Prioritising Coastal Adaptation Development Options for Local Government

SYDNEY COASTAL COUNCILS GROUP

Project Factsheet

The Sydney Coastal Councils Group (SCCG) project *Prioritising Coastal Adaptation Development Options for Local Government* provides guidance for decision-makers on the variables that shape responses to climate change. The project explores prioritisation of adaption options in response to coastal inundation and erosion. It brings together information on exposure and risk, feasible adaptation strategies and the multiple values that influence Local Government decision-making, including governance, economic, social and environmental. It also develops a broad range of criteria by which the performance of adaptation strategies can be evaluated.

INTRODUCTION

Managing the risks posed by climate change to coastal communities is a challenge faced internationally. While much of the literature relevant to coastal adaptation has focused on assessing the vulnerability of coastal communities, there is limited guidance for Local Government on the appraisal of specific adaptation options.

Prioritising Coastal Adaptation Development Options for Local Government addresses this need for guidance, via a participatory, multi-criteria analysis (MCA) of adaptation options that considers the adaptation preferences and risk exposure of local government areas, with a focus on three case study regions – coastal Sydney, Bega Valley Shire Council and Sunshine Coast Council. The project explored a range of analyses and tools to contribute learnings on how to progress more focused evaluations of coastal adaptation and the design of flexible adaptation pathways to manage risks related to coastal inundation and erosion.

The project was designed with two key considerations in mind:

- Coastal systems are valued for a range of qualities – economic, social and cultural, and environmental – that must be considered in assessing possible adaptation options.

- Achieving long-term success with respect to coastal adaptation will be contingent on the ability to monitor progress toward management goals, evaluate the extent to which specific policies and measures are contributing to that progress, and revisit past decisions to address barriers to effective adaptation.

METHODOLOGY

Traditionally, adaptation planning has focused on identifying discrete adaptation options that address specific risks to, or vulnerabilities of, particular areas. This planning tends to be fairly static, creating challenges for the design of flexible adaptation strategies that accommodate the inherent uncertainties associated with climate change and subjective preferences regarding appropriate policy responses.

The project sought to overcome these challenges, by considering (1) feasible coastal adaptation options, (2) the subjective preferences of Local Government staff regarding the appropriateness of those adaptation options and (3) place-based contextual information regarding the level of risk, value, or the suitability of an adaptation option to address a particular management challenge.

PHASE ONE: Identification and assessment of adaptation options

A Literature Review identified 15 feasible adaptation options categorised under four distinct categories - Protection, Accommodation, Retreat and Cross-Cutting Options (see Table 1). Local government staff then participated in workshops across the three study

Table 1: Coastal Adaptation Options

Protection
1. Shoreline stabilisation
2. Beach nourishment
3. Groynes or artificial headlands
4. Sea walls or revetments
Accommodation
5. Elevation of structures
6. Removable structures in at-risk areas
7. Risk spreading mechanisms
8. Water proofing of at-risk properties
Retreat
9. Acquisition of at-risk properties
10. Increase setbacks on at-risk properties
11. Block development on at-risk properties
12. Implement rolling easements
Cross-Cutting Options
13. Community education about risk
14. Assessments of vulnerability and risk
15. Integrated coastal zone management

regions (coastal Sydney, Bega Valley Shire Council and Sunshine Coast Council) in which multi-criteria analysis methods were used to capture their subjective preferences for the different adaptation options. The analyses incorporated multiple governance, economic, social and environmental criteria, across various time horizons (see Figure 1).

PHASE TWO: BBN and spatial visualisation of information

These responses were then incorporated into a Bayesian Belief Network (BBN) along with weightings for each criterion. Weightings were based on the relative importance survey respondents attributed to each criterion, as well as the significance of risks to financial, social or environmental assets. These risk characterisations were developed by integrating information on inundation and erosion hazards over different time scales for each of the three case study regions with available data indicative of asset densities.

The BBN (pictured in Figure 2) enabled a range of analyses of adaptation options including:

Figure 1: Illustration of project methodology

- generation of a **quantitative metric** of the relative performance of different adaptation options based upon individual criteria and/or value dimensions

- calculation of **overall utility of individual adaptation options** based upon underlying uncertainty in option performance against specified criteria and their associated weights

- **stratification of adaptation option utilities** based upon case study region and time horizon

- **testing of the sensitivity of utility scores** to underlying performance scores for individual criteria and/or weights.
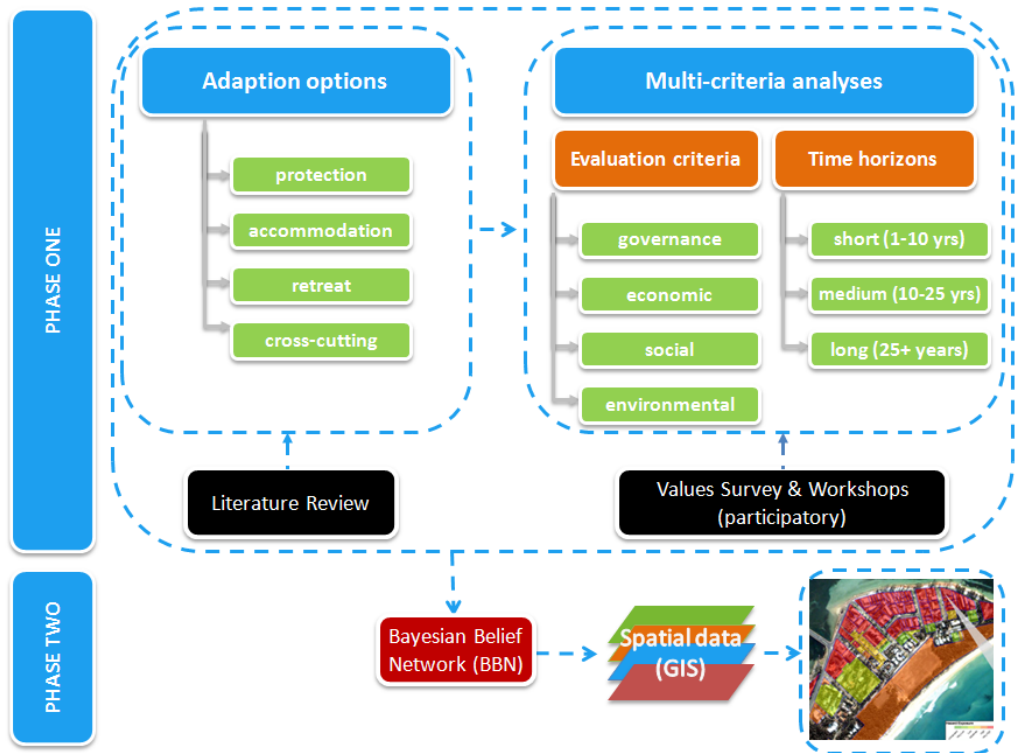
The results from this model were then exported to a GIS, enabling information on hazards, assets, and the utility of different adaptation options, to be readily visualised for any property in each study region (Figure 3).
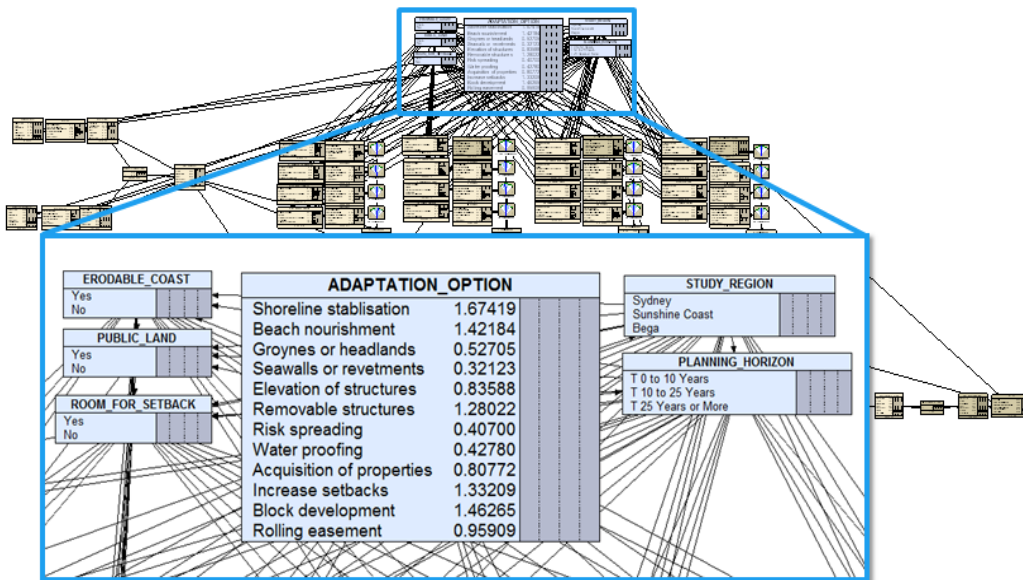

Figure 2: The Bayesian Belief Network (BBN) used in the evaluation of coastal adaptation options. The magnified grey nodes represent the different independent decision variables in the analysis (adaptation option, region and time-scale). The remaining nodes represent decision criteria, associated weights and summary metrics for MCA dimensions.

RESULTS

The project enables the visualisation of all properties exposed to coastal hazards in each study region, their relative complement of assets (financial, social, or environmental), risk to those assets, and the utility of different adaptation options (see Figure 3). This capability provides a way of screening adaptation options to identify those which are most consistent with site characteristics and the preferences of Local Government staff.

Ultimately, many adaptation options will necessitate trade-offs between values. Such trade-offs should be well-understood and transparent and MCA methods can enable us to better understand what values (and whose) are being incorporated in decision-making. It can also enable us to test whether our actions are consistent with our values. In practice, the survey component of this project would be extended to the local community, to incorporate their values and preferences for adaptation.

The project also highlighted the need to accommodate the dynamic nature of adaptation options by establishing review periods and triggers points (linked to climate change impacts drivers) that alert managers to the need to transition from one set of adaptation measures to another.

Figure 3: Illustration of the visualisation of results from the spatial MCA for North Narrabeen Beach north of Sydney. The map identifies all of the properties potentially susceptible to coastal hazards in the coming decades, with different colour shading to reflect different levels of exposure (green for low levels of exposure; red for high). The pop-up table adjacent to the map provides a list of metrics for the specific property indicated by the arrow, including hazard and asset classifications, identification of the single best adaptation option for the location, as well as quantitative and qualitative utility scores for 12 other adaptation options.
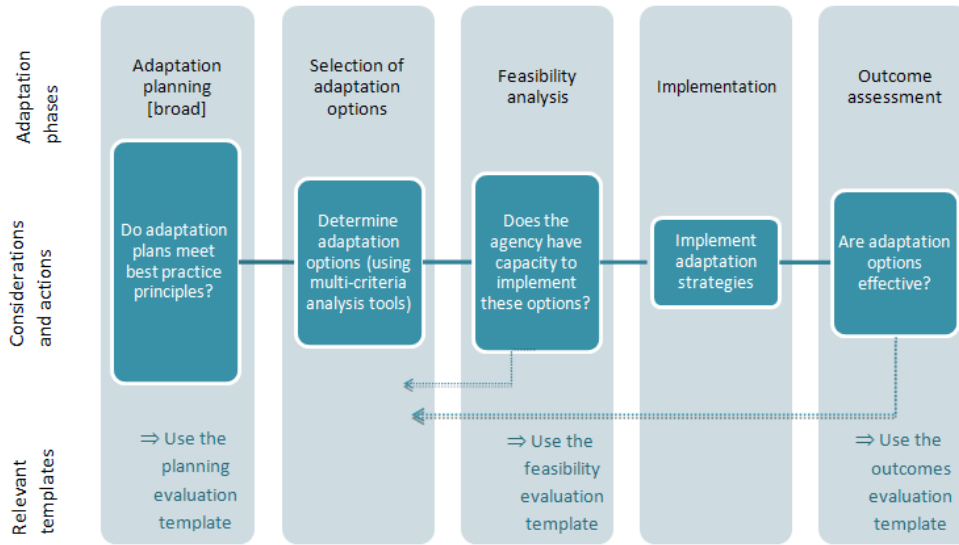
Key findings:

1) Staff in Local Government seek to balance multiple values in developing policy recommendations for coastal risk management. Nevertheless, the governance and political processes may ultimately force trade-offs in decision-making.

2) The perceived utility of different coastal adaptation options is similar across different regions and communities, suggesting there is a common understanding among Local Government staff with respect to what constitutes appropriate adaptation.

3) Capacity building activities are generally viewed as low-cost measures that perform well across a range of different criteria and create the necessary bottom up community support and evidence base for more substantive actions.

4) The most unfavourable coastal adaptation options are those that create long-term investment obligations for councils, incentivise risk-seeking behaviour and/or create 'moral hazard' by positioning Local Government as the insurer of last resort.

5) The utility of different adaptation options is sensitive to the time horizon used in the adaptation planning process, but uncertainty about the future poses limits to the utility of most adaptation options.

6) From the perspective of Local Government staff, adaptation options that perform well against various financial criteria also perform well from an environmental perspective.

7) The spatial distribution of coastal hazards, assets of value, and appropriate adaptation options varies significantly from one location to another as well as over time. Therefore, spatial adaptation planning is necessary to advance adaptation efforts.

8) While tools such as MCA can be helpful in prioritising adaptation options for specific locations, subsequent deliberation and planning is needed to develop 'risk weighted adaptation pathways' that outline how portfolios of options can be deployed over the near, medium, and long-term.

MONITORING AND EVALUATION GUIDE

To extend the utility of the project, a *Guide to Monitoring and Evaluating Coastal Adaptation* was developed. The Guide is designed to assist Local Government staff to monitor and evaluate climate change adaptation plans, strategies and activities.

The Guide is relevant to all council divisions and other stakeholders involved in planning, implementing, monitoring and evaluating climate change adaptation. It provides users with a step-by-step process for assessing the sustainability, feasibility and efficacy of coastal adaptation strategies using a series of templates. The Guide can be adapted to specific contexts and needs of individual Councils.

The templates contained in the Guide take users through an iterative process that begins with a preliminary rapid appraisal to more detailed evaluations of the intentions and principles of adaptation (planning evaluation template), organisational capacity (feasibility evaluation template) and the effectiveness of strategies once implemented (outcomes evaluation template) (see Figure 4). Worked examples drawn from hypothetical case studies representing contexts relevant to New South Wales and Queensland are included in the Guide to demonstrate its application and utility.
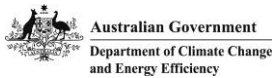
Figure 4: Schema for Local Government adaption process with evaluation

CONCLUSION

This project demonstrates how different values in Local Government decision-making and preferences regarding adaptation options can be integrated with information on hazards, assets, and the performance of different adaptation options to identify preferable adaptation pathways for Councils. The project also explores opportunities for monitoring and reporting on coastal adaptation efforts, to support a more integrated approach to coastal adaptation in Local Government.

Project partners

Sydney Coastal Councils Group led the project, assisted by researchers at Oak Ridge National Laboratory (USA) and the University of the Sunshine Coast. In addition, Sunshine Coast Regional Council and Bega Valley Shire Council joined as partners to expand the scope of the study to include three case study regions (Sydney, Bega and Sunshine Coast).

Participating Councils

For more information

Sydney Coastal Councils Group | (02) 9246 7791| info@sydneycoastalcouncils.com.au | www.sydneycoastalcouncils.com.au