Chapter 11
Managing Natural Resources for Extreme Climate Events: Differences in Risk Perception Among Urban and Rural Communities in Sydney, Australia

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Abstract Lack of perception of the risks posed by climate change has been identified as a major constraint to social adaptation. Factors contributing to risk perception include experience of extreme weather events; socio-cultural factors (norms and values); knowledge of causes, impacts and responses, and socio-demographics. Qualitative data was collected from a series of participatory placed-based workshops conducted in the Greater Sydney and South East regions of New South Wales, Australia with participants drawn from a mix of 12 urban and rural communities. Workshop discussions were based on an Emergency Management Framework: Prepare, Prevent, Respond and Recover (PPRR) for the most important local climate hazards—bushfires, drought, storms, and flooding. Qualitative information from the workshops was examined for evidence of the role of risk perception in the management of natural resources for extreme climate events and the capacity of communities to adapt. Perception of risk differed among locations (urban vs. rural) and types of events, in particular bushfire and flood. Recent experience of an event, livelihood dependency on natural resources and the socio-demographic dynamics of communities were identified as factors contributing to adaptive responses to improve protection of natural resources (such as soils, water and biodiversity).

Keywords Climate change • Climate change adaptation • Natural resource management • Risk perception

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Introduction

Climate change has been identified as an evolutionarily novel risk (Griskevicius et al. 2012) because of the magnitude, complexity and scale of the problem. These characteristics coupled with the slow, cumulative and largely invisible nature of climate change (van der Linden 2015) make it difficult to experience directly (Weber 2010), and complicate the mental construction of the risk (Breakwell 2010). Projections of future climate indicate that changes to the frequency and or severity of extreme climate events are likely to occur (Richardson et al. 2013). Complex event-driven extremes, which include severe drought, storms and floods, do not necessarily occur every year at a given location (Easterling et al. 2000). However, they are increasingly viewed as drivers of rapid social and policy change (Johnson et al. 2005; Lujala et al. 2015; Marshall et al. 2013; Moser and Ekstrom 2010) and, therefore, offer opportunities to explore actions on adaptation with otherwise disengaged communities.

Risk perception is a complex and multi-faceted phenomenon that involves the interaction of multiple human and environmental factors over time. Paton and McClure (2013) argue that people decide either by necessity or by choice to live in locations that expose them to the risk of extreme natural events because they perceive that the physical, economic and aesthetic amenities outweigh the risks. However, problems for exposed communities arise when they fail to perceive a change in the frequency or intensity of events that exceeds their historical coping capacity (Bürgelt and Paton 2014). To support communities through disasters, integrated warning systems have been developed that generally consist of three components (Mayhorn and McLaughlin 2014): hazard detection, emergency management response and public communication. Although these systems are increasingly becoming sophisticated, it is the rational response of the community to the hazard that ultimately determines its level of engagement with emergency preparedness (Helsloot and Ruitenberg 2004). The relationship between perception and preparedness is complex and is influenced by a range of factors including experience of extreme weather events; socio-cultural factors (norms and values); knowledge of causes, impacts and responses, and socio-demographics (Scolobig et al. 2012; van der Linden 2015; Wachinger et al. 2013).

Many of the factors associated with community risk perception of natural hazards are influenced by the increasing urbanisation of the global population (MEA 2005). Unlike rural areas, cities are often dislocated from their supply of natural resources (in particular water) (Padowski and Gorelick 2014), food (Mason and Knowd 2010) and energy generation (Godschalk 2003). This means that urban populations may be disconnected from environmental signals that might otherwise stimulate behaviour change in communities dependent on natural resources to support their livelihoods (Pretty 2002). Differences among urban and rural communities in norms and values (Argent et al. 2010), knowledge (McGee and Russell 2003) and socio-demographics (Luck et al. 2010) are also likely to result in differing perceptions of risk to climate change and extreme events, and variations

in adaptive capacity (Pretty 2003). For example, local ecological knowledge is an important component of capacity to manage natural systems. Local knowledge is considered to co-evolve with the ecosystem upon which it is based and is maintained through frequent interaction with the natural environment. Pilgrim et al. (2008) showed that ecological knowledge is inversely related to income levels among countries and suggested that the differences between countries were related to the level of urbanisation, reliance on services and the globalisation of trade and culture. In order to manage this disconnection from the environment in urbanized areas, emergency management institutions attempt to stimulate risk perception in exposed communities.

Over time governments have developed emergency service capability for dealing with natural disasters. In Australia, the State Government of New South Wales (NSW), in which the city of Sydney is located, has implemented a State Emergency Management Plan (NSW Government 2015). It is based on an adaptive management system and supported by local social capital (through community volunteer services such as the Rural Fire Service (RFS), State Emergency Service (SES) and local government). The Plan uses a four phase framework of prevent, prepare, respond and recover (PPRR, Fig. 11.1) to inform government and its emergency management agencies of the appropriate administrative and operational responses throughout the duration of an event (Bunker et al. 2015). It is becoming clear, however, that many communities, in particular those in urban settlements, are
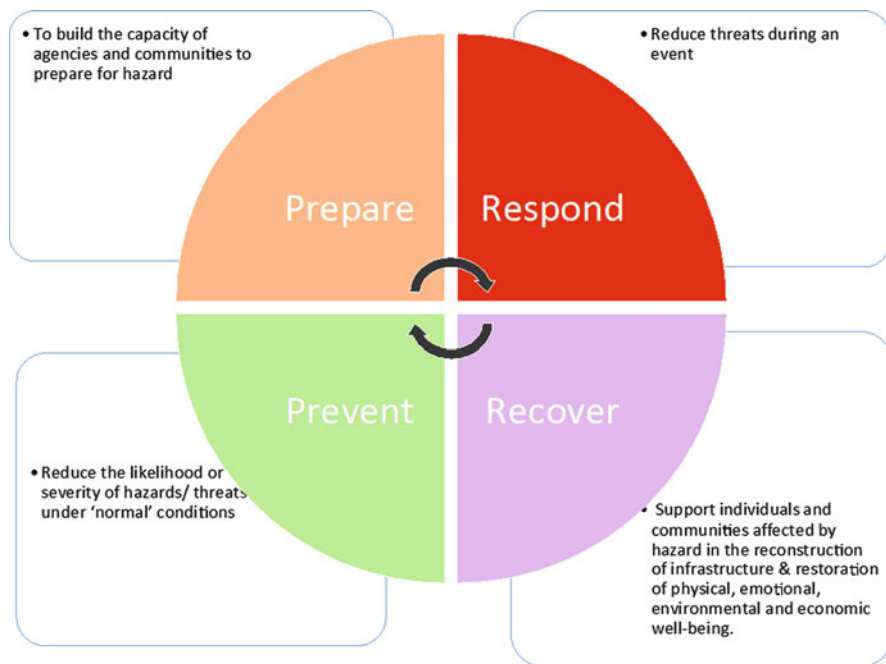
Fig. 11.1 Emergency management framework (PPRR) and definition of the phases. *Source*: authors

increasingly reliant on emergency services during the response phase of an event because of a failure to pro-actively undertake preparatory action. This has been in part attributed to the failure of risk communication to influence the at-risk individual's mental construction of risk and, in turn, how they act to mitigate consequences (Bostrom et al. 1994; Leiserowitz 2006; Reid and Beilin 2014).

This paper will examine how factors associated with perception of risk differed among locations (urban vs. rural) in relation to extreme climate events in Sydney and surrounding peri-urban areas. We anticipate that recent experience of an event, livelihood dependency of a community on natural resources and socio-demographic dynamics will be prominent among the components of risk perception that contribute to adaptive responses to extreme climate events.

Research Methodology

This methodology aimed to elicit information about community members' perceptions of risk of extreme climate events, the likely local impacts of these events and factors that increase local vulnerability to extreme climate events. We conducted a series of 12 placed-based, participatory workshops between May and November, 2014. Our approach was consistent with recent advocacy (e.g. Birkholz et al. 2014) for greater engagement with constructivist perspectives as an alternative to the more traditional reliance on rationalist approaches to understanding disaster risk perception (e.g. Reid and Beilin 2014). The workshops focused in particular on the management of natural resources (such as soils, water and biodiversity) and how management might change in response to the impacts of extreme climate events. In total 184 local community participants, and representatives from the agencies (government and NGOs) that support those communities from the Sydney Metropolitan and South East NSW regions, took part in the workshops.[1]

The Emergency Management framework (**Prevent, Prepare, Respond** and **Recover** (PPRR) was used to frame discussions around the most critical or disruptive local hazards facing these two regions: bushfires, drought, storms, and flooding. In particular we sought information about the local, lived experience (Lewis-Beck et al. 2013) of extreme climate events throughout the emergency management cycle.

In small groups, facilitators[2] led in-depth discussion of current actions to manage natural resources for extreme climatic events, sources of information and key information providers accessed by the community, and the range of support mechanisms available to enable adaptation. The discussion also canvassed views on the

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[1]Representing landholders, emergency service volunteers, local and state government agencies, business owners, Indigenous peoples, financial institutions and a range of non-government community organisations such as Landcare.

[2]The workshop facilitators included the authors from the Institute for Sustainable Futures, UTS and staff from state government NRM agencies.

aspects of the natural environment and local livelihoods and lifestyles that may be lost to the community if extreme events become more frequent or intense. Finally, we asked the participants to identify management strategies that could either reduce exposure to extreme events or increase resilience to extreme events while simultaneously protecting the natural resource base throughout the PPRR cycle.

Participants were provided an overview of the climate drivers for their region and potential hazards faced by communities in their local landscape. Information was drawn from two sources:

- Historical climate analyses from the Australian Bureau of Meteorology including national and South East Australian temperature trends, rainfall trends, anomalies and seasonality, and the occurrence of East Coast low pressure systems.
- A climate summary prepared as part of the NSW Office of Environment and Heritage's Climate Impact Profile (Tables 11.1 and 11.2). It should be noted that these workshops pre-dated the release of regional climate data through AdaptNSW (OEH 2015).

The qualitative information collected about each stage of the emergency management cycle was coded for workshop location and extreme event type. This information was subjected to qualitative meta-synthesis (Sandelowski et al. 2007) to identify emergent themes and provide deeper insights than might be possible

Table 11.1 Major climate impacts for the Sydney Metropolitan and South East NSW regions

Climate attribute/ impact	Sydney Metropolitan	South East NSW
Temperature	Hotter with more heat waves	Hotter
Rainfall	Likely to increase with significant rainfall in autumn	Likely increase in summer and decrease in winter
Flooding	Increasing intensity, localised flooding of urban areas in the vicinity of rivers and tributaries	Run-off and stream flow likely increase during summer leading to a heightened flood risk
Sea level rise	Increased exposure to beach erosion and inundation	Increased risk to coastal property and infrastructure Increased inundation and acidification of agricultural soils
Snow fall	n/a	Likely decrease
Biodiversity	Large changes in areas of high biodiversity value especially in the Blue Mountains World Heritage Area Potential changes in extent and range of both native flora and fauna and invasive species	Changes to natural ecosystems (alpine, low-lying coastal and fire sensitive) Potential changes in extent and range of both native flora and fauna and invasive species
Soil erosion	Changes projected through increased annual surface run-off	Likely increase on erodible soil types

Source: OEH (2015)

Table 11.2 Commonly expressed perspectives on emergency events: differences between emergency services personnel and the community

Emergency management perspective	Community perspective
Most people unaware of the risk	Most people aware of the risk, but have other priorities that take precedence
Most people in the community rely on the emergency services to respond to bushfire, storms, and flooding	Many people do not want to rely on help from emergency services
High public expectation of service provision during emergencies	Individual householders see themselves as the most responsible for personal and home safety
Can advise but not direct residents to take action	Frustrated by lack of specific advice on what to do and limited help provided

Adapted from Cottrell and King (2008)

from studies of a single location or event type (Major and Savin-Baden 2011). Quotes from workshop transcripts are presented in the results to illustrate common aspects of risk perception related to the most important narratives emerging from the workshops.

The information collected during this process was rich and informative; however, we recognise that in utilising this methodology a compromise must be made between the scientific rigor of formal psychometric testing of risk perception (e.g. Lachlan and Spence 2007) and the need for policy relevance to stakeholder concerns. The latter particularly includes the ability to capture spatial and temporal context, and the need for a research process to resonate with the public in order to best understand society's concerns and aspirations (Stevenson and Lee 2001).

Results and Discussion

The Prevent-Prepare-Respond-Recover (PPRR) framework proved useful to engage both urban and rural communities in discussions about extreme climate events. The framing of extreme events into a logical sequence facilitated structured discussion and revealed differences in activities across a range of climatic events. The application of consistent, well-developed and tested frameworks in participatory assessments provides a common language that can be used to organise complex information and problems (Brown et al. 2010).

In the case of this series of workshops, using the PPRR framework as a unifying theme for discussion revealed differences in perception of risk to life, property and natural resources from extreme climate events that differed among locations (urban vs. rural) and types of events. Of the factors commonly associated with risk perception (Fig. 11.2) those most widely identified in our workshops as mediating adaptive responses included:
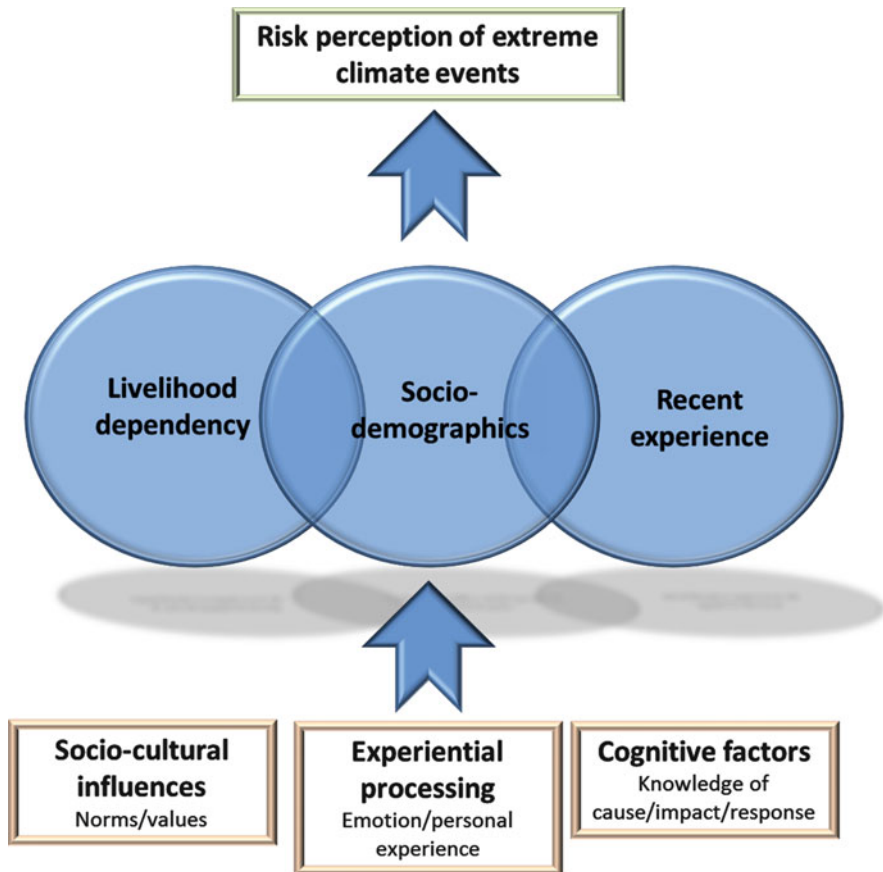
Fig. 11.2 Factors associated with risk perception among communities in South East NSW and the Greater Sydney regions. *Source*: authors

- Recent experience of an event,
- Livelihood dependency on natural resources, and
- The socio-demographic dynamics of communities.

Recent Experience of an Event

When it's cold, people don't think about the risks of bushfire.
  Peri-urban bushfire workshop

The focus is on preparing now because the experience of previous fires is fresh but it's hard to maintain that motivation five years down the track.
  Peri-urban bushfire workshop

Residents tend not to be pro-active in taking responsibility for protecting their own properties and expect agencies and others in the community to help.
  Urban flood workshop

The adoption of preparatory measures for extreme climate events reduces loss and injury within a given household, facilitates the capacity to cope with the temporary disruption associated with the event, and can minimise damage and insurance costs (Paton et al. 2006). For bushfires, Emergency Management (EM) agencies convey bushfire risk messages and strategies through multiple means to encourage preparation in cooler months of winter and spring. However, both EM service personnel and community workshop participants suggested that many people fail to act on these messages until the risk of fire risk is 'extreme' (AFAC 2005). Differences within and among communities in their willingness to prepare for natural disasters are related to variations in factors associated with perception of risk (Cottrell and King 2008). However, the views of EM personnel may diverge considerably from those of the community in regards to disaster preparedness (Table 11.2). The perspectives presented in Table 11.2 were commonly expressed in Greater Sydney and SE Region workshops.

> There was flooding from an unusual storm event in which a significant volume of rain fell in couple hours which overwhelmed the drains. As a result of this flood a community awareness campaign called Summer Safety campaign for storms was developed.
> Urban flood workshop

Recent extreme events present an opportunity to raise community risk awareness. Communities in two workshops had recently experienced bushfires, which had clearly raised awareness of risk in these locations, although this did not necessarily translate into greater preparedness of the community as a whole. Younger families (presumably because of competing priorities) and newer residents that lack local experience with bushfire were identified by participants as being less likely to engage in activities to reduce risk (prepare and prevent) without the stimulus of an imminent fire threat.

> This region is seeing an influx of young families moving in to take advantage of better housing affordability, they are ill-prepared and the motivation to prepare only comes over time.
> Bushfire workshop

For urban residents the preparation phase was commonly reported to be triggered by smoke in the air (often caused by hazard reduction burning) and media reports of actual fires (sometimes in other locations). This contrasts with communities in more rural areas where preparation is more anticipatory and driven by local knowledge of 'prolonged hot, dry and windy conditions' and 'signs in the surrounding landscape' such as water stressed vegetation, vegetation dieback or the build-up of fuel in natural areas. Connections to the local environment, observations of environmental change and personal weather experiences are factors known to be associated with climate risk perceptions (Higginbotham et al. 2014).

Lack of experience of extreme events is a barrier to effective engagement in preparedness (Weber 2010). Similarly, Higginbotham et al. (2014) found that "direct experience of extreme weather events appears to shape threat appraisal" (p. 701). In one location (the Blue Mountains located in Sydney's urban fringe), there was evidence that a recent major bushfire event had created novel social

opportunities to foster communication about bushfire risk within the community, in particular with newer residents, through the production and screening of a film called *As the Smoke Clears* that illustrates local bushfire recovery (https://www.youtube.com/watch?v=5PjhyiYcMK0).

> The film night put on by the Blue Mountains World Heritage Institute is a novel way to engage community as well as getting people together to share experiences.
>   Peri-urban bushfire workshop

> There is a sense of fear about being near the bush and this sometimes results in head in the sand attitudes.
>   Urban flood workshop

In contrast, there was reportedly little community awareness of the risk of flooding in the Hawkesbury-Nepean floodplain located in western Sydney, which was attributed to a lack of "collective community experience' with flood. The flood plain contains expansive human settlements that have not experienced a major flood event since 1867 (Gillespie and Grech 2002). Water flows in the Hawkesbury-Nepean region are managed for water supply for Sydney rather than flood control (Gillespie and Grech ibid). However, the potential exposure to flood, particularly under the altered rainfall regimes expected with climate change is recognized as among the highest in Australia (Dowdy 2015; Brewsher et al. 2013).

> We [emergency management staff] did a letter drop to about 3000 households in the flood plain to invite participation in a flood awareness raising event. But only about 30 people came to the event.
>   Urban flood workshop

The lack of response of Sydney's flood plain communities to traditional forms of emergency preparedness communication raises questions about its effectiveness. Paton et al. (2006) found that for communities exposed to bushfires the formation of "intention to prepare" and the formation of "intention to seek information" represented different cognitive pathways in relation to environmental hazards. Those who form "intentions to prepare" are more likely to prepare than those who form "intentions to seek information". For communication to be effective, engagement needs to be targeted specifically for each group, which may require EM institutions to embrace new forms of communication to increase the effectiveness of risk communication.

Livelihood Dependency

> The environment is a major tourist draw-card; consequently fire has huge socio-economic impacts especially on local businesses.
>   Peri-urban bushfire workshop

> Houses, sheds, hay, equipment—all of these are required to cope with and recover from fire. If lost, this has a serious impact upon individuals, but also the community as a whole.
>   Rural bushfire workshop

The extent to which communities understood and acted on the need to protect the environment from the impacts of extreme events appeared to be related to the dependency of community livelihoods on natural resources. Livelihood dependency would likely influence risk awareness through cognitive factors (rural communities have a greater knowledge of causes, impacts and responses) and differences in social norms and values between rural and urban communities (Fig. 11.2, van der Linden 2015). Pilgrim et al. (2008) demonstrated an association between economic growth and social capacity to manage the environment with wealthier, urban communities showing lower levels of ecological knowledge than rural communities. Increasing urbanisation of peri-urban areas adjacent to Sydney not only places these new communities at greater risk of extreme events such as bushfires, it also undermines their perception of the risk of these events.

Rural communities most often valued the natural resources they viewed as directly influencing agricultural production. In particular, they focused on protection of soils and surface water quality. They were also more aware of the impacts of events such as bushfire on animals both native and livestock, which often required euthanising during the recovery phase, a task rural communities reported as adding to the trauma of an extreme weather event.

> Native animals are likely to be hit by cars or attacked by feral animals after fire as they are disoriented from being forced out of their normal habitat.
>   Rural bushfire workshop

In urban areas, the protection of natural resources was related primarily to their amenity value, such as surface water quality for recreational activities (fishing, boating). Urban communities living in close proximity to national parks (such as the World Heritage listed Blue Mountains area) also recognised the potential for local economic impacts through damage to environmental tourism and changes to their community's cultural identity. However, community concern for the environment is reduced when natural assets have the potential to impact on houses; this view is encouraged by government policy. For example, workshop participants were concerned that recent changes to vegetation regulations in the vicinity of housing will increase clearing of trees in lower parts of the Blue Mountains, greatly impacting biodiversity and giving 'a false sense of security'. Accordingly, many urban communities reportedly view trees as a source of risk rather than as a natural resource asset, eschewing tree maintenance in favour of complete removal. Despite this there was general agreement at storm and flood workshops that improved selection and maintenance of backyard trees, rather than wholesale clearing ('tree-hysteria'), could reduce damage to property and maintain the ecosystem service benefits that tree canopies provide (e.g. reduction of heat, enhancement of biodiversity, human health and well-being).

Socio-demographics

> There is a continuation to put people at risk by allowing housing developments on the flood plain and legislation to stop development on flood prone land—distorted by political process.
>   Coastal storms workshop

> I've been working in the SES for 23 years and never, ever thought about NRM.
>   Emergency service volunteer coastal storms workshop

Workshop narratives suggested that rapid population growth and urbanisation can erode local knowledge and community connection to local environment. There were quite marked differences between urban and rural-regional emergency management staff in their understanding of the importance of managing natural resources for extreme climate events. Emergency service personnel are generally drawn from the communities they serve and their perspectives on environmental protection might reasonably be expected to reflect those of the community. In rural areas it was common for volunteer EM staff to be drawn from the local farming community bringing to emergency management an understanding of natural resource management and resulting in informal changes to operating procedures where they do not conflict with the protection of life and property. In urban areas, emergency management staff frequently stated that they rarely considered the impacts of extreme climate events on natural resources. The exception to this was for bushfire management in the Blue Mountains, where the extensive areas of reserves in close proximity to residential areas require a deep understanding of the science of endangered ecosystems and collaboration between National Parks and Wildlife staff, the RFS and local government (e.g. Hammill and Tasker 2010).

Conclusions

This paper has demonstrated that while risk perception is critical to promoting preparatory action for extreme climate events, the relative importance of the components of risk perception varied among communities and with respect to extreme event types. We found recent experience of an event, natural resource livelihood dependency and socio-demographic change most closely associated with variation in risk perception among community members living in the Sydney metropolitan region and the South East regions of NSW. While this study was limited in scope to the socio-economic, biophysical and cultural context of two regions in South East Australia, the findings are consistent with research on responses to extreme climate events in other locations (e.g. Higginbotham et al. 2014; Scolobig et al. 2012; Van der Linden 2015). We identified two key findings. Firstly, the disconnection between urban communities and the natural resources on which they depend limits their level of understanding of the impact of extreme climatic events on the environment. Secondly, in contrast, rural communities with a greater reliance on and understanding of natural resource management

are more likely to engage in preparedness for extreme events. The implication of these findings for EM institutions and policy-makers in seeking to improve the management of natural resources for extreme climatic events is that risk communication should be tailored to the ecological literacy of the community. Improvements to natural resource management may also require new governance partnerships between natural resource agencies, EM institutions and local communities to ensure that management actions are based on a shared understanding of the importance of environmental protection.

References

AFAC (2005) Position paper on bushfires and community safety. Australasian Fire Authorities Council Limited

Argent N, Tonts M, Jones R, Holmes J (2010) Amenity-led migration in rural Australia: a new driver of local demographic and environmental change? In: Luck GW, Black R, Race D (eds) Demographic change in Australia's rural landscapes, vol 12, Implications for society and the environment. CSIRO, Collingwood

Birkholz S, Muro M, Jeffrey P, Smith HM (2014) Rethinking the relationship between flood risk perception and flood management. Sci Total Environ 478(2014):12–20

Blue Mountains World Heritage Institute (2014) As the smoke clears. https://www.youtube.com/watch?v=5PjhyiYcMK0. Images published to highlight the recovery process in the Blue Mountains following the 2013 bushfires

Bostrom A, Atman CJ, Fischhoff B, Morgan MG (1994) Evaluating risk communications: completing and correcting mental models of hazardous processes, part II. Risk Anal 14(5): 789–798

Breakwell GM (2010) Models of risk construction: some applications to climate change. Wiley Interdiscip Rev Clim Change 1(6):857–870

Brewsher D, Grech P, Yeo S (2013) Hawkesbury's flood risk management plan: 15 years in the making. In: Proceedings of the floodplain management association national conference, 28–31 May 2013, Tweed Heads, NSW

Brown P, Nelson R, Jacobs B, Kokic P, Tracey J, Ahmed M, DeVoil P (2010) Enabling natural resource managers to self-assess their adaptive capacity. Agr Syst 103(8):562–568

Bunker D, Levine L, Woody C (2015) Repertoires of collaboration for common operating pictures of disasters and extreme events. Inf Syst Front 17(1):51–65

Bürgelt PT, Paton D (2014) An ecological risk management and capacity building model. Hum Ecol 42(4):591–603

Cottrell A, King D (2008) Understanding communities' needs for information and education. Risk Wise 2008:41–45

Dowdy A (2015) East Coast cluster report, Climate Change in Australia Projections for Australia's Natural Resource Management Regions. In: Ekström M et al (eds) Cluster reports. CSIRO and Bureau of Meteorology, Australia

Easterling D, Meehl G, Parmesan C, Changnon S, Karl T, O'Mearns L (2000) Climate extremes: observations, modeling, and impacts. Science 289(5487):2068–2074

Gillespie C, Grech P (2002) Reconciling development with flood risk: the Hawkesbury-Nepean dilemma. Aust J Emerg Manage 17(1):27–32

Godschalk DR (2003) Urban hazard mitigation: creating resilient cities. Nat Hazard Rev 4(3): 136–143

Griskevicius V, Cantú SM, Vugt MV (2012) The evolutionary bases for sustainable behavior: implications for marketing, policy, and social entrepreneurship. J Public Policy Market 31(1): 115–128

Hammill K, Tasker L (2010) Vegetation, fire and climate change in the greater Blue Mountains world heritage area. Department of Environment, Climate Change and Water, Sydney

Helsloot I, Ruitenberg A (2004) Citizen response to disasters: a survey of literature and some practical implications. J Conting Crisis Manage 12(3):98–111

Higginbotham N, Connor L, Baker F (2014) Subregional differences in Australian climate risk perceptions: coastal versus agricultural areas of the Hunter Valley, NSW. Reg Environ Change 14(2):699–712

Johnson CL, Tunstall SM, Penning-Rowsell EC (2005) Floods as catalysts for policy change: historical lessons from England and Wales. Water Resour Dev 21(4):561–575

Lachlan KA, Spence PR (2007) Hazard and outrage: developing a psychometric instrument in the aftermath of Katrina. J Appl Commun Res 35(1):109–123

Leiserowitz A (2006) Climate change risk perception and policy preferences: the role of affect, imagery, and values. Clim Change 77(1-2):45–72

Lewis-Beck MS, Bryman A, Liao TF (2013) Encyclopaedia of social science research methods: quantitative research. Sage, Thousand Oaks

Luck GW, Black R, Race D (eds) (2010) Demographic change in Australia's rural landscapes: implications for society and the environment, vol 12. CSIRO, Collingwood

Lujala P, Lein H, Rød JK (2015) Climate change, natural hazards, and risk perception: the role of proximity and personal experience. Local Environ 20(4):489–509

Major C, Savin-Baden M (2011) Integration of qualitative evidence: towards construction of academic knowledge on social science and professional fields. Qual Res 11(6):645–663

Marshall NA, Park S, Howden SM, Dowd AB, Jakku ES (2013) Climate change awareness is associated with enhanced adaptive capacity. Agr Syst 117(2013):30–34

Mason D, Knowd I (2010) The emergence of urban agriculture: Sydney, Australia. Int J Agric Sustain 8(1&2):62–71

Mayhorn CB, McLaughlin AC (2014) Warning the world of extreme events: a global perspective on risk communication for natural and technological disaster. Safety Sci 61(2014):43–50

McGee TK, Russell S (2003) "It's just a natural way of life. . ." an investigation of wildfire preparedness in rural Australia. Glob Environ Change B Environ Hazards 5(1):1–12

Millennium Ecosystem Assessment (MEA) (2005) Ecosystems and human well-being. Island Press, Washington, DC

Moser SC, Ekstrom JA (2010) A framework to diagnose barriers to climate change adaptation. Proc Natl Acad Sci 107(51):22026–22031

NSW Government (2015) https://www.emergency.nsw.gov.au/publications/guides-factsheets-bro chures/emergency-management-arrangements/key-elements-of-em.html. Accessed 2 June 2015

Office of Environment and Heritage (OEH) (2015) http://climatechange.environment.nsw.gov.au/. Accessed 28 May 2015

Padowski JC, Gorelick SM (2014) Global analysis of urban surface water supply vulnerability. Environ Res Lett 9(10):1–6

Paton D, McClure J (2013) Preparing for disaster: building household and community capacity. Charles C. Thomas, Springfield

Paton D, Kelly G, Bürgelt P, Doherty M (2006) Preparing for bushfires: understanding intentions. Disaster Prev Manage Int J 15(4):566–575

Pilgrim SE, Cullen LC, Smith DJ, Pretty J (2008) Ecological knowledge is lost in wealthier communities and countries. Environ Sci Tech 42(4):1004–1009

Pretty JN (2002) Agriculture: reconnecting people, land, and nature. Routledge, NY

Pretty J (2003) Social capital and the collective management of resources. Science 302(5652): 1912–1914

Reid K, Beilin R (2014) Where's the Fire? Co-constructing bushfire in the everyday landscape. Soc Nat Resour 27(2):140–154

Richardson K, Steffen W, Liverman D (eds) (2013) Climate change: global risks, challenges and decisions. Cambridge University Press, Cambridge

Sandelowski M, Voils C, Barroso J (2007) Comparability work and the management of differences in synthesis studies. Soc Sci Med 64(1):236–247

Scolobig A, De Marchi B, Borga M (2012) The missing link between flood risk awareness and preparedness: findings from case studies in an Alpine region. Nat Hazards 63(2):499–520

Stevenson M, Lee H (2001) Indicators of sustainability as a tool in agricultural development: partitioning scientific and participatory processes. Int J Sustain Dev World Ecol 8(1):57–65

van der Linden S (2015) The social-psychological determinants of climate change risk perceptions: towards a comprehensive model. J Environ Psychol 41(2015):112–124

Wachinger G, Renn O, Begg C, Kuhlicke C (2013) The risk perception paradox—implications for governance and communication of natural hazards. Risk Anal 33(6):1049–1065

Weber EU (2010) What shapes perceptions of climate change? Wiley Interdiscip Rev Clim Change 1(3):332–342