New Zealand Climate Change Research Institute

Te Pūtahi Hurihanga Taiao

Developing adaptive risk management for our changing climate

A report of workshop outcomes under an Envirolink Grant

Judy Lawrence and Martin Manning

NZCCRI 2012 report: 2012–1

June 2012

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Executive Summary

This report presents a summary of the context and outcomes of two workshops on adaptive risk management, as they relate to council decision-making on changing climate risks. The workshops were undertaken by the New Zealand Climate Change Research Institute (CCRI) at Victoria University of Wellington, in partnership with Tasman District Council and the Nelson City Council, and supported by an Envirolink grant. Envirolink grants are aimed at helping councils apply existing knowledge held by scientists on regional environmental issues.

Changing climate risk

- Scientific projections of future climate change are being undertaken with increasing regional resolution and confidence. The increases projected for temperature and sea level rise for the New Zealand region show that we need to plan for adapting to a climate that is outside human experience.
- Trends in extreme events are becoming more evident and show that the ranges of climate parameters, such as temperature and rainfall, are changing, in addition to changes in their averages and appear to be changing more rapidly than is reproduced in climate models.
- Sea level is expected to rise at an increasing rate over this century and to also continue rising for several centuries; this will clearly create a new challenge for all coastal management planning processes.
- New Zealand's average temperature has increased over the last 100 years by about 0.91°C/century and this is about 20% larger than the rate of rise in global average temperature.
- Similarly, an increase in heavy rainfall events has been identified over wide areas and can be related to the increase in atmospheric water vapour that is directly related to warming.
- For both an increase in extreme weather events and for future sea level rise, the rates of change are likely to increase during this century and changes could occur as a sequence of transitions, rather than a smooth trend.
- Flood risk is currently derived from historical analyses and measurable data projected forward to the future. This approach is unlikely to reflect the future with climate change, which is expected to be unlike the past in terms of magnitude and frequency of flood events.
- Planning in coastal areas and floodplains will to have to deal with a transition from the status quo exposure now to unsustainable exposure by the later part of this century.
- Adaptation approaches will have to be more decision-maker friendly by moving from classical top down 'what if' scenario approaches, to 'how much can current systems cope with'—an adaptation tipping point approach.

The challenges

- There was a perception that climate change was contested and that this made it a difficult issue to get on the agenda in a way that can be discussed strategically.
- A concern was expressed that each council across New Zealand was addressing climate change effects in different ways and facing court challenges alone.
- The current statutory limitations identified included:
    - how the statutory provisions are applied in practice
    - the pressures on councils from development interests

    - the desire on the part of councillors not to use development controls to limit private property expectations and adversely impact property values when information is uncertain
    - the inflexibility of the instruments over time which entrenches existing exposure to hazard risk.
- A general view was expressed that a more integrated approach across hazard risk management nationally would achieve more consistent results over time.
- There was concern at the possibility of withdrawal of insurance cover or, at best, a sharp increase in insurance premiums for council assets and services if reduction of climate-related risk was not addressed.
- There was a need expressed for wider discussion of who pays for precautionary responses to climate change effects.
- Business interests expect councils to set out what they can and can't do, identify climate risks and reduce them.
- A partnership approach between all interests was suggested, that could address intergenerational cost issues in a fair and equitable manner without transferring private costs to the general community.

Barriers and opportunities

Uncertainties

- There is a reluctance to apply information that is perceived to be uncertain. Caution is exercised by councils in such circumstances over potential legal challenges. This and the numbers of players and the complexity of developing and implementing practical adaptation methods has created delay in councils considering changing climate risk.

Regulatory constraints

- The current statutory and institutional arrangements constrain adequate climate change risk management, including the misalignment of statutory provisions, the planning practice, the decisions made in particular situations and organisational arrangements within and between councils.
- A misalignment of the relevant statutes (RMA, LGA, Building Act and Code and the SC&RC Act) is exacerbating climate-related risks.
- The evidential practice under the legislation leads to risk being misrepresented through the use of single numbers averages and best estimates. This also leads to the use of static representation of risk and of protection measures adopted.
- The devolution of responsibility for climate change effects has resulted in each council expending resources on issues that are common across all councils. This is inefficient.
- There is, however, some under use of statutory provisions at all levels of government.

Timeframes

- The different planning timeframes and electoral cycle at local government mean that changing and dynamic risk are dealt with differently by the different functional areas (e.g. asset and property management, resource management, political management).

Resources

- There is varying people and financial capacity and capability across councils to address changing climate risk.
- Asset and service levels are rising over time and there is a legacy of assets in places that will be affected by changing climate risk.
- There is limited ability for councils to consider land purchase for changing climate risk and this varies between council rating capacity.

Data information and monitoring

- There is general fragmentation and unnecessary inconsistencies emerging in the collection of climate impact and adaptation data and information across New Zealand and no one repository exists that is easily accessible for councils.
- Monitoring of changing climate risks and their impacts is weakly developed across New Zealand.

Role of central government

- It was acknowledged that central government has a commitment to addressing climate change (e.g. the emissions trading system (ETS) and investment in economically driven areas of risk such as water management, agricultural emissions research and adaptation in the agriculture and tourism sectors).
- There were some other areas that councils considered were more efficiently carried out at central government level or which would support local government better in its devolved functions on climate change adaptation:
    - consistent and reinforcing messages that adaptation to changing climate risk is an issue that needs to be addressed now
    - an impacts and adaptation data and information repository
    - a dedicated research programme on impacts and adaptation to climate change to enable strategic prioritisation of adaptation activity by local government
    - better alignment of legislation and with emergency management experience
    - routine strategic interpretation of climate events as a form of monitoring climate impacts
    - national scanning of climate-related risk hotspots across the country and across sectors.

Relationship between regional and territorial local councils

- A need was identified for better coordination and alignment across regional councils and TLAs when considering changing climate risk.
- Careful thought could be given as to how legislative and governance reform could assist more efficient consideration of changing climate risk.

Communication of risk

- It was considered that there is a low level of understanding in the community regarding climate-related risks.
- The use of averages, best estimates underestimate the extremes and their use has instilled a false sense of confidence in protection measures adopted based on them.

- The use of some probability formats is misleading (e.g. 1:100-year flood which is often interpreted to mean the risk is distant).
- This has resulted in barriers to understanding risk exposure as the climate changes.

Political issues

- The public has expectations that councils will protect them from harm. This drives the decision-making at a local level.
- The short election cycle places pressures on decision-makers to address community expectations.
- There is a mismatch between what is politically and socially acceptable and what the science and risk management tells councils and with their liability for damages under a business as usual scenario.
- There is a legacy of development and infrastructure exposed to climate risks that will create ongoing costs for councils.

Opportunities

- Some potential for better use of existing statutory provisions.
- Initiation of community conversations about changing climate risk and options to address them.
- Development of communities of practice across local government and between central and local government.
- Partnerships between insurance, banking and real estate sectors with public and private asset owners and local government to reduce climate risk exposure.
- Development of a contingency funding mechanism to address changing climate risk (e.g. for retreat, for development of community and council adaptive capacity).

Communication of risk

- Continuous engagement with communities will be necessary as information changes.
- Communication methods more likely to be successful in conveying risk and consequences include visualisation, animation and maps that relate to people's experiences in the real world at the community level.

Adaptation options

- Incremental adaptation will be time-limited and more transformational adaptation will be necessary before the current management responses become redundant due to the lag time for analysis of options and getting community agreement on response options.
- Consideration of the *lifetime* of the adaptation decision relative to *the rate of change* is likely to result in more flexible options.
- Consideration of options over a wide range of scenarios and, in particular, the consequences of extreme events, will provide a better basis from which decisions can be made on climate risks.
- A continuous cycle of strategic planning will be required for analysis and evaluation of response options over time. A national and region-wide scan of hotspots, with clear regional rules around climate risk management will set a good framework for decisions at TLA level.

Enablers

- Necessary conditions for consideration of climate risks included:
    - development of better tools to consider future risks, costs and benefits that are weighted evenly towards the future
    - monitoring risk exposure
    - discussing 'who pays, how and when' rather than 'what does it cost'
    - better alignment of regional and territorial local government functions and decision-making
    - continuity of institutional and political commitment over time.

1.0 Introduction

The purpose of the Envirolink funding scheme is to increase the interaction of regional and unitary Councils with research organisations and thus improve science input to environmental management activities. Local government has responsibility to consider the effects of climate change and to manage natural hazards when undertaking their functions, such as land use planning and the management of assets and infrastructure. As climate changes, local government will have to adapt and respond to increasing extremes of rainfall and coastal storms, with significant consequences for communities located at the coast and on floodplains.

This report presents a summary of the context and outcomes of two workshops on adaptive risk management, as they relate to council decision-making on changing climate risks. The workshops were undertaken by the New Zealand Climate Change Research Institute (CCRI) at Victoria University of Wellington, in partnership with Tasman District Council and the Nelson City Council, and supported by an Envirolink grant. Envirolink grants are aimed at helping councils apply existing knowledge held by scientists on regional environmental issues. The CCRI has developed expertise in the area of adaptive risk management through a four-year research programme funded by the Ministry of Science and Innovation PROJ-13942-GLO-VICLINK *Vulnerability, Resilience and Adaptation to Climate Change.* The materials for the workshops were based on the results of that research programme and informed by doctoral research undertaken by Judy Lawrence.

1.1 Background

The workshops conducted at Tasman District Council and Nelson City Council (both unitary authorities) were designed for professional practitioners in local government in both environmental and infrastructure services management, and for elected councillors and the business community.

The focus of the workshops was on the particular planning and management needs of councils in building community understanding and adaptive behaviours that can remain responsive over time to the dynamic nature of the climate risks. Both strategic and specific approaches were discussed including the regulatory environment, the barriers and opportunities, processes, methods, tools, data, communications and decisions across all types of council decision-making. The workshops were based on the assumption that the present devolved institutional arrangements for responding to the key climate risks continue, and explored how this may be supported by either working within these arrangements, or developing new arrangements through local and central government actions.

The 76 participants at the workshops included council officers across the range of council functions and elected council politicians from Tasman District Council and Nelson City Council, Marlborough District Council and business and central government stakeholders. Council staff (six) from Hawkes Bay Regional Council, Wellington City Council, Kapiti Coast District Council and Tasman District Council presented their experiences at the workshops. The two CCRI researchers, Judy Lawrence and Professor Martin Manning, made presentations prior to group discussions. The workshops were facilitated by Dr Glen Lauder (Tasman workshop) from CommonGround and Frances Sullivan (Nelson workshop) from Local Government New Zealand. The two workshop programmes are attached as Appendix 1.

1.2 Purposes of the workshops

- To establish better ways of communicating between experts, decision-makers and communities about changing climate risks and thus build more resilience through awareness and preparation.
- To identify the key factors in local government planning and management processes that can help develop more community and organisational resilience in the face of increased risks.
- To discuss a range of options for addressing changing climate risk by councils.
- To develop a framework for integrating across short-term and long-term environmental planning and asset and infrastructure management which avoids potential 'maladaptation' and is effective in responding to changing climate risks over space and time.

Regional councils and unitary authorities across New Zealand tend to operate independently when exercising their powers and functions that impact on climate-related risk decisions. Workshops such as these are one way of sharing knowledge between councils through a practice and research-based collaboration with external research providers.

A semi-formal system of sharing knowledge and experiences between regional and unitary council professional groups has been established by regional chief executive officers through Special Interest Groups (SIGs) under the auspices of resource management groups. Climate change risk considerations cut across the interests of several SIGs, viz., Policy, Hazards, Coastal, Land and Emergency Management. The intention is for the findings of the workshops set out in this report to be transferred through these professional networks and across council elected politicians.

2.0 Changing climate risk

Scientific projections of future climate change are being undertaken with an increasing amount of detail and are showing that we need to plan for adapting to a global climate that is outside the range experienced over the last 5,000 years (Kiehl, 2011). This will have major implications for New Zealand. Growing recognition of this issue has led to ongoing policy development that addresses both mitigation of future changes and adaptation to what will occur. While close interactions have developed between those involved in the research and government agencies through the Intergovernmental Panel on Climate Change (IPCC) at an international level, this needs to be complemented by other forms of direct interaction between scientists and users of their information, at both national and local levels.

While the scientific context for what is being covered here was summarised extensively in the last IPCC assessment report[1], the focus of this project has been to address the implications of climate change for risk management by New Zealand's local government agencies. In particular, how the uncertainties inherent in the scientific projections for the future climate can be closely related to the way in which local government already deals with the risks caused by variability in the current climate.

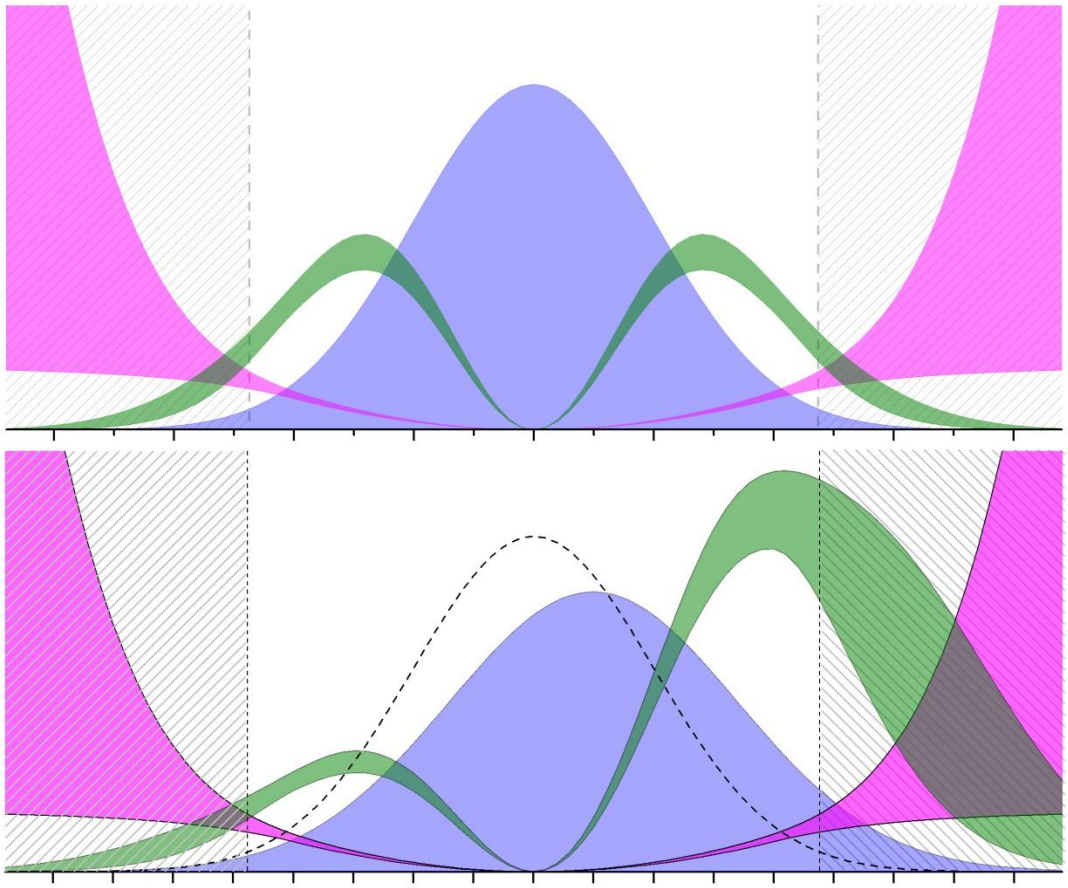
2.1 Increasing frequency of extreme events

New Zealand's average temperature has increased over the last 100 years by about 0.91°C/century and this is about 20% larger than the rate of rise in global average temperature[2]. The extent to which there has also been a trend in extreme cold or warm temperatures is harder to define for a small country like New Zealand, but global analyses over wide areas show clear evidence that the temperature ranges are increasing also[3]. Similarly, an increase in heavy rainfall events has been identified over wide areas and can be related to the increase in atmospheric water vapour that is directly related to warming. Since the last IPCC Assessment was completed in 2007, climate science has put more focus on the identification of trends in extreme events, which appear to be changing more rapidly than is reproduced in climate models.

In this context, Figures 1a and 1b show a simple schematic of climate change from a risk management perspective that is consistent with observations over the last 50 years. The risks associated with climate events are the product of the probability of their occurrence and the magnitude of the damages that would be caused. The upper panel shows a static situation in which

[1] www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml
[2] http://ftpmedia.niwa.co.nz/Seven_Station_Series/
[3] www.columbia.edu/~jeh1/mailings/2011/20111110_NewClimateDice.pdf

adaptation to past ranges of climate events has led to a narrow range of risks. This is because the situations, in which the damage costs would be extremely high, are limited to ones that are also extremely unlikely. The lower panel shows how the risks change as the range of climate events shifts and widens. While the average conditions are still similar to what has been common previously, extreme events that were only 1–2% likely to occur are now about 6–10% likely to occur. As the climate continues to change, this frequency in what have traditionally been treated as extreme events will continue to increase.



Figures 1and 1b. A schematic for risks due to changing extreme events

The upper panel shows a probability distribution for climate-related events in blue; the mauve areas show a wide range of potential damages from extreme events; and the green curves show the corresponding range of risks, where risk = probability × damage. The outer shaded areas show what is likely with less than 1% probability. The lower panel shows a shift and spread in the probability distribution for climate events that is consistent with observed changes in temperatures during the last 50 years. The damage curves are unchanged, and the green curves show the new range for low- and high-risk situations.

However, some characteristics of the risk raise additional issues that need to be addressed in the decision-making process. Currently expressions of risk in the flood context are derived from historical analyses and measurable data projected forward to the future. This approach is unlikely to

reflect the future with climate change, which is expected to be unlike the past in terms of magnitude and frequency of flood events.

Extensive surveys of the risks associated with climate change, such as by the UK 2012 Climate Change Risk Assessment report[4], have identified flood risk as a major issue. It is also becoming clear that this is creating a new concern about the extent to which both public and private property can remain insurable because of increasing flood risks[5].

2.2 Sea level rise

New Zealand has a large proportion of its public and private assets located near the coastline for historic reasons, but this now raises issues of structural vulnerability to future sea level rise (SLR). A new emphasis on scientific studies of SLR came after the last IPCC Assessment report which had identified a growing discrepancy between what was being observed in the major ice sheets and glaciers and the climate model projections that had been used for estimates of future SLR. New scientific estimates have become significantly higher than they were prior to 2007 and more detailed analyses of paleo-climate data has shown that sea level rose at a rate of about 1.6m/century the last time the planet became warmer because of a change in its orbit around the sun.

Figure 2 shows another schematic that combines many of the recently published estimates for SLR by 2100 into a probability range and then combines this with a wide range of potential damages so as to show the corresponding range of risks. While the most likely value for SLR shown here is 0.8m, a risk management perspective will have to consider the range of what may occur in ways that address the maximum risk.

For both low and high damages, this occurs at a significantly higher level than the most likely SLR. The main difference between these two cases will be that for low damage situations one can expect only a low priority for developing responses against SLR, whereas, for high damage situations the response will become essential.

[4] www.defra.gov.uk/environment/climate/government/risk-assessment/
[5] archive.defra.gov.uk/environment/flooding/documents/interim2/sop-insurance-agreement-080709.pdf

Adaptation to SLR clearly requires the development of new approaches for long-term planning. Scientists are quite confident that SLR will continue for several centuries because of the slow response of ice sheets and thermal expansion of the oceans to global warming. The need to plan for ongoing SLR was clearly recognised in the 2008 New Zealand Ministry for the Environment report on Coastal Hazards and Climate Change[6] which recommended that long-term planning should take account of a continuing rise of 10mm per year beyond 2100.

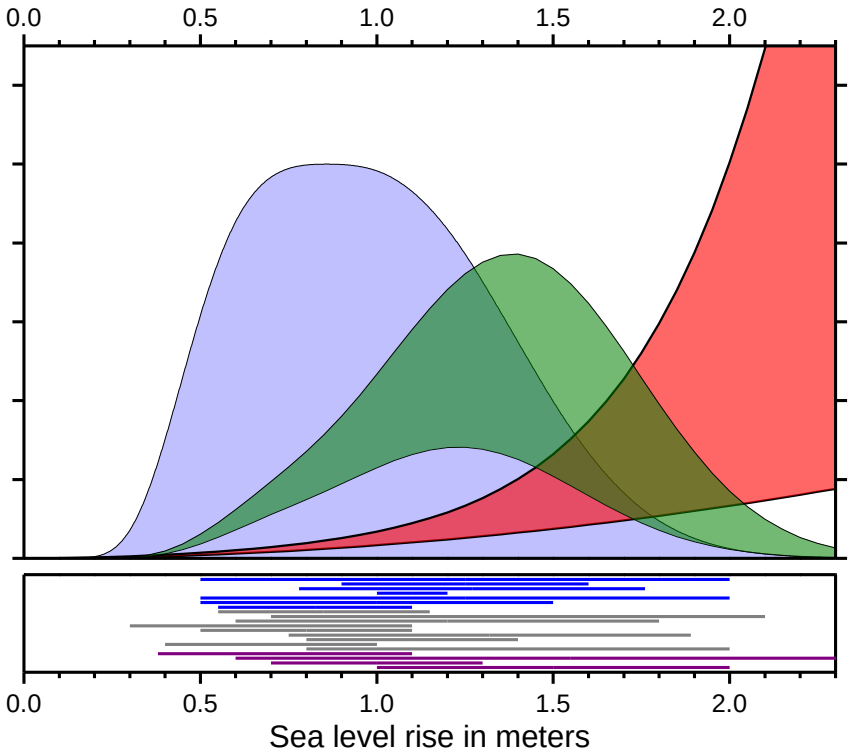


Figure 2. A schematic for the risks associated with sea level rise

The lower panel shows estimates given in recent peer-reviewed science papers with 4 in purple based on paleo-climate analyses, 9 in grey being results from semi-empirical model analyses and 7 in blue showing results from government reports or expert review papers. References for all of these papers are given in Manning et al. (2011), *Synthesis: Community vulnerability, resilience and adaptation to climate change in New Zealand*, available at: www.victoria.ac.nz/climate-change/reports. The upper panel shows a probability distribution for SLR in blue that combines these individual estimates, and that is combined with a wide range of potential damages shown in red to produce the risks that are shown in green.

New Zealand coastline and floodplains comprise many large areas of low-lying land. This means that planning will have to deal with a transition in different areas from the status quo exposure now to being unsustainable by the later part of this century. Both the range of feasible options and the extent to which they can be deployed will depend on local circumstances. But it is also important to recognise that planning for continuing change will need to be undertaken in ways that do not lock in

[6] www.mfe.govt.nz/publications/climate/coastal-hazards-climate-change-guidance-manual/

risk and create what is recognised in scientific studies as 'maladapted', with the consequences of high damage costs in the future.

Development of strategic responses to SLR is becoming a growing issue internationally. For example, the recent Australian Productivity Commission draft report on barriers to effective climate change adaptation[7] has suggested that a diversity of approaches across different units of local government can lead to inefficient or even counterproductive results. Also, the development of shoreline management plans in the UK[8] has shown that coastal management objectives can become embedded into local government policy in ways that require further development of more sustainable approaches that integrate short-term and long-term planning perspectives.

The extensive experience with sea walls and flood risk in the Netherlands has led to the development of strategies based on long-term planning horizons. Instead of using climate scenarios as their starting point, a concept of 'adaptation tipping points' has been applied to examine whether and for how long current risk management strategies will continue to be effective under different climate change scenarios and thus when alternative adaptive strategies are needed. This helps to answer decision-makers' questions, such as "*What* are the first issues that we will face as a result of climate change and *when* can we expect this?" (Kwadijk et al., 2010). This approach is shown in comparison with the traditional scenario approach in Figure 3 below. This shift in focus from protection to risk management has also shifted the debate around the balance of responsibility for preparing for future damages (Terpstra & Gutteling, 2008).

[7] www.pc.gov.au/projects/inquiry/climate-change-adaptation/draft (page 122)
[8] www.environment-agency.gov.uk/research/planning/104939.aspx

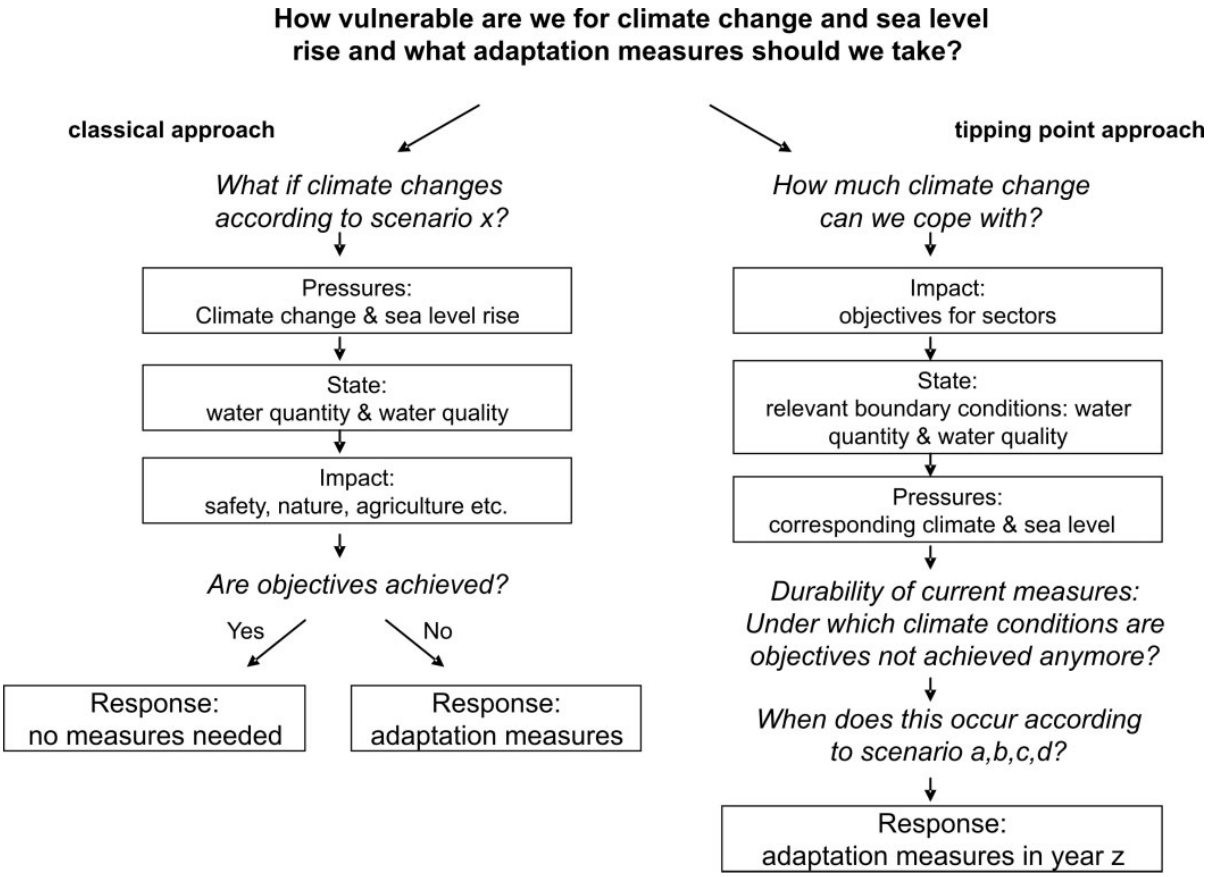


Figure 3. Classical top-down approach and adaptation tipping point approach to develop adaptation measures (Kwadijk et al., 2010)

The development of responses to the effects of climate change will be an issue with some common features internationally. Local circumstances and options for adaptation, however, will differ significantly by country and region, depending on the physical characteristics of the area, and the nature and vulnerability of people and assets at risk. In addition, response options will need to be driven by policy processes and value judgements based on the different economic and socio-political contexts. In this context, local government will need to be well informed about adaptation strategies in other countries, and develop their own adaptive capacity.

2.3 Rates of change in risk

Figures 1a,1b and 2 show changes in the risk related to climate change. The capacity to adapt to these can become limited when the rate at which they occur starts to require very rapid or emergency responses. The implementation of some previously planned adaptive strategies may become redundant. For both an increase in extreme weather events and for future sea level rise, the rates of change are likely to increase during this century.

Figure 4 is based on the schematic for changing risk shown in Figure 1a and 1b, but it now shows the change over time in the frequency of events that were initially only 1%, 2% or 5% likely to occur.

Recent studies of temperatures and rainfall suggest that changes so far have already moved along this type of evolution of risk curve. However, there are also a number of detailed analyses for temperatures in Australia (Jones, 2012) and rainfall in Europe and North Africa (Hoerling et al., 2011; Lyon & DeWitt, 2012), that suggest changes occur as a sequence of transitions rather than a smooth trend as shown here.

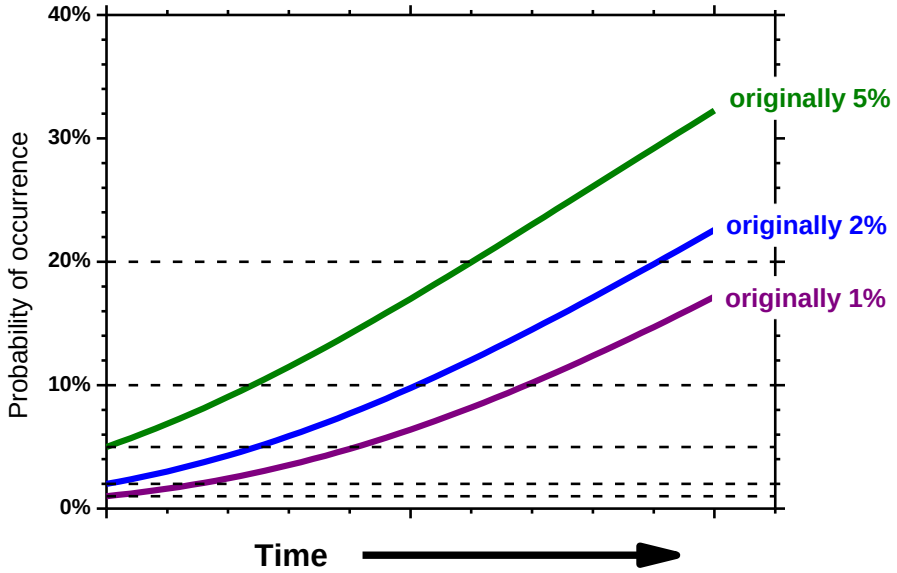


Figure 4. Changing frequencies for extreme events

This shows the rate of change in probability of occurrence for what was originally 1%, 2% or 5% likely events when the probability distribution continues to change as shown in Figure 1a and 1b. This is based on a recent summary of global temperatures (Hansen, Sato, & Ruedy, 2011) which suggests that some changes are already about one-third to one-half of the way along the time axis shown here.

The rates of change in risk associated with sea level rise will be very dependent on the extent of low-lying flat land near the coastline and the extent to which it can be exposed to storm surge events. The study done by NIWA on the effects of a changing probability of high tide exceedance in Nelson has also shown that local vulnerability to sea level rise will depend on the amount of rise relative to the tidal range that the coastline has become adapted to in the past (Stephens & Bell, 2009). These factors mean that the rate of change in sea level rise risk will be very dependent on local circumstances, but nevertheless high risk areas can be identified for more detailed analysis.

3.0 The challenges

3.1 The regulatory environment

Local government is responsible through the Resource Management Act (RMA), the Local Government Act (LGA), the Building Act (BA) and Code, the Soil Conservation and Rivers Control Act (SC&RC Act) and other related statutes for climate-related risk management of land use, infrastructure, assets and services and for the general development and welfare in New Zealand communities. Because climate risks are changing, historical records are becoming less relevant for the future. More frequent natural hazard events and possible surprises that tip us into new states, cannot be ruled out. Local government and communities will need new adaptive solutions, especially for decisions being made now for long-term assets and the location of people who will be affected by changing climate and increasing rates of change.

New Zealand is one of the few jurisdictions that has made express provision in statute for particular regard to be had to "the effects of climate change" (RMA Section 7(i)). This responsibility is devolved to local government and applies when exercising all functions and powers under the RMA. The RMA also embodies the principle of sustainable management, considers future generations and cumulative effects of low probability effects with high potential impact, and requires the avoidance and mitigation of natural hazards. The BA makes provision for the transparent noting of hazard risk on property titles under certain circumstances. These provisions are complemented by the New Zealand Coastal Policy Statement 2010 which requires a precautionary approach to "uncertain, unknown or little understood but potentially adverse effects of climate change", consideration of sea level rise to "at least 100 years", the avoidance and reduction of risk discourages "hard" protection structures and encourages transition mechanisms and timeframes to be considered.

These provisions appear to address changing climate risk but in practice, statutes like the BA, although more specific than the RMA, can be applied in a way that acts against climate change effects being adequately considered. For example, a pattern of site-specific decisions made under sections 71 and 72 may generate a cumulative risk in the face of climate change. This is a specific issue if regional or district councils have not promulgated rules about hazard risk. Also with respect to flooding, while the RMA indicates a 100-year timeframe for planning, the Building Code provides for a structural design life of 50 years or protection from a 2% Annual Exceedance Probability (AEP) flood (1:50-year return period flood). Often, less than 50-year timeframes are found acceptable provided the title is flagged to that effect. The adequacy of the legislative framework and its application was discussed at the workshops in some detail and reported here.

Within this institutional and risk management context , the workshops discussed the challenges faced by councillors, council advisors and stakeholders when addressing climate change effects in their areas of jurisdiction, as set out in the legislation under which they operate or which affects them as resource and asset managers. The following sections summarise the perspectives of the councillors, council staff and business stakeholders who participated in the workshops.

3.2 Councillors

There was a general view that the contested perception of climate change made it a difficult issue to get on the agenda in a way that could be discussed strategically. This was despite councils' responsibility to consider the effects of climate change when exercising their powers and functions (Resource Management Act Section 7(2)(i) RMA refers). It was noted that some councillors are not fully aware of this responsibility.

The uncertainties surrounding the timing and magnitude of climate change effects confounded a perception by some that there is a lack of evidence of climate change. This played out for councillors as an apparent inconsistency of information. Councillors suggested that climate change needed to be repackaged in the context of a range of hazards and risks to which the council was exposed. It was understood in a risk context that councils had a responsibility to provide risk-related information and to exercise their roles and responsibilities wisely. The Christchurch earthquakes had raised awareness of hazard risk and the disruption that could occur if hazard risk responses had been inadequately addressed. There was concern at the possibility of withdrawal of insurance cover or at best a sharp increase in insurance premiums for council assets and services.

A concern was expressed that each council across New Zealand addresses climate change effects in different ways and faces court challenges alone. A general view at the workshop was that a more integrated approach across New Zealand hazard risk management nationally would achieve more consistent results over time and overcome the reluctance amongst councils to be the test case at their individual cost. All levels of government were viewed as needing to play stronger roles to achieve this.

There was a need expressed for wider discussion of who pays for precautionary responses to climate change effects. It was acknowledged that costs are likely to fall on all levels of government and future private property owners if precautionary adaptation is not undertaken. A partnership approach between all interests was suggested, that could address intergenerational cost issues in a fair and equitable manner without transferring private costs to the general community. However, consideration of a way of funding such measures was seen as important and urgent.

3.3 Council advisors

There was a general view amongst the council advisors (and some councillors) that the current statutory framework has significant limitations for implementing provisions to address changing climate risk. The limitations identified included:

- how the statutory provisions are applied in practice
- the pressures on councils from development interests
- the desire on the part of councillors not to use development controls to limit private property expectations and adversely impact property values when information is uncertain
- the inflexibility of the instruments over time which entrench existing exposure to hazard risk.

See Section 4.0 below for elaboration of the barriers that were discussed.

Council advisors reported that even in greenfield sites, the pressure for development to be approved on the coast and on floodplains is high, and this results in attempts to 'mitigate' rather than avoiding the areas at risk. For example, mitigation measures applied currently were viewed as static in time and space with the effect of locking in developments behind hazard lines and within hazard zones. In addition, there was no guarantee that areas outside the defined lines and zones would be 'safe' from future climate change effects. This issue was seen as interacting with the timeframes commonly used in planning and design of protection structures, which were viewed as too short compared with the life of developments being allowed.

Pressure on council advisors to provide certainty in evidence and advice for decision-makers on uncertain future effects was reported as creating a tension that can result in information not being made public, or in some cases not presented to the council for recommended regulatory responses, because of the fear of litigation and the costs involved. This appeared to be a stronger pressure than the fear of litigation if the hazard risk is not made transparent and damages subsequently result.

Advisors considered that some of the current legislative provisions were under-utilised, could be better aligned and supported by central government to minimise repeat litigation on issues common across New Zealand, which is both costly and inefficient. Council advisors thought that central government could be more proactive by encouraging a more consistent approach. This could signal that climate change will bring increasing risk that will be inherited as a cost to private use of land. Opportunities to strengthen the decision-making system at several levels were identified and the

need to use new approaches was acknowledged. Box 1 summarises the key legislative improvements suggested at the workshops.

Box 1 Legislative and practice improvements suggested

- Use of section 86D RMA was costly and risky for the council to use for the Mapua Plan Change 32. Given the responsibility for managing hazard risk is a statutory requirement, all hazard risk rules should have immediate effect without having to go to Environment Court.
- Section 106 RMA should be used more for refusal of subdivisions and possible amendment made that defines "sufficient provision has been made or will be made in accordance with subsection (2)" that links this provision with the intergenerational provisions of the RMA.
- Models could be developed for more flexible planning rules and 'zoning' approaches that address changing climate risk.
- Models could be developed to address private ownership issues in hazard zones (e.g. planned retreat).
- Models could be developed for applying the intergenerational provisions in RMA.
- Mandatory LIMs and mandatory hazard records for properties at risk including photos.
- Alignment of the Soil Conservation and Rivers Control Act with the climate change and hazards provisions of the RMA and BA.
- Review adequacy of the Building Code standard at 2% AEP for flood risk in light of climate change science.
- Improvement of the BA decision-making arrangement for building consents under sections 71, 72 (e.g. reduce the specific duty under section 72 in light of the general duty under section 71).

3.4 Business stakeholders

Business participants had a clear view of council responsibilities in the climate change context. They expect councils to set out what they can and can't do, identify risks and reduce them. Business participants have high and critical asset bases and in some cases community assets like airports, ports and waste disposal systems. Business interests commented that insurance companies are going to more finely tune their products in future as a consequence of the Christchurch earthquakes. They believe that infrastructure risk is likely to be very closely looked at by insurers.

Business stakeholders expressed the view that the community needed to have buy-in to the responses to climate change risk and that the community should not be underestimated as to their interest and ideas for change. They suggested that people have the right to know what the risks are and need time to digest new information before decisions are taken on response options. They also suggested that the risks should be assessed in terms of what asset is at risk and its likely lifetime.

4.0 Barriers and opportunities for change

The workshops discussed a range of barriers to adapting to climate change. All were barriers in the sense that they should be able to be overcome, compared with being absolute limits to adaptation (IPCC, 2007; Moser & Ekstrom, 2010). In this context it is worth noting that all climate risks cannot be overcome by adaptation actions. Parry et al. (2009) have indicated that even the most restrictive emissions policies proposed to date will require complementary adaptation to major environmental, social and economic changes associated with expected increases in temperature above safe levels. We will need to plan for such higher temperatures and greater climate risks from extreme events and higher sea level rises. This will require much more investment in adaptation than is currently planned (Parry et al., 2009). Residual damages will need to be evaluated and addressed since all damages cannot be avoided due to technical and economic constraints. This means that future communities will have to live with transitions arising from some unavoidable damages.

The barriers discussed included the uncertainty of the science, the numbers of players and the complexity of developing and implementing practical adaptation methods; regulatory constraints; timeframes for decisions; resources; fragmentation and stewardship of data and information; monitoring inadequacies; role of central government; relationship between regional and territorial local councils; communication of risk; political issues; and community expectations.

4.1 Barriers

4.1.1 Uncertainty

There was discussion of the different types of uncertainties relating to climate risks in the future and a distinction made between not knowing the future and knowing the likely trajectory of the change. The range of players involved in the community, their different degrees of knowledge and their different attitudes and values played out in a complex way making it difficult for councils to address climate change adaptation head on. Relevant information was available for councils, but there was a reluctance to apply it and address the implications until everyone was on the same page. Some scepticism about anthropogenic climate change and lack of understanding about councils' responsibilities for considering the effects of climate change were providing barriers for its consideration. The fundamental issue in this context was whether the uncertain nature of climate projections would be legally challenged in the Environment Court, should councils take adaptive action affecting property ownership. Uncertainty appeared to create caution and delay in considering climate change risks.

4.1.2 Regulatory constraints

There was a general consensus that the current regulatory regime, set out in Section 3.1 above, was inadequate for addressing the changing nature of climate risks. This discussion had three components: the statutory provisions; the planning practice; and the decisions made in particular situations.

The statutory provisions were considered to be misaligned across the various statutes and in some cases could exacerbate risk (refer to Section 3.1 regarding the BA and Code). The SC&RC Act has a protection works focus that gives rise to static responses, the RMA has a precautionary focus while the BA and Code are often the default legislation if regional or district rules are not in place. This can result in short-term decisions that exacerbate risk, through the subdivision and building consent approvals.

The RMA operates within evidential practices that are more at ease with measurable historical facts as against predictive estimates of the future that inherently rely on probabilities and assumptions. This has the effect of 'forcing' certainty on the evidence with the result that precaution is constrained if evidence appears uncertain, or it results in a 'best estimate', or a 'number' is chosen which does not accommodate extreme events when damage is likely to occur. The result is that developments are allowed in areas that will be subject to climate changes over the life of the activity or building.

The planning practice has been to use hazard zones, set back lines or accommodation of risk through development controls such as consent requirements, raised floor levels and services, and removable houses. These practices are usually based on historic data projected forward and 'best estimates'. As such they have practical limits in the context of a changing climate in which sea level is rising and floods are becoming more frequent and larger. Combined with short planning timeframes the practice is locking in exposure to risk and reducing flexibility for future climate change effects. The regulatory practice under the RMA is also a slow one with a focus on isolating and resolving contest, rather than an environment where consensus can be reached. This is made worse by the fact that each council has to address the issues individually, rather than in a wider regional and national sense where commonality of issue is the case.

Some statutory provisions were observed as not having been used to their potential in the climate adaptation context nor currently for related coastal and flooding. For example, the only National Policy Statement to apply to coastal hazard and sea level rise situations is the NZ Coastal Policy Statement 2010 and guidance on this statement is still pending. The Ministry for the Environment's 2008 guidance on sea level rise and flood flows was described as variously interpreted in practice

with a preponderance of lower estimates being used or decided at the Environment Court. The guidance has become contested in the court situation. It was considered that section 106 of the RMA could be used more proactively by interpreting "sufficient provision" made for avoiding, remedying and mitigating in a longer timeframe (note the apparent issue with section 106 referred to in Section 3.1 above). The provision of regional rules on hazards, under which TLAs must operate, or district rules themselves, were seen as under-used provisions, since they have the potential to direct development in a more precautionary and flexible way.

4.1.3 Decision timeframes

The workshops discussed the barrier for long-term thinking about climate change arising from the different timeframes within which decision-makers operate. The short three-year electoral cycle was described as conspiring against the longer-term mandate for consideration of climate change risks, while the planning cycles for RMA processes, asset management and long-term plans were different. The use of 'best estimates' discussed above combines with the timeframes to significantly underestimate the potential damage from climate-related risks over the lifetime of activities and assets being decided today.

4.1.4 Resources

Resources were discussed in two different ways—people and their capability and funding for adaptive actions. There was a general perception that adaptation to climate change will cost a lot. The corollary that climate change risk will cost a lot, if not addressed, was regarded as the shift that needed to be made in current thinking to address long-term climate futures. It was acknowledged that the current tools for assessing costs of actions today and saved damages in the future, were inadequate and that new tools were needed. The authors noted that there are techniques that have been developed internationally such as robust decision-making and real options analysis (Dobes, 2008; Lempert & Collins, 2007), but that these are technically complex and costly in dollars and time to apply in local government decision-making contexts.

Workshop participants saw the need for a more nationally coordinated way of funding adaptation options where it was more efficient to do so. The availability of funding for managed retreat along streams and rivers and at the coast, for example, was seen as a major barrier to implementing managed retreat. The Twin Streams in Waitakere, Auckland was cited as an example where the success depended on available funding to underwrite the community efforts across the range of objectives. This example included managed retreat of 78 dwellings in the flood risk area.

Asset costs were reported as rising, as capital costs increase to cope with increasing risk (e.g. pipe capacity, land purchase adjacent to streams and secondary flow paths). The notion of a fixed level of

services in such circumstances where the goal posts are changing affects the community expectations of increases in service levels.

4.1.5 Data, information and monitoring

The fragmentation of data and information on climate risk was a consistent view reported. There was a concern that it was inefficient for each council to be commissioning modelling, impacts studies and options analysis when there were common elements that were of interest across all councils. Without some sort of national repository of information relevant to climate change adaptation, there was a risk that the wheel was being reinvented each time a council undertook its own study. Related to this was a concern expressed that unnecessary inconsistency of approach was emerging across New Zealand which could exacerbate risks and create inequalities depending on the vulnerability of each community and its ability to resource such studies.

The monitoring of change over time was reported as a weak activity in most regions.

4.1.6 Role of central government

The role of central government was raised in several discussions. It was acknowledged that central government had emissions reduction policies and was addressing water and agricultural adaptation issues. However, it was considered that there were several supporting activities that central government could provide These could make adaptation to climate change more efficient for local government to undertake and also reduce the risk of the transfer of private risk to ratepayers and taxpayers when damages occur. The activities included:

- stronger consistent national statements about the need for climate change adaptation under the RMA
- transparent consideration of climate change risks in national expenditure on transport infrastructure and the location of airports and management of ports
- development of decision tools for changing risk that are applicable and affordable for local government
- a nation scanning of climate-related risk hotspots across the country and across sectors.
- a repository for accessible data, information and monitoring systems nationally including LIDAR elevation information for the modelling of scenarios of future climate change
- a dedicated research programme on impacts and adaptation to climate change to enable strategic prioritisation of adaptation activity by local government
- better alignment of the relevant legislation and coordination with emergency management experience

- routine strategic interpretation of climate events as a form of monitoring climate impacts

In this context, workshop participants highlighted the need for central government leadership that actively supports local government efforts to address climate change risks that play out locally. Further amendment to local government legislation (RMA, LGA, BA and Code, SC&RC Act) was envisaged so they are better aligned and the funding available to ensure that the hotspots are adequately addressed for the long term.

4.1.7 Relationship between regional and territorial local government

The relationship between regional and local TLAs was an underlying issue discussed. In the Tasman and Nelson context both are unitary authorities and it was felt that unitary arrangements facilitated interdisciplinary communication about climate change risks that was more difficult where there were regional and TLAs dealing with the same issue (e.g. Hawkes Bay in the Haumoana context). In particular, there were no consistent mechanisms for cross-agency coordination of functions for their better alignment. This was considered an issue where legislative and local governance reform could assist if thought through carefully. However, the underlying misalignment and gaps in the RMA, LGA, BA and Code and the SC&RC Act were seen as considerable barriers that needed to be addressed to enable climate change risk to be addressed.

4.1.8 Communication of risk

The current way climate risk is communicated was considered to create greater certainty and precision than exists in reality (e.g. the use of averages/best estimates/single numbers, rather than considering a range and in particular the extremes). The long-term nature of a changing and non-linear risk was not being communicated adequately using probability formats. In addition, a 2% AEP or 1:50-year return interval per year was not considered adequate for planning purposes. As a result, rates of change were not being accommodated into planning practice. These practices were considered to be creating barriers to understanding the risk exposure and thus impeding conversations about possible response options.

4.1.9 Political issues

A number of political issues were raised as barriers to effective adaptation. Closely tied up with the political constraints were community expectations that drive political representation in a democratic system. Councils have a number of competing priorities so it was explained that often near-term priorities win out to longer-term considerations, especially if there is a perceived uncertainty surrounding them like climate change. This has led to reluctance by decision-makers to engage in the

strategic conversations with communities about climate change and the range of possible responses over time.

The false sense of security resulting from static responses to existing climate risks and the use of only certain formats for describing risk probability has maintained community expectations that councils will continue to protect them from harm. Within the three-year electoral cycle this is perceived as a hard issue for councils to tackle. Vision and leadership around long-term futures is generally lacking across councils with the obvious exception of Auckland Council where the requirement from central government to produce a spatial plan has enabled vision and leadership for a new future for Auckland to emerge. This was considered unlikely to happen autonomously in most councils under their current statutory mandates. The conclusion reached was that there is a mismatch between what is politically and socially acceptable and what the science and risk management is telling councils in terms of their liability for damages if business as usual continues. The legacy of development and infrastructure at risk from future climate change was seen as creating an ongoing cost to current and future generations.

4.2 Opportunities

Despite the statutory barriers outlined above in 4.1.2, participants suggested some opportunities could be taken under the current legislative frameworks to better use existing provisions that are not being applied in practice. Examples given included, using review periods more proactively. This could involve thinking about the long timeframes and the lifetime of each activity and designing more flexible 'zoning' approaches that don't result in lock-in (e.g. utilising trigger points or timeframes for activities at risk with plenty of warning to current land owners that certain land uses will be phased out). Careful community conversations sustained over long time periods was seen as a necessary condition for this to be given effect.

Participants suggested that there were opportunities for 'communities of practice' to be set up across New Zealand. These could develop models for applying intergenerational approaches to climate risk that address private ownership expectations and a 'business' case could be built for the planning of climate change adaptation measures. The Special Interest Groups of local government practitioners working together was suggested as a possible mechanism for this.

Opportunities have arisen as a consequence of the Christchurch earthquakes where business owners are thinking about how they might address the increasing unaffordability or potential withdrawal of insurance cover. Opportunities were suggested for the insurance and banking sectors, real estate and public and private asset owners to work with local government to develop ways to reduce risk exposure to climate change.

Models for deliberation with communities of interest have been tried in other environmental resource management areas. For example, it was suggested that the Land and Water Forum could be a possible model for community conversations around long-term planning for climate-related risks. This suggestion was based on the recognition that current processes are not delivering the community buy-in needed for the changes required to adapt to climate change in the public arena.

Resourcing for climate change adaptation was highlighted as a necessary condition for the changes needed in approaches to climate risk management to enable the consistency of approach to transition to more precautionary, ongoing and long-term adaptive responses. Funding of retreat from harm before and after climate events and for the development of deliberative processes and capability building across New Zealand were seen as priority candidates for funding. A contingency funding mechanism was suggested, with central and local government contributions, in recognition that ex post costs always fall across the entire nation.

5.0 Communication of risk

The factors influencing effective communication of climate change risk have been well documented in the literature. This section summarises the relevant factors affecting perceptions of risk. The workshop discussion is reported and then related to the case studies presented at the workshops for Takaka and the Hutt valley related to flood management, and Wellington, Kapiti Coast and Mapua related to sea level rise. Comment is then made on the means of communicating risk to communities based on the workshops and other experience across New Zealand.

5.1 Perceptions of risk

There are a number of factors that affect people's perception of risk and their willingness and ability to respond appropriately[9]. These have salience for decision-makers addressing the effects of climate change which appears to be in the future:

- Cognitive biases result in overweighting small and under weighting large probabilities.
- People edit out rare events when they are communicated by statistical description.
- Recent events are given more weight than distant events.
- As worry about one type of risk increases, concern about other risks decreases, as if people have only so much capacity for worry.
- Individuals tend to dislike losses more than equivalent gains.
- Perceived distance from an event will result in inaction, while placing the event in terms of an individual's present locality has been shown to result in emotional and cognitive engagement with the climate change issue and have a longer lasting effect by changing social norms and value systems.
- People tend to distinguish between personal and societal risk, the former judged to be lower than the latter.
- Fear framing is effective in motivating behaviour change making the distinction between alarmist information inconsistent with the science and alarming and consistent with science and intended to inform.
- Personal relevance of information is an effective motivator of action.
- Single action bias results in decision-makers taking one action to reduce risk and not taking additional actions that might provide further risk reduction.
- Making future events concrete and closer in time and space will raise visceral concern that could lead to action.

[9] This section draws from the behavioural psychology literature as it relates to climate change: for example, Tversky and Kahneman (1974); Weber (2006); Moser and Ekstrom (2010); Spence and Pidgeon (2010); Pidgeon and Fischhoff (2011).

- Prior experience has been shown to motivate risk reduction actions.

These factors have salience for how climate change effects are framed and communicated to affected communities. These factors are evident in the New Zealand context, the discussion and in the case studies presented at the workshops.

5.2 Communication approaches and tools

The workshop discussion focused on the means and the necessary supporting factors for successful communication. The main strengths identified were building trust through a comprehensive communication approach by scoping the issues with communities. Presentation of plausible effects of climate change that can be related to real-world experiences of the community within their lifetime were suggested as successful ways of conveying risk. The weaknesses discussed included the difficulty of conveying uncertainty without being perceived to be 'scaremongering' or closing off options that might be more flexible over time.

Engaging with the community as part of the solutions and giving time for communities to take on information at their pace in a form they can relate to was highlighted as essential for successful adaptation to be implemented. In this context the use of historical analogues where communities have been affected was suggested. Development of ongoing relationships with those affected was considered necessary to facilitate communications and build trust.

With respect to tools, animations and simple maps on aerial photographs were thought to be useful for illustrative effect, but care needs to be taken since they will not convey changes over time into the future. A range of media was considered to be more useful such as mapping, modelling scenarios and animated real-world flood events for example. It was suggested that demonstration of the sort of effects that could happen in the human lifetime (e.g. how many times capital stock needs replacement—carpets and wall linings) would ground the risk depiction in real-world experience that enables the community to link their experience to something tangible.

Story telling through social media using visual images and narratives was also suggested as an effective communication tool. The importance of conveying what is and is not known was considered to be important for building trust between researchers and the community.

Frequent communication was suggested as a way of reinforcing messages. Tailoring messages for the different groups who perceive risk differently was also seen as a good way of getting buy-in and understanding the range of views and values in the community. Taking the window of opportunity

afforded by storm events to also reinforce messages about managing climate risk was seen as a complement to discussions at other times.

The workshops discussed the need for the dynamic nature of climate risks to be communicated. For example, for sea level rise the permanent loss of land and the interaction with storm events/storm surges/wave height; for floods, episodic flooding with greater frequency and intensity and the overtopping of existing protection works and stormwater pipes. This would help convey the limits to structural protection solutions and the limits to pipe design, the need for secondary flow paths and limits to upstream development.

5.2 The New Zealand case examples

In the Takaka flood study it was found that different groups in the community perceive the risk differently depending on whether they were rural or urban dwellers, had experienced past floods, how long people have been in the community at risk, the value of fixed assets, perceived affordability of responses and consideration of adverse effects elsewhere in the area. The lesson from this case study indicated that the risk information should be presented separately from response options so that the community understands the risk before considering the options for addressing it.

In the Hutt Valley flood study[10] AEP (e.g. 1%) and Annual Return Interval (ARI, e.g. 1:100 year) formats were less well understood compared with the cumulative probability frequency (CPF) format that reflects a 63% chance of something happening over a fixed timeframe of 100 years, even though all expressions represent the same level of risk. The large denominator factor in the ARI expression (e.g. 1:440 year) engendered a perception of 'safety' and constrained the implementation of options to a preference for static structural protection. Those households that had experienced flooding supported a wider range of flood risk management options—protection, accommodation and retreat—and exhibited greater preparedness for flood events although within a small range of what they could control. More than half the respondents did not know their level of exposure to flood risk. The regional council responsible routinely used AEP and ARI expressions of risk.

In the Kapiti Coast case study, learning included a caution about consultation overload in communities and the need to find the 'right' space and time for conversations. Making someone in authority responsible at the council for ensuring integration across the organisation and for initiating conversations at all levels and in all areas about climate change risks was considered essential to

[10] http://www.victoria.ac.nz/sgees/research-centres/documents/vulnerability-and-adaptation-to-increased-flood-risk-with-climate-change-hutt-valley-household-survey.pdf

ensure consistency of approach. A participatory model designed to empower the community to take action and to build the community's sense of ownership and trust of council and of each other was considered more likely to be successful than 'consultation' as often practised where decisions are conveyed for comment. Consistent and simple messages, both internally within council and externally, built understanding of the issues.

Lessons from the introduction of planning controls using hazard zones on the highly active Hawkes Bay coast at Te Awanga and Haumoana have highlighted that credibility is based on more than science and technical competence and that clarity is essential for effective communication. Promising more than can be delivered is likely to break down trust and avoiding community engagement guarantees trouble. Unfair processes result in outrage and communication must be two-way. When disputes arise a dedicated process is necessary to resolve them as trust and credibility are both essential.

Wellington City is at the early stages of a strategic exercise with a tactical framework looking at asset management and a strategic component looking outside existing planning horizons. Material is being prepared to visualise different sea level rise scenarios with a range of other hazards such as tsunamis, earthquakes inundation in two critical locations (in the CBD and the low lying Kilbirnie isthmus) to establish what is at risk (infrastructure, property and economic, cultural and social values), to enable areas to be prioritised for further analysis of options to address the risk. The intention is to design tools that enable community engagement using the different scenarios and to explore response options as part of a strategic study.

The case studies findings are consistent with the international literature summarised above.

5.3 Implications for decision-making

The implications of perceptions of risk for decision-making about adaptation to climate change have important bearing on the communication of the risk, the processes for engagement with communities and the decision process itself. The type of activity about which a decision is being made is a critical factor in this process. In particular, the relationship between the rate of climate change and the lifetime of activity will influence how the decision is taken and the measures taken to reduce risk.

For example, human settlements and assets have different lifetimes—pipes may last 50 years, while buildings can last 100 years and subdivisions may remain permanently occupied. For planning purposes it is more useful to match the lifetime of the asset or land use with the chance of it being affected by an event over its lifetime. For an asset with a 100-year lifetime there is a 63% chance it

will experience a 100-year ARI event or there is a 1 in 4 chance that a 100-year event will happen in the next 30 years. Either of these expressions of risk have a greater chance of being understood correctly compared with communicating that the planning level for the activity is 1% flood (AEP) or 1:100-year flood (ARI) . Using chance-based expressions addresses the 'event distance' issue raised above in Section 4.1, even though they express the same level of risk. They appear to occur sooner, thus evince a more visceral response that is more likely to result in support or action.

There may also be interactions between different hazards in some locations that will need to be considered at the same time to address the issue of 'a finite pool of worry' referred to above in Section 4.1.

Current practice sets standardised levels of risk for protection, based on historical and measurable data. This approach underestimates extreme events since they are averages or best estimates and result in overconfidence in the standard. This constrains options to the more static ones that are difficult to change in future as the risk levels change. They do not characterise the uncertainty range of future frequencies which cannot be measured directly. A way of addressing this issue is to use a range of scenarios, but such approaches are usually based on only a few different climate and emissions scenarios and thus misrepresent the range of uncertainties involved in future climate. The use of multiple climate and emissions scenarios across the full range provides a tool for more strategic risk management, as uncertainties can be reflected and options analysis undertaken for the range.

Perceptions of risk are also changing within the insurance sector as a result of the rise globally in weather-related catastrophes. Worldwide, 2011 was the year with the highest ever economic losses recorded for the reinsurance industry, with US$265bn up to the end of June (Munich Re, 2011). Different ways of mitigating and adapting to them will be necessary as it is foreseeable that, in areas of unavoidable damage, insurance cover will become unaffordable.

5.4 Means of communication

The way risk is communicated to communities and interests has a profound effect on how risk is understood and therefore how the utility of the range of options is understood and what private actions follow.

Several of the case examples presented at the workshops confirmed that animated visual depiction of different risk scenarios was effective in communicating the range of possibilities to communities. Such approaches appeared to give credibility to the work of councils when communicating with affected parties, by enabling them to relate the visual effects to their own experience. These were

effective for flooding and sea level rise images. Depiction of flood depth and sea level rise in relation to elevation incorporated into hazard maps was also found to be effective in community conversations. Relating elevations to floor levels also had an added benefit of relating the risk to a level at which damages increase exponentially. This can be used to discuss thresholds that can be included in planning rules.

As discussed above, the case studies demonstrated the importance of explaining the risk descriptions or formats used.

Open days, workshops and walkshops have been used in several locations (e.g. Takaka, Kapiti Coast, Hutt Valley) and have proven an effective way of opening up the conversation about risk with communities. They have also helped identify community networks for ongoing community conversations. Continual engagement, based on these approaches with consistent messaging, has built trust with communities of interest that will enable a move towards discussion of response options over time.

6.0 Adaptation options

The appropriate response options for adapting to climate risk will be influenced by the institutional framework within which decisions are made by the responsible agencies; in this case, local government. In the New Zealand context the framework for local government includes the RMA for land use planning for the effects of climate change and hazards management, the BA and Code for structural building control, the LGA for asset and long-term planning, the SC&RC Act for flood and erosion protection, the Civil Defence and Emergency Management Act (CDEM) for emergency management. Completing the framework is the risk transfer element through the EQC Act and the insurance industry.

The appropriate balance between these elements will depend also on the degree of risk that each agency responsible is willing to take on. As the insurance industry becomes more risk averse it will tailor its products according to risk exposure, which is inevitable as economic losses from weather-related catastrophes increase. This is likely to put the balance back onto local government to address changing climate risk in a more precautionary way through its statutory responsibilities.

The insurance industry had input to one of the workshops and made the point that:

> *society needs to take over from scientists when it comes to risk management ... we need to find ways of raising risk awareness and preparing for the changing conditions ahead, to build up resilience for our communities*[11]

6.1 Types of response options

Typically there are three main types of response option used for addressing climate-related risks in addition to risk transfer through insurance and emergency management and warnings systems. These are shown on Table 1.

[11] Martin Kreft, New Zealand Regional Manager, Munich Re.

Table 1. Types of response options and their implications for risk management

Type of response	Description	Implications
Protect	Hard structures (e.g. stopbanks and sea walls)	Lock in developments, false sense of security, costly to maintain and change
Accommodate	Development controls (e.g. consent requirements, raise floor levels above defined flood, 'flood proofing' of services, removable houses)	Time limited, false sense of security, removed houses need somewhere to go or financial resources
Retreat	Planning rules to control existing development, triggered by change of ownership or withdrawal of protection, for example	Requires a long lead time, ongoing deliberation, possible legal challenges and funding and alternatives required

Existing urban settlements in coastal areas or on floodplains are typically protected by large structures designed to a 1:100-year return period. Rural areas are typically protected to lower levels with floods to some degree accommodated within the management of the property. For the larger flood schemes and on the coast, land use planning with some constraints and increasing use of accommodation measures have been adopted.

Retreat options have largely been used in situations where there has been repeat damage from natural hazards, although processes to undertake managed retreat are not well established in New Zealand. Some councils, like Hawkes Bay Regional Council and Tasman District Council, have indicated their preference for limiting or discontinuing protection works on the coast and progressively restricting land use activities nearer to the coast. A successful managed retreat of 78 houses in a floodplain took place in Waitakere City in the Auckland region. The success factor was availability of funding, linking the managed retreat project to wider community goals and outcomes and involving the community directly in the project, consistent messaging by the council, sharing information and explaining the problem, using staff with a combination of technical and people skills to communicate with property owners and demonstrating genuine care and respect for affected property owners over a period of eight years for the completion of the project.

However, it is clear from experience in New Zealand and internationally that incremental adaptation to climate changes over time has limits, as the adaptation options chosen will be largely a combination of structural protection and accommodation. Both these approaches will continue to

lock in existing exposure to risk and where settlements are growing will exacerbate the risk while giving a false sense of security to the communities living there.

Research in Auckland[12] on managed retreat from sea level rise indicated that even sea level rise of 0.50cm could be a critical level for the integrity of services, such as stormwater systems, while indications are that in South Dunedin, salt water intrusion in low-lying areas is already creating issues for services and buildings and has been identified as a priority area for council to address[13].

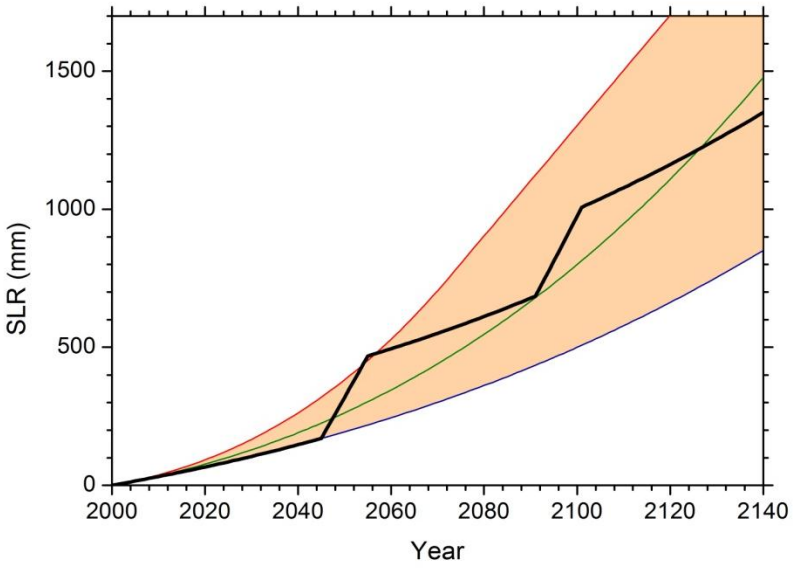


Figure 5. Provision for irregular rates of sea level rise

Evidence from the past shows that ice sheet loss can be sporadic rather than continuous, leading to variations in the rate of rise. There is also some evidence for inter-decadal changes in weather patterns leading to a varying rate of sea level rise in some places. This shows the need for anticipation, rather than emergency responses.

Figure 5 shows from past ice sheet loss that change can be in short steps rather than occurring continuously over time. This means that it will be increasingly necessary to plan for divergent possible futures and to start to transition into more transformative adaptation like retreat where that is possible. In thinking about how to achieve this it is useful to consider the *lifetime* of the adaptation decision relative to *the rate of change* when determining the type of response. A number of possible types of options can be considered that reflect the nature of the existing situation and the activity being decided upon (Stafford Smith et al., 2010).

[12] http://www.victoria.ac.nz/sgees/research-centres/documents/vulnerability-and-adaptation-to-sea-level-rise-in-auckland-new-zealand.pdf

[13] http://dcc.squiz.net.nz/__data/assets/pdf_file/0006/109779/MCA-Climate-Change-Report.pdf

In some circumstances, 'no regrets' decisions can be used where the approach taken is the same whatever the uncertainty of the climate change risk is (e.g. soft buffers like parks and passive recreational areas adjacent to streams or on the coast).

In other circumstances, the same type of response can be used but to a different extent depending on the uncertainty (e.g. height of sea wall relative to different sea level rises). In some situations there is a different type and extent of option with different future scenarios. Coastal defences, for example, may work to a point beyond which they become mal-adaptive and then retreat policies become appropriate. There will be cost thresholds associated with this type of adaptation and may work only where assets at risk have low value and where funding can support removal of land uses.

In other circumstances, it may be appropriate to monitor the business as usual approach with triggers identified for review at a defined point in time in the future. In such situations, reversible options may be appropriate.

Risk hedging is another approach where different responses are used in different places and depending on how the future turns out one of the options may be the way forward. Designing the ability to change in the future or inbuilt redundancy is how the provision of a wider base to stopbanks at the design stage for raising in future could be described. If it is affordable to do so and lock-in can be avoided, extra safety margins can be built in to the design of structures, for example.

A shorter life for some infrastructure could be contemplated so that a new approach can be used in the future at a lower cost.

These are just some of the more flexible approaches that can be contemplated to address the situation of ongoing changing climate risk. Such flexible decision pathways will be needed as a bridge between incremental adaptive responses within current frameworks and learning and reorienting as the future climate unfolds. This will help prepare for continuous and potentially transformative adaptation.

Currently the legislative frameworks available to local government in New Zealand have not delivered flexibility over time for consideration of a changing risk like climate change. They have evolved as a series of planning decisions in a snapshot in time with reviews that continue static planning mechanisms that have locked in exposure and sensitivity to changes in climate. Planning frameworks will now have to deal with continually changing climate risks. Consideration of a more strategic approach is appropriate.

6.2 Strategic approach to decision-making

Given the changing nature of climate risks set out above in Section 2.3 and the different types of uncertainty involved in future climate projections, it is clear that science alone will not deliver the sort of evidential certainty that the regulatory planning practice 'requires'. Uncertainty need not invite delay in decision-making. Rather, different perspectives and values can emerge from strategic conversations amongst communities of interests and thus enable exploration of what the range of climate change effects and options to address them might mean in a community context and thus help inform the decision-makers. This is the discipline of risk assessment. This two-way strategic process also helps scientists to better understand how to communicate with communities and decision-makers and help councils to evaluate the effectiveness of different approaches to risk treatment.

Underpinning such strategic processes is the way that the organisations responsible conduct them—local government agencies in the New Zealand context. The effort from these agencies will need to be sustained over time using cross-disciplinary teams within their organisations and supported by their organisations. This will require sustained interactions that can build understanding and trust amongst disciplines that work within different disciplinary and management frameworks often operating within different timeframes. Leadership from the top of local government will be essential to sustain such an effort. Such leadership might comprise political leadership of the issues as well as the organisational support to the staff to conduct community conversations in highly contested situations. Such support would include time, money and external support for facilitation and science input. Consistent messaging across councils and between the levels of government about changing climate risk and the need to address it will also support these deliberative processes and foster sharing of experiences.

The relationship between regional and territorial local government (TLAs) with respect to climate change effects will also need to be addressed. In particular, the more comprehensive provision of hazard information by regional councils in a form that can be used confidently by TLAs will assist. In addition, TLAs would benefit from regional rules around hazard management that support their rule-making and network services responsibilities at the local level. In some circumstances where transitions are being contemplated from the business as usual approach there will be benefit in several or all levels of government setting up deliberative processes with communities to stage the necessary changes to address the increasing and changing climate risks.

Taking SLR as the example, Figure 6 shows the lead time necessary for making the transition to a more transformative response and provides a useful way of thinking about staging such approaches discussed above.

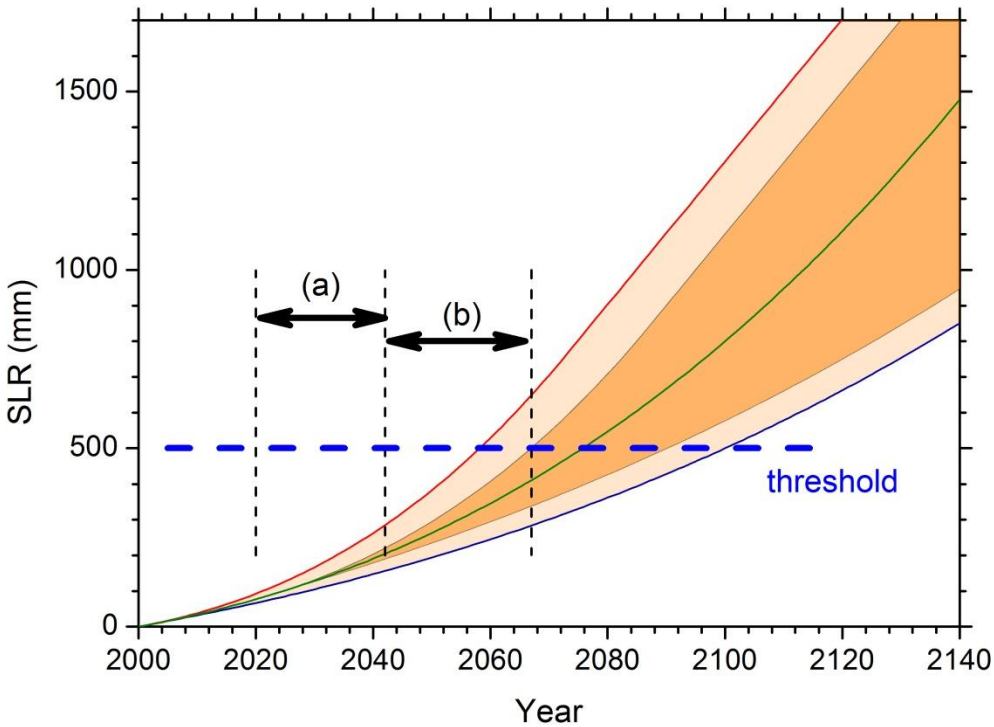


Figure 6. Planning for a sea level rise threshold of 500mm at which point intervention will have already become necessary
The orange curves show initial estimates for future SLR that are being progressively updated in the science so that the range with a darker colour shows an update on the paler coloured one. The period marked (a) is the time required for analysis of all the options that are available and for reaching a collective agreement in a timeframe that takes account of the uncertainty in future SLR. The period marked (b) is the time required either for construction of coastal defences or relocation away from the shoreline in a well-managed orderly way (based on Reeder & Ranger, 2011).

Table 2 illustrates the sequence of analysis that will be needed in the decision-making processes for changing risk to be evaluated. Figure 7 also illustrates the continuous process of strategic planning that will be required in a deliberative manner to consider the implications of climate risk and for the evaluation of the options for responding to them. This will be largely outside the statutory processes that are currently used. Through the RMA, more flexible measures will need to be designed to signal shifts in direction in response to triggers for change. It is expected that such triggers will have the effect of signalling the risk of damages in a more transparent way than is done currently.

Table 2. Decision analysis

Sensitivity to change	Planning process	Reducing risk
Short versus long-term planning issues	Incremental adaptation to transformation	Monitoring changes to provide advance warning
Extent of the exposure to climate risks	Precautionary risk management	Regularly assessed as still inside a risk envelope
Capacity to deal with rates of change in exposure	Ranges of options for different decisions	Advance warning of thresholds for structural change

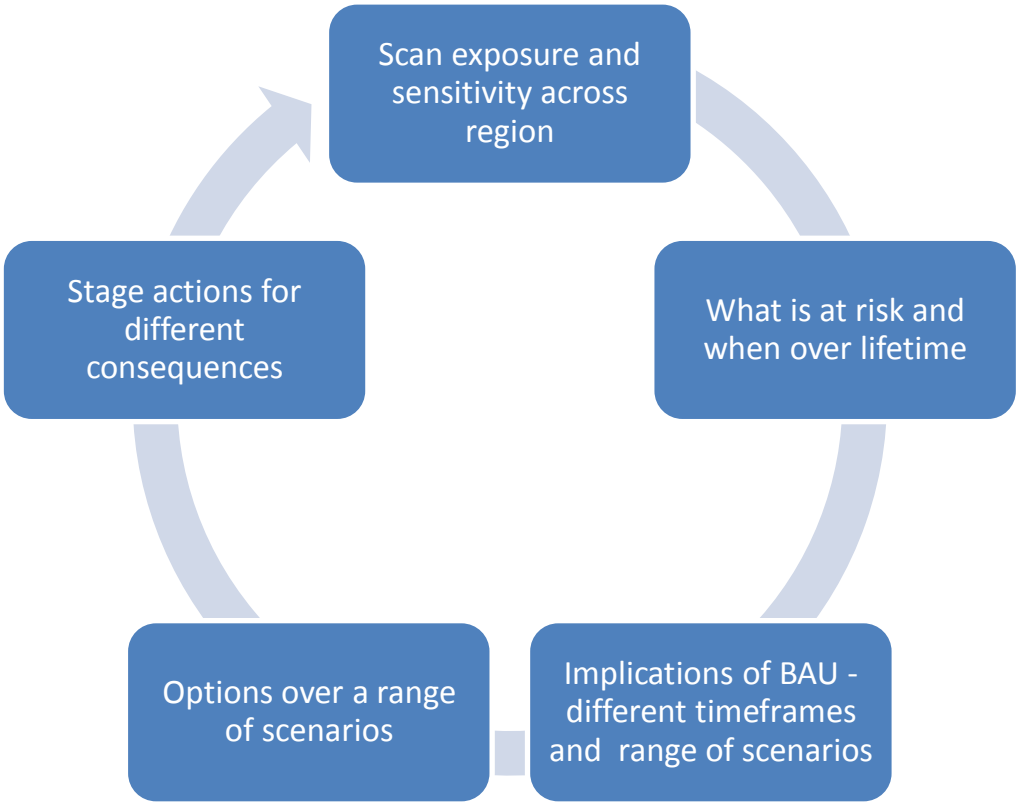


Figure 7. Continuous strategic planning in a deliberative manner to evaluate response options

Figure 7 shows the cycle of strategic planning required for continuous analysis and evaluation of response options over time.

Waiting for more science will not result in greater certainties, so it is important to get a good understanding of the sources, robustness and completeness of the information that is used to define and assess the risks before talking about options. It is useful to get a broad understanding of risk over a wider area so the discussion doesn't focus and polarise on a specific location or risk source. This can enable a range of risks to be addressed over time in a sequence of priorities based on the lifetimes of infrastructure or housing stock, for example. Undertaking an area-wide assessment or a

scoping approach first will help raise the profile of the issue and enable partnering with other agencies (e.g. NZTA) and other asset managers (e.g. airports/ports) to plan a community response together that can be developed over time.

Collaborating with other councils across New Zealand can help benchmark practice by comparing risk assessments for other locations, from other sources, methods or contexts. As one of the participants said:

> *Here's the issue, we're in it together, how do we address everyone's issues?*

7.0 Enablers

The workshops identified that some underlying conditions are required for the effective consideration of changing climate-related risks. Broadly these include the institutional environment within which decisions take place, the nature of the engagement process with communities of interest, techniques for addressing changing climate risk (statutory and non-statutory), monitoring change, deciding who pays for adaptation and when, suitable funding mechanisms for transformational change, equity issues today and over generations.

7.1 Mechanisms

The workshops identified that mechanisms are required to build the necessary conditions for more flexible reposes and made a number of suggestions considered necessary.

Engaging continuously with the communities affected by climate change was considered an essential first step in the decision-making process, well before response options are designed or decided. This was seen as enabling communities to have a shared understanding with councils of the risks involved and for their experience to be brought to bear on the issues. As well as immediately affected communities and business agencies like ports, airports, water, waste water and stormwater providers , other interests that were considered essential in such deliberations included insurers, valuers, real estate agents, solicitors, and banks.

The process of weighing and comparing different response options was discussed as one of the most difficult parts of the decision-making process. Traditional risk and cost benefit assessment methodologies as currently practiced do not deal well with unknowns, or with the benefits and costs out into the future. Consequently their use, will inevitably under-estimate future costs and benefits and render comparison of near term protection with staged and long-term retreat, meaningless. As discussed in Section 5.0 above, there are ways to overcome this difficulty that can assist decision-making under uncertainty and address intergenerational effects. To date these have not been used widely but are increasingly being used in other jurisdictions like the UK and Australia. An observation was made by a participant that 'who pays?' is a fundamental question to options analysis – not just an add-on later, and that 'How much does it cost?' is a misleading question often diverting attention to the near term and thus discounting future costs.

The issue of the interests of future generations goes to the heart of the debate in areas already at risk of a range of hazards such as repeat flooding, landslip and coastal erosion. 'Fairness' to individual property owners, communities at large and future generations are all matters that require wide and informed discussion before decisions on response options are taken. Whether the

community at large should eventually pay for ongoing private property ownership choices to locate in risky areas that have been allowed by responsible councils and insured by insurance companies, is a vexed question. Where the balance lies in terms of 'who pays' and 'when', is an important conversation and one which is being addressed in the Christchurch earthquakes context. This context was mentioned several times during the workshops as a wake-up call for climate change risk down the track. How Christchurch situation for property owners is resolved will have important flow on effects to how other natural hazards are addressed and where costs will lie in future. In this context a participant commented that;

Avoiding community engagement will guarantee trouble and an unfair process will generate outrage

When disputes arise dedicated processes are necessary for lasting resolution.

Monitoring of decision outcomes over time was seen as an important component for enabling continuous adaptation that manages property ownership expectations and those of the communities at large. The design of precautionary triggers that can be used in monitoring staged adaptation over decades was highlighted as a necessary for further development work.

While these workshops were focused at the regional and unitary level, alignment between the three levels of government was highlighted as a necessary condition for continuous adaptation to increasing and changing climate risks. In this context the misalignment between regional and territorial level practice with respect to hazard identification and rules was identified as an issue going forward.

Several missing enablers were identified as being more appropriately addressed by central government including an impacts and adaptation data and information repository, a clearer commitment to adaptation to climate change which could foster greater consistency between levels of government, a dedicated research programme on impacts and adaptation to climate change to enable strategic prioritisation of adaptation activity by local government, better alignment of legislation and with emergency management experience, routine strategic interpretation of climate events as a form of monitoring climate impacts.

Continuity of responsible institutions and political commitment over time were highlighted as essential ingredients for addressing long-term and uncertain risks that have the potential to create large disruption and costs to future communities if precautionary adaptation isn't considered and planned for now and continuously over time.

8.0 Conclusions

The workshops concluded the following.

8.1 Changing risks

There was a need to use a risk-based approach for planning purposes, rather than use uncertainty as a reason for delay in adapting to change. Risks will be continually increasing, even with mitigation of emissions, until they are reduced by adaptation measures.

Sea level rise raises a need for developing clearer long-term planning processes, and the future rates of change will start to limit adaptation options unless these have been planned well in advance.

8.2 Challenges

New Zealand's institutional environment for local government risk management has several components which overlap with one another and are not entirely consistent. The time frames used for different types of planning and decision-making also need to be defined and inter-related more clearly.

Councils have the problem of repeatedly dealing with challenges in the Environment Court. This requires the development of more uniform, comprehensive, consistent and precautionary approaches at a national level.

Current interactions between decision makers and their advisors and with the communities of interest tend to lead to oversimplifying the nature of the risks and to defining overly simplistic boundaries between safe and unsafe zones. They also create a false sense of security in the communities they seek to protect.

Businesses see some clear responsibilities for local government, and recognise that the insurance industry is becoming concerned about changing risks.

8.3 Barriers and opportunities

Barriers identified include: delays in response because of uncertainty; avoiding response through different interpretations of the regulatory framework; a general preference to deal with short-term problems and to delay response on long-term ones; limits in funding; and repetition of the process by each council.

There is a need for more involvement of central government in better alignment of the different statutes, and development of more consistency in approach across NZ.

Decision-making frameworks and tools need to enable rates of change in the risks to be considered adequately.

More proactive processes can be established to involve deliberation by communities, better recognition of trigger points for anticipatory responses, and the establishment of better resources for adaptation measures.

8.4 Communication

Biases in considering different types of risk are well known from psychological research and the framing and communication of risk information and its consequences needs to be based on this body of knowledge.

Communication methods more likely to be successful in conveying risk and consequences include visualisation, animation and maps that relate to peoples experiences in the real world at the community level.

Decisions are often made with no clear identification of the time-scale over which they will apply and the use of prescribed standards for risk protection can result in an over-confidence in the security they provide.

8.5 Adaptation

Science will not deliver the sort of evidential certainty that the regulatory and infrastructure planning practice 'requires', but uncertainty need not invite delay in decision-making.

Different perspectives and values can emerge from strategic conversations amongst communities of interests that can inform decision-making.

Sustained interactions with such interests and across council disciplines will build understanding and trust that will enable political leadership and organisational leadership to sustain such an effort.

A continuous cycle of strategic planning will be required for analysis and evaluation of response options over time. A national and region-wide scan of hotspots, with clear regional rules around climate risk management will set a good framework for decisions at TLA level.

Consideration of options over a wide range of scenarios and in particular, the consequences of extreme events will provide a better basis from which decisions can be made on climate risks.

Risk management options fall into the three categories of protect, accommodate, and retreat. Selection of the first two types of response should be done with recognition that further change will become necessary in the future.

Consideration of the *lifetime* of the adaptation decision relative to *the rate of change* is likely to result in more flexible options.

8.6 Enablers

The underlying conditions required for effective consideration of changing climate risks include:

- ability of the institutional environment to address changing climate risk
- continuous and inclusive deliberative processes with communities of interest
- flexible techniques for addressing changing climate risk (statutory and non-statutory)
- monitoring change
- deciding who pays for adaptation and when
- setting up suitable funding mechanisms for transformational change
- addressing equity issues today and over generations

The workshops concluded that the current decision-making frameworks and practices are not adequately addressing the dynamic nature of climate changes and the increasing rate of change. This has had the effect of entrenching risk, constraining future flexibility and limiting adaptation to climate change. It was recognised that the continued use of fixed and static response options will continue to lock-in risk going forward, making costs of longer term or more flexible options greater as time goes on.

There was an acknowledgement that climate change impact trends will worsen, so consideration of the consequences of the worst case assumptions will be necessary when setting development and infrastructure standards. Using single SLR numbers, best estimates of flood risk and measures for addressing climate risks like raised floor levels, set back lines and hazard zones, have limits because fixed, mid-range or average numbers will significantly underestimate the risk of damages in future to which communities are exposed.

Different activities were acknowledged to have different risk exposures and lifetimes, so tailoring and prioritising risk management options in relation to the scale and lifetime of the assets or other community values at stake was needed to achieve flexibility. The use of the threshold concept with triggers for the different activities was acknowledged as a way of identifying when current

management approaches might have limits and thus when more transformational response options will be necessary. In this context the planning lead time to effect such change needed to be factored into decision-making necessitating transitions over decades. Incremental adaptation was unlikely to be adequate.

The role that deliberative processes might play was identified as an important enabling mechanism for get better alignment across all levels of government, private property owners and communities working together. The importance of continuity of institutions and political commitment was stressed.

Some activities were identified as being better carried out nationally in a more coordinated way. These included:

- clearer commitment by central government to ensure adaptation to climate change is undertaken in a consistent and coordinated way and monitored for effectiveness to give local government greater confidence in making hard decisions without lengthy and costly litigation in the short term
- a dedicated climate change adaptation research programme integrated across institutions and disciplines working from a clear national research strategy modelled on the Australian National Climate Change Adaptation Research Facility (NCCARF)
- a data and information repository on impacts and adaptation options that can be accessed by local government to reduce repeat studies that have common information
- a mechanism for feedback between emergency management experience and long term planning for changing climate risk at local government
- strategic interpretation of storm events to enable councils to keep abreast of what is happening – interpreting events
- targeted funding of LIDAR for ground elevation data to enable risk hotspots to be identified nationally and regionally

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Appendix 1 Workshop programmes

Tasman District Council Workshop 3 February 2012

9.30 am **Introduction and Purpose—***Steve Markham Tasman District Council*

The workshop will focus on the particular needs in management and community understanding and behaviour terms, in seeking to remain responsive over time to the dynamic nature of the climate risks. Both strategic and specific approaches will be discussed within a menu of possible responses, including forms of approaches, processes, methods, tools, data, or decisions across the range of council decision-making.

9.35 am **Session 1 (a)** **What are the characteristics of changing climate risks that have salience for council decision-making?** *Professor Martin Manning NZ Climate Change Research Institute VUW*

Changing climate risks and their changing nature- sea level rise and increased flood frequency

9.55 am **Q & A** on the science, uncertainties and risk analysis implications

10.05 am **Session 1 (b)** **What is the current policy and regulatory context—the players and the levers for making decisions affected by changing climate risks.** *Judy Lawrence NZ Climate Change Research Institute, VUW.*

10.15 am **Group discussion 1**

Can the current policy and regulatory levers, tools and processes used and the timeframes address changing climate risk across all council functions?

What are the barriers and opportunities?

10.45 am **MORNING TEA** and view conclusions of each discussion group on the wall

11.00 am **Session 2** **Assessment and communication of climate change risk**

- Formats for flood risk and coastal storm risk communication (ARI, AEP, CEP)and public perceptions of risk- Judy Lawrence NZ Climate Change Research Institute, Victoria University
- Takaka flood risk modelling and risk profile results and their communication- Lisa McGlinchey Tasman District Council
- Scenarios and maps for responding to Sea Level Rise - Chris Cameron Wellington City Council
- Tasman coastal hazard maps -Eric Verstappen Tasman District Council

11.40 pm **Group discussion 2**

W*hat approaches, concepts, methods and associated processes have highest utility for communicating changing climate risk to central government, councillors and communities given the barriers and opportunities identified in Session 2?*

What are the strengths and weakness of each option or suite of options?

12.30 pm **LUNCH** and view conclusions of each discussion group on the wall

1.00 pm **Session 3** **Adaptation options**

- Strategic risk management for retreat from sea level rise and erosion—Alison Lash Kapiti District Council
- Coastal hazard risk mitigation policies and rules—Rose Biss Tasman District Council
- Talking risk with communities—a Hawke's Bay experience—Gavin Ide Hawkes Bay Regional Council

1.30 pm **Group discussion 3**

Matrices will be provided for group discussions sessions 4 and 5 to develop a menu of adaptation responses and their levers within the outcomes of protection, accommodation and retreat and across approaches, methods and tools relevant to these outcomes, and for implementation of options noting the resilience of each to changing risk to answer the following questions:

What are the range of strategic and specific adaptation options that can be used for adaptive management of climate risk over the next century and a half?

2.00 pm **Session 4** **Implementation issues**

Group discussion 4

What are the necessary supporting 'infrastructure' (processes, finance, organisational factors, new law, political factors) in council decision-making processes and organisational culture, or external to the council processes, can help implement the options for addressing changing climate risk?

2.30pm **Session 5** **Groups present conclusions on Session 3 and 4**

3.30 pm **AFTERNOON TEA**

3.45 pm **Session 6** **Synthesis from the day**

4.10 pm **Session 7** **Develop key messages for decision-makers and affected community stakeholders**

4.30 pm **CLOSE**

Nelson City Council Workshop 27 March 2012

9.30 am **Introduction and Purpose—***Nelson City Council and Tasman District Council*

The workshop will focus on the particular needs of decision-making at Councils and by stakeholders, for remaining responsive over time to the dynamic nature of climate risks.

9.35 am **What are the characteristics of changing climate risks that have salience for council decision-making?** *Prof Martin Manning NZ Climate Change Research Institute VUW*

Changing climate risks and their changing nature—sea level rise and increased flood frequency

9. 55 am **Q and A**

10.15 am **MORNING TEA**

10.30 pm **Some current practice around New Zealand**

- Takaka flood risk modelling and risk profile results and their communication- Lisa McGlinchey Tasman District Council
- Scenarios and maps for responding to Sea Level Rise—Chris Cameron Wellington City Council
- Talking risk with communities—a Hawkes Bay experience—Gavin Ide Hawkes Bay Regional Council
- Summary of best practice—*Judy Lawrence NZ Climate Change Research Institute VUW*

11.30 am Plenary discussion Challenges facing Councils and stakeholders

Some issues for discussion arising from Workshop 1

- How can the long-term and changing risk be effectively included in the decision processes of Councils and stakeholders
- How organisations can integrate long-term changing climate risk like managed retreat
- Inertia in Council processes
- Affordability of responding, who pays - balance between public and private, central government and local government?
- Accuracy versus uncertainty
- The tension between issuing hazard risk maps and being challenged for affecting property values, and not issuing them and being liable for not alerting property owners of the risk
- The cost-risk trap of investing in structural protection which may consume increasing capital to stay effective, and yet which may still fail at some point

12.00 noon LUNCH

12.30 pm The range of adaptation options and implementation issues *Judy Lawrence NZ Climate Change Research Institute VUW*

12.50 Group discussion Options and implementation issues

What options would work to address changing climate risk and what are the implementation barriers?

What communication and engagement processes with communities of interest work best for Councils and stakeholders?

1.40 pm Plenary report back

2.00 pm A risk managers approach to changing climate risk—a reinsurance industry perspective *Martin Kreft—NZ Regional Manager, Munich Re TBC*

How the insurance industry is responding to changing climate risk and what the implications are.

2.35 pm Q and A

2.45 pm Plenary discussion Summary of workshop findings

3.00 pm CLOSE