

Representation, representation, representation

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plus many many others

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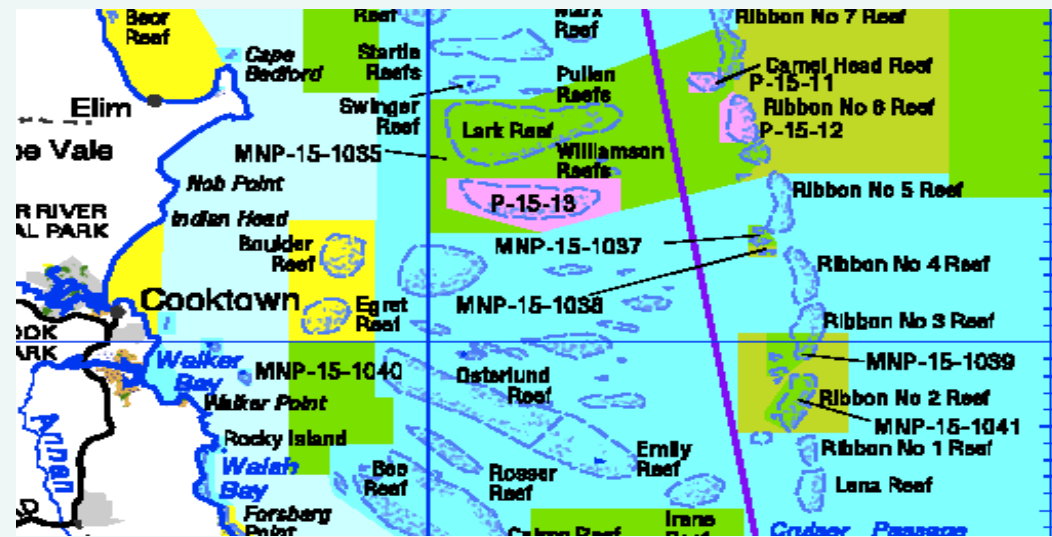


History of process

- Fundamental principles, late 1980s
 - Plus more
- A sympathetic right wing Minister for the environment, 1995
- About biodiversity not food

Systems of MPAs

- Brief history – c2.5% of the world's oceans are MPAs – there are take and non-take zones in that area
- Who decided where they went? Someone jumped in the water. Scoring approaches.
- **Be alarmed** – the processes for choosing them had had little to do with rigorous science or maths
- GBR – 3000 reefs, 14000 areas between reefs



What is systematic marine reserve system design?

Build a **connected/compact system** of protected areas that **equitably** represents **all** habitats and species while **annoying as few other** people as possible

The reserve system design problem

The mathematical problem to which Marxan finds good solutions is:

$$\text{minimize } \sum_i^{N_s} x_i c_i + b \sum_i^{N_s} \sum_h^{N_s} x_i (1 - x_h) cv_{ih}$$

subject to the constraint that all the representation targets are met

$$\sum_i^{N_f} x_i r_{ij} \geq T_j \quad \forall j$$

Meet the conservation targets

Annoy fisherfolk as little as possible

Make the system connected

and x_i , the control variables which tell you if a site is in or out, is either zero or 1

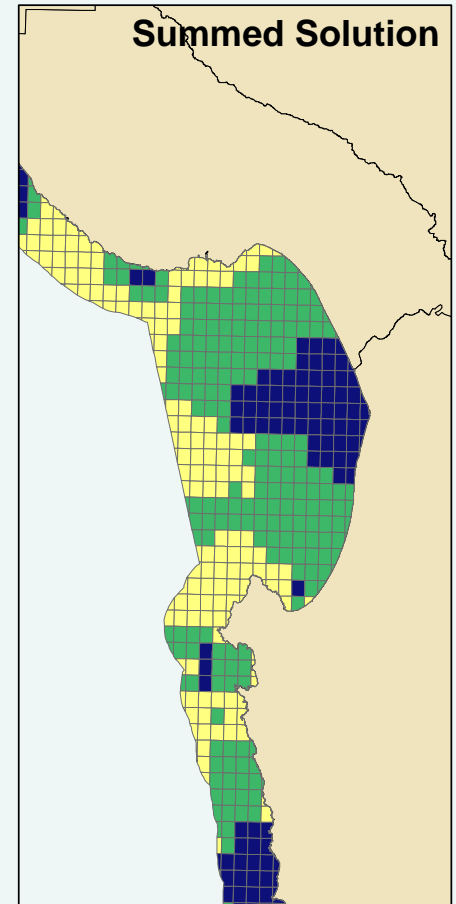
$$x_i \in \{0, 1\} \quad \forall i$$

Every site is either in the reserve system or out of the reserve system

We do have software to do this – Marxan
(<http://www.uq.edu.au/marxan/>)

- an algorithm (**not a model**)

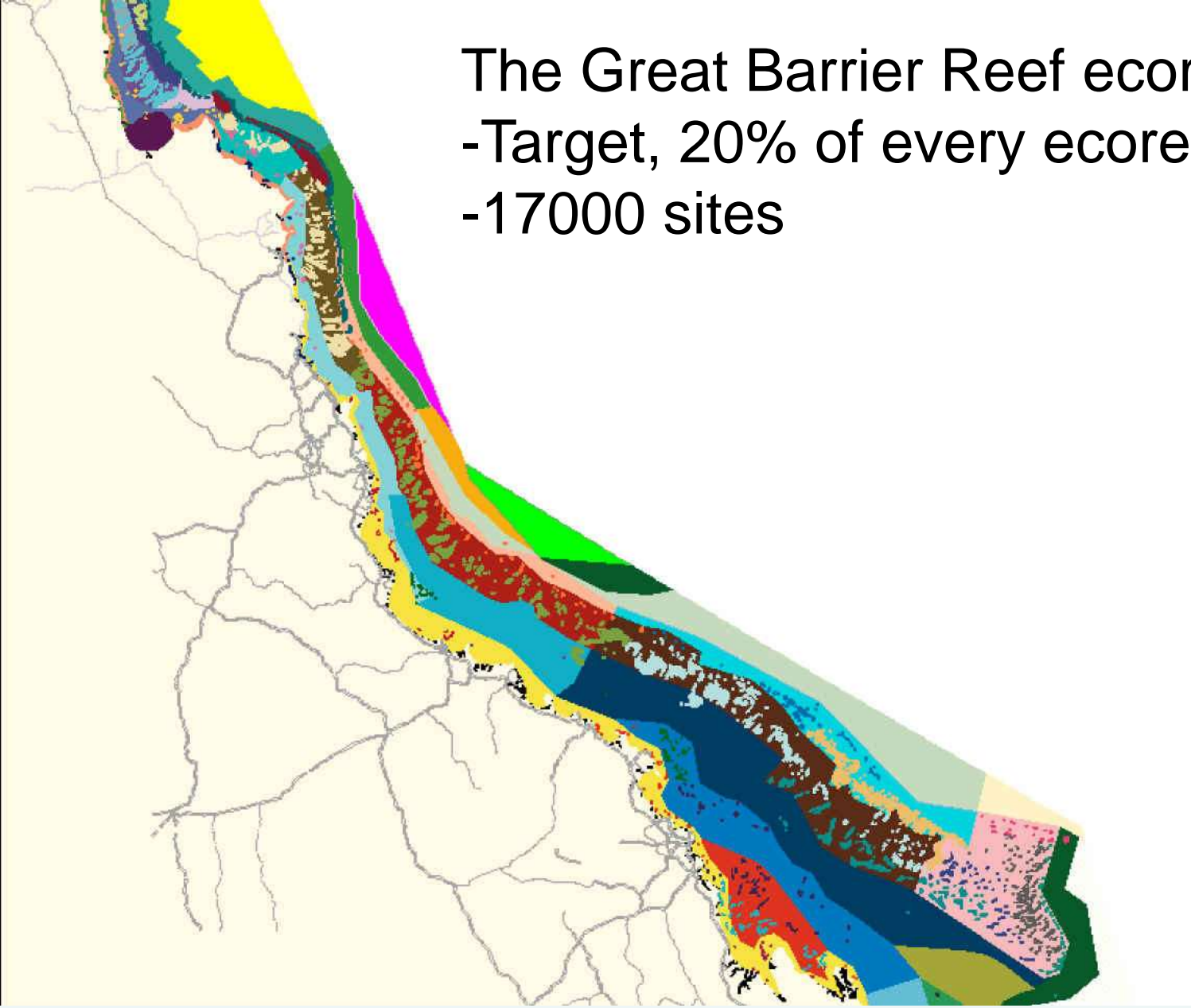
- Get me a **certain amount** (target) of every conservation feature for the **least total cost** in a fairly **compact/connected system - representation**
- Free, **transparent**, decision **support** and used in 100+ countries
- Provides a **variety** of **good** answers
- Must include cost information (and maybe risk)

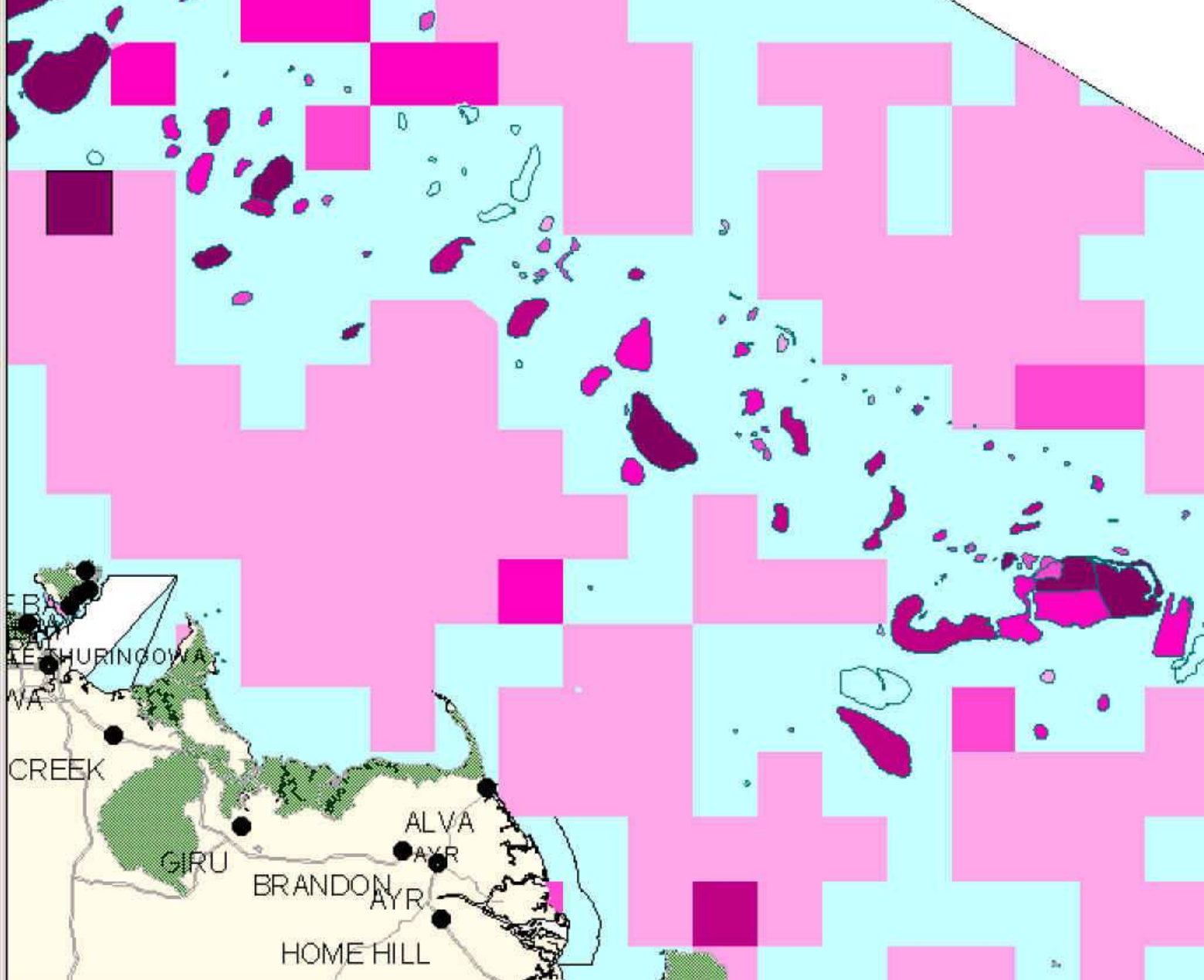


The Great Barrier Reef ecoregions
-Target, 20% of every ecoregion
-17000 sites

c1000km

...30 reef and 40 non-reef bioregions...



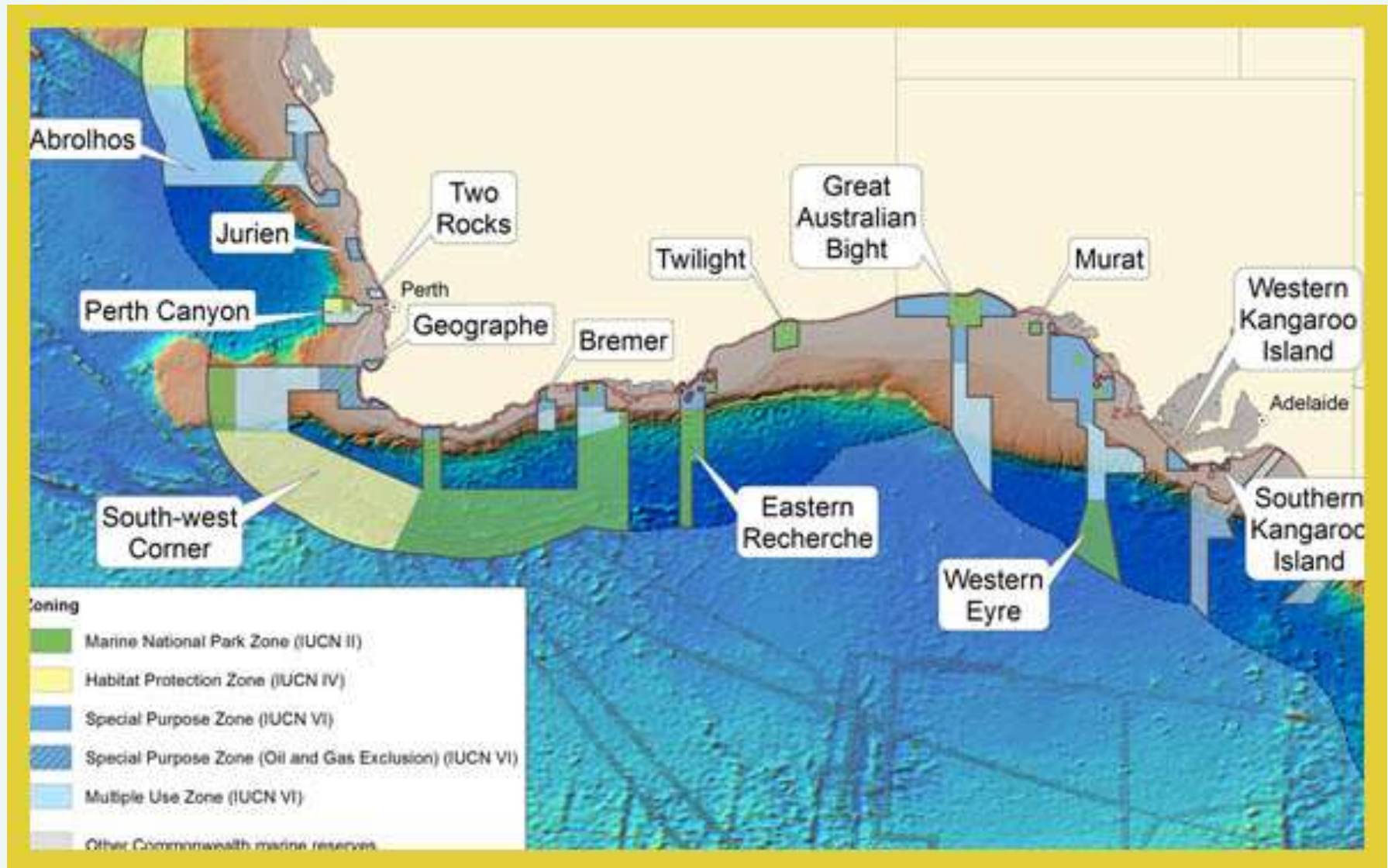


...Commercial fishing values...

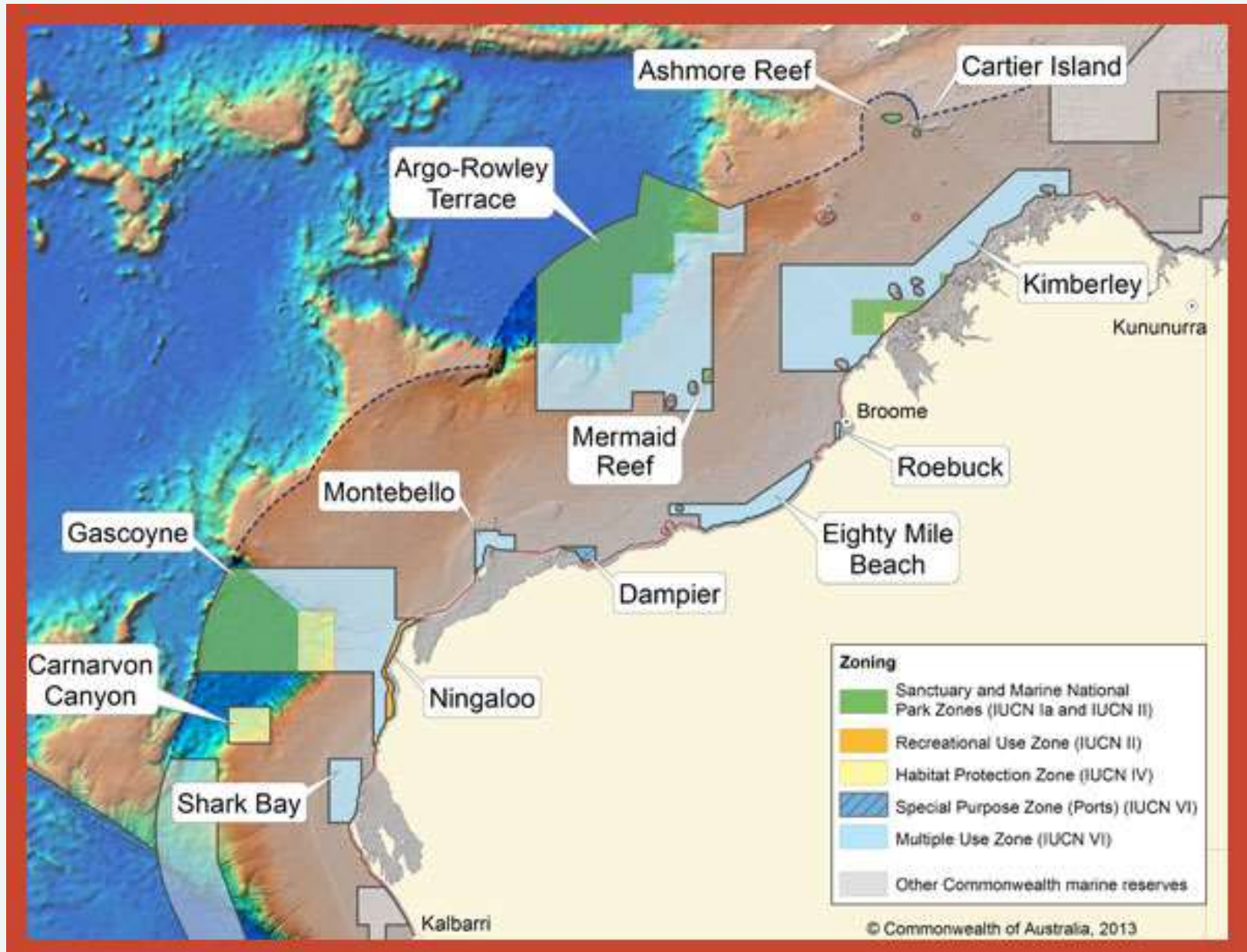
Results of systematic approach

- Good for GBR – high protection equality
 - Consensus statement, meetings to the end
- Poor for SE Australia – 0.5% shelf
- Coral Sea – consensus statement
- Better in SW – PEW report
 - Consensus statement
- Poor again for the north/NW – oil and gas
- Consensus statements

SW



NW



Protection equality, a measure of representation – it is much more than just percent protected

- GBR – protection equality = 80%
- SE – protection equality = 10%
- NW – protection equality = 12%

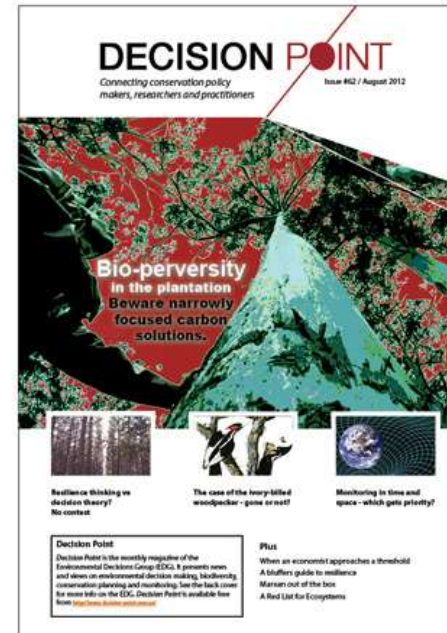
It can all become a dismal mess if you get the problem formulation wrong and you don't stick to targets.

Barr et al 2011, 2013

Final thoughts

- **Protection equality** is as important as size
- Conservation planning tools deal with dynamics, connectivity, zoning, ecology, targets, people ...
- Simple scoring systems, hotspots, and GIS overlays are inefficient and misleading
- Conservation in “Real Life” takes a long time and requires many players
- Fossil fuels wins – but can we cooperate?
- Don’t forget land-based threats and their management

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