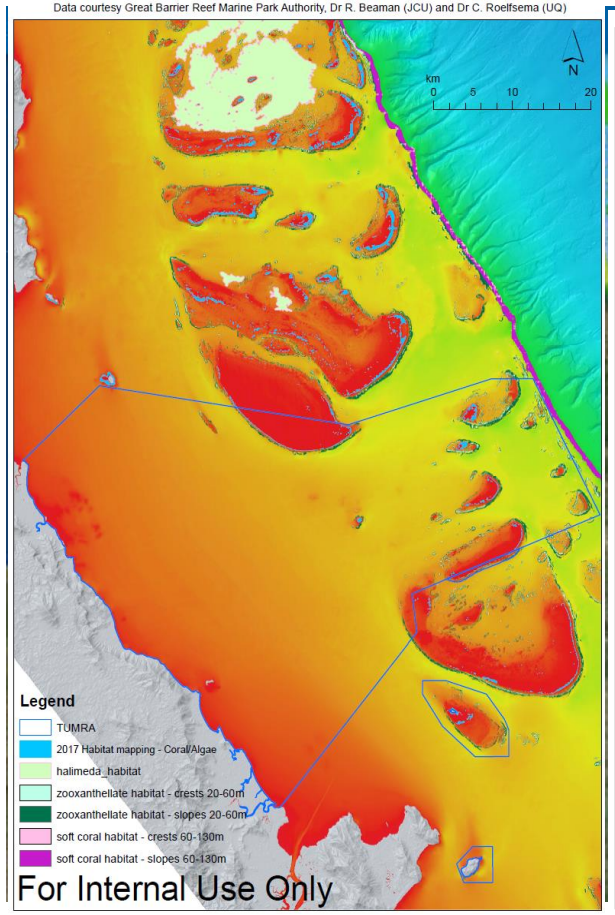
Users can view the spatial index of monitoring programs in the GBR.

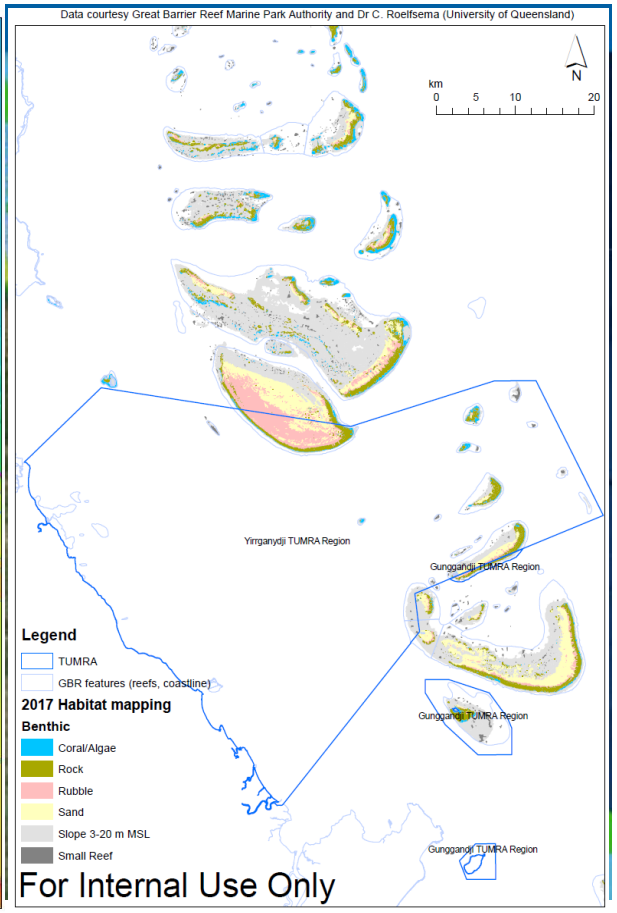


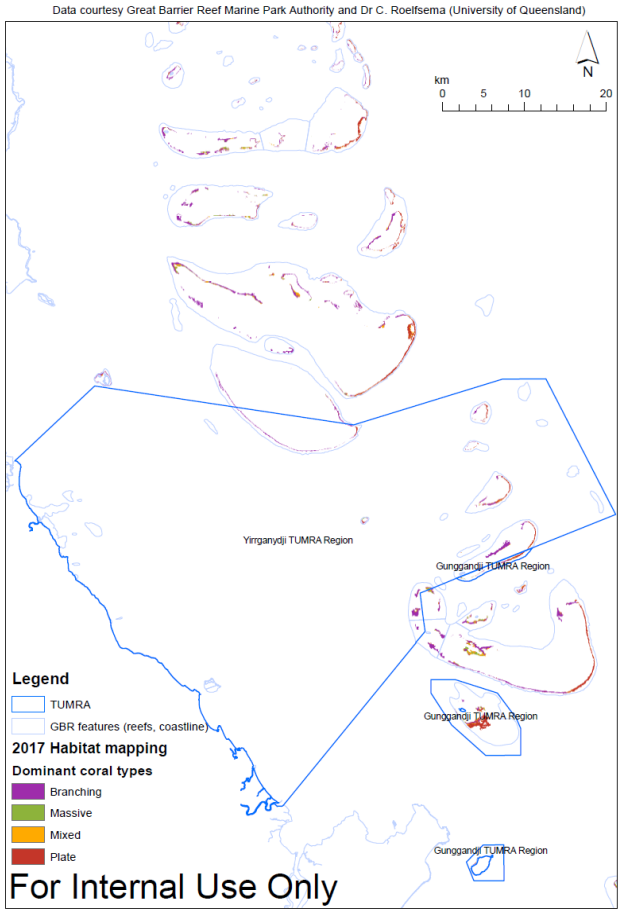
Collation and representation of Monitoring Site Parameters

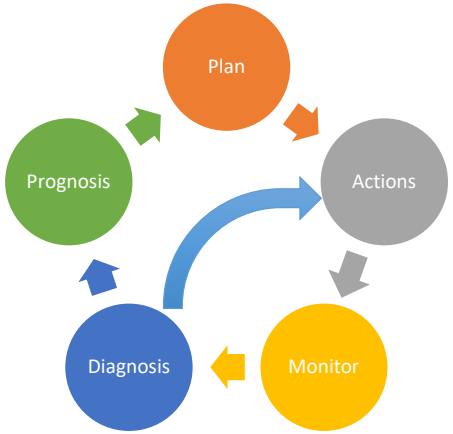
- Site Location
- What is being monitored?
- When monitoring has occurred?
- Frequency of sampling?
- Who is doing sampling?
- Program name?
- Parameters sampled
- Contact person
- Hyperlink to the monitoring data
- Data availability and data sharing agreements

Access to interactive maps of Reef data that is essential to Reef 2050 delivery….



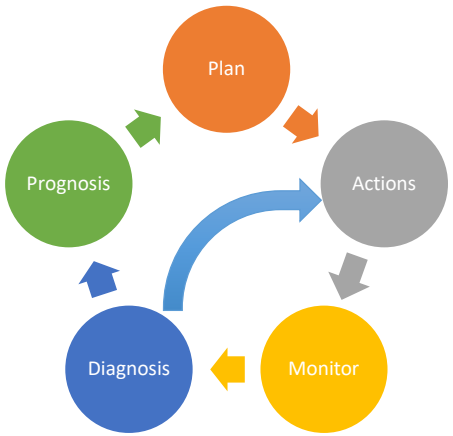




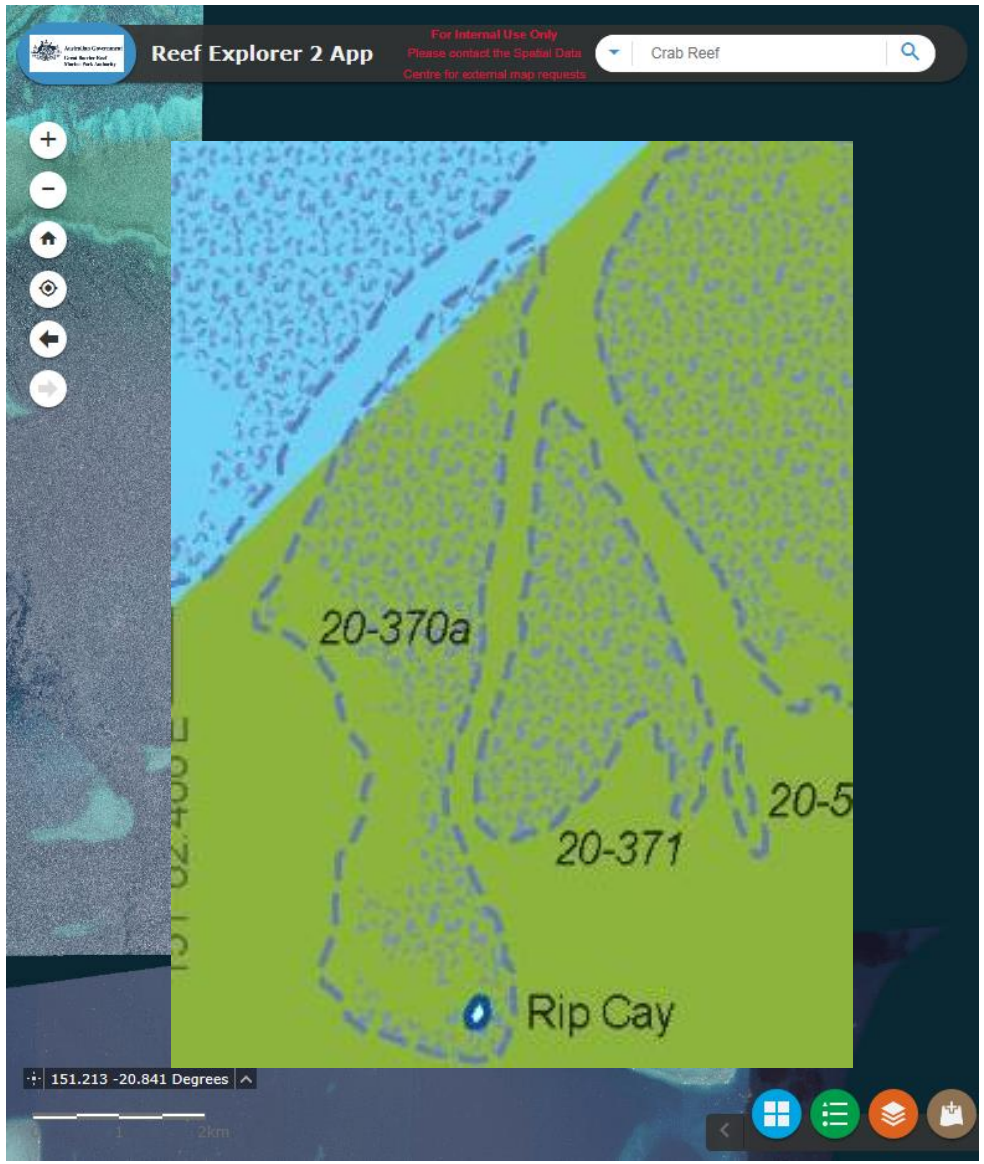


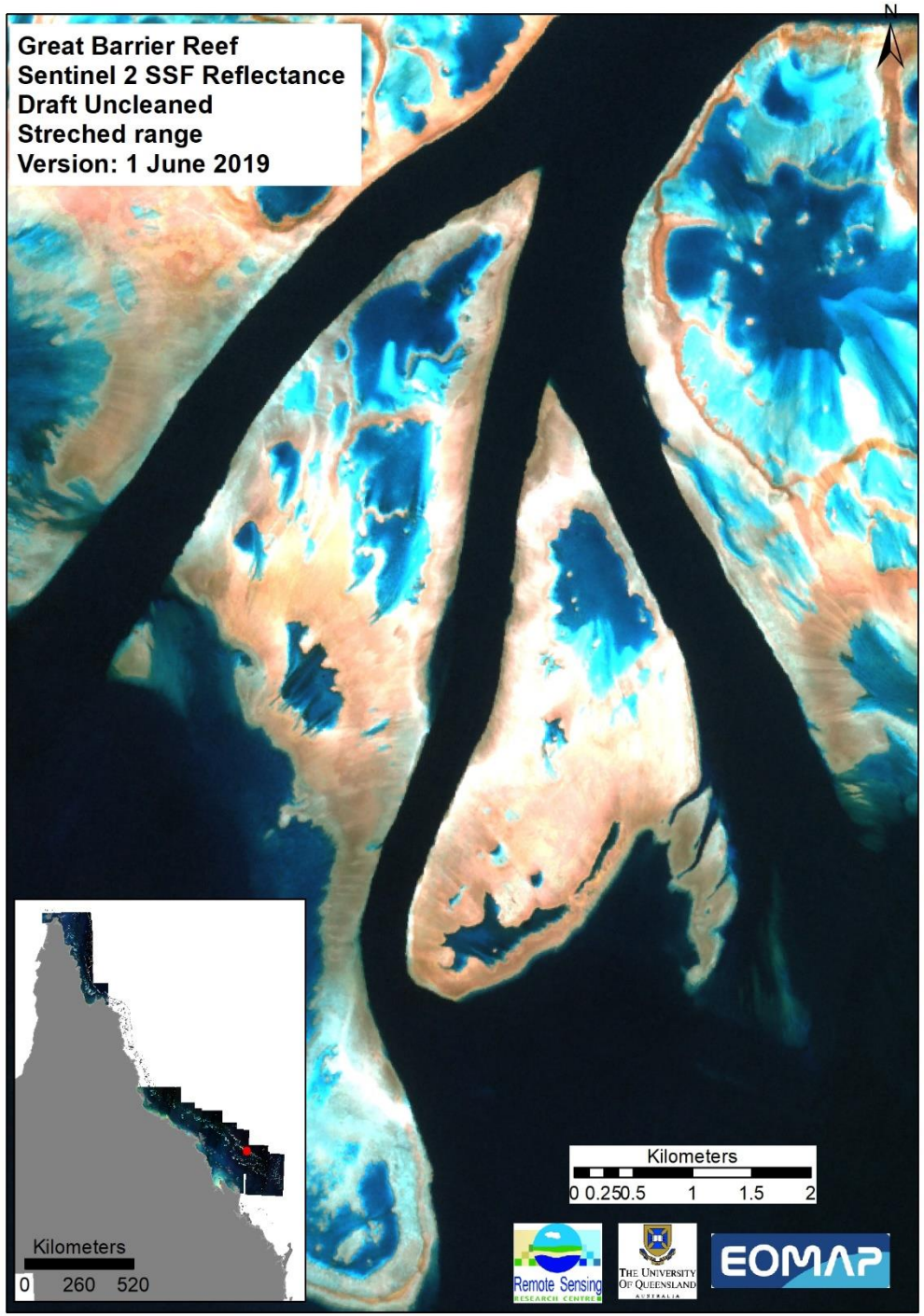
2020: Reef wide maps of the seafloor, habitat and coral types to guide actions.
Cairns region is already complete.


Interactive maps


Plan
Actions
Monitor
Diagnosis
Prognosis


Design/Planning
Evaluation

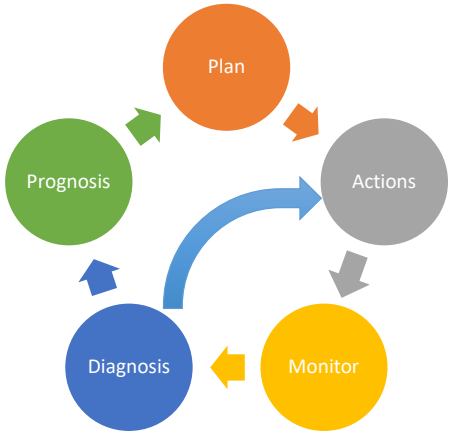

Reef Explorer 2 App
For Internal Use Only
Please contact the Spatial Data
Centre for external map requests
Crab Reef
20-370a
20-371
20-5
Rip Cay
151.213 -20.841 Degrees

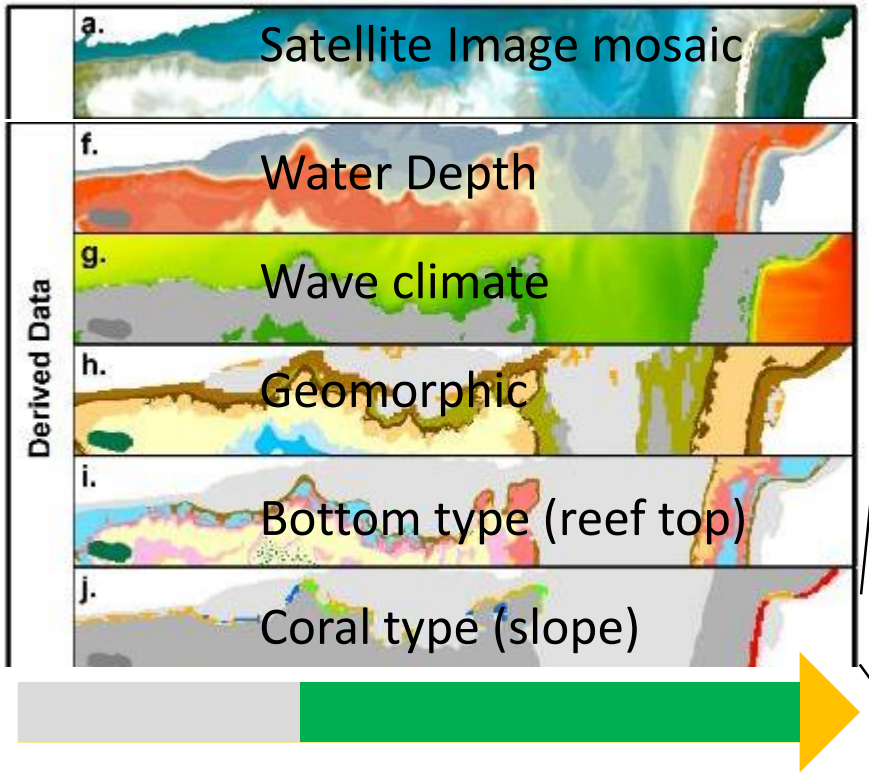

Great Barrier Reef
Sentinel 2 SSF Reflectance
Draft Uncleaned
Streched range
Version: 1 June 2019
N
Kilometers
0 260 520
Kilometers
0 0.250.5 1 1.5 2
Remote Sensing
The University Of Queensland
EOMAP

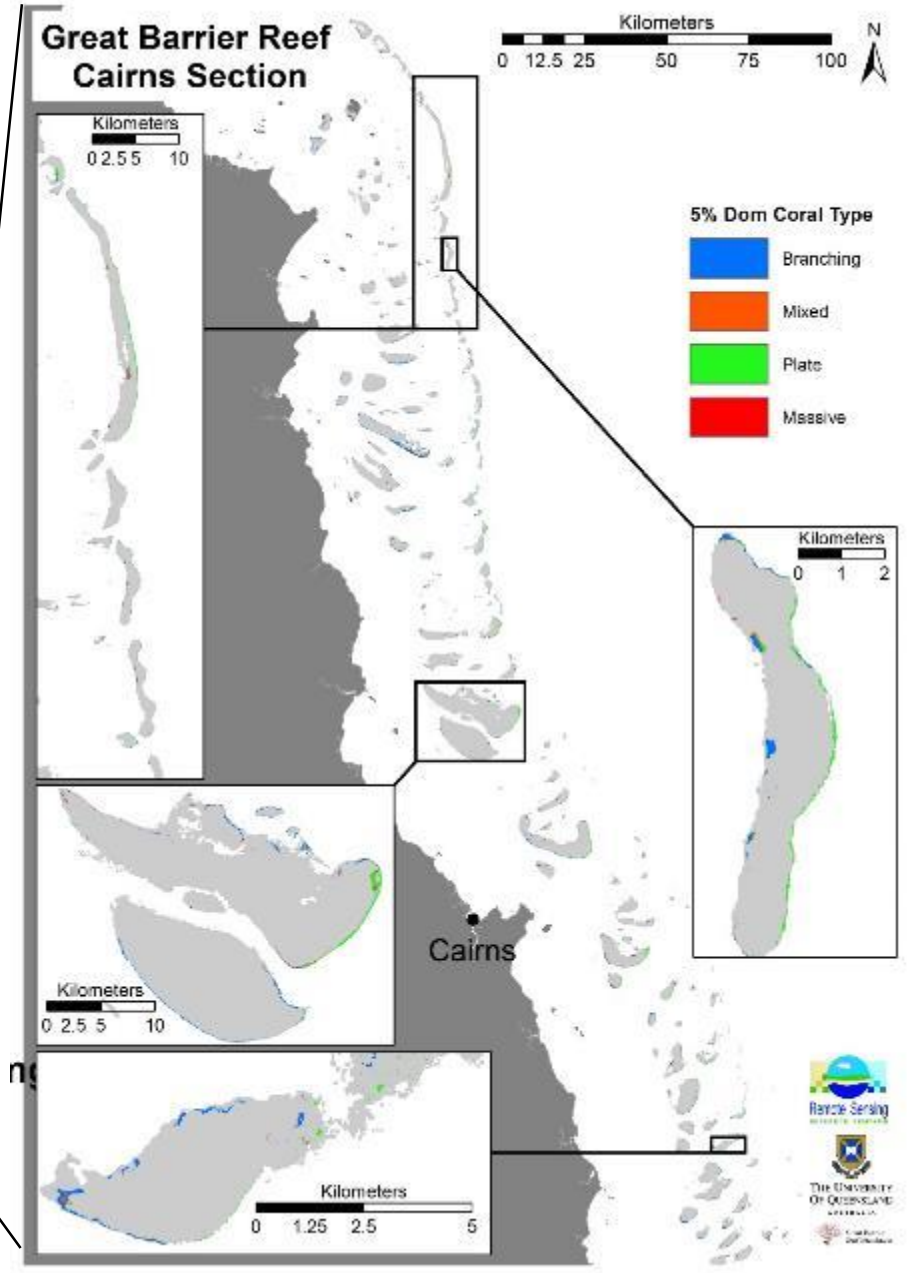
3D Habitat Maps for the Great Barrier Reef

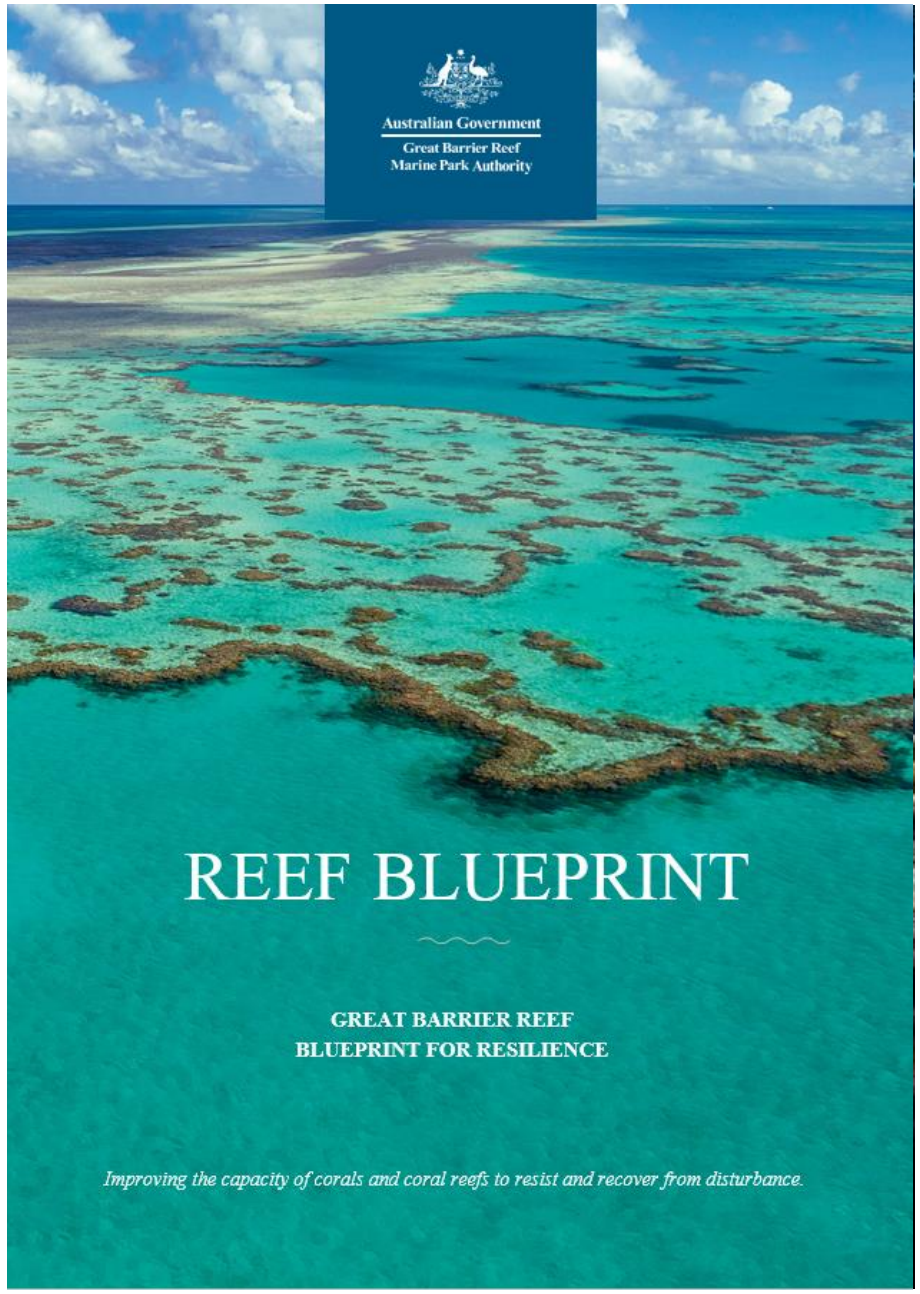
Coral Type - Slope

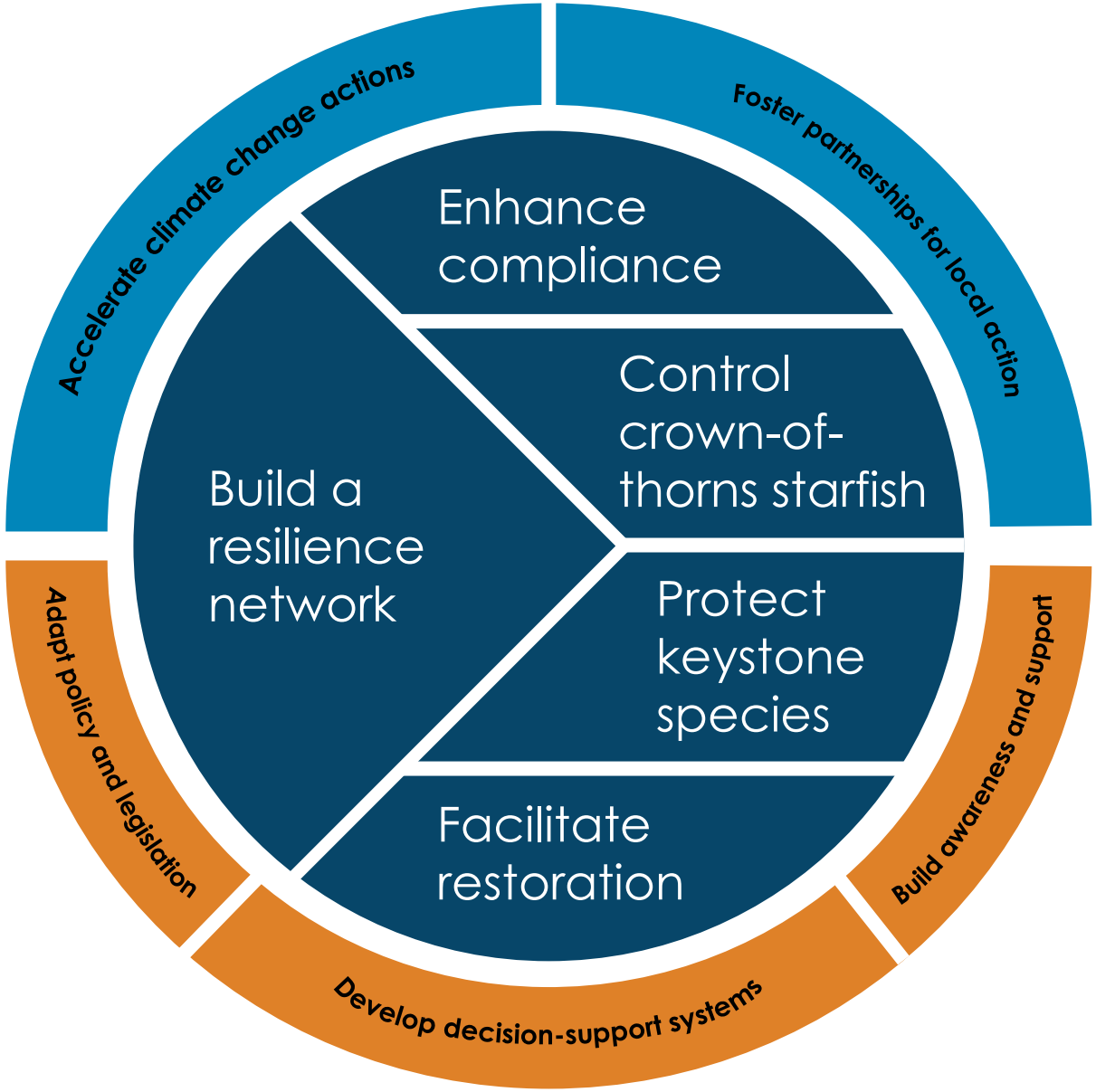
Resilience Network: “Where and When” decisions
COTS > FMP > Species > Restoration



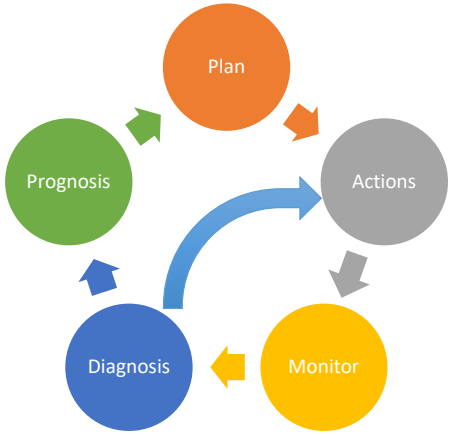




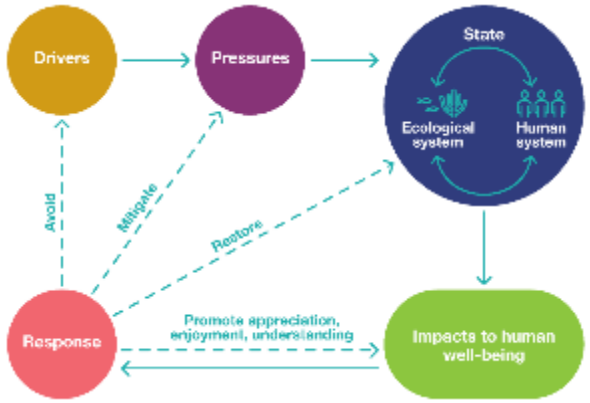

Australian Government
Great Barrier Reef
Marine Park Authority
REEF BLUEPRINT
GREAT BARRIER REEF
BLUEPRINT FOR RESILIENCE
Improving the capacity of corals and coral reefs to resist and recover from disturbance.

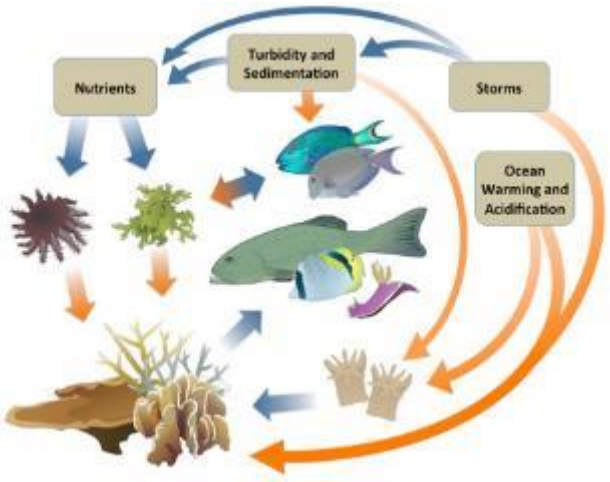

Accelerate climate change actions
Foster partnerships for local action
Enhance compliance
Control crown-of-thorns starfish
Build a resilience network
Protect keystone species
Facilitate restoration
Adapt policy and legislation
Build awareness and support
Develop decision-support systems

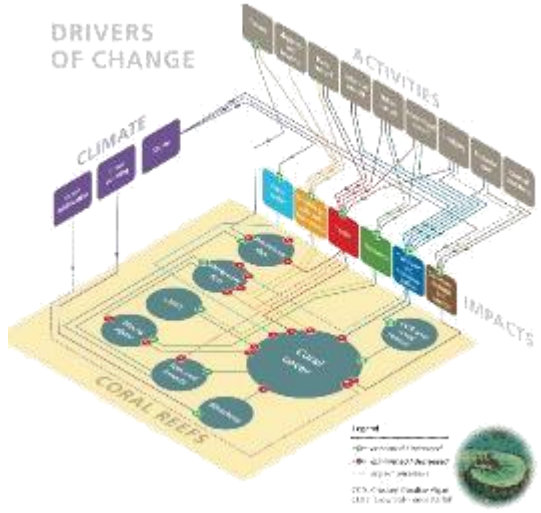
Guidance



Decision support tools

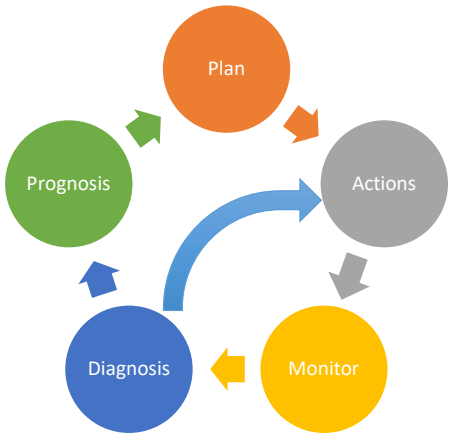


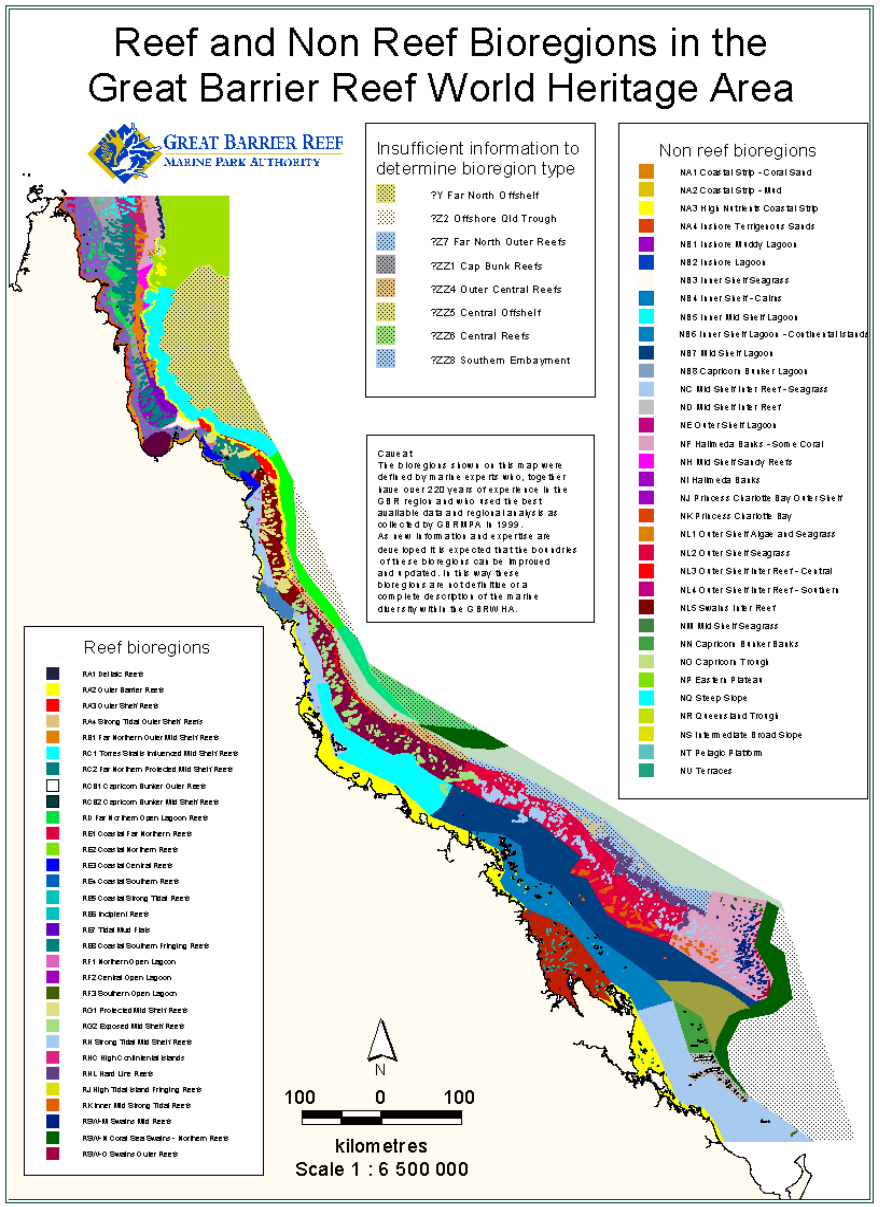


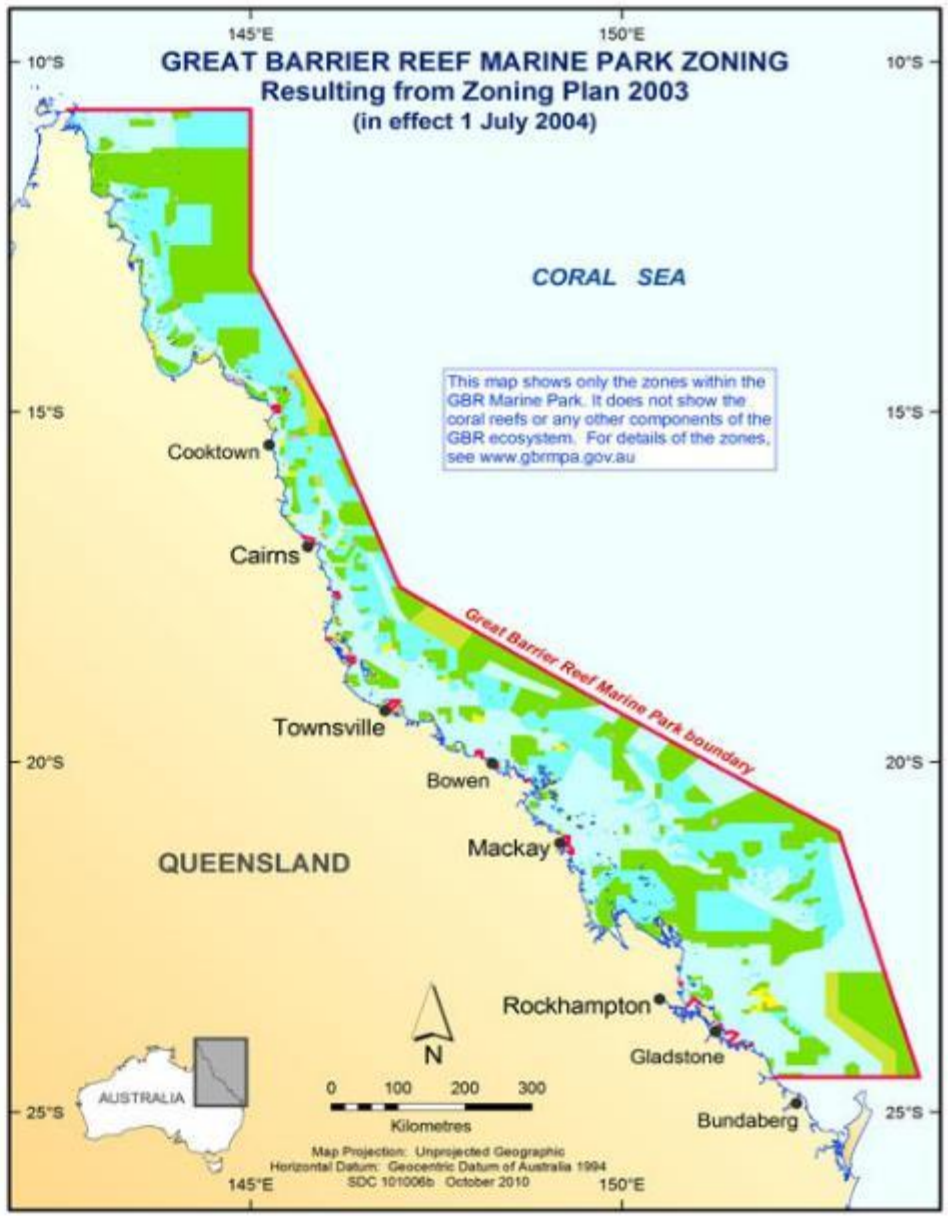


Resilience Network 1.0:
33% no-take MPA network

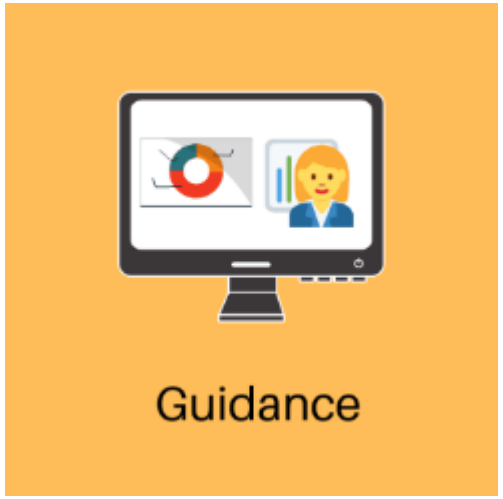
Guidance

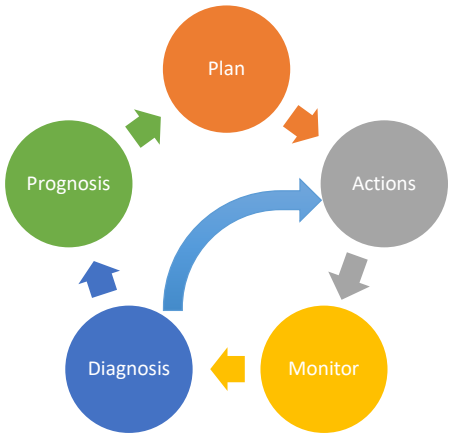


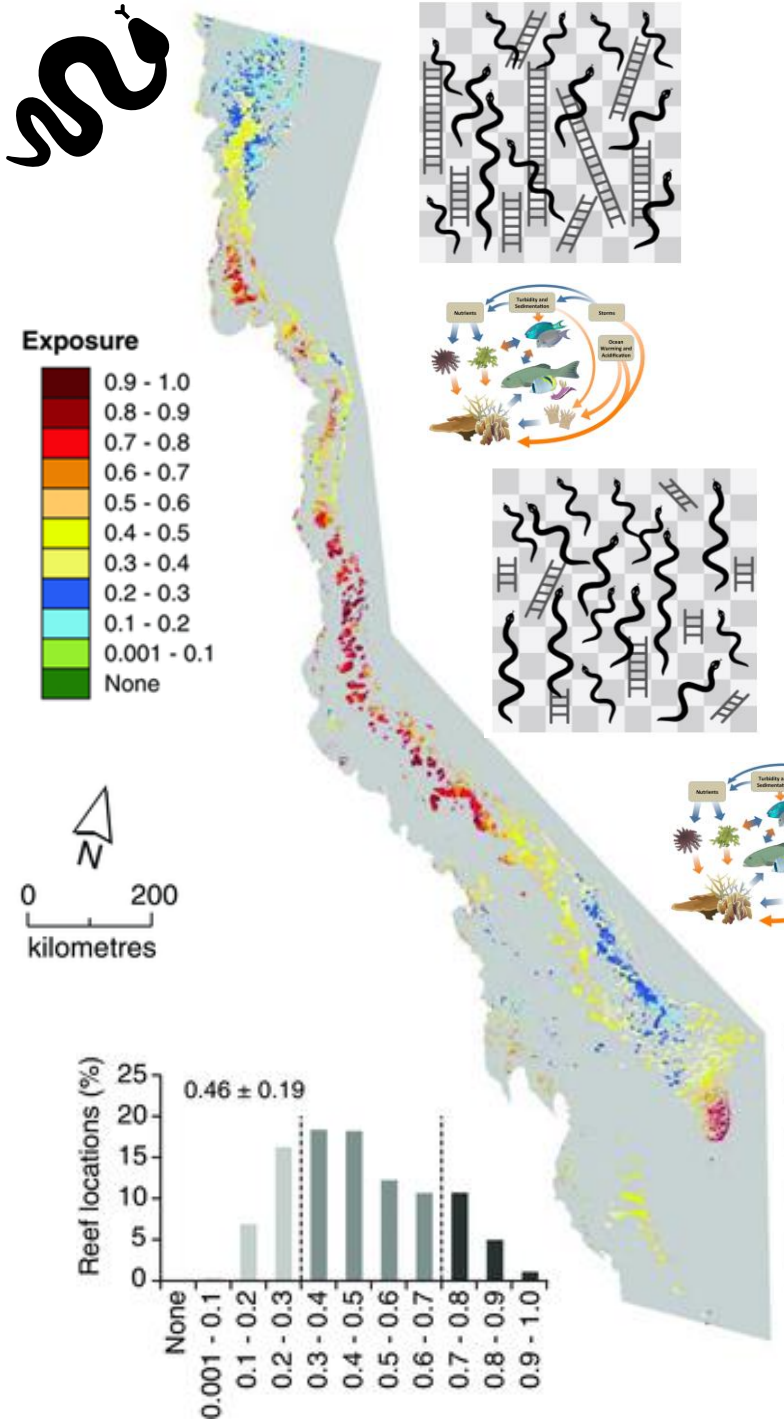


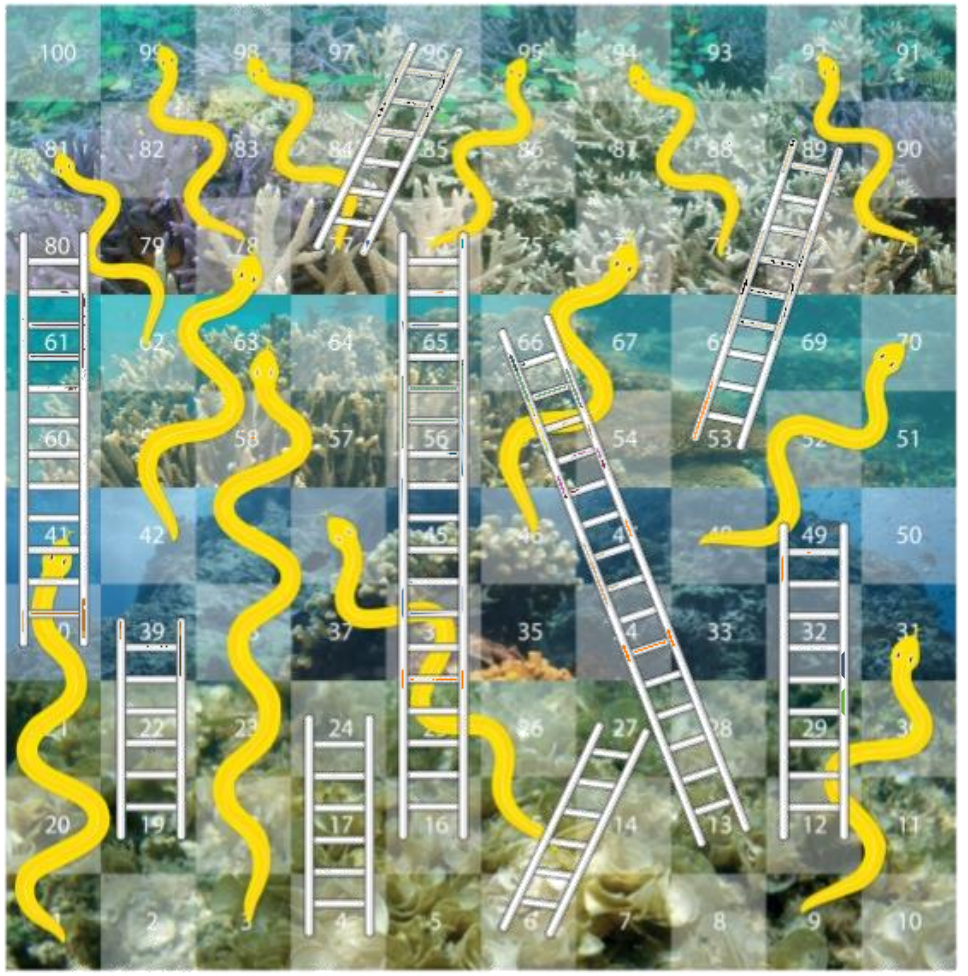


Biodiversity Heritage Integrity Environment



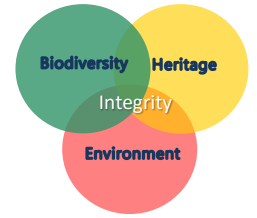


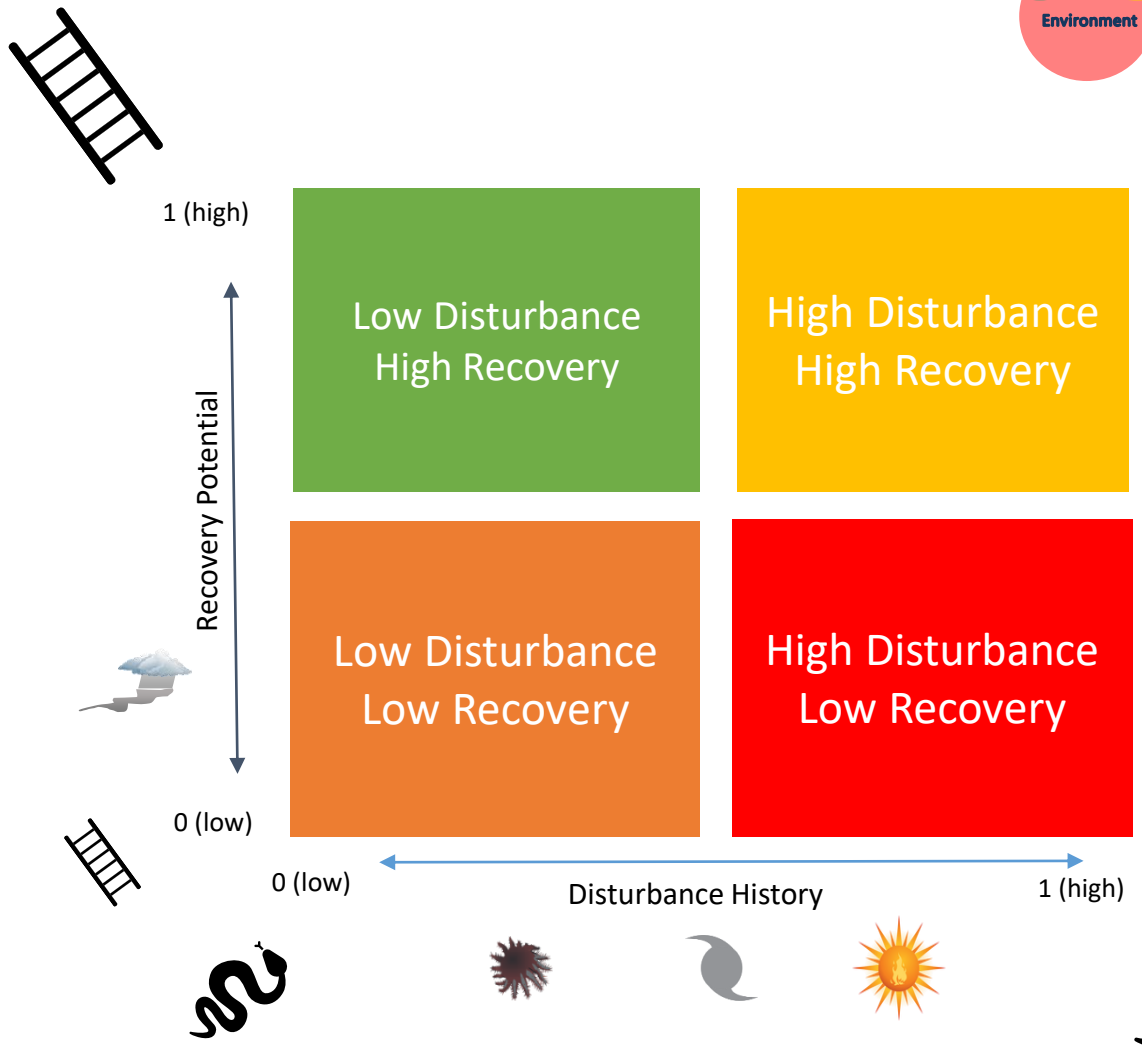




Kininmonth et al. (in review)

Resilience Network 1.0 > 2.0

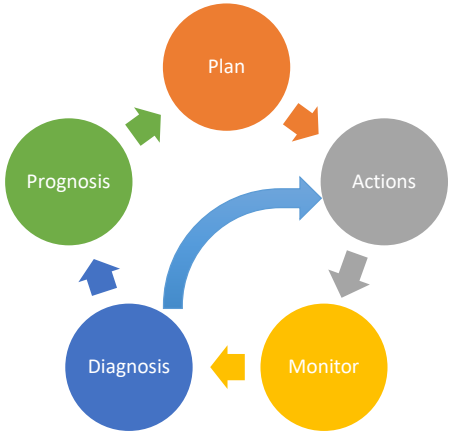




Principles for building resilience into MPA design
The Reef Resilience (R2) Toolkit – The Nature Conservancy
www.reefresilience.org

Resilience Network 2.0

Guidance



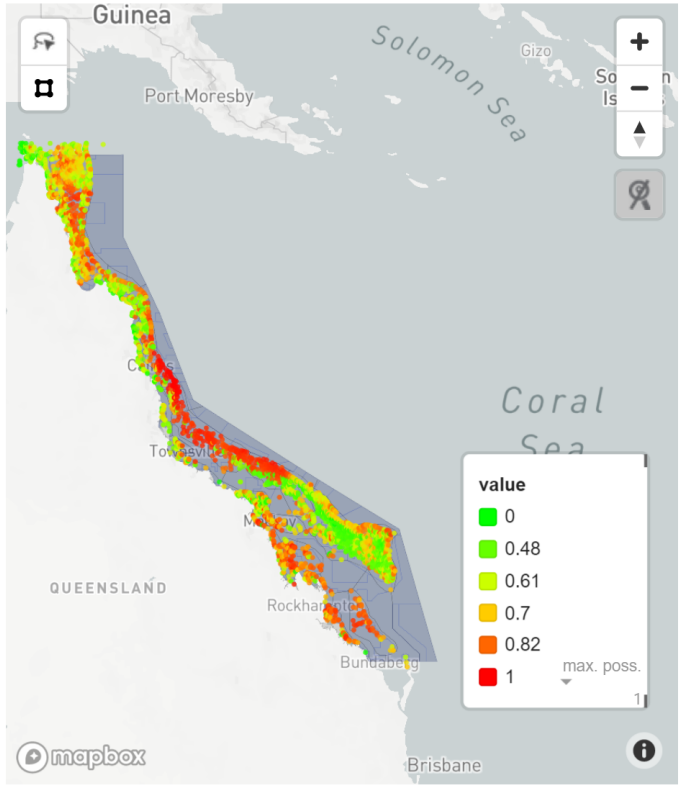
Australian Government
Great Barrier Reef Marine Park Authority

Reef 2050
Integrated Monitoring and Reporting Program
Resilience Report (Coral Reefs)

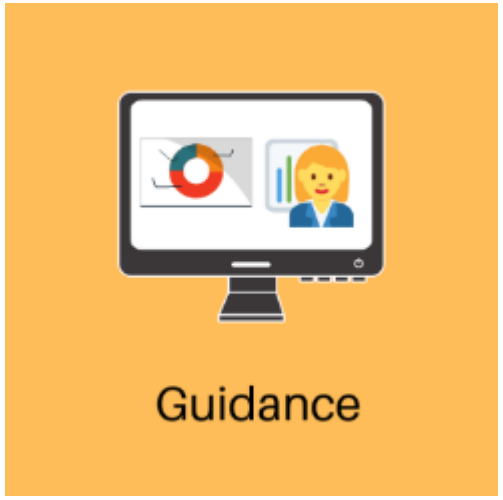
GBR_ZONE	MANAGEMENT_AREA	BIOREGION	REEF_ID
All	All	All	All

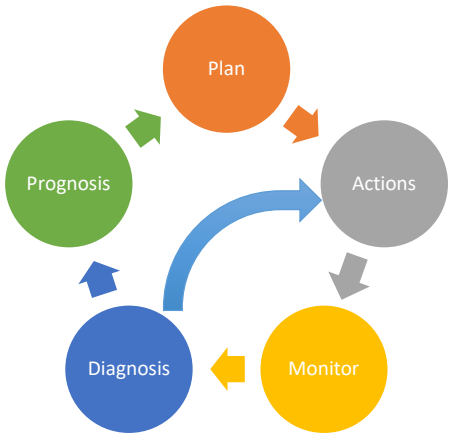
0 = good, 1 = bad | 0 = bad, 1 = good

Disturbance metrics	metrics: F-index, F-reco…	Year
Fdisturb	All	All

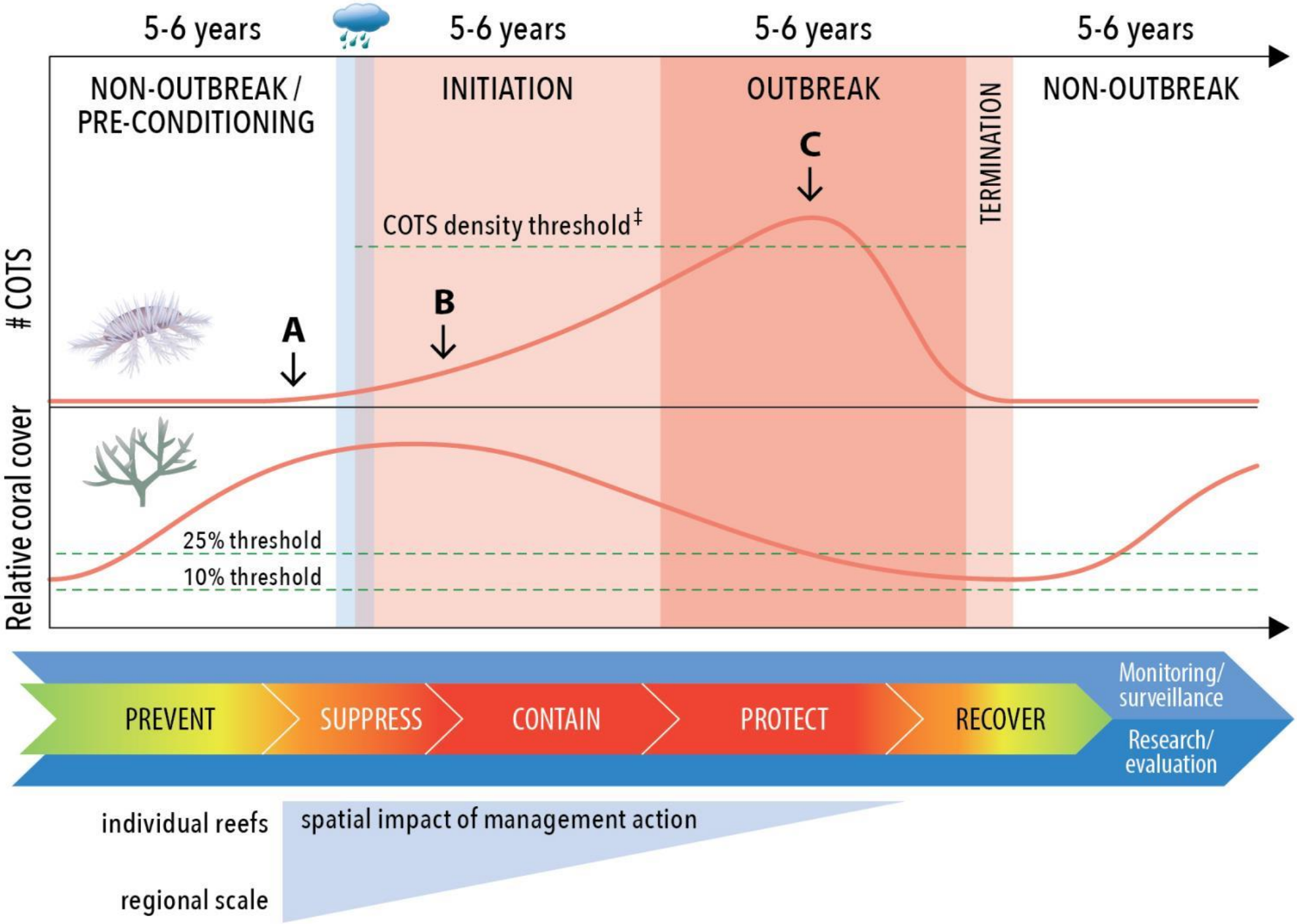


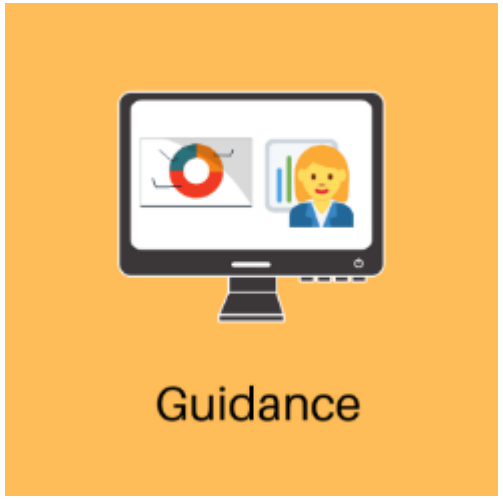
REEF_ID	REEF_NAME	Year	Type	value	GBR_ZONE	MANAGEMENT_AREA	BIOREGION
10-299	U/N Reef	2017	Fdisturb	0.68	Habitat Protection	FAR NORTHERN	RD Far Northern Open Lagoo…
10-314	Ida Reef	2017	Fdisturb	0.09	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-316	Tree Reef	2017	Fdisturb	0.31	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-317	Brush Islet Reef	2017	Fdisturb	0.44	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-318A	Albany Island Reef (No 1)	2017	Fdisturb	0.53	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-318B	Albany Island Reef (No 2)	2017	Fdisturb	0.53	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-318C	Albany Island Reef (No 3)	2017	Fdisturb	0.55	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-318D	Albany Island Reef (No 4)	2017	Fdisturb	0.54	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-320	Mai Reef	2017	Fdisturb	0.53	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-321	Albany Rock Reef	2017	Fdisturb	0.52	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-322	North Brother Reef	2017	Fdisturb	0.65	General Use	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-323	Middle Brother Reef	2017	Fdisturb	0.65	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-324	South Brother Reef	2017	Fdisturb	0.65	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-325	North Ledge	2017	Fdisturb	0.52	Habitat Protection	Outside GBRMPA zoning	RE1 Coastal Far Northern Reefs
10-326	Meggi-Damun Reef	2017	Fdisturb	0.39	Habitat Protection	Outside GBRMPA zoning	RE1 Coastal Far Northern Reefs
10-327	South Ledge	2017	Fdisturb	0.69	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-328	Ulfa Reef	2017	Fdisturb	0.68	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-329	Ariel Bank	2017	Fdisturb	0.67	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-330	U/N Reef	2017	Fdisturb	0.68	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-331	Harrington Shoal	2017	Fdisturb	0.68	General Use	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-332	U/N Reef	2017	Fdisturb	0.09	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-333	U/N Reef	2017	Fdisturb	0.65	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-334	Four Fathom Patches	2017	Fdisturb	0.67	General Use	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-335	Harrington Reef	2017	Fdisturb	0.54	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-336	Wyborn Reef	2017	Fdisturb	0.59	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-337	U/N Reef	2017	Fdisturb	0.62	Habitat Protection	FAR NORTHERN	RD Far Northern Open Lagoo…
10-338	Womer Reef	2017	Fdisturb	0.61	Habitat Protection	FAR NORTHERN	RD Far Northern Open Lagoo…
10-339	Brewis Reef	2017	Fdisturb	0.52	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-340	Turtle Island Reef	2017	Fdisturb	0.52	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-341	Shortland Reef	2017	Fdisturb	0.63	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-342	Trochus Reef	2017	Fdisturb	0.50	Habitat Protection	Outside GBRMPA zoning	RE1 Coastal Far Northern Reefs
10-343A	Turtle Head Island Reef (N…	2017	Fdisturb	0.48	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-343B	Turtle Head Island Reef (N…	2017	Fdisturb	0.48	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-344	Tern Reef	2017	Fdisturb	0.63	Habitat Protection	FAR NORTHERN	RE1 Coastal Far Northern Reefs
10-348	U/N Reef	2017	Fdisturb	0.76	General Use	Outside GBRMPA zoning	RC1 Torres Strait influenced …
10-349	U/N Reef	2017	Fdisturb	0.68	Habitat Protection	FAR NORTHERN	RC1 Torres Strait influenced

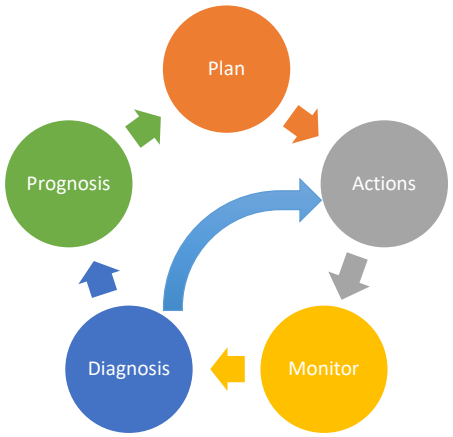

Guidance

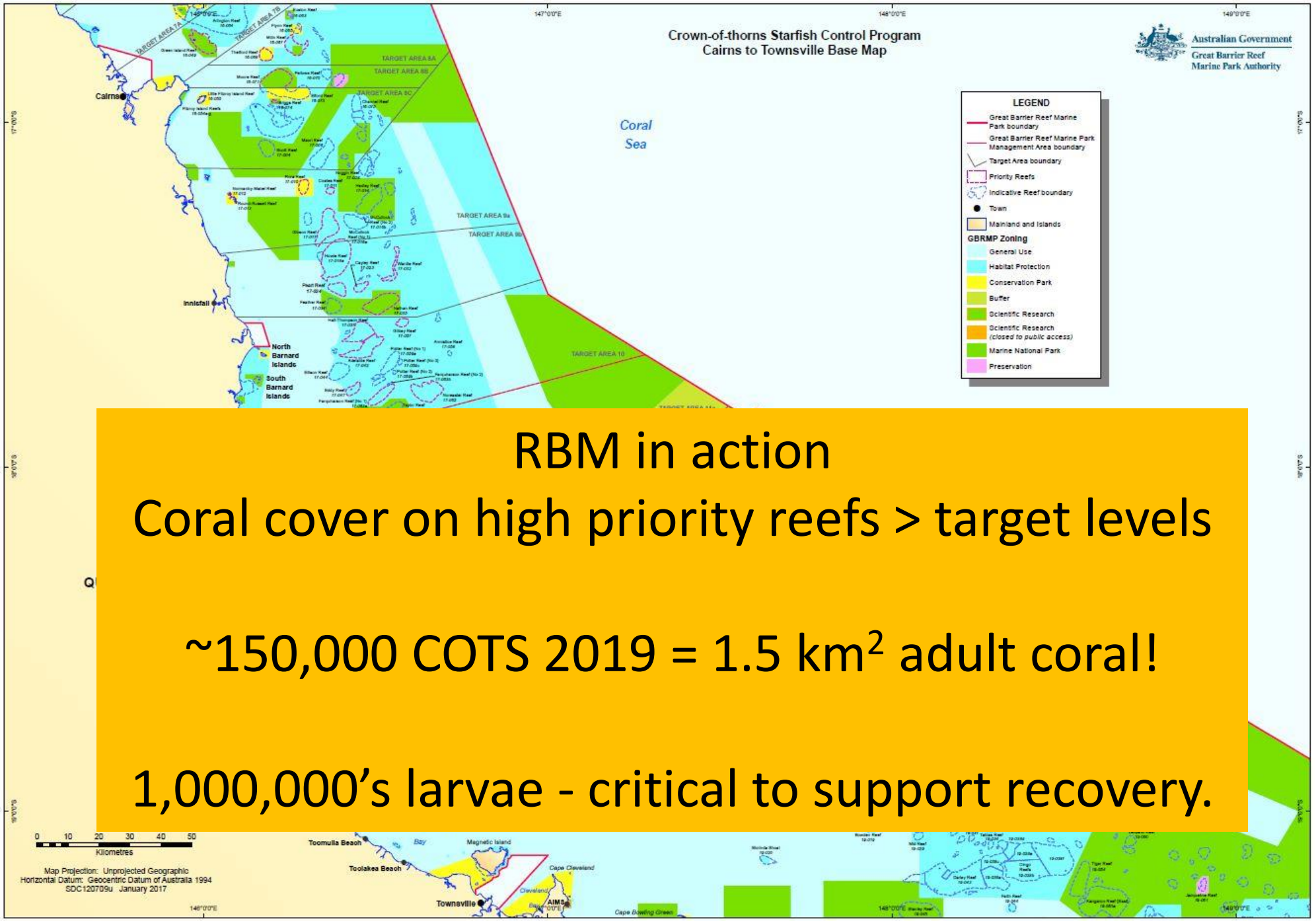

Plan
Actions
Monitor
Diagnosis
Prognosis


Design/Planning
Evaluation


5-6 years
5-6 years
5-6 years
5-6 years
NON-OUTBREAK / PRE-CONDITIONING
INITIATION
OUTBREAK
TERMINATION
NON-OUTBREAK
A
B
C
COTS density threshold‡
COTS
Relative coral cover
25% threshold
10% threshold
PREVENT
SUPPRESS
CONTAIN
PROTECT
RECOVER
Monitoring/ surveillance
Research/ evaluation
individual reefs
regional scale
spatial impact of management action







RBM in action

Coral cover on high priority reefs > target levels

~150,000 COTS 2019 = 1.5 km^2 adult coral!

1,000,000's larvae - critical to support recovery.

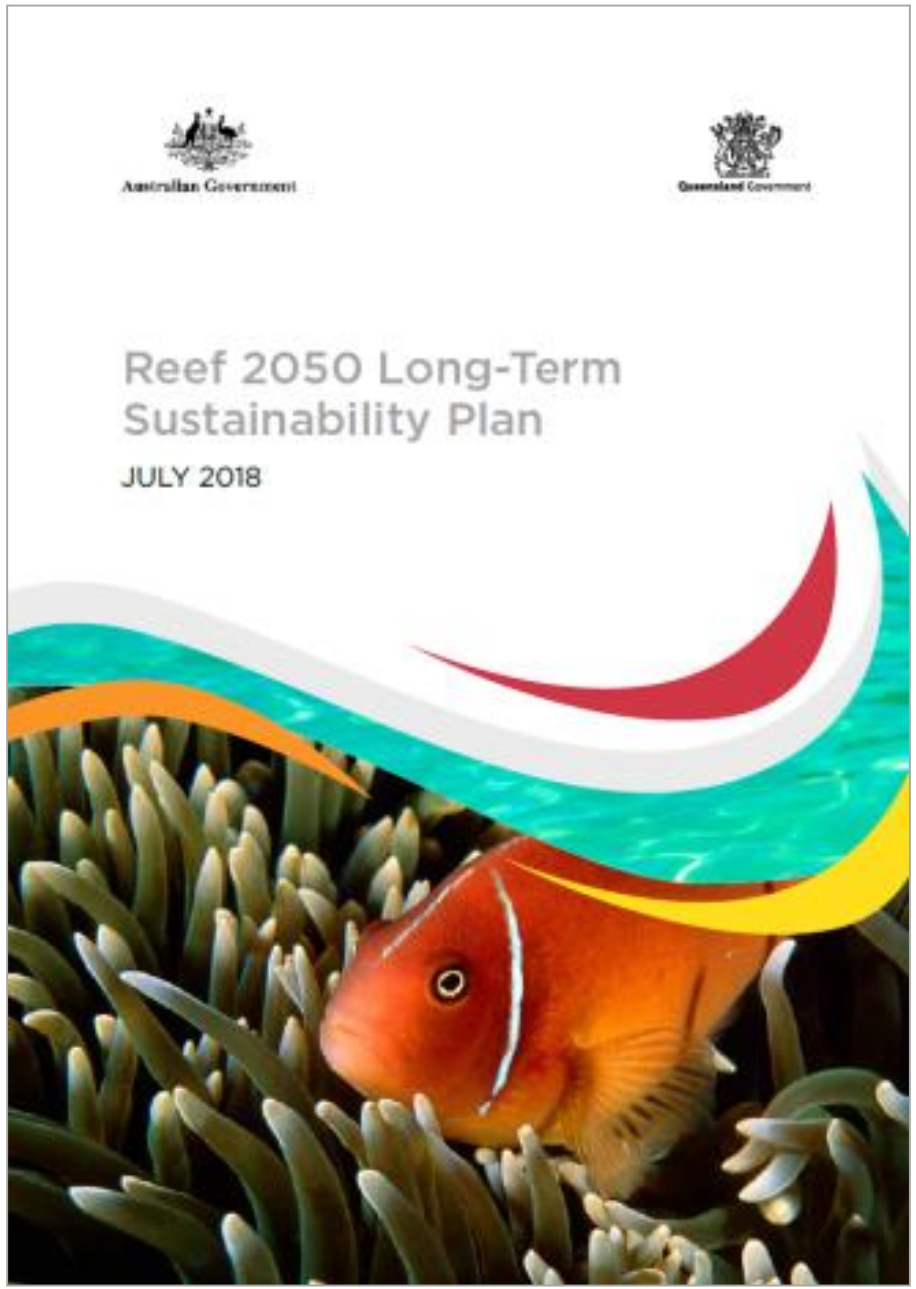
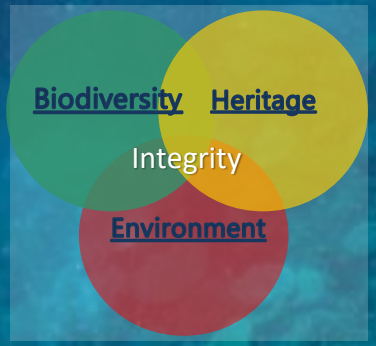


Image © newlyswissed.com

Outstanding Universal Value



Australian Government
Great Barrier Reef Marine Park Authority

EYE ON THE REEF

A Healthy Reef for Future Generations