



National guidance for adapting to coastal hazards and sea-level rise: Anticipating change, when and how to change pathway



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ABSTRACT

Sea-level rise challenges public policy-making because existing planning frameworks and methods are designed to promote certainty using static and time-bound planning and legal instruments. Sea-level rise is a dynamic and uncertain process, which is deeply uncertain towards the latter part of this century and beyond. Communities require decision making approaches that can enable adjustments to policies ahead of damage, without entrenching current exposure to hazards or incurring larger than necessary adjustment costs in the future. We first discuss the nature of the sea-level problem, the policy context that creates decision-making challenges and how they have been typically addressed through policy and practice. Secondly, we show how an assessment and planning approach, designed to address uncertainty and change (the Dynamic Adaptive Policy Pathways (DAPP) planning approach), has been integrated into national guidance for coastal hazard and climate change decision-making in New Zealand. The Guidance integrates hazard and sea-level rise assessments with uncertainty type and with the scale and scope of activity. It is underpinned with values-based community engagement, and uses signals and decision triggers for monitoring and adjusting pathways to meet objectives over time. The applicability of the approach in the Guidance for other policy problems involving uncertainty, is also discussed.

1. Introduction

Sea-level rise (SLR) poses a particularly challenging problem for public policy. It is a chronic ongoing change that will affect many communities in low-lying coastal situations. The rate and magnitude of SLR are deeply uncertain towards the latter part of this century and beyond, highlighting the need for adaptive management frameworks (Kopp et al., 2017). Sea-level rise compounds coastal hazard,¹ impacts through an increasing frequency of extreme inundation events, rising groundwater, and increased exposure of people and assets from the legacy of past decisions (Hinkel et al., 2014; Nicholls, 2011; Rouse et al., 2016). Many low-lying areas will become uninhabitable, necessitating eventual withdrawal in anticipation of the harm, or abandonment with all the associated social and economic disruption (Nicholls and Cazenave, 2010).

Governments at national and local levels have varying mandates to ‘do no harm’ and some have embedded consideration of climate change

impacts into their regulatory frameworks and adaptation plans, for example, the United Kingdom, Netherlands, Canada and New Zealand. Nevertheless, sea-level rise challenges those frameworks and the public policy tools and implementation methods which are currently used, such as coastal hazard lines, fixed review timeframes, and cost benefit analysis. This is because they are primarily designed to create certainty for people and communities (Ruhl, 2012), by using spatially and temporarily static instruments within the statutory frameworks (Lawrence et al., 2013). While ‘plans’ are reviewed periodically (every 10 years or so), they fix current risk understanding in space and time for the duration. For example, land uses are either in or out of coastal hazard zones, and properties at the landward edge will only be affected toward the end of a planning period. Such zones also give no information about timing or frequency of impacts from sea-level rise (Lawrence and Saunders, 2017; Stephens et al., 2017). If review periods are at intervals of around 10 years, and long-term SLR is not considered, this can enable further development where it will be exposed to SLR, and thus increase

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¹ Hazard, risk and hazard risk to mean the physical characteristics of the stressor; the combination of the consequences of a hazard on people and assets and the likelihood of occurrence (where it can be calculated or where scenarios are used); and the combination of the two terms to describe the source of risk, respectively. Vulnerability is defined as the predisposition to be adversely affected encompassing both fragility of assets in an engineering sense and the ability of people and group’s to adapt.

the difficulty of changing course in the future; early decisions will be required for more frequent inundation even with modest SLR. Decision-making approaches therefore need to ‘fit’ (Young, 2002) the policy problem of increasing risk profiles into the future. Policy approaches must therefore, enable adaptation choices that can be adjusted at just the right time, ahead of damage occurring, without entrenching current exposure to hazards, nor incurring larger than necessary adjustment costs in the future.

The consequence of these challenges is two-fold. Any adaptation strategy must remove lock-in of people and assets and be cognisant of future levels of risk (some of which, like SLR, will go on for centuries), or transition communities away from areas at risk. This suggests that public policy tools need to be able to deal with widening uncertainty bounds to accommodate ongoing change, compounded by deep uncertainty in upper-range SLR if the polar ice sheets become unstable (Kopp et al., 2017; Slangen et al., 2017). Furthermore, considerable engagement will be required with communities and stakeholders that are imminently affected, to understand their needs and values (Tschakert et al., 2017), and with those that inevitably will pay for the adaptation actions – local ratepayers and national tax payers. Decision makers and communities world-wide are familiar with paying for the ‘victims’ of climatic disasters, and systems are largely in place to do that after the ‘fact’. There is less familiarity with anticipatory planning that is dynamic in nature and which can operate and implement transformative change where deep uncertainty exists.

The precautionary principle is one policy concept that anticipates uncertainty by alerting decision makers to situations where the consequences could be serious or irreversible (United Nations, 1992). This suggests cautious anticipation ahead of climate change impacts, and not using lack of certainty as a reason to postpone action where irreversibility is present. In the context of SLR, if the principle is embedded within statutory instruments and there is guidance as to its use as intended (United Nations, 1992), the precautionary principle can provide a framework within which adaptive planning and the tools that fit the type of problem being addressed, can be situated. Such an approach has been evolving in New Zealand through statutory and non-statutory instruments. This paper uses a New Zealand example of how national guidance has been crafted and is being embedded into practice, to inform how adaptive actions can be framed, socialised, designed, implemented and monitored in situations of different types of uncertainty and dynamic change, ahead of harm and damage.

2. Background

The illustrative setting for this paper is New Zealand, an island nation with a long coastline (18,200 km) (Rouse et al., 2003) and with many of its major cities and smaller communities located in low-lying coastal areas. Some areas have experienced periodic coastal erosion, or have been subjected to coastal storm flooding (Stephens, 2015) increasing on the back of the historic average rise in mean sea-level of 0.2 m since 1900 (Stephens et al., 2017). Risk exposure (replacement value of buildings only) around the New Zealand coast has been estimated at \$3 billion and \$19 billion (2011 NZ\$) for coastal land elevations within 0.5 and 1.5 m respectively of spring high tide mark – based on ~85% of developed areas (Bell et al., 2015).

However, these signals have been insufficient for policy settings to shift from a focus on disaster response, to an anticipatory focus that can address uncertainties and changing risk profiles as sea-levels continue to rise and accelerate (Kopp et al., 2017; Slangen et al., 2017). The responses to more widespread and frequent climate-related events around New Zealand, have begun to highlight the inadequacies of current policy settings for addressing the challenge of rising seas (Parliamentary Commissioner for the Environment, 2015), and the effects of climate change more generally (Gluckman, 2013; Royal Society of New Zealand, 2016). Within this context, and following the last intergovernmental Panel on Climate Change (IPCC) review (Reisinger

et al., 2014), the Ministry for the Environment decided to revise its 2008 coastal guidance for local government and for those providing services and infrastructure in coastal areas. Four aspects for particular attention were:

- changes to the roles and responsibilities of local government in managing coastal hazard risks, for example the revised New Zealand Coastal Policy Statement (Minister of Conservation, 2010);
- the growing understanding of SLR impacts, including coastal flooding (which will overtake coastal erosion in terms of hazard exposure) impacts further inland including salinization and rising ground water;
- new adaptive tools that can enable uncertainty to be addressed in policy development and decision making;
- new public engagement approaches for communities affected by SLR to develop adaptation transition pathways.

Such non-statutory guidance sits within a suite of available instruments from national to local. The hierarchy of instruments is set out in the Resource Management Act (RMA) 1991, the primary statute for integrated planning and resource management. The New Zealand Coastal Policy Statement (Minister of Conservation, 2010) (the NZCPS) is the only national *statutory directive* for decision makers and includes direction for climate change adaptation at the coast for SLR, storm surge and associated wave height, with a planning horizon of at least a 100 years. Associated non-statutory national guidance includes the coastal hazards and climate change guidance and implementation guidance for the NZCPS. Plans developed by regional and district councils must give effect to the NZCPS objectives and policies.

Implementation in plans is required through three main RMA components: a) consideration of climate change, including its cumulative and high-probability effects, and low-probability events with high potential effects; b) management of significant risks from natural hazards as a matter of national importance; c) a general requirement to avoid, remedy or mitigate natural hazards. The Guidance, along with statutory provisions, on the face of it, can enable SLR as a policy problem to be addressed. However, in practice, the institutional framework has been unable to motivate actions that address the uncertainty around the rate and magnitude of sea-level rise, especially for decisions that have long lifetimes, such as decisions on the subdivision of land, buildings, above and below ground infrastructure and existing uses. A number of factors are at play here – the contested nature of climate change as a policy problem, in part due to the perception that the issue is uncertain and distant (Weber, 2006), development pressures in coastal areas, short-term political cycles, inadequate use of statutory instruments, methods for public engagement and analytical tools for managing uncertainty over long timeframes, and un-coordinated governance across scale and domains of interest (Lawrence, 2015; McIntosh et al., 2013; Spence et al., 2012; Weber, 2010).

While institutional arrangements globally and in New Zealand are well embedded in policy and operational practice for preparedness, responding and recovering from natural disasters, avoiding and minimising disasters through anticipatory planning is less well developed (Basher, 2016). Shifting decision making from a post hoc response towards anticipating potential impacts and thus reducing risk and costs across generations, has been slow to evolve. The 2015 Sendai Framework (UNISDR, 2015) focuses on this shift.

In the New Zealand context, development of regional rules has been limited as regional councils are naturally reluctant to start discussions with district/city councils on withdrawal from the coastal margins. Where they have done so, they have received opprobrium, but if they delay, the risk will escalate as further investment at the coast takes place. Consequently, the planning and emergency management activities are not well integrated. It is only recently that councils are starting to use processes that encompass anticipatory adaptive planning in coastal areas (e.g. Tasman District, Mapua and Ruby Bay Plan Change

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