National Environmental Research Program

TROPICAL ECOSYSTEMS hub

Project 9.4 Conservation planning for a changing coastal zone

Coastal development in the Great Barrier Reef coastal zone: Using scenarios for conservation planning

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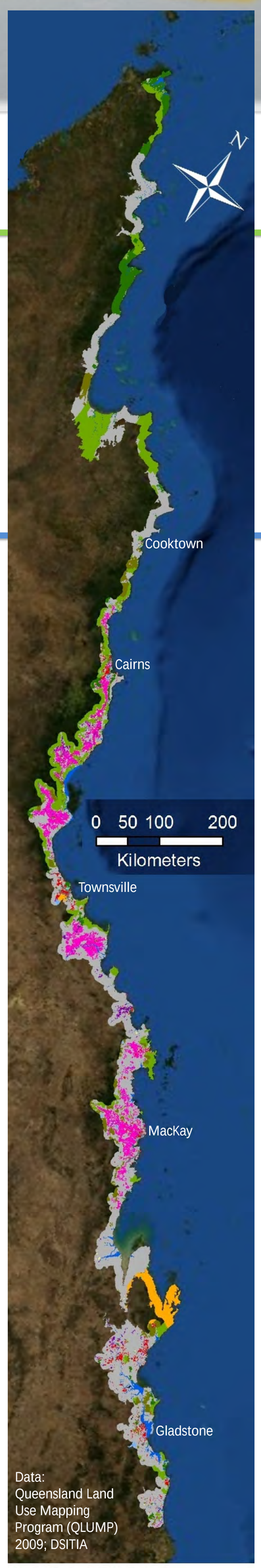

Figure 1: The Great Barrier Reef World Heritage Area coastal zone as defined in NERP 9.4

Rationale and objectives

The values of the Great Barrier Reef World Heritage Area (GBRWHA) are threatened by coastal development through habitat loss and runoff of sediment, nutrients and pollutants. Future coastal development is difficult to predict because it depends on volatile socio-economic and political factors. With this in mind, we develop a research project that uses spatially explicit scenario planning to identify plausible futures to 2035 for the GBRWHA coastal zone. A governance analysis is part of the project. Using a conservation planning approach, this project sets out to identify key priorities for restoring and protecting coastal ecosystems in the GBRWHA coastal zone (Figure 1). The objectives are to:

- **Compile spatial data** on the coastal ecosystems and socio-economic characteristics of the GBRWHA coastal zone
- **Produce spatially explicit land use scenarios** for the GBRWHA coastal zone to 2035
- **Analyse the governance system** in the GBRWHA coastal zone
- **Identify conservation and development goals** for the GBRWHA coastal zone
- Bring all the above information together to **determine spatial options for allocating protection and restoration actions** to achieve goals

Methods and outcomes

For conservation issues where the future is highly uncertain, **scenario planning** allows consideration of different plausible futures and the ways that current management decisions and policies can be adjusted to ensure persistence of selected ecosystems and species. Because conservation planning is inherently spatial, scenarios are spatially represented in the form of **land use maps**. Scenarios are built using storylines with varying levels and importance of five **socio-economic drivers** (Figure 2). These drivers determine the amount and type of coastal development and land use change in the coastal zone. The **systems of governance** (the process of decision-making and implementation), however, can play a significant role in mediating outcomes of the distribution of land use change. Analysis of governance can identify risks to the GBR coast (Dale *et al*. 2013).

The framework for analysis involves several steps all brought together (Figure 4). **Impacts** on selected ecosystems and species (the assets) are investigated in each scenario using spatial or quantitative modelling or qualitative assessment from experts. **Qualitative goals** (independent of scenarios) are defined based on current conservation plans. **Quantitative objectives** (specific to each scenario) are then determined based on impacts, answering the question: what should be done now to protect and restore the coastal zone to achieve the goals? Comparisons across all scenarios identify areas that will likely be at risk in the future regardless of variation in land use drivers. The scenarios will be used to determine where protection and restoration of coastal ecosystems is required to ensure the health of the GBRWHA.

Scenario descriptions and modelling

For each scenario stream, amounts of change are attributed to each land use class. The land use classes are extracted from the Queensland Land Use Mapping Project (QLUMP) 2009 data with additional inputs from other sources to obtain more detailed land use classes (Figure 1).

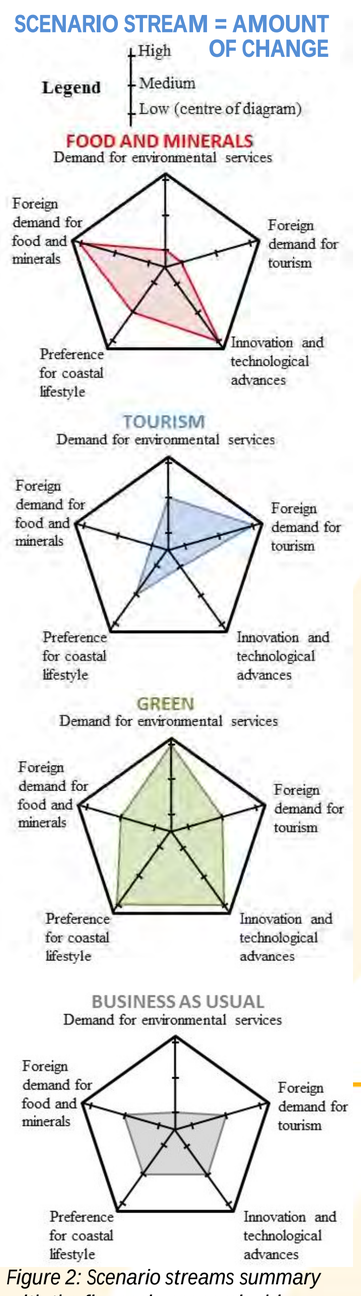

Figure 2: Scenario streams summary with the five socio-economic drivers

Spatial modelling starts by producing "suitability" and "probability" maps for each land use class in each scenario depending on a set of rules established through physical characteristics, governance effects and scenario storylines. The land use change modelling is conducted in IDRISI Selva (Clark University, Worcester, MA, USA), a well-established land use change software (example in Figure 3).

GOVERNANCE = SPATIAL ALLOCATION AND PRACTICES

Strong governance = - Development taking place in most suitable areas (following plans and regional ecosystems)
- No new ports, expansion of current major ports only
- Centralised organised growth
- Appropriate planning for sea level rise

Weak governance = - Placement of development without planning or acknowledgement of regional ecosystems
- New ports in most appropriate sites from mines
- Decentralised and mixed growth
- No appropriate planning for sea level rise

Each scenario stream is conducted in the two governance contexts. There are 8 scenarios in total.

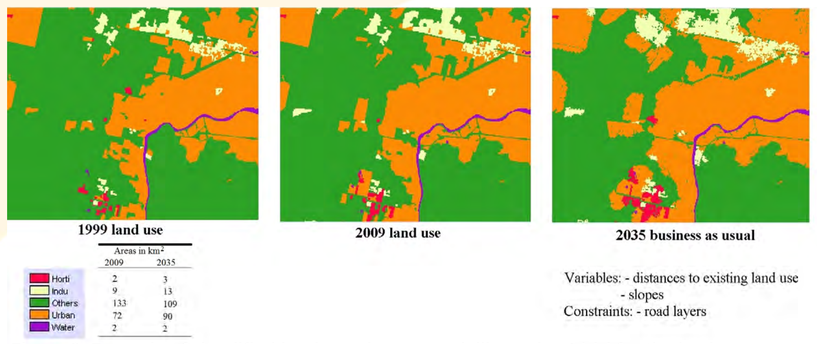

Figure 3: Example of simplified land use change modelling using Idrisi for the business as usual scenario stream in weak governance in a sample area of West Townsville.

Framework for analysis

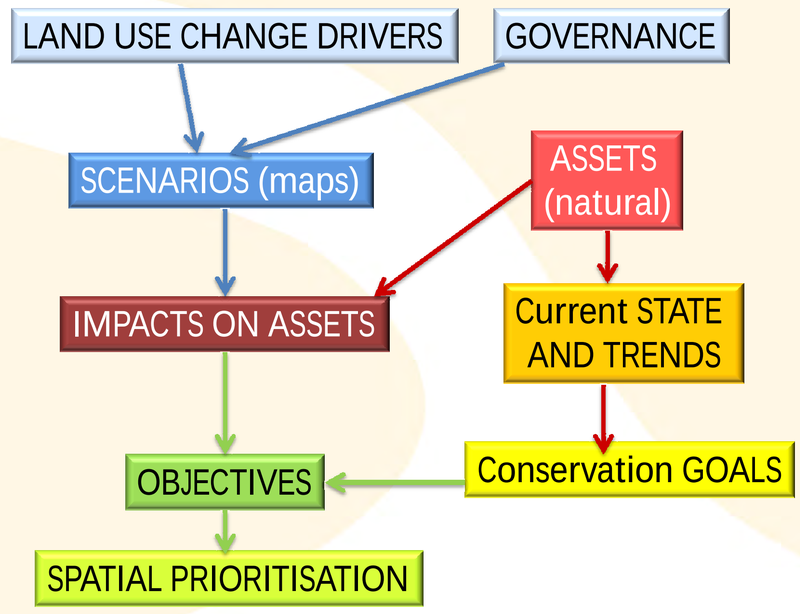

Figure 4: Framework to analyse spatially-explicit scenarios of the GBRWHA coastal zone to determine prioritisation for protection and restoration of coastal ecosystems.

Pathway to impact

- GBRMPA Outlook report 2013 → scenarios and impact assessments to feed into work on coastal ecosystems.
- GBR Strategic Assessment → governance analysis published in Dale *et al*. 2013. Risk analysis across governance systems: A Great Barrier Reef case study. Environmental Research Letters 8: 15-37.
- Spatial database for coastal GBR available for other projects and feeds into e-Atlas.
- Maps of scenarios can be used to discuss vision and impacts of current decisions in communities
- Priorities will be interpreted to government and NRMs

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

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