A framework for climate adaptation decision-making by local government in central Australia

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Abstract

Climate models indicate that Australia is likely to get hotter, with some data projecting a temperature rise in the range of 3 to 7◦C by 2100. Local adaptation responses will be required to mitigate the negative consequences of a warming atmosphere. Local governments will need to play an active role in local adaptation strategies so their communities are adequately prepared for the future climate. While most local governments in Australia face the challenge of decision-making under uncertainty, remote inland locations such as those in central Australia will face more complex decision-making environments due to remoteness and their typically heterogeneous populations. Despite the challenges for sound decision-making, effective adaptation responses are crucial. Adaptation decision-making will need to be embedded within the constraints and opportunities that are likely to arise as the climate and many other factors change. At the local government level, short term planning and transitional adaptation is likely to be a feature of adapting to climate change. Over longer time horizons a shift towards transformational adaptation will be required. In this paper we aim to understand adaptation decision-making for local government institutions in central Australia using the risk management framework.

Introduction

Climate models indicate that Australia is likely to get hotter, with some models projecting a temperature rise in the range of 3 to 7◦C by 2100 in northern Australia. Local adaptation responses will be required to mitigate the location specific negative consequences of a warming atmosphere. Despite tight budgets, short planning periods, competing priorities and limits to legal responsibilities, local governments will need to play an active role in adapting to the future climate. The adaptation research focus has transitioned from just identifying and quantifying the potential impacts of climate change to a more policy oriented approach, with recent studies using the term 'adaptation pathways' and focussing on the decision-making process and illustrating how various adaptation options can be implemented over time (Maru and Stafford Smith 2014).

The Risk Management Framework (RMF) is increasingly being used for adaptation decision-making by local governments due to its policy-oriented characteristics (see Trueck et al. 2013). Risk management framework recognises a decision cycle (e.g. Jones, 2010) and the main steps are:

i) Risk identification: This step identifies the main elements that are at risk due to a changing climate and factors including non-climate stressors that might contribute to the risk.
ii) Risk analysis: The consequences of the risk and its likelihood are identified and assessed in this step.
iii) Risk reduction: This step involves selection of suitable options, evaluation and prioritisation of options and implementation of options.

The framework also promotes adaptive management (Jones, 2010) as each decision cycle (steps i-iii) is followed by a monitoring period to check if the decision outcomes are adaptive or maladaptive (see Wise et al. 2014 and Fig. 1). In this paper, we test the applicability of this framework for local government institutions in central Australia.

Risk management for local governments in central Australia

Central Australia has a heterogeneous population including both indigenous and non-indigenous people. Days over 35°C are expected to increase from a current 90 days to 132-182 days per year by 2070 due to climate change. The warming atmosphere has a wide range of implications, including health consequences (e.g. heat stroke, exacerbated pre-existing cardiovascular conditions) an increase in energy requirements (e.g. increase in cooling energy requirements and associated increases in energy costs) and damage to infrastructure (e.g. roads, tele-communication).

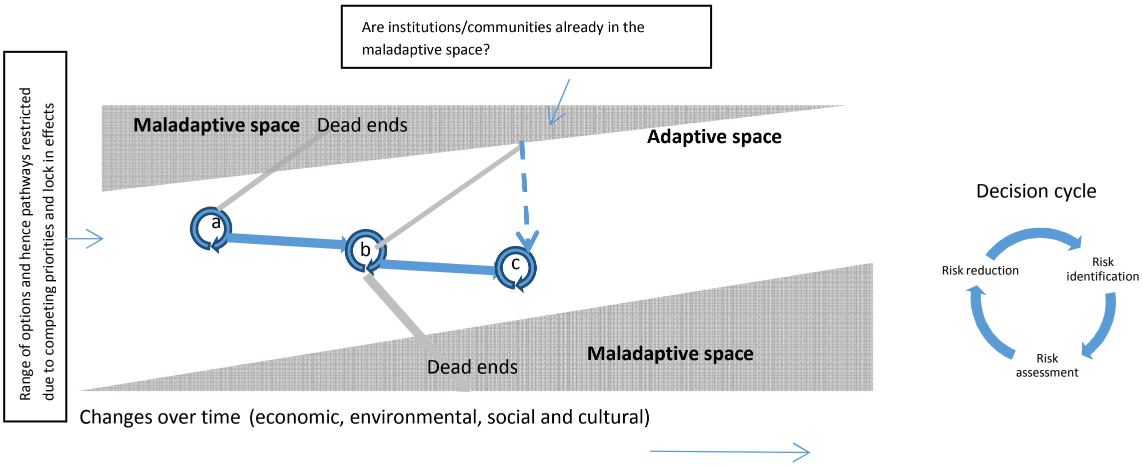
In step 1 of the RMF, a participatory approach would be beneficial for central Australia, given the heterogeneous population and the presence of vulnerable communities. The commonly used framework for assessing the risks (step 2, RMF) is the Triple Bottom Line (TBL) where assessments are made against economic, social and environmental aspects of the issue. The GRI (Global Reporting Initiative) and ICLEI (International Council for Local Environmental Initiatives) have set similar sustainability reporting guidelines for municipalities around the world (ICLEI 2008, GRI 2011). For instance, the City of Melbourne implemented the TBL to promote sustainable development, while Ku-ring-gai Council (New South Wales) adopted an extension of the TBL, the Quadruple Bottom Line (QBL). The fourth dimension in QBL is related to governance issues of a location and is meant to verify if decisions comply with the strategic and management plans of the local government (Davies, 2008). In the central Australian context, an extension to the TBL which includes governance and cultural factors may be necessary. The cultural component is particularly relevant for implementing options for Indigenous communities as certain options can be culturally inappropriate (e.g. installation of panel heaters during the Alice Solar City program, see Gerritsen et al. 2012). The relative importance of each component of the TBL/QBL is usually location-dependent.

In terms of selecting appropriate adaptation options, central Australian local governments will need to adopt a combination of incremental and/or transformative adaptation options depending on the local contexts and operating environments. Climate adaptation literature suggests a number of principles for climate adaptation decision-making and uncertainty management (e.g. Hallegate 2009; Weaver et al. 2013) many of which are relevant for central Australia. The main approaches include:

i) Choosing low regret/win-win/robust options
ii) Choosing flexible options or easily reversible options (e.g. low cost soft options such as awareness programs).
iii) Reducing uncertainty (data gaps) in decision-making by including community <u>or</u> stakeholder or expert interests or opinions.
iv) Using bottom-up approaches that examine vulnerabilities of potential policies in the face of climate change and identify options that reduce these vulnerabilities.

It is important to assess adaptation pathways that may become maladaptive in the future and pathways that remain adaptive over time (see Fig 1). One main strategy of adaptation decision-making is to reduce time horizons for investment planning by incremental/transitional investments. The advantage of this method is that the options are flexible and upgradable in light of new data and understanding. This depends on whether the deciding institution is already in a maladaptive space (see Figure 1). If the decision agency is in a maladaptive space, incremental options may not help to get back to the adaptive space and that may require transformational adaptation. In central Australia, this is particularly important as energy-intensive adaptation measures (e.g. use of air conditioners for heat stress) can be proposed to communities which are already facing energy poverty (Race et al. 2015, in prep.). Transformation in the form of renewable energy, as in decision cycle ‘c’ in Fig. 1, may be required for such communities to move towards the adaptive space. Institutions facing a number of pressing community interests prefer options with co-benefits (e.g.

Mathew et al. 2012), but this has the disadvantage that often the focus of action is skewed towards non-climate related priorities. Though greater diversity in options can reduce the option sensitivities to a varying future (Leach et al. 2010) and would be advantageous for vulnerable communities, it is pertinent that the choice of adaptation options can be constrained due to lock-in effects (Wilson et al. 2014) and requirements to meet mitigation and development goals simultaneously with the adaptation goals (Thornton and Comberti 2013). This indicates that there is a restriction in the number of adaptation pathways that can be implemented.



In Figure 1 Iterative adaptive learning decision cycles (blue arrows) indicate pathways in the adaptive space; grey arrows indicate pathways that lead to the maladaptive space; arrows with broken lines indicate transformative adaptation. Grey shaded areas represent the maladaptive space); the right hand diagram indicates the decision cycle. Source: modified from Wise et al. 2014.

Concluding remarks

The risk management framework is applicable to local government institutions in central Australia, but the investment decisions and strategies used for decision-making may differ from what is required in urban centres. An ideal strategy for central Australia would be to adopt the adaptive management strategy as long as the options enable the community to remain or steer towards the adaptive space. In most cases, transformative adaptation will be required in the long term.

References

GRI. (2011). Sustainability reporting guidelines. Version 3.1. Retrieved 30 November 2011, from http://www.globalreporting.org/NR/rdonlyres/7DB67FFF-81EE-402F-A218-36940C883DD5/0/G31GuidelinesinclTechnicalProtocolFinal.pdf

Hallegatte, S. (2009). Strategies to adapt to an uncertain climate change. Global Environmental Change A 19(2), 240-247.

ICLEI. (2008). Cities for Climate Protection (CCP) Australia adaptation initiative. Retrieved 9 February 2010, from http://www.iclei.org/fileadmin/user_upload/documents/ANZ/CCP/CCP-AU/Projects/AI/AdaptationToolkit/Toolkit_CCPAdaptation_Final.pdf

Jones, R.N. (2010). A risk management approach to climate change adaptation. In R. A. C. Nottage, D. S. Wratt, J. F. Bornman & K. Jones (Eds.), *Climate change adaptation in New Zealand: Future scenarios and some sectoral perspectives.* (pp. 10-25): New Zealand Climate Change Centre, Wellington.

Leach M, Scoones I. and Stirling A. (2010). *Dynamic Sustainabilities. Technology, Environment, Social Justice*. Earthscan, London.

Maru, Y. T., & Stafford Smith, M. (2014). GEC special edition–Reframing adaptation pathways. Global Environmental Change 28, 322-324.

Mathew S, Trueck S. and Henderson-Sellers A. (2012). Kochi, India case study of climate adaptation to floods: ranking local government investment options. Global Environmental Change 22, 308-319.

Race, D., Mathew, S., Campbell, M. and Hampton, K. (forthcoming) Energy Poverty in the Desert: Understanding household energy stress in central Australia. Submitted to Energy Policy.

Thornton T. and Comberti C. (2013). Synergies and trade-offs between adaptation, mitigation and development. Climatic Change 120, 1-14.

Trueck S., Mathew, S., Henderson-Sellers, A., Taplin, R., Keighley, T., Chin, W. (2013). Climate Adaptation Decision Support Tool for Local Governments: CATLog: Developing an Excel Spreadsheet Tool for Local Governments to compare and prioritise investment in climate change adaptation. NCCARF: Gold Coast, pp. 1-39.

Weaver C.P., Lempert R.J., Brown C., Hall, J.A., Revell D. and Sarewitz D. (2013). Improving the contribution of climate model information to decision making: the value and demands of robust decision frameworks. Wiley Interdisciplinary Reviews: Climate Change 4:39–60.

Wilson G. A. (2014). Community resilience: path dependency, lock in effects and transitional ruptures. Journal of Environmental Planning and Management 57:1-26.

Wise R.M., Fazey I., Stafford Smith M., Park S.E., Eakin H.C., Archer Van Garderenf E.R.M. and Campbell B. (2014). Reconceptualising adaptation to climate change as part of pathways of change and response. Global Environmental Change 28, 325-336.