

---

# Continuity and change in national riskscapes: a New Zealand perspective on the challenges for climate governance theory and practice

Iain White<sup>a</sup> and Judy Lawrence<sup>b</sup>

<sup>a</sup>*School of Social Science, University of Waikato, Hamilton 3240, New Zealand, [iain.white@waikato.ac.nz](mailto:iain.white@waikato.ac.nz)*

<sup>b</sup>*Climate Change Research Institute, Victoria University of Wellington, Wellington, New Zealand, [judy.lawrence@vuw.ac.nz](mailto:judy.lawrence@vuw.ac.nz)*

*Received on October 2, 2019; editorial decision on March 6, 2020; accepted on March 17, 2020*

---

**Climate change challenges how policy agents imagine and manage risks in space and time. The impacts are dynamic, uncertain and contested. We use riskscapes as a lens to analyse how New Zealand has perceived and mediated natural hazard and climate risks over time. We identify five different national riskscapes using a historical timeline, which have changed as global risks cascade into national and sub-national governance. We find that while there has been a major effort to reflect the dynamic and systemic language of risk theory in national policy, a significant challenge remains to develop appropriate governance and implementation strategies and to shift from long-held ways of doing and knowing.**

*Keywords:* governance, risk, climate change, policy, riskscapes, New Zealand

*JEL Classifications:* D81 Q54 Q58.

---

## Introduction

Climate change is challenging how policy agents imagine and seek to govern risks in space and time. While there is high scientific certainty that the effects of climate change will compound existing natural hazard risks, there is less certainty about the timing and extent of those changes. Not only are many effects dynamic and ambiguous, but future risk exposure will depend on the political context, such as how fast the world reduces its greenhouse gas emissions, the choices made regarding the management and use of land and resources, capital investment flows and the cascading effects of climate events globally and responses to them

(IPCC, 2019; World Economic Forum, 2020). As the physical effects of climate change have been observed and future trajectories become clearer, new areas for the attention of the social sciences are revealed. For example, the need to better understand how climate impacts and risks cascade across interconnected economic, social, cultural and environmental domains (Adger et al., 2005; Lawrence et al., 2018), or how to integrate climatic change with other public policy issues, such as urbanisation or social justice (Carter et al., 2015; Lawrence, 2016; O'Hare and White, 2017; Serrao-Neumann et al., 2017). The complex links between natural and social systems are heightened when

considering the globally complex politics at the heart of climate change. Even if the science is accepted, significant value-laden questions remain as to how and when risks should be mitigated or who should bear the costs.

As such, the dynamic and uncertain nature of climate change presents fundamental challenges for national and sub-national governance. For instance, the extent to which our politics, election cycles and decision-making practices are able to address long-term, uncertain issues such as climate change (Boston, 2017; White and Haughton, 2017). Beyond politics, other institutions have also come under the spotlight, most notably land use planning. A dominant international narrative for planning systems to speed up development, reduce regulatory ‘red-tape’ and become more ‘market-enabling’ (for example HM Treasury, 2015; New Zealand Productivity Commission, 2017) has emerged at the same time as planners need to tackle the complex and contested issue of climate change (Davoudi et al., 2009). A key challenge for national and sub-national governance is to reconcile the long-standing political desire to provide an objective, settled state of the world—one that allows various actors and agencies to invest capital and make quick decisions in a stable regulatory environment—with the real-world realities of a changing world that demands new ways of knowing and managing risk (Lawrence and Saunders, 2017; White, 2019). This tension has fuelled a rise in policy experimentation and the emergence of innovative approaches, such as new tools able to better capture and negotiate the spatial and temporal challenges of climate change (Haasnoot et al., 2013; Marchau et al., 2019; McFadgen and Huitema, 2017).

The concept of riskscape offers similar potential for new insights by redirecting theoretical understandings of risk to highlight ‘how different actors and social groups develop their particular visions of risk and translate these into spatial settings’ (Müller-Mahn, 2013, xviii). It aims to provide a common framework for

multiple risks, scales and interactions to be considered alongside the varied ways risks are imagined, constructed and mediated in an ongoing manner. The spatial focus seeks to merge formal institutional understandings of risk and territory with more imagined, subjective individual dimensions, both of which selectively render risks as real (see Müller-Mahn and Everts, 2013). These aspects are also connected. For example, an important means by which climate risks are given visibility, order and meaning is established at a national and sub-national level. Governments design the governance arrangements that influence how risks are understood, influence the focus of expert practices or delineate what counts as knowledge, provide direction to the institutional processes and practices, and shape regulatory environments. These arrangements enable risks to be manageable, at least in the short-term and shift over time depending upon scientific knowledge and socio-political priorities.

Exploring this national and coupled sub-national perspective forms the basis of this article: in simple terms, the theory posits that governments and individuals construct their own ‘riskscape’ that may change over time and space. But what can a riskscape perspective tell us about the ways a nation has responded to changing knowledge of hazard and climate risks over time, and how can this collective experience help inform riskscape theory and practice?

We choose New Zealand as our national focus as it is beset with a complex overlay of natural hazard risks, has many different types of governance arrangements across different hazards and has a high-level of devolution of powers and functions to the sub-national level of governance. New Zealand also has low-frequency and high-impact hazards that have severe local and national economic consequences, such as earthquakes or tsunamis; frequent climate-related hazards like pluvial flooding; or long-term and ongoing hazards such as coastal inundation from sea-level rise,

drought or changes in flood frequency. In practice, different agencies and actors manage one or many of these hazards and the risks they pose. There has also been a period of policy experimentation, with new approaches designed and being implemented to shift from reactive responses to anticipatory and transformational approaches (Barnett et al., 2014; Boston and Lawrence, 2018; Lawrence et al., 2019; Lawrence and Haasnoot, 2017; Ramm et al., 2018; Ranger et al., 2013).

We initially situate riskscape theory and research within a national climate change context, before drawing from New Zealand's natural hazards history to chart significant eras that characterise the riskscape, and link these to shifts in thought and practice. This allows us to identify and analyse the evolving relationships between the scientific understanding of risk and its national and sub-national governance. In doing so, we can appreciate how the emergence of the multi-hazard, multi-discipline, multi-scalar and multi-temporal knowledges and approaches that have recently become part of international practice on climate change are layered over previous riskscape imaginaries that still exert an influence in the present.

### **Revealing the different dimensions of riskscapes**

The concept of a riskscape is directly rooted in Appadurai's (1996, 33) identification of five differing global cultural flows—financescape, ethnoscape, technoscape, mediascape and ideoscape—as a new analytical framework and empirical approach. His use of the suffix *-scape* was designed to highlight the 'fluid, irregular shapes of these landscapes... [which] are not objectively given relations that look the same from every angle of vision but, rather, that they are deeply perspectival constructs, inflected by the historical, linguistic and political situatedness of different sorts of actors.' This initial work stimulated a flurry of other

'-scapes' research, including the 'riskscape' of Müller-Mahn and Everts (2013). Riskscape notions also have connections to two other bodies of literature. First, ideas concerning the spatiality of life, most notably those by Lefebvre (1991) and Soja (1996). These perspectives sought to shift away from space as concrete, territorial or material, or as individual mental spaces, representations or philosophical perspectives, to instead be constructed, conceived and experienced through various social relations, interactions and practices. From a risk perspective, there is also a clear connection to an established body of work emphasising the social and cultural construction of risk and how it is experienced in very different ways among diverse populations (for example Beck, 1992; Blaikie et al., 1994; Douglas and Wildavsky, 1982; Giddens, 1990).

Literature on '-scapes' therefore may be understood as similarly able to hold potential for providing new perspectives across numerous aspects of risk research and practice; whether related to imaginaries and reality, constructivist and positivist, relational or contained, or formal regulatory mechanisms and lived experiences. The section now identifies and analyses the key frames and ideas that scholars engaging with the theory and application of riskscapes have tended to use in order to provide a foundation for understanding changing national perspectives. While there is no one single accepted definition or approach, the literature reveals four themes that we highlight to inform the discussion.

### **Risks are connected in space and time**

The first common theme associated with riskscapes as a distinct concept is connectedness and mobility. Müller-Mahn and Everts (2013) use the example of the 2011 Fukushima disaster in Japan to highlight how the event had both immediate local effects and delayed global ones. For example, it increased the perception of risk with regard to the location and

design of nuclear power plants and nuclear power, which eventually stimulated changes in the energy policies of other countries, thus having global reach. Policy makers in other nations saw nuclear power as ‘riskier’, despite those places suffering no effects and being geographically disconnected. This case shows the value of the ‘-scapes’ perspective, which brings to prominence the fluidity of global risks and how they can become mobile and embedded in other national territories. It also allows us to unpack spatio-temporal aspects more deeply. For instance, inaction or the time-lag to action may depend upon the ability of national institutions that have a mandated responsibility to consider risks, or to objectively identify, assess and respond to these new constructivist perceptions of riskscape (Fuchs and Keiler, 2013).

By emphasising that risks are not bounded spatially or temporally the concept maps well onto climate change issues where an acknowledged global problem influences a multiplicity of national policy goals, each of which have regard to their own localised effects and are applied in different ways over different scales times. Significantly, however—as can be seen in the example of nuclear energy—high-profile flooding, bushfires or other climate-related impacts in one country can create the anticipation of possible impacts elsewhere (Beck, 2009) and so potentially stimulate national policy changes in new and unpredictable ways.

### **Risks are perceived and experienced differently**

The second theme flows from the first, focusing on the divergent ways that risk becomes visible and understood in places. It emphasises that people make sense of the world differently. Risks are mediated in and through everyday practice and for some, the anticipation of risks can be as influential as real events. Research here explores issues of risk perception, the variable feelings of safety and has a spatial aspect that links risk to a specific place and time (for

example Gee and Skovdal, 2017). Riskscape research has, for example, highlighted the construction of new riskscapes, or the fixing of different risks to a particular place, as can be seen from the ‘war on terrorism’ which, it is argued, is directed at ‘ungoverned territories’ to legitimise military action (Schetter, 2013). A further strand has engaged with issues of terminology and meaning and the ways that language relates to specific risk frameworks or the privileging of particular interventions (Weichhart and Höferl, 2013). So for climate change, while governments seek to make risk visible and give it meaning within a particular place through scientific reports, technical practices or policy documents, individuals or communities will inevitably interpret those signposts and expert cues differently, such as through their own perceptions of safety or via existing social groups. Equally, nations will perceive, experience and respond to global risks like climate change in different ways.

### **Risks are interconnected across systems**

Another strong motif in the literature focuses on the multiple and interconnected nature of risks that compound and cascade across domains (Pescaroli and Alexander, 2018). For example, a recurring strand of riskscape research seeks to combine data from the social and natural worlds, such as between air pollution models and census data, as a means to draw attention to the tensions between environmental risks and social justice (for example Jenerette et al., 2011; Konisky and Reenock, 2018; Morello-Frosch et al., 2001). This approach has been used to emphasise the intertwining, cascading and parallel nature of social and natural riskscapes and also how these are related to power and agency (Bonati, 2014), for example by linking environmental stressors and gender (Mair et al., 2011). Issues connected to combining these different knowledges has also received scholarly attention, such as research discussing the spatial fit of natural hazards and administrative and regulatory boundaries and

governance processes and arrangements (Renn and Klinke, 2013), including the difficulties in creating new ‘administrative spaces’ that link systems (Pohl et al., 2013).

### **Risks are contingent, emergent and uncertain**

A final conceptual theme highlights how riskscapes are dynamic and that despite efforts to provide order, such as by expert practices, economic analyses, or hazard maps, there will always be a level of unpredictability and ambiguity that resists this neat managerial control. Research here acknowledges how riskscape perspectives lead to new imaginaries or emphasise the inevitability of emergent effects. This literature holds synergies with relational perspectives that recognise complexity and the subjective way material, technical and discursive elements come together at particular points in time and space, disperse and potentially take on new forms in the future (Blok, 2016; Neisser, 2014). A further stream acknowledges the links to decision making, such as how uncertainty can spread like a contagion between technical and political worlds (Hanna et al., 2020), the layers of potential in the ways intellectual traditions of natural and human sciences interpret riskscapes (Zahnen, 2013), or how administrative traditions influence risk management outcomes (Van Buuren et al., 2018). These all tend to highlight the importance of understanding not just what is at risk, but how risks are perceived and addressed.

The varied interpretation and use of theory in the literature, from the relatively theoretical to the very applied and from the governance of risk to individual experiences, in part reflects the emergent nature of riskscape as a concept to different disciplines and their methodological traditions.

### **The changing national riskscape of New Zealand**

The Introduction developed the notion that just as individuals construct their own ‘riskscape’

that may change over time and space, governments also do. We now turn to exploring the idea of a ‘national riskscape’, with a view to understanding interactions with global and sub-national perspectives and how perceptions of risk influence policy frameworks. More broadly, we also provide insights into the potential utility of the notion for theory and practice. In this context, we draw from the review of literature (for example Müller-Mahn, 2013, xviii) to define ‘national riskscapes’ as representing how natural hazard and climate risks have been imagined and managed within national policy and devolved to sub-national institutions over time. Considering the ‘riskscape’ concept within a distinct national context initially requires reflection on the changing practices and discourses that have shaped the present and which may continue to exert influence. We therefore use a historical narrative to explore how a national government has responded to changing knowledge of environmental and climatic risks over time to help inform the relationship between contemporary riskscape theory and practice. First, we provide a timeline of key policy and legislative developments and the ways these led to changes in formal risk management policy and practices at national and sub-national levels, followed by a narrative account that also takes into consideration international shifts in risk discourses, science and governance.

### **The changing policy and legislative context**

A primary means by which national riskscapes can be created and perceived is via the formal institutions and powers of the state. While an aspect of natural hazard and climate change research focuses on legislation, policy and regulation, a riskscape perspective pushes us to consider wider issues. For example, how does the national scale accept or integrate international trends in best practice, what is the ‘right’ balance of economic responsibility

between the state and other parties, or to what extent are risks managed by particular disciplines in particular siloes?

Beyond more functional organisational, administrative or management aspects, these national instruments also provide an evolving context of expert cues that inevitably influence the riskscape perceptions and practices of others. For instance, they serve to selectively render certain risks as more visible or urgent for sub-national agencies. As such, they possess less tangible powers by providing an authoritative set of signals that comprise an 'official' account of fundamental issues, such as what are the risks, how urgent are they and which places are deemed risky (Haughton and White, 2017)? In this regard, there is a flourishing scholarly literature on the political economy or governmentality of official efforts to promote risk management and resilience, in particular how it can influence the riskscape of others by normalising risks or by redistributing responsibility away from the state towards individual adaptation (Evans and Reid, 2013; Joseph, 2013).

Table 1 provides a concise overview of the riskscape timeline, illustrating broad policy shifts and trends that have emerged since the New Zealand government began to take a role in hazard management. By taking a broad overview of the developing timeline, we can begin to build up a picture of the evolving perception of a riskscape within a national territory, such as the gradual transition from natural hazards to also acknowledging climate change and its impact on the riskscape. The table thus helps demonstrate how the governance of risks and focus of policy attention have become more connected in space and over time. In common with other countries, we can further appreciate how a national riskscape has gradually changed from being sub-national, mainly the remit of engineers and mainly concerned with soil erosion and floods. It highlights when land-use planning emerged as a risk management

mechanism and the subsequent shift from protective to preventative to precautionary measures. More recently, we see the influence of the international tier through the introduction of climate change into the national riskscape and how thinking about issues such as uncertainty and better integration has begun to influence the policy environment.

This historical perspective also allows wider insights into the pace of change and inter-scalar connections, such as how new global institutions, like the Intergovernmental Panel on Climate Change (IPCC) and UNFCCC, provide a means to cascade global science into national contexts and periodically unsettle existing riskscapes. We can further observe how changes have gathered pace as the increased exchange of international data and analyses create a faster moving policy environment for both national and sub-national agencies.

Taking a broader perspective, we can appreciate the potential utility of a theory that reveals the dynamic and relational understanding of contemporary risk, which cascades both upwards and downwards at various speeds. In many ways, its intellectual emergence reflects the contingent and subjective nature of current international risk thinking and practice.

### **The changing national riskscapes and narratives of risk**

We have categorised the national and sub-national riskscape of New Zealand into five distinct Eras, each of which give an insight into the changing nature of how natural hazard and climate risks are given meaning and the ways that historic legacies can still exert an influence in the current period.

#### **Era one: experiential and territorial risks (up to early 20th century)**

New Zealand started its journey towards the contemporary riskscape with fire and land clearance of young geological landscapes for settlement

**Table 1.** *Institutional and Regulatory Riskscape Timeline*

Experimental and territorial risks	Protect and control landscapes		From hazardscape to riskscape		From riskscape to riskscapes		Contested and political riskscapes	
	Era 1	Era 2	Era 3	Era 4	Era 5			
Riskscape trend	Soil erosion and flood protection	Land use planning	Environmental effects and hazards planning	Integrated catchment planning	Climate change and changing risk	Coastal hazards and precaution	Climate change impacts and uncertainty	Soft options, politics and retreat
Date	1940s–1960s	1970s–1980s	1990s	1990s–2001	2004	2010	2013	2017
Policy response	Soil Conservation and Rivers Control Act 1941 Earthquake and War Damage Commission 1945 Water and Soil Conservation Act 1967	Town and Country Planning Act 1971, 1977 Local Govt Act 1988	The Resource Management Act 1991 Building Act 1991. Local Government Official Information and Meetings Act 1992	Catchment management plans. Flood risk management plans. Coastal management plans	Changed RMA section 7(i). The effects of climate change	New Zealand Coastal Policy Statement (NZCPS)	IPCC science integration. Enhanced uncertainty guidance	Coastal Hazards and Climate Change Guidance. Closer links between climate change and natural hazards (RMA)
Dominant type and focus of response	Engineering and sub-national delivery	Start of national planning controls	National law and regulation. Stronger planning policies at sub-national level	Integrated sub-national planning and stronger hazard management Engineering	Stronger national planning and managing sub-national climate change effects	Stronger national direction over policies, plans and consents	Focus on tool development and guidance for sub-national decision makers	More decision tools for sub-national decision makers, for example adaptive tools (DAPP), scenarios, Serious Games
Main purpose	Security with structures. Public safety	Protection	Reduction, avoidance and mitigation of natural hazards. Increase public information	Link science to impacts and plans over scales	Reduce risk. Recognition of effects and consequences	Precaution. Avoidance, reduction and mitigation of natural hazards	Decision making to anticipate risk	Risk reduction, learning, anticipatory planning
References	Erickson (1986)	Erickson (1986); Memon and Gleeson (1995)	The Resource Management Act 1991	Greater Wellington Regional Council (2001)	The Resource Management Act 1991	Kenderdine (2010)	Lawrence et al. (2013a); Manning et al. (2014)	Lawrence et al. (2018, 2020); Stephens et al. (2018); Lawrence et al. (2019)

and economic development. Geological risks, such as experienced in the eruption of Mount Tarawera in 1886 and the Hawkes Bay earthquake in 1931, and the significant erosion of soil from landscape cleared of its protective forests, endure to the present day. The most frequent natural hazard, however, is flooding (Royal Society of New Zealand, 2016). Being located between the Southern Ocean and warmer tropical oceans, storms and cyclones have been a long-standing hazard, and with significant orography to generate rainfall, there is a legacy of widespread flooding and erosion, from the Great Floods of 1868 and 1878 to the present day. Early migrants settled around waterways and at the coast and the intensity of the precipitation and rapid rise of flood water presented a riskscape that was alien to European settlers, with drownings so frequent that it became known as the 'New Zealand death' (Te Ara, 2019). This perception stands in contrast with the experiential knowledge of indigenous Māori, which exhibited a healthy respect for risk in some locations. For example, historically Māori had not settled in great numbers in the Christchurch region (subject to earthquakes in 2011), as there were oral histories that it was risky land prone to liquefaction (White and Haughton, 2017). Furthermore, many Māori place-names have long designated specific territory as risky, such as *Mangakino* (dangerous stream) or *Whangateau* (channel with strong current) (King and Goff, 2006). The lack of relative state protection at this time meant that the riskscape was localised, experiential and characterised by citizens adapting, whether anticipatory or not.

### **Era two: protect, control and tame unruly landscapes (early 20th century until late 1970s)**

The establishment of the New Zealand Parliament in 1854 and the Ministry of Works and Development in 1876 provided the origins of the formal, official institutional riskscape

we have today. This heralded the resources of the state being used for more intensive clearance, planned settlement of new areas and the heroic engineering approaches designed to protect settlements and control nature. The first policy response of note was the Soil Conservation and Rivers Control Act 1941 and the building of large flood control schemes, using flood and drainage control structures on the major rivers and the draining of swamps to protect farms and towns. The Act set responsibility for preventing flood damage to state and sub-national institutions and gave them powers, such as the ability for local rating to be adjusted to capture economic benefits. Following a series of major earthquakes in 1929 in Murchison, 1931 in Hawke's Bay, 1934 in Pahiataua and 1942 in Wairarapa, the Earthquake and War Damage Commission (now the Earthquake Commission) was set up in 1945. This was designed to operate as a state insurance body of last resort, collecting levies and paying out claims to support people and property after the risk was realised. The Water and Soil Conservation Act (1967) was added to the statutory tools to 'control' erosion and the flow and flooding from rivers and lakes. The governance arrangements were top-down and hierarchal, but forward thinking in developing a cadre of engineers and soil conservators supported by a powerful public works organisation with ample government funds to support local contributions for sub-national implementation. The riskscape signposts in this Era have their fingerprints in colonisation and 'river management' worldviews connected to taming 'unruly landscapes' via technical knowledge and physical protection. The Era ended with the passing of the Town and Country Planning Act in 1977, which set the platform for the start of statutory planning controls. Much risk management literature discusses this period as creating a false sense of security among citizens and the expectation that development



will be protected (for example [Burby, 2006](#); [Parker, 1995](#)).

### **Era three: from hazardscape to riskscape (1980s–1990s)**

The shift from Era two to three gained pace and was characterised by a growing recognition of the interactions between social and natural systems, the emergence of a multi-disciplinary approach and the expansion of riskscape into new areas of the state and civil society. The Town and Country Planning Act (1977) strengthened the visibility and understanding of the Hazardscape, addressing the avoidance or reduction of danger, damage or nuisance, and specifically naming multiple hazards, including earthquakes, geothermal and volcanic activity, flooding, erosion, landslip, subsidence, silting and wind. From this time, there was a focus on using science to identify land exposed to hazards in order to restrict future development. The 1980s saw a shift in focus from structural measures towards non-structural measures and from protection towards management. For instance, integrated catchment management strategies were developed for flood risk management, which marks one of the first official signals of a transition in language from ‘hazards’ to ‘risk’. A raft of rapid institutional and legislative reforms between 1988 and 1992, in particular the Local Government Act (1988), Resource Management Act (1991), Building Act (1991) and a 1992 amendment of the Local Government Official Information and Meetings Act reflected wider societal changes about the relationship between the state and civil society that has had a lasting influence on sub-national responsibilities and public riskscape perceptions. From this point, individuals were gradually given more information on natural hazards, such as that provided to potential property purchasers and rights to be consulted in decision making. These developments help form much of the basis of the current riskscape signals between the state and citizens.

For example, there is a sub-national responsibility to make risk visible for citizens via maps. At the same time, the power of the state to implement significant structural programmes was subject to increasing citizen input.

### **Era four: from riskscape to riskscapes (1990s–2010s)**

From the late 1980s onwards, the global riskscape was fundamentally altered by the rise of climate change and the formation of the Intergovernmental Panel on Climate Change in 1988. Nationally, the response was swift, with the [Royal Society of New Zealand \(1990\)](#) releasing the first official report on the science. Despite their seemingly strong connections, during the start of this period the natural hazard and climate change discourses largely proceeded separately. There was a continued dominance of institutional political and funding responses based around the one-off hazard events that were evident in previous Eras, without much evidence of preparation for future changes. As can be seen in [Table 1](#), the Era also witnessed a number of policy initiatives designed to shift away from this historic, siloed legacy and better recognise the plurality of risks. The production of data and evidence became increasingly more sophisticated, particularly with regard to modelling exposure and loss under different scenarios. For example, the ‘Riskscape’ modelling tool (no relation to the theory) adopted a multi-hazard approach and sought to create a consistent probabilistic approach to integrate different risks ([King and Bell, 2005](#)). Despite these developments, the Era was characterised by hazards dealt with in a siloed fashion and competing with each other for policy attention. The international shift towards multi-hazard and multi-scalar assessment was yet to cascade into the national level in a substantive way. Similarly, while the influence of climate change and the use of future scenarios began to make multi-temporal risks visible, the shift from hazard risk towards anticipatory actions

remained un-mandated until 2004 when having regard to the ‘effects of climate change’ was added to the RMA.

**Era five: contested, political riskscapes (2010–current period)**

Since 2010, there has been a flurry of research and policy initiatives aiming to make various risks, not least climate change, more visible and manageable. For example, ‘precaution’ as an objective was included in the New Zealand Coastal Policy Statement (2010), which strengthened the national directions and tools to manage of coastal hazards, including sea-level rise. The revised Coastal Hazards and Climate Change Guidance for Local Government (2017) now has managing uncertainty and wide public engagement at its core, ‘significant natural hazard risk’ was added to ‘matters of national importance’ in the RMA in 2017, a national climate change risk assessment framework was developed in 2019 and a Climate Change Response (Zero Carbon) Amendment Bill (CCRA) was passed in late 2019 with almost unanimous political support. The Climate Change Response Act 2002 set up a Climate Change Commission

that prepares emissions reduction budgets and plans to meet national targets under the Paris Agreement and will undertake climate change adaptation risk assessments and monitor the implementation of the National Adaptation Plan to be prepared by the Government. These responses can be interpreted as a national government seeking to rapidly change the national riskscape by providing new ways to assess, plan and manage risks, along with updated information, tools and techniques to help decision makers at national and sub-national levels imagine, cope and plan within complex political contexts. Much of the tenor of recent official documents or research portrays risks as dynamic, multi-temporal, compounding and cascading, and explicitly acknowledges the difficulties that decision-making norms, processes and practices have had in making progress on climate change adaptation that avoids new reduces existing risk (for example Lawrence et al., 2018, 2019).

Figure 1 summarises the key characteristics and timing of the Eras and emphasises how previous perceptions and approaches are crucial in understanding the composition of the contemporary national riskscape. It demonstrates

Era One	Era Two	Era Three	Era Four	Era Five
Up to early 20 <sup>th</sup> C	Early 20 <sup>th</sup> C to 1970s	1980s to 1990s	1990s to 2010s	2010s to ?
Experiential and Territorial Risks	Protect and control Landscapes	From Hazardscape to Riskscape	From Riskscape to Riskscapes	Contested and Political Riskscapes
Local Scale Individuals reactive and anticipatory	National and regional scale Rise of legal, institutional, and regulatory capacity Siloed discipline (engineering)	Global Scale Institutions Rise in scientific capacity. New laws, tools, models, assessments, policies. Multi-discipline Rise in public information and citizen engagement	Multi-hazard Multi-scalar Multi-temporal	Intertwined risks Cascading risks Decision making under uncertainty

**Figure 1.** *The national riskscape eras of New Zealand.*  
Source: Adapted from Daniels (2009).

that the transition between Eras represent a gradual and messy layering of conceptual shifts that leave riskscape legacies. For example, the hard engineering of early approaches continues to play a vital role for protection, at the same time as critiques now firmly acknowledge how structures create a false sense of security that escalates development in ‘safe’ areas that are still exposed to the residual risk. Similarly, the long-standing focus on natural hazards as part of the national riskscape of New Zealand has created a history of institutions, technical disciplines and ways of working that has struggled to adapt to the more uncertain, contested and dynamic risks presented by climate change (Lawrence et al., 2013). The focus on providing new guidance and tools at the sub-national level also recognises the inherent difficulty that climate change presents for Local Government action, particularly as they have been given an increasing number of unfunded mandates. The language used and signals given can also be seen as acknowledgement of the contested politics and value-laden choices at the heart of many sub-national decisions, for example with regard to property rights or the economic risks presented by transitioning land use or local economies. The recent activity, in particular the CCRA and its focus on targets, policies and monitoring, holds potential to add another riskscape Era, one much more practically focused on reducing climate emissions and adapting to a changing climate.

### **Discussion: riskscape theory and risk management practice**

Reflecting on both the theoretical and policy discussions allows us to add to the riskscape discourse the idea of evolving *national* riskscapes that over time experience both pressures to change, particularly in response to periodic global agreements, and pressures to stay stable. The theme of connectedness of risks in space and time has a strong presence. However, the

historical narrative emphasises how it is not just natural hazard and climate risks that are more connected, but nations—and by extension, sub-national tiers too—are becoming increasingly linked with international bodies. The rise in prominence of the global scale in natural hazard and climate risk discourses from the 1980s onwards, often through new international agreements to which countries now become signatories and which are periodically reviewed (for example ‘the Rio Summit’, ‘the Sendai Framework’, or ‘the Paris Agreement’), has helped provide the justification for national and sub-national legislative and policy responses. Equally, international climate change conferences, decision support tools and best guidance assist in rapidly exchange knowledge to and between, national and sub-national practice.

The research also reveals a series of tensions between the theory of riskscapes and practices of risk management. While the concept emphasises how risks are always in a state of becoming and are constantly made and remade by actors and agencies in a subjective manner, national and sub-national plans, policy and practices seek to periodically ‘fix’ risks in space and time to provide certainty for local decision making. This issue is well recognised by scholars (for example Boston, 2016, 2017; Ruhl, 2012) and is due in part to the nature of national politics, where there is a degree of pressure to provide sub-national institutional and policy stability. This is similar to other public policy norms, which are subject to a process of periodically opening up for design and consultation, then closing down for implementation (Allmendinger, 2016). The intermittent opening of new national risk discourses is also subject to wider developments in science, technology and international governance. For example, with regard to climate change, there is a noticeable rhythm in activity, as new IPCC reports or other international activities seek to manufacture scientific certainty and create

new agreements that both seek to unsettle the current riskscape and support national governments in developing new policy with new signals for sub-national actors and the general public.

While the typical processes of opening up and closing down in national policy formation suggests national riskscapes may not be as fluid as other applications of riskscape theory, in practice the distinction is not so simple, nor stark. Indeed, our research argues that the rapid speed of policy change over recent times, combined with a growing political consensus and the increasing use of language designed to highlight contingency, uncertainty and dynamism, points to a national effort that is essentially narrowing the gap between riskscape theory and practice. For example, in New Zealand, the national research funding signals have increasingly reinforced practical relevance and useable outputs as part of their funding criteria, which has fuelled new data and tools for sub-national decision makers to manage contingency and uncertainty (for example [Ministry of Business Innovation and Employment, 2019](#)). More significantly, in previous Eras, the institutions of state and national and sub-national resources had focused on responses to extreme events and *post hoc* policy ([Boston and Lawrence, 2018](#)). This helped create a policy environment where climate change risks were dominated by an emissions reduction imperative, rather than proactively managing risk impacts or adaptation measures. This stance has meant there has been a consequent absence of market instruments, funding and tools for adaptation at sub-national scales. However, cross-party political unanimity was finally reached at the end of 2019 with the passing of the CCRA, potentially heralding a new Era of climate change policy implementation at sub-national levels. Whether this recent move brings an end to the recent Era of contested riskscapes politics remains to be seen, but it does provide national consistency in how political parties send risk

signals to actors and agencies and render risk visible among populations.

Similarly, the strong historic disciplinary focus on engineering, law and the ways these professions tend to perceive and manage riskscapes also helps explain why it has been difficult to shift to new ways that seek to recast risks as more complex, contingent and connected across systems. In this regard, we can appreciate how political risk is not just experienced by politicians and political parties, but by institutions and disciplines too. In practice, the negative responses from powerful lobby groups and the long-standing roles of engineering and law in New Zealand ([Lawrence et al., 2013](#)) helped shape the role, extent and influence of national climate change governance and, by extension, the perception of the national riskscape. It also helps us appreciate how attempts to change riskscapes bring political risks for both politicians and practitioners.

The strategic perspective of a national riskscape also assists in seeing how the direction of national research funding can send signals to other important governance actors, such as the scientific community, which in turn can influence politicians and practitioners. Although multi-disciplinary research is encouraged by the national funder—the Ministry of Business Innovation and Employment—to date, there is no strategic and coordinated investment dedicated to end-to-end climate change science to underpin the visibility and management of a national and sub-national climate change riskscape. That said, novel tool development for decision making under uncertainty has received some traction in the flood and coastal contexts and is in development in the water domain. For instance, dynamic adaptive policy pathways planning has been recently embedded in national guidance for coastal hazards and climate change ([Lawrence et al., 2018](#)), along with innovations for monitoring changing risk using signals and triggers ([Stephens et al., 2018](#)) and socio-economic scenarios ([Frame et al., 2018](#)).

Overall, the recent activity emphasises that issues remain in linking what are fast moving international and national riskscapes to the governance arrangements to support implementation. This is essentially connected with the interface between science and society, such as how to improve climate change adaptation, how best to move from knowing about climate changes and impacts to decision making under conditions of uncertainty, or how to monitor and sustain progress over scales and time. This implementation gap is critical to cementing the parallel hazard-climate discourses, as well as narrowing the gap between riskscape theory and practice.

This discussion also develops our understanding of the dimension of riskscape concerned with how risks connect across systems. While a strand of riskscape research seeks to link the natural and social worlds, such as by highlighting how risks disproportionately affect certain populations, the relationship between the different but intersecting policy domains is not yet influencing policy. That said, there is now an emerging authoritative national framework, which acknowledges the existence of multi-hazard riskscapes and recognises that these competing policy interests and issues will be a feature at sub-national scales. While its influence has yet to play out, the contemporary national riskscape increasingly acknowledges how risk is multi-scalar, temporal and experienced in divergent ways, according to the exposure and vulnerability of people, assets, communities and nature, necessitating both contingency actions and anticipatory planning under conditions of uncertainty (Boston, 2017). It discusses coping with the dynamism, uncertainty and ongoing change within riskscapes, from one-off high-impact climate events and cascading impacts, to slowly emerging issues like sea-level rise, to frequent flooding from precipitation extremes. Yet, while these types of interactions are central to riskscape theory and are becoming visible in policy, the research

emphasises there is still a need for the diverse set of governance arrangements able to recognise and manage these new perspectives and aims.

More generally, this discussion shows the value of the ‘-scapes’ perspective, which essentially highlights the fluidity of how nations respond to global risks and how future threats become embedded in national landscapes and cascade to sub-national levels. The long-term perspective brings to the fore the legacy of the previous Eras and how long-standing perceptions and practices of risk management continue to exert influence, even as new riskscapes are created and seek to affect the subjective knowledge of practitioners and citizens. It highlights how notions of a single risk to be managed by a certain discipline, model or technical institution, tell us more about the constraints of governance rather than the reality of risk. The theory also offers a valuable perspective on understanding climate change governance, where new global riskscapes have emerged that have led to a multiplicity of national policy goals, each of which will have their own localised effects with agents perceiving and adapting to uncertain risks in different ways.

Governments have traditionally been much more comfortable in more bounded territorial risk spaces than the unbounded imagined riskscapes of possible systemic interactions. However, we can see how more recent legislation, policy and expert practices seek to signal, if not address, the complex riskscapes that multiple parties will have to navigate, from global investors or insurers, to local politicians and technical staff, to citizens during election times. A key message, however, is that the New Zealand example shows that despite a significant amount of recent activity in policy, funding and other areas, significant issues remain in linking the new riskscapes imaginaries to the governance arrangements that can address these. In part, this is due to the power of preceding Eras and preceding riskscapes.

## Conclusion

The central questions informing this article are twofold: to analyse what a riskscape perspective can tell us about the ways a nation has responded to changing knowledge of hazards and climate risks over time, and to reflect upon how this can help inform riskscape theory and practice. This article draws attention to the ways national riskscapes are constituted as a complex assemblage of natural, social, economic or political forces that both govern land and resources and influence the exposure, vulnerability and sensitivity of people and places. These aspects highlight the importance of understanding the forces of stability when seeking change and how markets, institutional norms, disciplines or policies at national and sub-national levels constitute and stabilise riskscapes, at the same time as new information and signals seek to influence them to recast these into new forms. While there has been an understandable desire for a more singular, expert and territorial understanding of risk in previous Eras, more recent policy developments have also made progress in unsettling these expectations and highlighting the contingent and emergent nature of climate change. We also emphasise how risks intertwine, not just between multi-hazards, but the wider political challenges presented by climatic action at the national level.

This discussion further directs us to how the theory can contribute to practice. A core finding is that the growing awareness of the connectedness of climate risks in space and time needs to be matched by governance arrangements that can better recognise and cope with the dynamism, uncertainty and ongoing change within riskscapes. It is also clear that these need to be able to consider differing political preferences for making risk visible, the allocation of responsibility and the speed of transition. While changes in national governments always open windows of political opportunity, we argue that to change national riskscapes we need to go

beyond policy to include signals and directions to science, disciplines, institutions, as well as the practical realities of implementation.

The 'riskscape' concept can be situated as part of a growing social science research agenda that seeks to shift the intellectual and governance focus away from probabilistic, technical or managerial risk perspectives to a more social constructivist stance that recognises multiplicity, heterogeneity and interconnectedness. Researchers have used the idea as an intellectual device to create various new imaginaries that recognise how risk relations and experiences differ, shift and reform over space and time. In this regard, it is also clear that the concept itself is still in a state of emergence and development, particularly with regard to its translation from theory to practice.

Müller-Mahn (2013, 35) discussed the flaws in issue-centred riskscapes presented mainly through expert practices and which operate on a wide understanding of problems. He further argued that these understandings struggle to take into account the complexity of everyday life and the multiplicity of 'riskscapes' encountered at the local level. Our reflections through the historical riskscape of a nation seek to add to this discourse. In doing so we seek to redirect discussion on why substantive national action is hard, away from a focus on policy or legislation, to a focus on matching policy to implementation. Just as the riskscape notion allows us to become attuned to the multiplicity of risks faced at the local level, so too does it allow us to identify that climate risk has to be mediated through a lens of political, professional and institutional risks, and given the requisite governance and implementation support.

## Acknowledgements

This project was funded by the New Zealand Ministry of Business, Innovation and Employment through the National Science Challenge: Resilience to Nature's Challenges.

## References

- Adger, N., Arnell, N. W. and Tompkins, E. L. (2005) Successful adaptation to climate change across scales, *Global Environmental Change*, **15**: 77–86.
- Allmendinger, P. (2016) *Neoliberal Spatial Governance*. London: Routledge.
- Appadurai, A. (1996) *Modernity at Large. Cultural Dimensions of Globalization*, 4th edn. Minneapolis, MN: University of Minnesota Press.
- Barnett, J., Graham, S., Mortreux, C., Fincher, R., Waters, E. and Hurlimann, A. (2014) A local coastal adaptation pathway, *Nature Climate Change*, **4**: 1103–1108.
- Beck, U. (1992) *Risk Society: Towards a New Modernity*. London: Sage.
- Beck, U. (2009) *World at Risk*. Cambridge: Polity Press.
- Blaikie, P., Cannon, T. Davis, I. and Wisner, B. (1994) *At Risk: Natural hazards, People's Vulnerability and Disasters*. London: Sage.
- Blok, A. (2016) Assembling urban riskscapes, *City*, **20**: 602–618.
- Bonati, S. (2014) Resiliencescapes: perception and resilience to reduce vulnerability in the island of Madeira, *Procedia Economics and Finance*, **18**: 513–520.
- Boston, J. (2016) Anticipatory governance: How well is New Zealand safeguarding the future? *Policy Quarterly*, **12**: 11–24.
- Boston, J. (2017) *Governing for the Future: Designing Democratic Institutions for a Better Tomorrow*. Bingley, UK: Emerald Group UK.
- Boston, J. and Lawrence, J. (2018) Funding climate change adaptation: The case for a new policy framework, *Policy Quarterly*, **14**: 40–49.
- Burby, R. J. (2006) Hurricane Katrina and the paradoxes of government disaster policy: Bringing about wise governmental decisions for hazardous areas, *The Annals of the American Academy of Political and Social Science*, **604**: 171–191.
- Carter, J., Cavan, G. Connelly, A., Guy, S., Handley, J. and Kazmierczak, A. (2015) Climate change and the city: Building capacity for urban adaptation, *Progress in Planning*, January, 1–66.
- Daniels, T. L. (2009) A trail across time: American environmental planning from city beautiful to sustainability, *Journal of the American Planning Association*, **75**: 178–192.
- Davoudi, S., Crawford, J. and Mehmood, A. (2009) *Planning for Climate Change*. London: Earthscan.
- Douglas, M. and Wildavsky, A. (1982) *Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers*. Oakland: University of California Press.
- Erickson, N. J. (1986) *Creating Flood Disasters?: New Zealand's Need for a New Approach to Urban Flood Hazard*. New Zealand: National Water and Soil Conservation Authority.
- Evans, B. and Reid, J. (2013) Dangerously exposed: The life and death of the resilient subject, *Resilience: Policies, Practices and Discourses*, **1**: 83–98.
- Frame, B., Lawrence, J., Ausseil, A., Reisinger, A. and Daigneault, A. (2018) Adapting global shared socio-economic pathways for national and local scenarios, *Climate Risk Management*, **21**: 39–51. doi:10.1016/j.crm.2018.05.001
- Fuchs, S. and Keiler, M. (2013) Space and time: coupling dimensions in natural hazard risk management? In D. Müller-Mahn (ed.) *The Spatial Dimension of Risk. How Geography Shapes the Emergence of Riskscapes*, pp. 189–201. London: Routledge.
- Gee, S. and Skovdal, M. (2017) Navigating 'riskscapes': The experiences of international health care workers responding to the Ebola outbreak in West Africa, *Health and Place*, **45**: 173–180.
- Giddens, A. (1990) *The Consequences of Modernity*. Cambridge: Polity Press.
- Haasnoot, M., Kwakkel, J., Walker, W. and ter Maat, J. (2013) Dynamic adaptive policy pathways: A method for crafting robust decisions for a deeply uncertain world, *Global Environmental Change*, **23**: 485–498.
- Hanna, C., White, I. and Glavovic, B. (2020) The uncertainty contagion: Revealing the interrelated, Cascading Uncertainties of Managed Retreat, *Sustainability*, **12**: 736.
- Haughton, G. and White, I. (2017) Risky spaces: Creating, contesting and communicating lines on environmental hazard maps, *Transactions of the Institute of British Geographers*, **43**: 435–448.
- HM Treasury (2015) *Fixing the Foundations: Creating More Prosperous Nation*. Stationery Office. London: HM Treasury.
- IPCC (2019) *Climate Change and Land: Summary for Policy Makers*. Available online at: [https://www.ipcc.ch/site/assets/uploads/2019/08/Edited-SPM\\_Approved\\_Microsite\\_FINAL.pdf](https://www.ipcc.ch/site/assets/uploads/2019/08/Edited-SPM_Approved_Microsite_FINAL.pdf) [Accessed 29 September 2019].
- Jenerette, G. D., Harlan, S. L., Stefanov, W. L. and Martin, C. A. (2011) Ecosystem services and urban heat riskcape moderation: Water, green spaces and social inequality in Phoenix, USA, *Ecological Applications*, **21**: 2637–2651.
- Joseph, J. (2013) Resilience as embedded neo-liberalism: A governmentality approach, *Resilience: Policies, Practices and Discourses*, **1**: 38–52.

- Kenderdine, S. (2010) Examining climate change: An environment court perspective. In T. Daya-Winterbottom and Resource Management Law Reform Association of New Zealand Inc (eds) *Resource Management Theory and Practice*, pp. 35–92. Auckland: Thomson Reuters.
- King, A. and Bell, R. (2005) Riskscape new Zealand – A multihazard loss modelling tool. In Proceedings of Earthquake Engineering in the 21st Century (EE-21C) Conference, Topic 8: Technologies and Trends for Disaster Monitoring and Reduction.
- King, D. and Goff, J. (2006) Māori Environmental Knowledge in Natural Hazard Management and Mitigation. NIWA Client Report AKL2006-055. Available online at: [https://edit.niwa.co.nz/sites/niwa.co.nz/files/niwa\\_report\\_akl2006-055.pdf](https://edit.niwa.co.nz/sites/niwa.co.nz/files/niwa_report_akl2006-055.pdf) [Accessed 16th June 2020].
- Konisky, D. M. and Reenock, C. (2018) Regulatory enforcement, riskscape and environmental justice, *The Policy Studies Journal*, **46**: 7–36.
- Lawrence, J. (2016) Implications of climate change for New Zealand's natural hazards risk management, *Policy Quarterly*, **12**: 30–39.
- Lawrence, J., Bell, R., Blackett, P., Stephens, S. and Allan, S. (2018) National guidance for adapting to coastal hazards and sea level rise: Anticipating change, when and how to change pathway, *Environmental Science & Policy*, **82**: 100–107.
- Lawrence, J., Bell, R. and Stroombergen, A. (2019) A hybrid process to address uncertainty and changing climate risk in coastal areas using dynamic adaptive pathways planning, multi-criteria decision analysis and real options analysis: A New Zealand application, *Sustainability*, **11**: 406. doi:10.3390/su11020406
- Lawrence, J., Blackett, P. and Cradock-Henry, N. (2020) Cascading climate change impacts and implications, *Climate Risk Management*, **29**: 100234. doi:10.1016/j.crm.2020.100234
- Lawrence, J. and Haasnoot, M. (2017) What it took to catalyse uptake of dynamic adaptive pathways planning to address climate change uncertainty, *Environmental Science & Policy*, **68**: 47–57.
- Lawrence, J., Reisinger, A., Mullan, B. and Jackson, B. (2013) Exploring climate change uncertainties to support adaptive management of changing flood risk, *Environmental Science & Policy*, **33**: 133–142.
- Lawrence, J. and Saunders, W. (2017) The planning nexus between disaster risk reduction and climate change adaptation. In J. M. I. Kelman and J. C. Gaillard (eds) *The Routledge Handbook of Disaster Risk Reduction Including Climate Change Adaptation*, pp. 418–428. London/New York: Routledge.
- Lawrence, J., Sullivan, F., Lash, A., Ide, G., Cameron, C. and McGlinchey, L. (2015) Adapting to changing climate risk by local government in New Zealand: Institutional practice barriers and enablers, *Local Environment*, **20**: 298–320. doi:10.1080/13549839.2013.839643
- Lefebvre, H. (1991) *The Production of Space*. Oxford: Blackwell Publishers.
- Mair, C. A., Cutchin, M. P. and Peek, M. K. (2011) Allostatic load in an environmental riskscape: the role of stressors and gender, *Health and Place*, **17**: 978–987.
- Manning, M., Lawrence, J., King, D. and Chapman, R. (2015) Dealing with changing risks: A New Zealand perspective on climate change adaptation, *Regional Environmental Change*, **15**: 581–594. doi:10.1007/s10113-014-0673-1
- Marchau, V., Walker, W., Bloeman, P. and Popper, S. (2019) *Decisionmaking under Deep Uncertainty: From Theory to Practice*. Cham, Switzerland: Springer Nature.
- Memon, P.A. and Gleeson, B.J. (1995) Towards a new planning paradigm? *Reflections on New Zealand's Resource Management Act*, *Environment and Planning B*, **22**: 109–124.
- McFadgen, B. and Huitema, D. (2017) Experimentation at the interface of science and policy: A multi-case analysis of how policy experiments influence political decision makers, *Policy Sciences*, **51**: 161–187.
- Ministry of Business Innovation and Employment (2019) *National Science Challenges Performance Framework*. Wellington: MBIE.
- Morello-Frosch, R., Pastor, M. and Sadd, J. (2001) Environmental justice and Southern California's 'riskscape': The distribution of air toxics exposures and health risks among diverse communities, *Urban Affairs Review*, **36**: 551–578.
- Müller-Mahn, D. (ed.) (2013) *The Spatial Dimension of Risk. How Geography Shapes the Emergence of Risksapes*. London: Routledge.
- Müller-Mahn, D. and Everts, J. (2013) Risksapes: The spatial dimensions of risk. In D. Müller-Mahn (ed.) *The Spatial Dimension of Risk. How Geography Shapes the Emergence of Risksapes*, pp. 22–36. London: Routledge.
- Neisser, F. N. (2014) 'Risksapes' and risk management – Review and synthesis of an actor – Network theory approach, *Risk Management*, **16**: 88–120.
- New Zealand Productivity Commission (2017) *Better Urban Planning: Final Report*. Available online at: [https://www.productivity.govt.nz/sites/default/files/Urban%20planning%20final%20web%20pdf\\_0.pdf](https://www.productivity.govt.nz/sites/default/files/Urban%20planning%20final%20web%20pdf_0.pdf) [Accessed 15 November 2018].



- O'Hare, P. and White, I. (2017) Beyond 'just' flood risk management: The potential for-and limits to-alleviating flood disadvantage, *Regional Environmental Change*, **18**: 385–396.
- Parker, D. J. (1995) Floodplain development policy in England and Wales, *Applied Geography*, **14**: 341–363.
- Pescaroli, G. and Alexander, D. (2018) Understanding compound, interconnected, interacting and cascading risks: A holistic framework, *Risk Analysis*, **38**: 2245–2257.
- Pohl, J., Zehetmair, S. and Mayer, J. (2013) Risk, space and system theory: Communication and management of natural hazards. In D. Müller-Mahn (ed.) *The Spatial Dimension of Risk. How Geography Shapes the Emergence of Riskscapes*, pp. 52–67. London: Routledge.
- Ramm, T. D., Watson, C. S. and White, C. T. (2018) Strategic adaptation pathway planning to manage sea-level rise and changing coastal flood risk, *Environmental Science & Policy*, **87**: 92–101.
- Ranger, N., Reeder, T. and Lowe, J. (2013) Addressing 'deep' uncertainty over long-term climate in major infrastructure projects: Four innovations of the Thames Estuary 2100 Project, *European Journal of Decision Process*, **1**, 233–262.
- Renn, O. and Klinke, A. (2013) Space matters! Impacts for risk governance. In D. Müller-Mahn (ed.) *The Spatial Dimension of Risk. How Geography Shapes the Emergence of Riskscapes*, pp. 1–21. London: Routledge.
- Royal Society of New Zealand (1990) *New Zealand Climate Report 1990*, Bulletin 28, Wellington: The Royal Society of New Zealand.
- Royal Society of New Zealand (2016) *Climate Change Implications for New Zealand*. Available online at: <https://royalsociety.org.nz/assets/documents/Climate-change-implications-for-NZ-2016-report-web3.pdf> [Accessed 16 June 2020].
- Ruhl, J. (2012) Panarchy and the law, *Ecology and Society*, **17**: 31. doi:10.5751/ES-05109-170331
- Schetter, C. (2013) Ungoverned territories: the construction of space of risk in the 'war on terrorism'. In D. Müller-Mahn (ed.) *The Spatial Dimension of Risk. How Geography Shapes the Emergence of Riskscapes*, pp. 97–108. London: Routledge.
- Serrao-Neumann, S., Renouf, M., Kenway, S. J. and Low Choy, D. (2017) Connecting land-use and water planning: Prospects for an urban water metabolism approach, *Cities*, **60** (part A): 13–27.
- Soja, E. W. (1996) *Thirdspace: Journeys to Los Angeles and Other Real-and-Imagined Places*. Oxford: Blackwell.
- Stephens, S., Bell, R. and Lawrence, J. (2018) Developing signals to trigger adaptation to sea-level rise, *Environmental Research Letters*, **13**, 104004.
- Te Ara (2019) *The Encyclopaedia of New Zealand: Floods*. Available online at: <https://teara.govt.nz/en/floods/page-1> [Accessed 30 September 2019].
- Van Buuren, A., Lawrence, J., Potter, K. and Warner, J. (2018) Introducing adaptive flood risk management in England, New Zealand and the Netherlands: The impact of administrative traditions, *Review of Policy Research*, **35**, 907–929.
- Weichhart, P. and Höferl, K. M. (2013) A place for space in risk research: the example of discourse analysis approaches. In D. Müller-Mahn (ed.) *The Spatial Dimension of Risk. How Geography Shapes the Emergence of Riskscapes*, pp. 37–51. London: Routledge.
- Greater Wellington Regional Council (2001) *Hutt River Floodplain Management Plan: For the Hutt River and Its Environment*. Wellington: Greater Wellington Regional Council.
- White, I. (2019) Rigour and rigour mortis? Planning, calculative rationality and forces of stability and change, *Urban Studies*, 1–16. doi:10.1177/00420980198886764
- White, I. and Haughton, G. (2017) Risky times: Hazard management and the tyranny of the present, *International Journal of Disaster Risk Reduction*, **22**: 412–419.
- World Economic Forum (2020) *The Global Risks Report 2020*. Geneva: World Economic Forum. Available online at: [http://www3.weforum.org/docs/WEF\\_Global\\_Risk\\_Report\\_2020.pdf](http://www3.weforum.org/docs/WEF_Global_Risk_Report_2020.pdf).
- Zahnen, B. (2013) Bethinking oneself of the risk of (physical) geography. In D. Müller-Mahn (ed.) *The Spatial Dimension of Risk. How Geography Shapes the Emergence of Riskscapes*, pp. 172–188. London: Routledge.