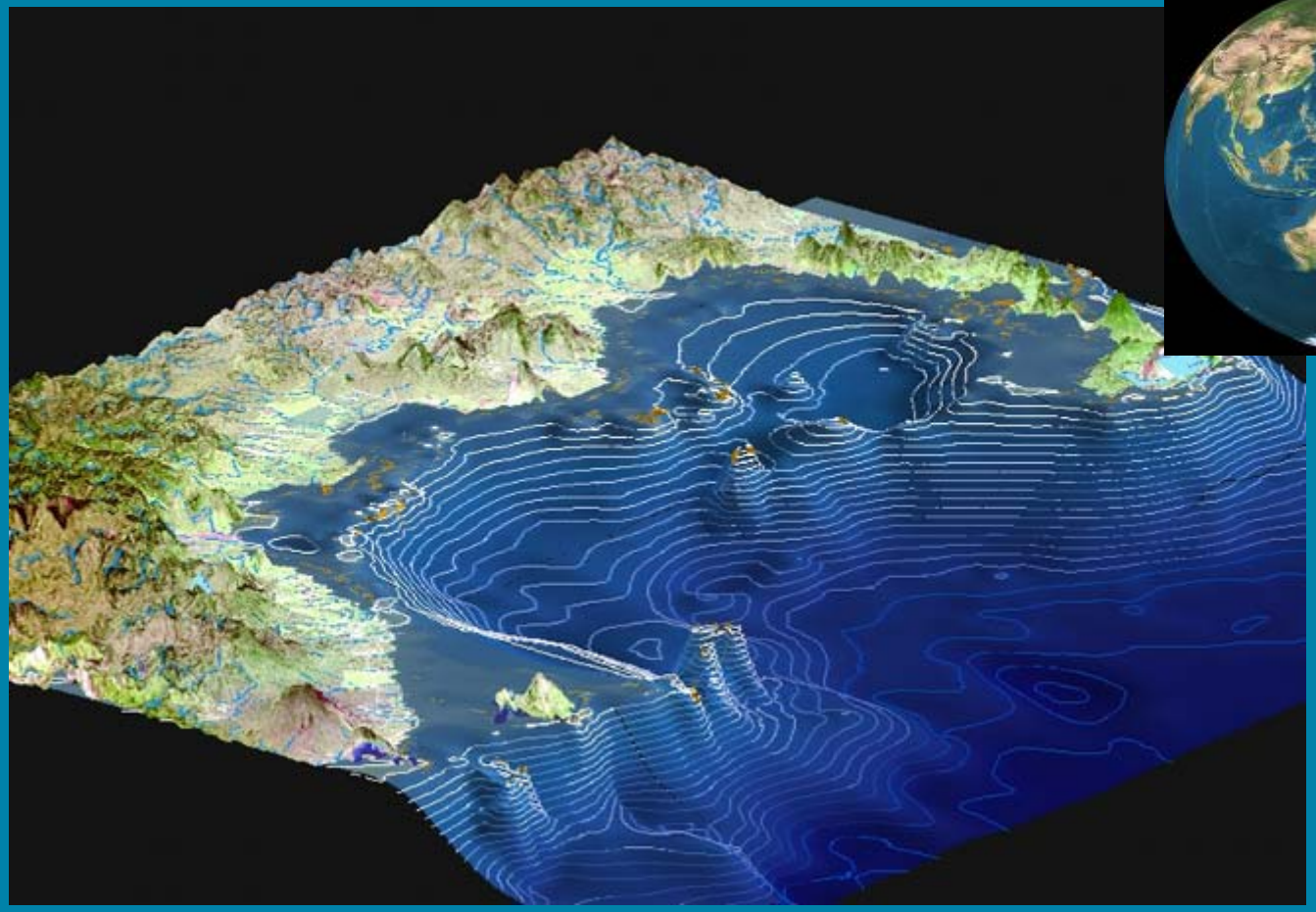
The Nature Conservancy
Protecting nature. Preserving life.

Resilience in practice: Kimbe Bay, Papua New Guinea

Rod Salm August 2008



Large, well defined bay (140 x 70 kms) with varied marine habitats, close together
Nearshore: coral reefs, seagrasses, mangroves – most in excellent condition
Offshore: globally significant oceanic waters (whales & pelagic fish), seamounts

MPA network design objectives

To maximize biological objectives by taking into account key biological & physical processes & incorporate resilience to climate change

To maximize benefits & minimize costs to local communities & sustainable industries

Resilience principles

1. Spread risk through representation and replication
   - conserve representative examples of each habitat type
   - include a least 3 replicates & 20% of the area of each bioregion
   - spread them out

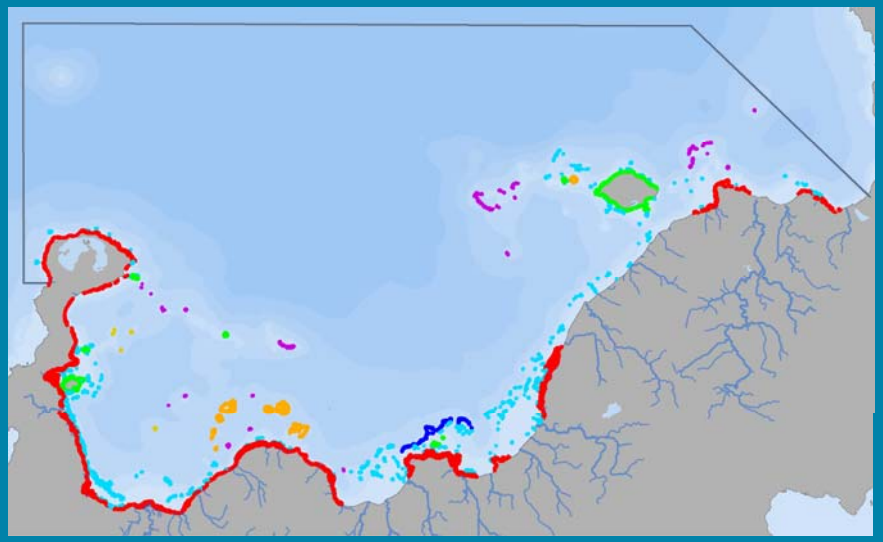
2. Include critical (special and unique) areas
   - areas more resistant/resilient to coral bleaching
   - areas that support high species diversity
   - critical habitats for target species

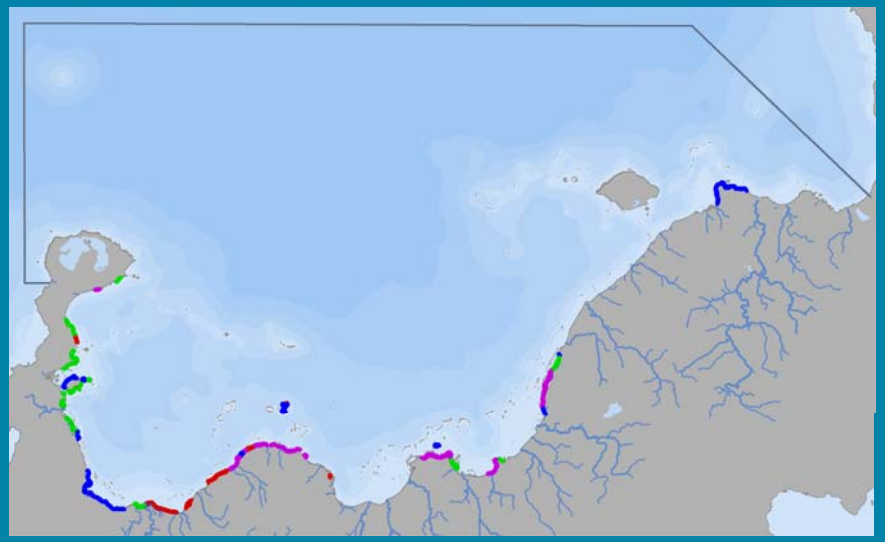
3. Incorporate patterns of connectivity
   - use system wide approach that recognizes patterns of connectivity within & among ecosystems
   - include entire biological units (e.g., whole reefs)
   - choose bigger over smaller areas

Applying resilience principles: Representation & replication

Easiest and most straightforward to apply because:

- Easy to get information (GIS data layers)
- Easy to apply through MARXAN (software package to support MPA network design)
- Representation - very straightforward in analysis
- Replication and spread – not as straightforward (manual accounting)





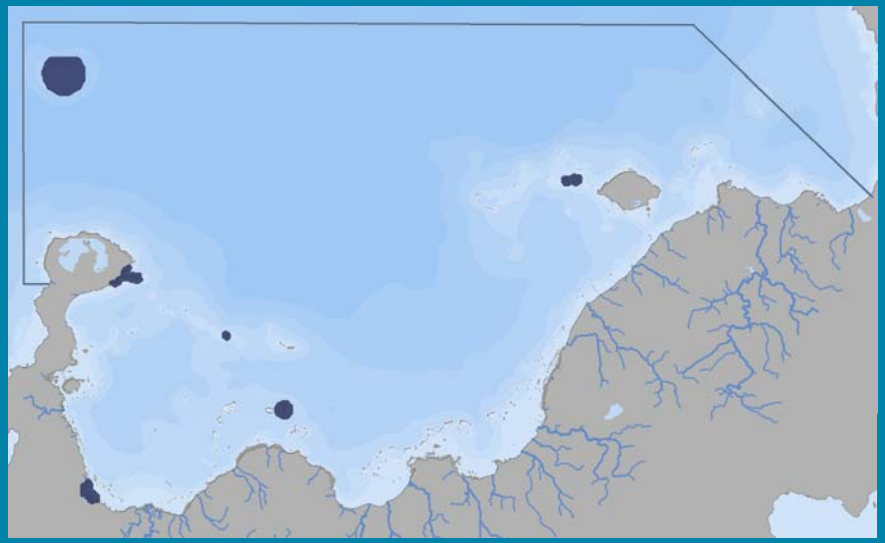
Applying resilience principles: Critical areas

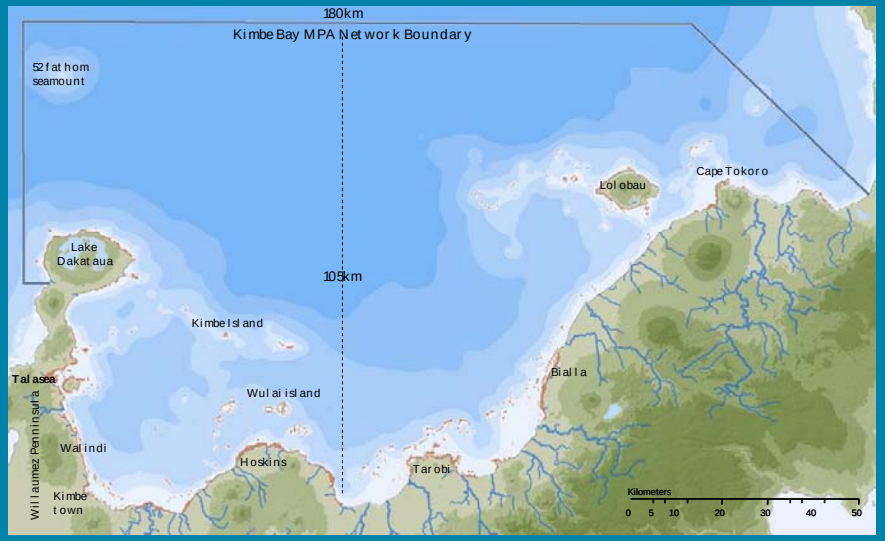
Easy to apply for most targets (special and unique areas)

- information easy to get and easy to apply

Harder to apply for resilient or resistant sites because

- science still developing (harder to identify & confirm)





What resilience looks like for corals

high cover
high diversity
low disease
broad size range

strong recovery
good substrate
good water quality
good herbivores

Applying resilience principles: Connectivity

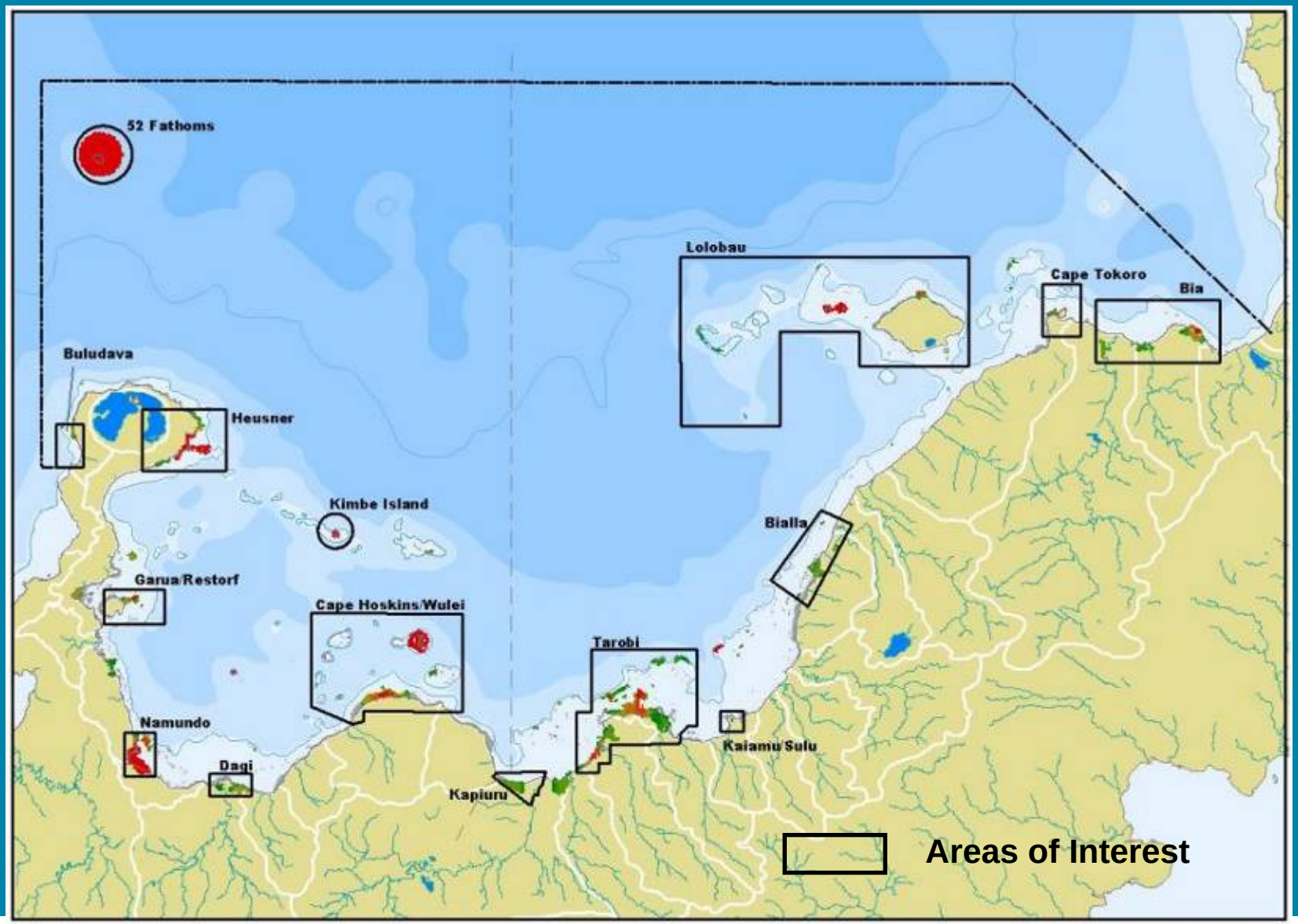
Some principles easy to apply because info easy to get & apply

- connectivity among habitat types
- whole ecological units (where discrete)
- bigger vs smaller areas

But info on biological patterns of connectivity difficult

The Nature Conservancy
Protecting nature. Preserving life.

Kimbe Bay MPA network design



MPA Network Management Principles

1. Engage communities and get their support
   - use traditional management framework where possible
2. Keep reefs healthy through effective management
   - healthy reefs are more likely to survive major impacts
3. Consider both sea- and land-based threats

MPA network design process

02/04-07/06: science & data

1st science workshop → objectives, boundaries, design principles

- Priority research design → minimum data for design

→ best data in GIS layers

2nd science workshop → GIS data layers revised

- MARXAN analysis → network design options

3rd science workshop → scientific network design

07/06-present: communication and negotiation

- Finalize & discuss network design with stakeholders
- Implementation

Summing up

Successfully applied most principles, still some challenges

- identifying and incorporating patterns of connectivity
- identifying and protecting resistant or resilient areas

High priority science needs

- practical, low cost, low tech method to determine biological connectivity
- test assumptions: rules of thumb & risk spreading strategies
- further test resilience and resistance hypotheses
- develop MARXAN functionality to implement resilience principles

The Nature Conservancy
Protecting nature. Preserving life.™

If the perils of our time are unprecedented, then so are the opportunities

-Anonymous