CoastAdapt

Case Study

The Sydney Coastal Councils Group experience: Prioritising coastal adaptation options at the local level

Overview

The Sydney Coastal Councils Group (SCCG) undertook a project Prioritising Coastal Adaptation Development Options for Local Government to provide guidance to decision-makers on the variables that shape responses to climate change. The project explored prioritisation of adaption options in response to coastal inundation and erosion. It integrated 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 developed a broad range of criteria to evaluate the performance of adaptation strategies.

The project addressed the need of local government for guidance on assessing adaptation options, via a participatory, multi-criteria analysis (MCA) of interventions that considered the adaptation preferences and risk exposure of local government areas.

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 optimal adaptation pathways for councils. The project also explored opportunities for monitoring and reporting on coastal adaptation efforts, to support a more integrated approach to coastal adaptation in local government.

Context

Australia's coastal communities are vulnerable to the effects of climate change due to concentrations of population, and associated assets and infrastructure, as well as the inevitability of rising sea levels and their influence on coastal processes and dynamics (Preston et al. 2013). Implementing policies and measures to facilitate coastal adaptation requires reconciling competing societal values that collectively shape decision-making. This includes economic development, maintenance of scenic and recommendation amenity, ensuring public health and safety, and preservation of natural resources. Hence, coastal adaptation is a multi-objective process where values are balanced and traded to arrive at societally-acceptable outcomes (Preston et al. 2012). Accordingly, evaluating coastal adaptation options is a significant analytical and policy challenge. Challenges associated with climate change, such as the need to consider multiple time frames and the uncertainties of planning for the long-term, make traditional policy analysis tools such as cost/benefit analysis difficult to implement in a meaningful way. Many of the values people hold with respect to the costs and benefits of policy choices are difficult to capture in economic units. In addition, people's perceptions of risks, and hence acceptable policies and actions, will change over time.

To explore these decision challenges, a participatory, multi-criteria analysis (MCA) of coastal adaptation options for local government was undertaken. The goal of the MCA was to elicit information from local government stakeholders regarding their relative preferences for different coastal adaptation options and, subsequently, incorporate those preferences into an analysis of management alternatives at the local level. This enables different coastal adaptation options to be considered in the context of economic, social, political or environmental aspects. Furthermore, MCA provides opportunities for the direct participation of stakeholders as they can assign weights to those values to reflect their preferences and priorities.

Background

The SCCG is a co-operative organisation that advances sustainable management of Sydney's urban coastal environment. It consists of 12 Member Councils that represent nearly 1.3 million Sydneysiders over an area of 1,284 square kilometres adjacent to Sydney's coastal and estuarine areas. The SCCG is responsible for developing new knowledge to help build capacity of their member councils. In 2011 SCCG obtained funding from the Australian Government to facilitate one of the Coastal Adaptation Pathways projects entitled *Prioritising Coastal Adaptation and Development Options for Local Government.*

The project was undertaken in three Australian regions: metropolitan Sydney, Bega Valley Shire Council in coastal New South Wales and Sunshine Coast Regional Council in Queensland (Figure 1). This gradient of urban to regional landscapes enabled the MCA to explore how different local government perspectives interact with assessments of place-based hazards and assets at risk.

The project was undertaken by researchers from the Climate Change Science Institute, Oak Ridge National Laboratory, and the Sustainability Research Centre, University of the Sunshine Coast in collaboration with the local government partners.

Project methodology and outcomes

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 uncertainties associated with climate change and subjective preferences regarding appropriate policy responses. The project sought to overcome these challenges by taking a multipronged approach as outlined in Table 1 and Figure 2.

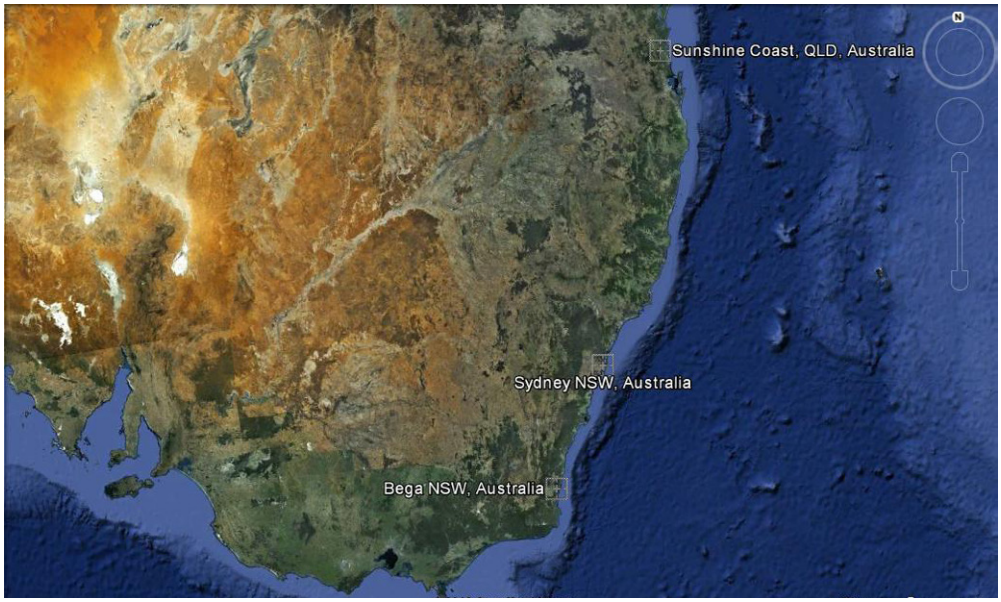

Figure 1: Location of three case study regions representing 17 local government areas (15 SCCG member councils and regional councils of Bega Valley Shire Council in New South Wales and Sunshine Coast Regional Council in Queensland). Source: © Google Earth 2016.

Table 1: The various stages of the project, the approaches used and the outcomes for the SCCG. Source: Sydney Coastal Councils Group. Further details can be obtained from here.

Project Stage	Approach	Outcome
Stage 1, Phase 1	Survey of local government staff to build understanding regarding the fundamental values that influence decision making	No one value had greater or lesser importance than others with local government generally seeking to balance a plurality of values. Environment tended to be slightly more important. Staff have a responsibility to attempt to balance different values. However, decisions made by elected representatives sometimes favour some values over others. Beach erosion, shoreline recession and inundation were considered to be more relevant to local government than other coastal hazards. Questionnaire respondents ranked council staff, Councillors and State Government agencies as among the most influential on local government decision-making.
Stage 1, Phase 2	Identification of feasible coastal adaptation options	A literature review identified 15 feasible adaptation options categorised under four distinct categories – protection, accommodation, retreat and cross-cutting options (Mangoyana et al. 2012).
Stage 2, Phase 1	The subjective preferences of Local Government staff regarding the appropriateness of identified coastal adaptation options	Staff across the three case study regions have reservations about the utility of coastal protection measures (e.g. hard infrastructure options). The performance of different options generally declined with longer time horizons due to perceptions of increasing risk, increasing costs of adaptation, and increasing uncertainty. Options that performed poorly against financial criteria also tended to perform poorly against environmental criteria. Cross-cutting, non-structural adaptation options generally performed quite well across all time horizons (see Figure 3).
Stage 2, Phase 2	Place-based contextual information regarding the level of risk, value, or the suitability of an adaptation option to address a particular management challenge MCA workshops Development of a Bayesian Belief Network (Figure 4) Spatial representation of MCA results within a GIS A framework for monitoring and evaluation of adaptation in a Local Government	Soft protection and retreat measures were the most favourable options. The most obvious result was the general low utility of protection measures (hard and soft). This is a consequence of several factors including: • many properties are poorly suited for the application of protection measures to address erosion • the general bias against seawalls and revetments as well as the requirement in the model for those options to be applied only to areas with both high risk of exposure and high financial asset values. When all criteria were considered, accommodation measures were not favoured, with the exception of elevated or removable structures. Retreat measures such as blocking development or rolling easements were favoured. Increasing setbacks and/or acquisition of properties were favourable in some circumstances, depending on the conditions at the property of interest (see Figure 5). Guide provides a framework for evaluating adaptation practice in local government, focusing on three key areas – best practice planning, adaptive capacity and monitoring outcomes.

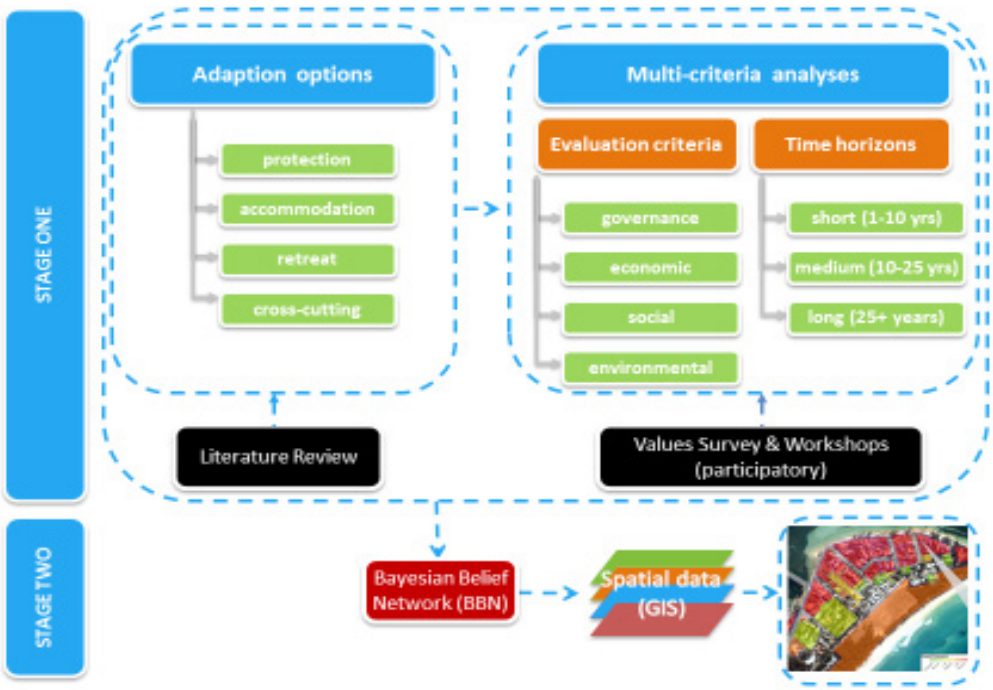

Figure 2: Illustration of project methodology. Source: Sydney Coastal Councils Group.

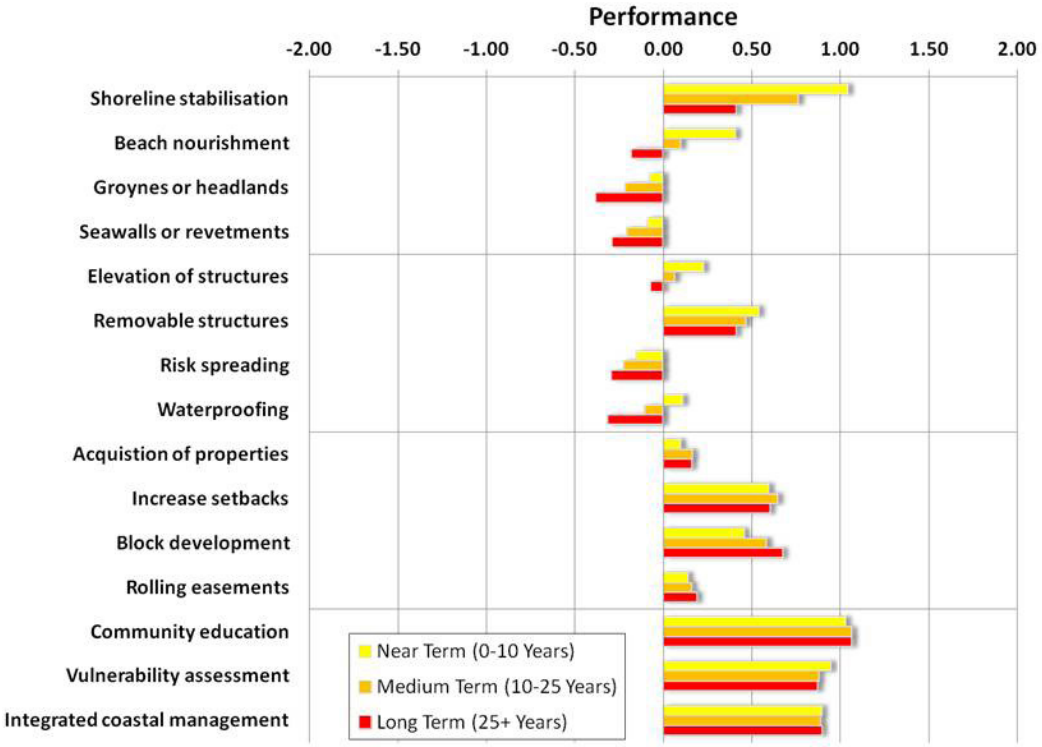

Figure 3: Comparison of average raw performance of different coastal adaptation options for different time horizons. Results are based upon the weighted average of performance scores for all case study regions. Positive values represent a favourable assessment of performance. Negative values indicate an unfavourable assessment of performance. Source: Preston et al. 2013.

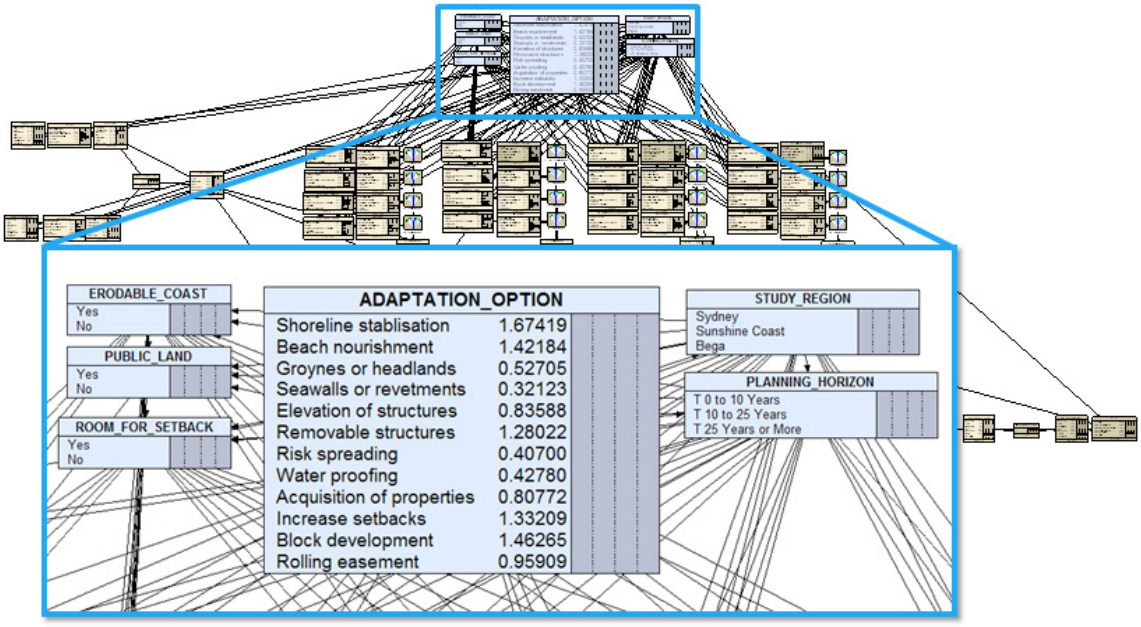

Figure 4: The Bayesian Belief Network (BBN) used in the evaluation of coastal adaptation options. The magnified light blue nodes represent the different independent decision variables in the analysis (adaptation option, region and time-scale). The remaining nodes represent decision criteria, associated weights and summary metrics for MCA dimensions. Source: Sydney Coastal Councils Group. Preston et al. 2013.

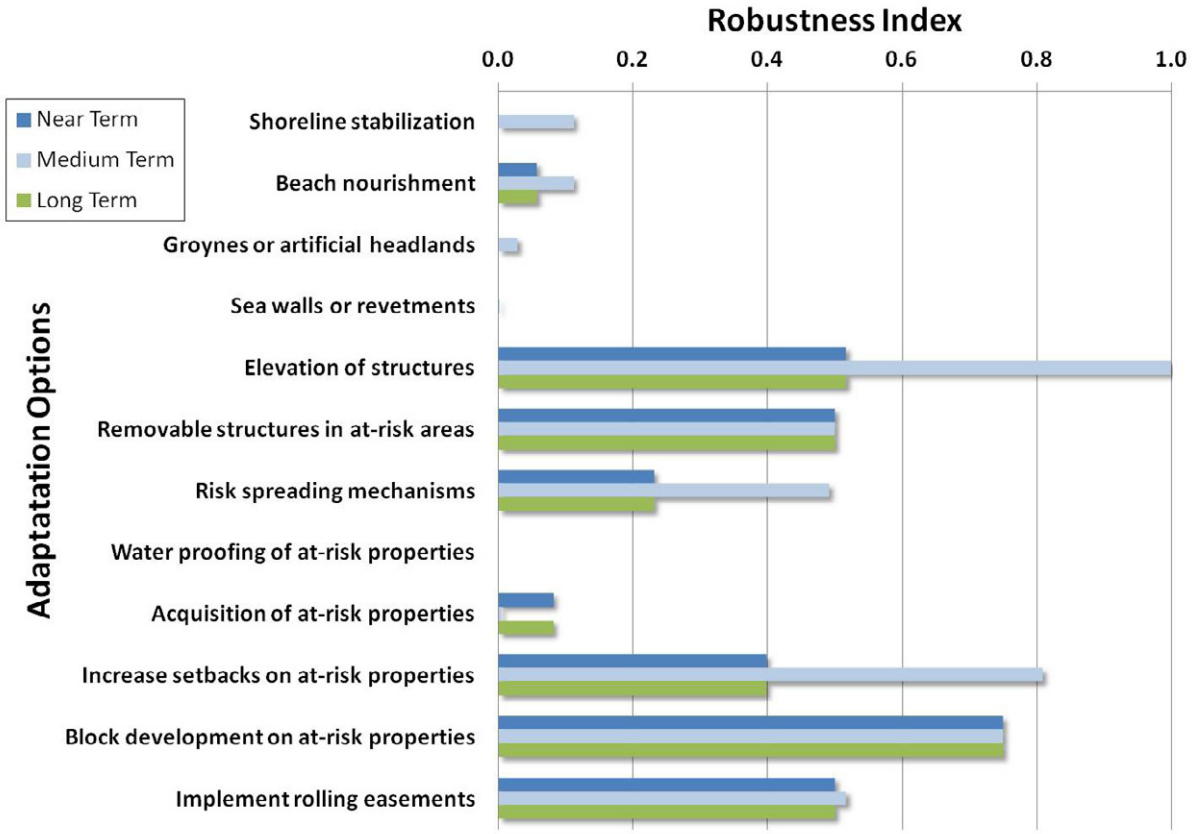

Figure 5: Assessment of the robustness of different coastal adaptation options in the Sydney Coastal Councils Group region. A result of 0 indicates a particular adaptation option is not favourable for any property in any model variant and a value of 1 indicates an option is favourable for all properties across all model variants. Source: Preston et al. 2013.

Implementation of flexible adaptation decision pathways

The approach and tools were used to outline the potential risks to different locations over different time scales and determine the most acceptable adaptation options for managing risk over those time scales. However, the MCA examines adaptation options independently and, while it can screen such options for utility, there needs to be subsequent decision-making and deliberation to determine how to construct portfolios of options as well as the additional actions that may underpin their implementation.

Tools such as MCA can assist in prioritising adaptation options for Local Government, but it is essential to invest effort in the monitoring and evaluation of adaptation implementation. Accordingly, a framework for monitoring and evaluation of adaptation in a local government context was included as part of the project. This provides a mechanism to test whether selected adaptation options are in fact performing as anticipated, thereby providing an evidence base to continue or revise adaptation efforts.

The Guide to Monitoring and Evaluating Coastal Adaptation is designed to assist local government staff to monitor and evaluate climate change adaptation plans, strategies and activities.

The Guide provides users with a step-by-step process for assessing the sustainability, feasibility and efficacy of coastal adaptation strategies using a series of templates (Figure 6). The Guide provides a framework for evaluating adaptation practice in local government, focusing on three key areas – best practice planning, adaptive capacity and monitoring outcomes. These three areas help to build a picture of the sustainability, feasibility and efficacy of adaptation initiatives.

Project outcomes and next steps

The project enabled 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 (Figure 7). This capability provided a way of screening adaptation options to identify those which are most consistent with site characteristics and the preferences of local government staff. This GIS-enabled view of coastal risk and adaptation options highlights the potential value of coastal information systems that allow Local Government staff to readily access the full range of information needed for informed management decisions.

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 (and whose) values 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.

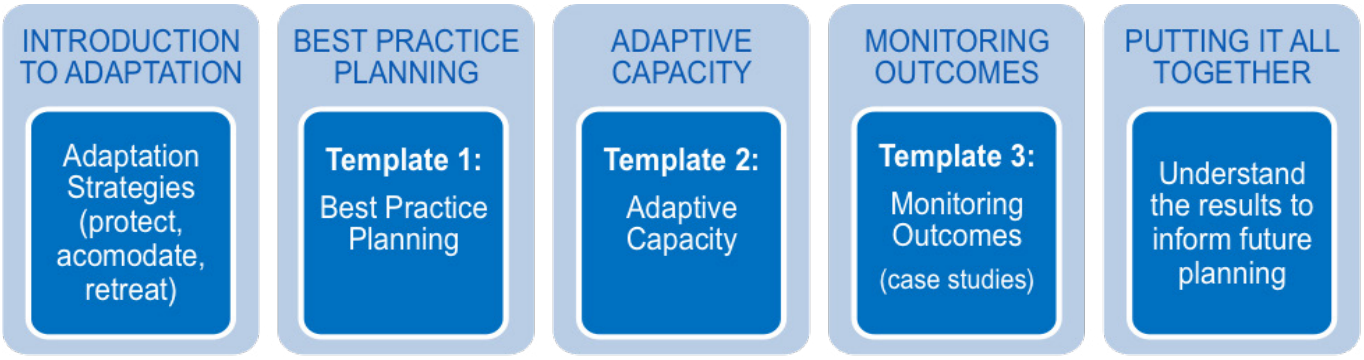

Figure 6: Schema for local government adaptation processes with evaluation. Source: Sydney Coastal Councils Group.

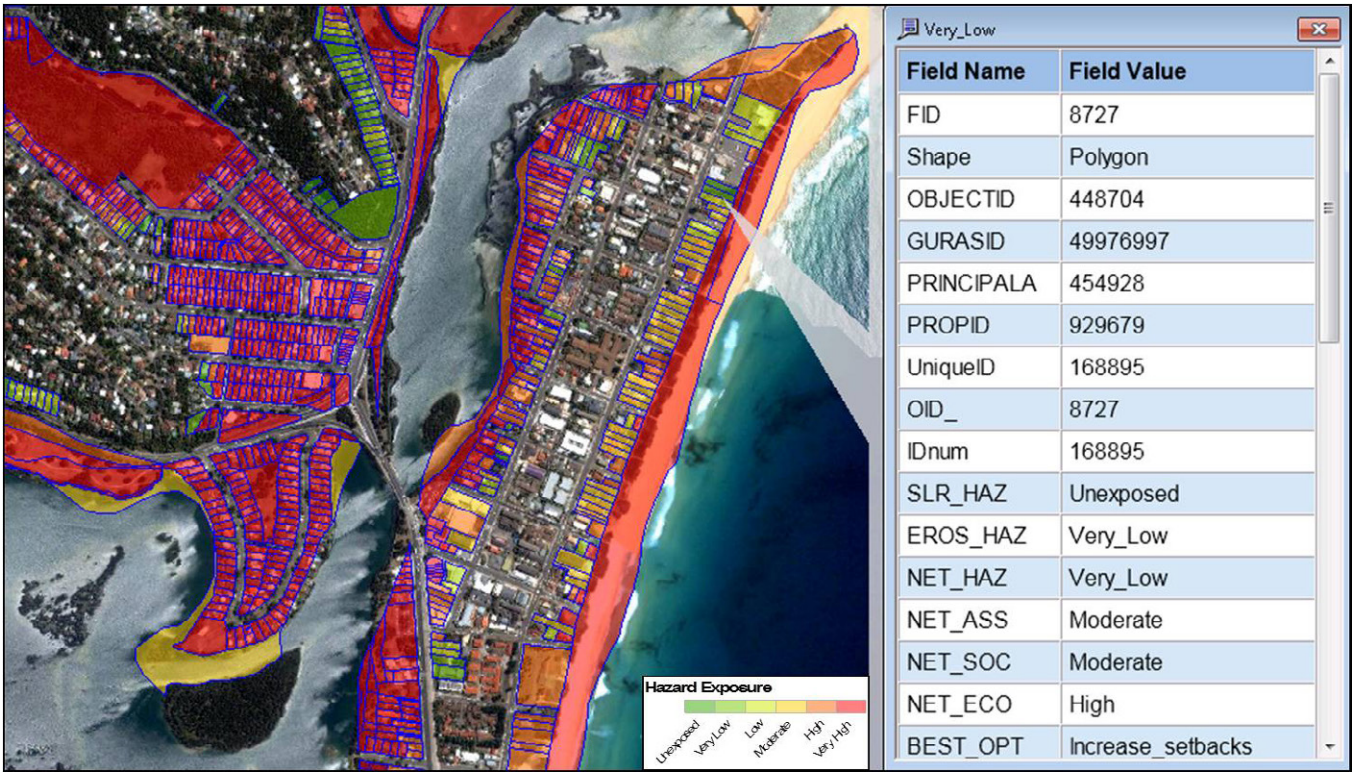

Figure 7: Illustration of the visualisation of results from the spatial MCA for North Narrabeen Beach north of Sydney. The map identifies all of the properties potentially susceptible to coastal hazards in the coming decades, with different colour shading to reflect different levels of exposure (green 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. Source: Preston et al. 2013.

Property scale consideration of options was found to be a very useful component of the project, because many adaptation options will be not be deployed using a 'one size fits all' approach. Rather, different decisions and different options will have to be made along coastlines in order to balance the costs of adaptation with the need to protect, accommodate or retreat in the face of sea-level rise.

The MCA for coastal adaptation options illustrated the potential strengths and challenges of MCA for supporting decision-making. This study illustrated how a diverse set of criteria can be used to prioritise different adaptation options, without the need for translating those criteria into common monetary units as is often the case with traditional cost-benefit analysis. In so doing, MCA also enabled the exploration of the potential trade-offs implied by the selection of a particular adaptation option.

While all of these insights provide new context to understand how local government views coastal adaptation, the novelty of the project arose from its generation of property-specific evaluations of adaptation options. As the methods developed were new and previously untested, the results of the MCA and the application of the project are best interpreted as a 'proof-of-concept'. The project illustrates how geospatial data could be integrated with subjective value preferences of stakeholders to evaluate adaptation options in a manner that reflects the heterogeneity of coastal landscapes. Using a Bayesian Belief Network, the uncertainty in both geospatial information and local government values could be incorporated into the analysis. Meanwhile, by using a GIS environment to visualise the MCA results, the project developed a mechanism to facilitate communication of results. Using GIS as a platform for the convenient delivery of a broad range of information about coastal hazards, assets and plausible management responses to a diversity of stakeholders enabled improved decision support for adaptation planning efforts.

Summary of 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 presumed 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, suggesting common assumptions regarding trade-offs between the economy and the environment may not manifest in practice.

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.

Conclusions

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 funding

Sydney Coastal Councils Group facilitated 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).

Project funding

Funding was provided by the Australian Government represented by the Department of Climate Change and Energy Efficiency. The Coastal Adaptation Decision Pathways project is an Australian Government Initiative.

Australian Government
Department of Climate Change and Energy Efficiency

For more information

Sydney Coastal Councils Group

+61 2 9246 7791

info@sydneycoastalcouncils.com.au

www.sydneycoastalcouncils.com.au

Participating Councils

University of the Sunshine Coast Sustainability Research Centre

SYDNEY COASTAL COUNCILS GROUP

Sunshine Coast Council Queensland | Australia

City of Botany Bay

City of Sydney

Hornsby Shire Council

Leichhardt Council

Manly Council

Mosman Council

North Sydney Council

Pittwater Council

Randwick City Council a sense of community

Rockdale City Council On Historic Botany Bay

Sutherland Shire Council

Warringah Council

Waverley Council

Willoughby City Council City of Diversity

Woollahra Municipal Council

Oak Ridge National Laboratory
Managed by UT-Battelle for the Department of Energy

Bega Valley Shire Council

References

Preston, B.J., D. Thomsen, T.F. Smith, R. Mangoyama, M. Maloney, B. Conlon, and G. Withycombe, 2012: Linking Societal Values and Decision-Making in Coastal Adaptation: From Multi-Criteria Analysis to Monitoring and Evaluation. Coast to Coast 2012: Living on the edge: Program and abstract handbook.

Preston, B.L., M. Maloney, D. Thomsen, T. Smith, R. Mangoyana, and B. Conlon, 2013: A Multi-Criteria Analysis of Coastal Adaptation Options for Local Government. Prepared for the Sydney Coastal Councils Group by Oak Ridge National Laboratory Oak Ridge, Tennessee and the University of the Sunshine Coast, Queensland. Accessed 20 June 2016. [Available online at http://www.sydneycoastalcouncils.com.au/sites/default/files/MCA_of_Coastal_Adaptation_Options_for_Local_Government.pdf].

Mangoyana, R.B., D.C. Thomsen, T.F. Smith, B.L. Preston, S. Heinz, M. Maloney, G. Withycombe, and I. Armstrong, 2012: Literature Review of Climate Change Adaptation in the Coastal Zone. Accessed 20 June 2016. [Available online at http://www.sydneycoastalcouncils.com.au/sites/default/files/Coastal%20Adaptation%20Lit.%20Review%20final%20v2.pdf].

This Case Study was prepared by Geoff Withycombe from Sydney Coastal Councils Group. Please cite as: Withycombe, G., 2016: The Sydney Coastal Councils Group experience: prioritising coastal adaptation options at the local level. Case Study for CoastAdapt, National Climate Change Adaptation Research Facility, Gold Coast.

CoastAdapt

NCCARF
National
Climate Change Adaptation
Research Facility

Australian Government
Department of the Environment and Energy