

# **Strategic Emergency Management in Australia and New Zealand**

*Discussion Paper on the implications of  
research and future challenges*

June 2013



**bushfire** CRC

## CONTENTS

Executive Summary.....	4
Who is this paper for?.....	10
INTRODUCTION.....	10
Part I – Contexts.....	11
Drivers of change within the sector .....	11
Increasing intensity and frequency of disasters.....	11
Trade-offs in risk management .....	12
Increasing costs of disaster .....	12
Impact on profiles of land use .....	13
National and international policy drivers.....	13
Disaster Risk Reduction .....	13
Inquiries and Reviews.....	14
Part II – Scoping the emergency management sector.....	16
What constitutes a disaster?.....	16
What is emergency management? .....	16
What is <i>strategic</i> emergency management? .....	17
Defining Roles and Responsibilities.....	17
Comparison of local incident level with strategic emergency level.....	18
Research conducted.....	20
Part III – Challenges for the future .....	28
Increased uncertainty, complexity and convergence .....	28
Disaster Risk Reduction and policy disconnects .....	34
Expectations and community ‘resilience’ .....	38
Social media, networking and emergence.....	41
The political-operational nexus.....	42
Evaluating emergency management response effectiveness .....	43
Capability development .....	46
Conclusion.....	51

**Authors:**

Dr Christine Owen

Dr Karyn Bosomworth

Dr Chris Bearman

Dr Ben Brooks

Copyright 2013 Bushfire CRC

## EXECUTIVE SUMMARY

The research conducted as part of the *Organising for Effective Emergency Management* project has been discussed with senior emergency management leaders to identify and discuss industry implications. Through this process seven challenges facing senior emergency management leaders have been identified. The purpose of this paper is to outline the challenges discussed and to raise questions for supporting strategic levels of emergency management in the future.

Increases in the frequency, duration and magnitude of emergency events have placed significant challenges on the emergency services sector. Emergency events that are unprecedented in intensity and geographic spread and have significant impacts on communities are called “out of scale events”. In such events there are a range of emergency management activities performed by people working at operational, tactical and strategic levels. At an *operational level*, first responders are working directly on the front line of the fire or incident ground. At a *tactical level*, local incident management teams work at supporting front line responders in containing and mitigating the event and in enabling communities to make good decisions. At a *strategic level* (which may be regional state or national) there is a focus on two elements: oversight of incident management operations and consequence management for longer term recovery.

Emergency managers operating at strategic (regional, state, national) levels face an increasingly complex set of future challenges that must be addressed. Strategic level emergency management is engaged in high-consequence, non-routine and out-of-scale emergency events. At this level there is high political engagement; longer term concerns for direct and indirect consequences on economical and societal well-being. The emphasis at a strategic emergency management level is on: (i) oversight of incident management operations and (ii) consequence management.

Influencing these challenges are drivers such as climate change as well as other social, political and economic factors. The first five challenges discussed pertain to the contextual drivers influencing the emergency management sector and the last two are enablers internal to the sector. The challenges are:

### **1. Increased uncertainty, complexity and convergence**

Challenges facing strategic emergency managers are likely to be more complex in the future due to the likelihood of increased frequency, intensity and duration of emergency events. They happen to increasingly urbanised communities with greater reliance on critical infrastructure.

There is increasing pressure to provide seamless lateral and hierarchical delivery of services and real-time information to an increasing variety of stakeholders. The implications for strategic emergency management are that these changes increase interdependencies in decision-making within and between teams. These increased

pressures on team decision-making will also be exacerbated by the necessary increases in team size as more stakeholders are engaged.

- What key issues need to be addressed for unprecedented events to be well-managed? And why are they key?
- What changes or steps need to be taken to move us towards being able to better manage out-of-scale events? Right now? In the medium to longer term?

## **2. Disaster Risk Reduction and policy disconnects**

The research found that there is a concern in the industry about the disconnects between policy and funding support to mitigate potential threats through disaster risk reduction strategies. Failure to address these disconnects makes emergency management response all the more difficult.

- What steps need to be taken to better connect Disaster Risk Reduction principles and strategic emergency management? Why are these steps important?
- What changes are needed to increase the effectiveness of current arrangements at local/State/National levels in emergency management response and recovery for unprecedented events?

There are also challenges between national, state and local levels of government and a need for better integration and coordination across a range of jurisdictions. This requires a longer-term strategic perspective and an engagement with jurisdictions that are not traditionally part of the process of traditional emergency management response. Closer ties are needed between jurisdictions with emergency responsibilities (e.g., fire and police).

- How might the National level be engaged to better support emergency management response in out-of-scale events?

The implications for strategic emergency management teams are that they need to be engaged in a broader and longer term view of disaster planning. There will need to be better ways of conceptualising and managing unanticipated and emerging problems. There is a need for longer term strategic perspectives and greater attention and engagement with Disaster Risk Reduction policies and approaches, including resilience building.

Policy fragmentation undermines the potential for integrated and coordinated approaches to planning, preparedness, response and recovery across jurisdictions in strategic emergency management. Even more so when considering the longer-term and strategic perspective of Disaster Risk Reduction that also requires engagement with agencies not traditionally included in emergency management

## **3. Expectations and 'resilience' of communities**

The research found perceptions that community and elected representative expectations were increasingly unrealistic and that while the policy rhetoric included exhortations to enhance community resilience the reality was that resilience in some communities had

actually declined. This results in greater expectations on emergency services in times of need with the anticipation of individualised or personalised attention. This is consistent with a prevailing attitude that societal life should not be disrupted and somehow living within our existing landscape and environment is risk-free. Strategic emergency management teams need to coordinate with political officials to ensure the messages to communities are clear about expectations and at the same time to make nuanced judgements about the various information sources flowing to and from community members via social media. It is also important to engage multiple stakeholders in discussion about what are realistic expectations given current financial constraints. There is a need to also confront perceptions of what is acceptable and unacceptable risk.

- How can emergency management leaders contribute to enhancing community resilience, including a capacity to live with and in hazard-prone environments?
- What are the contributors to lack of community preparedness?

#### **4. Social media, networking, and emergence**

Social media has become increasingly important in recent disaster events. With these changes come challenges in how strategic emergency management must live with the tensions of potential information distortion and self-organised emergence on the part of community members in sharing information outside the official emergency management channels. The value of social media and the engagement of social media sources within emergency management remains a controversial and contested space for senior emergency management leaders. The implications for strategic emergency management teams are that information from diverse sources and variable quality now needs to be taken into consideration. Thus, two questions emerge:

- What steps need to be taken to enable emergency management to provide an authoritative account of an event and at the same time live with the tensions of information sharing outside of its apparent “control”?
- What are the opportunities and constraints for emergency services in engaging community social media participation as part of operational response? How might this be addressed?

#### **5. The political-operational nexus**

Political representatives have a key role to play in emergency events particularly in their relationship to government administration and decision-making. Yet, the roles and relationships between political and operational ends of an emergency management response can be challenging at a strategic emergency management level. The implications for strategic emergency management include the need for greater engagement of the polity before, during and after emergency events to ensure seamless government and political decision-making.

- During out-of-scale events, what should political leaders do to meet community needs? What changes are required to make this happen?
- What is needed for effective operational-political partnerships in decision making during out-of-scale emergency events?

## **6. Evaluating emergency management response effectiveness**

Developing criteria to evaluate the outcomes of how emergency events are managed is in need of attention. Strategic emergency management teams need ways of gaining real-time operational feedback on progress in order to monitor workload conditions for contingency planning. The opportunity to develop process and outcome measures appropriate to the industry can assist personnel and external stakeholders to better recognise the challenges and provide such personnel with some protection from post-hoc adversarial inquiries. Two questions for discussion include:

- How would we know that major/out-of-scale events had been well-managed
- What can and should be done to be able to identify effective emergency management performance from the perspective of (a) community; (b) government; and (c) other stakeholders?

## **7. Development and Capability**

There are challenges in managing within the current emergency services environment that can be considered as chaotic and constantly changing. The implications for strategic emergency management include a need to identify strategies to enhance the sector's capacity for reflection and learning, and to overcome the tendency for reactive acting within narrow frames of problem solving. In this respect there is a need to change occupational identity beyond reactive "command and control".

These demands set up new challenges for leadership and the development of capability. The implications for strategic emergency management are that there is a need to develop the skills and capacity for personnel working in strategic emergency management teams. They need capacity building in efficient strategies to share, refute and calibrate distributed situation awareness to build shared mental models; to recognise the migration towards degraded conditions within their own teams and in the teams they are monitoring; and to develop the capacity to collectively recover from degraded situations that may have led to breakdowns in coordination. In addition, there are implications for strategic emergency management leadership development. From these challenges, two more questions emerge:

- At a strategic emergency management level, what new capabilities are needed for out-of-scale emergency events
- What steps need to be taken to facilitate and share learning across the sector

The discussion paper will be used to continue consultation with key stakeholders on the research utilisation options that can be proposed to build a resilient emergency services sector to manage these future challenges.



*“The area of local incident management is well defined and supported by the AIIMS framework. However, the strategic emergency management domain is less well understood. It is imperative that we fully appreciate and develop the strategic emergency management capability in order to face the challenges of the future.”*

Commissioner Lee Johnson, President Australasian Fire and Emergencies Services Authorities Council (AFAC conference 2012)

## WHO IS THIS PAPER FOR?

This discussion paper is aimed at decision-makers, policy-developers and stakeholders who need to ensure that the emergency management sector is able to meet future demands, including working with communities to better prepare for, manage and recover well from emergency events.

## INTRODUCTION

Senior fire and emergency management personnel face far more complex challenges than did their predecessors and these challenges are going to increase in the future (Murphy & Dunn 2012). To help the sector deal with these challenges, the Bushfire CRC has funded research entitled *Organising for Effective Emergency Management*, which has explored issues and challenges facing personnel at the strategic emergency management level.

Based on an analysis of current literature as well as empirical research conducted using observations, interviews and secondary sources databases, this discussion paper provides a synthesis of the key challenges facing senior leaders in the Australian and New Zealand Emergency Management sector, contextualising those challenges in terms of key internal and external drivers of change. Following further consultation with the industry, a strategic options paper for managing these challenges in the future will be put forward for industry consideration.

This discussion paper:

- outlines the external and internal drivers for change in emergency management
- situates strategic emergency and local incident management within the context of Disaster Risk Reduction, including resilience building
- discusses ten key issues that have emerged from the research and their implications for the future of strategic emergency management
- poses questions for industry consideration and outlines the next steps in developing a strategic options paper for addressing future strategic emergency management

## PART I – CONTEXTS

### Drivers of change within the sector

Challenges and drivers of change facing senior emergency managers come from a variety of external and internal factors. External drivers come from social, economic, environmental, political factors as well as policy responses to issues such as climate change mitigation and adaptation. Internal drivers for change in emergency management come from post disaster inquiries, internal reviews and industry supported research and analyses. These analyses identify previous failures, strengths and opportunities for improving the sector's capacity to achieve its legislative, policy and practical goals. However, if the drivers of and for change are not strategically addressed, they will interact to create consequences that will compound and increase the complexities senior emergency managers already confront.

#### *Increasing intensity and frequency of disasters*

Like most of the planet, both Australia and New Zealand have seen increases in the frequency, duration and magnitude of emergency events (COAG, 2011; CSIRO & BoM 2010; Yates & Bergin 2009). The summer of 2010-2011 saw every State and Territory in Australia, except the Australian Capital Territory, impacted by emergency events unprecedented in intensity and geographic spread. These occurred within two years of other unprecedented events (see Box 1). Such 'out-of-scale' events (Murphy & Dunn 2012) might be considered 'the new normal', in that they are not outlier aberrations or exceptions to the norm but rather indications of what might be expected on a more regular basis. Examples of recent globally occurring 'out-of-scale' events are outlined in Box 2.

#### Box 1

##### Examples of major natural hazard events in Australia and NZ from the past 10 years

**January 2009 heatwave** – the country's hottest month on record (BoM 2013), & linked to 374 deaths in Vic (DHS 2009)

**February 2009 bushfires** in Victoria resulted in 173 deaths and displacement of thousands

**Tropical Cyclone Yasi** February 2011, one of the most powerful cyclones to affect Queensland left behind significant damage, with a disaster situation declared for a number of coastal and adjacent local government areas

**Christchurch earthquake** February 2011 (itself one of 7,000 aftershocks to the September 2010 quake) caused major damage to half of the city centre's buildings, leaving many beyond repair (Brookings Institute 2012)

**2010-2011 Floods in Queensland and Victoria** – frequent rain led to Australia's wettest two-year period on record (BoM 2012). The Qld floods were some of the most significant on record ([BoM 2010](#)). In terms of extent, impact and severity, the flooding along Australia's east coast was amongst the most significant in the country's recorded history ([BoM 2011](#)).

## *Trade-offs in risk management*

Yet senior leaders of emergency services organisations frequently find themselves at the end of a decision-making chain that leaves them dealing with the consequences of increasing hazard events. This situation is because in parts of Australia it has become increasingly common to trade-off risks from natural hazards, such as floods and fire, and other policy drivers such as development, against an increased emergency management capacity (Handmer et al. 2012). For example, areas of risk associated with locating residential development can be managed on the assumption that improved warnings and emergency response will adequately manage the increased risk (Handmer 2008; Molino 2007). While varying attempts to reduce the extent of climate change through emissions reductions continue, much work in preventing a continuation of disasters lies in the planning and building sectors, rather than with agencies responsible for responding to and recovering from emergencies (Handmer et al. 2012).

To strategically position the emergency management sector, there is an imperative to consider such longer-term strategic issues and to contextualise emergency management response within broader goals of governance, disaster risk reduction and sustainable development.

## *Increasing costs of disaster*

Alongside the above drivers of change, the costs of natural hazard disasters are increasing. For example, although the number of disasters that occurred in 2011 was below average, it was the most expensive year in history in terms of disaster losses — primarily because of the \$210 billion loss experienced by Japan (Brookings Institute 2012). From 1991-2005 around 60 per cent of costs due to disasters were incurred in OECD countries, most likely due to its higher asset base (Brookings Institute 2012).

Declaring one type of natural hazard more destructive than another can be somewhat misleading, as it depends on whether the impact is measured from lives lost, numbers of people affected, cost to the state, environmental degradation and repair. In Australia's natural hazard typology, droughts, floods, storms and bushfires feature repeatedly. According to the USA Centre for Research on the Epidemiology of Disasters (CRED), it is only since the mid-90s that extreme heat events have featured in the 'top ten'<sup>1</sup>.

---

<sup>1</sup> <http://www.emdat.be/result-country-profile> (The International Disaster Database)

### **Box 2**

#### **Examples of global 'out-of-scale' events**

**Hurricanes in USA** each year, particularly the ones that cause damage (Katrina 2006; Sandy 2012)

The **earthquake in Haiti** (2010)

The **Asian Tsunami** (2004)

The **Japanese earthquake** and subsequent tsunami and nuclear power plant melt down (2011)

The massive **floods in India and Pakistan**

According to COAG (2004), Australia typically encountered approximately eight disasters each year between 1967 and 1999, where the total cost per event was greater than \$10 million. However, since 1980, the average number of disasters of that magnitude has been increasing. While floods, droughts, cyclones and bushfires have always been a part of the Australian environment, climate change is likely to increase the intensities and frequencies of these sorts of events (IPCC 2001, 2007a, 2007b, 2007c, 2011 2012; QFCI 2012, 2011; GWA 2011; VBRC 2010; Beer 1988 , 1995; Cary 2002, 2004; COAG 2004; Steffen 2009).

### *Impact on profiles of land use*

There is also a growing body of work indicating that climate change will compound factors already contributing to vulnerabilities to natural hazards. It is interesting to note, that only six per cent of the Australian landmass is [currently] arable, and that land clearing, water extraction and poor soil conservation are all causes of a [current] decline in the quality of Australia's soils (DFAT 2008). Climate change has the capacity to exacerbate these biophysical factors, which in turn have implications for our communities and land use patterns (e.g., types of agriculture or forestry). All of this will influence the 'profiles' of rural areas, including who and what and is 'at risk', and who may be available and capable of volunteering.

### *National and international policy drivers*

Policy drivers can be internal to emergency services organisations and the industry that drive change; they can come from research as well as national and international post-event inquiries that examine the management of past events. They also come from key policy agendas, such as those developed by ISDR (Hyogo Framework for Action) and COAG (National Strategy for Disaster Resilience).

### *Disaster Risk Reduction*

At the international level, managing and reducing the risks of natural hazard disasters comes under the rubric of **Disaster Risk Reduction**.

Theoretically, Disaster Risk Reduction focuses on the underlying or root causes of hazards and vulnerabilities to them, with an overall focus on development and capacity-building (Wisner, Blaike, Cannon & Davis 2004). The majority of 'underlying drivers of risk' are social and political factors, such as economic policies, land use planning, lifestyle choices, and factors influencing socio-economics.

*Disaster Risk Reduction is "the conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development..... [It] is concerned with building the resilience of communities to be able minimise the effects of disasters that might happen in the future".*

International Strategy for Disaster Reduction (ISDR)'s Hyogo Framework for Action (HFA 2009).

**Disaster Risk Reduction focuses on these underlying drivers of vulnerabilities that turn a hazard into an emergency and an emergency into a disaster.** Disaster Risk Reduction therefore, is a longer-term process than emergency management and more complex in terms of managing multiple interdependencies and trade-offs. Disaster Risk Reduction recognises that the character and severity of impacts from hazards and emergencies depend more upon the vulnerabilities (exposure, sensitivities and adaptive capacities) of our social, economic, and environmental systems to those impacts, than the nature of the hazard or emergency alone.

In February 2011, the Council of Australian Governments (COAG), a peak intergovernmental forum, adopted the National Strategy for Disaster Resilience. This strategy seeks to link emergency management preparedness, planning, response and recovery to a broader agenda of Disaster Risk Reduction and resilience.

### *Inquiries and Reviews*

Inquiries and reviews can be a source of major revision within the emergency management sector. Alternatively they can reinforce existing ideological positions or assumptions and inhibit learning. According to one of the expert opinions (Boin & Hart 2010) provided to the Victorian Bushfire Royal Commission (Teague, McLeod & Pascoe 2010), impediments within existing emergency management arrangements that needed to be overcome included (in part):

- obsession on the part of the emergency responders to obtain full and accurate information before engaging in action or providing advice to affected communities
- total reliance on command and control, rather than recognition of the variety of relationships involved including those who do not fit within a 'command and control' paradigm
- underestimating post-emergency crises

A range of other studies have found existing emergency management models to suffer from the following organisational and inter-agency problems, particularly when the event is complex and there are multiple stakeholders involved in its management (e.g., Comfort 2005; Comfort & Kapucu 2006; Peek & Sutton 2003):

- lack of suitable communications infrastructure, including a lack of compatibility between data systems and communications technologies
- communication difficulties between coordination centres and the incident ground
- poor integration of different agencies 'response' plans
- poor and varied levels of situational awareness (including projections) among emergency management partner organisations
- lack of timeliness and accuracy in information dissemination

Moreover, the increase in litigiousness has a negative impact on preparedness, as well as to reactions to loss and influences Government's perceptions of risk. In addition, inquiries conducted in law are problematic because of tacit assumptions and expectations made about emergency management and that emergency management is not properly defined in law (Eburn & Dovers 2012).

## PART II – SCOPING THE EMERGENCY MANAGEMENT SECTOR

### What constitutes a disaster?

From an operational perspective, disasters occur when agencies, the services they provide and the communities they work with become overwhelmed (Turner 1976). At a strategic emergency management level, this operational ‘disaster’ manifests in an inability to assess scale, magnitude and consequences in an integrated way. From a community-based perspective, according to the United Nations Office for Disaster Risk Reduction (UNISDR<sup>2</sup>), a disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.

The UNISDR goes on to note that disasters are often described as a result of the combination of: the exposure to a hazard; the conditions of vulnerability that are present; and insufficient capacity or measures to reduce or cope with the potential negative consequences. Disaster impacts may include loss of life, injury, disease and other negative effects on human physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation.

### What is emergency management?

An emergency is a situation or event, actual or imminent, which endangers or threatens to endanger life, health, property or the environment, and which requires a significant and coordinated response (EMA 2011; UNISDR 2009). Emergency management is a key component of disaster risk reduction.

The UNISDR (2009) defined **Emergency Management** as involving “plans and institutional arrangements to engage and guide the efforts of government, non-government, voluntary and private agencies in comprehensive and coordinated ways to respond to the entire spectrum of emergency needs” (p. 13). In Australia, emergency management is defined in terms of the organisation and management of resources for dealing with prevention, preparedness, response and recovery (PPRR). EMA (1998) suggested that it involves plans, structures and arrangements established to bring together the normal endeavours of government, voluntary and private agencies in a comprehensive and coordinated way to deal with the whole spectrum of emergency needs including prevention, response and recovery. Successful emergency management arguably therefore, requires the co-operation and coordination of a diverse range of organisations.

---

<sup>2</sup> <http://www.unisdr.org/we/inform/terminology#letter-d>



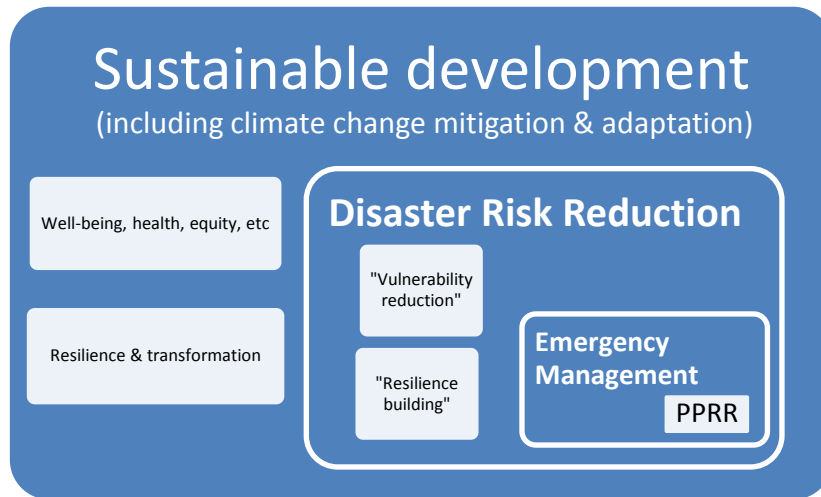


FIGURE 1: SITUATING EMERGENCY MANAGEMENT WITHIN BROADER POLICY AGENDAS

## What is *strategic* emergency management?

When major emergency events occur, multiple activities need to be coordinated at all levels of government in order to support communities affected. These activities have typically been divided into different levels – operational, tactical and strategic – where different types of demands and decisions are bounded, in part, by different timescales (ISO 22320, 2011).

*Incident Management is “the process of controlling the incident and coordinating resources”.*

AFAC, EMA

### *Defining Roles and Responsibilities*

Table 1 illustrates the **different roles and responsibilities** of first responders, managers responsible for developing the incident tactics on the incident ground and strategic emergency management. First responders are working directly on the fire or incident ground in emergency *operations*. Personnel working in an incident management team develop and procure resources to manage and support the *tactics* needed to respond to the incident at an *operational* level. For example as well as determining how to resolve the incident the IMT captures and shares intelligence on the impact and potential of the incident. Above the local incident management level are those personnel engaged in evaluating the broader tactical implications of the event. Within Australian and New Zealand jurisdictions, *strategic* emergency management occurs at state levels in Australia and at a national level in New Zealand. Strategic level activities address the elements identified in Table 2.



**TABLE 1: LEVELS OF COORDINATION IN EMERGENCY EVENTS**

<i>Layers of emergency management in response</i>	<i>Description</i>	<i>Australia/New Zealand application</i>
<b>Operational</b>	First responders; front line personnel working directly on the fire or incident ground	First responders; incident ground personnel
<b>Tactical</b>	Local level incident management work is directed at containing and mitigating the event.	Local IMT
<b>Strategic</b>	Activity occurring above the local operational and tactical levels is concerned with monitoring overall incident operations as well as for addressing the direct and indirect issues across the whole-of government and community	Regional/State National (NZ)

### *Comparison of local incident level with strategic emergency level*

Table 2 highlights the differences in focus and responsibility when working at a **local incident management level** compared to a more **strategic emergency management level**.

**TABLE 2: FEATURES OF LOCAL INCIDENT AND STRATEGIC EMERGENCY MANAGEMENT**

<b>ASPECTS</b>	<b>Local incident management</b>	<b>Strategic emergency management</b>
<b>Event complexity</b>	Usual operating mode is appropriate to address most situations	High impact, non-routine, multiple events direct and indirect consequences; emphasis on moving from response to recovery
<b>Location</b>	Locally defined	Broader context
<b>Time span</b>	Immediate, reactive  Several hours- days	Longer duration, proactive, forward thinking (consequence management of indirect effects)  Days to months
<b>Resourcing and prioritising</b>	End of shift handovers, upwards requests for more resources	Prioritisation of resourcing across events. Anticipation of resource exhaustion. Inter-state and international deployment requests
<b>Information flows</b>	Structured command and control policies	Emphasis on state-level and political aggregation.
<b>System Oversight</b>	Safety monitoring and assurance through structures (e.g., safety officer roles and responsibilities)	Reliability assurance. Focus is to monitor and evaluate not micro-manage
<b>Inter-agency liaison</b>	Minimum to moderate	Significant- engagement with whole of government

**Local level incident Management** is a core component of Emergency Management. Both AFAC and EMA define Incident Management as “the process of controlling the incident and coordinating resources”. Within the Australasian Inter-service Incident Management System (AIIMS) framework there should be one (local) incident management team per incident. At a strategic level, where the incident is of potential consequence to be of state or national significance, there is a need to monitor local tactical incident management and operations in order to be attuned to changes that may escalate routine events into large out-of-scale events. In addition, there may be multiple events that need to be monitored and managed (e.g., fire and flood or multiple fires). For personnel working at a strategic emergency management level, the focus on the time frames for managing the event will be different because at this level there is a need for longer term thinking about the indirect consequences of an event (e.g., loss of tourism for a regional economy) need to be considered.

Table 2 also highlights how the information needs at the local and strategic levels are different in both content and context. For example, the information pertinent to local incident management is not necessarily pertinent to political issues, and hence the strategic level. At a strategic level, there is a role in working with state-wide media and meeting the information demands of political leaders. Requests for information from political leaders and their staff need to be considered and addressed in time-frames that may compete with tactical or operational needs and it is up to the strategic level to manage these.

The focus of local incident and strategic emergency management is also different when considering issues of safety assurance. At a strategic management level it is important to evaluate the success or failure of local level tactics as well as potential future areas of weakness. There is also a greater emphasis on monitoring and assuring the overall reliability of the emergency management frameworks at this level. Such emphases require engagement across multiple jurisdictions and government departments. In contrast, at a local incident management level only those agencies and businesses directly affected are engaged. Finally, the various activities occurring at operational, tactical and strategic levels must be coordinated such that they support each other to cohesively meet the above-mentioned needs.



## Research conducted

The research team<sup>3</sup> have been engaged in conducting research<sup>4</sup> to address a range of research questions. The research questions, methods used and connection to the main challenges discussed in this section are identified in Table 3.

**TABLE 3: CONNECTION BETWEEN RESEARCH AND CHALLENGES DISCUSSED**

Research question	Methods used	Main challenges
1. How is emergency management coordination above the IMT organised?	Interviews, observations, organisational surveys	<ul style="list-style-type: none"> <li>• The political-operational nexus</li> <li>• Disaster Risk Reduction and policy disconnects</li> <li>• Social media, networking, and emergence</li> <li>• Evaluating emergency management response effectiveness</li> </ul>
2. How does information flow to and from regional and state levels of emergency management influence the capacity of personnel to adjust to emerging conditions?	Secondary sources analysis, interviews, simulation evaluation	<ul style="list-style-type: none"> <li>• Disaster Risk Reduction and policy disconnects</li> <li>• The political- operational nexus</li> <li>• Social media, networking, and emergence</li> <li>• Expectations and 'resilience' of communities</li> </ul>
3. How has a lack of shared mental models by key personnel in emergency incident management led to breakdowns in coordination in previous incidents?	Secondary sources analysis, interviews	<ul style="list-style-type: none"> <li>• Increased uncertainty, complexity and convergence</li> <li>• Evaluating emergency management response effectiveness</li> <li>• Development and Capability</li> </ul>
4. How might we best train and educate personnel in the most effective emergency management coordination above the IMT?	Training evaluation, interviews, observations	<ul style="list-style-type: none"> <li>• Increased uncertainty, complexity and convergence</li> <li>• Evaluating emergency management response effectiveness</li> <li>• Development and Capability</li> </ul>
5. What challenges need to be managed in the future?	Interviews, observations, surveys	<ul style="list-style-type: none"> <li>• Increased uncertainty, complexity and convergence</li> <li>• Expectations and 'resilience' of communities</li> <li>• Evaluating emergency management response effectiveness</li> </ul>

<sup>3</sup> Dr Christine Owen, Dr Chris Bearman, Dr Ben Brooks, Dr Roshan Bhandari, Prof Douglas Paton and PhD students Steve Curnin, Jafar Hamra and Alireza Abbasi

<sup>4</sup> For more details of the various research methodologies used and the research outputs, please go to <http://www.bushfirecrc.com/projects/8-1/effective-incident-management-organising>

		<ul style="list-style-type: none"> <li>Disaster Risk Reduction and policy disconnects</li> </ul>
6. What changes are needed to support the regional and state levels of emergency management coordination?	Synthesis	<ul style="list-style-type: none"> <li>Consultations and workshops considering the above</li> </ul>

A brief synopsis of the research findings and how they relate to the challenges follows.

### **1. How is emergency management coordination above the IMT organised?**

Interviews, observations and surveys were used to address this research question. The roles performed at regional and state levels to support information flow throughout the incident control system and to support overall adaptation can be grouped around 5 core activities important in complex collective problem solving work (after Rasmussen, 1978).

#### ***Problem detection and situation assessment***

- Activities associated with problem detection included the sub-themes of situation assessment and risk assessment.
- The challenges for information flow between emergency management layers include establishing effective communication and accountability flows between the various layers so that there was clarity around resource allocation and communication infrastructures. This was particularly important for those in urban fire services and for personnel operating at a regional level.
- Gaining sufficient information for a full assessment of the situation was made difficult by multiple and escalating individual incidents and the need to consider multiple stakeholder needs.

#### ***Task execution and resource management***

- The second theme identified included activities associated with supporting the execution of tasks, which involved considerable resource management.
- Two sub-themes identified included managing competing priorities and managing resources. In large events, interstate and international deployments are needed and different policies and procedures need to be negotiated.
- Challenges for information flow within emergency management layers relate to the need for clarity and transparency on resource tasking, closing request/action loops and managing with insufficient resources. Prioritisation of resource requests is also a challenge.

#### ***Prediction and planning for future states***

- The third theme involved activities associated with anticipation and prediction and included three sub-themes: gaining and maintaining situation awareness; determining likely future impacts and developing strategic plans.

- Challenges to information flow between emergency management layers included incomplete and inconsistent information as well as the ability to access related information for consequence management (e.g., location sites for future evacuations) and managing goal and priority conflicts.
- Information systems implications include the need for feed-forward modelling and networked distribution points for information flow between related stakeholders.

### *Sense-giving, sense-making and the development of strategy*

- The fourth theme related to activities associated with sense-making and the development of broader emergency management strategy.
- Challenges faced at state and regional levels included managing competing government and political interests as well as ensuring consistent messaging to affected communities. Providing meaning (sense-giving) to different stakeholder groups was of particular concern.

### *Evaluation and quality assurance*

- The final theme was focussed on evaluation and assuring the quality of the incident management processes in place. Activities associated with monitoring the safety health of the incident management system were discussed.
- The challenges for information flow between layers in the emergency management framework include overcoming incomplete information and the withholding of information by different stakeholder groups.

For more information please see the following reports on the Bushfire CRC website: (Owen 2011; Bhandari, Owen, Curnin & Brooks 2012; Bhandari & Curnin 2012; Curnin & Owen 2013)

## ***2. How does information flow to and from regional and state levels of emergency management influence the capacity of personnel to adjust to emerging conditions?***

The findings are based on an analysis of various commissions of inquiry reports applying the Human Factors Accident and Classification System (HFACS) to interrogate three secondary sources of information about the Wangary, Canberra Fire Storm and Black Saturday fires. These initial findings were then triangulated with the insights gained from the interviews and surveys. Key findings included the following:

- During coordination events decisions will regularly be made under a good deal of uncertainty, however the secondary sources indicate that when poor decisions were made this coincided with limited discussions about the level of uncertainty.

- There are competing trade-offs and demands from a variety of stakeholders that involve political leaders and their staff as well as relationships with other government departments, businesses and members of affected communities.
- At a strategic level it is clear that personnel in the Regional Control Centres frequently struggled to effectively supervise IMTs. These types of challenges were also evident at the State coordination level, reflecting the demands of both operational oversight and other stakeholders' needs in terms of consequence management.
- The system of coordination is regularly degraded during a major emergency event – either through lack of information on the incident itself or resources, or fatigue, those coordinating must work outside the boundaries of what might be considered the 'safe system'.
- The need to manage a degraded system and the sheer complexity of the coordination effort suggests that coordinators need to be able to apply simple, robust 'heuristics' (rules of thumb) to manage emergency events.
- Safety theory suggests that one way to approach this is by making boundaries between safe, nearly safe and unsafe systems visible. This is different to traditional approaches that place 'defences' along pre-planned paths.

For more information please see the following reports on the Bushfire CRC website: (Brooks 2011; Brooks, Owen, Bearman & Grunwald 2012; Bearman, Grunwald, Owen & Brooks 2012; Bearman & Grunwald 2011; Brooks, Owen, Bearman & Grunwald 2011; Curnin 2013)

### ***3. How has a lack of shared mental models by key personnel in emergency incident management led to breakdowns in coordination in previous incidents?***

The research methods discussed above also were used to address this research question. The findings include the following:

- Incident management involves teams of people with different skills, roles and responsibilities coming together to make coordinated decisions about the best way to support the management of that incident.
- From time to time there will be breakdowns in the functioning of this team because of a lack of shared understanding of the situation, inconsistent plans or differences in opinion over how to execute that plan.
- A breakdown can be formally defined as a situation where there is a failure in coordination, cooperation or communication that leads to a temporary loss in the ability to function effectively (Bearman et al. 2010).

- At a more fine grained level individual instances of disagreement between participants are referred to as *disconnects*. A breakdown may therefore contain several disconnects between the individuals or teams.
- Disconnects can generally be classified as one of three types: operational, informational or evaluative (Bearman et al. 2010).
  - *Operational disconnects* occur when there is “either a difference between the actions of one party and actions expected by the other party or a mismatch in the plans that each party has about the physical operations of the response.” (Bearman et al. 2010, p.178).
  - *Informational disconnects* occur when there is “a difference in the information that each party possesses” (Bearman et al. 2010, p.179).
  - *Evaluative disconnects* occur when there is “a difference in the evaluation or appraisal of information that is available to both parties.” (Bearman et al. 2010, p.179).
- Considering breakdowns in terms of disconnects provides a detailed analysis that identifies recurring events that contribute to both the causes and consequences of breakdowns. The focus on disconnects also highlights the different components of the breakdown that must be resolved and the consequences of not resolving these components for effective teamwork.
- Such breakdowns can impair team functioning, leading to teams: not possessing important information, being unprepared for action, developing conflicting plans and not acting in a timely way.
- Research conducted suggests that breakdowns are wide-spread, occur at all levels of incident management and are often not resolved effectively.
- Some implications of these findings for regional/state involve the need to develop better ways of measuring performance and to further develop the capacity to provide oversight of IMT’s, particularly in the context of increased uncertainty, complexity of events and the way these converge to increase the demands on incident management delivery.

For more information please see the following reports on the Bushfire CRC website: (Owen & Brooks 2012; Owen, Brooks & Johnson 2012; Chapman & Bearman 2011; Brooks, Owen, Bearman & Grunwald 2011; Bearman & Grunwald 2012; Bearman, Grunwald, Owen & Brooks 2012).



#### ***4. How might we best train and educate personnel in the most effective emergency management coordination above the IMT?***

Analysis of existing training methods have been conducted and discussed in interviews with subject matter experts. A number of reports have been prepared that have investigated current approaches for training and simulation within emergency management coordination in Australia and New Zealand, considered literature associated with advances in safety management, training systems for high risk industries and emergency management competencies. Findings include the following:

- The peer-reviewed literature on training for safe and reliable systems in high risk environments indicates we should train to develop both Technical skills (e.g., knowledge of fire behaviour) and Non-Technical Skills (e.g., decision-making, maintaining situational awareness, leadership, communication) and that these categories of NTS are reasonably consistent across high risk environments.
- In other domains (especially forms of transportation) this has followed a typical path – from building a knowledge base of the way human error currently occurs and is managed, to establishing training materials that include two key components: (1) what are these categories and how can we deepen people’s knowledge of them (e.g. situational awareness); and (2) what tools can we give people to manage these issues effectively.
- In the Emergency Management domain, development of training pathways above the IMT are more ambiguous than the training pathways below or at the IMT.
- Simulations are complex training events, often developed with significant resources/time investment; however a review of recent simulations indicates that they tend to have a strong emphasis on technical skills and limited emphasis on issues like situational awareness, communication, leadership and decision-making.
- Further, the tools to systematically assess individual competence levels above the IMT within these training events are often lacking, making assessment difficult.
- Having said this, the ‘pathways’ still exist to some degree. There are clearly training opportunities that develop leadership capabilities, and the work of Owen and Omodei has been instrumental in increasing knowledge of NTS.
- Training has also evolved to recognise the need for contextual learning (as indicated by the complexity of simulations and the emergence of the staff ride as an effective learning opportunity).
- This all points to the need to link the improvements in contextual learning with more defined training pathways above the IMT. In the development of non-technical skills there needs to be an integration of knowledge and the tools people might use to apply that knowledge.

For more information please see the following reports on the Bushfire CRC website: (Chapman & Bearman 2011; Brooks & Owen 2012; Owen 2012; Owen & Brooks 2012; Owen, Brooks & Johnson 2012; Hamra, Hossain, Owen & Abbasi 2012; Paton & Brient 2012).

## **5. What challenges need to be managed in the future?**

Interviews (with 34 senior emergency management leaders) as well as two organisational surveys (n=200; n=103) contributed to addressing this question. Participants were asked to discuss the challenges they faced and to reflect on what they saw as the major challenges facing emergency management in the next 5-10 years in terms of critical industry needs that would require attention. The findings reported included:

- **Changes in complexity and duration of events.** The types of events agencies are were reported as becoming more complex particularly when they involve multiple events (including different types of events- simultaneous flood/fire).
- **Doing more with less.** Participants reported that their services were operating in a climate of budgetary constraint. While there was an expectation on the part of the personnel interviewed of what should be in a discussion about how to address some of these challenges in the future, there was also acknowledgement that significant funding from Governments would be unlikely. This has on flow impacts on resourcing discussed below.
- **Increasing community expectations** and a perception of a decline in community resilience. For participants interviewed a common theme related to increasing perceptions of expectations for both information as well as support from the public and what is perceived by emergency management personnel as a decline in community resilience to be able and ready to take care of themselves.
- **Political relationships.** Participants reported that in major events it is inevitable that there is political attention and engagement. They discussed their challenges in working with politicians and integrating operational and political decision-making s (e.g., promising to re build communities in fire prone or flood prone area; warning the public early).
- **The consequences of poor planning and preparedness.** Participants discussed the need to develop closer alignments between preparedness-for-response and response. In part this is about recognising the importance of State and Federal funding inequities and a need to provide funding for disaster mitigation. For some of those interviewed it was also about needing to build closer relationships with those agencies/authorities who do not see their core business as involving emergency events but who nevertheless get called upon in major events (e.g., Education; Local government). Participants discussed the importance of having strong structures/agreements in place before the event with those agencies likely to be engaged.

- **Closer linkages between emergency management response agencies.** Another common theme discussed the need to get better at emergency management liaison as well as to develop closer ties with the Police. These challenges in some sectors are exacerbated due to organisational and institutional change (e.g., local government outsourcing core parts of the business and relying on contractors for plant and operations).
- **Keeping up with change/lack of future thinking.** There is a real concern that agencies are not attending to changes in attitudes (which requires a change in response on the part of agencies - from one of “I’ve got the uniform” to power through influence, particularly when agencies are not in a position of control but are rather in a support role (implications for professional development of commanders). There are also other changes occurring (e.g. social media; technological change) that agencies are not yet able to capitalise on. There is also a sense that there is change fatigue and an increasing risk averse concern to managing future events including vulnerability to litigation. There is also a sense of keeping noses to the ground and not getting sufficient time to look further ahead rather than at what’s on the immediate horizon.
- **Loss of expertise.** There has been a massive exodus out of the industry based on people both getting older as well as not wanting to put themselves in a position of ending up in court. There is also a concern about the psychological scarring that is not yet healed based on previous overwhelming events.
- **Recruitment/resourcing.** The critical issue discussed here was that there were never enough resources to achieve sufficient ongoing Regional and State level operations, particularly in long duration events. In addition participants were concerned that the levels of experience are polarising - there are fewer people with considerable experience – who might not have been locally operationally current for more than 5 years and who had not had access to recent training; and an increasing group working at Regional and State levels with limited or no experience.

For more information please see the following reports on the Bushfire CRC website: (Owen 2011; Owen 2012; Bhandari, Owen, Curnin & Brooks 2012; Bhandari & Curnin 2012).

These research outputs have been reviewed and discussed with senior emergency management leaders including members of the AFAC AIIMS Steering Committee, which has also acted as a Reference Group. The final research question: *What changes are needed to support the regional and state levels of emergency management coordination?* is part of the consultation process to which this Discussion Paper is directed.

The following section draws heavily on the research outputs and issues emerging through the consultation process, out of which the following seven challenges for the future have been identified.

## PART III – CHALLENGES FOR THE FUTURE

The drivers of change and the research findings outlined above have important implications for the future of emergency management in Australia and New Zealand. These implications have been grouped into key challenges, drawn from the research and consultation processes to date, and are discussed in the context of:

1. Increased uncertainty, complexity and convergence
2. Disaster Risk Reduction and policy disconnects
3. Expectations and ‘resilience’ of communities
4. Social media, networking and emergence
5. The political-operational nexus
6. Evaluating emergency management effectiveness
7. Development and Capability

It is important to note that the presentation of these key challenges should **NOT** be interpreted as a hierarchy or an order of priority. However, there are relationships between them and where appropriate these will be discussed.

### Increased uncertainty, complexity and convergence

The report ‘Hardening Australia’ (Yates & Bergin 2009) noted that disasters are likely to become larger, more complex, occur simultaneously and in regions that have either not experienced the natural hazard previously or at the same intensity or frequency. A core challenge for the emergency management sector is that while the number and intensity of adverse events is increasing (that is, extreme weather events or complex technological/ infrastructure breakdowns) factors driving social and ecological vulnerabilities from those events are also increasing. For example, building development continues to be allowed in ‘high risk areas’ placing people at risk; ecosystems are changing (e.g., getting drier) and are thus capable of carrying more intense fire).

*The frequency and intensity of adverse events is increasing while factors driving social and ecological vulnerabilities to those events are also increasing.*

### Increased demand for services

Over the coming decades, a range of factors including demographic shifts, rural adjustment and broader business development will affect the structure and delivery of emergency management services. Moreover, demographic changes including changes in lifestyle expectations, domestic migration, and community fragmentation are also increasing community susceptibility, as well as altering local social networks and sustainability of volunteer groups (COAG, 2011).

For emergency service and disaster management organisations, this means increased demand for existing response services as well as a need to shift the kinds of services provided.

### **Increased vulnerabilities**

Drivers of these changes include climate change, as well as increased vulnerabilities exacerbated by socio-economic shifts, increasing centralisation of and dependence upon technology, and environmental degradation. Each factor has implications for future emergency management; but in combination, the implications become even more complex.

In terms of climate change, Bosomworth and Handmer (2008) argued that together with the danger of increased physical injury, climatic hazards (such as wildfire) can also increase exposure to disease pathogens and/or their vectors, exposure to airborne allergens and chemical residuals, and psychosocial and mental health outcomes associated with loss, disruption and displacement. Water shortages, smoke inhalation, burning injuries, loss of income, regional food shortages, and psychosocial responses are all potential health impacts of wildfire (Few, 2007. p. 282). Mental and physical health is also likely to influence the capacity of various communities to prepare, but particularly, to respond and recover.

### **Increasing urbanisation**

Like much of the world, Australia is an increasingly urbanised society. The State of Australian Cities 2012 report highlighted that in 2011, 77.3 per cent of the population lived in 18 cities with populations greater than 100,000 people up from 75.9 per cent in 2001 (DoT 2012). Increasing urbanisation of Australia society has the concomitant effect of reducing populations in rural areas. These shifts are likely compounded by government withdrawal of services, driven by globalisation and economic rationalist agendas, from areas with shrinking demand for those services (McKenzie, 1999). As a result of fewer people and possibly fewer relevant skills in rural areas, communities may have less capacity to cope with the passage of a disaster event, or to recover from it. In contrast those living in urban communities have less history of self-reliance because of their easy access to services and support. Arguably people living in urban communities have an increasing expectation of delivery of those services and are thus more vulnerable if those services are not able to be delivered.

#### **Climate change will exacerbate Australia's already highly variable climate.**

Australian average annual mean temperatures have increased by 0.9°C since 1910 (Hennessy et al. 2008). Most of this warming has occurred since 1950, with the greatest warming in central and eastern parts and the least warming in the far northwest.

This CSIRO-BoM report stated that the real extent and frequency of exceptionally hot years have been increasing rapidly over recent decades and that trend is expected to continue. Further, over the past 40 years (1968-2007), exceptionally hot years are typically occurring over 10-12% of the area in each region, (i.e.,) about twice the expected long-term average of 5%. By 2010-2040, the mean area is likely to increase to 60-80%, with a low scenario of 40-60% and a high scenario of 80-95%. On average, exceptionally high temperatures are likely to occur every one to two years (*ibid*).

In our increasingly urbanised coastal areas, rising sea-levels combined with increased storm and cyclone activity represents an increasing hazard for this 'coastal country'. At the same time, increasing numbers and intensities of heatwaves will stress major infrastructure, ecosystems and our increasingly urbanised society especially those less able to manage their thermo-regulation such as the elderly, the very ill and the very young. In Australia, heatwaves claim more human lives than any other natural hazard (Nicholls 2008), and multiply the impact of the urban heat island effect (Coutts et al. 2007 & 2010).

### *Resourcing/volunteers*

Obtaining resources for managing out-of-scale emergency events is going to be a challenge in the future in four respects:

- Workforce rationalisation and economic cutbacks have impacted on the government and agencies who have historically supplied such personnel
- Resources are part of an aging demographic and the negative impact of the adversarial nature of the post event inquiries have taken their toll on the motivation levels of current staff to put themselves into positions of decision making authority
- Organisational restructuring, downsizing and outsourcing has seen the supply of existing services and resources historically supplied from, for example, local government, no longer continuing to be available

In addition, demographic changes affecting communities also impact on the potential resource base within emergency services organisations. The sector relies heavily on volunteers and non-government organisations for prevention, preparedness, response, and recovery, and attempts to spread the risk across Australian society (Howard 2009).

There are about 500,000 volunteers in the sector, with approximately 350,000 involved in response and recovery activities. The full-time and volunteer resource base is already under significant stress. Recent research has concluded that many volunteers are struggling to balance full-time paid work and family responsibilities

with higher expectations of compliance and associated training, as well as emergency callouts (Evans and Saxton 2003; Institute for Volunteering Research 2004; McLennan & Birch 2005; Parkin 2008; Paul 2001; Reinholdt 2000; Woodward and Kallman 2001).

Moreover, agencies who employ paid staff to undertake emergency services work also face similar challenges. This is particularly the case in protracted, longer duration emergency events where fatigue is a challenge.

*We need to assess whether the current personnel resourcing mix is the most appropriate for a future changing climate.*

### *Increased likelihood of simultaneous events*

Strategic emergency management needs to consider how it is going to manage the increased likelihood of simultaneous events. Such occurrences may limit the capacity of

each jurisdiction to draw on resources from interstate or the wider region, although the sharing of significant resources across jurisdictions is still relatively recent and its limits have not yet been tested (Handmer et al. 2012).

Moreover, a better understanding is needed of how Australia would manage without international assistance, should available resources become depleted due to the increasing frequency and extended fire seasons occurring overseas. A corollary of this is the issue of how to best harness regional and international capacity to enhance domestic and regional capacity. For example, there is an increasing exchange of personnel and equipment between the hemispheres (especially between

Australia and the USA). It may be that the partial dependence on fire-fighting equipment in the northern off-season will become untenable as fire seasons lengthen and overlap.

*What are three key things that need to happen for unprecedented events to be well-managed? And why are they key?*

There is also a need to understand the potential for other impacts affecting our near neighbours to produce flow-on effects for Australia and New Zealand, in order to assess what impacts this may have on our countries. Published research on the strain likely to be placed on Australia's emergency management focuses on the implications for regional security and stability (Dupont et al. 2008 paper for the Garnaut Climate Change Review), rather than natural disasters *per se*. Some examples of the potential implications of climate change for regional security and stability include Barnett (2001), who identified accelerated sea-level rise as a particular problem for Pacific Island countries, and the 'Small islands' chapter of the IPCC's 2007 assessment report (Mimura et al. 2007, p. 689) states that "small islands, whether located in the tropics or higher latitudes, have characteristics which make them especially vulnerable to the effects of climate change, sea-level rise, and extreme events". Emergency services organisations are likely to be called upon to provide support in the region; there are also implications for regional security.

### *Increasingly connected systems*

Increasing interdependence places increasing pressure is placed on emergency management arrangements (e.g., increasing reliance on, for example, critical infrastructure). Yet these increasing interdependencies are occurring at a time of budgetary constraint and workforce rationalisation

within emergency services organisations. For example, there is an increasing call for seamless, delivery of services laterally (across different emergency management stakeholders) and hierarchically (within emergency management arrangements-local-regional-state). However, as discussed above, jurisdictions approach the required coordination mechanisms in different ways and this has implications for resource sharing.

*There is increasing pressure to provide seamless lateral and hierarchical delivery of services and real-time information.*

Part of the increasing complexity facing strategic emergency management comes from a range of interdependencies between social, technical and infrastructure systems that can also increase our vulnerabilities to hazards. One of the issues this interconnectedness raises, is when the impacts of a disaster in one location can affect many others because of our reliance on, for example, energy, transport or agriculture (Boin & 't Hart, 2010).

Additionally, because our society is increasingly inter-connected through infrastructure systems such as water and transport, and other key systems such as food production are increasingly centralised the impact of a hazard may have implications beyond its localised

impact. For example, during the Victorian fires of 2009, several of Victoria's water catchments and treatment plants were impacted. This required the provision of alternative drinking water supplies via water as well as 'boil water' alerts.

In another example, Brisbane's drinking water systems recently came close to running dry, "as minor flooding broke out from a swollen Brisbane River, because the city's main water treatment plant was knocked out by the volume of silt being washed down from catchments in the Lockyer Valley" (Walker & Owens 2013)<sup>5</sup>.

Structurally there are added layers of complexity as these key infrastructure assets are both privatised and fragmented in the delivery of services (e.g., regulators, distributors, suppliers). At a societal level, economic rationalism and globalisation expose communities and individuals to market fluctuations. Combined with loss of crops, livestock or other agricultural values as a result of changes in weather such as drought, is a phenomena referred to as 'double-exposure' (Schipper & Pelling, 2006). If such people must also face a natural hazard event, it may present a threshold beyond which they have little, if any, capacity for response or recovery (Bosomworth and Handmer 2008).

### *The role of and implications for infrastructure*

There is also a growing body of research highlighting that more extreme weather events will result in significant impacts upon critical infrastructure and communities. Exposure to



such events is increasing often because of development in 'high risk areas', alongside the implications of climate change.

Most infrastructure has been designed, built and maintained on the premise that the future

<http://www.theaustralian.com.au/in-depth/queensland-floods/drinking-water-threat-for-brisbane-as-city-escapes-major-flooding/story-fn7iwx3v-1226564241082><sup>5</sup>



climate will be similar to that experienced in the past (Victorian Government 2007).

Yet, as Philip and Taylor wrote in 2011, “climate change poses a significant risk to infrastructure and its owners, managers and operators (and, perhaps, users). Given the strong link and dependence on electricity in our society, interconnectivity of urban systems means that negative impacts on one system could influence the functioning of another. Negative impacts on transport infrastructure have been shown to generate one of the widest spread set of implications across the functioning of various urban systems (Jollands et al. 2007). Consequently, the Federal Government has identified infrastructure as one of the national priorities for adaptation action (COAG 2010a)”.

One of the consequences of increasing event duration and complexity has been an increased need to look for support from across state borders or even internationally. There have been some inroads into making this process easier.

The changes in governance arrangements and post 2009 attempts at clarification have also drawn attention to the need to build closer relationships with those agencies/authorities. The convergence needed with other stakeholders, such as the police services was another area in need of attention.

**More ‘out-of-scale’ events are going to place higher cognitive demands on strategic emergency management leaders and team members.**

**Demographic changes will mean younger and less experienced personnel will need to step up and manage emergency events sooner than was typical in career progression pathways of the past.**

**In addition to this there will be an increased number of stakeholders who need to be engaged and involved, resulting in larger teams and an increased interdependency on coordination between stakeholder teams.**

**These changes are likely to result in increased demands for information and a greater potential for breakdowns in coordination, particularly when coupled with the other pressures discussed below.**

## Disaster Risk Reduction and Policy disconnects

As described in Part I, Disaster Risk Reduction focuses on the underlying drivers of vulnerabilities. It is a longer-term (and more political) process than emergency management, and therefore more complex in terms of managing multiple interdependencies and trade-offs. Disaster Risk Reduction recognises that the character and severity of impacts from hazards and emergencies depend mostly upon the vulnerabilities (exposure, sensitivities and adaptive capacities) of our social, economic, and environmental systems to those impacts, rather than the nature of the hazard or emergency alone. Without focussing on the broader socio-political drivers of vulnerabilities to hazards, the emergency management sector will face increasingly difficult challenges.

*What steps need to be taken to better connect Disaster Risk Reduction principals and strategic emergency management? Why are these steps important?*

### *Uneven attention to disaster risk reduction*

The research (see for example Owen et al. 2012) has found a deep practitioner concern about the limited attention to Disaster Risk Reduction strategies, which if in place would ameliorate efforts required in response. According to some senior emergency management leaders the attention required to implement disaster risk reduction strategies was lagging and the senior emergency managers interviewed perceived they were then left to deal with the consequences when emergency events happened.

One of the most obvious drivers of our increasing vulnerabilities to hazards is development in so-called 'high risk' areas.

### *Increasingly vulnerable populations*

For example, (COAG, 2004) showed that “across Australia, populations and the built environment continue to develop in hazard-prone areas. Major urban development, particularly in coastal and river valley locations, has continued sometimes without reference to hazard assessments or consideration of appropriate mitigation measures. In this context we use the term ‘mitigation’ as the activities associated with managing and reducing the impacts of the potential for a disaster as well as reducing the negative impacts of a disaster. This has resulted in certain urban development and essential infrastructure being at risk of damage from natural hazards. In regional areas too, as a result of inadequate risk assessments and mitigation action, transport infrastructure, such as roads and rail links, is flooded each year, disrupting travel for local populations and tourists, the carriage of commodities for communities and business, and the supply of materials for industry.” Moreover, as was highlighted above, such issues become even more challenging when considering the implications of climate change for shifting, and increasing extreme weather events. The increasing exposure of populations to such events is a world-wide challenge.

The UNISDR's 2011 Global Assessment Report, highlighted that the world's population has increased by 87 per cent between the years 1970 and 2010 from 3.7 billion to 6.9 billion placing further pressures on arable lands, water catchments and infrastructure. In addition droughts and floods continued to put fragile ecosystems and developing countries at risk and make the communities who live within them increasingly vulnerable. In the same 40 period (i.e., between 1970 and 2010), the average numbers of people exposed to flooding every year increased by 114 per cent (from 32.5 to 69.4 million annually). Relatively speaking, ever more people are living in flood plains, suggesting that the economic advantages of living in such an environment must outweigh the perceived risks of flooding. However, weather-related mortality risk remains highly concentrated in countries with low GDP and weak governance."

*What strategies are needed to strengthen the implementation of Disaster Risk Reduction in order to reduce pressure on future emergency management response?*

Communities may be more exposed to severe weather events they have not hitherto experienced. It is critical that we learn from and overcome past cases of limited community preparedness. The potential for impacts from unfamiliar hazards on underprepared communities is a significant challenge facing disaster managers. Particularly considering that it is probable that a sizeable proportion of the public has not considered the implications of climate change for natural hazards (WMO 2007).

**Strategic emergency managers and their teams will need resilience and a capacity to change. There will need to be better and more flexible ways of sharing resources and a need for a longer term, strategic perspectives especially with respect to emerging challenges. There is a particular need for greater attention and engagement with Disaster Risk Reduction principles and approaches in order to ensure a more integrated approach to support both emergency management and community resilience.**

In this context, strategic emergency managers need to be engaged in a broader and longer term view of disaster planning and to work across governments to collaboratively facilitate build social and ecological resilience; particularly as this resilience has direct implications for emergency management. In addition, doing so would provide an opportunity to achieve a better integration across government portfolios.

From a political and policy context, the sector might give consideration to the implications of the Federal Government's ceasing to fund climate change adaptation research (cessation of National Climate Change Adaptation Research Facility - NCCARF), while at the same time committing to the establishment of a new CRC for Bushfire and Natural Hazards.

This situation might be interpreted as a shift in political focus and an increasing reliance upon 'emergency management' as our climate change adaptation strategy. Without explicit attention from the emergency management sector, this situation could represent a retrograde step that ignores decades of disaster risk reduction and more recent climate change adaptation research that stresses the need to deal with underlying drivers of vulnerabilities. Disaster risk reduction and adapting to climate change is more than an ability to map 'risks' and respond to incidents. Sole reliance upon the emergency management sector not only creates greater pressures upon the sector (including unrealistic expectations) it has great potential make us more vulnerable to the impacts of climate change not less.

From a governance and policy coordination perspective, Disaster Risk Reduction may provide a conceptual and practical framework through which Australia's Emergency Management sector might achieve its goals; especially if it can help to overcome systemic policy fragmentation.

### *Government policy disconnects*

Various Bushfire CRC research has found that the structures of governance within and between jurisdictions are underpinned by various state legislative arrangements empowering different agencies with their authority and responsibilities (Sullivan & Norman 2011; Eburn & Dovers 2012; McLennan & Handmer 2011; Bhandari et al. 2012). In our own research (Bhandari & Curnin 2012) we have noted the different legislative, policy and governance arrangements that underpin different strategies that are used at state level operations. This has implications by creating impediments for resource sharing at strategic levels.

This fragmentation has also led to the situation where each state has different jurisdictional and governance arrangements in place, setting up challenges for attempts to integrate emergency service arrangements across State borders. In out-of-scale events it is likely that multiple State jurisdictions are involved even if only in mutual aid arrangements. While on-the-ground mutual aid works reasonably well, the different arrangements at regional and state level mean that sharing resources is more challenging.

*Governance arrangements are fragmented between states and between organisations, which can create 'siloes'.*

Structural impediments have also been observed in various post event inquiries. In the 2010-2011 review of flood warnings and response, for example, Comrie (2011) pointed to a lack of an overarching policy framework resulting in siloed and uncoordinated structures that invariably break down when attempting to provide a cohesive response to an emergency event.

**Changes in governance arrangements increase interdependencies in decision-making within and between teams as well as increase pressures on teams due to the tighter coupling necessary for coordination; exacerbated by necessary increases in team size as more stakeholders need to be engaged.**

**Greater attention to external liaison is therefore needed for multi stakeholder coordination and to technologies that support distributed situation awareness. Addressing these challenges will provide opportunities for clarifying scope and responsibilities of various organisations. Other emergent opportunities will come with breakthrough technologies to provide distributed situation awareness, aiding coordination.**

### *National, State and local government relationships*

The National Security Statement noted that while emergency management is primarily a matter for the states and territories, the Australian Government's role in crisis coordination and disaster response, undertaken by Emergency Management Australia (EMA), is much more passive during disasters than, for example, the role played by the Federal Emergency Management Agency (FEMA) in the United States (NSS 2008). Australia has no similar centralising agency. This means that when emergency events cross State borders there may be not clear service for a range of hazards.

The challenges of policy fragmentation are not just ones based on Commonwealth-State or State to State relationships but also derive from tensions between administrative areas of responsibility. Howes et al. (2012), suggested that because state governments

have traditionally divided up their responsibilities into discrete areas (e.g., emergency services, the environment, public health, infrastructure etc.), 'silo mentalities' within organisations and sometimes horizontal rivalries guarding responsibilities and resources have developed. Such 'mentalities' have implications for how complex multi-sectoral issues in disaster risk reduction and emergency management may be addressed.

Policy fragmentation is also exacerbated due to other more structural changes; such as local governments downsizing their core business, outsourcing and relying on contractors for plant and operations.

*What changes are needed to increase the effectiveness of current arrangements at Local/State/National levels in emergency management response and recovery for out-of-scale events?*

This BCRC research found that for strategic emergency management leaders, policy initiatives such as a whole-of-government, all-hazards approaches to emergency management sound good in principle. However, the details have yet to be worked through in practice.

**Policy fragmentation undermines the potential for integrated and coordinated approaches to planning, preparedness, response and recovery across a range of jurisdictions in strategic emergency management. Even more so when considering the longer-term and strategic perspective of Disaster Risk Reduction that also requires engagement with jurisdictions not traditionally included in emergency management.**

Nonetheless, the all-hazards ethos has been touted as an important factor in encouraging some agencies who do not consider their core business to involve emergency management despite being called upon in major events (e.g., education, utilities), to recognise their responsibilities as well as to learn from previous events.

## **Expectations and ‘resilience’ of communities**

Communities and individuals vary in their capacity to prevent, prepare for, respond to, and recover from the impact of natural hazards. Understanding factors that contribute to these variations and using these insights to support communities in building their resilience is an important objective of the emergency management sector. Such a perspective begins to reflect disaster risk reduction principles. It is also worth noting that “community” is often defined by location; however communities can be defined by forms of identity other than place, such as interest, gender, age, and workplace. These non-place based communities can often be dependent upon disaster sensitive ITC to communicate during events<sup>6</sup>.

*There is a need to understand community expectations; from where such expectations come; and how to shift the dialogue to one that recognises the ‘realities’ of living in hazard-prone environments*

With climate change driving an increasing frequency, intensity and duration of out of scale emergency events, an extra dimension is added to the challenges for resilience: the capacity to deal with expanding and changing risks in the future, and to change or transform the systems and approaches on which our current situation is based (ones that assume no change).

---

<sup>6</sup> See also Philips, M. <http://www.bushfirecrc.com/resources/firenote/community>

## *The concepts of resilience and vulnerability*

This research found that senior emergency management leaders feel a disconnect between the Government's desire for resilient communities and the reality facing emergency management leaders in supporting communities preparing for, responding to, and recovering from an emergency event. In many respects communities are self-sufficient and resourceful. However there is a worrying trend reported in the research of a gap between what can reasonably be expected from vulnerable populations as well as community preparedness for out of scale emergency events.

In short, mounting evidence suggests that the collective consequence of how we have chosen to live is presently unsustainable and does not bear up to the pressures placed on our society from out-of-scale events – yet there is an expectation that emergency services organisations and communities should be able to manage without much need for adaptation.

*How can emergency service agencies contribute to enhancing community resilience to live with and in hazard-prone environments?*

Resilience has been variously interpreted to mean to resist the impacts of a disruption or adversity; the capacity to bounce back from the negative impacts of a disruption; the capacity to adapt to those impacts; or even the capacity to transform and shift to something new (Folke 2006; Gallopín 2006; Pelling 2012). The concept is closely connected with the ideas of vulnerability and climate change adaptation (Gallopín 2006; Mercer 2010). The research literature in this area is now very large as most policy sectors of society are employing the term (COAG 2011; Manyena 2006; Pelling 2003; Prosser and Peters 2010).

Relevant recent Australian research included the NCCARF report into the 2008 Queensland floods (Apan et al. 2010); assessment of climate change vulnerability in Australian rural farming communities using a rural livelihoods analysis (Nelson et al. 2010a, 2010b); factors that make for resilient bushfire affected communities (Pooley et al. 2010); and factors that helped or hindered community capacity building after the Canberra Bushfires (Winkworth et al. 2009).

## *Shared responsibility*

While acknowledging the importance of the idea of 'shared responsibility', there is still much work to be done (McLennan & Handmer 2011a; 2011b). Our research found a reported disquiet among some senior leaders on what constituted shared responsibility, whether public expectations are unrealistic, or whether the concept of 'shared responsibility' reflects a more neo-liberal agenda or notions of 'small government'. Such ideas suggest management of what is sometimes called 'residual risk' (what land is allowed to be developed, where people can afford to live for example) is shifted onto individuals whether or not they have the physical, mental, financial or social capacity to manage living in hazard-prone environments.

More recently attention has turned to the concept of resilience as one that may enable a more integrated and proactive approach. However, as was noted above, one of the problems is that there is not a common understanding of what constitutes resilience, with different perspectives on what this means. However, attempts at enhancing self-reliance are also undermined by mixed and sometimes contradictory messages which both emergency services organisations and the government have historically provided.

*What needs to change for community members to be fully engaged in sharing responsibility during out-of-scale emergency events?*

More realistic expectations and greater community preparedness and self-reliance need to be established as part of enhancing resilience and developing an understanding of shared responsibility.

**There is a need for increased sensitivity to different community needs, especially groups in communities who, for various reasons, may be more vulnerable to hazards. Strategic emergency managers need to liaise with political officials to ensure messages for communities are clear about expectations and, to make nuanced judgements about the various information sources flowing to *and from* community members via social media.**

**It is also important to engage multiple stakeholders in discussion about what are realistic expectations, which includes challenging perceptions of acceptable and unacceptable risk, as well as responsibilities.**

Senior emergency managers acknowledged the need to develop an understanding of the psycho-social influences on human behavioural change and the sustained efforts needed to bring about the systemic community changes needed to facilitate wide scale resilient communities. Their concern however was about the length of time this social change will take given the frequency of out-of-scale events that need to be managed immediately.



## Social media, networking and emergence

According to the Australian Attorney-General's Office, "recent disaster events, in Australia and internationally, have demonstrated the importance of social media, not only in delivering vital information to the community during emergency events, but also in strengthening relationships between emergency services and Australian communities".

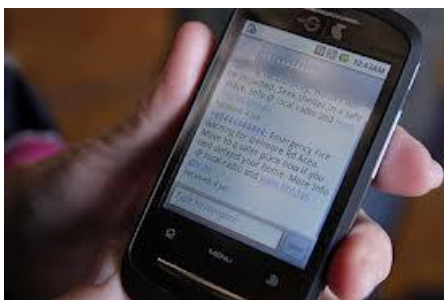
A number of governments, non-government, public and private businesses are developing new tools for use in the social media domain. For example, the CSIRO has developed 'Emergency Situation Awareness (ESA)

software 'to detect unusual behaviour in the Twitter stream and alert users in the emergency services when a disaster event is being broadcast online'<sup>7</sup>.

During the US response to the Haiti earthquake US government agencies, for the first time, employed social media technologies such as wikis and collaborative workspaces as the main knowledge sharing mechanisms (Yates & Paquette 2011).

Another US study suggested that community information resources and other backchannel communications activity enabled by social media are gaining prominence in the disaster arena, despite concern by officials about the legitimacy of information shared through such means (Sutton et al. 2008).

"These emergent uses of social media are pre-cursors of broader future changes to the institutional and organizational arrangements of disaster response" (*ibid*) with which emergency managers are going to have to live.



*How can emergency services harness the use of social media, networking and emergent groups in preparing for, responding to and recovering from out-of-scale emergency events?*

*What are the opportunities and constraints for emergency services in engaging community social media participation as part of operational response? How might these be addressed?*

In their analysis of the use of social media, including Facebook and Twitter, during the 2011 South East Queensland floods (10-16 January), Bruns et al. (2012) examined the role of Twitter in disseminating and sharing information and updates from state and local authorities as well as everyday citizens. They argue that their findings point to an

---

<sup>7</sup> (<http://www.csiro.au/en/Outcomes/ICT-and-Services/emergency-situation-awareness.aspx>)

important role for social media in crisis communication, which has implications for the practical work of emergency services and media organisations, as well as for further scholarly research. However, the value of social media and the engagement of social media sources remains a controversial and contested space for senior emergency management leaders (Owen 2012). One concern about any innovative approach to communication with affected communities is that it captures all the attention. Social media is important but the debate about its use tends to drown out all the other equally important information streams and ensuring their effectiveness.

**Information from diverse sources and variable quality needs to be included in emergency management. Such information needs to be both pushed out to community members, as well as pulled in as intelligence to inform the operational response. This presents an opportunity for strategic emergency managers to enter into a dialogue and partnership with community members. However, it also places additional strains on resourcing of information and intelligence units.**

## The political-operational nexus

Issues surrounding community and political expectations can come into stark relief during incident management, especially of major disasters such as the Queensland floods of 2011 or Victoria's bushfires of 2009. The research suggests that there is an absence of understanding about the connection between the political and operational responses in emergency events. Government ministers have an important role in operational responses, especially in providing credibility, authority and decision-making but connections between politics and operations are not clearly defined or seamless; leading to inconsistent, ad-hoc, 'politically' (or media) driven responses. However it appears that the role of political leaders in emergency events is not clear.

*During out-of-scale events, what should political leaders do to meet community needs? And what changes are required to make this happen?*

This challenge presents an opportunity to engage political decision-making before times of crisis in order that operational goals and possibilities are well-understood during the 'heat of the moment'. Developing the necessary understanding raises several issues for the sector. For example, the need to clarify the role and purpose of state/national level of emergency management, as identified in *Part II – Scoping the emergency management sector*, is relevant here.

At issues is also what constitutes acceptable levels of risk and how this might be addressed in the political-operational context. This is particularly important in decision-making about the relative strengths and weaknesses of trade-offs between, for example, economic costs and social outrage. Some guidance on this question through the issue of tolerable and intolerable risk can be found within the NCCARF risk assessment guidelines (Handmer et al. 2012). However, emergency services leaders were also concerned that these guidelines are weak in their guidance on the prioritisation of trade-offs. Moreover, there is no meaningful policy dialogue occurring about what such trade-offs might mean for risk and decision-making during an emergency response.

*What is needed for effective operational-political partnerships in decision making during out-of-scale emergency events?*

**The political-operational challenges demand that the emergency management sector engage the polity before, during and after emergency events. This could increase the skills of strategic emergency management teams as well as emphasising the need for full engagement of political representatives in the entire planning, preparedness, response and recovery spectrum. Moreover, it calls into question the roles and functions of strategic emergency management teams and how the effectiveness of tactical, operational and strategic emergency management efforts are monitored and measured.**

## Evaluating emergency management response effectiveness

The research found that in many jurisdictions, strategies used to monitor the appropriateness of emergency management objectives, and whether or not they are being achieved are still in a developmental stage. There is a concern in the industry that evaluation of the success or failure of management of an emergency event is conducted by (ill-informed) external sources (such as the media) in a post-hoc and arbitrary manner and that the tenor of the critique depends on the outcome (Owen et al. 2012). Given the scrutiny of emergency management processes in post-event inquiries, it is important that those at a strategic emergency management level, as well as political and government leaders have well established and understood process as well as outcome measures that can aid evaluation of emergency management performance. Absence of these process and outcome measures represents considerable risk and exposure for emergency services organisations to unfair criticism and litigation.

*We need an agreed process and outcome measures of emergency management to aid assessment of performance and to manage expectations.*

In many other safety critical industries, sole reliance on outcome measures alone have been found to be flawed and even dangerous to the longer term viability of the safety-critical system (Dekker 2006; Hollnagel, Woods & Levensen 2006). The same can be said of emergency management. The outcome from an emergency event might have been successful despite risks and unsafe practices being undertaken (and thus luck that there was not an adverse event). Conversely, all the best measures and processes might have been in place and performed well but the outcome might have still had negative impacts because of the nature of the event or the pre-existing vulnerabilities that made avoidance of impact virtually impossible. It is important that those working in senior leadership positions have process and outcome measures to be able to assess whether or not their management objectives are on track.

*At a strategic level, what constitutes an appropriate set of objectives for out-of-scale events?*

### ***Managing under degraded conditions***

It is also important to acknowledge that in 'out-of-scale' events, emergency management arrangements and systems are already degraded- and that safety occurs through recognition and pro-actively managing in sub-optimal conditions (Brooks 2012). By 'degraded' we mean that within the emergency management system there is a lower level of quality of operations than might be desirable or even necessary to maintain a desirable level of safety – be it in the information available or received, in the reactions of people to external stimuli, in the assets to manage the event or other aspects of the coordination system.

*What are the indicators of movement toward vulnerable or unsafe conditions?*

When people, technologies and systems are not fully functional these elements begin to compromise the safety of the system. These can include personnel who are fatigued, equipment that is not working as it should but that nevertheless personnel 'make do' with what they have. Operating in a degraded mode increases the risk of error and mistake.

It is important to also acknowledge that mistakes will be made; that no complex operation can ever be perfect (Brooks 2011). There is a need therefore, to push back against a naïve view that in complex dynamically unfolding events there can ever be one all-knowing person who is 'in control'. Of concern here is the need to disabuse government, political leaders and the media that complex, out-of-scale events can follow some predetermined path for which strict adherence to policies and procedures will enable sufficient management. What is required is adaptive behaviour (Abbasi et al. forthcoming) effective teamwork communication (Bearman et al. 2012) and learning as part of the process of adaptive coordination (Hamra et al 2012). Strategies must be flexible to enable practitioners to recognise when the boundaries of system performance are degrading in

*How would we know that major/out-of-scale events had been well-managed?*

order to cope with what can be characterised as 'ugly' situations (Brooks et al. 2011; Bearman et al. 2012).

This issue heightens the essential need that measures be established and understood by political, media and community leaders *prior* to an event so as to manage the seemingly increasing unrealistic expectations of communities, media and politicians of the emergency services. The increase in number and frequency of out-of-scale extremes only serves to underscore this imperative.

The Australasian Fire Authorities Council (AFAC) has called for the processes of coronial investigations and inquiries into fires around Australia to change as they are badly failing emergency services and the public; the current system places an enormous burden on authorities and is not delivering the invaluable learning required by emergency services organisations. A press release (AFAC 2007, p. 1) stated: AFAC is concerned about the effect these more litigious and adversarial inquiries are having on the industry<sup>8</sup>.

*If risk cannot be eliminated, what steps need to be taken to develop an agreed set of measures of the effectiveness of preparedness, response and recovery management?*

Some of these concerns are:

- Staff and volunteers, who despite protection from legislation, are still burdened with having to give evidence in highly charged court scenarios
- Individuals responsible for operational decisions during bushfires are placed under enormous stress during the period of the inquiry which often carries over into the following fire season.
- Inquiries are often excessively drawn out - operational issues that require rectification may not occur in time for the following fire season
- The ability to learn is lost as agencies need to protect their staff and decisions taken
- Outcomes are limited as legislation can only deal with one jurisdiction when many fires occur across multiple states
- Converging pressures on local incident management delivery

This research also found that state levels of emergency management coordination appeared to be reporting summative (i.e., calculating the number of resources on a particular incident ground) rather than adding-value to sense-making to inform strategic and consequence management required at a state level.

---

<sup>8</sup> See also Eburn, M.

[http://www.bushfirecrc.com/sites/default/files/managed/resource/what\\_do\\_inquiries\\_really\\_need\\_to\\_know\\_about.pdf](http://www.bushfirecrc.com/sites/default/files/managed/resource/what_do_inquiries_really_need_to_know_about.pdf)

**There is a need to develop a suite of process and outcome measures tailored to the sector. Strategic emergency management teams need ways of gaining real-time operational feedback on progress to monitor workload conditions for contingency planning. A future challenge is a need for shared mental models within and between teams at all levels of the emergency management system (including politics and media) as well as strategies to monitor performance within complex networks of arrangements. The opportunity to develop process- and outcome-measures appropriate to the sector can assist personnel and external stakeholders to better recognise the challenges; including the migration from safe to unsafe operational boundaries under degraded conditions. These pre-agreed measures would provide personnel with some protection from post-hoc adversarial inquiries.**

Source: <http://www.directionsmag.com/articles/mobile-gis-gives-recovery-specialists-an-advantage-in-the-victoria-bushfire/122461>

## **Development and Capability**

There are two aspects discussed below that provide guidance for addressing these future challenges. They relate to the need to change what has been an historically reactive “command and control” culture. This needs to be addressed to develop better capability to manage out-of-scale events as well to create opportunities for learning and institutional change. The second aspect in need of attention is the leadership and professional development needs to the sector to build capability.

### ***Changing a reactive and operational culture***

There are challenges in managing within a chaotic and changing environment and constraints from working within a traditionally reactive and operational modus operandi and uniform culture. On the one hand there is a need to move beyond a reactive-response culture to one that is more strategic in its focus and approach. In addition agencies find it particularly challenging to compartmentalise time and influence to prepare agencies, government and the community for what may come in the future.

For example, this research (Brooks, Owen, Bearman & Grunwald 2011; Bearman, Grunwald, Owen & Brooks 2012; Owen 2012) noted the limited opportunity to stop and learn from the major events before the “next big one” occurs or for which preparation needs to be undertaken.

Moreover, the sense of a limited appetite for failure in communities and politicians, also constrains the sector’s willingness to experiment and to admit mistakes - the very essence of learning and improving (Bosomworth 2012). There is also reported change fatigue and

an increasing risk aversion to managing future events including personnel concern about being exposed to litigation (Eburn & Dovers 2012).

**There is a need to identify strategies to enhance the sector’s capacity for reflection and learning, and to overcome the tendency for reactive acting within narrow perspectives of problem solving. From this perspective, there is a need to change occupational identity beyond reactive “command and control”.**

**There are opportunities for leaders to change reactive operational cultures and to develop new skills in strategic thinking. There is also an opportunity to shift the paradigm of “command and control” and to be inclusive of communities as part of the operational response. These issues also raise implications for how the tensions between command and control and strategic emergency management are best managed.**

### *Adversarial inquiries and risk-averse climate*

As discussed in the ‘measuring success’ section, the adversarial nature of post event inquiries has also taken its toll on people’s interest in stepping into critical decision-making roles. The adversarial nature of post-event inquiries was noted as increasing the likelihood of risk-averse approaches to emergency and incident management, which as was highlighted above, can entrench an unwillingness to experiment, to admit mistakes or a lack of knowledge. All of this has dire consequence for learning and adaptation. There is clearly a need to develop, as a bare minimum, ways of suitably protecting qualified and experienced people when they are managing complex incidents, especially as those situations are replete with incomplete information and difficult circumstances.

Senior emergency managers need to both keep up with considerable levels of change while also operating within a context of increasing economic and financial constraint that often lead to workforce restructuring. Such factors lead to real challenges in attaining sufficient time to look beyond the immediate horizon. This is a particular challenge to natural hazard managers and emergency services, when considering that they must now adjust to a constantly changing risk profile and accept that historical information—despite being a basis for forward projects – may nevertheless be of limited use in the context of climate- change and potential future natural hazard risks (Handmer et al. 2012).

*What development capability (e.g., leadership skills and training, policy enablers) are needed to strategically manage unprecedented events?*

It is critically important that stakeholders with an interest in emergency management recognise the enormous complexity of managing unpredictable, unbounded emergency events that cannot be reduced to simple pre-determined prescriptive solutions. In essence, emergency services organisations need to develop new processes to enhance learning for uncertainty, complexity and adaptation. Many agencies have begun to address these challenges with improved leadership and professional development programs.

### ***Leadership development and capability***

The demands associated with incident complexity, managing uncertainty as well as community and political expectations, and changes in the sector's cultural identity, set up new challenges for leadership and their capability development. According to a recent report by the Noetic Group (Murphy & Dunn, 2012) the context facing senior leaders in the field of public safety and emergency management is much more complex than that faced by their predecessors. Many of the above challenges underscore this and place new demands on the sector's leadership and capability, including a need to explicitly shift from the traditional focus on capability to manage an event to a more political and strategic planning and policy focus.

Moreover, out-of-scale events require new skills and development needs (complexity thinking; managing uncertainty and competing relationships; meta-leadership). These are underpinned by related challenges:

- aging demographic of workforce
- intermittent nature of major events
- lack of standardisation of competencies across jurisdictions
- lack of development of appropriate professional development (including leadership) and assessment tools for complex and higher order thinking

However, this situation also presents an opportunity to develop new ways of thinking about leadership and capability; expanding higher skill expertise in a broader range of personnel who can operate at a multi-jurisdictional level. Developing such a capacity would help address some of the other challenges highlighted herein.

### ***Meeting and managing the leadership and capability needs***

The demands associated with rising incident complexity and uncertainty places pressures on the traditional cultural identity of emergency services personnel. This contributes to new challenges for leadership and capability development.

These challenges require strategic emergency managers to have the skills required for complex thinking; managing difficult situations, including the emotional challenges faced by senior emergency managers when they are dealing with

*At a strategic emergency management level, what new capabilities are needed for out-of-scale emergency events?*



out-of-scale of events. This requires changes to the traditional emergency services culture discussed above where being emotionally distant and aloof is seen as part of a cultural identity.

In some jurisdictions there has been a concerted effort to develop new leadership programs aimed at relationship management and the human factors related skills of communication, conflict resolution and negotiation and in others this was in need of attention. Personnel operating in senior positions at regional and state/national levels were frequently doing so with limited professional development. In particular, capability development is needed in human factors and decision-making skills (including decision-making under stress, communication conflict resolution and negotiation skills) as well as in meta-leadership.

The NOETIC Group report represents a recently collated focus on lessons learnt studies and post-activity reviews for a range of emergency management events. It concluded that "it is clear there has been a lack of resources and insufficient attention given to training" (Murphy & Dunn 2012, p.7). That study also found that response training for routine accidents is effective at all levels, except in the case of novel or 'out-of-scale' disasters. This lack of training and support places undue stress on people who care deeply about the outcomes.

While this research project concurs with that general conclusion, it has also identified some improvements in contextual learning, human factors and leadership education within the industry (Brooks 2012). In some jurisdictions there has been a concerted effort to develop new leadership programs aimed at relationship management and the human factors related "non-technical" skills of communication, conflict resolution and negotiation. Yet, while there has been a lot of attention on at the operational and tactical levels, there has been limited systematic focus on training at the strategic level. It has been observed that strategic emergency management team members and leaders are sometimes relying on their own IMT-related training, despite many not having worked at that level for up to five years. This raises the issue of refresher training and professional development to provide more contemporary support (since even IMT training has moved on considerably over the last five years) as well as an opportunity to develop the skills required in strategic emergency management. Such training would also provide opportunities to redress what some participants called the "command and control" type of culture to one of influence and negotiation.

*What steps need to be taken to facilitate and share learning across the sector?*

Agencies also need to develop capabilities, in what Marcus, Dorn and Henderson (2006) called "meta-leadership". In discussing terrorism preparedness in the US they asked the question: *If leadership, as traditionally understood, is working to build the capacity within organizations, then what different brand of leadership is necessary to get beyond that silo thinking to achieve the cross-agency coordination of effort required?* It was observed by a

number of participants that more attention was needed in cross-agency training in order to facilitate the relationships needed as well as the skills required.

The challenges of maintaining workforce capability in an all-hazards environment was also noted. As was argued earlier in this report, incidents are becoming more complex, and large out-of-scale events may involve a set of problems that had not previously been experienced. Under these circumstances what is needed is a focus on managing the unknown rather than technical skills.

In a related research component of the *Organising for Effective Incident Management* research project, a review of training pathways for personnel above the IMT was conducted alongside evaluation of existing simulation scenarios to explore opportunities in developing shared mental models at a strategic emergency management level (Brooks, 2012a, 2012b). That report suggested improvements in the following areas that may in turn support the challenges identified:

*We need to consider cross-agency training to facilitate the needed relationships and required skills.*

- integration gaps (effective linking of formal training pathways with exercising, assessment and role performance), including the three stages of non-technical skills training (awareness raising, practice and continual reinforcement)
- need for review, assessment and possible development of new 'rules-of-thumb' or 'quick strategies' for coordination above the IMT to counteract this complex, dynamic and uncertain environment
- need for training 'at the edge of chaos' (Renaud, 2010) to be more effective when coordinating out-of-scale events
- need for advanced courses on decision-making that acknowledge the literature on practical and critical thinking
- improved approaches to assessment

**The leadership and capability needs for strategic emergency management teams require skill, capacity and leadership development; including the ability for personnel to recognise shifts towards degraded conditions and requirements for collective recovery.**

## CONCLUSION

This paper discussed key findings emerging from the *Organising for effective incident management* research project and outlined the implications arising based on consultation with emergency services sector leaders. From analysis of the literature, inquiries and the empirical research conducted as part of the *Organising for Effective Emergency Management* project, seven challenges facing senior emergency management leaders have been identified. These challenges need to be confronted if leaders are going to face the internal and external drivers of change in the future. Feedback on the discussion paper will be used to inform a change framework as part of the research utilisation from the research project to facilitate the continued development of a resilient emergency services sector.

## REFERENCES

- Abbasi, A., Hossain, L., & Owen, C. (forthcoming). Social connectedness and adaptive team coordination during fire events. . *Fire Safety Journal*.
- AFAC (Producer). ( 2007). Coronial Systems Need Review. [Press Release Tuesday 18th December] Retrieved from [http://www.afac.com.au/latest/media/coronial\\_inquests\\_2\\_.pdf](http://www.afac.com.au/latest/media/coronial_inquests_2_.pdf)
- Apan, A., Keogh, D., King, D., Thomas, M., Mushtaq, S., & Baddiley, P. (2010). The 2008 Floods in Queensland: A Case Study of Vulnerability, Resilience and Adaptive Capacity. Queensland, Australia: University of Southern Queensland.
- Barnett, J. (2001). Adapting To Climate Change In Pacific Island Countries: The Problem Of Uncertainty. *World Development* 29(6), 977-993.
- Bearman, C., & Grunwald, J. (2011). Breakdown in coordinated decision making in teams fighting large-scale bushfires in Australia (Report prepared for the Bushfire CRC under the project: Organizing for Effective Incident Management). Melbourne, Australia: Bushfire CRC.
- Bearman, C., Grunwald, J., Owen, C., & Brooks, B. (2012). *Coordinated Decision Making Breakdowns in the Wangary, Kilmore East and Canberra Firestorm Fires*. Paper presented at the AFAC/Bushfire CRC Conference 28th – 30th August, Perth, Western Australia.
- Beer, T. (2008). John Handmer and Stephen Dovers (eds), Handbook of disasters & emergency policies & institutions. [Book review]. *Natural Hazards*, 47, 137-139.
- Beer, T., Gill, A. M., & Moore, P. H. R. (1988). Australian bushfire danger under changing climatic regimes. In G. I. Pearman (Ed.), *Greenhouse: Planning for Climatic Change* (pp. 421-427). Melbourne: CSIRO.
- Beer, T., & Williams, A. (1995). Estimating Australian forest fire danger under conditions of doubled carbon dioxide concentrations. . *Climatic Change*, 29, 169-188.
- Bhandari, R., & Curnin, S. (2012). Report on a case study comparing aspects of incident management approaches above the IMT *Organising for Effective Incident Management*. Tasmania: Bushfire Cooperative Research Centre.
- Bhandari, R., Owen, C., & Brooks, B. P. (2012). Organisational features and their effect in the response process of emergency management organisations. *Journal of the Overseas Development Institute*.
- Bhandari, R., Owen, C., Curnin, S., & Brooks, B. (2012). Guidance and Directions on Incident Management Approaches *Report prepared for the Bushfire CRC under the Project: Organising for Effective Incident Management*) Melbourne, Australia.: Bushfire CRC.
- Boin, A., & 't Hart, P. (2010). Organising for effective emergency management: lessons from research. *Australian Journal of Public Administration*, 69(4), 357-371. doi: 10.1111/j.1467-8500.2010.00694.x
- BoM. (2010). Monthly Weather Review, Queensland December 2010. Queensland, Australia: Queensland Climate Services Centre: Bureau of Meteorolgy.
- BoM. (2011). Frequent heavy rain events in late 2010/early 2011 lead to widespread flooding across eastern Australia. (pp. 28). Melbourne, Victoria: National Climate Centre, Bureau of Meteorology.
- BoM. (2012). National Climate Centre, Bureau of Meteorology; Australia's wettest two-year period on record; 2010-2012 *Special Climate Statement*
- Bosomworth, K. (2012). *Adaptive governance in fire management: exploring the role of bureaucrats in reflexive learning*. (PhD), RMIT University, Melbourne.
- Bosomworth, K., & Handmer, J. (2008). Climate change and community bushfire resilience *Community Bushfire Safety* (pp. 175-183). Collingwood: CSIRO.
- Brooks, B., & Owen, C. (2012). Training Pathways for Effective Emergency Management Coordination above the IMT *Organising for Effective Incident Management*. Melbourne, Australia: Bushfire CRC.
- Brooks, B. P., Bearman, C., & Owen, C. (2012). Report on simulation scenarios developed and reviewed with lead end user and piloted *Organising for Effective Incident Management*. Tasmania: Bushfire Cooperative Research centre.

- Brooks, B. P., Owen, C., Bearman, C., & Grunwald, J. (2011). Human factors issues in secondary sources (Report Prepared for the Bushfire CRC Under the Project: Organising for Effective Incident Management) (pp. 39 p.). Melbourne, Victoria: Bushfire CRC.
- Brooks, B. P., Owen, C., Bearman, C., & Grunwald, J. (2012). Report on human factor issues prevalent in coordination failure in secondary sources. *Organising for Effective Incident Management*, 1(1), 1-39.
- Bruns, A., Burgess, J., Crawford, K., & Shaw, F. (2011). [#qldfloods and @QPSMedia: Crisis Communication on Twitter in the 2011 South East Queensland floods].
- Cary, G. (2004). *Climate change and bushfire incidence*. Paper presented at the NSW Clean Air Forum
- Cary, G. (Ed.). (2002). *Importance of a changing climate for fire regimes in Australia*. Melbourne, Australia: Cambridge University Press.
- Chapman, J., & Bearman, C. (2011). Framework for Eliciting Shared Mental Models for use in Bushfire Fieldwork (Report Prepared for the Bushfire CRC Under the Project: Organising for Effective Incident Management). Melbourne, Australia: Bushfire CRC.
- COAG. (2004). Natural disasters in Australia: reforming mitigation, relief and recovery arrangements. *A report to the council of Australian governments by high level officials' group. Department of Transport and Services (DTS)*. Canberra: Council of Australian Governments (COAG), Commonwealth of Australia.
- COAG. (2011). National strategy for disaster resilience: Building the resilience of our nation to disasters (pp. 19). ACT: Commonwealth of Australian Governments.
- Comfort, L. K. (2005). Risk, security, and disaster management *Annual Review of Political Science*, 8 335-356
- Comfort, L. K., & Kapucu, N. (2006). Inter-organizational coordination in extreme events: the world Trade Center attacks, September 11, 2001. *Natural Hazards*, 39, 309-327.
- Comrie, N. (2011). Review of the 2010-2011 Flood Warnings and Response Final Report (pp. 1-244). Victoria.
- Coutts, A., Beringer, J., & Tapper, N. (2007). Impact of increasing urban density on local climate: Spatial and temporal variations in the surface energy balance in Melbourne, Australia. *Journal of Applied Meteorology*, 47(4), 477-493.
- Coutts, A. M., Beringer, J., & Tapper, N. (2010). Changing urban climate and CO2 emissions: Implications for the development of policies for sustainable cities. *Urban Policy and Research*, 28(1), 34-47.
- CSIRO (Producer). (2013). Emergency Situation Awareness Tool for Social Media. [Social Media] Retrieved from <http://www.csiro.au/en/Outcomes/ICT-and-Services/emergency-situation-awareness.aspx>
- CSIRO, & BoM. (2010). State of the Climate (pp. 6): CSIRO, Australian Bureau of Meteorology.
- Curnin, S. (2013). An organisational typology of coordination failure (above the IMT) *Report prepared for the Bushfire CRC under the Project: Organising for Effective Incident Management Bushfire CRC*. Melbourne, Australia BushfireCRC.
- Curnin, S., & Owen, C. (2013). The challenges of multi-agency coordination. *Disaster (Submitted)*.
- Dekker, S. (2006). *The Field Guide to Understanding Human Error* (second ed.). Aldershot, England: Ashgate Publishing Limited.
- Department of Transport, D. (2012). State of Australian Cities 2012 Australian Government Department of Infrastructure and Transport (DoT) Major Cities Unit.
- DFAT. (2008, May 2008). Australia's environment at a glance Retrieved 15 May, 2013, from [http://www.dfat.gov.au/facts/env\\_glance.html](http://www.dfat.gov.au/facts/env_glance.html)
- DHS. (2009). January 2009 Heatwave in Victoria: An Assessment of Health Impacts (pp. 16). Melbourne, Victoria: Victorian Government Department of Human Services (Office of the Chief Health Officer).
- Dupont, A., & al., e. (2008). Climate change and security: managing the risk, paper commissioned by the Garnaut Climate Change Review.

- Eburn, M., & Dovers, S. (2012a). Mainstreaming Fire and Emergency Management-What is possible? What is feasible? *Bushfire CRC / AFAC Fire Note*, (97), 1-4. Retrieved from
- Eburn, M., & Dovers, S. (2012b). Mainstreaming fire and emergency management across legal and policy sectors. *The Journal of Emergency Management*, 27(2), 14-19.
- EMA. (1998). Australian Emergency Management Glossary *Australian Emergency Manuals, Series Part I: The Fundamentals Manual 3.*: Commonwealth Government of Australia.
- EMA. (2011). National Emergency Risk Assessment Guidelines *Australian Government, Attorney-General's Office, Emergency Management Australia: State Emergency Service Tasmania.*
- Few, R. (2007). Health and climatic hazards: Framing social research on vulnerability, response and adaptation. *Global Environmental Change*, in press.
- Folke, C. (2006). Resilience: The emergence of a perspective for social–ecological systems analyses. *Global environmental change* 16(3), 253-267.
- Gallopin, G. (2006). Linkages between vulnerability, resilience, and adaptive capacity. *Global environmental change* 16(3), 293-303.
- Government, V. (2007). Climate Change and Infrastructure: Planning Ahead *Part of the Victorian climate change adaptation program.* Victoria, Australia: A Victorian Government Initiative
- GWA. (2011). Shared Responsibility: The report of the Perth Hills bushfire review. Perth: Government of Western Australia
- Hamra, J., Hossain, L., Owen, C., & Abbasi, A. (2012). Effects of networks on learning during emergency events. *Disaster Prevention and Management* 21(5), 584 - 598.
- Handmer, J., & Dovers, S. (2008). Policy development and design for fire and emergency management. *The Australian Journal of Emergency Management*, 23(1), 21-29.
- Handmer, J., McKellar, R., McLennan, B., Whittaker, J., Towers, B., Duggie, J., & Woolf, M. (2012). National Climate Change Adaptation Research Plan: Emergency Management - Update 2012 (pp. 34). Gold Coast, Australia: National Climate Change Adaptation Research Facility (NCCARF).
- Hennessy, K., Fawcett, R., Kirono, D., Mpelasoka, F., Jones, D., Bathols, J., . . . Plummer, N. (2008). An assessment of the impact of climate change on the nature and frequency of exceptional climatic events CSIRO/The Bureau of Meteorology, Commonwealth of Australia.
- Hollnagel, E., Woods, D., & Leveson, N. G. (2006). *Resilience engineering: concepts and precepts.* Abingdon: Ashgate.
- Howes, M., Grant-Smith, D., Bosomworth, K., Reis, K., Tangney, P., Heazle, M., Burton, P. (2010). *Rethinking emergency management and climate adaptation policies.* Paper presented at the Australian Political Studies Association Conference, University of Tasmania: Hobart.
- Institute, T. B. (2012). The year that shook the rich: a review of natural disasters in 2011 *London school of Economics project on Internal Displacement* London: The Brookings Institute.
- IPCC. (2001). Climate change 2001—synthesis report—a contribution of working groups I, II, and III to the third assessment report of the intergovernmental panel on climate change. In T. e. a. Watson R (Ed.). Cambridge: Cambridge University Press.
- IPCC. (2007a). Summary for Policymakers. In S. Solomon, Qin, D, Manning, M, Chen, Z, Marquis, M, Avery, KB, Tignor, M. & Miller, HL (Ed.), *Climate Change 2007: The Physical Science Basis.* Cambridge: Cambridge University Press.
- IPCC. (2007b). Summary for Policymakers . In M. Parry, Canziani, OF, Palutikof, JP, van der Linden, PJ & Hanson, CE (Ed.), *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Cambridge: Cambridge University Press.
- IPCC. (2007c). Summary for Policymakers). In B. Metz, Davidson, OR, Bosch, PR, Dave, R & Meyer, LA (Ed.), *Climate Change 2007: Mitigation of Climate Change.* Cambridge: Cambridge University Press.
- IPCC. (2011). Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change adaptation: Summary for Policymakers , Geneva: UN: Intergovernmental Panel on Climate Change.
- IPCC. (2012). Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. In C. B. Field, V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D.

- Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (Ed.), *A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change*. Cambridge, UK New York, USA: Cambridge University Press.
- ISO. (2011). ISO 22320:2011 *Societal security - Emergency management - Requirements for incident response* (pp. 21).
- ISO, A. N. (2009). AS/NZS 31000:2009 *Risk management - Principles and guidelines* (pp. 24).
- Kolmannskog, V. O. (2008). Future floods of refugees: A comment on climate change, conflict and forced migration. Oslo: Norwegian Ministry of Foreign Affairs.
- Liath, S. (2004). Averting a disaster within a disaster: The management of spontaneous volunteers following the 11 September 2001 attacks on the World Trade Center in New York. *Voluntary Action Journal*, 6(2).
- Lynn, K. (2003). Wildfire and rural poverty: Disastrous connections. *Natural Hazards Observer*, 29(2), 10-11.
- Manyena, S. (2006). The concept of resilience revisited. *Disasters*, 30(4), 434-450.
- Marcus, L., Dom, B., & Henderson, J. (2006). Meta-leadership and national emergency preparedness: A model to build government connectivity. *Biosecure Bioterror*, 4(2), 128-134.
- McKenzie, F. H. (1999). Impact of declining rural infrastructure in Australia.
- McLennan, B., & Handmer, J. (2011a). Framing challenges for sharing responsibility: a report of the sharing responsibility project. Melbourne: RMIT University & Bushfire Cooperative Research Centre.
- McLennan, B., & Handmer, J. (2011b). Mechanisms for sharing responsibility: a report of the sharing responsibility project. Melbourne: RMIT University & Bushfire Cooperative Research Centre.
- McLennan, J., & Birch, A. (2005). A potential crisis in wildfire emergency response capability? Australia's volunteer firefighters. *Environmental Hazards*, 6, 101-107.
- Mercer, J. (2012). Disaster risk reduction or climate change adaptation: Are we reinventing the wheel? *Journal of International Development*, 22, 247-264.
- Mimura, N. L., Nurse, R. F., McLean, J., Agard, L., Briguglio, P., Lefale, R., . . . Sem. (2007). Small islands. Climate Change 2007: Impacts, Adaptation and Vulnerability. In O. F. C. M.L. Parry, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, (Ed.), *Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 687-716). Cambridge, UK: Cambridge University Press
- Molino, S. (2007). Think or swim - Planning developments so lifebuoys aren't needed (pp. 9). Parramatta NSW: Molino Stewart Pty Ltd.
- Murphy, J. G., & Dunn, W. F. (2012). Medical education in the clouds. *CHEST Journal*, 141(1), 5-7. doi: 10.1378/chest.11-1951
- O'Neill, S., & Handmer, J. (2012). Responding to bushfire risk: the need for transformative adaptation *Environmental Research Letters*, 7(1), 7. doi: doi:10.1088/1748-9326/7/1/014018
- Owen, C. Report on preliminary results of survey *Organising for Effective Incident Management*. Tasmania: Bushfire Cooperative Research Centre.
- Owen, C. (2012). Report on challenges and implications facing senior personnel engaged at regional and state levels of emergency management operation coordination *Organising for Effective Incident Management*. Melbourne, Australia: BushfireCRC.
- Owen, C. (2012). Summary of human-technology interface implications *Organising for Effective Incident Management*. Tasmania: Bushfire Cooperative Research Centre.
- Owen, C., & Brooks, B. P. (2012). Summary of human-technology interface implications: end user feedback *Organising for Effective Incident Management*. Tasmania: Bushfire Cooperative Research Centre.
- Owen, C., Brooks, B. P., & Johnson, C. (2012). Report on testing of scenarios to enhance communication' *Organising for Effective Incident Management* Bushfire Co-operative Research Centre.

- Parkin, D. (2008). Future challenges for volunteer based emergency services. *The Australian Journal of Emergency Management*, 23(2), 61-67.
- Paton, D., & Brient, L. (2012). Identifying Characteristics of Adaptive Capacity in Strategic Emergency Management. (Report on analysis of interviews prepared for the Bushfire CRC *Organising for Effective Incident Management*. Melbourne, Australia: Bushfire CRC.
- Paul, L. (2001). Volunteering issues and challenges. *Australian Journal on Volunteering*, 6(2), 30-36.
- Pearce, T., Handmer, J., Higgins, J., King, D., McDonald, J., Pagano, F., . . . Whetton, P. (2009). Emergency Management and Climate Change: National Adaptation Research Plan (pp. 1-36): National Climate Change Adaptation Research Faculty (NCCARF).
- Peek, L., & Sutton, J. N. (2003). Disasters: An exploratory comparison of disasters, riots, and terrorist acts. *The Journal of Disaster Studies, Policy and Management*, 27(4), 141-157.
- Pelling, M. (2003). *The vulnerability of cities: Natural disasters and social resilience*. London: Earthscan.
- Pooley, J. A., Cohen, L., & O'Connor, M. (2010). Bushfire Communities and Resilience: What can they tell us? *Australian Journal of Emergency Management*, 25(2), 33-38.
- Prosser, B., & Peters, C. (2010). Directions in disaster resilience policy. *The Australian Journal of Emergency Management* 25(3), 8-11.
- QFCI. (2011). Queensland Floods Commission of Inquiry - Interim Report 1 August 2011 (pp. 262). Brisbane: Qld Floods Commission.
- QFCI. (2012). Queensland Floods Commission of Inquiry: Final Report. March. Brisbane: Queensland Commission of Enquiry.
- Reinholdt. (1999/2000). Managing change within the emergency services to ensure long term viability of volunteerism. *Australian Journal of Emergency Services*, 14(4), 6-9.
- Renaud, C. (2010). *Making sense in the edge of chaos: A framework for effective initial response efforts to large scale incidents*. (M.Arts ), Naval Postgraduate School, Monterey, CA.
- Schipper, L., & Pelling, M. (2006). Disaster risk, climate change and international development: scope for, and challenges to, integration. *Disasters*, 30(1), 19-38.
- Sullivan, K., & Norman, B. (2011). Integrating spatial planning with bushfire risk and emergency management in the context of climate change: critical literature review-stage 1. *Urban and Regional Planning*. ACT: University of Canberra.
- Sutton, J., Palen, L., & Shklovski, I. (2008). *Backchannels on the Front Lines: Emergent Uses of Social Media in the 2007 Southern California Wildfires* Paper presented at the Proceedings of the 5 th International ISCRAM Conference, Washington, DC, USA, .
- Teague, B., McLeod, R., & Pascoe, S. (2010). 2009 Victorian Bushfires Royal Commission Final Report. Melbourne: VBRC.
- Teague, B., McLeod, R., & Pascoe, S. (2010). 2009 Victorian Bushfires Royal Commission Final Report - summary. Retrieved from [http://www.royalcommission.vic.gov.au/finaldocuments/summary/PF/VBRC\\_Summary\\_PF.pdf](http://www.royalcommission.vic.gov.au/finaldocuments/summary/PF/VBRC_Summary_PF.pdf). Melbourne: Parliament of Victoria.
- Turner, B. A. (1976). The development of disasters - a sequence model for the analysis of the origins of disasters. *Sociological review*, 24, 753-774.
- UNISDR. (2009). UNISDR Terminology on disaster risk reduction (pp. 35). Geneva, Switzerland: United Nations National Strategy for Disaster Reduction.
- Walker, J., & Owens, J. (2013). Drinking water threat for Brisbane as city escapes major flooding, from <http://www.theaustralian.com.au/in-depth/queensland-floods/drinking-water-threat-for-brisbane-as-city-escapes-major-flooding/story-fn7iwx3v-1226564241082>
- Winkworth, G., Healy, C., Woodward, M., & Camilleri, P. (2003). Community capacity building: Learning from the 2003 Canberra Bushfires. *The Australian Journal of Emergency Management*, 24, 5-12.
- Wisner, B., Blaikie, P., Cannon, T., & Davis, I. (2004). *At risk: Natural hazards, people's vulnerability and disasters* (2nd ed.). London and New York: Routledge.
- Woodward, A., & Kallman, J. (2001). Why Volunteers leave: Volunteer Exit Survey in the emergency services *Australian Journal on Volunteering*, 6(2), 91-98.



- Yates, A., & Bergin, A. (2009). Hardening Australia: Climate change and national disaster resilience *Special Report* (Vol. 24). ACT: Australia: Australian Strategic Policy Institute Ltd.
- Yates, D., & Paquette, S. (2011). Emergency knowledge management and social media technologies: A case study of the 2010 Haitian earthquake. *International Journal of Information Management* 31(1), 6-13.