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Department of the Environment, Water, Heritage and the Arts

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Program 5(i): Climate Change: Great Barrier Reef

Project 2.5i.4: Tools to support resilience-based management in the face of climate change

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Project 2.5i.4 CSIRO Milestone Requirement

- 1. Convert the conceptual model developed in milestone reporting period 2 into a prototype Bayesian Belief Network (BBN).**

In November 2008 a one-day workshop was held to develop a conceptual model capturing key relationships between reef condition and tour operator viability. An extensive review of the current state of knowledge was undertaken in the key disciplines of economics, tourism, and coral reef ecology. The conceptual model was evaluated against the findings and amended accordingly. Changes primarily reflect recent advances in current thinking in economics and tourism, the addition of detail where time constraints prevented detailed representations by participants, as well as adjustments required to accommodate the BBN modelling platform.

Since submission of the [last milestone report](#), these changes have been finalised and the conceptual model converted into the influence diagram shown schematically in Figure 1. Before the model can be parameterised it needs to be verified by those responsible for its creation. The participants of the workshop are thus requested to review the influence diagram for accuracy and appropriateness, and are also asked to provide guidance on likely data availability for its parameterisation. Thus far the diagram has been evaluated by one of two coral reef ecology experts and all five reef tourism experts; data availability was also identified in these meetings. One data set has arrived but will require recoding before it can be used. Another data set has been flagged, but cannot be accessed until the technician returns from travels in late June 2009.

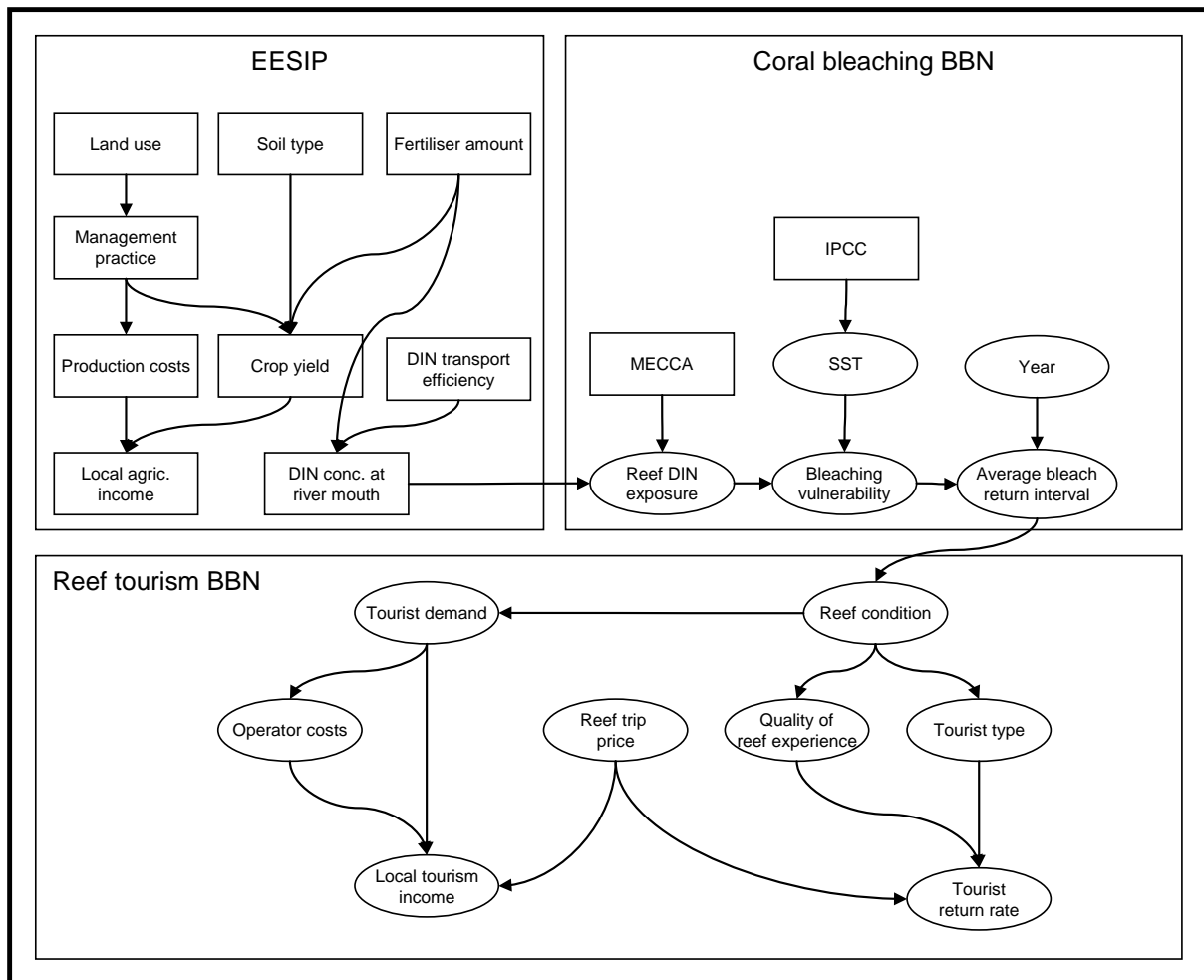


Figure 1: Schematic influence diagram of the purpose-built reef condition-tourism Bayesian Belief Network, showing linkage to models produced by MTSRF Projects 3.7.5 and 2.5i.4.

2. Scope the feasibility of developing a model framework to assess the influence of climate change on the efficacy of land practice changes in reducing the delivery of nutrients from the Tully River into the Great Barrier Reef World Heritage Area.

The purpose of the scoping activity was to assess the feasibility of incorporating climate change impacts on current estimates of sugar cane best management-practice (BMP) cost-effectiveness for water quality improvement in the Tully-Murray catchment into the Project 2.5i.4 BBN.

The influence of climate change on the cost effectiveness of sugar cane best management practice for water quality improvement in 2070 has been assessed by Roebeling *et al.* (2007). Climate change was assessed deterministically according to changes in temperature, rainfall, and CO₂ as projected in Cai *et al.* (2005). For sugar cane they found that “Climate change... [is] shown to potentially impact on the attainment of water quality targets. While climate change does not seem to affect ... BMP cost-effectiveness, it may lead to a significant increase in levels of water pollutant (DIN) delivery under some climate change projections for 2070.” The report is illuminating in that it highlights key areas suitable for focus in ensuing BBN modelling work. However the report does not indicate the processes by which the projected changes in rainfall, temperature and CO₂ will actuate the predicted changes in BMP cost-effectiveness. Further, climate scenario projections have changed substantially since this report was produced, and these changes have substantial capacity to affect model results.

Preliminary interviews with a cane agronomist provide a different perspective on the impacts of climate change to productivity and DIN. According to the expert, current evidence suggests that by the year 2070, DIN delivery is expected to be impacted more by land practice change than by climate change. However, financial impacts are expected as a result for climate change via reduction in yield, given recent worst-case projections of reduced rainfall and higher temperatures.

It is clear that developing a model framework capable of assessing the influence of climate change on BMP cost-effectiveness in the Tully catchment is feasible and worthwhile. Key points raised during the scoping exercise include:

1. A full consideration must be undertaken of the key pathways for climate change to affect DIN delivery and productivity.
2. Climate change scenarios must represent the current state-of-the-science.
3. Analysis of the relative impact of land practice change vs. climate change will be fruitful.

The results of this scoping exercise indicate therefore that the climate change/BMP effectiveness problem is not trivial; development of a model framework is feasible given adequate resourcing.

Cai, W., Crimp, S., Jones, R., McInnes, K., Durack, P., Cechet, B., Bathols, J. and Wilkinson, S. (2005) *Climate change in Queensland under enhanced greenhouse conditions*. Report 2004-2005. CSIRO Marine and Atmospheric Research, Aspendale.

Roebeling, P.C., Webster, A.J., Biggs, J. and Thorburn, P.J. (2007) *Financial-economic analysis of current best-management-practices for sugarcane, horticulture, grazing and forestry industries in the Tully-Murray catchment*. CSIRO Sustainable Ecosystems, Townsville.