Decision support systems for Great Barrier Reef managers

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PROGRAM OVERVIEW

• 9.1: Dynamic vulnerability maps and decision support tools for the Great Barrier Reef (Ken Anthony, AIMS)
• 9.2: Design and implementation of Management Strategy Evaluation for the Great Barrier Reef inshore (MSE-GBR) (Cathy Dichmont, CSIRO)
• 9.3: Prioritising management actions for Great Barrier Reef islands (Bob Pressey, JCU)
• 9.4: Conservation planning for a changing coastal zone (Bob Pressey, JCU)
DECISION SUPPORT TOOLS – WHY?

- Complex systems
- Cumulative impacts
- Overlapping scales

- Need a suite of tools
  - Tactical vs strategic
  - Local vs regional vs GBR
  - Qualitative vs semi-quantitative vs quantitative
Project 9.1 -Framework

SCENARIO MODELLING

LOCAL / REGIONAL
- Land-use practices
- Coastal development

GLOBAL / REGIONAL
- Cyclones
- Ocean warming

DECISION ANALYSES

Management options / alternatives

Review of results against objectives: min vulnerability & max resilience

ECOSYSTEM MODEL

Coral growth & recovery
- Coral bleaching and disease

Coral mortality
- Run-off and nutrient export
- Algal growth
- COTS

Coral vulnerability

Coral resilience

Decision analyses

Review of results against objectives: min vulnerability & max resilience
PROJECT 9.1: INPUT SCENARIOS

All stressors combined  Climate change & storms  Management potential

Areas that can give returns on management investment

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PROJECT 9.2: MULTI-CRITERIA DECISION ANALYSIS

QUALITATIVE MODELLING

OBJECTIVES
- Hierarchy
- Relative importance

MANAGEMENT STRATEGIES
- Information
- Issues
- Actions

RELATIVE IMPACT
QUALITATIVE MODEL
PROJECT 9.2 COASTAL DEVELOPMENT
HIGH LEVEL OBJECTIVES

Repulse Bay to Clairview (Mackay)

Importance weight

Environment Governance Well-being

0.0 0.2 0.4 0.6 0.8 1.0

6. Please indicate the relative importance of three different objectives for protecting environmental assets. The total score should equal 1.0. The indicator score for the individual objective has to be at least one (1) and cannot be zero (0).

- OBJECTIVE 1.1: High native vegetation connectivity (species and habitat connectivity between catchment, fresh- and salt-water habitats)
- OBJECTIVE 1.2: Improve riparian zones (reduce soil and water runoff into waterways and wetlands)
- OBJECTIVE 1.3: Decrease entanglement in fishing netting (reduce long-term conservation of the variety of aquatic resources and their supporting systems)

7. Please indicate the relative importance of three different objectives for protecting environmental assets. The total score should equal 1.0. The indicator score for the individual objective has to be at least one (1) and cannot be zero (0).

- OBJECTIVE 1.1: Reduce direct impacts of infrastructure and development (Minimize the negative impacts to biodiversity associated with the existing development and future planning in the region)
- OBJECTIVE 1.2: Minimize human induced changes in water flow regimes (Maintain water flow regimes to allow for catchment to flow normally)
PROJECT 9.2 - HIGH LEVEL OBJECTIVES
PROJECT 9.2 - OVERALL RELATIVE IMPACT

Reference Group

Managers
PROJECT 9.3 - DATABASES

- Biological records for southern GBR National Park Islands
  - More than 30,900 records from 204 islands
  - Years: 1843 to 2014
  - Native animal species (plants later) – overwhelmingly birds
  - Alien plants and animals
  - Records to be culled for quality, e.g. date
PROJECT 9.4 - SPATIAL SCENARIOS

- 1st step: Coastal zone definition
- 2nd step: Spatial scenarios
- 3rd step: Cumulative impact assessments
- 4th step: Goals and objectives
- 5th step: Prioritisation decisions

Marine scenarios = Marine consequences (raster maps for each impact, eg shipping)

Land use scenarios
PROJECT 9.4 – BAYESIAN BELIEF NETWORKS

- 1st step: Coastal zone definition
- 2nd step: Spatial scenarios
- 3rd step: Cumulative impact assessments
- 4th step: Goals and objectives
- 5th step: Prioritisation decisions

Sub-models:
- Growth sub-model
- Sediment sub-model
- Habitat sub-model
- Toxicity sub-model

Variables:
- Growth Condition
- Light Intensity
- Temperature
- Salinity
- Nutrients
- Sediment
- Toxicity
- Habitat
- Spatial
- Coastal
- Prioritisation
- Goals
- Objectives
- Impact
- Decision
WHAT HAVE WE LEARNT

• Stakeholder engagement is essential
• Both local and large-scale decision support systems are needed
• Tools/Methods
  – Priority areas for management
  – Priority actions for management
NEXT STEPS?

• Further develop tools
• Overarching framework of how the DSS fit together
• Link with social and economic work
• Need to link with tools being developed outside NERP for example
  – eReefs models
  – Models of Intermediate Complexity of Ecosystems (MICE - Morello et al. in press. MEPS
  – GBR-Atlantis