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DISASTER RESILIENT AUSTRALIA
GET READY

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Some contributions to the *Australian Journal of Emergency Management* are reviewed. Academic papers (denoted by Ⓡ) are peer reviewed to appropriate academic standards by independent, qualified experts.

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COVER

The bushfire near Coonabarabran, NSW, made international headlines when it threatened the Siding Spring Observatory. CRC researchers, at the request of local fire agencies, visit fire-affected areas to conducted independent, community-based research. These types of studies maximise the lessons learned from bushfires.

Image: Bushfire CRC

ABOUT THE JOURNAL

The *Australian Journal of Emergency Management* is Australia's premier Journal in emergency management. Its format and content is developed with reference to peak emergency management organisations and the emergency management sectors—nationally and internationally. The Journal focuses on both the academic and practitioner reader and its aim is to strengthen capabilities in the sector by documenting, growing and disseminating an emergency management body of knowledge. The Journal strongly supports the roles of Emergency Management Australia (EMA) and the Australian Emergency Management Institute (AEMI) as a national centre of excellence for knowledge and skills development in the emergency management sector. Papers are published in all areas of emergency management. The Journal emphasises empirical reports but may include specialised theoretical, methodological, case study and review papers and opinion pieces. The views in this journal are not necessarily the views of the Attorney-General's Department.

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DISASTER RESILIENT AUSTRALIA
GET READY

Foreword

By Hon Nikki Kaye, Minister of Civil Defence, New Zealand.

This issue of the *Australian Journal of Emergency Management* is published as New Zealand hosts the Australasian Fire and Emergency Service Authorities Council conference, *After disaster strikes, learning from adversity*. Our countries have much to learn from each other. The conference is an opportunity to come together and share the combined wisdom of experience, research and analysis from across the sector, to enable a deeper understanding of the approaches needed to secure the region's future and prosperity.

Natural hazards and even man-made emergencies know no boundaries and in our region there are a myriad of recent examples we can learn from, including the bushfires that struck many Australian states, cyclones and flooding that periodically strike the region, and in New Zealand's case, earthquakes and tsunami risks.

Few, if any, countries in the world can respond on their own to a national disaster. As neighbours, New Zealand and Australia have a long history of working together successfully. We both value the alacrity and ease in which our Ministers and agencies are able to share information in times of adversity and agree to support each other's operations.

Strong relationships are critical at all levels of emergency management and not just in the response. In a community prepared for emergencies, relationships should promote co-operation and self-reliance. At the incident level in a response, relationships will be personal and team-focussed. In a multi-agency setting, it will be about attaining a shared objective through drawing on the expertise and capabilities of all those involved. The key to successful emergency management is having strong working relationships, trust, and clearly specified processes and arrangements that cover the most likely scenarios, that can be adapted to cope with those contingencies that are at the fringes of our experiences and imagination.

Building strong, well-prepared and resilient communities is at the heart of civil defence emergency management in New Zealand. As the Minister of Civil Defence, I am conscious that the bulk of the work required to generate community resilience, let alone respond to an emergency, relies heavily on community volunteers. I have nothing but admiration for those men and women who commit so much of their time to helping their communities get ready, and praise for those that courageously and selflessly undertake response roles frequently in dangerous conditions.

To our international friends attending the AFAC conference in Wellington, I take this opportunity to wish you a warm welcome to New Zealand. To all those attending I hope the conference expands your understanding of emergency management and fosters international engagement and strong connections which help make our countries and region safer.

Hon Nikki Kaye

Minister of Civil Defence, New Zealand

After Disaster Strikes, Learning From Adversity

Australasia's pre-eminent emergency management conference

Join us for the 2014 AFAC and Bushfire & Natural Hazards CRC conference in Wellington, New Zealand, to be held at Shed 6 and TSB Bank Arena, for Australasia's largest emergency services and public safety conference and trade exhibition.

The conference, from 2-5 September, is designed for delegates with a responsibility for, or involvement in, emergency management. It is the principal gathering of emergency management practitioners, technical experts and researchers in our region.

This year's theme is *'After disaster strikes, learning from adversity'*. Natural and man-made disasters strike all countries, but particularly in our region. The conference will give delegates the opportunity to examine how emergency management services, land managers and communities prepare, respond to and assist with disaster recovery, as well as, develop evidence-based policy and practice for the future.

Image: AFAC

New Zealand Fire Service Chief Executive and National Commander Paul Baxter officially launching 2014 conference program.

Conference Program

New Zealand Fire Service Chief Executive and National Commander Paul Baxter officially launched the full speaker program for the 2014 annual conference in Melbourne on 30 April 2014. 'It has got everything you could possibly hope for: it's a really exciting program. The conference just continues to develop, going from strength to strength,' Mr Baxter said.

This year's program includes 16 leading International and New Zealand speakers, as well as a range of industry experts, together presenting over 90 sessions across the four days. The trade exhibition will then expand on the wisdom of our speakers by showcasing a range of our industry's most innovative products and services.

AFAC Chief Executive Officer Stuart Ellis said this year's conference theme was designed to bring delegates together to share the combined wisdom of experience, research and analysis from across the sector as well as enable a deeper understanding of the approaches needed to secure the region's future and prosperity.

For more information, to download your copy of the program or to register please visit the AFAC website **www.afac.com.au/conference**.

2014 Queen's Birthday Honours recipient — Mike Rothery PSM


Image: AEMI

Mike Rothery PSM

Mr Mike Rothery, First Assistant Secretary, National Security Resilience Policy Division has been awarded the Public Service Medal. The award was announced on 9 June as part of the Queen's Birthday 2014 honours list.

Mike has been central to developing and implementing the concept of national security resilience in Australia. During 30 years of distinguished public service he has advocated and gained widespread support for innovative policy to protect Australia's people, information and assets, including critical infrastructure, from national security threats such as terrorism, cyber and identity crime, and natural disasters. He was instrumental to the development of the Australian Government's first *Cyber Security Strategy* in 2009, which continues to guide the Government's response to cyber threats. Mike oversaw the development and implementation of the *Protective Security Policy Framework* which underpins Australia's collaborative approach to the sharing of sensitive and important information across government and with industry in a secure way. Mike achieved a fundamental and extremely positive shift in national emergency management policy by leading the development and implementation of the *National Strategy for Disaster Resilience*.

The Public Service Medal recognises outstanding service by employees of the Australian Government and state, territory and local government employees. Mike was awarded the medal for outstanding public service through the delivery of innovative and effective strategies that protect our communities and improve the national capacity to respond to and recover from national security events.

Experience counts: research finds lessons from bushfires

By Nathan Maddock, Bushfire and Natural Hazards CRC

Research teams are helping communities across many states to gather valuable safety lessons from recent destructive bushfire seasons.

The last few summers have seen a return to hot conditions, following cooler and wetter than normal conditions, thanks to the influence of La Nina weather patterns. Extreme temperatures, ferocious winds and dangerous fire weather have been faced across southern Australia, resulting in large and destructive bushfires.

In the summer of 2012-13, the worst were in Tasmania and NSW. The 2013-14 fire season started early, with more major blazes across NSW in October 2013, followed by devastating fires in Western Australia and South Australia in January 2014.

A bushfire of the intensity of the Forcett fire, which flared up under catastrophic conditions on 4 January 2013, had not been experienced in Tasmania since Black Tuesday in 1967. While this bushfire did not burn into Hobart, as was the experience in 1967, 193 homes were destroyed and 24 000 hectares of bushland and pasture were burnt. In the town of Dunalley, a third of all homes, as well as the primary school and police station, were razed. Boomer Bay, Connellys Marsh, and Murdunna were also devastated and, like Dunalley, significant infrastructure was damaged or destroyed. There was social dislocation and the impact on communities was profound.

In the same fire season, NSW experienced challenging bushfire conditions. Catastrophic fire danger ratings were issued for the first time across a number of areas, including urban centres. A number of major bushfires burned across the state and 62 houses were destroyed; 53 from the Coonabarabran area of central NSW alone.

In October 2013, bushfires again threatened many communities, with more than 200 homes lost across the greater Blue Mountains, the Port Stephens area and Wingecarribee Shire in NSW. Western Australia and South Australia were also not spared, with destructive fires in the Perth Hills and to the north and the fringes of Adelaide.

To maximise lessons learnt during these serious fire seasons, the fire services in NSW, Tasmania, South Australia and Western Australia individually requested that the Bushfire CRC, and its successor the Bushfire and Natural Hazards CRC, undertake independent, community-based research. This research builds on similar projects undertaken by the CRC following the Black Saturday fires in Victoria in 2009, and the Perth Hills and Lake Clifton (Western Australia) bushfires in 2011; adding to the collective knowledge.

Both the Tasmania and NSW research programs, or task forces, focused on people's preparation, decision-making, and actions taken during the fires. For both projects the research team comprised of Australia's leading bushfire researchers from Bushfire CRC partner universities of the Australian National University, Central Queensland University, La Trobe University, RMIT, University of Canberra, University of Tasmania, University of Western Australia, and the University of Canterbury, NZ.

Researchers visited residents in the various fire-impacted areas to learn from their experiences with the bushfires, focusing on their knowledge of bushfire risk, preparations before the bushfire, and their actions taken on the day.

Bushfire CRC CEO, Gary Morgan, indicated that the research is of national significance. 'The data gathered is informing not just the residents of Tasmania and NSW, nor just the Tasmania Fire Service and NSW RFS, but communities and fire agencies across Australia and New Zealand,' he said.

Tasmania research – fire in a tourist hotspot

The research task force team visited the areas affected by the Forcett bushfire in the weeks immediately following the fire. From a base in the car park of the Dunalley pub, the team was led by the University of Tasmania Prof. Timothy Skinner (now at Charles Darwin University) and Dr Jim McLennan from La Trobe University. A total of 226 interviews were conducted of residents across the Tasman Peninsula, in both the effected and surrounding areas. This was made possible with the assistance of staff at the University of Tasmania Rural Clinical School and the Menzies Research Institute.

Damien Killalea, Director of Community Fire Safety at the Tasmania Fire Service (TFS) indicated that the bushfire presented a unique opportunity to assess people's responses.

Dr Jim McLennan interviews residents after the fires near Coonabarabran, NSW.

'There were some unique elements about this fire. The conditions were classed as catastrophic at points and, given the time of year was the New Year holiday period, there were a large number of tourists in the area. These tourists may not have been exposed to TFS safety messages,' said Mr Killalea.

The research also looked at what TFS staff had learnt from Black Saturday, and the changes that have been made to bushfire community safety in Tasmania since that time.

'This bushfire was the first time the TFS has applied on a large scale what we have learnt since 2009. It was a chance to test the range of measures we have put in place.

'The research was vital in that it allowed us to see and measure how the various community safety initiatives put in place in recent years were picked up by the community. The fact that no one died in the conditions that we saw was a great relief.

'The findings from this research are wide-reaching and will inform development of Tasmanian Bushfire Policy.

'Getting independent research findings from the Bushfire CRC is invaluable. For decades, fire agencies made decisions about what was good for the community, and about what they [fire agencies] were going to do, which often overlooked things like public safety. Listening to community members tell us about what they went through and getting direct feedback about what they experienced and how they felt and reacted, is the best way to inform future policy and practices,' Mr Killalea said.

NSW research –record-breaking fire seasons

January 2013 saw temperature records broken across NSW, with many fires occurring. Three of the most significant were at Dean's Gap in the Shoalhaven, Cobbler Road near Yass, and areas around Coonabarabran. The Coonabarabran fire made international headlines when it tore through the Warrumbungle National Park and Siding Spring Observatory.

Rural Fire Services Commissioner, Shane Fitzsimons, noted that these were major fires. 'Both the Dean's Gap and Cobbler Road fires started under catastrophic conditions on 7 January, while the Coonabarabran fire that started on 12 January was particularly large, intense, and had a significant impact on the community.

'The NSW RFS took this opportunity to take a close look at what people did before, during and after the fires, and to see what could be learned from the experiences. The research is possible due to the continuing relationship between the NSW RFS and the Bushfire CRC. Research in this area helps all agencies better understand people's actions and lessons can be identified,' Commissioner Fitzsimmons added.

Throughout February and March, the research team visited the areas surrounding Coonabarabran, Yass, and the Shoalhaven to interview fire-affected residents. Over 230 semi-structured interviews were conducted with community members. In addition, an online survey was conducted with over 970 residents in affected communities.

CRC Research Manager, Lyndsey Wright, said the three fires were chosen for the research due to the extent of areas burnt and the potential for extensive losses, particularly related to houses, stock and, possibly, lives.

'A large number of houses were lost around Coonabarabran and stock losses were particularly significant in the Coonabarabran and Yass shires. But both could have been much higher if it were not for a combination of fortunate weather changes, enormous efforts by RFS volunteers, and the response from residents to minimise the impacts,' said Ms Wright.

While this is the first time the CRC has conducted this type of research in NSW, the experience of the research team, particularly Chief Investigator, Dr Jim McLennan, was invaluable. Dr McLennan is involved with similar research[1] that shows the degree of readiness residents of a particular area may be for a fire.

'Previous research task forces in Victoria, Western Australia and Tasmania demonstrate that readiness for a bushfire threat in a given location is usually related to the history of bushfire in that area. For any given household, a bushfire is a rare event, with most households in bushfire-prone areas not threatened by a fire in the life of the household. Therefore, perceived risk of a bushfire is commonly low.

'Few residents of bushfire-prone areas are actually prepared and ready to leave safely. A majority of people do not have any real appreciation of what a serious bushfire entails, because they are such rare events for any given location,' Dr McLennan said.

The research considers the preparedness of long-term residents, as well as 'tree change' or 'sea change' residents (people who have moved from a city to more rural or coastal areas, attracted by the lifestyle they afford). Previous research shows that 'lifestyle' residents may not be as prepared as people who have lived in a particular area for a long time.

'We look at how confident residents are in their ability to safely defend or evacuate, and how well they understand what this actually involves. Are people fully aware of the physical efforts required to safely defend a home from bushfire, and the significant mental effort required too?

'Similarly, what is the understanding of the right time to evacuate to ensure the safety of all members of the household?' Dr McLennan said.

Adding to the depth of knowledge is the interviews from the greater Blue Mountains, Port Stephens area and Wingecarribee Shire bushfires in October 2013. On this occasion, more than 190 interviews were conducted with residents about their experiences during the fires.

Longer-term benefits

TFS, NSW RFS, and fire agencies across Australia and New Zealand will benefit from the research conducted well into the future. Ms Wright said 'Community participation in the research was fantastic, which enabled a good cross section of community members to be interviewed. The data provides substantial depth to explore for a long time.'

Dr McLennan drew comparisons between bushfire safety and road safety. 'Communicating community bushfire safety is not easy; there is no silver bullet. Similarities can be made with attempts to reduce the road toll. It is now second nature to buckle up, stay under 0.05 and, more recently, practice safe driving with mobile phones. But the reduction in the road toll is the cumulative effect of driver education, infrastructure engineering, and law enforcement, which took decades to achieve across Australia.

'Why would raising community bushfire safety be any easier? Fire agencies need to look for new ways to raise householder awareness of risk and encourage planning and preparation. This needs to go beyond the passive availability of community education material on websites and in paper publications,' Dr McLennan explained.

Full research findings from the 2013 Tasmania and NSW bushfires are available at www.bushfirecrc.com/research/contract.

Similar community safety studies of the bushfire in WA's Perth Hills, and SA's Eden Valley, Bangor and Rockleigh areas have been investigated by the Bushfire and Natural Hazards CRC, with findings available at www.bnhcrc.com.au.

Image: Bushfire CRC

Researchers interview residents in Yass, NSW during the study.

1 McLennan J. Elliot GE. Wright L. 2014, *Bushfire survivial preparations by householders in at-risk areas in south-eastern Australia*. Australian Journal of Emergency Management, v19, no2, pp.11–17.

Australian Emergency Management Handbook and Manual Series

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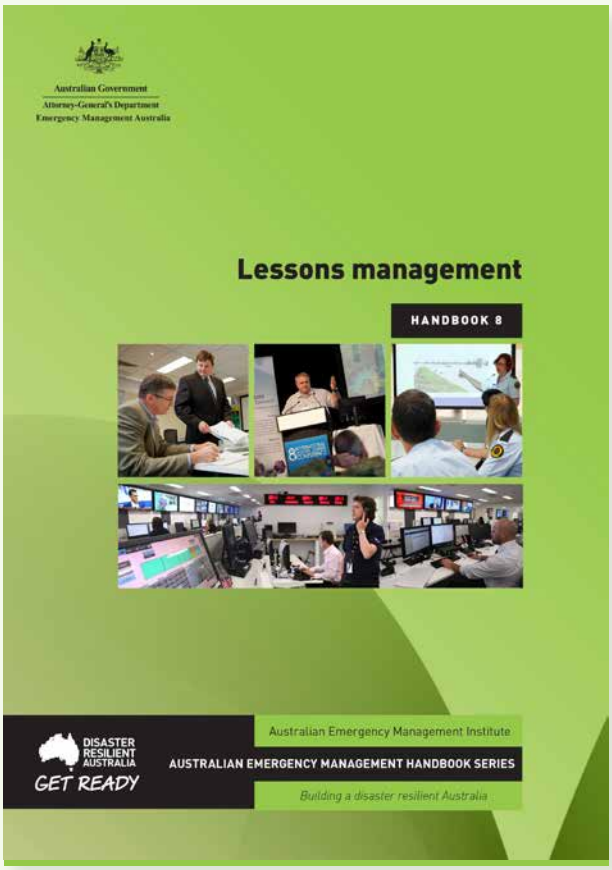

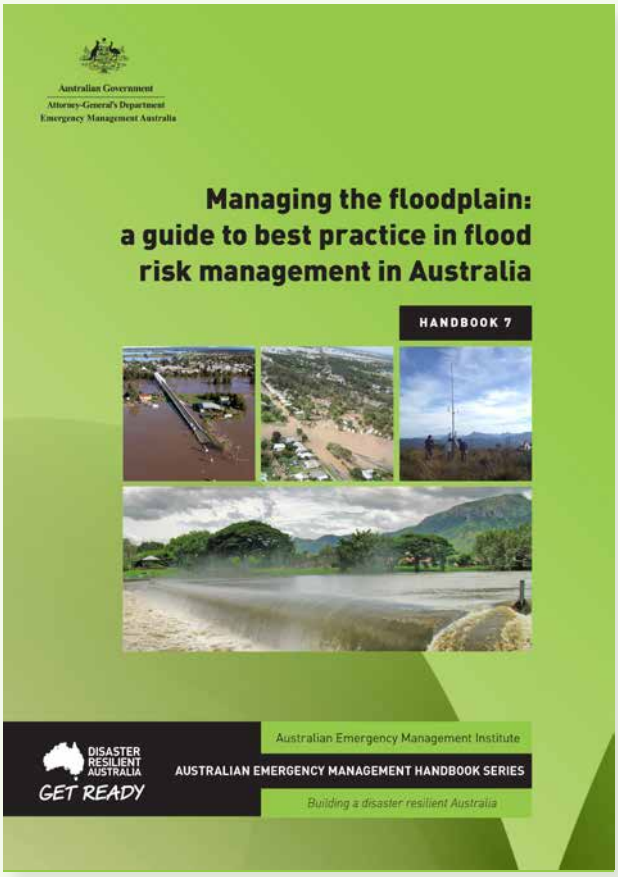

A version of this paper was presented at the Australian & New Zealand Disaster and Emergency Management Conference in May 2014.

Why emergency management should be interested in the emergence of antibiotic resistance

Associate Professor Dale Dominey-Howes, Dr Carolyn Michael and Dr Maurizio Labbate explain why the emergence of antibiotic resistance should be rebranded as a disaster risk management problem.

ABSTRACT

Bacterial epidemics and pandemics are biological risks to life every bit as significant as floods, fires, storms and earthquakes. Antibiotics have been a significant tool in the management of epidemics and pandemics (as well as for fighting general infections) since their discovery in the 1930s. Due to the development of antibiotic resistance by bacteria, we are now approaching a post-antibiotic era where our capacity to manage infectious disease, particularly bacterial epidemics and pandemics, is compromised. Despite considerable efforts by global heath organisations, we need new ways of thinking and acting on the global risk of antibiotic resistance. We argue for a rebranding of the issue to one of a disaster risk and suggest the use of the risk management process and expertise of emergency management to present a new way of thinking about this globally significant risk to life.

Introduction

Disasters take lives, cause devastation, impact individuals, families and communities and disrupt our socio-economic systems (Adger, *et al.* 2005). Infectious disease resulting in epidemics and pandemics represent a disaster risk to life every bit as significant as fire, flood, storm and other common, high profile disasters. Emergency management agencies under the structure of emergency management and response plans, prepare for, and respond to, sudden and slow onset disasters using an 'all hazards approach' and the emergency risk management process. For example, in New South Wales, epidemic and pandemic emergency management arrangements fall to the NSW Ministry of Health via the State Emergency Management Plan (EMPLAN).

Before the 1930s, bacterial infections caused significant morbidity and mortality. Historically, bacteria have been responsible for epidemics and pandemics including the Black Death and Tuberculosis. Antibiotics have saved countless lives, revolutionised medical care (by allowing invasive medical procedures otherwise associated with a high risk of bacterial infection Gottlieb & Nimmo 2011), and provided a powerful tool to aid in the fight of bacterial epidemics and pandemics. However, bacteria have become resistant to antibiotics and we are reaching a 'post-antibiotic era' where bacterial infections will be difficult, if not impossible to treat (Prasad & Smith 2013, CDC 2013, WHO 2012).

As a *slow onset* disaster, antibiotic resistant infections are rising and already affect millions of people globally (WHO 2012). *Sudden onset* antibiotic resistant outbreaks regularly occur in hospitals, affecting the most vulnerable and require costly interventions. In the United States for example, over two million people are affected by antibiotic resistant infections with at least 23 000 deaths annually. This equals US$20 billion in extra healthcare costs and US$35 billion in lost productivity (CDC 2013). Such statistics have led to calls to urgently address this problem coming from, among others, the World Health Organization (WHO) and the Center for Disease Control (CDC) (CDC 2013, WHO 2012) and from respected individuals such as the UK Chief Medical Officer, Professor Dame Sally Davies (Walsh 2013) and the Chief Australian Scientist (Prasad & Smith 2013). They have also become increasingly urgent with Professor Dame Sally Davies calling for antibiotic resistance to be placed on the risk register *ahead* of terrorism (Walsh 2013).

For sudden onset bacterial epidemics and pandemics, antibiotics are one of the major management tools. The emergence of antibiotic resistance means that the capacity of health systems to manage the associated disaster risk is more complicated. The risk is heightened by poor community awareness of the problem of antibiotic resistance (Francis, *et al.* 2012).

How the antibiotic resistance problem has developed

Bacteria, among the oldest forms of life, are mostly harmless to humans and are essential for a healthy environment (e.g. nutrient cycling) and body (e.g.

production of vitamins). Only a minority are pathogenic and, so, deleterious to humans. Bacteria are remarkably resilient and adaptable and have managed to occupy almost every ecological niche overcoming all manner of environmental challenges. Thus, as foretold by the discoverer of Penicillin, Alexander Fleming, resistance to antibiotics was always a given. Particularly striking is the rate at which bacteria have evolved antibiotic resistance. In just 70 years since the first use of Penicillin, some bacterial infections are no longer treatable (CDC 2013, WHO 2012). In this context, humanity is largely to blame. Much has been said about the reasons for the resistance problem (CDC 2013, WHO 2012) which is highly complex. However, in its most basic form, *antibiotic use leads to antibiotic resistance*.

Widespread use, overuse and misuse of antibiotics in multiple settings including medicine, agriculture, and animal husbandry to prevent infection (i.e. prophylaxis), or as a method of promoting increased animal growth, has created strong selective pressures in favour of bacteria that resist antibiotics. Consequently, resistant bacteria are found increasingly on and in humans, farm animals, seafood, fruit and vegetables and in the environment (Baquero, Mrtinez & Cantón 2008, Kemper 2008, Wright 2010). Bacteria acquire antibiotic resistance in two ways. The first is by genetic mutation. The second is by actually passing genetic material containing genes that provide resistance between bacteria — a process called horizontal gene transfer (HGT). The consumption of food or direct contact with people or environments containing antibiotic resistant bacteria can cause normal healthy bacteria in and on humans to acquire resistance via HGT. This acquired resistance may then spread through human communities and may be passed on to disease-causing bacteria during an infection. Once resistance has been acquired by a pathogenic bacterium it is maintained by the continued pressure of antibiotic use, as observed by the levels of resistance in hospitals where antibiotics are commonly used. Through antibiotic use, overuse and misuse, we have added unnecessary fuel to the fire of antibiotic resistance and decreased the shelf life of these important drugs.

Antibiotics are among the most commonly prescribed drugs in human medicine and it is estimated that up to 50 per cent of all the antibiotics prescribed are unnecessarily or ineffectively prescribed (CDC 2013). In Australia, 22 million scripts are written for antibiotics each year. It is extremely likely that a significant number are unnecessary due to inappropriate prescription for, among other reasons, viral infections — a distinction not often understood by the public, health practitioners and the media. In fact, a National Prescribing survey found 62 per cent of patients did not know that overusing antibiotics increased resistance (NPSMW 2013). To date, resistance to one antibiotic was circumvented by the development of new antibiotics. However, following the development of each new antibiotic, bacteria have evolved or acquired new resistance capability. Unfortunately, we can no longer rely on the development of new antibiotics because their pharmaceutical development has stalled due to economic and regulatory reasons (Power 2006). Drug discovery and development is expensive and it is estimated that ~US$1 billion is spent before a drug reaches the market (Power 2006). Given the speed at which bacteria become resistant, a pharmaceutical company may only achieve *circa* five years of revenue before drug effectiveness begins to diminish. Furthermore, courses of treatment are short (typically one week) so the capacity to generate profit is modest. Consequently, society is left with a situation where the current suite of antibiotics is losing its effectiveness and there is a dearth of new antibiotics coming onto the market. Unless something changes quickly, the post-antibiotic era of untreatable bacterial infections, including epidemics and pandemics, is inevitable.

Addressing the antibiotic resistance problem

The problem of antibiotic resistance has not been ignored and expert panels in consultation with governments have made recommendations for reducing the burden of antibiotic resistance. In the most recent WHO report (WHO 2012), recommendations included:

1. **Preventing bacterial infections and the spread of antibiotic resistance:** Implementation of good hygienic practices is effective in controlling the spread of bacterial infections. Regular hand washing can prevent infections being spread. Furthermore, isolation of hospital patients infected with or detected as carrying resistant bacteria is advised.
2. **Surveillance of antibiotics and antibiotic resistance:** Through effective surveillance of antibiotic use and antibiotic resistance, policies and actions may be developed and implemented to control antibiotic use and contain resistance outbreaks. Surveillance of antibiotic resistance can guide prescription in life-and-death medical situations to ensure appropriate selection of an effective antibiotic.
3. **Antibiotic stewardship:** Proper administration of antibiotics by heath practitioners would reduce the selection pressure on bacteria and reduce the emergence of resistance. This includes not using antibiotics when they are not effective and selecting the most appropriate antibiotic for specific infections. Part of the solution is better education of the problem so that appropriate behaviour regarding the use of antibiotics is encouraged.
4. **Reduce use of antibiotics in agriculture:** The use of antibiotics for growth promotion in animals adds unnecessary pressure. As a source of human food, there is direct contact between humans and antibiotics and antibiotic resistant bacteria that facilitates the spread. Even more concerning is that resistant human pathogens are commonly found on food animals. Some countries have banned the use of antibiotics in agriculture but the use is still widely practiced.

5. **Development of new antibiotics, vaccines and other treatments:** More investment from governments into research and development and greater incentive for industry to invest in the development of new antibiotics and vaccines is required.
6. **Development of improved diagnostic tests of bacterial infections:** To assist improved antibiotic stewardship and surveillance, cheaper and more rapid methods to identify specific bacterial infections and detecting antibiotic resistance are required.

Many of these recommendations have been implemented globally. However, their effectiveness is dependent on their enforcement and whether resources are available to implement them. With the declining effectiveness of antibiotics there is a future risk that control of bacterial infectious outbreaks will be troublesome. Already we are seeing hospitals regularly dealing with outbreaks of superbugs requiring ring-fencing of vulnerable patients (barrier nursing), increased cleaning procedures, and increased surveillance of superbugs on patients, hospital staff and the hospital environment. Hospital-acquired (nosocomial) infections, most of which are multi-drug resistant, affect 5-10 per cent of hospital patients costing in excess of AU$2-3 billion (Gilbert, Iredelle & Merlino 2014). At the moment, the vulnerable are at most risk of untreatable nosocomial infections because of compromised immune systems and being exposed to invasive medical techniques such as surgery and catheter use that facilitate direct access of bacteria to the bloodstream.

It seems unlikely that the recommendations previously listed will stem the flow of the emergence of antibiotic resistance. However, it is clear that dealing with the problem is complex and requires a multi-pronged approach that involves consultation and co-operation among stakeholders.

Rebranding antibiotic resistance as a disaster risk management problem

To date, responsibility for responding to the *slow onset* risk of antibiotic resistance has fallen to the health and medical industries. Globally, health authorities and practitioners have done a tremendous job. But, given the scale of the looming crisis, the time has come for other experts to join the fight. Since slow onset antibiotic resistance forms the foundation and trigger for an inevitable rapid onset epidemic or pandemic, the use of the emergency risk management process provides a novel way of thinking about responding to the risk *now.* It provides a useful foundation to engage with the public and others on preparing for and managing the disaster risk of antibiotic resistant bacterial infections generally, and bacterial epidemics and pandemics specifically. The public is, in a sense, already primed to the value of risk management. By analogy, if hundreds or thousands of people were dying each year in bushfires, floods, storms or tropical cyclones, this would be considered a very serious 'disaster risk management problem'. Bacteria are biological *risks* to life and as such, they fall within the context of risk management. Given that many thousands of people *are* dying each year due to the acquisition of antibiotic resistant bacterial infections, the implications for the field of disaster risk management become obvious. This is without consideration of the occurrence of antibiotic resistant bacterial epidemics and pandemics. As such the potential for this approach to be understood by the public is high.

We propose that the issue of antibiotic resistance be *rebranded as a disaster risk management problem* and that the emergency risk management process be adopted in order to provide new ideas and innovations to address the problem. The emergency risk management process (Figure 1) is described in AS/NZS ISO 31000:2009. The process should be integral to management and decision-making, integrated into practices and culture, and tailored to communities and their risk profiles. In an emergency management context, risk management is a process that involves dealing with risks arising from emergency events (such as the occurrence of bacterial epidemics and pandemics). It is a systematic method for identifying, analysing, evaluating, and treating emergency risks and takes an iterative approach with well-defined activities, leading to implementation of effective risk-treatment strategies. In the case of antibiotic resistance, mitigation measures for sudden onset antibiotic resistant epidemics and pandemics identified by the framework complements measures already implemented by medical health authorities for slow onset antibiotic resistance infections generally.

The process comprises five elements:

- establishing the context
- identifying the risks
- analysing the risks
- evaluating the risks, and
- treating the risks.

These elements are supported by enabling activities of communicating and consulting, and monitoring and reviewing, which apply to each of the major elements of the process. Risk assessment (the yellow part of Figure 1) also comprises the *identification, analysis and evaluation of risk* elements of the emergency risk management process. This is important to understand, together with the idea of 'communication and consultation' with stakeholders, because high community perceptions and awareness of risk to life is one of the central tenants of effective disaster risk reduction (Bird 2009, Hoppner *et al.* 2012).

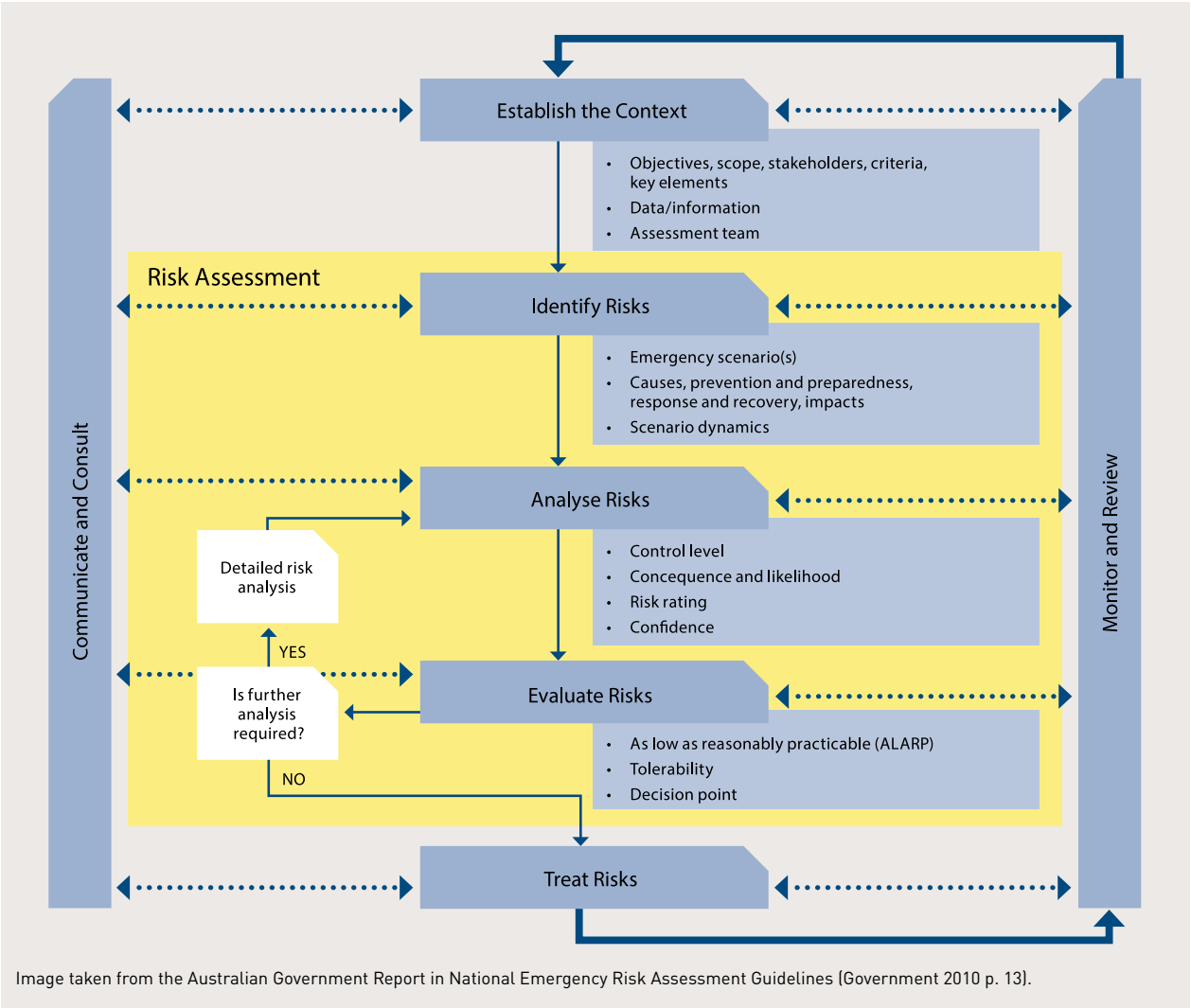

Image taken from the Australian Government Report in National Emergency Risk Assessment Guidelines (Government 2010 p. 13).

Figure 1: The emergency risk management process used by governments worldwide.

In relation to the emergence of antibiotic resistance and its effect on the risk profile of epidemic and pandemic infections, poor community risk perception is thought to lead to inappropriate behaviours such as patients demanding antibiotics for viral infections or patients failing to complete a course of antibiotics. Given the significance afforded the problem by global organisations like the CDC and the WHO, it is curious that the issue of antibiotic resistance seems so little understood, or of such low concern, to the public generally. This continues despite Option 3 (Antibiotic stewardship) by the WHO (and repeated by others) of engaging with the community through education programs to raise awareness of the issue.

Poor community risk perception is well known in the wider disaster risk reduction literature for influencing appropriate and inappropriate risk behaviour. Significantly, we do not have a comprehensive understanding of how communities perceive antibiotics, their use, and the problem of antibiotic resistance generally. A thorough understanding of these factors is necessary to guide education programs and strategies that reduce risk and increase community resilience. Consequently, we are missing a significant element of the data required to assess the risk as detailed in the emergency risk management process. Addressing the problem of why communities have poor risk perception is easily investigated and one of the simplest challenges to address. Risk managers have a critical and useful role to play. Risk managers can help as they are experienced in investigating why communities behave the way they do, hold the views and perceptions of risks they do, and can communicate complex risk information to the public.

Where to from here

Modification of community behaviour is probably the cheapest and most effective way of dealing with the issue of antibiotic resistance and managing the associated risk. An understanding of the barriers that are preventing appropriate decision-making in the request and prescription of antibiotics is necessary for designing targeted and effective education campaigns to the community and health practitioners. Consequently, in order to address this issue and shift the public discourse to one of increased community engagement and awareness, a rebranding of the issue

away from one of 'general health and medicine' to one of 'disaster risk reduction' would be helpful and represents a novel approach not yet considered. It is our opinion that the emergence of antibiotic resistance is in fact, a risk that ought to be framed as a disaster risk management problem. Consequently, we make an urgent and novel call for the emergency management community and socio-behavioural experts in risk perception to recognise the threat that the emergence of antibiotic resistant bacterial infections represents generally, and antibiotic resistant bacterial epidemics and pandemics specifically. It is our profound view that such an approach would deliver multiple benefits including:

- increased community understanding and awareness of the profound risk to health and life of the emergence of antibiotic resistance generally and the implications for the occurrence of antibiotic resistant bacterial epidemic and pandemic infections specifically
- improved individual and community behaviour (risk management/adaptation) in relation to the risk leading to a reduction in the selection pressure driving the emergence of antibiotic resistance
- enhanced skills and capacity of the health service professionals to treat and support communities facing antibiotic resistant infections, especially epidemics and pandemics
- improved emergency management capacity to anticipate and cope with the risk of antibiotic resistant epidemics and pandemics as well as the emergence of resistant infections in the community, and
- reduced death, suffering, loss and burden of disease.

We strongly urge the emergency management community and risk researchers to join the fight before it is too late – before an antibiotic resistant bacterial epidemic or pandemic strikes.

References

Adger N, Hughes T, Folke C, Carpenter S & Rockstrom J 2005, *Socio-ecological resilience to coastal disasters. Science 309: pp. 1036-1039.*

Australian Government 2010, *National Emergency Risk Assessment Guidelines. Department of Police and Emergency Management. At: ww.em.gov.au/Documents/National%20 Emergency%20Risk%20Assessment%20Guidelines%20 October%202010.PDF.*

Baquero F, Martínez J & Cantón R 2008, *Antibiotics and antibiotic resistance in water environments. Curr Opin Biotechnol 19: pp. 260-265.*

Bird D 2009, *The use of questionnaires for acquiring information on public perception of natural hazards and risk mitigation – a review of current knowledge and practice. Natural Hazards and Earth System Sciences 9: pp. 1307-1325.*

Centers for Disease Control and Prevention 2013, *Antibiotic resistance threats in the United States 2013.*

Francis N, Gillespie D, Nuttall J, Hood K, Little P, Verheij T, Coenen S, Cals J, Goossens H, Butler C & Group GP 2012, *Antibiotics for acute cough: an international observational study of patient adherence in primary care. Br J Gen Prac 599: e429-437.*

Gilbert L, Iredell J & Merlino J 2014, *Healthcare infection prevention and control really is everyone's business. Microbiology Australia 35: pp. 3-4.*

Gottlieb T & Nimmo GR 2011, *Antibiotic resistance is an emerging threat to public health: an urgent call to action at the Antimicrobial Resistance Summit 2011. Med J Aust 194: pp. 281-283.*

Hoppner C, Whittle R, Brundi M & Buchecker M 2012, *Linking social capacities and risk communication in Europe: a gap between theory and practice. Nat Hazards 64: 1753-1778.*

Kemper N 2008, *Veterinary antibiotics in the aquatic and terrestrial environment. Ecol Indic 8: pp.1-13.*

National Prescribing Service Medicine Wise (NPSMW) 2013, *Antibiotic resistance is everyone's problem - be part of the solution. At: www.nps.org.au/media-centre/media-releases/ repository/Antibiotic-resistance-is-everyones-problem-be-part-of-the-solution [14 April 2014].*

Power E 2006, *Impact of antibiotic restrictions: the pharmaceutical perspective. Clin Microb Infect 12: pp. 25-34.*

Prasad S & Smith P 2013, *Meeting the threat of antibiotic resistance: building a new frontline defence. Australian Government, Office of the Chief Scientist.*

Walsh F 2013, *Antibiotics resistance 'as big a risk as terrorism' - medical chief. BBC News, United Kingdom.*

World Health Organization (WHO) 2012, *Overcoming antibiotic resistance. World Health Organization Report on Infectious Diseases.*

Wright GD 2010, *Antibiotic resistance in the environment: a link to the clinic? Curr Opin Microbiol 13: pp. 589-594.*

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How chief officers view success in fire policy and management

Dr Michael Eburn and Professor Stephen Dovers, Australian National University, undertake research into possible measures of success when evaluating emergency response.

ABSTRACT

This paper reports on research that asked chief officers from Australia's fire and emergency services what they identify as a measure of success. When identifying appropriate measures of success, community members need to consider and acknowledge multiple, sometimes competing issues. Accordingly this research cannot give a definitive answer to 'what is the measure of success?' but it is argued that emergency services, political leaders and at-risk communities need to engage in a more meaningful discussion about what can realistically be expected from each other. The outcomes of those discussions have to move past the rhetoric that 'this should never happen again' and need to be reflected in the policy and legislative goals that instruct emergency managers and in the ongoing communication about risk and responsibility for managing risk.

Introduction

In his review of the 2011 Perth Hills bushfires former Australian Federal Police Commissioner Mick Keelty (2011, p. 3) said:

> *'There remains one question the answer to which eluded the Special Inquiry but it is an answer that requires further examination and that is: What is the measure of success of the outcome of a bushfire? Is the loss of no lives the only performance measure? If so, how many houses is an acceptable number to lose?'*

In a review of the response to the 2013 Tasmania Fires, former South Australian Police Commissioner Malcolm Hyde (2013, p 198) said:

> *'How do you judge success in emergency response operations? This was a question considered in the Special Inquiry into the Perth Hills Bushfire 2011, and it was not able to be answered... This conundrum is not lost on chief fire officers. At an Executive Forum this year, chief fire officers and commissioners considered this very issue, noting there were different ways to measure success; they too were unable to answer the question.'*

Keelty said that finding the answer to this question requires further examination. To contribute to that examination a sample of senior officers from Australia's fire and emergency services were canvassed on what they used, or could use, as their measures of success. The research does not attempt to, and cannot, give a definitive answer to 'what is (or should be) the measure of success?', rather it reports the views of the sample, and presents a series of arguments to inform further research and discussion.

Current Australian policy calls for responsibility for natural hazards is to be 'shared' (COAG 2011). In order to share responsibility governments and its agencies need an articulated view of its role and how to define 'success'. Determining the policy and management objectives for fire and emergency management is complex, messy, and political but if emergency services, and those who lead them, wish to avoid being judged by unknown, vague or conflicting criteria, they need to engage in discussions between themselves, their staff, their community, and their political leaders to explain what they see as success and failure. In order to start that discussion, researchers from the Australian National University (funded by the Bushfire Cooperative Research Centre) asked a sample of chief officers from Australian fire and emergency services organisations what they considered to be appropriate measures of success.

Methodology

Semi-structured interviews of 30-120 minutes were conducted with chief officers who attended the 2011 Australasian Fire and Emergency Services Authorities Council (AFAC) Command Forum, and who agreed to take part. These officers were either the Commissioner of the agency, who was both chief executive and principal operations officer, or, in those agencies where operational responsibility was separate from the administrative role, officers charged with managing response operations. These included operations officers, chief fire officers, and fire control officers.

Regardless of the formal title, all participants are referred to here by the term 'chief officer'.

There were 36 chief officers at the 2011 AFAC Command Forum representing 27 separate fire and emergency services agencies from each Australian jurisdiction as well as New Zealand. Interviews were conducted with 18 officers (50 per cent), representing 16 agencies (60 per cent), and seven of the nine (including New Zealand) jurisdictions (seven per cent).

The interviews were recorded and transcribed except in two cases where technical failures led to reliance on manual transcriptions made during the interview. The responses were analysed to identify what the chief officers saw as the measure of success when responding to an emergency and, in particular, a catastrophic event such as the Black Saturday bushfires in 2009. The research was approved by the Australian National University Human Research Ethics Committee (ANU 2011). Although all participants were asked common stimulus questions, only representative quotes are set out in this paper. The interviews were given with a commitment to anonymity and research participants are not disclosed. A discussion paper reporting the larger research project and including quotations and inferences drawn from the interviews was circulated to a wider officials group, including the interviewees, to communicate results and verify the analysis as valid. The conclusions reported here were presented to the 2013 Sydney AFAC Command Forum to inform their discussion on identifying measures of success.

Background

Before reporting the chief officers' views, some background will help identify why this issue is important to emergency managers. Following major natural hazard events such as the Victorian Black Saturday bushfires in 2009, the Queensland and Victorian floods in 2011, the Perth Hills bushfires in 2011, and the Tasmanian fires in 2013, Australia has used formal, complex, post-event inquiries to identify how the tragedy occurred and what can be done to prevent a similar occurrence in the future. (The authors will report, elsewhere, on research into the current carriage of such inquiries and possible future alternatives (Eburn & Dovers, forthcoming)). A problem facing post-event inquiries is identifying the standard by which emergency services are to be judged: that is, what does success actually look like? (Keelty 2011, Hyde 2013). Neither the Commonwealth, nor the states and territories, have a clear statement on what emergency management policy is meant to achieve. They fail to state either the policy objective or how achievement of that objective will be monitored and evaluated. For example the objectives of emergency management are described in legislation as:

- 'to protect and preserve life, property and the environment' (*Emergencies Act 2004* (ACT) s 3)
- to ensure that 'adequate measures' are taken to 'prevent, prepare for, respond to and assist recovery from emergencies' (*State Emergency and Rescue Management Act 1989* (NSW) s 10(1)(a))
- to provide 'effective' response to a disaster or emergency and to have 'effective' disaster management (*Disaster Management Act 2003* (Qld) s 3), or
- to ensure that emergency management is organised 'within a structure which facilitates planning, preparedness, operational co-ordination and community participation' (*Emergency Management Act 1986* (Vic) s 4A).

The *Emergency Management Act 2013* (Vic) has been passed by the Victorian Parliament but, at the time of writing, is not yet in force. Once commenced, the Act will convey the express objective of fostering 'a sustainable and efficient emergency management system that minimises the likelihood, effect and consequences of emergencies'. The statutory objective, in those terms, recognises that there are limitations in emergency management (hence the goal to 'minimise' rather than avoid, the impact of emergencies) and trade offs (hence the need to ensure arrangements are both sustainable and efficient).

Statements that agencies 'can take appropriate and timely action to prevent or mitigate, respond to and recover from emergencies' (Emergency Services Commissioner 2009, p. 1.5) or that an agency is required to take '... all necessary steps for the prevention and suppression of fires and for the protection of life and property in case of fire' (*Country Fire Authority Act 1958* (Vic) s 20) imply that such control, action or necessary steps can, in fact, be taken (Interviewee #14); but this is not always the case.

Policy objectives that refer to 'effective' or 'adequate' measures are unhelpful as they are devoid of meaning. A goal to have 'effective' or 'adequate' measures begs the question of 'effective or adequate for what purpose?' The fire and emergency services are 'adequate' for most events; events that are 'routine' and even rare but 'normal' 'non-routine' events, but not for 'complex unbounded' events (Handmer & Dovers 2013). In the event of overwhelming events, the resources and response of emergency services will always be 'inadequate' even if they save many, but not all, lives.

Objectives 'to protect and preserve life' or to 'control' or 'prevent' the impact of an event are also unhelpful, as they imply that all lives can be protected or control can be exercised. If a life is lost or the fire or hazard is not controlled, prevented or supressed, then there has been failure regardless of what is saved and preserved. It follows that the current range of policy objectives is not necessarily helpful in either guiding action or informing post-event evaluation and does not provide an answer to the critical question – 'What is the measure of success of the outcome of a bushfire (or other natural hazard)?'

The chief officers' measures of success

In light of Keelty's question, the chief officers interviewed were asked to explain the measures they applied, or thought should be applied, to determine whether the response to an emergency, and in particular a bushfire, had been a success. The chief officers nominated a number of possible measures, which are reported under three themes each having its own limitations.

Theme I: Measure what is saved rather than what is lost

The majority of chief officers believed that response is measured by what is lost, rather than what is saved.

Theme 1: Measure what is saved rather than what is lost
... if you save 500 houses and you lose 10, should you be satisfied? Yes, on one hand you would say, well, you know there was 510 houses that could have been lost. We only lost 10. (Interviewee #3)
... if you look at the extent of the impact and how many people could have potentially died, and how many people were in that area and didn't die, and you got it right down to 173 out of say potentially 10,000 people. That to me is probably quite successful. You know, people see 173, they don't see how many people were in the area and affected and impacted. (Interviewee #8)
... the media's sensationalised the fire fighting and they never really ... look at all the houses that didn't burn down ... No, it's all about doom and gloom. The guy going through all his possessions that are burnt ... create a bit of controversy over that... that's their measure. (Interviewee #11)
... what's always reported is the losses rather than the saves ... ultimately we're judged usually by a couple of hours on a Saturday afternoon ... Where all your prevention and preparation works essentially counts for naught. (Interviewee #12)
Generally most events, we measure success in a negative context ... it's about measure of loss. How many houses were lost, or how many people died... there's got to be some measure there that relates efforts to things that have been saved, so people and houses. (Interviewee #16)

The difficulty with this measure is identifying what is saved. If a house does not burn, or better yet, if effective hazard reduction activities coupled with pro-active policing means no fire happens, even on a day of catastrophic fire weather conditions, then it's hard to claim credit for the absence of fire. In 2012 the South Australian power provider, ETSA, disconnected the power on a day of extreme fire danger. There was criticism of their actions (ABC 2012); in particular Broome and Smith (2012) argued that the risk to human health and safety from disconnecting the power exceeded the reduced risk of death and injury from bushfire. If a post-event review had found there had been a spike in the number of deaths due to heat related effects that may have been avoided had the electricity supplied been maintained and air conditioners operated, then it would be possible to say ETSA's decision 'caused' those extra deaths. But it is impossible to say how many people did not die from the bushfire that did not, and may never have, happened.

Further, to put the issue in harsh terms 173 people died in 2009 during the Black Saturday fires but that may well have been a successful outcome if the objective had been to 'minimise' the number of deaths. The agency response may have saved many more people than died but it is unacceptable to stand before a community, particularly one that was affected by fire, and claim that the loss of 173 lives was evidence of successful firefighting and community engagement, or even a reasonable outcome when measured against realistic expectations or possible outcomes. Again, the counter-factual of deaths avoided is difficult, if not impossible, to establish.

Theme II: We stuck to the plan and did our best

Another suggested measure of success, is to ask whether the agency and staff did all, or the best, that they could? Did they stick to the plan and meet their objectives?

Theme 2: We stuck to the plan and did our best
... our Commissioner would be satisfied if we could demonstrate that we have followed our procedures and we had done everything that - you know, we ticked the boxes... (Interviewee #3)
The expectation is ... everyone's done the best job they can with the resources they have and the knowledge and skill sets that they have. (Interviewee #5)
So, to me, the measure of success from an agency perspective is... can we tick all the boxes and say we did everything possible.... (Interviewee #6)
If you set the objectives for the operation based on the context of what's unfolding and you meet those objectives that's probably a reasonable measure of success... If [the objective was to] ... minimise the loss of life and you did, so if you lost four out of 5000, that's minimised it. (Interviewee #8)
... what were your objectives? Were your objectives met? Now, I think that is the only measure you can come up with and if you say my objective was to save the life of the people living here, and if that objective was achieved then I would say yes, it was a success because that was what you were intending to do and if you achieved it then you have succeeded. (Interviewee #9)

Objectives are unlikely to be met in every event as circumstances may overwhelm resources and because the fire or other event may not behave as expected. Decisions are made in a dynamic environment that is information poor. A decision may be the best decision given the information available but it does not follow that the outcome will be as expected or that the objective will be achieved or that, in the circumstances, the response was a failure.

Further, adhering to the plan can also lead to an unsuccessful outcome. A Scottish Sherriff (the equivalent of the Australian Coroner) criticised incident controllers at a rescue scene because 'they rigidly stood by their operational guidelines' (Leslie 2011) and delayed a rescue with the effect that a trapped person died from the complications caused by the delay. The Sheriff said that the Incident Controller considered that the operation was a success because he struck rigidly to the fire service policy, which required him to withdraw his officers and wait for the arrival of the Police Mountain Rescue Squad. According to the Sheriff however, 'this was not a successful operation: a woman died who had not only sustained survivable though life threatening injuries, but who had also ultimately suffered and died from acute hypothermia...' (Leslie 2011). Relying on pre-defined guidelines and procedures, sticking to the plan and focussing on pre-set objectives, leads to a situation where managers are 'damned if they do; and damned if they don't', with the assessment depending on the outcome rather than the processes followed.

An argument that success is achieved when 'everyone's done the best job they can' is also doomed to fail, at least in the face of media and political scrutiny and often in inquiries. After catastrophic events there are post-event inquiries and each one will find areas of breakdown in communications, resources, or decision-making. Each inquiry is able to point to examples where, with hindsight, someone did not do 'the best' that they could have done (Schapel u.d, Doogan 2006, Hope u.d).

It should be noted that courts of law, unlike the media and, arguably post-event inquiries, can be much more sympathetic to the circumstances of an emergency. In deciding questions of legal liability the courts have recognised that an emergency warrants prompt action that, in hindsight, may not have been the best decision. It has been said that a rescuer, 'acting under the pressure of emergency, is to be judged leniently as to the reasonableness of his conduct' (*Wallis v Town of Albany* (1989) Aust Torts Reports 80-283 , ¶69,011) and that:

> *[A] man is not to be charged with negligence if he ... finds himself faced with a situation which requires immediate action of some sort and if, in the so called "agony of the moment", he makes an error of judgment and takes a step which wiser counsels and more careful thought would have suggested was unwise.*
>
> (*Leishman v Thomas* (1958) 75 WN(NSW) 173 , p. 175)

Finally:

> *The law appreciates that a rescuer may act – and may feel impelled to act – under the pressures of the moment, where delay may be considered vital to the safety of those he is considering protecting from risk. It is not appropriate to subject a rescuer's actions, or his subjective view of the risks involved to himself and/or to others, to fine scrutiny in the court room.*
>
> (*Tolley v Carr* [2010] EWHC 2191, ¶22-¶23).

As the Canberra bushfires in 2003 show, a post-event inquiry into a catastrophic event may be very critical but the court findings may not be the same. After that event the ACT Coroner made adverse comments about the then Minister and the performance of three senior officers in the Emergency Services Authority (Doogan 2006), but the litigation over those fires settled with a verdict in favour of the Territory Government (Andrews & Doherty 2012).

Theme III: No responder deaths

A consistent view of interviewees was that no responder deaths was a measure of success. Even so, some officers recognised that the community may expect that emergency responders will put themselves at risk to help others.

Theme 3: No responder deaths
I suspect that a community would think [if no civilians died, but a fire fighter died] well, they're fire fighters; they're like front line troops. They are putting themselves in danger to tragedy; that fire fighters died; but that's one of the risks of doing the job that they do. (Interviewee #1)
Our success rates in fire fighter safety are very high. So that has to be an indicator.... The aspirational goal is no loss of life, but not at the cost of more lives. ... [A fire fighter death] will always scar that operation. It's no longer successful because there's been a fire fighter death. ... the fire fighter death brings it right down. It brings it right down because ... fire fighters are meant to be trained to avoid all of that. To be calculated and risk savvy ... So when they die something has clearly gone wrong; clearly gone wrong... (Interviewee #8)
Look I think the community are accepting [of fire fighter deaths] ....the community will probably say well, you choose to do that and you do accept the risk that you might die doing it. I think they'd perhaps probably say that to fireys. But I don't think they'd be keen for us to say it back the other way. You choose to live on the side of a hill with trees all around you - you've got to accept the risk that you're going to die. I don't think there's too many people would really agree with that. (Interviewee #10)

This measure is supported by modern health and safety legislation. This was highlighted in the UK by the (ultimately unsuccessful) criminal prosecution of incident controllers who responded to a warehouse fire where four firefighters died (Ellicott 2011, Hayes 2011). In Australia, uniform workplace, health and safety laws require a 'person conducting a business or undertaking' to 'so far as is reasonably practicable' ensure the health and safety of workers (for example, *Work Health and Safety Act 2011* (NSW) s 19(1)). While chief officers, incident controllers, and first responders must consider the interests of individuals who are at risk from fire or other hazard, the law is clear that the primary duty is to firefighter safety.

Although the chief officers saw firefighter safety as a measure of success, they were pragmatic that the community may not share that view, expecting firefighters and emergency workers to put themselves at risk to protect others. A recent UK Coroner said, when delivering a critical review of the actions of two

paramedics who refused to enter a water filled ditch to try to rescue a trapped driver, 'I was brought up in a country where men risked their own lives to save the lives of others. That was a period in our history which has almost ceased' (Robinson 2013).

Discussion

There is no assumption that there should, or could, be a single measure of success when reviewing the response to a natural hazard. What constitutes a success is contested, and each potential measure is not without its difficulties. Different stakeholders may all want and expect different outcomes depending on their role and responsibilities, and each event is dynamic with considerable uncertainty. The problems of measuring success were identified, even in this initial exploration, and what represents a success will vary with each stakeholder's position. This may not be news to those engaged in the broader study of politics and political science but may be news to the chief officers and their staff who find themselves subject to regular criticism after each event, as the following sample of recent Australian newspaper headlines shows:

- State cops fire blame (*Herald Sun* 24 July 2003)
- Fire claims aims to make governments accountable (*Canberra Times* 21 July 2005)
- Fireys 'blunders' to blame for deaths (*The Australian* 19 December 2007)
- State blamed for bushfires (*Sunday Age* 3 October 2010)
- Nowhere to hide for WA authorities after fire fiasco (*The Australian* 19 August 2011)
- Damning report on Tasmania's bushfire crisis finds lives probably put at risk (*ABC* 16 October 2013)

This study has gathered the views of the leaders of a substantial sample of Australia and New Zealand fire and emergency services. They represent one perspective. Communities, media commentators, social and environmental researchers, governments, courts and others may have different views. It is argued that the measures of success proposed by the chief officers who took part in these interviews may also be flawed and therefore ineffective or unacceptable as measures of success. What this shows is that just as the post-event inquiry does not have clear measures of success by which to judge the preparation for, and response to, a major event (Keelty 2011, Hyde 2013), neither do the officers charged with leading the response to the emergency.

This discussion has not answered Keelty's question and does not identify what are reasonable measures of success, rather it reveals the absence of clear measures of success. Research *per se* cannot identify 'the' measures of success, they are not waiting to be discovered; rather they need to be negotiated between stakeholders. Current Australian policy calls for responsibility for natural hazards is to be 'shared' (COAG 2011). In order to share responsibility it is vital that governments and its agencies have an articulated view of what it and the fire and emergency services organisations would consider a successful outcome. There are no clear measures of success and the suggested measures identified by chief officers are themselves problematic and identify critical policy gaps. It falls on agencies and their political leaders to engage with stakeholders to identify and explain what they see as success and failure. If communities and individuals better understand what they can expect from emergency services organisations, they can make a more informed judgement on what they need to do to protect themselves.

Conclusion

This research was stimulated by Commissioner Keelty's question 'What is the measure of success of the outcome of a bushfire?' As Commissioner Keelty noted, this question 'requires further examination' and this research forms part of that further examination. Identifying the views of chief officers is important as they lead their agencies and their views and intentions affect the operational decisions at the front line. The major finding from this research is that there are no clear measures of success and that the suggested measures identified by chief officers are themselves problematic and are unlikely to stand up to detailed scrutiny in the next post-event inquiry. It has been argued that identifying some measures of success is essential in order to inform those at risk as to what they may expect from emergency service agencies and what they must do for themselves; and to give those agencies at least some starting point for evaluating performance after the next significant event. The chief officer views can form the starting point of a discussion within and between agencies and the community. In the longer term, realistic statements identifying negotiated measures of success and acknowledging the necessary trade-offs and tensions, could be expressed in policy statements and legislative materials, and communicated more widely.

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References

ABC 2012, *'ETSA defends decision to cut power'. At: www.abc.net.au/news/2012-01-03/etsa-defends-power-cut-decision/3756354 [3 January 2012].*

Andrews L & Doherty M 2012, *'Fire litigation ends for ACT' The Canberra Times (online). At: www.canberratimes.com.au/act-news/fire-litigation-ends-for-act-20120920-268d2.html [20 September 2012].*

ANU 2011, *Australian National University Human Research Ethics Committee, Human Ethics Protocol 2011/480, 26 September 2011.*

Broome R & Smith W 2012, *'The definite health risks from cutting power outweigh possible bushfire prevention benefits' 197(8) Medical Journal of Australia pp. 440-441.*

Council of Australian Governments (COAG) 2011, *National Strategy for Disaster Resilience, Commonwealth of Australia, Canberra.*

Doogan M 2006, *'The Canberra Firestorm: Inquests and Inquiry into Four Deaths and Four Fires between 8 and 18 January 2003', ACT Coroners Court, 2006.*

Eburn M & Dovers S (Forthcoming) *'Learning lessons from disasters: alternatives to Royal Commissions and other quasi-judicial inquiries' Australian Journal of Public Administration (accepted for publication).*

Ellicott C 2011, *'Three brigade bosses to be charged with manslaughter over deaths of four firefighters in warehouse blaze'. At: www.dailymail.co.uk/news/article-1361454/Fire-brigade-bosses-charged-manslaughter-warehouse-blaze.html.*

Handmer J & Dovers J 2013, *'Handbook of Disaster Policies and Institutions: Improving Emergency Management and Climate Adaptation' (2nd edition). Earthscan-Routledge, London.*

Hayes S 2011, *'Atherstone fire charges could be dropped' Lemington Observer (Online). At: http://leamingtonobserver.co.uk/2014/02/12/news-Atherstone-fire-deaths-caused-by-major-organisational-failings-96070.html.*

Hope AN (u.d) *'Inquest into the deaths of Trevor George Murley, Lewis Kenneth Bedford and Robert Wayne Taylor' (Western Australia Coroners Court, undated).*

Hyde M 2013, *'2013 Tasmanian Bushfires Inquiry: Volume One' (State of Tasmania: Hobart, Australia).*

Keelty M 2011, *'A Shared Responsibility: The Report of the Perth Hills Bushfire February 2011 Review' (Government of Western Australia, Perth).*

Leslie DJ 2011, *'Fatal Accident Inquiry under the Fatal Accidents and Sudden Deaths Inquiry (Scotland) Act 1976 into the Death of Allison Hume' [2011] FAI 51. At: www.scotcourts.gov.uk/opinions/2011FAI51.html [16 November 2011].*

Office of the Emergency Services Commissioner 2009, *'Emergency Management Manual Victoria; Part I Emergency Management in Victoria' (Government of Victoria, Melbourne).*

Robinson M *'Coroner condemns paramedics who refused to save drowning man in ditch 'for health and safety reasons' MailOnline. At: www.dailymail.co.uk/news/article-2368415/Coroner-condemns-paramedics-refused-save-drowning-man-ditch-health-safety-reasons.html#ixzz2b4ERinRp) [18 July 2013].*

Schapel AE (u.d.) *'Inquest Into The Deaths Of Star Ellen Borlase, Jack Morley Borlase, Helen Kald Castle, Judith Maud Griffith, Jody Maria Kay, Graham Joseph Russell, Zoe Russell-Kay, Trent Alan Murnane and Neil George Richardson' (Coroners Court of South Australia undated).*

Teague B 2009, *'Victorian Bushfires Royal Commission, Chairman's Opening Remarks'. At: www.royalcommission.vic.gov.au/getdoc/ee8eec7c-da6c-4c97-9ec8-3553d705f102/Opening-Remarks---Chairman.*

The Age 1939, *'Commission on Bush Fires'.*

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Negotiating risk and responsibility through law, policy and planning

Dr Blythe McLennan, RMIT University, Dr Jessica K Weir, University of Canberra and University of Western Sydney, Dr Michael Eburn, Australian National University, Professor John Handmer, RMIT University, Professor Stephen Dovers, Australian National University and Professor Barbara J Norman, University of Canberra, distil and summarise some key conclusions regarding developing public policy for natural hazard risk in Australia.

ABSTRACT

The 2011 *National Strategy for Disaster Resilience* (COAG 2011) sets the context for natural disaster management as a 'shared responsibility' of all sectors of government and society, as part of building a more comprehensive approach to emergency management. However, it remains difficult to change relationships and practices to share responsibility, either between emergency management agencies and other government sectors, or between governments and at-risk communities. This paper reports on the research of three independent but complementary projects established through the Bushfire Cooperative Research Centre to identify the legal, policy and planning structures and processes that could enhance integration of emergency management imperatives across public policy sectors, agencies and portfolios. This article distils and summarises some key conclusions regarding a central, yet seriously under-acknowledged facet, of developing public policy for natural hazard risk in Australia: the political and social negotiation of risk and responsibility. This is an overview paper and many of the issues raised require further exploration.

Introduction

Nationally and internationally, the development of comprehensive emergency management policy and practice is focusing attention on both the need for a whole-of-society approach and for inclusion of all aspects of risk management, of which the initial emergency response is one aspect (Handmer & Dovers 2013, EMA 2004b). This has concentrated research attention on the policy and governance challenges of bringing the possibility of future risk events into the present. At the same time, the expansion of climate change exacerbates disasters and is underscoring the importance of this work (see, for example Hughes & Steffen 2013, IPCC 2012, Gurran, Norman & Hamin 2012, Norman *et al.* 2013).

In Australia, primary statutory responsibility to manage natural hazard risk rests firmly with state fire and emergency services organisations, with federal government support and national scale co-ordination. However it does not automatically follow that emergency services organisations in Australia can and should solely bear this responsibility on behalf of the rest of government and society. That emergency management is inherently a collective undertaking involving a range of parties acting in co-ordination to achieve a mutual goal has been a central tenant in formal arrangements, if not in practice, since the 'all hazards, all agency' focus of the Comprehensive Emergency Management model adopted in the late 1980s (see EMA 2004a). While the focus of the Comprehensive model was firmly on the players in the emergency management sector, subsequent policy developments have expanded the range of both government and non-government parties with recognised responsibilities to manage and respond to natural hazard risk in a co-ordinated way. In particular, the addition of a more overtly risk-based management approach from the 1990s put greater emphasis on the responsibilities of the exposed people and communities to reduce risk (Kanowski, Whelan & Ellis 2005, Elsworth *et al.* 2009). While the more recent and widely supported shift towards a 'whole-of-nation, resilience-based' strategy (McLennan & Handmer 2013a, COAG 2011) positions disaster management as a shared responsibility of government and society.

These policy developments comprise important steps in ongoing attempts to confront the complex, interdependent and multi-faceted challenges of managing natural hazard risk in modern Australia. They address the reality that managing natural hazard risk is beyond both the control of any single policy sector, or the collective public institutions of government.

Yet despite the growing emphasis on 'shared responsibility' in disaster and emergency management policy rhetoric, it is difficult to change actual relationships and practices to share responsibility; either between emergency management and other government sectors (e.g. 'mainstreaming' policy across sectors, see Eburn & Jackman 2011) or between governments and at-risk communities.

It was in this context that a three-year research program (the 'Mainstreaming program') was established through the Bushfire Cooperative Research Centre in mid 2009. The Mainstreaming program identified legal, policy and planning structures and processes that could enhance integration of emergency management imperatives across public policy sectors, agencies and portfolios. The program comprised three independent but complementary projects:

- The Law and Policy project (Australian National University) asked how law impacts on the responsibilities of the emergency management sector and, in particular, state emergency services organisations.
- The Planning project (University of Canberra) exposed bushfire-aware planning issues encountered by planners and fire authorities that have responsibilities for managing bushfire risk in different jurisdictions and landscapes.
- The Sharing Responsibility project (RMIT University) critically examined the idea and practice of sharing responsibility between governments and communities to manage disaster risk.

The research undertaken independently in each of the three projects is reported elsewhere.[1] This article distils and summarises three key program conclusions about political and social negotiation on risk and responsibility. It focuses on negotiating expectations of success, negotiating multiple values in planning, and negotiating citizen-State relationships.

Negotiating expectations of success

The Law and Policy project revealed the importance of negotiating expectations of success in emergency management. In the paper, *How chief officers view success in fire policy and management* (page 16), Eburn and Dovers argue that establishing shared responsibility for emergency management imperatives requires a negotiated understanding between a broad range of parties about what it is they wish to achieve, and who will do what. The *National Strategy for Disaster Resilience* (NSDR) (COAG 2011) identifies the ideals of developing resilient communities and shared responsibility but gives no indication of what measures identify when a sufficient level of disaster resilience has been achieved.

If governments, communities and individuals are going to negotiate on issues of responsibility for risk management they need to understand what they can reasonably expect from each other, what they are trying to achieve, and how they will identify whether or not their objectives have been achieved. In the context of emergency management the desired objectives may seem obvious, for example that there are no fatal fires, or floods, or no damage to property or the environment, but those objectives are unrealistic not least when considering the costs that would be incurred trying to achieve a zero fatality approach to fire and flood risk. Another objective may be to 'minimise' the loss of life but that implies some loss is tolerable provided it is the minimum achievable in the circumstances.

Image: Jessica Weir

A thank you sign outside properties after the Sand Hills Fire, New South Wales, January 2013.

1 See www.bushfirecrc.com/category/projectgroup/1-community-expectations.

Notwithstanding this, governments and emergency services organisations are subject to critical review after many events, not just catastrophic tragedies, but have difficulty explaining their response or whether or not, in all the circumstances, the outcomes should be judged as effective or not. As one senior emergency services officer responded in a survey conducted as part of the Law and Policy project: 'we'll be judged by the post incident conversation; governments and emergency services organisations have to try to anticipate what that conversation will be' (Eburn & Dovers 2013). In essence agencies are judged in hindsight by whether or not an outcome is 'acceptable' rather than by the question of whether or not they achieved the objectives set for them by the government, on behalf of the community.

To develop useful measures of success, stakeholders need to identify the reality of emergency management policy which includes recognition that safety cannot be guaranteed. Governments and communities have to accept that some outcomes are the result of political choices about land-use planning, resource allocation and priorities, made long before any fire, flood or storm impacted. A more open discussion of reasonable expectations is needed, leading to a better shared understanding, informing revised expectations expressed in policy documents and legislative goals. Stated goals can be the basis of communication to inform understanding of 'shared responsibility', and be reference points for assessment in the inevitable post-event inquiries in future.

Negotiating multiple values in planning

The Victorian Bushfires Royal Commission found that urban and regional planning is a key activity for reducing bushfire risk. This is also included in the NSDR as part of building community resilience and shared responsibility (Teague, McLeod & Pascoe 2010, COAG 2011). Planning that takes bushfire-awareness into account can reduce the risk posed to lives, homes, infrastructure and other values, as well as reducing the risk faced by emergency response crews protecting these during a bushfire event (Kelly 2010, Buxton *et al.* 2011, Hughes & Mercer 2009). In state and territory regional planning there are strategic decisions concerning where development will occur, and what sort of development it will be. At the local level the focus is on implementing and enforcing planning regulations and building standards. Much planning for bushfire risk is based on zoning areas as high risk, and then prescribing treatments for those areas arising out of the emphasis on risk management that developed in the 1990s.

By undertaking such planning roles, planners working for local authorities are taking responsibility for their share of bushfire risk, however they do so by negotiating their other responsibilities to the diverse environmental, economic and social values prioritised by governments and communities. Compromise can occur as part of this, although planners can look to risk mitigation measures to help negotiate priorities. For example, planners in Canberra continue to emulate the leafy 'bush capital' planning heritage, with the increase in bushfire risk countered in part by larger fuel reduction zones. The effectiveness of such measures depends on the scale of the bushfire event, and planning treatments are challenged by the uncertain and dynamic risk context. Vegetation growth, growing urban complexity, economic development, new research findings, climate change and policy change are constantly reshaping the risk landscape. In the Northern Territory, invasive African fire weed is creating a new high intensity fire landscape.

Kings Highway between Bungendore and Braidwood, New South Wales, January 2013.

Planners must be responsive to, and are sometimes captive of, how bushfire risk is perceived and valued in society and by those in power. If bushfire risk is not considered as important as other interests and agendas, it is difficult to include it in the strategic plan and urban design, as well as to enforce it. The implementation of many regulations, such as slashing and burning to reduce fuel loads in bushfire risk landscapes, relies on whether individuals in the private and public sector are informed, accept and share responsibility for this risk. Being attuned to risk perceptions held, or not, in society is important for local, state and federal politicians who rely on their constituents for re-election, with the planners reliant on politicians to make important planning decisions. Planning is often depicted as a purely technical profession, but it can be enlisted to meet the ambitions of those with money and power rather than the priorities of civil society (Gleeson 2012, p. 245).

Bushfire risk is now a compulsory inclusion in planning in Victoria, and planners and fire authorities are seeing a strong sense of shared commitment across and within agencies to reduce bushfire risk, as well as innovative ways to address bushfire risk on particular sites (Weir 2013). In the focus group research, the planners and fire authorities discussed how energy and ingenuity was being invested in finding options that match bushfire risk mitigation with other values in society, such as biodiversity conservation (see also Paterson 2007). They also reported on how their efforts are revealing where the contribution of planning starts and ends. By delineating the contribution of planning, the Victorian experience highlights how shared responsibility needs to go much further than relying on one sector and is, as the NSDR says, a collective responsibility.

Negotiating citizen-State relationships

There appears to be wide support for the vision of citizens and the State (communities and government) sharing responsibility for disaster and emergency management. Yet despite this support, there is also considerable confusion and divergent views among stakeholders (e.g. agencies, political advisors, formal and informal volunteers, civil society groups) about what this entails and the kinds of citizen-State relationships that best enable it. High level policy statements like the NSDR do not—and cannot—provide sufficient actionable guidance for the many different phases, levels and settings where risk management activities take place.

Crucially, sharing responsibility for emergency management between citizens and the State is a central issue of modern risk governance. The legitimacy and effectiveness of public institutions that manage complex risks are being challenged in a globalised and dynamic world (McLennan & Handmer 2013a, section 2.1.3). In Australia, as in other modern democratic political systems, a dominant policy response to this challenge across a range of sectors has been to emphasise the need for greater citizen responsibility and community resilience. This same shift is evident in Australian emergency management. At the same time, many public institutions have become increasingly risk averse in the face of rising criticism, legal proceedings and public enquiries, and their limited capacity to control complex risks.

A central conclusion of the Sharing Responsibility project (derived from a joint Australian and international research focus) is that enabling more legitimate and effective responsibility-sharing between citizens and the State in Australian disaster management requires a fundamental shift towards

House surrounded by vegetation, Mornington Peninsula, Victoria.

The bushfire season coincides with summer holidays. Mossy Point, New South Wales.

more inclusive governance arrangements. It is through such arrangements that government and non-government actors can establish relationships and processes to negotiate shared risks and responsibilities:

> *'Inclusive governance is based on the assumption that all stakeholders have something to contribute to the process of risk governance and that mutual communication and exchange of ideas, assessments and evaluations improve the final decisions rather than impeding the decision-making process or compromising the quality of scientific input and the legitimacy of legal requirements ... As the term governance implies, collectively binding decisions cannot be confined to governments. Rather it involves the four central actors in modern plural societies: governments, economic players, scientists and civil society organizations.'*
>
> (Renn & Schweizer 2009, p. 175).

Thus there is a need in Australian disaster management to develop more inclusive governance arrangements at a range of levels that involve broader social participation throughout the whole policy and management process — from agenda-setting through to implementation and evaluation (see for example Aguilar & Montiel 2011). It is important to emphasise that this social participation is not community engagement by another name. Community engagement is a part of implementing a solution to a problem as it is framed (e.g. recognised and defined) by a government agency or network. By contrast, inclusive governance involves non-government actors in framing the problems and shaping the solutions as well as in implementing them (Renn & Schweizer 2009). Thus there is an underlying assumption inherent in inclusive governance styles 'that governments today cannot remain as firmly in control of policy processes as in the past and, at the same time, take a more "enabling" role' (Edwards 2002, p. 58). Instead, policy processes and outcomes are recognised as involving active negotiation with non-government actors, including those from civil society. This is well-aligned with the NSDR's focus on government's role to enable rather than direct community resilience (McLennan *et al.* 2012, McLennan & Handmer 2013b).

Inclusive governance is very challenging to current thinking and practice in emergency management. Existing and emerging governance arrangements in this sector are still very government-centric, despite an emerging 'community empowerment' rhetoric. For

Burnt emergency services sign, Kings Highway, New South Wales, January 2013.

example, the agenda for developing more networked and collaborative governance arrangements laid out in the Victorian Government Emergency Management Reform white paper notably refers only to government actors and networks (Victorian Government 2012). Yet there is also implicit but firm support for developing more inclusive governance frameworks within the NSDR's vision of shared responsibility and disaster resilience, and among both government and non-government Australian disaster management stakeholders (see McLennan *et al.* 2012, McLennan *et al.* 2013, McLennan & Handmer 2013b).

Developing more inclusive governance frameworks is not, of course, a magic bullet for achieving more legitimate and effective responsibility-sharing between citizens and the State in disaster management. As was clearly identified by government speakers in two stakeholder workshops held as part of the Sharing Responsibility project, increasing social participation in disaster policy processes presents significant responsibility-sharing challenges of its own, most notably to government accountability (see also Edwards 2002, Levidow 2007, Walker, Tweed & Whittle 2013). However, these speakers clearly positioned such challenges as issues to be actively wrestled with in order to enable resilience-based disaster management.

Conclusion

These three projects highlight the different dimensions and complexity of the negotiation of risk and responsibility within sectors and levels of government, between governments and citizens, and between stakeholders. The focus on policy and governance reported on here has been a recent one for Australian emergency management and one where research and practitioner interests have been sharpened and co-ordinated. Globally there has been a dearth of attention to the strategic policy and institutional dimensions within which emergency management operates (Handmer & Dovers 2013). The issues and questions raised here demand ongoing investigation and discussion, and this is planned to occur in more of an all-hazards context under the auspices of the Bushfire and Natural Hazards Cooperative Research Centre. Broadening the debate around emergency management will challenge traditional approaches and organisations, but conversely offers opportunities for emergency management to become genuinely mainstream and a task shared across society.

References

ABC (Australian Broadcasting Commission) 2012, *ETSA defends decision to cut power. At: www.abc.net.au/news/2012-01-03/etsa-defends-power-cut-decision/3756354 [3 January 2012].*

Aguilar S & Montiel C 2011, *The challenge of applying governance and sustainable development to wildland fire management in Southern Europe, Journal of Forestry Research, vol. 22, no.4, pp. 627-639.*

Broome R & Smith W 2012, *The definite health risks from cutting power outweigh possible bushfire prevention benefits, Medical Journal of Australia, vol. 197, no.8, pp. 440-441.*

Buxton M, Haynes R, Mercer D & Butt A 2011, *Vulnerability to Bushfire Risk at Melbourne's Urban Fringe: The Failure of Regulatory Land Use Planning, Geographical Research, Vol. 49, No.1, pp. 1-12.*

Council of Australian Governments (COAG) 2011, *National Strategy for Disaster Resilience: building our nation's resilience to disasters, Commonwealth of Australia.*

Eburn M & Jackman B 2011, *Mainstreaming fire and emergency management into law, Environmental and Planning Law Journal, vol. 28, pp. 59-76.*

Edwards M 2002, *Public sector governance — future issues for Australia, Australian Journal of Public Administration, vol. 61, pp. 51-61.*

Elsworth G, Gilbert J, Rhodes A, Goodman H 2009, *Community safety programs for bushfire: what do they achieve, and how?, Australian Journal of Emergency Management, vol. 24, pp. 17-25.*

Emergency Management Australia 2004a, *Emergency Management in Australia: Concepts and Principles, Manual 1, Commonwealth of Australia.*

Emergency Management Australia 2004b, *Emergency Risk Management Applications Guide. Manual 5, Commonwealth of Australia. (Currently under revision).*

Gleeson B 2012, *'Make No Little Plans': Anatomy of Planning Ambition and Prospect, Geographical Research, vol. 50, no.3, pp. 242-255.*

Gurran N, Norman B & Hamin E 2012, *Climate change adaptation in coastal Australia: an audit of planning practice, Ocean & Coastal Management. At: http://dx.doi.org/10.1016/j.ocecoaman.2012.10.014.*

Handmer J & Dovers S 2013, *Handbook of disaster policies and institutions, 2nd edition, London, Routledge/Earthscan.*

Hughes R & Mercer D 2009, *Planning to Reduce Risk: The Wildfire Management Overlay in Victoria, Australia, Geographical Research, vol. 47, no. 2, pp. 124-141.*

Hughes L & Steffen W 2013, *Be Prepared: Climate Change and the Australian Bushfire Threat, Climate Council of Australia.*

Hyde M 2013, *2013 Tasmanian Bushfires Inquiry: Volume One, State of Tasmania, Hobart.*

IPCC (Intergovernmental Panel on Climate Change) 2012, *Managing the risk sof extreme events and disasters to advance climate change adaptation. Geneva: IPCC.*

Kanowski PJ, Whelan RJ & Ellis S 2005, *Inquiries following the 2002-2003 Australian bushfires: common themes and future directions for Australian bushfire mitigation and management, Australian Forestry, vol. 68, pp. 76-86.*

Kelly K 2010, *PIA Policy Response to the Victorian Bushfires of February 2009, Australian Planner, vol. 47, no.1, pp. 48-51.*

Levidow L 2007, *European public participation as risk governance: enhancing democratic accountability for agbiotech policy?, East Asian Science, Technology and Society: An International Journal, vol.1, pp. 19-51.*

McLennan BJ, Austin E, Hearne J, Henry S, Rance A & Travers A 2013, *Sharing responsibility for implementing the National Strategy for Disaster Resilience: account of a multi-stakeholder workshop. RMIT University, Bushfire CRC, National Climate Change Adaptation Research Facility, Melbourne.*

McLennan BJ, Bosomworth K, Keating A, Kruger T & Towers B 2012, *Visions of sharing responsibility for disaster resilience: account of a multi-stakeholder workshop, RMIT University, Bushfire CRC, National Climate Change Adaptation Research Facility, Melbourne.*

McLennan BJ & Handmer JH 2013a, *Sharing responsibility in Australian disaster management, RMIT University & Bushfire CRC, Melbourne.*

McLennan BJ & Handmer JH 2013b, *Visions of sharing responsibility for disaster resilience: sharing control, in ' Proceedings of Bushfire CRC & AFAC 2012 Conference Research Forum' Thornton RP & Wright LJ (eds), pp. 13-25, Bushfire CRC, Perth.*

Norman B, Steffen W, Maher W, Woodroffe C, Capon A, Webb R, Rogers K, Lavis J, Sinclair H & Weir B 2013, *Coastal Urban Climate Futures in South East Australia: Wollongong to Lakes Entrance, National Climate Change Adaptation Research Facility, Gold Coast.*

NSWRFS (New South Wales Rural Fire Service) 2006, *Guideline: Bush Fire Prone Land Mapping, New South Wales Rural Fire Service, Sydney.*

Paterson RG 2007, *'Wildfire Hazard Mitigation as 'safe' Smart Growth', in Troy A & Kennedy RG, (eds) Living on the Edge, Advances in the Economics of Environmental Resources, Emerald Group Publishing, pp. 43-71.*

Renn O & Schweizer PJ 2009, *Inclusive risk governance: concepts and application to environmental policy making, Environmental Policy and Governance, vol. 19, pp. 174-185.*

State Disaster Management Group 2012, *Queensland State Disaster Management Plan, State of Queensland, Brisbane.*

State Emergency Management Committee 2012, *'NSW State Emergency Management Plan', State of New South Wales, Sydney.*

Teague B, McLeod R & Pascoe S 2010, *'2009 Victorian Bushfires Royal Commission: final report', State of Victoria, Melbourne.*

Victorian Government 2012, *Victorian emergency management reform: white paper, Victorian Government, Melbourne.*

Victorian Government 2013, *Emergency Management Manual Victoria, Victorian Government, Melbourne.*

Walker G, Tweed F & Whittle R 2013, *A framework for profiling the characteristics of risk governance in natural hazard contexts, Natural Hazards and Earth Systems Sciences Discussions, vol. 1, pp. 2207-2229.*

Weir JK 2013, *'Fire authorities and planners: reducing risk across diverse landscapes', in L.J. Wright (Ed) 2013, 'Proceedings of Bushfire CRC and AFAC 2013 Conference Research Forum' 2 September 2013, Melbourne Australia, Bushfire CRC.*

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Nine design features for bushfire risk reduction via urban planning

Constanza Gonzalez-Mathiesen and Associate Professor Alan March, University of Melbourne, share their view of international planning jurisdictions and how they deal with bushfire threats. ®

ABSTRACT

This paper reports the results of research into the design and planning controls of nine international planning jurisdictions dealing with bushfire or wildfire threats. The research sets out fundamental principles to guide the design of settlements at the site and subdivision level with the aim of improving the ability of land-use planning to deliver resilience outcomes in bushfire-prone areas. The analysis and categorisation of design elements internationally was supported by interviews with Australian bushfire experts. The research concludes that there are nine fundamental land-use principles guiding the design of settlements at risk of bushfire impacts.

Introduction

Bushfires, also known as wildfires, can present significant risks to life and property at the interfaces between urban and rural areas. However, the risks and consequences of bushfire hazards can often be reduced or avoided if appropriate measures are set in place to improve the resilience of buildings and communities. An important way of improving resilience in these urban-bushland and urban-rural interface areas is the initial design of buildings, roads, gardens and other features in ways that reduce bushfire risks.

The research was carried out using a qualitative approach via grounded theory method. Two sources of data were examined. Firstly, nine cases of international policy and guidelines and documentary information from the USA (four cases), France (two cases), Spain (two cases) and Australia (one case) were examined (see Table 1). These cases were chosen based on the quality of detail and evidence base, availability of information to the researchers, the jurisdiction's potential bushfire severity being high or extreme, and the language knowledge of the authors. Secondly, semi-structured face-to-face interviews with five Australian key professionals and scientists in the bushfire field were conducted to verify the results.

By categorising the design intent and mechanisms of the land-use and design controls in the data analysed, this research establishes nine fundamental design principles that guide the design of settlements at the site and subdivision level. This provides an understanding of the range of issues relating to design that can deliver resilience in settlements in bushfire prone environments.

Urban planning and design for bushfire risk reduction

Current international trends show that more disasters occur each year, that their economic impact is higher, and that more people are affected by them (Coppola 2011, p. 18). In Australia, recent analysis has confirmed that climate change effects will lead to significant increases in the incidence of bushfires, and that this will put significant pressure on the ability to manage negative impacts over time as more people seek out rural and natural living environments (Hughes & Steffen 2013, pp. 43-49). However, if managed properly, natural hazards such as bushfires do not necessarily have to become disasters. In fact, all disasters, when systems are overwhelmed with catastrophic effects, are essentially human–made in some sense. Being able to establish clear pathways to deal with the threat of natural hazards so that they do not result in disasters — often understood under the broad umbrella term of resilience — is now a core part of the challenges of urban planning.

An important part of urban planning design is a process of solving problems (within a particular context where actions are needed to improve them (Lawson 1990, Lawson 2004)) through to analysis, synthesis and evaluation. Design facilitated by land-use planning requirements can provide a consistent and logical basis to positively influence design outcomes (Blessing & Chakrabarti 2009, p. 87). For instance, it has been shown that property losses are closely linked with proximity to vegetation, but that, over time, this has not been acted on systematically in Australia (Crompton *et al.* 2010). Within the 700 metres or so from the urban boundary in which fires typically have impacts

(Chen & McAneney 2004), considerable work is required to improve the characteristics of urban areas to reduce bushfire impacts via design that improves the resilience of settlements and improves opportunities for active interventions during the response phase.

By incorporating disaster management considerations, land-use planning has the capacity to guide the design of settlements to reduce disaster risks, while still allowing some growth in medium risk areas (Burby 1998, pp. 9-10). Further, land-use planning processes can be particularly effective in supporting disaster management. For example, the preparation of land-use plans by local governments ideally includes gathering and analysing data to determine the suitability of land for development (Burby 1998, pp. 1-2, 18), which can include risk assessments (Deyle *et al.* 1998, p. 160). Moreover, the planning of urban development can include monitoring (Hopkins 2001, p. 16) that can integrate disaster risks and community engagement.

Nine principles

Urban planning can act as a regulatory framework for settlement design, significantly contributing to bushfire risk reduction. While each disaster is to some extent unique, it nonetheless is generally comprised of elements that have a basis in previous events (Alexander 2009, p. 163). Bushfires are no exception. Although bushfires take place in a diversity of contexts and fire regimes (National Wildfire Coordinating Group 2006, p. 75), they behave according to known scientific principles (Ramsay & Rudolph 2003, p. 12). Understanding the main mechanisms of fire behaviour and progression allows fundamental elements to be identified that will lead to improved design of sites and subdivisions at risk of bushfire.

Based on the research, nine planning principles can be identified from international contexts for the guidance of buildings and settlement design in bushfire prone areas. In this paper, the principles are organised under

Table 1. International policies and guidelines used in the study.

Country	Administrative Division	Year of Publishing	Name of the Policy
USA	Federal	2012	Codes and Standards, NFPA 1141, Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas.
		2012	NFPA 1142, Standard on Water Supplies for Suburban and Rural Fire Fighting.
		2013	NFPA 1144, Standard for Reducing Structure Ignition Hazards from Wildland Fire.
		2014*	NFPA 1143, Standard for Wildland Fire Management.
	California State	2013	California Code of Regulations. Title 14- Division 1.5- Chapter 7- Subchapters 2 and 3
		1943	California Government Code. Title 5, Division 1, Chapter 6.8. Very High Fire Hazard Severity Zones, Section 51175-51189
		1939	California Public Resource Code. Division 4. , Part 2, Chapter 3. Mountainous, Forest, Bush and Grass Covered Lands 4291- 4299
	San Diego County	2011	General Plan - Chapter Seven, Safety Element.
	Orange County	2005	General Plan
FRANCE	*Commune d'Assas*	2005	*Plan de Prévention des Risques Naturels Prévisibles d'Incendies de Foret* (PPRif)
	Commune de la Gaude	2011	*Plan de Prévention des Risques Naturels Prévisibles d'Incendies de Foret* (PPRif)
SPAIN	*Comunidad Autónoma de Extremadura*	2006	*Plan de Prevención de Incendios Forestales de la Comunidad Autónoma de Extremadura* (Plan PREIFEX)
	Comunidad Autónoma de Galicia	2006	*Decreto 105/2006, do 22 de xuño, polo que se regulan medidas relativas á prevención de incendios forestais, á protección dos asentamentos no medio rural e á regulación de aproveitamentos e repoboacións forestais.*
		2007	*Lei 3/2007, do 9 de abril, de prevención e defensa contra os incendios forestais de Galicia.*
AUSTRALIA	Victoria State	2013	Victoria Planning Provisions, clause 52.47

*Note 2014, referenced as reported, pre-released copy.

two categories: *reducing vulnerability* and *co-ordinating and improving response* (see Table2). The convergence of themes across the different international contexts suggests the value of the principles for developing and testing land-use policies for other places. This applied and place-based approach provides clear pathways to applied resilience via urban planning, adapted to the context of each site.

Table 2. Summary of the nine design principles identified.

Reducing vulnerability	Co-ordinating and improving response
1) Consideration of the overall context and landscape impacts on exposure from overall fire likely behaviour.	1) Consideration of the availability, capacity, location and travel times of emergency services, if available.
2) Determination of adequate separation from heat and flame sources, given topography, vegetation, likely weather and any other relevant factors.	2) Facilitation of the efficient access and egress of emergency services, including integration of separation spaces as spaces for active defence or evacuation locations.
3) Management or modification of vegetation, landscaping or other fuel sources such as outbuildings.	3) Ensure water availability for firefighting, including appropriate location, supply, connectivity and signage.
4) Management of the density, location and design of structures, including reducing vulnerability to ember attack, and integration of building and planning standards appropriate to context and siting.	4) Deal with civilian response actions, including the range of possible actions such as finding refuge, actively defending, or evacuating properties.
5) Protection of infrastructure, and care for land uses with greater vulnerability e.g. kindergardens.	

Reducing vulnerability

Internationally, five planning principles can be identified in the guidance of the design of sites and subdivisions to reduce vulnerability, based in the first instance on physical mitigation measures. These considerations can improve the mechanisms of interaction between fire as a natural process that takes place in a range of vegetated areas, and the physical structures that support the well-being of humans. Figure 1 summarises these principles diagrammatically.

Consideration of context and landscape impacts on exposure

The first planning principle observed across almost all of the cases studied is *consideration of context and landscape impacts on exposure* as a critical foundation to informing design responses to the nature of fire threats for each context. In order to develop bushfire resilience, urban planning and design outcomes must be directly responsive to the nature of the risks at each site. The codes studied demonstrate establishment of different design requirements according to the range of different possible risk levels and types, by integrating spatial risk assessments within land-use planning processes. These require that the features affecting possible fire behaviour for a given area to be assessed should include aspect, topography, fuel load and proximity to forest/vegetation, water bodies, wind, fire weather, and likely direction and intensity of the fire front. For example, very high fire hazard severity zones are identified in the California Code of Regulations (2006, section 51178):

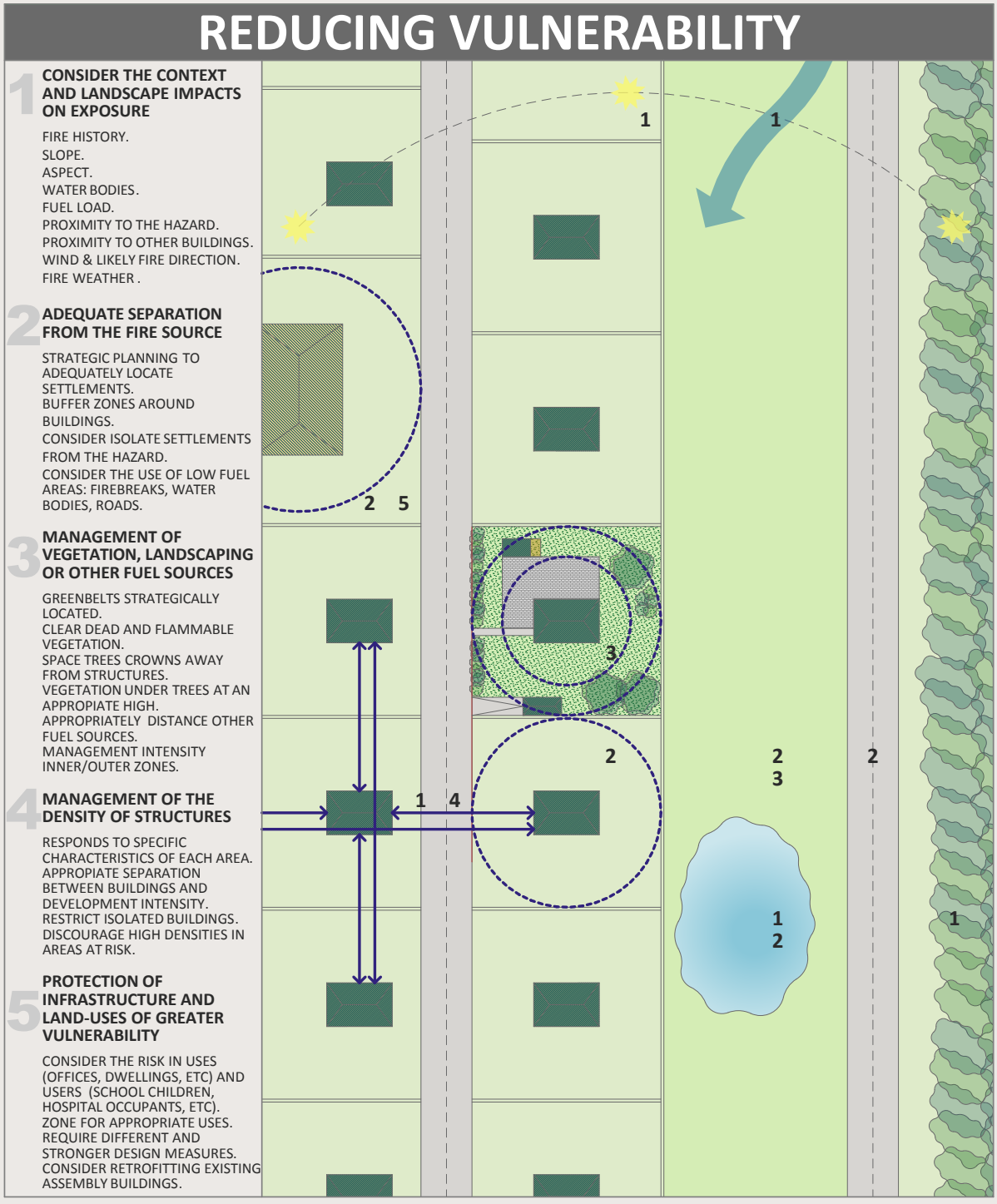
> *'Based on fuel loading, slope, fire weather, and other relevant factors including areas where [....] winds have been identified [...] as a major cause of wildfire spread.'*

Ideally, the initial design response would have determined the highest likely fuel loading that is possible in the landscape (given that some forests take decades to reach a 'steady state') as the basis for the design response. This would preclude the need to subsequently re-assess each year on a site-by-site basis, considering the season's severity, the area's fire history and any changes to vegetation over time, to forecast the exposure for each summer. However, since sites often include structures developed prior to bushfire design standards, or ongoing modifications to vegetation, this monitoring may often be necessary as a remedial measure.

Determination of adequate separation from the fire source

Secondly, the *determination of adequate separation from the fire source* is a fundamental measure for reducing bushfire exposure and, hence, vulnerability. This is required by all codes studied in some way. Separation from ambient heat and direct flame contact can be delivered through the provision of setbacks between buildings or settlements, and the particular fire threats associated with each context. New developments can be required to provide low fuel spaces, such as firebreaks, roads, or managed low-fuel gardens, increasing overall separation from fire hazards. For example, the *Comunidad Autonoma de Extremadura* (2006 p. 8058) requires 50 metre-wide firebreaks between peri-urban and rural areas, and between urban and peri-urban areas. At the scale of individual sites, buffer zones around buildings can deliver the appropriate separation. For example, a 50 metre buffer zone is required by *Comunidad Autonoma de Galicia* (2006 p. 10.471). At the subdivision scale, planning and design has real capacity to achieve separation in contrast to small individual sites where possibilities

may be constrained by existing lot patterns. This situation implies that existing lots or settlements can be constrained in their ability to provide appropriate separation. Therefore retrofitting measures that modify fuel levels or improve the resistance ratings of individual structures themselves might be appropriate. It also implies that the role of planning at the strategic level is critical to the correct location of new settlements that can achieve these requirements, maintaining that when the risks are too great in some area, no development occurs. Even so, the strategic direction of development may be affected by political and economic interests and pressures separate to resilience concerns.



(Source: The authors)

Figure 1: Reducing bushfire vulnerability.

Management or modification of vegetation, landscaping or other fuel sources

The third principle is *management or modification of vegetation, landscaping or other fuel sources* close to settlements and buildings. This principle works in parallel with hazard separation and is one of the most common methods for reducing bushfire risks in the planning codes studied. Nevertheless, it raises significant issues in relation to the appropriateness of human interventions into natural systems, especially the imposition of artificial fire regimes, the removal of natural vegetation, or introduction of non-native species. Considerations include clearance of flammable or dead vegetation, particularly around structures and under trees (National Fire Protection Association 2013 p. 10, County of San Diego 2011, p. 8), adequate separation from other fuel sources, such as wood piles or combustibles (*Commune d'Assas* 2005 p. 8, 15, *Commune de la Gaude* 2011 pp. 22-23), and the use of greenbelts (California Code of Regulations 2006, section 1276). Landscape design including the selection of appropriate species can also play an important role. Fuel management can occur on a sliding scale of intensity in relation to the proximity to structures, acknowledging that it is crucial that measures are appropriately maintained over time, and that vegetation may take many years to reach a 'steady state'. Additionally, there might be social or economic constraints to vegetation management, for example people's desire to live surrounded by nature, or problems with smoke taint to grapes resulting from fuel reduction burning. Overall, it is more appropriate to manage vegetation at the subdivision scale, a more powerful way of 'designing out' underlying bushfire risk via land-use planning. Successful resolution of this principle would represent integration with natural and human processes.

Management of the density, location and type of structures

The fourth principle is the *management of the density, location and type of structures*, which can reduce the likelihood and the impacts of bushfire attack by establishing and integrating the appropriate density of structures and their ability to withstand fire attack according to the specific characteristics of each context. On the one hand, isolated buildings should be restricted where exposure is too high. In the French cases, a minimum separation and prohibition of isolated buildings in peri-urban and rural areas at risk is established (*Commune d'Assas* 2005, p. 6, *Commune de la Gaude* 2011, p. 17). On the other hand, in some circumstances higher population densities in exposed areas are discouraged in order to limit population numbers at risk and to avoid building-to-building fire spread. For example, the USA cases studied require that population density minimise the numbers of people exposed to bushfire (County of San Diego 2011, p. 4, Orange County 2005, p. V-75). Nevertheless, it has been demonstrated that larger settlements with clearly defined and well managed edges are generally better at resisting fire penetration. The Australian case that was studied demonstrates integration between the building and planning codes being able to stipulate, on a sliding scale, the ability to withstand heat, flame and ember attack, and the particular characteristics of sites and subdivisions. This means that design outcomes could, within limits, be flexible in many cases, allowing trade-offs between the design standard required of a structure and separation distances or other landscape factors.

Protection of infrastructure and land uses of greater vulnerability

Finally, given that certain groups of people or individuals are more susceptible to the consequences of fire events, the *protection of infrastructure and land uses of greater vulnerability* is another important land-use planning concern for bushfire-prone areas. A common method of managing social vulnerability observed in the codes studied was to zone or regulate land-use to appropriately reflect the risks associated with a given site. For example, high numbers of vulnerable people, such as school children, the infirm or elderly, would be restricted in high risk areas, particularly if evacuation needs exacerbated these risks (County of San Diego 2011, p. 4, *Commune de la Gaude* 2011). Additionally, the design performance associated with these more vulnerable land uses can require achievement of higher building standards, improving physical resistance (Victoria Planning Provisions 2013, California Public Resource Code 1939, as amended).

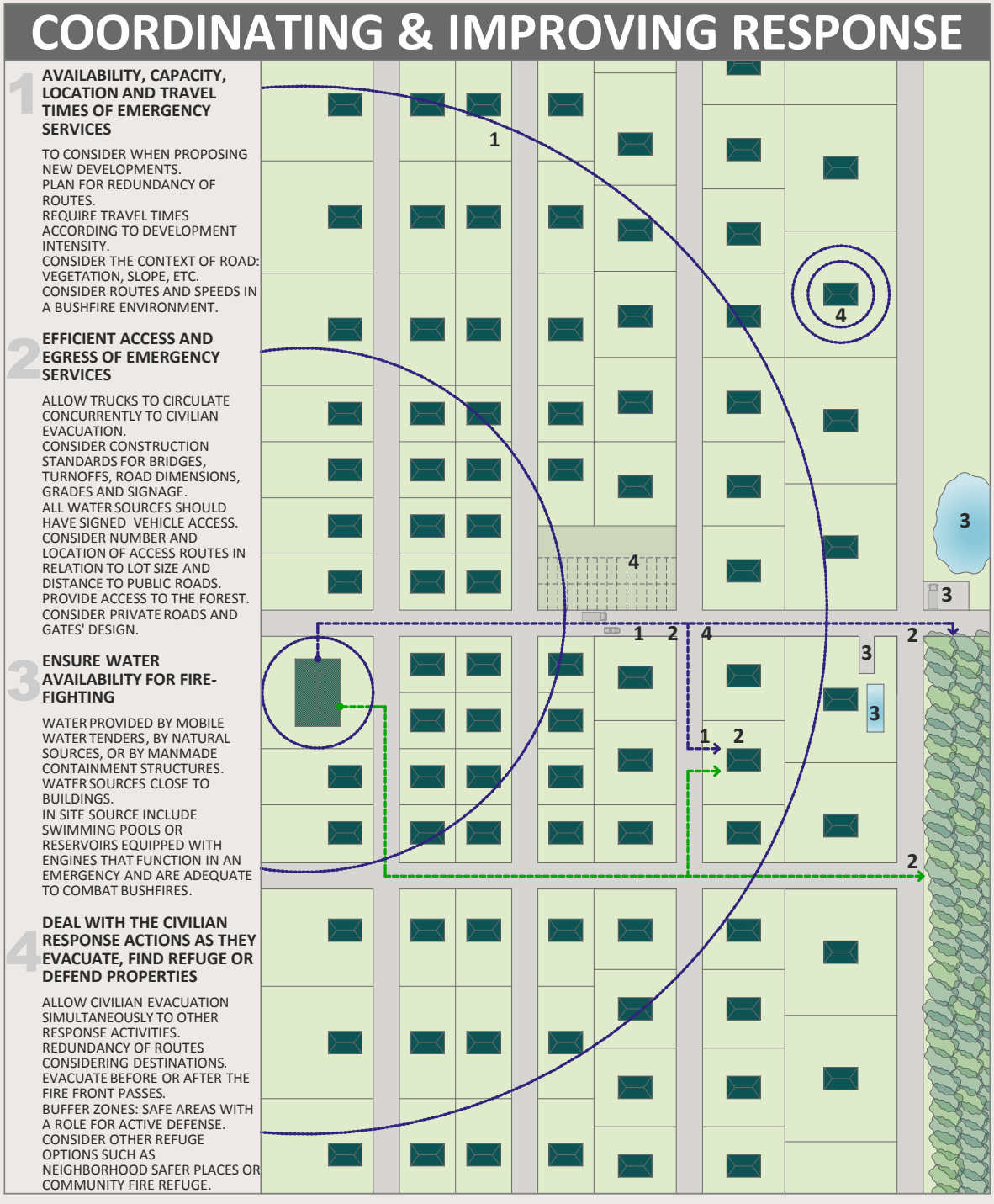
Co-ordinating and improving response

An additional four principles that improve active response can be identified in the codes studied. These act as a set of structural measures for the design guidance of sites and subdivisions to reduce vulnerability to bushfires, based on improving the ability to actively defend properties or to evacuate. Land-use planning, through these principles, can increase resilience by facilitating and co-ordinating improved emergency response actions of emergency services and civilians immediately before, during or immediately after potential disasters. Figure 2 shows the main themes associated with co-ordinating and improving bushfire response.

Consideration of the availability, capacity, location and travel times of emergency services

The first principle observed in most of the codes studied is *consideration of the availability, capacity, location and travel times of emergency services*. This recognises the link between the ability of land-use planning policy to influence the location and layout of settlements, and the ability of emergency crews to respond effectively. However, it was also recognised in many of the policies that this may not be reliable as a viable tactic in many locations due to particular terrain, street layouts or isolation. Response assessments were required in the design phase to

integrate several non-planning considerations such as resources, location, dispatch, and expected travel times. Traffic management was required to plan for route redundancy in the case of traffic networks being overwhelmed, for instance, by smoke, road blockages, or other fire effects. In the Victorian context, citizens cannot expect emergency services to attend every site during an emergency. This is a reflection of resources realities and learning since Black Saturday in 2009. Due to the extensive scale of bushfire disasters, emergency services need to prioritise their response actions, suggesting that resilience, in many cases, relies on increasing community responsibility to actively respond to events, based on appropriate design principles underlying the settlement being defended.



(Source: The authors)

Figure 2: Co-ordinating and improving bushfire response.

Facilitation of the efficient access and egress of emergency services

Secondly, assuming agency response can take place, *facilitation of the efficient access and egress of emergency services* is one of the most important and common design measures that land-use planning and design offers to redress residual vulnerability. This may include technical requirements to ensure that fire appliances can circulate in ways that allow active defence, in some cases allowing the access of response agencies and the evacuation of residents concurrently (California Code of Regulations 2006, Section 1273, County of San Diego 2011, p. 8). In addition, opportunities that allow emergency services to access fire edges in active firefighting processes must be provided (*Commune d'Assas* 2005, p. 9). At the site scale, private roads and gate design, location and number of access routes according to the size of each lot, and distance to public roads is also important (*Commune d'Assas* 2005, p. 7, National Fire Protection Association 2012, pp. 7-10). The design of sites must also consider the ability for firefighters to circulate, for instance, clearing vegetation along roads.

Water availability for firefighting purposes

The third principle is to ensure *water availability for firefighting purposes* by residents and responding agencies. This is a fundamental and frequent design consideration observed in the study of land-use regulation in bushfire-prone areas. Technical requirements are generally defined based on risk levels. At the subdivision scale, water supply for suppression activities typically takes into account the availability and quantity of water delivered by mobile water tenders, by human-made containment structures, or by natural sources (California Code of Regulations 2006, Section 1275). Also the visibility of water supply points, appropriately signed (California Code of Regulations 2006, Section 1275), and their accessibility allowing vehicle access (*Comunidad Autonoma de Extremadura* 2006, p. 8092) are important. At the individual site scale, water sources, such as swimming pools or reservoirs equipped with engines that can function in a bushfire scenario (*Commune d'Assas* 2005, p. 15) without depending on electricity supplies, need to be appropriate for bushfire suppression (County of San Diego 2011, p. 9), be sited near buildings (*Commune de la Gaude* 2011) and be sufficient to last throughout the event. Additionally, many planning provisions allowed for response mechanisms to include automated fire protection or suppression systems such as sprinklers. Nonetheless, passive measures were prioritised over active ones, which can be less reliable since they may require power and need to be strictly maintained to ensure operation under duress.

Civilian response actions

The final principle in land-use planning resilience is to deal with *civilian response actions* as they evacuate, find refuge or defend properties. Facilitating evacuation (if appropriate) and ensuring defensible space can have many and often inter-related dimensions, also affected by other regulations. For example, Australia's ongoing policy has been to 'leave early, or prepare, stay and defend', which strongly discourages late evacuation. While controversial, overall, the policy appears to be appropriate except in extreme cases, but implies that resilience requires significant preparation, information, and social learning—additional to and beyond the scope of planning regulations. In many fires, active defence by appropriately equipped, physically fit and mentally prepared civilians will prevent small fires escalating to destroy buildings. Importantly, at the individual site level, if persons have decided to stay and defend, or have been surprised by events, the design and maintenance of a building will significantly aid the use of a house as a place of refuge while a fire passes. Additionally, if separation from fuel sources and fuel management are integrated into the design of a structure on its site (as specified above), even if a house does catch fire, the managed low fuel area (such as a house's backyard) will provide a place of refuge for people, because the main fire front is likely to have passed by the time they have to leave the building. This safe area can have a role for active defence, as it can be implied in the 'defendable space' concept set by Victoria Planning Provisions (2013) and in the 'defensible space' idea established by the California Code of Regulations (2006, section 1271). Nevertheless, since evacuation cannot be relied on as a failsafe mechanism in many situations and the provision of a safe space for active defence is not always possible, it is crucial to consider the provision of other alternatives of refuge, such as neighbourhood safe places or community fire refuges.

Conclusion

Based on examination of a number of leading international examples and verification with leading Australian experts, this paper has summarised nine key principles that ideally would exist as fundamental features of any planning code which seeks to reduce bushfire risks via urban planning and design. Planning approaches can set out fundamental principles for the design of settlements to increase resilience to bushfires. These principles are under two major categories: reducing vulnerability and co-ordinating and improving response. Bushfire resilience depends, to a great extent but not exclusively, on the layouts of settlements being resistant to bushfire effects. The physical design of a settlement can be more bushfire resilient if it reduces human vulnerability through social and physical mechanisms and maximises the ability for active human resistance to bushfire threats, such as firefighting. These design principles can significantly contribute to achieving resilience and design outcomes should respond to the particular nature of the bushfire threat in a given place in order to improve effectiveness. Further, the physical design of settlements can facilitate improved human resistance to threats as another aspect of resilience. This paper has focussed on the level of the site and subdivision,

but it is acknowledged that further important work is also required at the strategic level.

References

Alexander D 2009, *Principles of Emergency Planning: Standardisation, Integration and Sustainability. Building Safer Communities. Risk Governance, Spatial Planning & Responses to Natural Hazards, p. 58, pp. 162-174.*

Blessing L & Chakrabarti A 2009, *DRM, a Design Research Methodology, London, New York, Springer.*

Burby RJ 1998, *Natural Hazards and Land Use: An Introduction. In: BURBY, R. J. (ed.) Cooperating with Nature. Washington D.C.: Joseph Henry Press.*

California Code of Regulations 2006, *Title 14- Natural Resources, Division 1.5- Department of Forestry, Chapter 7- Fire Protection, Subchapters 2 and 3. California, USA.*

California Public Resource Code 1939, as amended. *Division 4. Forest, Forestry and Range and Forage Lands, Part 2. Protection of Forest, Range and Forage Lands, Chapter 3. Mountainous, Forest, Bush and Grass Covered Lands 4291- 4299 California, USA.*

Chen K & McAneney J 2004, *Quantifying bushfire penetration into urban areas in Australia. Geophysical Research Letters, 31, pp. 1-4.*

Commune D'Assas 2005, *Plan de Prévention des Risques Naturels Prévisibles d'Incendies de Foret (PPRif). Préfecture de l'Herault, France.*

Commune de la Gaude 2011, *Plan de Prévention des Risques Naturels Prévisibles d'Incendies de Foret (PPRif). Préfecture des Alpes Maritimes, France.*

Comunidad Autonoma de Extremadura 2006, *Plan de Prevención de Incendios Forestales de la Comunidad Autónoma de Extremadura (Plan PREIFEX). España.*

Comunidad Autonoma de Galicia 2006, *Decreto 105/2006, do 22 de xuño, polo que se regulan medidas relativas á prevención de incendios forestais, á protección dos asentamentos no medio rural e á regulación de aproveitamentos e repoboacións forestais: España.*

Coppola D 2011, *Introduction to International Disaster Management, Amsterdam, Boston, London, New York, Oxford, Paris, San Diego, San Francisco, Singapore, Sydney, Tokio, Elsevier.*

County of San Diego 2011, *General Plan - Chapter Seven, Safety Element. California, USA.*

Crompton R, McAnenery K, Chen K, Pielke RJ & Haynes K 2010, *Influence of Location, Population, and Climate on Building Damage and Fatalities due to Australian Bushfire: 1925–2009. 2010 American Meteorological Society, 2, pp. 300-310.*

Deyle RE, French SP, Olshansky RB & Paterson RG 1998, *Hazard Assessment: The Factual Basis for Planning and Mitigation. In: BURBY, R. J. (ed.) Cooperating with Nature. Whashington D.C.: Joseph Henry Press.*

Hopkins LD 2001, *Urban Development: The Logic of Making Plans Washington, Covelo, London, Island Press.*

Hughes L & Stefen W 2013, *Be prepared: climate change and the Australian bushfire threat. Canberra: Climate Council of Australia.*

Lawson B 1990, *How designers think, London, Boston, Singapore, Sydney, Toronto, Wellington, Butterworth Architecture.*

Lawson B 2004, *What designers know, Amsterdam, Boston, Hiedelberg, London, New York, Oxford, Paris, San Diego, San Francisco, Singapore, Sydney, Tokyo, Architectural Press.*

National Fire Protection Association 2012, *Codes and Standards, NFPA 1141, Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas [Online]. At: www.nfpa.org/codes-and-standards/document-information-pages [9 October2013].*

National Fire Protection Association 2013, *Codes and Standards, NFPA 1144, Standard for Reducing Structure Ignition Hazards from Wildland Fire [Online]. At: www.nfpa.org/codes-and-standards/document-information-pages [9 October 2013].*

National Wildfire Coordinating Group 2006, *Glossary of Wildland Fire Terminology*.

Orange County 2005, *General Plan. California, USA.*

Ramsay C & Rudolph L 2003, *Landscape and Building Design for Bushfire Areas. [electronic resource], Melbourne, CSIRO Publishing.*

Victoria Planning Provisions 2013, *Particular provisions, clause 52.47 Bushfire Protection: Planning Requirements In: Department of Transport, P. A. L. I. (ed.). Victoria: State Government Victoria.*

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Associate Professor Alan March and Susan Henry published a paper titled 'A better future from imagining the worst: land use planning & training responses to natural disaster', in the August 2007 AJEM. This paper, freely available online, inspired a Chilean student, Jorge Leon, to research in the field of land use planning and come to Australia to study at the University of Melbourne with Associate Professor March. See page 57 for the full story.

Investigating the hazard preparatory information-seeking habits of far north Queensland coastal communities

Sandra Astill and Dr Peter Griggs, James Cook University, provide details from recent research into the hazard preparatory information-seeking habits of residents in three far north Queensland towns.

ABSTRACT

Contemporary emergency management advocates the use of hazard preparatory information to educate individuals located in areas exposed to the effects of natural hazards. The provision of this information has been identified as an influencing factor increasing resilience of communities, encouraging careful preparation of property and households, and speeding up the post-event recovery process. To date research has focused on the written message, largely ignoring the hazard preparatory information-seeking habits of those at risk. This study examined the hazard preparatory information-seeking habits of residents in three coastal communities in far north Queensland with differing cyclone and storm surge history. The results showed that resident-owners, with more than five years occupancy, and therefore, more natural hazard experience, were the most likely to seek hazard preparatory information. In addition, some business owners located in areas with no previous cyclone impact experience were unlikely to seek information on preparing their properties and they stated that insurance coverage would mitigate any losses.

Introduction

As climate change experts forecast an increase in the frequency of high magnitude cyclones, low-lying and exposed coastal communities have become the focus of research into the predicted vulnerability of their citizens (Knutson *et al.* 2010, p. 163, Emanuel 2005, p. 688). Social vulnerability to the impacts of such events have been identified as the most significant factor underlying future vulnerability projections, particularly as coastal migration and urbanisation guarantee future increases in loss of life and property (Pielke *et al.* 2005, p. 1573, Sarewitz, Pielke & Keykhah 2003, p. 808, Reser, 2007, p. 383). In the past it had been assumed that when people perceived adverse effects from high-risk events, they were more likely to take ameliorative steps to protect themselves, their family and property (O'Connor, Bord & Fisher 1999, p. 461). Related to this assumption has been the role of information and knowledge on the formation of risk perceptions. O'Connor, Bord and Fisher (1999, p. 461) stated that hazard preparatory information such as local government and emergency services brochures and media-based community awareness campaigns, had the potential to influence an individual's perception of risk, influence environmental behaviour by heightening awareness, as well as assisting in defining problems and identifying appropriate courses of action. Paton (2003, p. 210), however, stated that emergency managers have often assumed that merely making hazard preparatory information available would encourage individuals to prepare for a hazard according to the information provided.

Emergency management, particularly in Australia, places reliance on individuals remaining alert and informed by taking appropriate precautions to protect themselves against risks from natural hazards (Emergency Management Australia 2004, p. 5). This self-help approach to disaster management has placed the ultimate responsibility for knowledge, awareness and preparation directly with the individual, assuming each person understands that disasters fundamentally affect those who are vulnerable, as well as assuming those who require the information recognise their own vulnerability (Lidstone 1994, p. 18, Anderson-Berry & King 2005, p. 390). But what if those who require this information the most do not actively seek it? The aim of this research was to determine if residents and business owners, whose properties were located in areas vulnerable to the effects of cyclones and storm surges, actively sought information on how to better prepare themselves, their families and their properties for the impact of such an event. In addition, the

research examined if length of residency, past hazard experience and tenancy also had an influence over the information-seeking habits of these individuals.

Study sites

Prospective study sites located between Cooktown and Townsville in far north Queensland were examined for two criteria. Firstly, the locations had to contain residents and businesses located within 150 metres of the shoreline. Cutter (1996, p. 533) described the proximity to impact as a geographical element of vulnerability. The region of far north Queensland was examined for study sites due to its vulnerability to cyclone events, the most recent being severe tropical *Cyclone Larry*, a Category 3 cyclone in 2006 and severe tropical *Cyclone Yasi*, a Category 5 system in 2011. As the 5.4 metre storm surge associated with *Cyclone Yasi* devastated the townships of Cardwell and Tully Heads in 2011 (Boughton *et al.* 2011, p. 98), it was clear that surveying participants whose properties were positioned within 150 metres of that shoreline would encapsulate those who could experience the highest level exposure to both cyclone and storm surge impacts in the future. The second criteria took into consideration local government recognition of the risks associated with residing in low-lying areas, particularly in respect to the effects of cyclone-related storm surge. Therefore, each study area also had to lie within the Queensland Government designated Storm Surge Zone and be identified on storm surge mapping found on Queensland local government websites.

Holloways Beach and Machans Beach, two coastal suburbs north of Cairns, were chosen as the first study area as each fulfilled the two study area criteria, and were examples of communities that had not been directly affected by a cyclone in the previous decade (Figure 1). Combining the data collected from these two adjacent sites enabled the comparison of attitudes to cyclones and storm surges with the township of Cardwell, which was chosen as the second study area (Figure 1). The choice to use Cardwell took into consideration not only its proximity to the foreshore and location within the Strom Surge Zone, but also recent cyclone and storm surge history. These two study sites where chosen as both were similar in respect to their population size, location of residential dwellings and businesses to the water's edge, vulnerability to the potential effects of cyclone and storm surge, and both locations contained a mix of high and low cost housing. In addition, their differing cyclone history provided an ideal basis upon which to compare the risk perceptions of their inhabitants.

Methodology

A questionnaire was designed to establish if there was a relationship between the hazard information-seeking habits of residents and business owners whose properties were located within 150 meters of the shoreline in Cardwell, Machans Beach and Holloways Beach and their perception of risk in relation to cyclones and storm surges. Four pilot studies were conducted to test the questions in both study sites and to ensure the participants in Cardwell were not suffering from survey fatigue after the interest shown in the township following *Cyclone Yasi.* Following this rigorous testing, it was deemed that the questionnaire required no further changes.

A self-administered, paper-based questionnaire containing 34 questions requiring both qualitative and quantitative responses was delivered to and collected from prospective respondents. Of the 160 surveys delivered, 100 were completed and collected for analysis; 47 from Cardwell and 53 from Holloways Beach and Machans Beach. Participation was voluntary. Questions were developed to ensure the research collected demographic data, past cyclone and storm surge experience, whether a participant sought material on how best to prepare for an event, if they had successfully found information, and whether that material had been useful.

Stratified random sampling methods were employed to select participants for the survey, with maps of each study area used to divide the suburbs into three strata zones identified as SZ1, SZ2 and SZ3. Properties within SZ1 were located between 0-50 metres from the foreshore, while those in SZ2 were 51-100 metres from the foreshore. Residents and businesses in SZ3 were positioned 101-150 metres from the foreshore (Figure 1). Ethics approval to conduct the research was received from the James Cook University Ethics Committee. Data collection was undertaken between 3 September and 12 December 2012. Once data collection was complete, quantitative responses were manually coded and entered into Microsoft Excel. Qualitative data was transferred from each survey, categorised into themes and then transferred into tables for presentation.

Results

The total sample population of 100 respondents consisted of 40 per cent males and 60 per cent females (Table 1). Most respondents were between the ages of 51-60 years, with more than 50 per cent of respondents classifying themselves as a homeowner. Residential renters were the next most identified group, followed by those respondents classifying themselves as business owners and finally, those who both resided and owned businesses in the study areas. Data also showed that most respondents, regardless of their location, had occupied their property for more than five years, and should, therefore, have experienced more than one cyclone (Figure 2).

In order to understand the hazard preparatory information-seeking habits of respondents, participants were asked to describe where they had sourced information, what they felt was the most reliable source

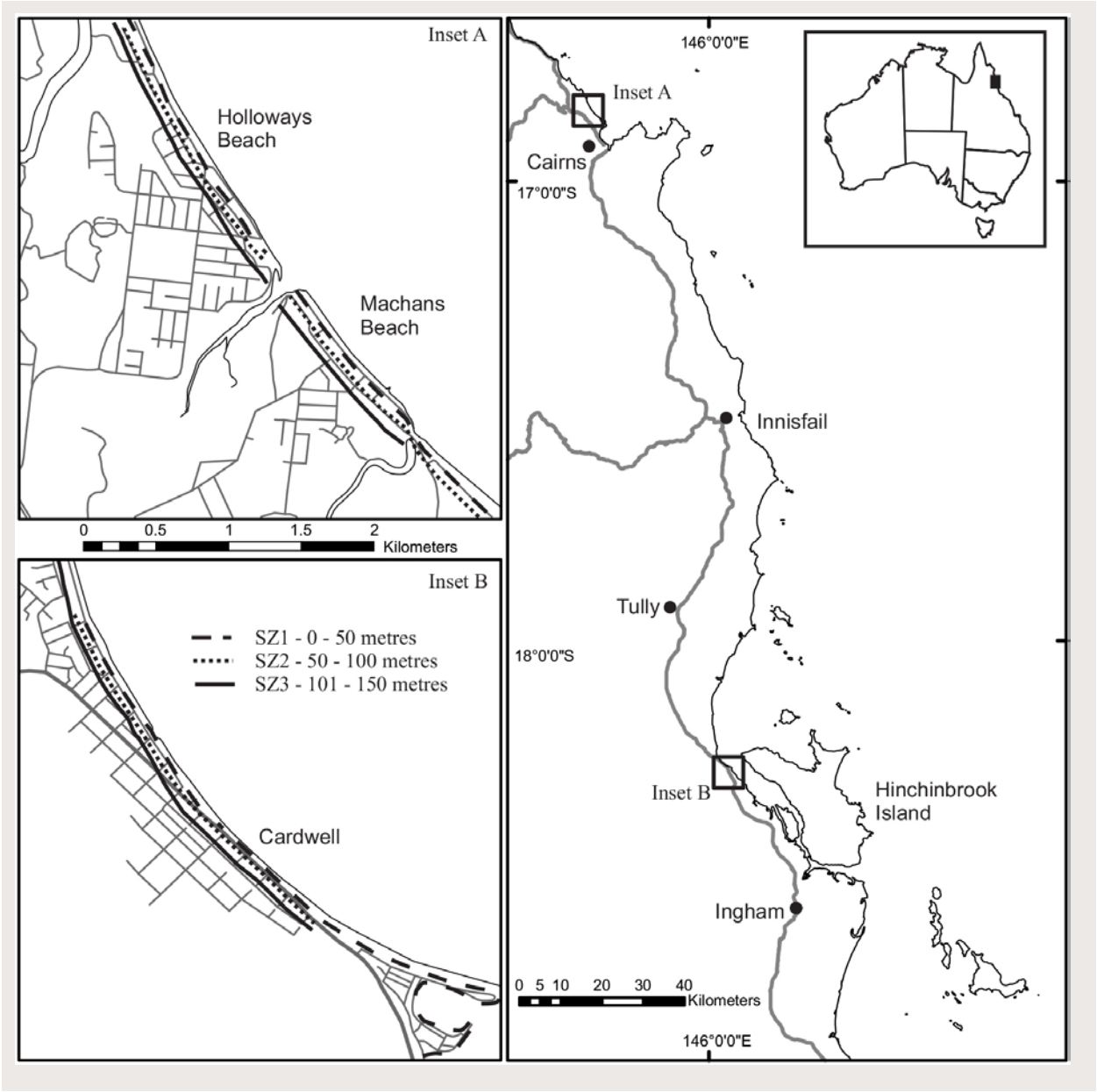


Figure 1: Map showing study sites for research.

of information, and why they had chosen that particular source. The results showed that most respondents, particularly those located within 50 metres of the foreshore, preferred to rely on a combination of information from the media sources, such as television, radio and newspapers, local and state government printed material, such as local council and Emergency Queensland cyclone readiness brochures, and past experience (Table 2).

When respondents were asked for their opinion as to the most reliable sources of information on cyclone preparation, the results indicated respondents from Machans Beach and Holloways Beach preferred weather forecasts and the media (Table 3). Results from Cardwell varied, with respondents within 50 metres of the foreshore stating the most reliable source of information was brochures. Participants between 51-100 metres of the foreshore stated television, while those within 101-150 metres of the foreshore preferred to rely on past experience. It was apparent from these results that respondents with recent cyclone experience whose properties are located within 50 metres of the foreshore, were most likely to seek printed information regarding cyclone preparedness, whereas respondents located further than 50 metres from the foreshore were content to rely on media reports and their past experiences. The most interesting responses were from those who stated they were unable to find any information at all, or that all information was unreliable, inferring that respondents had sought information, but were either unsuccessful or dissatisfied with the quality of the information they found.

Table 1. Demographic profile of study sites.

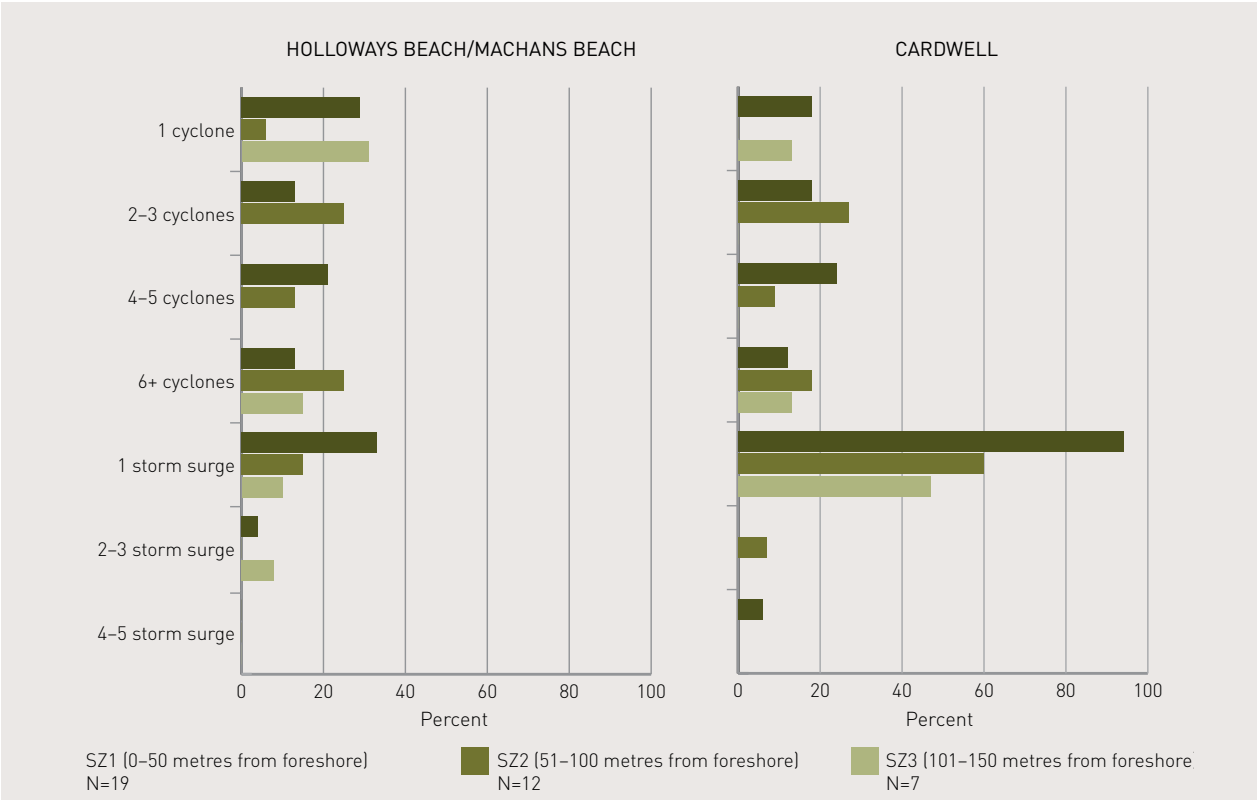
DEMOGRAPHIC FEATURE	DEMOGRAPHIC DETAIL	SA1 Machans Beach and Halloway Beach N=53 (%)	SA2 Cardwell N=47 (%)
Gender	Male	38	43
	Female	62	57
Age	18-30	8	4
	31-40	11	9
	41-50	25	4
	51-60	28	43
	61-70	21	17
	70+	8	23
Tenancy Status	Residential Owner	53	57
	Residential Renter	30	21
	Business Owner	8	6
	Business Owner & Resident	9	15
Location from Foreshore	SZ1 (0-50 meters from foreshore)	45	36
	SZ2 (51-100 metres from foreshore)	30	32
	SZ3 (101 – 150 meters from foreshore)	25	32
Length of Residency	Less than 1 year (no cyclone experience)	19	6
	Between 1 and 5 years (experienced Cyclone Yasi)	23	32
	More than 5 years (experienced with more than one cyclone)	47	49

Source: Questionnaire, 2012.

Table 2. Source of respondents' hazard information (respondent could choose more than one response).

Location	General Knowledge (%)		Past Experience (%)		Friends and Neighbours (%)		Printed Authority Material * (%)		Media** (%)		Weather Forecasters (incl. Bureau of Meteorology Website) (%)		School (%)		No Response (%)	
	MB/HB	C/W	MB/HB	C/W	MB/HB	C/W	MB/HB	C/W	MB/HB	C/W	MB/HB	C/W	MB/HB	C/W	MB/HB	C/W
SZ1	8	6	21	53	21	24	33	41	58	35	34	24	4		4	6
SZ2	6		44	40	19	20	31	7	53	27	12	14	6		6	13
SZ3	15	7	31	60	31	13	8	20	38	40	15	33	8			13

MB/HB = Machans Beach and Holloways Beach: C/W = Cardwell
SZ1 = 0 - 50 metres from shoreline; SZ2 = 51 - 100 metres from shoreline; SZ3 = 101 – 150 metres from shoreline.
MB/HB SZ1 N = 24, SZ2 N = 16, SZ3 N = 13. C/W SZ1 N =17, SZ2 N = 15, SZ3 N = 15
* Cyclone readiness material produced by local councils, Queensland Government Disaster Management, insurance companies etc.
** television, radio, newspapers and other print media.
Source: Questionnaire, 2012



Source: Questionnaire, 2012.

Figure 2: Past cyclone and storm surge experience of respondents.

When respondents were asked why they had chosen information from particular sources the most frequent response was that these were the most convenient (Table 4). Results indicated that respondents in this study, regardless of their location, preferred to use information that was easy to access.

Respondents were asked if the acquired information had influenced their perception of risk and their preparation for a cyclone. Results were examined to compare the responses from each tenancy status. When questioned as to whether information was an influence on a respondent's perception of risk, results showed that hazard information had increased the risk perception of most residential owners, regardless of location, as well as residential renters and business owners who were also residents in Holloways Beach and Machans Beach. These outcomes however, differed in Cardwell with most residential renters stating the information had no effect of their perception of risk. Participants who were business owners only, and did not reside in Holloways Beach and Machans Beach, and whose business was located within 100 metres of the water, also indicated the information had increased risk perceptions, but those located further back stated there had been no change. Business owners in Cardwell located within 100 metres of the foreshore declined to answer this question, but those located more than 101 metres from the foreshore indicated an increase in their risk perception. These respondents comprised mainly of motel and caravan park owners who had suffered extensive damage to their businesses, as well as high financial losses, closing their businesses for many months.

Finally, participants in Cardwell who indicated they were both business owners and residents stated that hazard information had increased their perception of risk if their property was located between 51-150 metres from the foreshore, but those located within 50 metres of the water mostly indicated that the information had no influence. Results also showed that most respondents, regardless of tenancy status and location, found the information had influenced their preparation for a cyclone or storm surge. The only exceptions were residential renters within 50 metres of the foreshore in Cardwell and business owners located between 51-100 metres of the foreshore from Machans Beach and Holloways Beach who stated that the information had not better prepared them for the effects of a cyclone.

Data was then examined to determine whether a respondent's length of residency influenced their perception of risk in relation to hazard preparatory information (Figure 3). Results illustrated that when hazard preparatory information had been used by a respondent, their perception of risk in relation to the potential damage a cyclone or storm surge could cause was most likely to increase or remain unchanged, regardless of the length of time they had occupied their property. Most importantly, this data also confirmed that the use of information rarely decreased an individual's perception of risk.

Table 3. Respondents' opinions of the most reliable source of hazard information.

Type of Information - *Examples of respondents' comments...*	SZ1 0-50 m from shoreline				SZ2 51-100 m from shoreline				SZ3 101–150 m from shoreline			
	MB/HB N=24		C/W N=17		MB/HB N=16		C/W N=15		MB/HB N=13		C/W N=15	
	Cyclone (%)	Storm Surge (%)	Cyclone (%)	Storm Surge (%)	Cyclone (%)	Storm Surge (%)	Cyclone (%)	Storm Surge (%)	Cyclone (%)	Storm Surge (%)	Cyclone (%)	Storm Surge (%)
... brochures (unspecified) (MB/HB, SZ1)	8	4	18	24	6	19		7	8	8		
... brochures from my insurance companies (C/W, SZ3)												7
... I just read (MB/HB, SZ2)					13		6	6			13	7
... info from Emergency Managers like the SES (C/W, SZ1)			6	6								
... weather forecasters (C/W, SZ2)	38	38	18	12	13	13	7	7	1	23	30	13
... media ((C/W, SZ3)	21	38	36	42	38	37	79	40	55	17	51	28
... the Internet (MB/HB, SZ2)	8	4	18	18	19	13	13	20	15	8	20	13
... I rely on my own past experience (C/W, SZ2)	8	8	18	6	6	13	7	13	8	8	47	29
... information from people who have lived here all their lives (C/W, SZ2)	25	21		6	13	19	7	7	8	8	13	
... I just get information from everywhere (MB/HB, S23)			6									
... I can't find any (C/W, SZ2)	4						7	7			7	13
... watch the animals (MB/HB, SZ3)									8	8		
... I go to the Council website (MB/HB, SZ1)	13	21		6		13				8		
... I think all information is unreliable (MB/HB, SZ2)					13							
No response			6	6	19	6	13	13	17	15	13	13

MB/HB = Machans Beach/Holloways Beach; C/W = Cardwell.
Source: Questionnaire, 2012.

Discussion

This study found that the majority of respondents, regardless of their geographic location or their proximity from the beach, preferred hazard information to be disseminated via mass media, as this method was easy to access. This result inferred respondents were mostly unprepared to actively seek out information *per se*. Rather, they preferred information to be transmitted directly into their homes. In addition, the information most sought was up to date weather reports. An important observation was that the questions were answered in a manner which showed that respondents only sought information when a cyclone was imminent. This infers that participants had not undertaken early preparations, preferring instead to seek extra information when a cyclone was likely to impact on the area.

Investigating whether a respondent's proximity to the foreshore influenced information-seeking habits found that respondents whose properties were located within 50 metres of the shoreline in Cardwell, despite recent past experience, still sought printed information in the form of brochures, to assist with preparation, while those located between 51-150 metres of the shoreline preferred to rely on media reports and past experiences. These findings appear to concur with those made by Anderson-Berry and King (2005, p. 44) who stated that despite previous research suggesting that frequent contact or familiarity with a natural

Table 4. Respondents' reasons for choosing particular source of hazard information.

Why did you choose those particular sources of information? *Examples of respondent comments...*	Machans Beach and Holloways Beach N=53			Cardwell N=47		
	SZ 1 N=24 (%)	SZ 2 N=16 (%)	SZ 3 N=13 (%)	SZ 1 N=17 (%)	SZ 2 N=15 (%)	SZ 3 N=15 (%)
... it is the most accurate and reliable (MB/HB, SZ2)	25	32	23	6	20	14
... it is convenient, readily available anytime (MB/HB, SZ1)	38	31	23	24	27	20
... it is easy to understand...I hate the technical stuff (C/W, SZ2)		6		6	7	
... it is regularly updated (MB/HB, SZ2)	8	13		6		
... it is most informative (C/W, SZ1)				6		
... it is generally interesting (C/W, SZ3)				6		7
... I want information that is easy to file and keep handy (C/W, SZ1)				6		
... I like it because it is home delivered and I don't have to search for it (MB/HB, SZ3)	4	6	8	6	7	
... I had nothing else to use (C/W, SZ2)					7	
... I like the pictures (MB/HB, SZ2)		6				
... It was locally relevant (MB/HB, SZ3)			8			
...I needed brochures for the vision impaired but didn't know where to get them (MB/HB, SZ1)	4					
... I trusted the source (MB/HB, SZ3)	4		8			
... I don't know why I used it, I just did (C/W, SZ3)						20
... Did not respond	13	13	31	29	47	27

SZ1 = 0 - 50 metres from shoreline; SZ2 = 51 - 100 metres from shoreline; SZ3 = 101 – 150 metres from shoreline.
Source: Questionnaire, 2012.

hazard reduced perceived risk, their research had found that the study sample perceived the risk from both cyclone and storm surge as high, despite surviving *Cyclone Steve* during the sample collection period. This heightened sense of risk appears to influence individuals in the most vulnerable locations to seek out further information to improve their preparation actions. For example, Cairns Regional Council place hazard preparedness information in Council operated facilities such as local libraries, Council chambers and neighbourhood community centres, which may not be an obvious location to look for hazard preparedness information if you are a new resident, for example.

Conversely, the results from respondents in Holloways Beach and Machans Beach located within 50 metres of the shoreline indicated that the majority did not actively seek out preparatory information. Rather, they too preferred hazard information from the media. This result was repeated throughout the entire study area, which, according to Park, Scherer and Glynn (2001, p. 282), raises concerns. They warned that preferring mass media hazard information messages had the potential to influence an individual's perception of risk within his or her society but may not necessarily affect personal perception of risk, nor might it translate into behavioural changes required to protect the individual. The concern here is that if the preferred method of receipt of information for far north Queensland communities is the mass media, emergency managers might consider designing campaigns that emphasis personal risk while using the media to disseminate information prior to cyclone season. At the very least, consideration could be given to designing campaigns that use the media to redirect individuals to informative websites, libraries or other locations distributing preparatory information.

The influence hazard preparatory information had on the risk perception of respondents was examined from the perspective of past experience, tenancy status and location from shoreline. James, Hawkins and Rowel (2007, p. 1) and Cutter (1996, p. 533) had identified that the proximity to a natural hazard altered an individual's perception of risk. Data from this study agreed with these findings, as respondents whose properties were located within 50 metres of the foreshore did have a heightened perception of cyclone and storm surge risk compared to those located further back. This research

also confirmed Li's (2009, p. 379) observations that suggested as an individual's personal experience with a natural hazard increased, so did their perception of risk associated with that natural hazard, resulting in a heightened sense of preparation and sheltering behaviour. The majority of respondents in this study had occupied their properties for more than five years and, as such, had either been directly impacted by a cyclone or had seen the catastrophic consequences of cyclones in the near vicinity. This past experience had resulted in a generally heightened risk perception level among participants, although differences in attitudes were evident between those in differing tenancy levels.

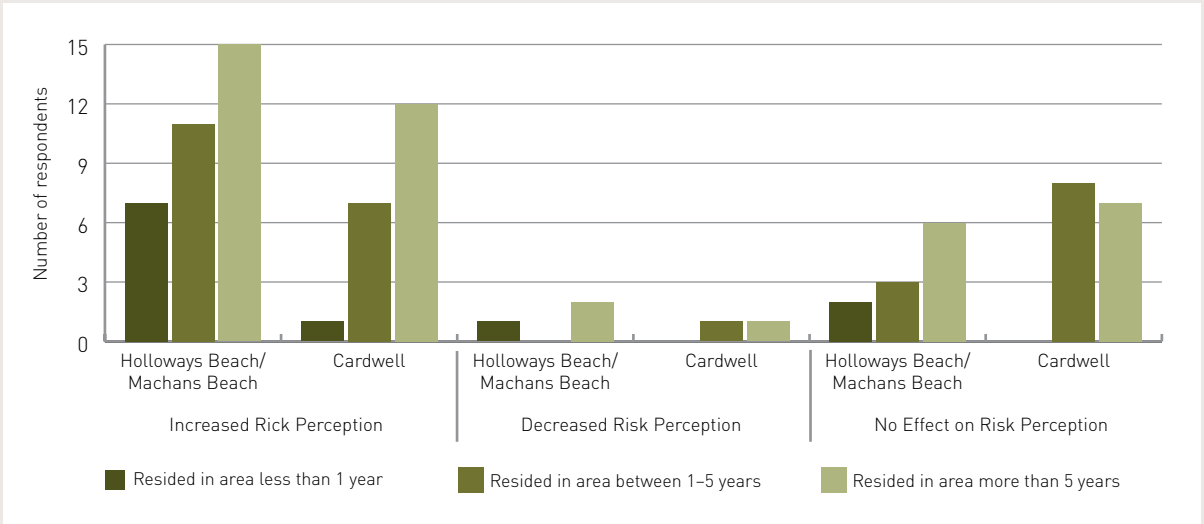
Examining the responses from residential owners and renters, those who were business owners only, as well as those who were both residents and business owners showed that most respondents, regardless of tenancy status, stated that hazard preparatory information had increased their risk perceptions. The only exceptions were business owners in Holloways Beach and Machans Beach located between 101-150 metres from the water, along with some residential renters in Cardwell located within 50 metres of the foreshore. Grothmann and Reusswig (2006, p. 114) stated that differences in attitudes between owners and tenants were to be expected for two reasons. The first was that an owner had far more to loose than a tenant in the face of a natural disaster as the hazard had the potential to cause serious damage to infrastructure. Secondly, tenants are often not permitted to make adjustments to buildings or properties to further protect against damage from a natural hazard. Therefore, the outcomes for residential renters were expected, but the responses from business owners were not (Table 5).

The responses from these respondents inferred that insured business owners with no previous hazard experience believed that insurance reduced the risk of financial losses, which translated into a reduced need to prepare for a cyclone or storm surge. This attitude was confined only to Holloways Beach and Machans Beach and only to business owners located over 100 metres from the beach. The remaining participants from Holloways Beach and Machans Beach and no other respondents from Cardwell stated this belief. It is the recommendation of this study that further research

Table 5. Machans Beach and Holloways Beach business owners' views on hazard preparation.

Respondent location	Respondent response
Machans Beach/ Holloways Beach 101–150 metres from foreshore Business Owner	*'...I don't worry about reading anything because insurance covers everything... that's why I have insurance. Most of the information is of no use anyway...it's not written for businesses.'*
Machans Beach/ Holloways Beach 101–150 metres from foreshore Business Owner	*'...I don't have time to read anything...I just do the basics and leave. I have insurance so that I don't have to worry.'*
Machans Beach/ Holloways Beach 101–150 metres from foreshore Business Owner	*'...No-one with a business has time to worry about things like that.'*
Machans Beach/ Holloways Beach 101–150 metres from foreshore Business Owner	*'...I figure if the storm surge reaches me, then it would have destroyed everything here in Holloways Beach anyway....I won't have anyone coming here to stay, so what does it matter.'*

Source: Questionnaire, 2012.



Source: Questionnaire, 2012

Figure 3: Comparing length of residency on the influence hazard information had on respondent perception of risk.

be undertaken to determine if business owners without hazard impact experience believe that insurance reduces the risk of financial loss, as well as the need to seek information on how to better prepare for an event in the future. Actions such as these have the potential to cause avoidable damage to not only property but also to surrounding properties.

Conclusion

This study confirmed that it is not simply the provision of hazard information that influences a person's perception of risk; it is whether that person perceives a need to seek out that information. Emergency managers may need to consider designing campaigns that focus on changing the hazard preparatory information-seeking habits of those who are vulnerable. When information is sought, found and used, it has the potential to increase an individual's perception of risk, which potentially translates into the intention to better prepare for an event in the future. Most importantly this study confirmed the importance of understanding that each community has unique hazard preparatory information-seeking habits, and that these must be considered if information is to reach those in harm's way. If emergency managers in Australia continue to rely on individuals being responsible for their own hazard mitigation and knowledge, then the challenge will be to develop ways that capture the attention of those who are most vulnerable, and which encourage vulnerable citizens to seek out and use information designed to improve both the physical preparation of their property and the psychological preparation of themselves and their families. More research should be carried out in this area.

References

Anderson-Berry L & King D 2005, *Mitigation of the Impact of Tropical Cyclones in Northern Australia Through Community Capacity Enhancement, Mitigation and Adaption Strategies for Global Change, vol. 10, pp. 367-392.*

Boughton GN, Henderson DJ, Ginger JD, Holmes JD, Walker GR, Leitch CJ, Somerville LR, Frye U, Jasasinghe NC & Kim PY 2011, *Tropical Cyclone Yasi Structural Damage to Buildings, CTS Technical Report No. 57, James Cook University, Townsville, Australia.*

Cutter SL 1996, *Vulnerability to environmental hazards, Progress in Human Geography, vol. 20, no. 4, pp. 529-539.*

Emanuel K 2005, *Increasing destructiveness of tropical cyclones over the past 30 years, Nature, vol. 436, no. 4, pp. 686-688.*

Emergency Management Australia 2004, *Emergency Management in Australia: Concept and Principles, Emergency Management Australia, Canberra.*

Grothmann T & Reusswig F 2006, *People at Risk of Flooding: Why Some Residents Take Precautionary Action While Others Do Not, Natural Hazards, vol. 38, pp. 101-120.*

James X, Hawkins A & Rowel R 2007, *An Assessment of the Cultural Appropriateness of Emergency Preparedness Communication for Low Income Minorities, Journal of Homeland Security and Emergency Management, vol. 4, no. 3, pp. 1-24.*

Knutson TR, McBride JL, Chan J, Emanuel K, Holland G, Landsea C, Held I, Kossin JP, Srivastava AK & Sugi M 2010, *Topical Cyclones and Climate Change, Nature Geoscience, vol. 3, no. 3, pp. 157-163.*

Li GM 2008, *Tropical cyclone risk perceptions in Darwin, Australia: a comparison of different residential groups, Natural Hazards, vol. 48, pp. 365-382.*

Lidston JG 1994, *Learning to Live Safely in the Australian Environment, in JW Handmer (ed), Education for disaster reduction: World Disaster Reduction Day 1993, Resource and Environmental Studies, 9, Centre for Resource and Environmental Studies, Australian National University, Canberra, pp. 15-22. At: http://eprints.qut.edu.au/16840/1/16840.pdf [7 February 2013].*

O'Connor RE, Bord RJ & Fisher A 1999, *Risk Perceptions, General Environmental Beliefs, and Willingness to Address Climate Change, Risk Analysis, vol. 19, no. 3, pp. 461-471.*

Park E, Scherer CW & Glynn CJ 2001, *Community involvement and risk perception at personal and societal levels, Health, Risk & Society, vol. 3, no. 3, pp. 282-292.*

Paton D 2003, *Disaster preparedness: a social cognitive perspective, Disaster Prevention and Management, vol. 12, no. 3, pp. 210-216.*

Pielke RA, Landsea C, Mayfield M, Laver J & Pasch R 2005, *Hurricanes and Global Warming, American Meteorological Society, vol. 86, pp. 1571-1575.*

Reser JP 2007, *The Experience of Natural Disasters: Psychological Perspectives and Understandings, in International Perspectives on Natural Disasters: Occurrence, Mitigation and Consequence, J.P. Stoltman, J. Lidston & L.M. DeChano (Eds), Springer, The Netherlands, pp. 369-382.*

Sarewitz D, Pielke R & Keykhah M 2003, *Vulnerability and Risk: Some Thoughts from a Political and Policy Perspective, Risk Analysis, vol. 23, no. 4, pp. 805-811.*

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Integrating disaster preparedness and resilience: a complex approach using System of Systems

Antonella Cavallo, University of Adelaide, discusses a 'System of Systems' approach to building resilience. ®

ABSTRACT

The number of natural and human-made disasters has increased in recent times as a result of many factors, including climate change (IPCC 2014, Climate Council of Australia 2014) and increased interconnectivity of potential risk factors (Helbing 2013). The nature of disaster events has made institutional organisations around the world aware that new disaster prevention strategies are required. In this context, international and national standards have been changed to focus more on community resilience as well as disaster management. In Australia, the *National Strategy for Disaster Resilience* (COAG 2011) has embraced this change and pushed for 'shared responsibilities' between government, emergency services, communities and individuals. The Strategy does not provide a definition of resilience; hence, it gives space to a conceptual exploration of an approach to support communities in building their own resilience.

This article contributes to the conceptual conversation around community resilience in Australia by discussing new ways of thinking. Particularly, it focuses on the balance between specified and general resilience, that is, the ability of a community to prepare for known and unknown risks. This distinction is taken further to discuss a complementary conceptual approach to current command-control strategies in support of general community resilience building based on systems thinking. The integration of *ad hoc* traditional approaches and systemic methods is considered as the key to increased community resilience.

It should be noted that this article concentrates on the 'front-end of disaster management' emphasising planning and preparation and not on responding to disaster events. Current disaster preparedness strategies could effectively be complemented by incorporating this new approach to general resilience to build community resilience before disasters happen.

Introduction

The *National Strategy for Disaster Resilience* (COAG 2011) was released in 2011. The Queensland floods had just occurred. The nation was in shock, authorities included. How was it possible that some parts of the country well known for drought problems were now suffering severe consequences of flooding? For many people, that was the first real sign of climate change; the first signs that the 'impossible' can happen. This national experience and the increasing number of disasters worldwide were a warning signal to many. The costs of the disaster response made it clear that better preparation for disasters was needed. International standards and agreements, such as the United Nations *Hyogo Framework for Action* (HFA), played an important role in the development of a discourse that is inclusive of those organisations, community groups and people who are traditionally left out of the disaster-planning phase. In recent years, the intensity and increasing frequency of disaster events have triggered a review of the traditional disaster management framework: prevention, preparedness, response and recovery (PPRR). The introduction of 'disaster resilience' into disaster management has introduced a new way of thinking about disaster mitigation, which does not replace the traditional command-control approach, but it is complementary to it.

The traditional approach refers to the delivery of expert services to recipient communities. A proposed complementary approach would see the role of

communities reviewed at the national level to involve community members in an active collaboration to prepare for disasters. This would contribute to 'community resilience' defined as the engagement of community resources by its members to face 'uncertainty, unpredictability, surprise and change' (Magis 2010). Similarly, the Stockholm Resilience Centre states that:

> *'Resilience is the capacity of a system, be it an individual, a forest, a city or an economy, to deal with change and continue to develop'*
>
> (Moberg & Simonsen 2011).

More commonly, resilience is referred to as the ability of a community to 'bounce back' after something bad happens (Zolli & Healy 2012). Despite efforts to define exactly what resilience is, there seems to be a common understanding that resilience cannot be confined to a closed framework. So far, no 'recipe solution' has been identified to build or increase resilience in a community. Instead, common characteristics of resilient communities have been identified and discussed in government documents, such as the *National Strategy for Disaster Resilience.*

The focus of this article is on the need for emergency management organisations and the wider community to share a vision and a common approach towards building resilience to unexpected disaster events. Current approaches to disaster prevention focus on the risks that can be identified and managed. They focus on specific risks that are known or can be known. However, there are a number of risks that are not identified, which the wider community might therefore not be prepared for. Additionally, it has been acknowledged that many risks cannot be predicted but that there is potential to prepare for them (Cavallo 2010, Gilpin & Murphy 2008, Loch, DeMeyer & Pich 2006, Meadows 2002), therefore unknown risks can be managed to some degree. There is also a need for disaster management to have a more holistic approach, which goes beyond individual organisations to create a 'shared responsibility' involving not only emergency management organisations and institutions, but also communities and individuals (Cavallo 2010, COAG 2011). Based on this, it is argued that the emergency management sector needs to invest in strategies that build general resilience in the community. This refers to the capacity of the community to prepare for unknown shocks (Walker & Salt 2012). In addition, a new perspective is required that incorporates 'System of Systems' (SoS) thinking. This is a complex holistic approach that recognises the contribution of stakeholders across the wider community to prepare for disaster events.

Disaster resilience in a complex System of Systems (SoS)

Systems theory represents an opportunity for a global vision of disasters and their overall management. Disaster prevention is often organised on the assumption that it can be broken down into a series of work packages, which are addressed individually by emergency services agencies. However, when a disaster occurs, any number of different organisations and individuals emerge to help. These are independent and at the same time interdependent. This way of thinking could be built into the planning and prevention phase, that is, before disaster events. In short, disasters need to be considered as a whole, because they are greater than the sum of their component parts (Cavallo & Ireland 2012). In this sense, a disaster is the expression of the interactions between different systems such as emergency services organisations, weather, community, environment, isolated members of the community and other factors. For this reason, disasters have to be approached holistically in terms of space, for example inter-organisational relations, and time, such as the system's historical context (Meadows 2002). It might not be possible initially to describe the whole system in an exhaustive way. However, an awareness that other parts of the system exist and that there is a portion of uncertainty involved in the strategy is fundamental. Indeed, this can contribute to constructing a more thoughtful risk management plan and increase the system's resilience.

System of Systems offers certain elements, which particularly apply to the disaster prevention discourse. They are autonomous, that is they decide to belong to a System of Systems such as the emergency or to maintain connection with the other systems in the same SoS. They are heterogeneous and contribute to the evolution of the SoS towards unpredictable states or conditions (Boardman & Sauser 2008). An example of this is the market, populated with independent, but interdependent competitors. Equally, before, during and after disasters, independent systems operate, while at the same time being interdependent.

Organisations, community groups, councils and others can be represented as both independent and interdependent systems within a whole system. On one hand, some parts of the system are connected to one another in a hierarchical way, for example, government and its agencies (green in Figure 1). On the other hand, other parts of the system operate in an autonomous way and collaborate informally (white in Figure 1).

This model represents the core emergency management agencies, which are connected to different levels of government hierarchically and are typified by a command-control mindset. Other agencies comprise the periphery of this model suggesting their relative autonomy and flexibility in the way they operate.

Resilience is complex and dynamic

Resilience is a dynamic system property, which can change over time depending on system conditions. In this sense, resilience can be defined as the distance between current system conditions and the system 'critical threshold' (Resilience Alliance 2010). The difference between system and SoS is shown in Table 1. Systems, problems or projects are complex

'if their future is uncertain' (Flach 2012). For example, community resilience is complex because it is not possible to precisely define the elements needed to make a community resilient. Even if the time at which the threshold will be reached is unknown, knowing that there is a threshold can support building resilience in a system (Resilience Alliance 2010). This is very important, because when applied to disaster resilience, it proposes that even if we do not know the nature and timing of a disaster event, raising awareness about the possibility of an unexpected event will reduce the likelihood of crossing the 'critical threshold', that is to say that it will increase the system's resilience.

Disaster preparedness and disaster resilience

An important aspect of this analysis is the distinction between specified and general community resilience in disaster prevention. This distinction is often driven by disaster preparation and response nexus; therefore it is commonplace to think in terms of specified rather than general resilience (Walker & Salt 2012). Systems practitioners need to complement command-control strategies by investing in general resilience before disasters occur.

Disaster preparedness is about preparing communities and response systems to face the risks that have been identified in a certain area. Once the risks are identified, a risk management plan can be put into place to prepare the population to face those risks. The assumption behind such an approach is that once the hazard is identified, the technical sectors of response can be broken down into packages of actions, plans, instructions, etc. which can be addressed independently. Once all the packages have been addressed, it is assumed that the 'boxes have been ticked' because the sum of those completed packages gives the impression that the risk has been dealt with in its entirety (Park *et al.* 2013). For example, after identifying the hazard of an earthquake, different organisations prepare to address a range of risks like structural instability of buildings, impacts on social, administrative and financial structures, and urgent household needs. For each group of risks, further risk areas are identified and action plans are formulated accordingly. For example, a householder may consider their access to essential goods, such as food and water. Supermarkets, pharmacies, etc. might not be accessible in the wake of a disaster. One recommendation is to store enough water and non-perishable food in the house suitable for at least three days (see Figure 2).

Figure 2 shows that disaster preparedness follows a pyramid-shape structure where risks are identified one by one and linear action plans are elaborated on the basis of the identified risks.

Disaster preparedness can be seen as a System of Subsystems. The hazard is broken down into a series of independent joint actions, that is to say a reductionist approach is used. Providers mitigate the identified risks in specific top-down programs, while the community members are clients. The causal relationships behind such an approach are linear, e.g. cause 1 has effects 1, 2, 3. Networked effects are hardly ever considered.

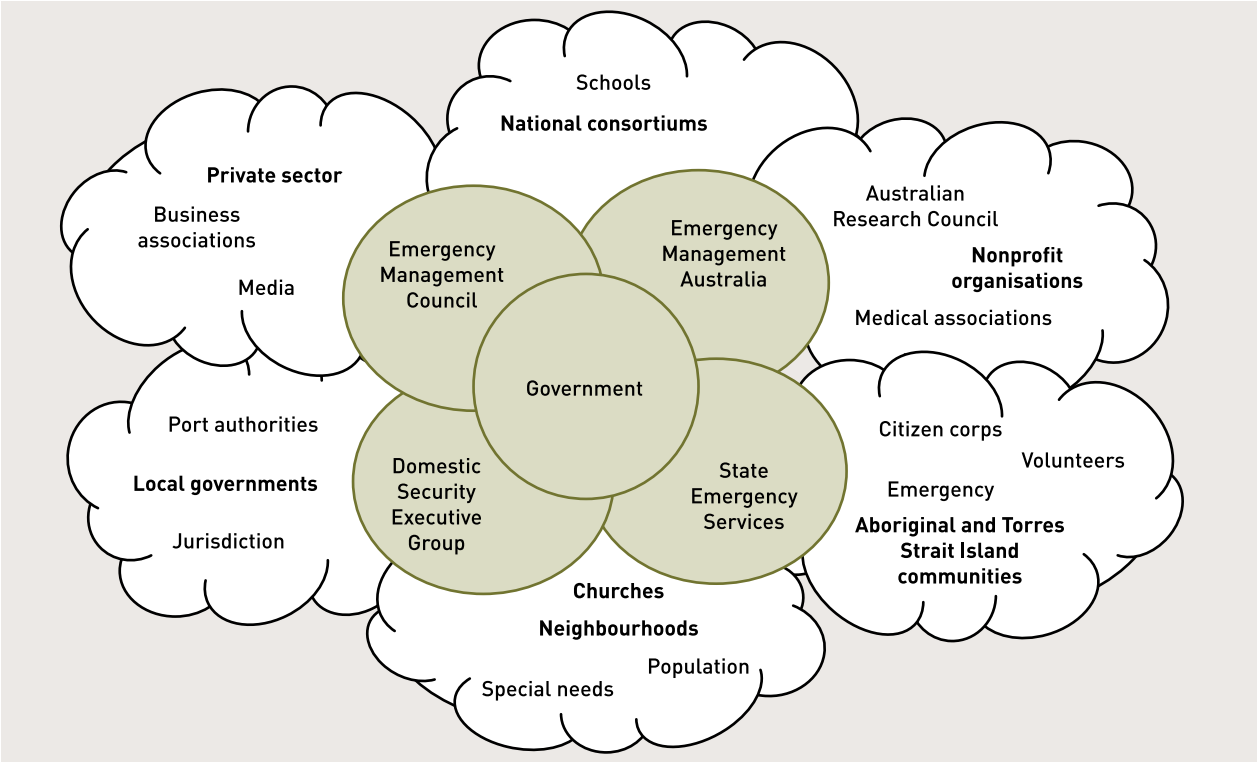


Figure 1: Map of generic emergency management System of Systems.

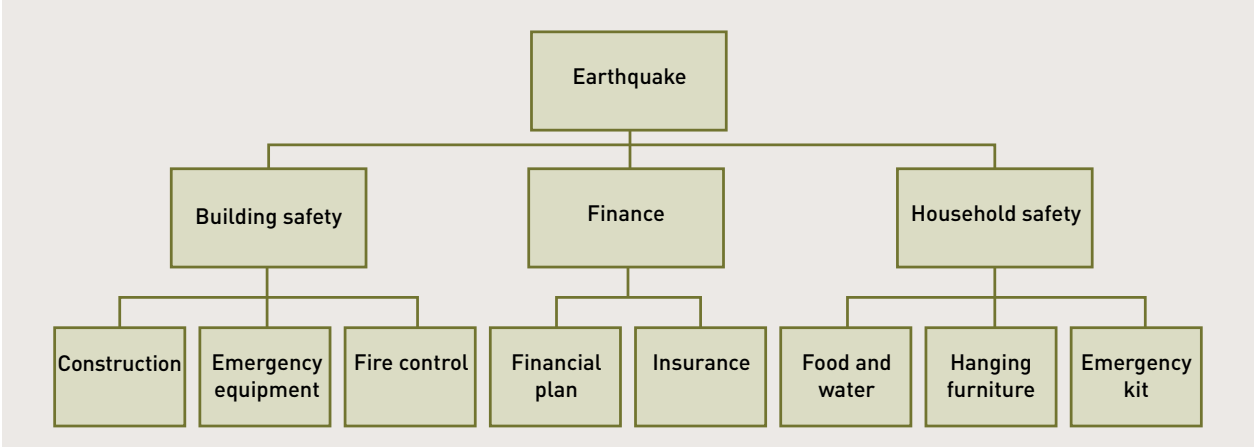


Figure 2: Example of a draft risk break down structure for earthquakes.

Many organisations consider the practice of analysing networked risks 'too complex'. Because some practices are already in use, strategies can be selected by analysing the needs and responding to those (Snowden & Boone 2007).

Contrary to mainstream projects and disaster preparedness, complex projects such as building resilience to disaster cannot be broken down into subsystems (Flach 2012) because, in the process, the interactions characterising the system would be lost. Disaster preparedness involves complex responses. Traditional reductionist approaches are a viable strategy to break down problems. However, building resilience is more complex because it requires the reconnection of elements broken down over time or are yet to be established (for example, institutions are much more aware of the synergies between community activities and events and disaster resilience building processes).

Building disaster resilience complements disaster preparedness programs because it is based both on bottom-up and top-down approaches; on inductive and deductive thinking. It starts from the system components and goes to the top to create an overall perspective of the system, e.g. from the community members up to the governmental perspective and from there, back to community members to obtain feedback and continue building resilience. These aspects of disaster preparedness and disaster resilience are illustrated in Table 1.

Disaster management has long been studied from the perspective of emergency management institutions, organisations and agencies as service providers and affected community members as clients; passive receivers. As a consequence, affected communities have been considered as separate from disaster management activities. In the last decade, things have changed and several studies have shown the potential intrinsic value in involving communities to increase the effectiveness of disaster preparedness (Aldrich 2012).

The *National Strategy for Disaster Resilience* highlights the importance of building relationships throughout 'communities of interest' and 'communities of practice'. The main aspect found to have a direct influence on the resilience of a community is the degree of connectedness between its members (Arbon *et al.* 2012). In essence, people who know other people are likely to be more resilient than isolated members of the community. In this context, organisations involved in disaster preparedness are left with the question of what it means in practice to support communities to build their resilience to disasters and to the unexpected. Ideally, the mechanisms that underpin planned collaboration between government and non-government organisations and the wider community would both respond effectively to major disaster events and also increase the capacity for long-term community resilience.

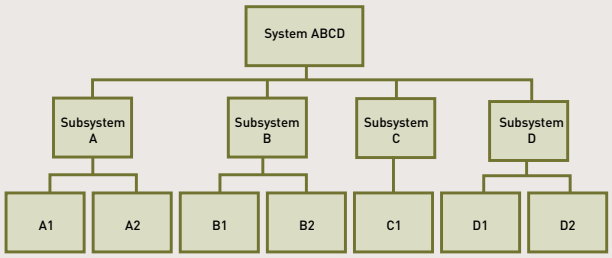
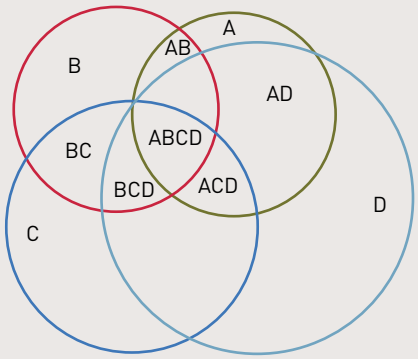
Some would say that the resilience of a system depends to a great extent on the social capital of people in a community (Aldrich 2012) and on the ability of the system, involving all of the organisations and players, to manage identified risks. Disaster prevention and mitigation are influenced by risk management plans. These are formulated after risk identification, evaluation and analysis. In turn, they inform risk mitigation and monitoring strategies. This procedure, embraced by international standards such as ISO 31000[1], is based on the ability of an organisation to identify its risks and manage them. However, it does not take into consideration those risks, which are unforeseen or often of a multi-causal nature (Comes & Cavallo 2013). This paper argues for a non-linear approach to risk assessment so that multi-causality is likely to be better understood and approached.

Correspondences with communities

This discussion builds on Soft Systems Methodology (Checkland & Poulter 2006) and on the more recent concept of the Evolutionary Learning Laboratories (Bosch, Nguyen & Maeno 2013). Both acknowledge the importance of going beyond the superficial symptoms to address 'the basis of the iceberg' to use a metaphor by Maani and Cavana (2007).

1 ISO 31000 - Risk management www.iso.org/iso/home/standards/iso31000.htm and ISO/TR 31004:2013 for Risk management - Guidance for the implementation of ISO 31000.

Table 1. Two complementary ways of thinking about disaster preparedness and disaster resilience.

Specified resilience	General resilience
Disaster preparedness thinking	Disaster resilience thinking
Reductionist thinking	Inductive, deductive and abductive thinking
	
System of subsystems (SoSS)	System of Systems (SoS)
Identified risks	Unforeseen, unanticipated risks or unprepared community
Linear thinking	System thinking
Sense and respond	Probe, sense and respond
Mitigate negative events	Keep safe operating space

They argue that a systemic approach can help organisations to find a paradigm for collaboration in addressing multi-faceted, complex problems involving a large number of stakeholders.

Building resilience within specific groups poses such a challenge. In terms of stakeholders, there are multiple organisations working in disaster prevention. While the methods of analysis detailed above are different, both suggest that building community resilience to disasters is best addressed by involving all stakeholders. In order to achieve this, the world-views of the stakeholders and of the agencies need to be taken into equal account. Ultimately, while this approach does not necessarily guarantee a definitive solution, it does offer a 'desirable and feasible' way forward for all parties. Translated into practical terms, this means starting a conversation at the community level and taking it up to an intermediary agency and finally to the level of government agencies. A key point of difference with previous approaches to disaster mitigation is that the relationship between emergency services organisations and other stakeholders would operate very differently. Currently the information on disaster prevention is 'pushed down' to the community. However, there is no information on the existing capability of the community to play a collaborative role in mitigating risks. A key focus here is on how best to support members of the public to collaborate more actively in building resilience within their communities, based on their specific worldviews as well as their current and potential capabilities. Building resilience in the community is a process which needs to go from the parts to the whole and from the whole back to the parts (Morin 2007). For this reason, the search for a paradigm to support the wider community to build resilience needs to start with them. In more 'complex' terms, their self-organisation is at the centre of this study.

Conclusion

This conceptual paper presents a new approach to building community resilience by drawing on complexity theories and 'complex risk management' (Cavallo 2010).

Disasters are complex Systems of Systems. In disasters some elements of risk cannot be predicted or prepared for. This is also due to the complexity of which many risks are the expression. Risks that can be addressed in traditional ways are also mixed with systemic risks, which require new approaches. Current strategies focus on structured programs that acknowledge the presence of the former but often neglect the co-existence of conditions that have an influence on further risks. Disaster preparedness can help the construction of deployment action plans for risks which can be identified, but it cannot cover those situations that have not been planned for and which have systemic cascading effects. Therefore, in order to achieve both, disaster preparedness needs to be integrated with strategies to build community resilience in a sustainable way. While disaster preparedness can be approached with reductionist approaches, building resilience is a complex project, which is characterised by much uncertainty.

Many aspects are significant in building resilience. However, most studies point to the degree of connection of community members within and beyond their living area as the most important factor positively influencing general community resilience. By drawing on the specific needs, characteristics and capabilities of

particular communities and their environments, disaster preparedness allows individuals different ways of building and contributing social capital. The connections individuals develop within and outside the community can help them recover more quickly from a disaster or an unexpected event (Aldrich 2012).

Further study in South Australia is exploring ways to support populations in increasing resilience to unexpected events. The holistic view taken in this paper (Cavello & Ireland 2014) proposes the involvement of all potential players in disaster prevention and risk mitigation, including both specialist organisations and community members, to better provide disaster preparedness and to build community resilience.

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References

Aldrich, DP 2012, *Building Resilience. Social Capital in Post-Disaster Recovery, The University of Chicago Press, Chicago.*

Arbon P, Gebbie K, Cusack L, Perera S & Verdonk S 2012, *Developing a model and tool to measure community disaster resilience, Torrens Resilience Institute, Adelaide.*

Australian Emergency Management Institute 2012, *'Attorney-General's Department Disasters Database', Attorney-General's Department, Canberra. At: www.disasters.ema.gov.au/Default.aspx.*

Boardman J & Sauser B 2008, *Systems Thinking. Coping with 21st Century Problems, CRC Press, Broken Sound Parkway, NW.*

Bosch OJH, Nguyen NC & Maeno T 2013, *'Managing Complex Issues through Evolutionary Learning Laboratories', Systems Research and Behavioural Science.*

Cavallo A 2010, *Risk Management in Complex Projects. An exploratory study to managing unknown unknowns in uncertain environments, Lambert Academic Publishing, Saarbruecken.*

Cavallo A & Ireland V 2012, *'SoS in Disasters: Why Following the Manual Can Be a Mistake', IEEE International Conference on System of Systems Engineering, Genoa.*

Cavallo A & Ireland V 2014, *Preparing for complex interdependant risks: A systems approach to building disaster resilience. International Journal of Disaster Risk Reduction (2014), http://dx/doi.org/1016/j.jdrr, 2014.05.001.*

Checkland P & Poulter J 2006, *Learning for Action: A Short Definitive Account of Soft Systems Methodology, and Its Use Practitioners, Teachers and Students John Wiley & Sons.*

Climate Council of Australia 2014, *Angry Summer 2013/2014. At: www.climatecouncil.org.au/uploads/ff37af7492b4b698420c1aebdaed54a0.pdf.*

COAG 2011, *National Strategy for Disaster Resilience. Building the resilience of our nation to disasters, Commonwealth of Australia.*

Comes T & Cavallo A 2013, *'Designing decision support systems at the interface between complex and complicated domains', 19th Americas Conference on Information Systems AMCIS2013 Chicago, Illinois, USA.*

Flach JF 2012, *'Complexity: learning to muddle through', Cognition, Technology and Work, vol. 14, no. 3, pp. 187-197.*

Gilpin DR & Murphy PJ 2008, *Crisis Management in a Complex World, Oxford University Press, New York.*

Helbing D 2013, *'Globally networked risks and how to respond', Nature, vol. 497, no. 7447.*

IPCC 2014, *Oppenheimer M, Campos M, Warren R, Birkmann J, Luber G, O'Neill B & Takahashi K 2014, 'Climate Change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change', in M Brklacich & S Semenov (eds), vol. 1, Intergovernmental Panel on Climate Change (IPCC), Stanford, CA, pp. 13-19.*

Loch CH, DeMeyer, A & Pich MT 2006, *Managing the unknown. A new approach to Managing High Uncertainty and Risk in Projects, Wiley, Hoboken.*

Maani K & Cavana RY 2007, *Systems thinking, Systems Dynamics: Managing Change and Complexity, 2 edn, Pearson Education New Zealand, Auckland.*

Magis K 2010, *'Community Resilience: An Indicator of Social Sustainability', Society & Natural Resources, vol. 23, no. 5, 2010/04/05, pp. 401-416.*

Meadows D 2002, *'Dancing With Systems', The Systems Thinker, vol. 13, no. 2.*

Moberg F & Simonsen SH 2011, *'What is resilience?'. At: www.stockholmresilience.org/21/research/what-is-resilience.html.*

Morin E 2007, *'Le vie della complessità', La sfida della complessità, Bruno Mondadori, Milano, pp. 25-36.*

Park J, Seager TP, Rao PSC, Convertino M & Linkov I 2013, *'Integrating risk and resilience approaches to catastrophe management in engineering systems', Risk Analysis, vol. 33, no. 3, pp. 356-367.*

Resilience Alliance 2010, *'Assessing resilience in social-ecological systems: Workbook for practitioners. Version 2.0'. At: www.resalliance.org/index.php/resilience_assessment.*

Snowden D & Boone MJ 2007, *'A Leader's Framework for Decision Making: Wise executives tailor their approach to fit the complexity of the circumstances they face', Harvard Business Review, November.*

South Australian Fire and Emergency Services Commission 2012, *Prevention and Preparedness. Hazard Leaders, Adelaide. At: www.safecom.sa.gov.au/site/emergency_management/prevention_and_preparedness.jsp.*

Walker B & Salt D 2012, *Resilience practice. Building Capacity to Absorb Disturbance and Maintain Funtion. How can landscapes and communities adapt and transform in a changing world?, Island Press, Washington, DC.*

Williams T 2002, *Modelling Complex Projects, John Wiley & Sons, Ltd, Chichester.*

Zolli A & Healy AM 2012, *Resilience. Why Things Bounce Back, Headline Business Plus, London.*

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Disaster resilience: can the homeless afford it?

Dr Danielle Every and Dr Kirrilly Thompson, Central Queensland University Appleton Institute, consider the vulnerability of homeless people and suggest ways to support their resilience. ®

ABSTRACT

Research in the US suggests that people experiencing homelessness are more at risk during natural disasters because they have limited access to the economic, social and community resources needed for preparation, evacuation and full recovery. Although this vulnerability is recognised in Australian disaster management documents, little is currently known about the unique vulnerabilities of people experiencing homelessness, nor about specific, targeted interventions that can increase their resilience to natural disasters. This paper provides a literature review of research into the vulnerability of homeless people. The review identifies important issues to consider when planning responses to disasters and highlights suggestions for how greater disaster resilience support can be offered. The review also outlines some gaps in knowledge about homelessness, vulnerability and resilience that may impede effective disaster management for this group.

Disaster resilience and disaster vulnerability

In Australia disaster management has a focus on developing disaster resilience. This is articulated in the *National Strategy for Disaster Resilience* (COAG 2011) that defines resilience as the ability to function under stress, to adapt to change, to be self- (rather than government) reliant, and to have social capacity. However, this definition assumes that people have the social and economic resources to be self-reliant while adapting to change and recovering from unexpected and stressful events (Maguire & Cartwright 2008). In the context of disaster, Tierney (2006) indicates that resilience means people can:

> *'...afford to live in a home that was designed and built to resist disaster forces, to stockpile emergency supplies, and to save money for use during emergencies... [and have] the ability to pursue a wide range of options and to access multiple sources of aid following disasters.'*
>
> (Tierney 2006, p. 121)

Research by Wisner *et al.* (2004) demonstrates that disaster risk (death, injury, economic loss, psychological damage) is not random, but rather its distribution maps onto existing social inequalities. These include access to health care, political representation, and economic capital, as well as liveability (or existence) of a home and environment, and lower quality of life (Cutter, Boruff & Shirley 1990, Boon 2013). This complex relationship between resilience and vulnerability suggests that we cannot displace the responsibility for developing resilience onto people who are, by virtue of the social and economic inequalities that structure their lives, unable to access the necessary resources to do so. To build disaster resilience, these underlying social and economic inequities must be redressed.

A group who are particularly vulnerable to disasters, but have been less often considered in research and disaster risk interventions, are people experiencing homelessness. To help develop strategies to redress inequality in disaster risk, this paper reviews what is and is not known about the vulnerability of homeless people in disasters and suggests potential resilience-building strategies.

Homelessness in Australia

According to the Australian Bureau of Statistics *Census of Population and Housing: Estimating Homelessness 2011*, there are 105 237 people in Australia who are homeless (ABS 2011). The majority of these are under 35 years of age. There are 17 845 children under 12 who are homeless, including 400 children who sleep rough (AIHW 2012, Gibson & Johnstone 2010). Families account for 26 per cent of the homeless population in Australia, particularly women and children who have experienced domestic violence (AIHW 2012).

People experiencing homelessness are people who do not have a permanent home and who are:

- sleeping outdoors or in improvised dwellings (sleeping rough)
- sleeping in specialist homelessness shelters and boarding houses
- living in supported accommodation
- living in severely crowded conditions, or
- staying with different friends, relatives and acquaintances (AIHW 2012, Chamberlain & McKenzie 1992).

What makes homeless people vulnerable during disasters?

There is currently little research on the specific vulnerabilities of homeless people in relation to disaster risk and there is a particular lack of Australian research. However, using theories on social vulnerability generally, together with research from the US on homelessness and on people living in poverty, some general risk factors can be identified. These include:

- lack of resources
- lack of access to services
- limited social inclusion, and
- pre-existing physical, mental and emotional stressors (Wisner 1998).

These four social, economic and personal factors affect the preparation, response and recovery of vulnerable groups. People living below the poverty line, without adequate or reliable shelter and limited social and economic opportunities, are less likely to be prepared, warned, found and evacuated, or provided adequate support post-disaster (Morrow 1999, Wisner 1998). Research on these vulnerabilities is reviewed in relation to disaster preparation, warnings, response and recovery.

Preparation and homelessness

Preparation for a disaster includes, at the individual level, having a disaster plan and gathering emergency supplies, and at the community level educating people about disasters, the effects and how to prepare for and respond to them (Fothergill & Peek 2004).

In relation to individual preparation and homelessness, there is no readily available research on the levels of disaster preparedness among homeless people. However, a US report on including homeless people in disaster planning (Edgington 2009) noted that they have no means to purchase and store extra resources such as protective gear, radios, batteries, food and clothing, and maps. Like other people experiencing poverty, they are far less likely to be physically prepared in a disaster because they lack the resources to do so (Fothergill & Peek 2004). Also, few homeless people have access to shelter that is reliably temperature controlled or that can be modified to enhance its safety. They are not able to adequately prepare a home environment for extreme temperature emergencies like heat waves, storms and snow, or natural disasters such as fires or earthquakes (Ramin & Svoboda 2009).

In relation to community education about preparation, research into homelessness and disaster preparation in Tokyo noted the difficulty of reaching people who were homeless as they may not stay in the same place for any length of time. They also tend to be in places that are not easily visible or accessible (Uitto 1998). Aspects of limited resources and transience make planning, preparation and community engagement about disasters particularly challenging for this vulnerable group.

Warning communications, disaster responses and homelessness

Adequate warnings of possible or pending disasters require successfully disseminating understandable messages about risks. Risk communication and risk perception are particularly influenced by social and economic factors like poverty, social exclusion and physical and mental illness (Fothergill & Peek 2004, Njelesani *et al.* 2012, Fornili 2006), all of which are correlates of homelessness. People experiencing homelessness are less likely to have access to the mediums through which disaster warnings and information are commonly communicated i.e. television, radio, and internet. They are therefore less likely to know about an emergency or the recommended course of action (Edgington 2009).

Fothergill and Peek's (2004) summary of the relationship between poverty and risk perception suggests that people who are socially and economically disadvantaged (as are homeless people) may take warnings less seriously and be less likely to perceive them as valid. Spiers (n.d.) also found that risk perception is affected by mental illness. He found that how people perceive risk is related to aspects of the illness itself. People may have negative experiences with authority and experience negative effects from sudden changes in the environment. There are likely to be similar impacts on understanding risk for homeless people, particularly those who experience mental illness.

Disaster warnings like evacuation are more likely to be heeded by people in established accommodation, employed and financially secure (Enarson & Fordham 2001). If homeless people do use evacuation shelters, research in the US suggests that they may be subject to policing and surveillance. In addition, Tierney (2006) indicated they may be isolated and ostracised by others in the shelter because of their appearance or actions. Such research shows that the lack of resources, limited community inclusion, and pre-existing illnesses call for communication methods and disaster response services that acknowledge these factors.

People experiencing homelessness cannot always access the services they need.

Recovery and homelessness

The *Community Recovery Handbook* (AEMI 2011) indicates that disaster recovery is the reconstruction of the built environment, as well as the restoration of psychological, social, and economic wellbeing. There is no existing research with homeless people on the psychological and economic losses of disasters. However, there is some existing research on the recovery of people from low incomes and people with a physical and mental disability that may not be dissimilar from the challenges faced by the homeless.

When considering environmental and economic recovery, people on low incomes experience a greater proportionate loss of housing, finances and livelihoods (Fothergill & Peek 2004). This is related to them being unable to afford insurance or adequate cover, having no savings to fall back on, and being precariously employed in casual or marginal work that excludes sick leave entitlements. Despite not appearing to have a home or mainstream income, homeless people still face displacement and loss of income. During disaster recovery, safe places and sleeping places may be inaccessible. They are also unable to earn money from small enterprises (such as selling the *Big Issue* magazine), collecting recycling, or the bartering economy (Edgington 2009). People experiencing homelessness report greater stress over the loss of their income, and are more likely to report they have lost hope after a disaster (Fothergill & Peek 2004).

Disruption and loss of services provided to homeless people, such as temporary housing, health care, food distribution, and counselling, can affect recovery. These services may be overwhelmed by new clients who have been rendered homeless by the disaster event and resources may be stretched to accommodate those who were homeless before the disaster.

For homeless people their psychological recovery is likely to be influenced by pre-existing high rates of mental illness, substance abuse disorders, and poor physical health that may arise from the experience of homelessness and inadequate systems of care (Ramin & Svoboda 2009). Pre-existing trauma heightens the experience of disaster and people experiencing homelessness are potentially more likely to experience higher emotional distress, negative psychological impacts, and post-traumatic stress disorder (Fothergill & Peek 2004). The psychological recovery of homeless people may also be compounded by the loss of pets (Thompson *et al.* 2014). Studies show that people who are homeless are strongly attached to their animals, and their loss is a source of profound grief (Irvine 2003, Slatter, Lloyd & King 2012).

Building the disaster resilience of the homeless

Two principles that could underpin disaster resilience programs for people experiencing homelessness are suggested. These are foregrounding social and economic inclusion, and linking with existing community connections using service providers.

Buckle, Mars and Smale (2000) argue that resilience is based in social and economic inclusion. Thus programs that increase disaster resilience for homeless people should begin by supporting this inclusion. These programs could include:

- training for agencies to develop disaster plans for themselves
- training for homeless people on what to expect in a disaster and where they can access assistance
- training for service providers and emergency personnel on working with homeless people in disasters
- outreach warning communication strategies
- specialist counseling services post-disaster, and
- funding schemes for recovery which support homeless people to establish new housing or supporting better shelter options if they choose not to live in accommodation.

Relief organisations have new clients who have become homeless by the disaster and their resources are stretched to accommodate those as well as those who were homeless before the disaster.

These programs might also build on existing community connections through service providers. People who are homeless generally have links to service providers through temporary accommodation, food distribution, or support and counselling services. These agencies are likely to be the best starting point for engaging with people about activities and ways to build their disaster preparedness.

Conclusion

Disaster resilience is the contemporary focus of disaster management. However, resilience policies and programs that don't acknowledge the effects of social and economic vulnerability on disaster resilience mean that many people and groups are being asked to prepare for, respond to and recover from disasters without the existing resources to do so. It is not possible to consider preparedness without asking 'are people able to afford the preparedness initiatives?', or consider communication without also asking 'are people able to purchase the communication devices?', or think about recovery without also asking 'is this funding targeted at people who own homes?'

In this paper, the current status of knowledge about the vulnerability and resilience of homeless people is reviewed and the question asked 'Can homeless people afford resilience?' The answer is 'no'. Homeless people include men, women and children. They are socially and economically marginalised, highly transient, and may be experiencing physical and mental illnesses, all of which are factors that affect their access to the resources needed for disaster preparedness, response and recovery. Full inclusion in disaster resilience for any vulnerable group can only be one part of a broader socially inclusive economic and social system. Building on existing community links and existing knowledge about outreach, funding support and education is one part of the broader push towards reducing vulnerability. This review highlighted that there is limited research to build evidence-based programs. It is recommended that further research be conducted on disaster management inclusion of homeless members of communities that build resilience through ongoing social and economic inclusion.

References

Australian Emergency Management Institute 2011, *Community Recovery: Handbook 2. Australian Attorney-General's Department: Canberra.*

AEMI 2013, *National Strategy for Disaster Resilience: Community Engagement Framework: Handbook 6. Australian Attorney-General's Department: Canberra.*

Australian Bureau of Statistics 2012, *Census of Population and Housing: Estimating Homelessness 2011. Canberra: Australian Bureau of Statistics.*

Australian Institute of Health and Welfare. *Specialist Homelessness Services Data Collection 2011-12. Australian Institute of Health and Welfare: Canberra.*

Boon H 2013, *Preparedness and vulnerability: an issue of equity in Australian disaster situations. Australian Journal of Emergency Management, 28(3), pp. 12-16.*

Jacobs K & Williams S 2009, *Natural disaster preparation and response: issues for state housing authorities). AHURI (Australian Housing and Urban Research Institute).*

Buckle P, Mars G & Smale S 2000, *New approaches to assessing vulnerability and resilience. Australian Journal of Emergency Management, Summer, 2000, pp. 8-14.*

Chamberlain C & MacKenzie D 1992, *Understanding contemporary homelessness: issues of definition and meaning. Australian Journal of Social Issues, 27(4), pp. 274-97.*

Centre for Social Innovation 2010, *READY: A multi-media disaster preparedness toolkit for homeless services. Centre for Social Services: Needham, MA.*

Council of Australian Governments 2011, *National Strategy for Disaster Resilience, Commonwealth of Australian. At: www.em.gov.au/Publications/Program%20publications/Pages/NationalStrategyforDisasterResilience.aspx.*

Cutter SL, Boruff BJ & Shirley WL 2003, *Social Vulnerability to Environmental Hazards. Social Science Quarterly, 84(2), pp. 242-61.*

Department for Communities and Social Inclusion 2013, *People with vulnerabilities in disasters. Environmental scan and gap analysis of projects/programs for people with vulnerabilities in disasters 2013. Department for Communities and Social Inclusion: South Australia.*

Dyer JG & McGuinness TM 1996, *Resilience: analysis of the concept. Archives of Psychiatric Nursing. 10(5), pp. 276-82.*

Edgington S 2009, *Disaster planning for people experiencing homelessness. Nashville, USA: National Health Care for the Homeless Council, Inc.*

Enarson E & Fordham M 2001, *Lines that divide, ties that bind: race, class and gender in women's flood recovery in the US and UK. Australian Journal of Emergency Management, Summer, 2001, pp. 43-52.*

Family and Youth Services Bureau (n.d.) *Ready for Anything. A disaster planning manual for runaway and homeless youth programs. National Clearing House on Families and Youth: Silver Spring, MD.*

Fornilli K 2006, *Disasters and substance use disorders: response and responsibility. Journal of Addictions Nursing, 17, pp. 71-77.*

Fothergill A & Peek L 2004, *Poverty and disasters in the United States: A review of recent sociological findings. Natural Hazards, 32, pp. 89-100.*

Gibson C & Johnstone T 2010, *Investing in our future: children's journeys through homelessness and child protection. A scan of the literature, policy and practice. Adelaide: Australian Centre for Child Protection: University of South Australia.*

Homelessness Australia 2012, *About homelessness. At: www.homelessnessaustralia.org.au/index.php/about-homelessness/homeless-statistics.*

Irvine L 2013, *My dog always eats first: Homeless people and their animals. Boulder, Colorado: Lynne Rienner Publishers.*

Jacobs K & Williams S 2009, *Natural disaster preparation and response: issues for state housing authorities. Australian Housing and Urban Research Institute: Melbourne, Victoria.*

Maguire B & Cartwright S 2008, *'Assessing a community's capacity to manage change: A resilience approach to social assessment', Bureau of Rural Sciences, Australian Government.*

Morrow BH 1999, *Identifying and Mapping Community Vulnerability. Disasters, 23(1), pp. 1-18.*

Njelesani J, Cleaver S, Tataryn M & Nixon S 2012, *Using a human rights-based approach to disability in disaster management initiatives. In S. Cheval (ed). Natural Disasters. At: www.intechopen.com/books/natural-disasters/using-a-human-rights-based-approach-to-disability-in-disaster-manatement-initiatives.*

Price-Robertson R & Knight K 2012, *Natural disasters and community resilience: A framework for support. Child Family Community Australia Paper No. 3. Australian Institute of Family Studies: Melbourne.*

Ramin B & Svoboda T 2009, *Health of the homeless and climate change. Journal of Urban Health, 86(4), pp. 654-64.*

Rockefeller Foundation 2012, *Rebound: building a more resilient world. New York: Rockefeller Foundation.*

Slatter J, Lloyd C & King R 2012, *Homelessness and companion animals: more than just a pet?. British Journal of Occupational Therapy, 75(8), pp. 377-83.*

Speier T (n.d.), *Introduction to crisis counselling programs and services to persons with serious and persistent mental illness. In: Responding to the needs of people with serious and persistent mental illness in times of disaster, USA: Centre for Mental Health Services. At: http://cretscmhd.psych.ucla.edu/nola/Video/MHR/Governmentreports/1-Responding_to_Needs_Serious_Mental_Illness.pdf.*

Tierney K 2006, *Social inequality, hazards and disasters. In R. Daniels & DK, Kunreuther (eds). On Risk and Disaster: Lessons from Hurricane Katrina. (pp 109-128). Philadelphia: University of Pennsylvania Press.*

Tobin K & Freeman P 2004, *Emergency preparedness: A manual for homeless service providers. Centre for Social Policy Publications, Paper 30. At: http://scholarworks.umb.edu/csp_pubs/30.*

Thompson K, Every D, Cornell V, Rainbird S, Smith B & Trigg J 2014, *Animal attachment and disaster resilience in vulnerable communities in Australia. World Society for the Protection of Animals (WSPA): Melbourne: Vic.*

Uitto JI 1998, *The geography of disaster vulnerability in megacities: A theoretical framework. Applied Geography, 18(1), pp. 7-16.*

Wisner B 1998, *Marginality and vulnerability: Why the homeless of Tokyo don't 'count' in disaster preparations. Applied Geography, 18(1), pp. 25-33.*

Wisner B, Blaikie P, Cannon T & Davis I 2004, *At risk: Natural hazards, people's vulnerability, and disasters. 2nd ed. New York: Routledge.*

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Dr Kirrilly Thompson is a cultural anthropologist and senior research fellow at Central Queensland University Appleton Institute in Adelaide, South Australia. Her research interests include human-animal relations, risk and culture. Dr Kirrilly leads a three-year Australian Research Council project titled 'Should I stay or should I go? Increasing natural disaster preparedness and survival through animal attachment'. The project considers ways in which animal attachment can be reconsidered as a protective factor for human survival of fires and floods.

Research of this type informs the work related to vulnerable communities. Other articles in this area are welcome.

Urban planning and disaster

Journalist Linley Wilkie, talks with Chilean PhD student, Jorge Leon, whose research into land-use planning and discovery of the AJEM brought him to Australia.

Jorge Leon, PhD candidate at University of Melbourne.

Jorge Leon was working as an assistant professor at Chilean university, *Universidad Técnica Federico Santa María* when he first encountered the University of Melbourne's Dr Alan March. It was following the February 2010 tsunami that devastated coastal regions in south-central Chile and, having completed his masters degree in urban planning, Jorge was keen to undertake a PhD in urban planning and disaster. While researching the possibilities, he came across an article written by Dr March titled *A better future from imagining the worst: land use planning and training responses to natural disaster.*

'The article compared the planning process to the emergency management process and looked at the similarities and differences between the two,' explained Jorge of the piece that appeared on the online version of the *Australian Journal of Emergency Management* (AJEM). 'It was precisely the area I wanted to research.' After contacting Dr March to discuss the possibility of the Associate Professor supervising his doctorate, Jorge moved to Australia in November 2011 and is now a PhD student at the University of Melbourne Faculty of Architecture, Building and Planning.

In what has proven to be a productive few years since his successful application, Jorge's concepts regarding urban planning for disaster were reinforced this year following an earthquake in his homeland. His studies have also branched into further areas with Dr March – little wonder Jorge is such an advocate for open source journals such as AJEM, given the wealth of information and professional contacts they provide.

'The majority of journals are supported by businesses, such as academic institutions and research institutes and subscribers pay a yearly fee to access these journals,' he said. 'It's so important to have open journals that can be accessed by any person. AJEM is good because it provides very interesting topics and its approach engages a wider audience. It's more interesting and easier to read for a person who comes from outside academia,' he said.

Dr March says it's not unusual for overseas students to contact him about PhD opportunities at the University of Melbourne. 'We have a very strong pull from international PhD students and have more international PhD students than Australian ones. People are quite keen to do a PhD overseas because it adds an extra dimension to their study and allows for some comparative understanding, as well as being a career path with different opportunities,' he said.

For Jorge, his PhD at the University of Melbourne provided an opportunity to research the relationship between urban design and evacuation during rapid onset disasters, specifically tsunami evacuation. When I first spoke with Jorge in late 2013, he was studying two tsunami cases in Chile; one in the port city of Talcahuano, which was seriously affected by the 2010 tsunami ('Not a lot of people died, but a large part of the city was washed out by the waves,' he recalls) and other in Iquique. The northern city had experienced three or four tsunamis throughout history, the most recent in 1877.

'With earthquakes, the gap between them is very important and you can predict you're going to have an earthquake every 50 or so years,' Jorge explained. 'In this case it's been almost 150 years, so they are expecting a large one. The problem is during the last one it was a minor city, but now the city has grown and you have about 180 000 people in a very vulnerable condition.'

On 1 April 2014, Iquique experienced the earthquake seismologists predicted, measuring 8.2 on the Richter scale. 'Although it was a very large earthquake, the good news is it was not the major earthquake that was expected,' said Jorge; the quake measuring a rupture length of 200km, instead of the expected 600km. He says the tsunami triggered by the earthquake caused relatively minor damage, with flooding predominantly restricted to fishing coasts. 'It had perfect timing, if there is such a thing, because it happened on a weekday at 8:46pm and not in summer, which is the

tourist season in Chile. The critical CBD area, which is the most populated place in the city, was not as occupied as it is during summer. The beaches weren't crowded with people and kids weren't in school, so it was a relatively good scenario,' explained Jorge.

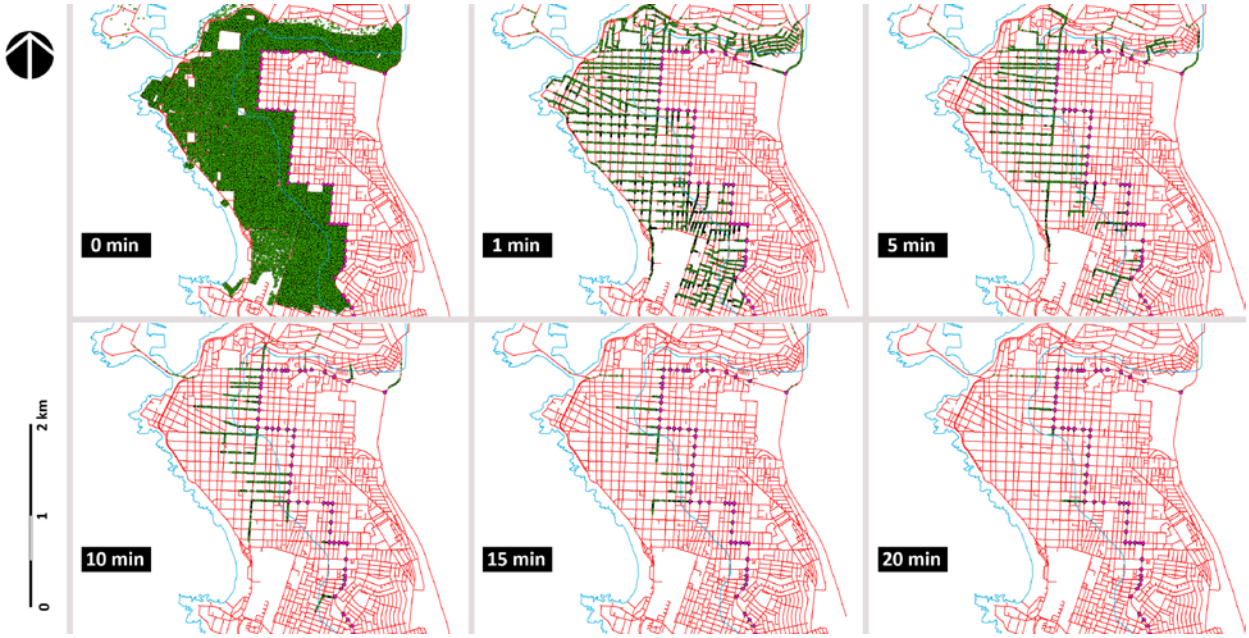
Jorge said he had read in subsequent articles that Iquique residents reacted quite well, save for the expected problems. 'Many people used their cars to evacuate, so there were reports about a lot of congestion. The evacuation took a lot of time because of this and there was a problem with pedestrians and traffic. People were hit by cars, but none of them died.' Jorge says issues also arose due to highly overcrowded assembly places. 'Iquique is a city in the desert and seriously lacks any type of open green spaces. So everyone tried to assemble in the streets and those places were not prepared for those people.'

Jorge said the response to April's earthquake supports his previous hypothesis and observations. 'Many of the things I thought would happen actually happened, however the overall pressure of the emergency was not as high as expected, because there was no serious tsunami. The good thing is the population reacted quite well in the city because they were expecting this kind of event. The physical environment of the city however, was not quite as prepared.'

It's this point that speaks directly to Jorge's research in urban planning and disaster. 'Chile is located very close to a seismic fault line, where the two plates collide.

El Mercurio on March 17 2014, many people were in the streets.

La Estrella on March 17 2014, people tried to evacuate by car.



Snapshots from the Iquique tsunami evacuation model, showing the evacuees (green dots), the urban network (red lines), the safe assembly points (in pink), and the expected flooding area (blue line), for different times during an emergency.

They usually happen 200km from the Chilean coast and a typical tsunami moves at between 100 and 500km per hour, depending on the ocean's depth. So as soon as the earthquake ends, you have probably a maximum of 30 minutes to get to safer ground. It's a very chaotic and complicated situation' said Jorge. He reasons that urban design can help move people in a more effective way, likening it to existing building practices. 'Buildings have been built with security measures, such as safe assembly areas, for decades. That hasn't happened yet for the overall design of a city and I'm trying to translate that model to the urban realm,' he said.

Jorge proposes a set of design recommendations for cities and is working towards providing an assessment tool to compare two scenarios. 'If we implement this type of recommendation, we could improve the situation by a certain amount and remove the population (of Iquique, for example) in less than 10 minutes.' Dr March says he automatically saw the merit in Jorge's proposal. 'I realised that while it's about tsunami, which is not an area I've worked in much, it is work that goes right to the core of disaster, risk management, urban planning and design. When you start looking at this stuff, the theoretical and practical parallels across these disciplines are very transferable, Dr March said.

Jorge's broader thoughts on urban planning address the rights of individuals to build where they choose, versus the responsibility of authorities to warn people of the risks. 'You're always going to have a set of very competing needs or requirements. There is no such thing as a 100 per cent safe location or city or house. That's impossible. However I do think that governments or people involved with emergency management have a responsibility to let people know that they are actually doing a trade-off – "If you're going to build here, you're going to be in a vulnerable condition forever and your house may last 50 years, or you may face 10 emergencies" – people have a right to know that,' he said.

Jorge believes people often live with the illusion that they are in a very safe location, or can be protected from natural disasters. 'I met with researchers when I was in Chile and they said after a big tragedy you have a five-year window to put into place all the things you need to change. People cannot continue to live with the feeling of vulnerability all the time, so after those five years they try to forget or want to believe they are safe. That's why it's important to have a plan about how you're going to rebuild after the disaster, instead of starting to develop a plan after the disaster happens. Everything has to be ready,' he said.

Dr March says in an area of urban planning research that is relatively new, Jorge has shown it is possible to join together thinking about urban planning and design with thinking about disaster risk reduction. 'There's so much work that needs to be done in that field and Jorge has shown that it can be done for a particular case.' Dr March said Jorge has also demonstrated that his research has international relevance which can be drawn back into the wider literature and applied not just to tsunamis, but other events such as bushfires.

'Jorge and I have done some work looking at evacuation possibilities and recasting those methodologies onto quite different scenarios, such as a suburb of Bendigo, to see if it could add understanding about the design of subdivisions when we consider the way fire moves through a landscape,' he said. 'That's been fantastic and everything a PhD should be. You get very specific outcomes but also things that can be applied elsewhere and can be published.'

ALIES
AUSTRALASIAN LIBRARIES IN THE EMERGENCY SECTOR

A closer look at the Australian Institute of Police Management library service

Eke Woldring and Dean Kimpton provide an overview of the AIPM Library.

The Australian Institute of Police Management (AIPM) is located by the sea in Manly, New South Wales and offers programs that develop and unite leaders from the police, emergency services and public safety sectors. In 2013, the AIPM proudly supported leaders from 93 different public sector agencies.

The AIPM runs two graduate programs, the Graduate Certificate in Applied Management (Policing and Emergency Services) and a Graduate Diploma of Executive Leadership (Policing and Emergency Services). These courses have served as important professional development opportunities for senior executives worldwide, including all current serving Australasian police commissioners. Complementing the graduate programs, there are development programs for future leaders, volunteer leaders and strategic commanders. Course participants come from all over Australia and the world.

The library patrons

Typical graduate program students are experienced practitioners in the policing, emergency management and public safety sector, yet new to academic learning.

The library resources and services provide an important cog in the learning process.

After their initial enrolment, a new student will be signed up to AIPM Online, the learning management system, using Moodle software. As the student completes their distance education subjects, they will be required to read articles, do assignments and contribute to online forums.

Program participants come to Manly for a residential program and there are a number of assessment tasks that require research activity. The library staff (Louise and Eke) support the students in finding the best available sources to provide the evidence they need to complete the assignments.

Some research questions include:

- strategies to encourage emergency management training across police, fire, SES
- encouraging leadership development in younger staff
- the ethics of private companies funding law enforcement activities
- team building strategies with sworn and unsworn employees
- partnerships in child welfare
- dealing with mentally ill and vulnerable people
- the use of Twitter in the workplace
- the impact of non-emergency calls to 000 on response times
- follow-up services for victims of burglary to reduce secondary burglary
- strategies to disrupt and reduce supply of cannabis to remote locations
- attitudes of younger employees to privacy on social media, and
- stakeholder engagement in remote areas.

In responding to these queries, the library staff search the catalogue for locally held material, databases, Google Scholar for academic articles (with links to AIPM ejournals), and the Internet using advanced searching features. The Librarians are skilled at searching for information and mentor the students to find relevant and authoritative sources of information. The orientation session encourages students to use the wide variety of search tools available and to take these skills with them for future information needs. The library scores very highly in the post program evaluation and students leave the residential course with improved information literacy skills and a new appreciation of the extensive information available through libraries.

So why read?

A recent comment on the Harvard Business Review blog, states the leadership benefits of reading are wide-ranging. 'Deep, broad reading habits are often a defining characteristic of our greatest leaders and can catalyze insight, innovation, empathy, and personal effectiveness.' (Coleman 2012). However, reading takes time, and students tend to be busy, working people, so the aim is to sift and share the best available information to support the professional development and lifelong learning for members of the AIPM community.

Many sign up to the weekly library blog, 'Know it Now', a current awareness service for AIPM staff, students, alumni and members of the emergency management community keen to stay informed to current issues and trends in the sector (at: www.aipm.gov.au/library/blog). As well as the weekly blog, students have access to ejournals, ebooks, databases such Emerald (a leadership and management collection of ejournals) and, of course, books. There is a significant hard copy print collection but, increasingly, resources are online and available and accessible via the Internet for study, wherever and whenever required.

The AIPM Library offers a wide range of specialist information to patrons.

The library has a business lounge, a place to browse the contemporary print collection in a relaxed, comfortable environment.

AIPM Library contacts

Email: library@aipm.gov.au
Website: www.aipm.gov.au/library
Phone: 02 9934 4743

Reference

Coleman J 2012, *For those who want to lead, read. At: http://blogs.hbr.org/2012/08/for-those-who-want-to-lead-rea/ [5 February 2014].*

bushfire CRC

RESEARCH TO DRIVE CHANGE

Sharing outcomes. Building knowledge.

The Bushfire CRC is taking an important step to make sure research findings from the past three years are accessible to a range of audiences.

It is producing a number of documentary-style videos and conducting online forums for its partners around Australia and New Zealand to stimulate discussion and raise awareness of the various projects and their outcomes. The forums began in May 2014 and continue to September.

The online forums are a practical approach that allows staff and volunteers from fire and land management agencies, along with researchers, to participate. Each forum features leading researchers and industry end-users discussing research findings, what each finding means, and answering questions. Importantly, each video and forum is accessible in the future, along with Bushfire CRC *Fire Notes* and more in-depth research reports.

The Bushfire CRC believes the *Research To Drive Change* online forums are an important step in achieving the recognition the science deserves. Log on and attend the online forums free of charge.

Research to Drive Change online forums: May to September 2014

Topics covered:

- bushfire community safety
- next generation fire modelling
- extreme fire behaviour
- firefighter health and safety
- ecology
- incident management
- economics to help decision-making.

Registration details and forum dates:

www.bushfirecrc.com.

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Notes from the field

Two EMPA conferences break new ground in disaster comms

EMPA Secretariat

The Emergency Media & Public Affairs organisation held two EMPA conferences in consecutive weeks in May and June 2014.

After a string of annual events around Australia since 2007, EMPA's inaugural New Zealand conference was held at the Heritage Hotel, Auckland on 22-23 May. Sponsored by Auckland and Christchurch City Councils, *EMPA NZ 2014* attracted more than 150 delegates representing local councils, national government and a range of industry organisations with an interest in communicating before, during and after disaster events.

Highlights included presentations by Bob Jensen, Principal Assistant Deputy Secretary at Department of Homeland Security, USA, and Denis McClean, Head of Communications and Outreach at UNISDR, Geneva. Both discussed the growing importance of the communicator in disasters, with McClean presenting moving post-typhoon video of the Philippines.

Keynotes included John Hamilton Director of CDEM, NZ along with Sir Bob Parker, former Mayor of Christchurch. Mark Crosweller Director-General of Emergency Management Australia impressed the delegates with his presentation on ethics in disaster management.

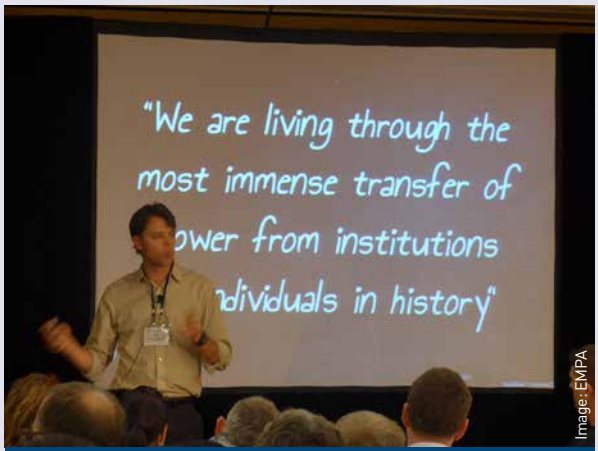
A 'Fast Fives' session saw 10 NZ communication practitioners on stage for five fast minutes where they had to present a particular aspect of their job function. This not only gave great insight into the breath of activities undertaken but also exposed the skills and talents required by communicators generally.

EMPA's Australian conference was supported by EMA and was held in Canberra from 1-3 June. The event continued the strong tradition set by earlier conferences in covering a variety of communications, warnings and public information issues.

Denis McClean (UNISDR) crossed the Tasman to address the 90 delegates in Canberra, and Craig Fugate, Administrator of FEMA, USA provided a video

John Hamilton, Sir Bob Parker and Mark Crosweller.

NZ conference delegates.



Dan Neely's energetic community education presentation.

Daniel Gleeson, Attorney-General's Department and Alastair Wilson, Fellow EMPA.

message in support of Australian and New Zealand communicators who respond when an emergency situation arises.

The conference workshop was conducted by Peter Rekers and Rebecca Riggs of Crisis Ready, and immersed delegates in several complex disaster exercises on the imaginary island of Kriso.

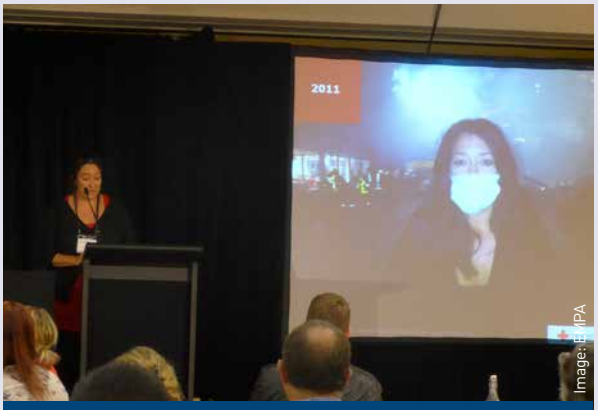
The ABC's Ian Mannix asked the question 'How do we overcome peoples' resistance to warnings', and Kate Brady from Australian Red Cross explored 'The Language of Emergencies'- a provocative self-examination of the words we use and how these form our attitudes to response.

Research in selected topic areas is funded from profits from both conferences. EMPA Research Committees in both Australia and New Zealand have been established. Nominations of research topics are open and the next raft of research grants will be announced in the coming months.

About EMPA: **www.emergencymedia.org.au.**

Expert panel: Denis McLean, Bob Jensen, Sir Bob Parker, Mark Crosweller, and John Hamilton.

Kate Brady spoke about use of language.



Corinne Ambler spoke about being a journalist reporting on the earthquake and, since then, as a communicator for Red Cross.

Vince Cholewa explains the public information management process.

Canberra conference delegates.

Notes from the field

Australian & New Zealand Disaster and Emergency Management Conference

ANZDEMC Secretariat

The Australian & New Zealand Disaster and Emergency Management Conference was held at the QT Gold Coast from the 5-7 May 2014.

The Conference themed "EARTH; FIRE AND RAIN" was a great success with the program including 11 keynote presenters, 60 session presenters, 10 optional workshops and 21 poster presentation over the three days.

The program examined what we have learnt in the past few years and provided a comprehensive forum to address the expertise, competencies and systems relating to the preparedness for future disasters, emergencies and hazards and the ability to recover from them quickly and efficiently.

Streams covered risk and crisis management, policy and governance, social media, volunteer and community involvement, business continuity, relief and recovery. Delegates heard Keynote addresses from:

- Associate Professor Brett Aimers, Chief Professional Officer, St John Ambulance Australia
- Dr Paul Barnes, Deputy Director & Leader, Infrastructure Program, QUT Centre for Emergency & Disaster Management
- Dr Penelope Burns, Senior Lecturer, Department of General Practice, University of Western Sydney
- Mr Neil Comrie, Bushfires Royal Commission Implementation Monitor
- Mr Mark Crosweller, Director General, Emergency Management Australia
- The Honourable Lianne Dalziel, Mayor of Christchurch
- Associate Professor Dale Dominey-Howes, School of Geosciences, Faculty of Science, The University of Sydney
- Dr John Durkin, Director, BeTr Foundation, London UK
- Dr Michael Eburn, Barrister, Associate Professor, ANU College of Law, The Australian National University
- Dr Ljubica Mamula-Seadon, Director, Seadon Consulting & Research, New Zealand
- Major General Stuart Smith, Commander 1st Division/Deployable Joint Forces Headquarters

The hosting associations would like to thank all of those who participated in this year's conference; the speakers who provided very beneficial, powerful and thought-provoking presentations, the dedicated efforts of our sponsors and supporters, our Conference Chair Associate Professor Brett Aimers and Committee members. Without the huge efforts of those involved this event would certainly not be possible.

Image: ANZDEMC

The Honourable Lianne Dalziel, Mayor of Christchurch – Keynote address.

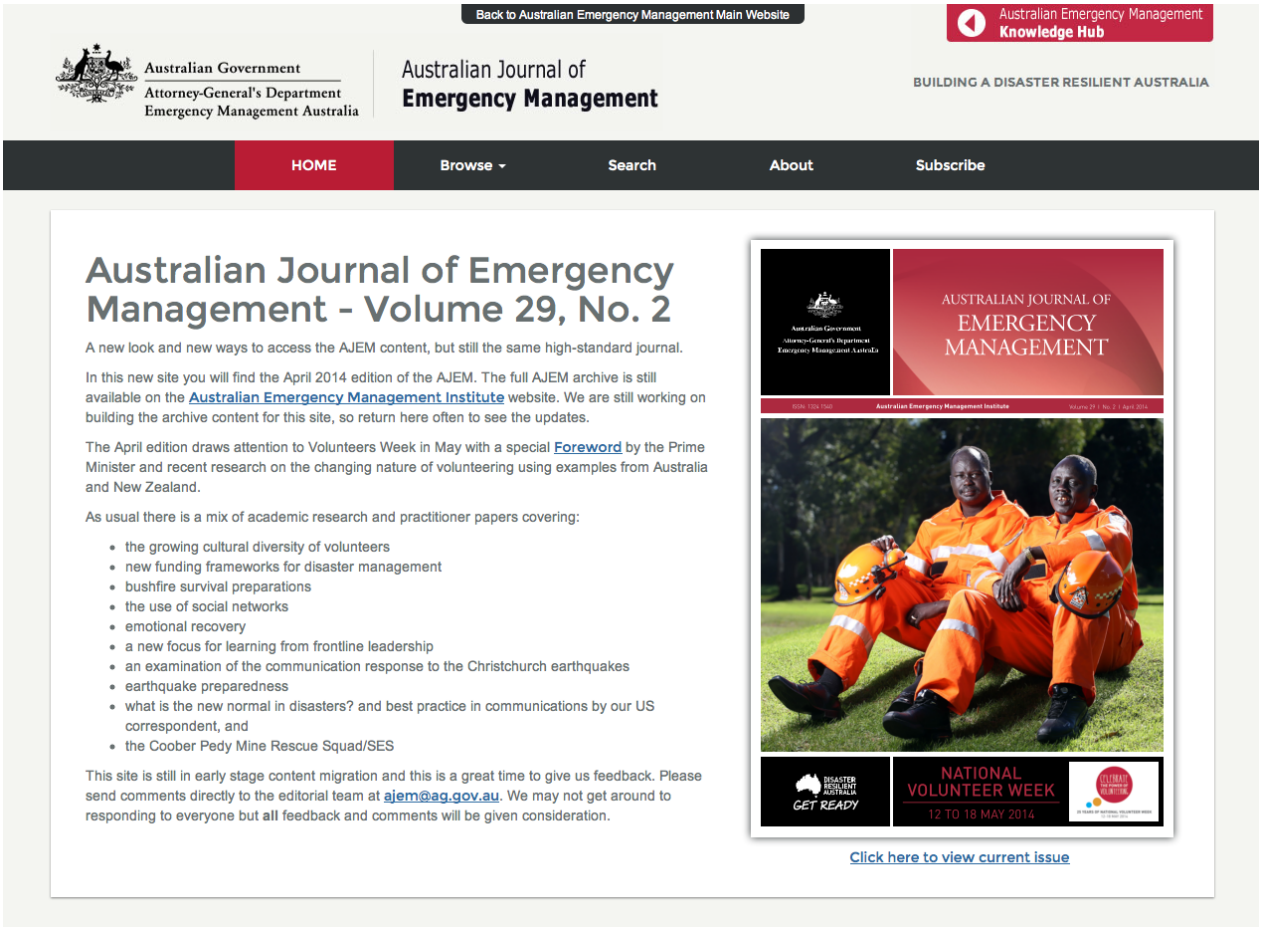
Image: ANZDEMC

Major General Stuart Smith, Commander 1st Division / Deployable Joint Forces Headquarters – Keynote address.

Image: ANZDEMC

Over 350 delegates attended.

AJEM starts a new journey



In 2015 the Australian Emergency Management Institute will mark 25 years of publishing the *Australian Journal of Emergency Management*. To acknowledge this significant milestone, we are introducing changes to ensure our enthusiastic readers can continue to enjoy the Journal well into the future.

The Journal has been documenting research and stimulating discussion and scholarly debate since 1985. Its pages have featured extensive analysis, considered views, lessons learned and insights into current and future issues. It is now among the key resources for researchers in all areas of emergency management, both locally and internationally. Its contributors – both authors and peer reviewers – are across the globe.

In recognition of our broadening scope and global relevance, we are now publishing AJEM on the new website platform.

But hold on! The new website only has a few AJEM editions visible, I hear you say. Archived editions are all still available online at **www.em.gov.au/ajem**. During 2015 AJEM will reopen its print subscription list for those wanting a print copy mailed to an address on a cost-recovery basis. Email subscription remains free of charge.

For AJEM devotees and new readers alike the new site brings easy search and ready access to the wealth of AJEM material right to the fore. Yes, it's all about the content. And as its article library rapidly grows, unique searches will delivery targeted content tailored to you.

For authors and reviewers, the site will become the central place to manage contributions. There is just so much amazing 'stuff' behind the scenes! Little by little (or maybe a lot) it will keep growing in article library and content.

So, visit the site often and take a look at what's new each month. We'll have a "New Site Poll' running for a few months to feed any comments you make directly to the development team. So, your say counts.

Direct access to the site is:
https://ajem.infoservices.com.au or go to **www.em.gov.au/ajem** for the archive.

Email us: **ajem@ag.gov.au**.

Australian Emergency Management Institute

Australian Government
Attorney-General's Department
Emergency Management Australia

The Australian Emergency Management Institute (AEMI) is part of the Australian Attorney-General's Department.

AEMI is a Centre of Excellence for education, research and training in national emergency management and disaster resilience.

AEMI prides itself on delivering the most comprehensive accredited emergency management education and training available in Australia drawing upon experts and professionals from a wide range of fields within emergency management.

AEMI's flagship educational product, the Advanced Diploma of Public Safety (Emergency Management), as well as our masterclasses, seminars and workshops, are at the forefront of current and 'over-the-horizon' thinking within Australia and internationally.

Every year, AEMI's specialised educational services attract approximately 3000 emergency management professionals including crisis leaders, policy makers, private, government and non-government officials, senior managers, operational managers, public affairs and communication practitioners across all industry sectors.

Australian Emergency Management Institute (AEMI)

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