Redefining heatwave

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Australian Institute for
Disaster Resilience

Australian Journal of Emergency Management

About the Journal

The *Australian Journal of Emergency Management* is Australia's premier journal in emergency management. Its format and content are 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. 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 role of the Australian Institute for Disaster Resilience (AIDR) 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 encourages empirical reports but may include specialised theoretical, methodological, case study and review papers and opinion pieces. The views in the Journal are not necessarily the views of the Australian Government, AIDR or AIDR's partners.

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Editor-in-chief

Dr Michael Rumsewicz, Bushfire and Natural Hazards CRC

Editorial Committee

John Bates, Australian Institute for Disaster Resilience
David Bruce, Bushfire and Natural Hazards CRC
Luke Brown, Attorney-General's Department

Editorial Team

Managing Editor: Christine Belcher
Design, typesetting and production: Biotext
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The *Australian Journal of Emergency Management* welcomes submissions. The Contributors' Guidelines are available at **ajem.infoservices.com.au/page/about**. In brief, contributions should be no longer than 3000 words, be submitted as a Word file and contain photographs, graphs and tables in their original software applications as separate files.

All articles must contain an abstract and a small biographical paragraph about each author. A Copyright Release form and the Editorial Policy are available on the website. Authors should familiarise themselves with the Journal before making a submission. Contributions should be forwarded electronically to **ajem@aidr.org.au**. All research articles are peer reviewed. The *Australian Journal of Emergency Management* is indexed by several indexing organisations throughout the world.

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Contact Us

Mail: Australian Journal of Emergency Management
Australian Institute for Disaster Resilience
Level 1, 340 Albert Street
EAST MELBOURNE VIC 3002

Email: ajem@aidr.org.au

Phone: +61 3 9419 2388

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Foreword

Dr Michael Rumsewicz, Editor-in-Chief, Australian Journal of Emergency Management

Heatwave deaths outnumber the combined total of deaths from all other natural hazards across Australia. With the Australian severe weather season rapidly approaching, it is timely to publish two papers in this edition of *the Australian Journal of Emergency Management* that discuss advances in characterising heatwaves and attempts to forecast their potential impacts.

This heatwave focus introduces a selection of papers from the recent Bushfire and Natural Hazards CRC Research Forum of the AFAC16 annual conference. The conference theme, 'Mitigation – Response – Recovery: Getting the Balance Right' highlights the need to better understand how the interactions between community, business and government affect disaster resilience, and, ultimately, the long-term social and financial cost of disasters.

Robert Glasser's opinion piece provides an excellent overview to the theme, highlighting the estimated $9 billion annual social and economic cost of disasters in Australia and why the *Sendai Framework for Disaster Risk Reduction* includes specific targets for reducing damage to critical infrastructure and disruption of basic services and economic losses.

Research articles in this edition span the mitigation, response and recovery spectrum, examining issues such as risk ownership and public-private partnerships, understanding and evaluating resilience, enhancing community engagement, improving decision-making during disasters, and re-building after major bushfires.

The full range of Bushfire and Natural Hazards CRC Research Forum papers from AFAC16 is online at **www.bnhcrc.com.au.** Papers from the AFAC16 conference 'Mitigation – Response – Recovery: Getting the balance right' are available at **www.afac.com.au/events/proceedings**.

And finally, a reminder that this will be the last edition of the Journal to be distributed free of charge as a printed version. Online access to the Journal will continue to be provided at no cost to email subscribers and through the website. To continue to receive printed copies of the Journal you can subscribe to future print issues through the AJEM website (**ajem.infoservices.com.au**). If you would prefer to receive the free email alert for the online edition so that you don't miss out, you can subscribe to email alerts at **https://www.aidr.org.au/publications/the-australian-journal-of-emergency-management**

Dr Michael Rumsewicz
Editor-in-Chief

Australian Journal of Emergency Management
Australian Institute of Disaster Resilience
Bushfire and Natural Hazard CRC

Disaster risk management should be an integral part of economic planning

By Robert Glasser, Special Representative of the UN Secretary-General for Disaster Risk Reduction and Head of the UN Office for Disaster Risk Reduction

Research carried out on behalf of the Australian Business Roundtable for Disaster Resilience earlier this year showed that over $450 million was spent annually by the Australian government on restoring essential public infrastructure following extreme weather events between 2002 and 2011. In other words, that is around 1.6 per cent of total spending on public infrastructure.

The research also includes a calculation that some $17 billion will need to be spent on replacing essential infrastructure impacted by disasters between 2015 and 2050, out of total spending on infrastructure of approximately $1.1 trillion over the same period. The Australian Business Roundtable for Disaster Resilience has also highlighted that when both social and economic impacts are included, the price tag for disasters in Australia last year alone exceeded $9 billion or 0.6 per cent of GDP.

This goes some way towards explaining why the global plan for reducing disaster losses, the *Sendai Framework for Disaster Risk Reduction,* includes a specific target focussed on reducing damage to critical infrastructure and disruption of basic services, and another on reducing economic losses in relation to global GDP. Neither of these targets can be achieved without a marked shift to include disaster risk management as an essential element of economic planning.

Private investment largely determines disaster risk. The private sector accounts for 70 to 85 per cent of overall investment in most economies. Disasters directly affect business performance and undermine longer-term competiveness and sustainability. When business continuity breaks down it can easily translate into lost customers and bankruptcy.

The recent history of disasters worldwide is punctuated by examples of how they can disrupt globalised supply chains in often unforeseen ways because disaster risk has been off the radar in economic planning at both senior management and boardroom levels. For instance, there were massive reductions in automobile production in the USA, India and China as a result of the 2011 Japan earthquake and tsunami. And yet, disaster risk remains conspicuously absent in business forecasts and operational plans.

If a survey was carried out of small and medium enterprises in Australia, how many would be able to say their investments take account of the disaster risks which could threaten their future business growth or their very existence?

Not so long ago a survey carried out for the UN Office for Disaster Risk Reduction's (UNISDR) Global Assessment Report on Disaster Risk Reduction found that less than 15 per cent of companies with fewer than 100 employees in disaster-prone cities in the Americas actually have business continuity or crisis management plans in place.

Disaster risks are rarely visible in a world where investing is increasingly short-term and speculative. Often hidden in complex and opaque financial instruments, investments are made blind to disaster risk, despite escalating economic losses worldwide from disasters.

There is a growing number of initiatives to reverse this trend. One such is the Australian Business Roundtable for Disaster Resilience. Another is ARISE, the Private Sector Alliance for Disaster Resilient Societies initiated by UNISDR. ARISE has a broad membership across industries and sectors dedicated to reducing disaster losses through the implementation of the *Sendai Framework for Disaster Risk Reduction*.

The key message is that good economic and business planning must include disaster risk management in order to guarantee long-term sustainable growth.

Reducing future risk starts now: integrated planning could hold the key to Australia's mitigation of disasters

By Nathan Maddock, Senior Communications Officer, Bushfire and Natural Hazards CRC

With the cost of natural hazards forecast to rise dramatically over the next 30 years, mitigation of these hazards has never been more important, especially once the fact that every dollar spent on mitigation can save four dollars in recovery costs is factored in. In an effort to counter this, Bushfire and Natural Hazards CRC research is providing quantifiable evidence that will support mitigation options for a range of natural hazards, reducing the amount of money that government spends on emergency response and recovery.

It is all about strategic investment now to reduce future costs, says Professor Holger Maier, who is leading the CRC project to develop an integrated modelling tool to support strategic decisions.

'Everyone wants to talk about mitigation and risk reduction. But we need to put a value on these things, so that we have an evidence base that enables decisions to be justified on a rational basis with the best available information,' said Professor Maier.

An outcome of this research may be recommendations that land where people currently live may not be liveable in the future, with the risk of hazards such as earthquake too great.
Image: John McCombe, New Zealand Fire Service

Although as it currently stands, decision-makers do not have this vital information.

'There is nothing that allows for comparison of different hazards and their mitigation options, and to also look at long-term planning,' said Professor Maier.

To address this gap in Australia's emergency management preparations, the tool has been in development for the last three years by a truly international team. The team consists of CRC researchers from the University of Adelaide (Professor Maier, Graeme Riddell, Jeffrey Newman, Dr Aaron Zecchin, Emeritus Professor Graeme Dandy and Charles Newland) and the Research Institute for Knowledge Systems in the Netherlands (Associate Professor Hedwig van Delden and Roel Vanhout) leading the collaboration, with expert assistance from Dr James Daniell and Andreas Schäfer from the Karlsruhe Institute of Technology in Germany.

The team has been developing a generic approach to assessing the long-term impacts of different mitigation options on different hazards. This approach is then applied to a series of case studies to investigate the effectiveness of policy and planning investment options for optimal mitigation of natural hazards. The case studies comprise three separate locations; Adelaide, Melbourne and Tasmania, with each location looking at a range of hazards and their mitigation options over time. This allows emergency managers to assess the dollar costs of the impacts of mitigation decisions.

'The idea is that people can start looking at the impacts of long-term changes—things like climate change, economic conditions, and population and the impact

With the costs of natural hazards rising, mitigating risk is key. Here the NSW Rural Fire Service is undertaking a hazard reduction burn at Ku-ring-gai in Sydney's north.

Image: Adam Streichler, New South Wales Rural Fire Service

these have on the different risks associated with different hazards.

'We can also look at different mitigation options and risk reduction strategies so we can assess different combinations of risk reduction measures, such as changing building codes, building flood levees, land use planning or community education.

'It provides a holistic framework for looking at different hazards and mitigation strategies,' explained Professor Maier.

Finding the evidence with case studies

Evidence holds the keys to change, and to gather this evidence, the team's case studies, in addition to focusing on different locations, are assessing different combinations of hazards, with different emphases, all under the direction of end-user partners.

The Adelaide case study is assessing earthquake, bushfire, coastal inundation, flooding and heatwave. The Melbourne case study is looking at bushfire, flood and potential earthquake. Tasmania's study is investigating bushfire and flood. For each case study, the tool will analyse areas of risk both now and into the future, test different types of risk reduction options, identify mitigation portfolios that provide the best outcomes for a given budget, and consider single or multiple types of risk reduction options. End-user partners emphasise the importance of understanding where various societal groups are likely to live in the future, as well as their vulnerability to risks in these areas.

With natural disasters currently costing Australia in excess of $9 billion annually, a figure projected to skyrocket to $35 billion by 2050, facts around economic

effectiveness of mitigation options will be incredibly valuable to high-level strategic decision-makers within emergency and land management agencies, as well as treasury and premier and cabinet government departments, as they look to reduce the costs associated with natural disasters.

This has bred an appetite for this type of assessment of mitigation decisions in emergency and land management in Australia.

'At the moment a lot of the focus has been on responding to hazards, but because there is such a large projected cost associated with natural hazards, there has been a realisation that we need to start looking at longer-term strategic planning.

'There is also the realisation that climate change is going to have an effect and that our population is ageing and becoming more vulnerable. So the key question really is: how do we prepare for that?

'It really is a complicated problem, when we are looking at how the different hazards interact with each other, and with a given budget, it is difficult to know how emergency agencies can get the best bang for their buck. The tool will help agencies assess what the best strategies are, to get the best outcomes for a given amount of money spent,' Professor Maier said.

The greater Adelaide case study is currently the most progressed, with a working prototype nearly ready to hand over to end-users. For greater Melbourne and Tasmania, end-users in these states have worked with the research team to assess how they would use the system, and what its functionally should be, with the team currently working on data collection for these areas.

This research is helping quantify mitigation benefits for a range of hazards, including floods such as at this caravan park.

Image: Country Fire Authority

What is known now?

The learnings and outcomes so far, especially from the Adelaide case study, are varied, Professor Maier explained. There are learnings about the actual system and how the modelling behind it works, but there are also outcomes for end-users.

'Some of the scenarios we have developed in consultation with end-users, which represent different plausible futures, have resulted in quite different outcomes in terms of where people would live (in the future) and what the risks would be for different hazards.

'This indicates that the planning you need to do to cater for these plausible futures would be quite different,' said Professor Maier.

End-user Ed Pikusa, Principal Flood Management Officer at South Australia's Department of Environment, Water and Natural Resources, believes the research will lead to better decisions in emergency management right around Australia.

'All emergency management practitioners and land managers across the country need to make informed choices to reduce losses from natural disasters.

'We ask questions like "what are the benefits and costs of mitigation options?", "how do we quantify many of the intangibles?" and "who owns the risk?"'

'In a multi-stakeholder environment it can be complicated, and it is hoped tools like those being developed by this project will help agencies answer these important questions,' Mr Pikusa said.

While helping emergency services answer the difficult question of where to invest money in order to achieve the largest reduction of risk—the main aim of the research—it cannot be underestimated how valuable the process has been in other contexts.

'The outputs from the tool are one thing, but it is also about providing people with an environment that enables them to think more strategically, and for agencies to start working together and imagining what could happen in the future. This has been a really positive experience.

'In the future, it is hoped that the tool will be able to be rolled out to other states and cities. The idea is to make the approach as generic as possible.

'All going well, we would like to develop case studies looking at different types of applications for end-users, such as local councils, single-hazard agencies and agencies responsible for high-level planning such as state treasury or premier and cabinet departments; agencies that are making high-level strategic decisions.

'The tool is flexible enough to be applied in a lot of different contexts. It allows users to answer the question 'is this something we should be doing?',' Professor Maier said.

Part of the big picture

The project is a vital part of the CRC's research program, as it uses the outputs of many other studies. CRC Research Manager Dr Michael Rumsewicz believes it has the potential to be a game changer in how Australia builds resilience to natural disasters.

'It has been exciting watching this project develop, and getting an appreciation for both the power of the approach and how it brings many apparently disparate pieces of information together.

'It already draws together information from about a half a dozen other CRC projects, and has the potential to link to even more across our broader research programs in economics, risk, social resilience, volunteering, engineering, information management, prescribed burning and coastal management.

'More generally, though, as I have gone around the country talking to people about the major issues facing Australia regarding natural hazards, a recurring theme has been 'we do not know how to quantify the benefit of mitigation spending'.

This project, with its focus on being end-user driven, and how it brings together research from a variety of sources, provides the evidence base needed to support long-term political and operational decision-making.

'This is a world-leading piece of research enabled by the contributions of end-users and researchers working together as a united team for a common goal,' said Dr Rumsewicz.

Find out more about this research at **bnhcrc.com.au**.

Churchill Fellowship: media images and imitative behaviour in disasters

By Philip Campbell, New South Wales State Emergency Service

In 2015, a Churchill Fellowship was undertaken to investigate the media's use of images of people undertaking risky actions during natural disaster events. The research considered if people were repeatedly exposed to such images were they likely, when in a similar position, to copy the action and act in an unsafe fashion rather than follow safety advice.

With $50 million spent annually in Australia on natural disaster public education and resilience-building campaigns, concern had been expressed by some agencies that media channels were publishing or broadcasting images of risky actions that contravened safety messaging. It was thought this may lead to imitative (copycat) behaviour. Not only might such imagery compromise public safety, but it placed at risk the significant investment by agencies and non-government organisations in public education campaigns.

The Fellowship involved a literature review and qualitative interviews with selected media channels, emergency services organisations, psychologists and communicators in New Zealand, Canada, the USA and England.

Few people have direct experience of a disaster and, over time, people's exposure to disasters come from the media and online channels. Very little may come from interaction with emergency services organisations. Over time a 'memory bank' of images and actions of what to do in an emergency may be based on these images, which are weighted to those in the media. Media images usually show risky behaviours and rarely show positive and safe actions. This means the bank of images people draw on when at a stressed decision point is more likely to be, for example, people driving through floodwaters. This is at odds with safety messages that people wait for floodwaters to recede or take an alternate route. Images in the media may even present risky behaviour, such as playing in floodwaters, as fun or desirable.

In emergency situations people are under a high level of psychological stress. This can inhibit higher-order thinking and involve a shift towards visually-biased, lower-order thinking. To understand these psychological processes when people decide to enter, say, floodwaters and how media images could be a trigger to risky actions, risk communicators and psychologists with an interest in natural hazard risk communication were interviewed.

Media organisations play important roles in emergency events. They help disseminate critical safety and preparedness messaging and are a vital channel when emergencies arise. They provide public information and let people know what actions they may need to take. However, the tendency to focus on dramatic, sensational images, the showing of risky behaviour by people, and permitting frontline journalists to take risks and ignore safety and evacuation warnings, means they can work against the safety of people and responders. Understanding media culture and free press principles and getting media organisations to alter or reframe their actions requires a patient, inclusive and cooperative approach that respects the right of journalists to be at the scene of an emergency.

Informed by this Fellowship, the NSW SES engaged with all major media outlets in NSW to discuss the effect of media imagery on public behaviour. In addition, where images have been broadcast, the media outlet was contacted and asked to remove the image or refrain from similar images in the future. Most media have been understanding and cooperative, but with high churn of journalists, it is an ongoing process.

The Fellowship research also contributed to a major project into flood deaths. Preliminary work has been undertaken with several university schools of journalism to help students understand the issues related to use of images in disaster events.

The full report on this study is available on the Winston Churchill Memorial Trust website, **www.churchilltrust.com.au/fellows/detail/3897/ Philip+Campbell**

Applications for Fellowships are open between February and May each year.

Teaching resilience

By Hansika Bhagani, Australian Institute for Disaster Resilience

In 2016, Tasmania experienced both bushfire and flood. According to the Tasmanian State Natural Disaster Risk Assessment, Tasmania is also not immune to severe storms, earthquakes and landslides.

To help prepare the next generation for these natural disasters, the University of Tasmania offers an undergraduate unit called 'Resilience in the face of emergencies'. It is a 'breadth' unit; a semester-long course of study that is open to students from all faculties. It provides students with the skills and understanding that allows them to make a difference in their own lives, and the lives of others.

Dr Benjamin Brooks is Unit Coordinator and is joined in teaching it by Dr Christine Owen and Dr Deb Carnes. The course is informed by a project led by Dr Brooks through the Bushfire and Natural Hazards CRC that is looking at decision-making during emergencies (for more information on this project see page 38). This unit, he explained, is critical for students to understand 'wicked' problems—problems where the issues are resistant to being resolved and where attempted solutions can affect the things that people depend on.

'The wicked problem we are dealing with now is how we improve resilience in the modern world when the number and scale of emergencies are increasing and acting to erode resilience. We want to improve it, but everything that is happening is eroding it,' he said.

To understand resilience, students explore the concept from a range of perspectives including psychological and physiological, and at different levels, including personal, community, organisational, governmental and global.

'Often people take a very narrow perspective of resilience, being simply the ability to bounce back. In fact resilience includes other aspects such as the work we do in order to be more resilient, even before an event occurs,' Dr Brooks said.

'There are about a million books written by people where they've found themselves in an emergency and what they did in order to get out of that. Unpacking those accounts in terms of what the key aspects of psychology and physiology are that determines why this person actually made it through is really critical,' he said.

Students are asked to be creative in imagining a disaster scenario, undertaking a personal audit of their resilience based on that scenario, and extrapolating the issues they discover to a community context. On a practical level, students are asked to identify three things that would improve the resilience of their household.

The concept is taken further with students having to think critically about how their personal resilience factors might have effects at state or national levels.

'If they decided that one of the things their household needed was an independent water supply for three days, then we challenge them to think about what the implications are for everyone in the state or in Australia if that was scaled up. What impact does that have at a government level, how does that change the ways these levels of community and organisations should manage resilience and response?' he said.

Many of the students have been affected by natural disaster, but the unit encourages them to think outside the usual emergency scenarios.

'There could be anything from getting lost in the bush to some sort of medical emergency. Essentially we're trying to teach people about resilience because it's not just theoretical, it has a very practical application,' Dr Brooks said. While the unit focuses on emergencies, Dr Brooks was surprised to hear feedback from students that the unit had built their personal resilience in many other areas.

'We had students talking about how their parents had recently split up and they were going to take some of the concepts they've learnt in the course and apply it to that situation. We didn't realise the scope of what we were dealing with until students started pointing out that they could use the learnings from the course to deal with all sorts of personal, emotional or social issues,' Dr Brooks said.

While the course has been running since January 2016, Dr Brooks said the next step is to turn the unit into a massive open online course for others in the community.

'We think there are lots of people in the community who could benefit from a profound understanding of resilience. The next stage is to think about how to design that course, and make it a bit more interactive online to account for the fact that you don't have people standing in front of you,' he said.

'I wish these courses were available when I was a student. We spend a lot of time learning specific areas of expertise, and while university education and assessments are becoming more contextualised and more authentic, units like this are doing what I hoped for university students. It demonstrates the complexities of being in the real world and gets them to think through what that means,' he said.

AIDR adds to disaster resilience body of knowledge

By Amanda Lamont, Australian Institute for Disaster Resilience

The importance of working together, sharing collective knowledge and expertise and building capability in communities and emergency management agencies is central to building the nation's resilience. As disasters increase in occurrence and complexity in Australia and overseas the imperative to work together is more important than ever.

The Australian Institute for Disaster Resilience (AIDR) is bringing together experts in the humanitarian, operational and research areas of emergency management to revitalise the national disaster resilience Body of Knowledge (BOK).

The BOK encompasses disaster, resilience, and emergency information, and resources from national and international sources and is available to the public, professionals and organisations. It comprises resources, information, research, data, capability-building tools and professional development opportunities related to disaster resilience.

Sitting within the BOK is the Australian Disaster Resilience Knowledge Hub, a central platform with information relating to disasters and disaster resilience.

The Knowledge Hub is the first place to go to access resources including the Emergency Management Library, the *Australian Journal of Emergency Management* (containing over three decades of published articles and research) and the national collection of disaster resilience handbooks.

The Knowledge Hub is being upgraded to make sure its collections are current and available to emergency services agencies, the public, community groups and anyone else interested in disaster resilience. The Knowledge Hub will be relaunched at the end of 2016 with a new look and updated information and resources.

The Knowledge Hub can be accessed at **www.emknowledge.org.au**.

National disaster resilience handbook collection

The national disaster resilience handbooks are a collection of emergency management principles and practice references. Information in the handbooks is important to the understanding, management and delivery of services in disasters. The collection has been developed over time with the support of national committees representing a range of state and territory agencies and disaster management experts. The handbook collection covers themes including evacuation planning, community recovery, disaster health, the national strategy for disaster resilience - community engagement framework and national emergency risk assessment.

Alongside the handbooks is a suite of documents, guidelines, events, professional development programs, communities-of-practice and research that helps users integrate the information into practical application.

As a collection of national reference documents the handbooks can be used by anyone involved in managing disasters; before, during and after. The information in the handbooks is general enough to be used nationally across a multitude of emergency events, yet specific enough to guide development of plans, procedures and programs for specific contexts.

The handbook collection is undergoing a major review to ensure the content is current, relevant and accessible. Working groups from government agencies, community groups and public and private sector organisations will provide their expertise in this process.

The current manual series will also be reviewed and will form part of the suite of materials supporting the handbooks.

AIDR welcomes contributions and feedback regarding the review of the handbook and manual collections. Contributions can be submitted via the AIDR website at **www.aidr.org.au** or email **enquiries@aidr.org.au**.

EMPA: Disaster Communications Conference, New Zealand

By Rebecca Riggs, Crisis Ready

The Emergency Media and Public Affairs (EMPA) 2016 New Zealand conference was held in Auckland 15–17 August and brought together emergency managers, researchers, editors and journalists and a wide range of communication practitioners including public information managers and social media, engagement and recovery communication specialists.

Bobby Newson, Kaihatu, Auckland Council welcomed us and reminded us of the spirits of the wind and fire and water that influence the work we do every day. Communication experts came together to share compelling stories of their experiences and the lessons they have learned.

Imogen Wall from the United Kingdom discussed her work with agencies including UNOCHA, Save the Children and ActionAid, in humanitarian emergencies such as those in Aceh and Haiti. She shared her insights into the vital importance of effective communication with survivors of disasters and the growing understanding of the value of affected people as producers of information and creators of communication platforms and tools.

Sarah Stuart-Black (Director CEDM New Zealand) shared a national perspective on the development of emergency communication and her passionate commitment to continued growth and change.

Mark Crosweller (Director-General Emergency Management Australia) asked us to consider the narrative of the work we do. Discussing mythologies from the Holy Grail to Star Wars, he inspired a shared awareness of the challenges and possibilities of the journeys we take, as we respond to disasters and work with the people who have been affected by them.

EMPA Fellow Bob Jensen (formerly FEMA and Department Homeland Security USA) outlined ways to engage and partner to create 'whole community engagement'.

A half-day focus on achievements, innovations and breaking the mould in social media created enthusiastic dialogue, as Mia Garlick (Facebook Australia and NZ), Matthew Prior (formerly Waikato CDEM) and Lucy Bell, (Department of Environment, Land, Water and Planning, Australia) shared their considerable knowledge and discussed their different experiences and possible future directions.

A very well-received Masterclass in Emergency Communication Planning was held on the third day. It allowed delegates to examine and discuss the context of planning and the challenges they face and offered new perspectives, systems and tools.

EMPA exists to lead and support the continual evolution of effective communication and community engagement before, during and after emergencies by providing a network for all who practise and research in this sector. With the energy and open minds of the delegates and the commitment of the speakers to create real change, the EMPA New Zealand conference did just that.

The 2016 conference was sponsored by Auckland Council. EMPA's next New Zealand Disaster Communications Conference will be 14-16 August 2017.

The 2017 EMPA conference in Australia is sponsored by Emergency Management Australia and will be held in Sydney from 4-6 June 2017.

For more information: **www.empa.org.au.**

Lucy Bell, Matthew Prior and Mia Garlick presented at the conference.

Image: Bob Jensen

Disasters and Social Resilience:
a bioecological approach

Reviewed by Michael Tarrent, Adjunct Associate Professor at Queensland University of Technology

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Boon, Cottrell and King have launched into 'resilience', the fad topic of the 2000s, using Bronfenbrenner's model of bioecological systems to introduce 'a fresh methodology and a model for examining and measuring impacts and responses to disasters'. It also addresses the demand to measure, no matter how complex, uncertain or subtle. They go on to state: 'This framework or theoretical lens permits an accurate examination of individuals as well as larger entities such as communities and cities'. They have attempted a very tough task because resilience is such a seductive concept. Everyone can see what they want in it; from those who genuinely want to understand the complexities of disasters through to those who are just expropriating the latest fad term.

The book has the very ambitious goal: 'the interconnectedness between communities, organisations, governing bodies, policy and individuals in the field of disaster studies has never been accurately examined or comprehensively modelled'. I am not entirely sure that the disaster research community would agree with such an assertion or whether this book has achieved this remarkable objective. There is a very long history of researchers grappling with disasters and social effects. In 1920, Samuel H. Prince published *Catastrophe and Social Change, based on a sociological study of the Halifax Disaster*.[1] Disaster researchers have been grappling with disasters and social and individual effects ever since. Significant progress in addressing these challenges was achieved by Dynes and Quarantelli at the Disaster Research Centre established in 1963. They were supported by other research groups that evolved in the latter half of the 20th century, largely in the US but also in Canada and Australia.

The authors work with the idea that 'resilience in its various and diverse definitions is considered to be an adaptive state for individuals and communities to aim for when threatened with the prospect of impending hazard events'. They make the very important point that 'empirical evidence has led to an emerging agreement in research circles that resilience can be investigated as a desired outcome condition or as a process leading to a desired outcome'.

The book is structured in two main parts. The first four chapters provide context and an introduction to Bronfenbrenner's model of bioecological systems and sets up the rationale for its application in the natural disaster context. The next five chapters address each element of Bronfenbrenner's system and finish off with a set of recommendations for policy and emergency management.

Bronfenbrenner was a child development psychologist, who developed an ecological systems theory of child development. He 'was highly influential in changing the perspective of development psychology because it acknowledges the importance of environmental and societal influences on a child's development'.

Bronfenbrenner's model has the following five components or elements: microsystem, mesosytems, exosystem, macrosystem and chronosystem. The systems 'are consecutive layers comprising the social and environmental milieu which are visualised as a nested set'.

Microsystem are patterns of activities, roles and interpersonal relations including clubs, church, home, workplaces. Mesosytems are networks between microsystem entities examining influences of family and neighbours on a person's disaster resilience. Exosystem includes things like hospitals, shopping malls, local community facilities and infrastructure, but would also include 'the effects of emergency management warnings upon preparedness and subsequent disaster resilience'. Macrosystem includes culture, government, customs, beliefs, values and laws. Chronosystem is the timing of events or the effects of environmental changes over time. 'The effects of environmental changes such as climate change and individual mobility in relation to changes in individual disaster resilience.' 'This moves each of the other systems into different spaces and phases of resilience.'

It is disappointing to see the authors making some basic errors such as claiming that 'the phases of disaster in Australia are planning, preparedness, response and recovery' when they are prevention, preparedness response and recovery. However the book makes a useful contribution to disaster management by highlighting the complexities of the concept of social resilience in the context of disasters. It provides an opportunity for the reader to reflect on social resilience and disasters.

1   Prince SH 1920, *Catastrophe and Social Change, based on a sociological study of the Halifax Disaster. At: https://archive.org/details/catastrophesocia00prinuoft.*

AUSVETPLAN turns 25

By Dr Francette Geraghty-Dusan, AUSVETPLAN Veterinary Officer, Animal Health Australia

'World-class' and 'indispensable' were just some of the descriptions of the Australian Veterinary Emergency Plan (AUSVETPLAN) provided by past and present contributors at AUSVETPLAN's 25th birthday celebration in August 2016.

Managed by Animal Health Australia (AHA), AUSVETPLAN documents national agreements on the roles, responsibilities, coordination arrangements, and control policies and their implementation guidelines, for emergency animal disease (EAD) responses. The availability of AUSVETPLAN manuals ensures that information about the policies and procedures to manage an EAD incident in Australia are immediately at hand and the responsibilities of those involved are clear, so that no time is lost in mounting a response.

The Australasian Inter-service Incident Management System used by traditional emergency services provides the basis for the AUSVETPLAN Control Centres Management Manual. This means there is potential to use other emergency services staff during an EAD outbreak. However, responding to an EAD can be considerably different to responding to other emergencies such as a natural disaster.

AHA's AUSVETPLAN Manager, Dr Belinda Wright, said, 'In the case of a fire or flood, the emergency response may only last days or weeks, whereas an EAD response can last months. There is also the potential for diseases to spread rapidly across large distances with consequences not just for the local community or industry, but for other sectors such as national tourism and trade.'

AUSVETPLAN has had to address these challenges over the past 25 years, as well as undergo a process of constant review to ensure it remains useful in a fluctuating animal health environment. This has meant that since its inception in 1991, AUSVETPLAN has grown from 15 manuals to a suite of 95 technical documents that are now collaboratively written and reviewed using a cloud-based online authoring system and published by AHA on behalf of its government and industry members. It has proved its importance by guiding the successful response to Australia's 2007 equine influenza outbreak, addressed emerging diseases such as the Nipah virus, and, this year, received an Australian Biosecurity Award.

Australia's Chief Veterinary Officer, Dr Mark Schipp said that AUSVETPLAN has become renowned as the international benchmark for EAD preparedness and response.

'AUSVETPLAN provides comprehensive response strategies for use in the event of an EAD outbreak. It has enhanced Australia's reputation for excellence in this area and assists in negotiations with our trading partners who often require evidence of disease prevention and control as part of the export certification,' said Dr Schipp.

Although AUSVETPLAN is developed specifically with the Australian context in mind, it continues to be adapted for use in other countries, most recently for Nepal, Timor L'este and Papua New Guinea.

Past CEO of AHA, Mike Bond, remembers the document's usefulness to many nations dealing with the H5N1 highly pathogenic avian influenza crisis from 2003 onwards.

'I recall that I received requests from the Chief Veterinary Officers of Belize and Tanzania asking for permission to use the AUSVETPLAN manual as a basis for their emergency planning, highlighting the respect and credibility that the AUSVETPLAN series had – and continues to have,' said Mr Bond.

Twenty-five years on from its inception, AUSVETPLAN continues to meet the needs of initial responders and remains the cornerstone of Australia's EAD preparedness and response. AHA looks forward to continuing to manage AUSVETPLAN on behalf of its government and industry members.

Dr Peter Dagg, Dr Francette Geraghty-Dusan and Dr Belinda Wright: the current AHA AUSVETPLAN management team.

Image: Animal Health Australia

Emergency Management Liaison Officer training

By Ian Carlton, Regional Officer Emergency Management, Victoria State Emergency Service

Since 2013, the Barwon South West Regional Emergency Management Training and Exercising Committee have been conducting a one-day Emergency Management Liaison Officer Training (EMLO training) for agency staff and volunteers. To date, over 165 personnel from 30 different emergency management agencies have undertaken this vital training.

The original EMLO training package was developed and piloted by the Office of the Emergency Services Commissioner in 2009. In 2012, a need was identified and a request for EMLO training was raised by a number of agencies. Courses were being conducted by three different regions within Victoria, each with slight variations. In collaboration with various Victorian regions, presenters consolidated and improved the course. The content was the same for each region with regional adjustments incorporated within a consolidated exercise. Examples are Ballarat for Grampians Region, Colac for Barwon South West Region and Melbourne for Central Region.

Emergency Management Victoria recognised the importance of the training and refined it, releasing it as a consistent EMLO training package for all Victorian emergency services agencies. This has given rise to partnerships and relationships that has led to expanded networks within the regions. When the need arises, staff are trained and confident in the role they will be undertaking.

The training is focussed on the role of the EMLO, with the emphasis on the requirements from the Emergency Management Manual Victoria (see extract following).

Support agencies may provide or may be requested by an emergency response coordinator or controller to provide an emergency management liaison officer(s) to the State Control Centre, Regional Control Centre or Incident Control Centre.

An EMLO:
- *represents the agency in the relevant control centre*
- *may represent the agency at the IEMT or REMT, if the relevant agency commander is unable to attend (not the SEMT, where a senior agency representative is required to attend)*
- *should be empowered to commit, or to arrange to commit, the resources of the agency to respond to an emergency*
- *provides advice in relation to the role and activities of the agency*
- *should maintain communications with the agency.*

Where an EMLO cannot be deployed to a particular location, the EMLO may perform the role from a remote location, for example through a teleconference or video conferencing link.

Source: Emergency Management Manual Victoria

Training is conducted by a multi-agency training team comprising representatives from Victoria Police, Country Fire Authority, Ambulance Victoria, Department of Health and Human Services, local government and the Victoria State Emergency Service.

Training is conducted within the Incident Control Centre in the Barwon South West Region. Here, attendees become familiar with an incident control centre where they will most likely be deployed. Participants put their new skills into practice by attending exercises at the incident control centre or by attending actual incidents. This helps them gain confidence in the role.

The benefits of being familiar with the Barwon Incident Control Centre and the people they will work with, is the networking opportunities this brings. Operational deployments have identified the importance of this ongoing professional development. New relationships form and people become familiar with other EMLOs. The benefit is a greater awareness of different agency roles and responsibilities. This knowledge comes into its own in times when EMLOs are required to work under difficult and stressful circumstances within an incident control centre.

ABSTRACT

The introduction of resilience as a key policy direction for natural disaster, and the growing recognition by governments that they cannot sustain community expectations by 'owning' the bulk of natural hazard risk, is driving change. Making natural disasters everyone's business is not a short-term proposition. It requires repositioning how we as a society view, interact with, and understand risk in both current and future contexts. Longer-term strategic thinking and clarity of risk ownership are crucial if this is to be achieved. This task is difficult because the risks associated with natural hazards are systemic, resulting in interactions between seemingly unrelated risks. This requires a shared understanding as to how these different areas of risk interact with a wide range of values over multiple time scales. How this understanding can be integrated into decision-making requires extensive collaboration. In many cases, risk ownership will be shared, which can make it a confusing and frustrating space for policy makers and practitioners alike.

Owning the future: risk ownership and strategic decision-making for natural hazards

Celeste Young and Roger N. Jones, Victoria University, examine strategic risk concerning prevention and preparedness before emergency events, and recovery after events.

Four workshops held in 2015 investigated values, risk and consequences, actions and ownership for strategic risk management linked to prevention, preparedness and recovery. Building on a foundation of values at risk – social, economic, environment and built infrastructure – ownership of these values was linked to ownership in designated areas of strategic risk management. For values at risk, patterns of ownership at the institutional scale showed relatively even balance, but when risks, consequences and actions were surveyed, they became skewed towards two areas of government: state and local. Further work is needed to determine how these patterns of ownership can be more evenly distributed to achieve more sustainable outcomes.

Introduction

In 2012, the US National Academies declared 'disaster resilience is everyone's business and is a shared responsibility among citizens, the private sector, and government' (National Academies 2012). This is reflected in Australia, where the *National Strategy for Disaster Resilience* states 'disaster resilience is the collective responsibility of all sectors of society, including all levels of government, business, the non-government sector and individuals' (COAG 2011).

There is broad agreement that investment in prevention and preparedness provides significant returns on investment in avoided damage, and that planned recovery can minimise unavoidable damage and subsequent loss (Deloitte Access Economics 2013, Kelman 2013, Hallegatte 2015). However, Australia's capacity to be disaster resilient in this respect is limited by a lack of investment and limited connectivity between the major institutions concerned.

For the Bushfire and Natural Hazards CRC project 'Mapping and understanding bushfire and natural hazard vulnerability and risks at the institutional scale', interpretation of the above implies a shared capacity for the ownership of natural hazard risks (i.e. risk ownership). Risk ownership is identified as a key attribute of resilience at the institutional scale (Jones, Young & Symons 2015a, 2015b, Young, Symons & Jones 2015a, 2015b). The 2015 workshops and desktop assessments examined risk ownership of natural hazards from a decision-making perspective.

The area of focus in this paper is strategic risk concerning prevention and preparedness before events, and recovery after events. Omitted is the response phase during events.
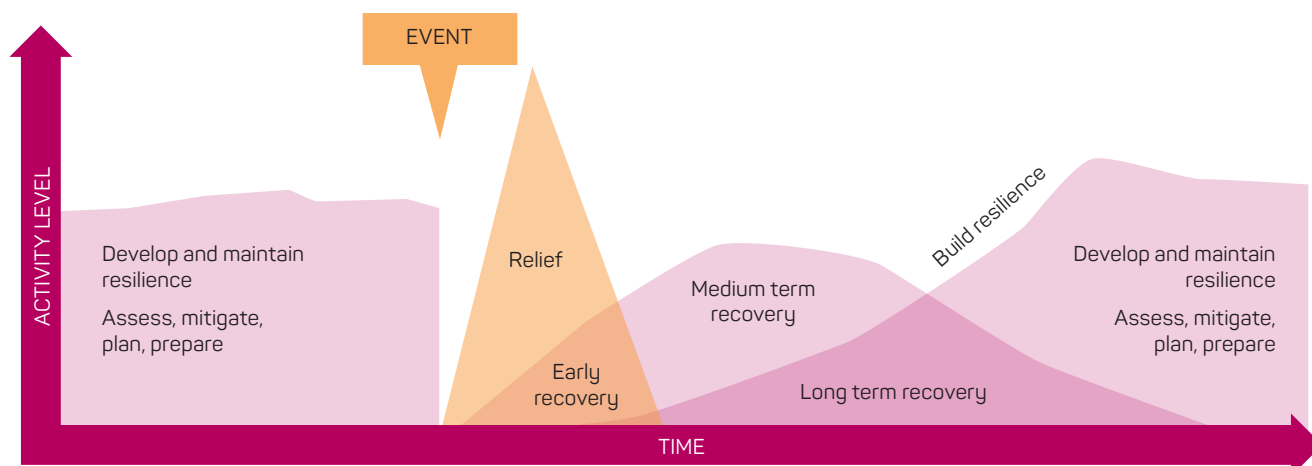
Figure 1: Projected resource requirements for effective integrated natural hazard risk management tasks across time scales (Young, Symons & Jones (2015b) adapted from AEMI (2011)).

This work is based on the following propositions:

- The current decision-making environment is dominated by a risk-based approach of individual hazards but the *National Emergency Risk Assessment Guidelines* strongly recommend a shift to an all-hazards, all-values approach (AEMI 2014).

- This, combined with the systemic nature of natural hazard risks means that a value-based approach, which focuses on key values at risk and outcomes based on aspirations and goals, is more robust than the individual risk-based approach.

- Hazard response is largely based on a tactical command-and-control system whereas the strategic focus shifts to long-term preparation, prevention and recovery, requiring different institutional arrangements dictated by different patterns of risk ownership and different forms of decision-making.

- The two types of risk ownership in use (asset owners, designated risk managers) need integration into a single system of understanding, decision-making and implementation.

Assessing risk ownership at the institutional scale was undertaken using the following core components:

- values: economic, social, environmental and built infrastructure

- ownership: covering ownership of values at risk through to ownership of actions, including preparation, prevention and recovery

- institutions: federal, state and local government, the community, industry and business.

The workshops

Two major questions for the four workshops undertaken in Victoria, New South Wales, Tasmania and South Australia were:

- What types of decision-making structures are being used to apply values at risk in the strategic planning of natural hazard risk management?

- What are the current strengths and gaps in risk ownership at an institutional level?

A total of 118 participants from government, boundary organisations and business and industry attended the workshops. The workshops used a scenario-based approach concentrating on fire, flood and heatwave. The following exercises were used during the workshops.

Exercise 1: Establishing understanding

Presentations provided an overview of the research undertaken to date, followed by a group discussion.

Exercise 2: Ascertaining values at risk

Participants were asked to map the social, environmental, built environment and economic values likely to be affected by the scenario event. Participants mapped dependencies being one-way (supporting dependency) and two-way (mutual dependency). They also listed the institutional owners of those values and selected what they considered the most significant value for the next exercise.

Exercise 3: Mapping risks to values and owners

Using the nominated value, participants listed the consequences of their hazard scenario across social, economic, environmental and built infrastructure areas. They allocated the resulting risks and consequences to short-, medium- and long-term timeframes. Finally, they were asked to allocate owners for the identified risks.

Exercise 4: Mapping owners of risk actions

Participants were asked to list actions that could be undertaken in the short- and long-term to mitigate the risks identified in the mapping stage of the exercise. In Victoria, participants were asked to allocate ownership in these areas according to RAP criteria (who is Responsible, who is Accountable, and who Pays).

Exercise 5: Needs, barriers and opportunities

Each group was asked to identify needs, barriers and opportunities and consolidate key themes from the workshop.

Figure 2: Key components of the workshop process.

The key components of the workshop process are shown in Figure 2.

All responses were recorded on templates that were later transcribed and collated. A mixture of basic statistical methods and analysis was used to synthesis the data with the detailed results presented in a workshop report (Young, Jones & Symons 2016a).

Understanding systemic risk

Natural hazard risk is systemic, and risk ownership needs to be understood within that context. Natural hazards are externally generated but the condition of the system they impact on greatly affects the level of subsequent damage. Both externally and internally generated risks can interact, producing consequences that resonate well beyond the direct effects of a specific hazard event.

It is important to understand how the different types of risk and their interactions with a system affect an institution, organisation, or community (Figure 3). It is also important to understand which forms of governance are suited to the nature of a particular risk and its context.

Internally based risks are more likely to have limited impacts within a defined system and are more amenable to controls by risk owners. The effectiveness of these controls often determines the ability of institutions, organisations and communities to manage effects of externally driven risks. Effective management of these internally driven risks is a key part of building organisational resilience and the ability to proactively respond rather than react to an event with simple damage control.

Externally based risks are often beyond the control of any single institution. They are usually systemic and highly dynamic and can have multiple owners. The boundaries of these risks are often unclear, spanning
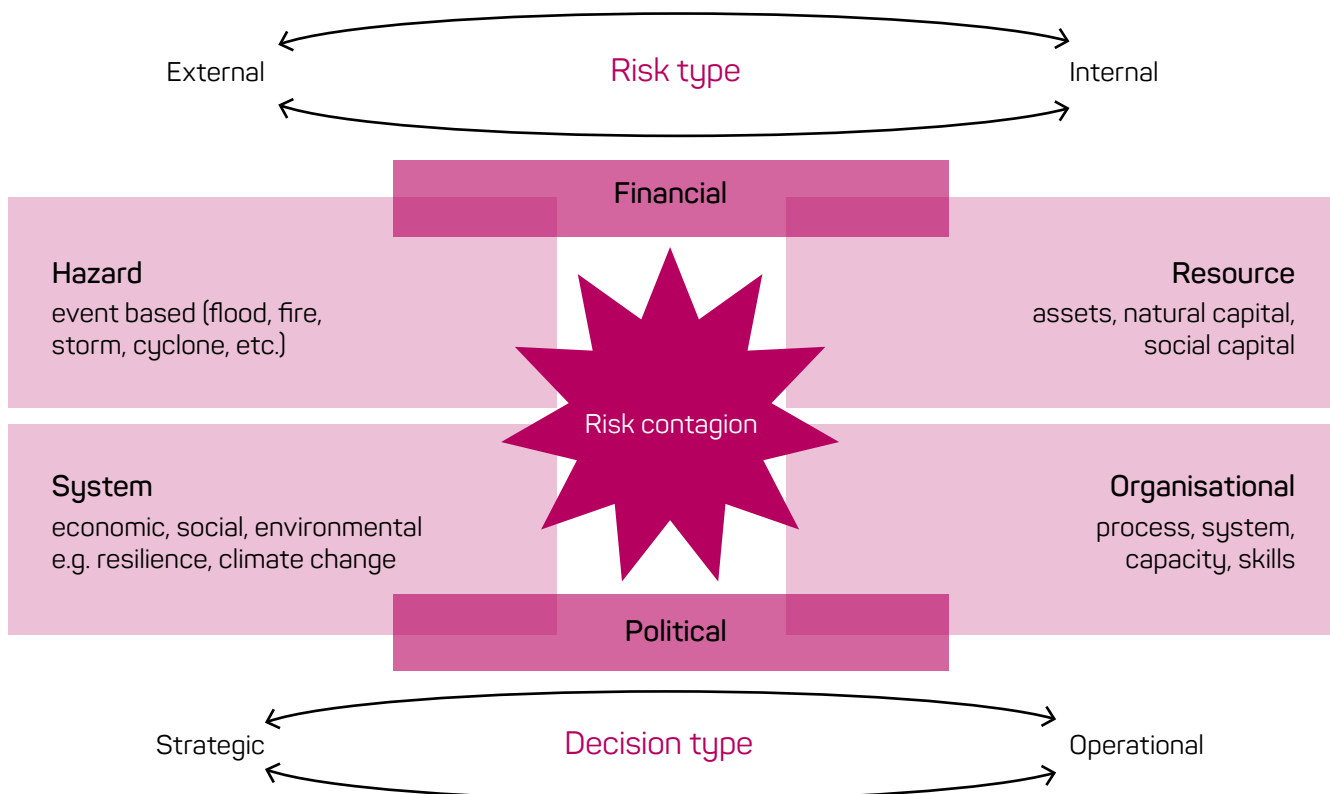

Figure 3: Risk system with internal and external components (Young *et al.* 2016) – adapted from PWC (2013) and Kambil, Layton & Funston (2005).

multiple areas (both geographic and institutional) and timeframes. They can be prepared for, but not predicted, and because of the high level of uncertainty regarding the future, often have unanticipated outcomes.

The strategic management of natural hazard risk also needs to account for political and financial risk. The internal aspects of these risks will influence perceptions and decision-making at an individual scale, as well as at institutional scales. External risks arise from external policy and financial markets that can influence the level of risk different parties are exposed to.

Institutions, organisations and communities may own their internal risks but may not have explicitly taken ownership of natural hazard risks or contemplated the full impact of those risks on their values and goals.

The values associated with these risks are also systemic and have a significant influence on decision-making (Figure 4). Although this project focused primarily on the interaction between the external and natural hazard risk, the role of internal values is still a major consideration in terms of what decisions are made and how they are made.

What values are important to an organisation and the risks associated with them will determine the types of decision-making to be used. It also defines who needs to be involved, the thinking frameworks, and the leadership needed to effectively manage the risk (Table 1).

Risk ownership

Risk ownership is dynamic, having two senses as illustrated by the following definitions (Young *et al.* 2015):

- as an asset owner: 'Asset owners are generally best placed to manage risks to their property' (Productivity Commission 2014, p. 314)
- as a designated risk manager: '...a person or entity that has been given authority to manage a particular risk and is accountable for doing so' (ISO 2009).

Exposed to natural hazards, risk ownership can change abruptly. Two of the key ways this can happen are as a result of:

- risk contagion
- the exceedance of capacity thresholds.

'Risk contagion' is a term most commonly used in relation to financial risk. It describes how financial shocks travel through an economic system and can 'infect' other areas of the economy. Impacts are seen to spread across geographical and institutional borders 'like a contagious disease' (Bordo & Murshid 2001), creating a cumulative effect far larger than the initial event. This type of systemic understanding of risk is well understood in the natural hazard literature through catastrophe risk (Hewitt & Burton 1971, Burton, Kates & White 1993) in areas of social and environmental systems. However, the idea of risk contagion has recently emerged in business models as a way to understand how different areas of risk can be affected by seemingly unrelated risks. This is particularly relevant to the natural hazard sector where

Table 1: Simple, complicated and complex decision-making related to practical application (Adapted from Jones *et al.* (2014)).

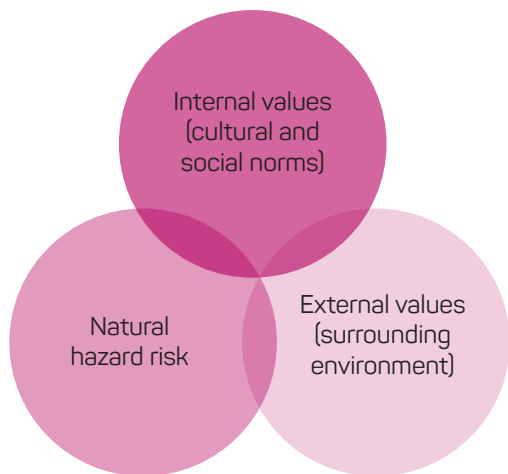| Type of decision	Simple	Complicated	Complex
Characteristics	Linear, actionable, can be solved with one solution. Often static risks with known treatments and outcomes.	Systemic, can be bounded but may require more than one solution to address. Will use a mixture of known and unknown treatments. Dynamic, but usually able to be stabilised over time.	Systemic, unbounded, multiple interrelated actions and solutions required to address the issue. The treatment will often evolve and change over time. Highly dynamic and unpredictable, high levels of uncertainty. Often high-impact low probability.
Example	A faulty piece of machinery.	Containment of a natural hazard event.	Climate change, resilience.
Actors	Individual to organisational: person(s) with allocated responsibility or the asset owner.	Collaborative: parties associated with, and effected by, the event. Shared ownership with delegated areas of responsibility.	Extensive collaboration: a 'whole-of-society approach'. Complex collaborative ownership that is shared across all areas of society.
Thinking frameworks	Logical, analytical, prescriptive and practical.	Short- to medium-term thinking, analytical, responsive. Predominantly prescriptive, but has intuitive elements that respond to changing circumstances.	Long-term, strategic, conceptual, lateral, analytical, creative, reflexive, continuous, flexible.
Leadership actions	Direct and review.	Consult, assess, respond and direct.	Consult, facilitate, empower and direct.

Figure 4: Different value and risk components in relation to decision-making.

risk ownership may be allocated for direct impacts, but not for indirect knock-on effects (e.g. Hallegatte 2015).

Another aspect associated with changing risk ownership is the breaching of capacity thresholds (environmental, social or economic; Jones *et al.* 2013) where the original risk owner will transfer the responsibility of the risk to another owner (either by a prior arrangement or by default) because they lack the capacity to address or manage the risk.

In terms of risk ownership, identifying whether the nature of the risk is changing through contagion or capacity exceedance is important as this determines how the ownership may be transferred or where risks may become 'unowned'. It can also help identify potential areas of vulnerability and support better long-term management of these risks.

Key findings from the workshops

The workshops explored the role of values and risk ownership in strategic decision-making in the emergency management sector. They highlighted the complexity and the challenges of making value-based strategic decisions in relation to natural hazards and the cultural, political and organisational barriers faced by different organisations.

Across all workshops, 330 values were identified and 621 risk ownership allocations were made to these values, 403 risks and consequences were identified, with 172 ownership allocations made. For actions, 191 were identified and 204 allocations made across the workshops in NSW, South Australia and Tasmania. In the Victorian workshop, 91 ownership allocations were made using the RAP criteria.

Specific activities across 12 identified risk areas identified during the workshops show the current diversity in state-based approaches, contexts and levels of maturity related to strategic thinking, risk ownership and resilience. They also raised some of the challenges facing the emergency management sector in establishing a common understanding of natural hazards and their strategic management. The ownership exercise in the Victorian workshop using the RAP criteria was particularly contentious.

The collated results of the value, risk and consequence, actions ownership mapping exercises are shown in Figure 5. Ownership of values at risk are fairly evenly distributed across the various institutions, but this changes as the focus moves to risks and consequences, where the role of local and state governments increases and business and industry and the community decreases. For actions, some balance is re-established, but state government still retains the largest share of ownership.

The allocation of ownership to delegated risk managers showed an increase in government responsibility and an increase is shared and unowned risks. This is perhaps counter to the 'everyone's business' and 'shared responsibility' sentiments national strategies and suggests directions for further research. In particular, there is a need to clarify if these findings reflect the real levels of private and public sector ownership and what balance of public and private ownership is sustainable and can best support community resilience. Further research to clarify how ownership is shared between institutions, to identify unowned risks, and to understand how ownership can be most effectively delegated is needed.

The workshops produced a number of common themes relating to needs, barriers and opportunities. The most common themes raised concerns about limitations of current decision-making structures, approaches, systems and tools, in particular, the inability of these to
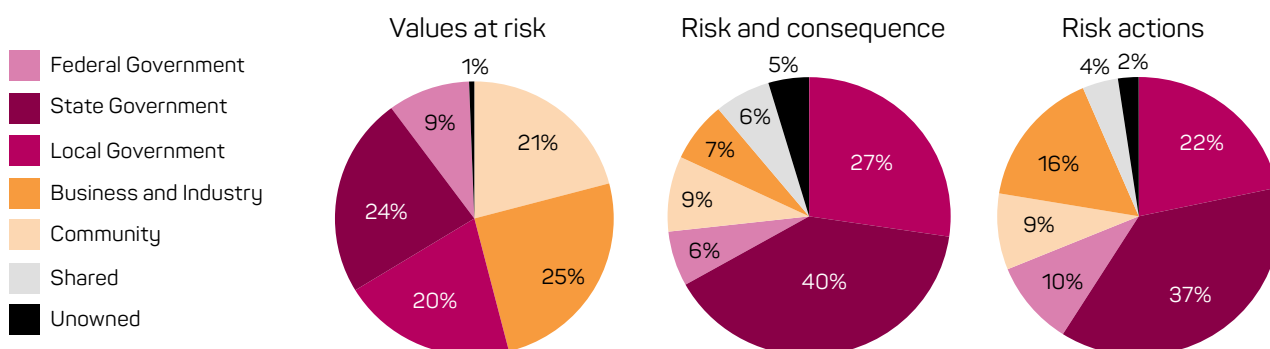

Figure 5: Allocation of institutional ownership across decision-making areas.

meet the emerging needs of communities, government and non-government organisations trying to implement resilience and recovery. Exploring ownership in greater detail can help address these needs.

In summary, key findings were:

- Many gaps remain, and further work is needed to develop more robust institutional and organisational arrangements that support risk ownership and strategic planning of natural hazards.

- In determining risk ownership, it is important to understand who the owner is, what the allocation is for, how it is allocated, and whether the associated responsibilities can be fulfilled.

- Allocation needs to be supported by clear process structures, skilled facilitation and be given sufficient time for effective outcomes to be achieved. It also needs to take a systemic approach that assesses risks and values together.

- Patterns of ownership indicate imbalances within current public and private sector arrangements, especially between the owner of values at risk and ownership of the risks associated with these.

- Complex social values, such as community cohesiveness, are key in understanding risk ownership, especially when taking a multi-hazard approach.

- Skills and capacity in the area of strategic decision-making need further development.

- The transitional pathways and specific needs across the states were diverse indicating a need for flexible, innovation-based practice and funding models to support future development.

- Boundary organisations[1] have a unique role in the emergency management process and should be considered as a stand-alone institution.

Innovation for the future

We can't do this without our communities and know we can't just keep telling them what to do because that just doesn't work. We have to work it out with them and that takes time and lots of listening, a lot of patience and an acceptance that sometimes it is two steps forward and one back. Tasmanian workshop participant

New decision-making arrangements are needed if communities and the private sector are to be actively involved in building resilience. These needs are already driving policy and social innovation. Inclusive approaches that really engage communities as part of the decision-making process are being developed. Current activities identified in these areas are the 'Safer Together

Community First' policy (Victorian Government) and the 'Bushfire Ready' neighbourhoods program (Tasmanian Fire Services). 'Safer Together Community First' is a policy framework for inclusive decision-making between communities and government. The 'Bushfire Ready' neighbourhoods program works from a strong evidence base and focuses on engagement with communities to build understanding and acceptance of risk so that communities feel empowered to act and are responsible for their own risks.

Changes in organisational cultures, longer-term strategic development and resource allocation have been important for these innovations. There is a need to rethink current expectations in these areas across the emergency management sector to support further innovation.

Towards values-based decision-making

The strategic risk management of natural hazard risks is built on a foundation of values at risk covering economic, social, environmental and built infrastructure values, rather than the specific hazards (e.g. fire, flood). This allows the ownership of key values to be linked with the ownership of actions intended to benefit those values at risk.

The use of values as the basis of the decision-making process places the focus on what is most important. It can help address both long- and short-term aims and goals across public and private institutions. Identifying what values have priority over a range of timescales provides a foundation for long-term planning.

This can also help communities to develop strategies that take ownership of the values most important to them and what their responsibilities are in relation to this. However, institutional arrangements between different actors will be needed to manage shared risk and changing ownership that manages risk contagion and capacity limits. As risk ownership is a 'negotiated process' (Young, Jones & Symons 2016a) this process is not without challenges. It requires collaboration and meaningful engagement to achieve fruitful outcomes. It is a long-term proposition that involves multiple parties and requires the development of fit-for-purpose frameworks.

Key components and questions for the values-based decision-making process framework currently in development as part this project are described in Figure 6.

Conclusion

Plan for the future because that is where you are going to spend the rest of your life. Mark Twain

Risk ownership of natural hazards has traditionally been focused in the area of effective response, administered primarily through command-and-control mechanisms.

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1 A boundary organisation is a bridging institution, social arrangement, or network that acts as an intermediary between different interest groups. Its functions include communication between researchers and stakeholders, translating science and technical information, and mediating between different views of how to interpret that information (Jones *et al.* 2014).
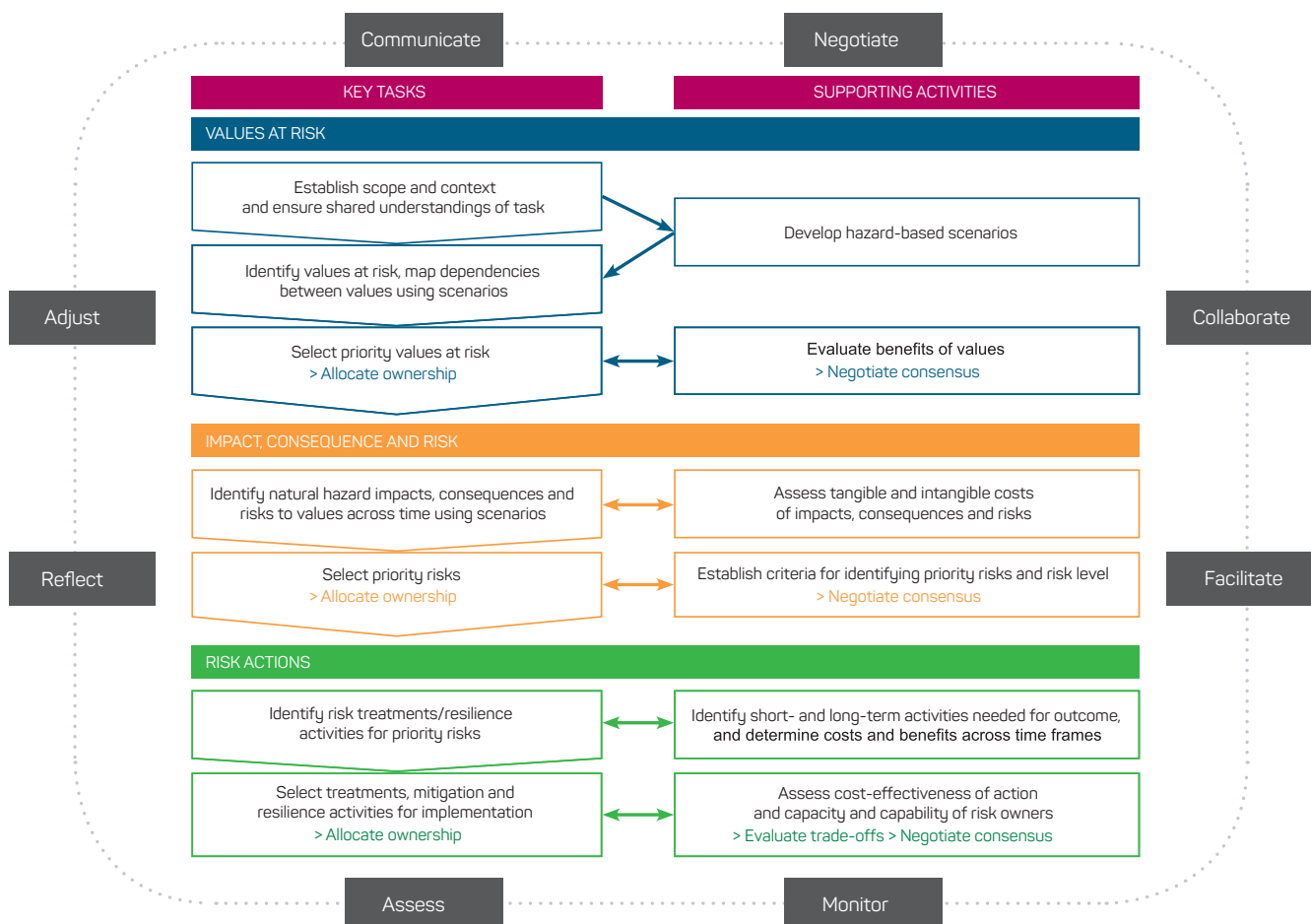
Figure 6: Risk ownership process.

However, the changing nature of natural hazards and the socio-economic context in which they occur is leading to the emergence of new and different types of risks. The need for community, businesses and government to build greater resilience to these risks requires a strategic focus that goes beyond the event and builds greater capacity in all areas of our society.

Effective long-term planning, preparedness and recovery requires:

- robust risk cultures across communities and public and private organisations

- organisational flexibility and responsiveness and the frameworks to support this

- a willingness to work with what is unknown and to accept that there is no one perfect solution or answer; to ask 'what if' rather than state 'what is'

- an understanding of current perceptions of how success, failure and risk appetites can impede progress

- the development of values-based decision-making and governance

- capacity and capability building that can be achieved in the face of resource constraints is needed across all institutions.

The workshops explored preferences concerning values and risk ownership in strategic decision-making. They identified cultural, political and organisational barriers facing people in different public and private organisations in relation to these areas. More importantly, they highlight the opportunity to transform how society thinks about and responds to natural hazards. They point to a need for greater understanding of what the risks are and who owns them across different areas of society. Targeted resources, community engagement, long-term policy and investment and re-alignment of current expectations that match current capacities and capabilities across both the public and private sectors are needed if these challenges are to be overcome.

At the heart of risk ownership are communities and businesses, and the need for common understandings and collaboration between them and the public sectors. Strategic decision-making based on values and ownership of risks provides the bridge between the present and the future; one that can help decisive action and collaboration in the present, while thinking and planning ahead. It is a crucial factor for preparedness and effective response to natural hazards now and in the future.

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About the authors

Celeste Young is a Collaborative Research Fellow at the Victoria Institute of Strategic Economic Studies, Victoria University. Her key areas of focus are developing frameworks and methods for using and implementing research in decision-making, understanding risk, innovation and stakeholder engagement. She has developed a number of successful frameworks and programs that are used in areas of climate change adaptation and was a contributing author to the Foundations of Decision Making chapter in the latest IPCC report.

Roger N. Jones is a Professorial Research Fellow at the Victoria Institute of Strategic Economic Studies, Victoria University. He works on understanding and managing climate change risk, natural hazard risk and the ecological economics of urban systems. He was a lead author on chapters assessing risk and decision making in the last three IPCC reports.

ABSTRACT

This paper presents research from collaboration between the Cyclone Testing Station (CTS) at James Cook University and insurer Suncorp over the last two years. A key outcome of this work has been an insurance premium reduction program by Suncorp known as the 'Cyclone Resilience Benefit'. Background research conducted for the program by the CTS is discussed and its details are briefly reviewed. Insights from the program delivery to over 14 000 homeowners to date are discussed. Although still in preliminary stages, the development of this industry program based on academic research demonstrates the benefits of strategic partnerships in the field of natural disaster risk mitigation.

Building community cyclone resilience through academic and insurance industry partnership

Jon Harwood, Suncorp Group Limited, and Dr Daniel J. Smith and Dr David Henderson, Cyclone Testing Station, detail an academic-industry partnership to bring cost benefits to cyclone-prone communities.

Introduction

Australia's annual insured losses due to natural disasters exceed $480 million on average (ICA 2014), continuously highlighting the need for well-designed homes and infrastructure. Cyclone and severe storm events are particularly costly, contributing to nearly half of all nominal natural hazard insurance losses over the period from 1970–2013 (see Figure 1).

While cyclone events are relatively infrequent, the resulting losses are excessive and the risk associated with insuring properties in cyclonic regions of Australia (e.g. Queensland) has led to affordability issues. For Suncorp, the average offered premium price for new business homes in north Queensland is $2500 annually. Many studies by academic, private and government organisations within Australia and abroad suggest that a focus on pre-disaster mitigation can reduce building stock vulnerability (Australian Government Treasury 2015, Smith, Henderson & Ginger 2015a, Smith, Henderson & Ginger 2015b). This can reduce cyclone-induced losses and allow for risk-reflective insurance pricing (i.e. lower premiums for stronger houses). Indeed, some engineering approaches for improving vulnerability already exist (Standards Australia, 1999a, b) but are not widely implemented.

Investigating the psychology of natural hazards, Kunreuther and colleagues (2009) suggest the shortage of homeowner investment in risk reduction may be due to a lack of risk awareness, underestimation of risk, budget constraints, and difficult computations for cost-benefit trade-offs. There are also other psychological and situational barriers in the decision-making process. In 2014, Suncorp Insurance and the CTS began a collaborative research effort to investigate and reduce the engineering, financial and psychological barriers to widespread vulnerability reduction and insurance affordability in Queensland.

The first phase of the research involved claims analysis from cyclones Yasi and Larry to identify key engineering vulnerabilities in Queensland housing (Smith & Henderson 2015b). One of the more costly storms in Australian history, Cyclone Yasi, resulted in estimated economic losses of over $2 billion, with insured losses of over $1.4 billion (see Table 1).
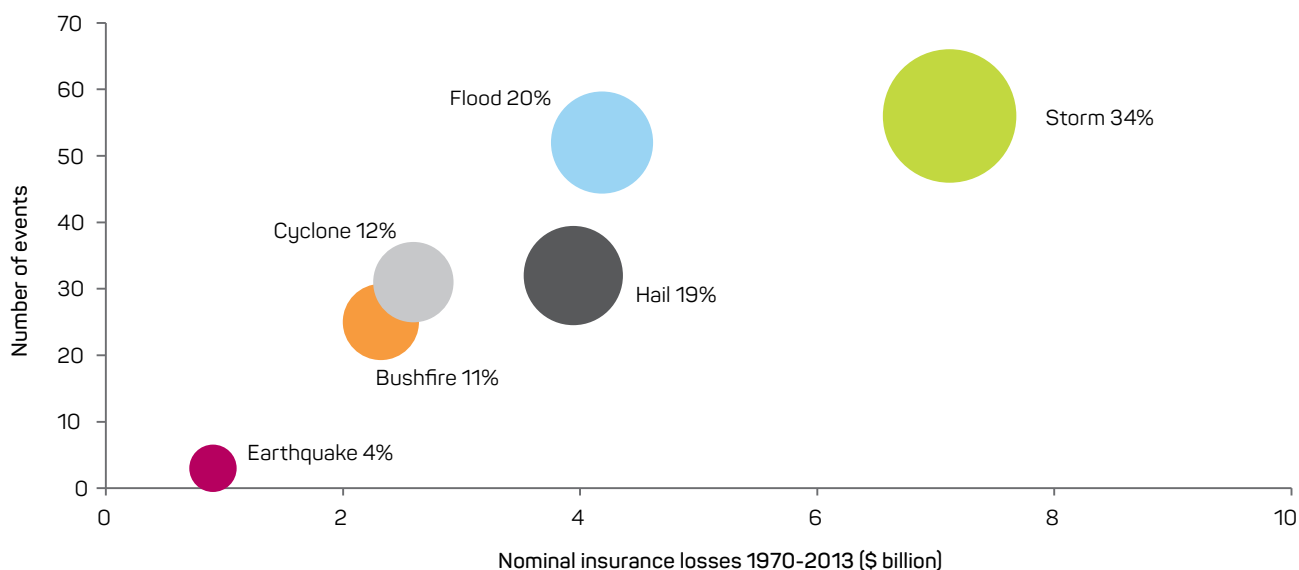
Figure 1: Insurance losses by natural hazard (ICA 2014).

The second phase of research provided a preliminary cost-benefit analysis of implementing some of the existing engineering recommendations for reducing housing vulnerabilities identified in the first phase of research (Smith & Henderson 2015a). Drawing on this research, Suncorp released its Cyclone Resilience Benefit[1] program in 2016. The product allows homeowners in cyclone-prone regions to receive up to 20 per cent reductions in insurance premiums based on the building features their home has that are known to reduce vulnerability in cyclones (e.g. window shutters).

vulnerability of existing housing stock to cyclone risk, leaves Suncorp challenged in generating profitable growth. Suncorp's approach to managing its exposure in cyclonic regions hinges on a concept known as 'shared value' (Porter & Kramer 2011), in which a company's success and social progress are intertwined. Addressing issues of insurance premium affordability by reducing the vulnerability of the housing stock in north Queensland alleviates a societal problem. It also creates economic value for Suncorp and, therefore, a clear shared-value opportunity.

Background

Since the Queensland floods and Cyclone Yasi in 2011, there have been 11 separate inquiries into insurance affordability and preparedness for natural disasters (Table 2). The more significant of these include the *Northern Australia Insurance Premiums Taskforce Report*, the *Productivity Commission Natural Disaster Funding Report*, and three reviews by the Australian Government Actuary. The strong government focus on insurance affordability in recent times has further motivated the insurance industry to examine pragmatic solutions to address affordability concerns and continue offering insurance policies in high-risk natural hazard areas. Two common themes emerged from the inquiries:

- the insurance affordability issue is driven primarily by natural hazard risk, specifically cyclone risk in northern Queensland
- pre-disaster mitigation is the best approach to insurance affordability.

The occurrence of disasters such as Cyclone Larry and Cyclone Yasi have led to higher claims cost, increased reinsurance costs, and subsequent increases to customer premiums. Increasing costs, coupled with the

Building science research

Damage investigations carried out by the CTS following severe wind storms have typically shown that Australian houses built prior to the mid-1980s do not offer the same level of structural performance and protection during windstorms as houses constructed to contemporary building standards. The investigations also show that the majority of houses designed and constructed to current building regulations have performed well structurally by resisting wind loads and remaining intact (Boughton *et al.* 2011, Henderson *et al.* 2006, Reardon, Henderson & Ginger 1999). However, these reports also detail failures of these structures (Figure 2 and Figure 3) resulting from design and construction failings, poor water ingress protection, or degradation of construction elements (i.e. corroded screws, nails and straps, and decayed or insect-attacked timber).

The Suncorp and CTS collaboration commenced the research program by leveraging the CTS experience from damage investigations to examine Suncorp's 25 000 claims following cyclones Larry and Yasi.. The aim was to develop a deeper understanding of factors that cause cyclone-induced losses. This was achieved by determining the relationship between physical damage modes identified in post-event field surveys and insured

1   Cyclone Resilience Benefit program. At: www.suncorp.com.au/insurance/safety/cyclone-**resilience.**

Table 1: Losses from most costly, land-falling cyclones in Australia since 2006 (Harwood *et al.* 2014).

Event	2011 Normalised Economic Loss $m	2011 Normalised Insured Loss $m	Insured %	Date
Cyclone Larry	1,692	609	36%	March 2006
Cyclones George and Jacob	N/A	12	N/A	March 2007
Cyclone Yasi	2,080	1,469	71%	February 2011
Cyclone Oswald	1,650	1,098	67%	January 2013
Cyclone Ita	N/A	8	N/A	April 2014
Cyclone Marcia*	750	544	73%	February 2015

*Not 2011 normalised, i.e. 2015 loss (Swiss Re 2016)

Table 2: Government inquiries into national disasters since 2012.

Government Inquiry	Date
National Disaster Insurance Review	November 2011
House of Representatives Standing Committee on Social Policy and Legal: *In the Wake of Disasters Volume 1 and 2*	February-March 2012
Queensland Floods Commission of Inquiry	March 2012
Australian Government Actuary: *First Report on Investigation into Strata Title Insurance Price Rises in North Queensland*	October 2012
Productivity Commission Natural Disaster Funding Report	May 2014
Australian Government Actuary: *Second Report on Investigation into Strata Title Insurance Price Rises in North Queensland*	June 2014
Joint Select Committee on Northern Australia: *Inquiry into the Development of Northern Australia: Final Report*	September 2014
Financial System Inquiry	November 2014
Australian Government Actuary: *Home and Contents Insurance Prices in North Queensland*	December 2014
Government response to the Senate report on recent trends in and preparedness for extreme weather events	July 2015
Northern Australia Insurance Premiums Taskforce	March 2016

Figure 2: Removal of roof cladding and battens from windward face.

Figure 3: Roof cladding with battens still attached flipped on to leeward side.

loss trends in the claims data. Some key findings from the study are:

- 86 per cent of claims were for minor damage (less than 10 per cent of sum insured), making up 25 per cent of the total claims cost. These were largely preventable (building-age independent) claims involving non-structural items like overgrown trees, shade sails, and outdoor furniture indicating that preparedness can be improved in north Queensland.

- Homes built before 1982 (predating modern building codes) were more vulnerable to structural failure than contemporary homes.

- Less than 3 per cent of claims were severe (i.e. less than 50 per cent of sum insured value), and these were often due to structural failure. However, they accounted for 27 per cent of the total claims cost, presenting a case for strengthening older, more structurally-vulnerable homes in the region.

- The majority of contemporary houses remained structurally sound, protecting occupants and meeting the life safety objective of Australia's National Construction Code (NCC). However, a significant proportion of contemporary homes experienced water ingress (resulting in loss of amenity) and component failures (i.e. doors, windows, soffits, guttering) with the potential for damage progression to other buildings. These buildings failed to meet specific objectives and performance requirements of the NCC.

In 2015, a second phase of research involved preliminary estimation of the cost-benefit ratio of several existing cyclone mitigation strategies in collaboration with economic consultant Urbis. The results compiled by Urbis are shown in Table 3.

In addition, the second phase of work explored the literature to understand homeowner behaviours and attitudes towards natural hazard risk and investing in mitigation (see Smith *et al.* 2016 for a detailed discussion). As discussed, a number of key psychological and situational barriers were identified. However, the decision-making process is often complicated and the key influences extend far beyond the homeowner. For example, Kunreuther, Meyer & Michel-Kerjan (2009) describe the 'politician's dilemma', which refers to an elected official who often must weigh the choice between charging additional taxes for risk reduction measures with long-term benefits versus a potential loss in the next election.

The Cyclone Resilience Benefit

The Cyclone Resilience Benefit (CRB) was released in early 2016 to address premium affordability issues in northern Australia. The CRB promotes risk mitigation by rewarding the efforts of homeowners who make their homes less vulnerable to cyclone damage through home improvements and cyclone preparation plans. Prior to the CRB, the cyclone component of the premium for a

Suncorp home insurance policy generally considered the following attributes:

- location of the property
- age of the property
- year of construction (i.e. pre- or post-1980s)
- building type
- roof material.

However, these criteria resulted in an incomplete view of a property's vulnerability. The most important factor was the year of construction, as the cyclone component of the premium for a pre-1980s home could be up to three times that of a post-1980s property. There was no system capability for understanding work done to properties that would reduce the cyclone damage risk of pre-1980s properties (e.g. roof replacement, cyclone shutters, etc.), nor capability to recognise further mitigation work done on post-1980s properties. The CRB is a new rating system developed to better understand housing vulnerability and acknowledge the efforts of customers who invest in strengthening their home. In addition to the attributes considered, the CRB recognises upgrades to several aspects of the home including the roof, windows, doors, garage doors, sheds, as well as general preparedness (i.e. cyclone action plan).

The CRB is accessible to all Suncorp customers who live above the Tropic of Capricorn in Australia and the reduction amount varies between 1 per cent and 20 per cent of the property's total premium. Since the CRB applies only to the cyclone and storm components of the premium, customers in higher cyclone risk areas receive larger reductions than those further from the coast and in southern latitudes. Properties that currently have higher premiums based on a relatively high level of structural vulnerability (e.g. pre-1980s), receive larger reductions than those with lower relative vulnerability (e.g. post-1980s) and therefore lower current premiums.

To determine the pricing rate for each mitigation upgrade, both the Suncorp and CTS research and expert judgement were used. Potential reductions to both the cyclone and storm peril components of the premium were included since improved performance of the property under cyclonic conditions reduces vulnerability during non-cyclonic storms (which are less severe in both intensity and duration). A reduction is not currently included for contents policies since the Suncorp and CTS research has primarily focused on the structure of the building envelope and less on loss from wind-driven rain.

The Cyclone Resilience Benefit questionnaire

The primary link between Suncorp and homeowners interested in the CRB is a questionnaire regarding mitigation upgrades the home may have. In order to ensure details about the home are properly identified and communicated, it is important that the questionnaire is clear, concise and easy to follow. Each question is designed to elicit information about a particular type of
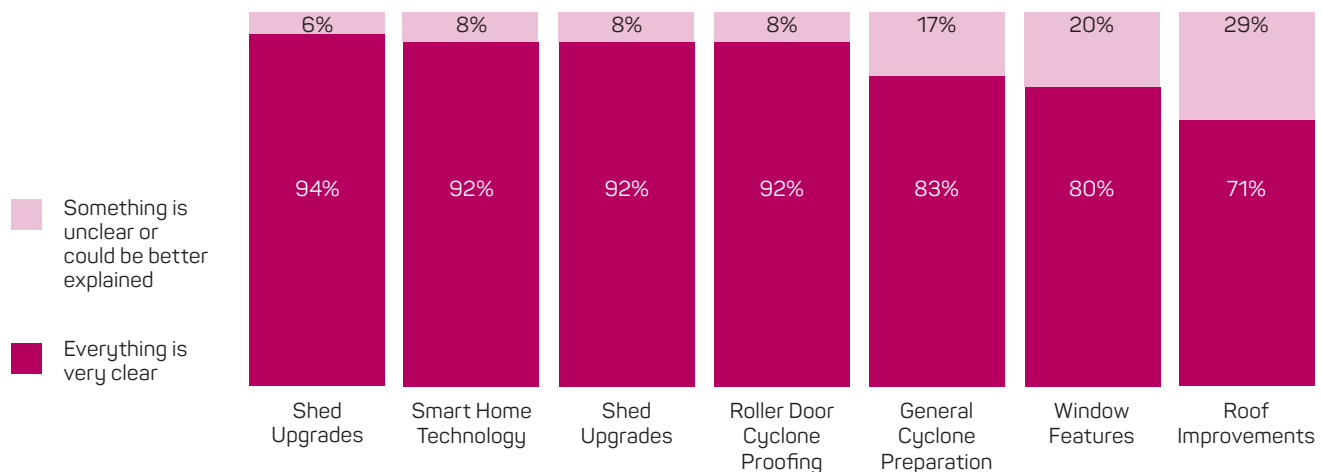
Figure 4: Suncorp customer survey results for each question of the Cyclone Resilience Benefit rating questionnaire.

housing vulnerability. Before releasing the CRB, Suncorp commissioned a customer survey to test the feasibility of the question set and received valuable feedback as a result. There were 65 surveys completed in total with all respondents living in either north Queensland (52 per cent), far north Queensland (43 per cent), or north-west Queensland (5 per cent). Each was a homeowner of the residence they currently live in. Figure 4 shows the results of survey in terms of homeowner understanding of the CRB rating questionnaire.

Key findings of the survey were:

- Customers suggested more extensive answer options for most questions. Improvements are required to enable customers to provide accurate and informed answers for general cyclone preparation, window features and roof upgrades.

- Customers felt that knowing the year of construction, along with knowledge of local building codes, should enable Suncorp to remove some of the burden of understanding and reporting technical construction terms that they entrusted to their builder or to the prescribed building code.

- Two-thirds of Suncorp customers would be prepared to complete the resilience survey to understand if they could lower their premiums based on mitigation.

- In addition, 29 per cent of customers didn't believe that the questions on roofing details were clear. Specific feedback on the roof question suggested more explanation of answer options, links to definitions or pictures illustrating options, the inclusion of an option that the roof is built to current codes or to specific wind-category rating (upgrades not required). Alternatively, limit the question to the age of the house and basic construction of roof only (new houses are typically built to cyclone standards).

The questionnaire also asked customers about their perceived natural hazard threats for north Queensland (Figure 5). Over 90 per cent of respondents concluded that cyclones were a high or medium risk. This suggests that there is a significantly high level of risk awareness of natural hazards, likely due to the frequency of cyclonic events in the region and community outreach programs

(e.g. 'Get Ready Queensland'). However, risk awareness often does not translate into investment in mitigation by homeowners. A key aim of the CRB and the Suncorp and CTS collaboration is to promote mitigation investment by providing financial incentives via premium reductions.

Insights from the Cyclone Resilience Benefit data

The CRB received a positive response from the north Australian community. Over 14 000 homeowners have potentially received policy savings to date by answering the CRB questionnaire. The average premium reduction to date is approximately $100 annually. The collected CRB data will be continuously analysed to better understand housing vulnerability in the current building stock, homeowner attitudes towards mitigation, and how the CRB can be further enhanced.

Of the pre-1980s homes, 41 per cent indicated that no additional upgrades had been completed for the roof structure to date (Figure 6). Although it is broadly accepted that these homes have a relatively higher level of structural vulnerability, roofing upgrades and replacements are expensive and the cost-benefit analysis case for homeowners is often not financially viable or not readily understood. While some upgrade solutions do exist (Standards Australia 1999a, b), they are often cost prohibitive or aesthetically displeasing. Although the average premium reduction for a full roof replacement is 16 per cent for pre-1980s homes, the cost is often in the order of $30,000 (Smith & Henderson, 2015a). Therefore, a key challenge in risk reduction for northern Australia is the innovation of more cost-effective retrofit options. However, even homes built to modern construction standards can have increased vulnerability due to corroded connections (e.g. roofing screws.) and deteriorated building materials. Savings for complete roof replacements may result in up to 10 per cent reductions for contemporary housing.

Figure 7 shows the proportions of CRB users with window protection. It is interesting to note that only 5 per cent of users have cyclone shutters. The use of shutters can significantly reduce the vulnerability of a structure

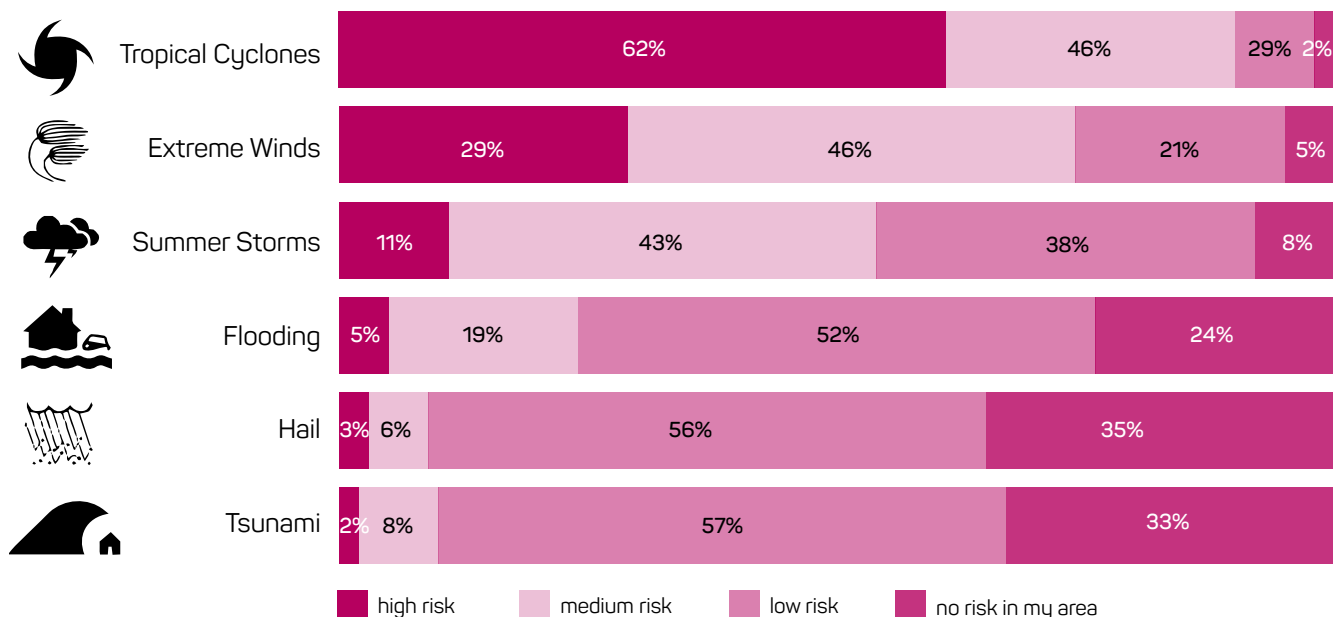|	high risk	medium risk	low risk	no risk in my area
Tropical Cyclones	62%	46%	29%	2%
Extreme Winds	29%	46%	21%	5%
Summer Storms	11%	43%	38%	8%
Flooding	5%	19%	52%	24%
Hail	3%	6%	56%	35%
Tsunami	2%	8%	57%	33%

Figure 5: Perceived weather perils in North Queensland.

by keeping the building envelope intact (i.e. reducing likelihood of internal pressurisation) and reducing the potential for water ingress. Depending on the house, shutter installation could be added for around $3,000.

Discussion

Housing vulnerability to severe wind events in Australia has become a key societal issue as exposure increases due to population growth. The resultant losses are severe and have damaging impacts at a range of societal levels. Reducing vulnerability in the built environment is a difficult task that will require time, innovation and a concerted effort by stakeholders at all levels. The CRB represents a critical step forward by promoting risk-reflective pricing in the insurance industry that encourages investment in mitigation by homeowners. In March 2016, Suncorp, the Queensland Government and the CTS commenced a three-year research program in partnership with the University of Florida (Prevatt & Florig 2015, Smith *et al.* 2016, Smith *et al.* 2015c) to develop a cyclone mitigation tool known as 'ResilientResidence'.[2] In the immediate future, this research will:

- refine the current understanding of relationships between physical damage and monetary loss
- investigate approaches to changing homeowner attitudes towards mitigation investment
- develop a vulnerability rating system for standardised assessment
- develop information delivery mechanisms to help raise awareness, promote behavioural change, and facilitate risk mitigation.

2 ResilientResidence. At: **www.resilientresidence.com**

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Full roof replacement 23%

No additional work 41%

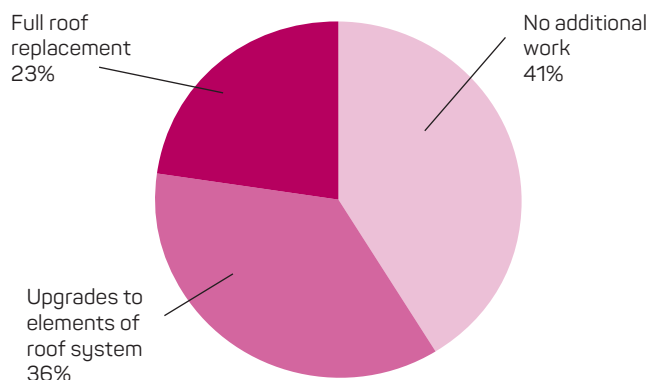Upgrades to elements of roof system 36%

Figure 6: Proportion of Suncorp Cyclone Resilience Benefit users with upgrades to the roofing system for pre-1980s housing.

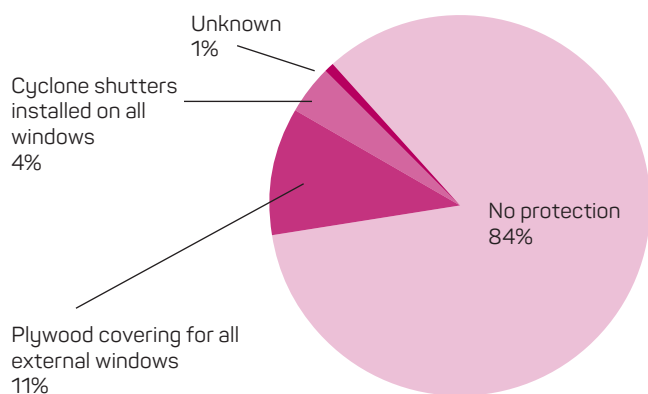Figure 7: Proportion of Suncorp Cyclone Resilience Benefit users with window (i.e. shutters) protection.

Pie chart labels:
- Unknown 1%
- Cyclone shutters installed on all windows 4%
- No protection 84%
- Plywood covering for all external windows 11%

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About the authors

Jon Harwood is the Product Solutions Manager with Suncorp Group Limited.

Dr Daniel Smith is a research fellow with the Cyclone Testing Station.

Dr David Henderson is Director of the Cyclone Testing Station investigating effects of wind loads on low-rise buildings.

The Excess Heat Factor as a metric for heat-related fatalities: defining heatwave risk categories

Dr Thomas Loridan and Lucinda Coates, Risk Frontiers, and Dr Daniel Argüeso and Dr Sarah E. Perkins-Kirkpatrick, Climate Change Research Centre, and Professor John McAneney, Risk Frontiers, present a technical classification for heatwave to help predict fatality numbers.

Introduction

Heatwaves can have considerable economic and societal impacts (Nairn & Fawcett 2013) and are responsible for the largest number of deaths in Australia from natural disasters (Coates *et al.* 2014). However, there is no consensus about what constitutes a heatwave event (Perkins 2015) or even about the way one should go about quantifying heatwave intensity. Acknowledging this gap, Nairn and Fawcett (2015) designed a heatwave index to account for:

- the ability of local communities to adapt to its climate
- the dramatic effects that sharp temperature spikes can trigger through a lack of acclimatisation.

This metric, called the Excess Heat Factor (EHF), is an ideal method to homogenise the description of heatwave intensity from a hazard point of view. It also lends itself to the characterisation of various severity thresholds.

Using the 85th percentile of all positive EHF values from 1958-2011, Nairn and Fawcett (2015) define a severity classification scheme and label heatwave events as either low-intensity, severe or extreme. This approach is a natural step towards better risk communication. However, the implications of a high EHF are dependent on the risk being studied. For applications such as energy demand or infrastructure damage the threshold EHF values above which action needs to be taken will be significantly higher than when trying to accommodate, for instance, human discomfort and increased use of health services (Hatvani-Kovacs *et al.* 2015, Scalley *et al.* 2015). In this study the focus is on potential heat-related fatalities. The PerilAUS database (Coates *et al.* 1996) is used as an archive of deaths attributed to extreme heat conditions in Australia. From a ranking of the heatwave episodes associated to these deaths (in terms of EHF magnitude) a set of four heatwave severity categories is defined. These capture conditions that historically led to a greater number of deaths and should help communication about heat-related risks. Using Census population data to normalise the PerilAUS records, a fatality curve to link these categories to a potential death toll is used. This paper introduces a methodology to generate realistic, synthetic heatwave scenarios.

ABSTRACT

Heatwaves represent Australia's most significant natural disaster in terms of mortality. A unanimous definition of what constitutes a heatwave does not currently exist. However, recent work from the Bureau of Meteorology (Nairn & Fawcett 2013) has provided a metric designed to summarise their intensity. This metric, called the Excess Heat Factor, is being increasingly adopted by the research community as it is well-suited to characterise heatwave hazards. Yet the link between the Excess Heat Factor and the potential societal or economic impacts heatwaves can have is still not well understood. Using the PerilAUS archive of heat-related fatalities in Australia, this paper proposes to develop a classification of heatwave events in terms of their risk potential for human loss of life. This paper also quantifies the likely death toll from populations exposed to each of these categories. The category scheme is used to analyse the risk gradient of the three most lethal events in south-east Australia since 1900. The scheme helps communicate about heatwave fatality risk in Australia and provides some insight into the location of the populations under greatest threat. This study also catalogued 466 events in south-east Australia using the Excess Heat Factor and the newly developed heatwave categories. Using principal component analysis to identify the key modes of variability, a synthetic catastrophic heatwave scenario is generated and analysed for projected fatalities.

Excess Heat Factor

There have been many ways to define a heatwave event (Perkins 2015), however the EHF methodology introduced by Nairn and Fawcett (2013, 2015) is being adopted as the standard metric in Australia. It recognises the need to account for both minimum and maximum daily temperatures when assessing heatwave intensity, and explicitly separates the impact of short- and long-term temperature anomalies.

An excess heat index is computed to capture a-typical occurrences of high heat accumulation at a particular location in respect to that location's long-term temperature average. For this purpose the daily mean temperature (TM) is calculated as the average of the daytime maximum and night-time minimum air temperatures over a three-day period compared to the 95th percentile of TM at the location of interest (TM95). Daily minimum and maximum temperature data for Australia are available from the Bureau of Meteorology from 1911 (Jones, Wang & Fawcett 2009). In this study the significant excess heat index (EHI) on day '*i*' is defined as:

Equation 1:

$$EHI_{SIG}(i) = max\left[\frac{(T_{Mi}+T_{Mi-1}+T_{Mi-2})}{3} - T_{M95}, 0\right]$$

A positive EHI$_{SIG}$ indicates an unusually warm three-day period relative to the local climate statistics while all other days are assigned a value of zero.

An acclimatisation index (EHI$_{ACC}$) is brought into play to capture sudden rises in temperature in relation to the recent past. The index is computed in a similar fashion to Equation 1, this time comparing the three-day average to the past month (30-day) average:

Equation 2:

$$EHI_{ACC}(i) = \frac{(T_{Mi}+T_{Mi-1}+T_{Mi-2})}{3} - \frac{\sum_{k=3}^{32} T_{M(i-k)}}{30}$$

A positive value of EHI$_{ACC}$ indicates a sharp temperature rise, to which the local population might not have time to acclimatise.

The EHF is obtained as a combination of EHI$_{SIG}$ and EHI$_{ACC}$:

Equation 3:

$$EHF(i) = EHI_{SIG}(i) \times max\big(1, EHI_{ACC}(i)\big)$$

The strengths of the EHF as a measure of heatwave occurrence and intensity are that it:

- is location dependent and explicitly acknowledges that populations in warmer climates are more resilient in the face of higher daily mean temperatures
- accounts for both short-term and climate-scale temperature anomalies.

The EHF can be used as an accumulated index characterising heat load over time. For that purpose, the daily EHF values are summed over a certain time period, such as the duration of the event. The resulting integrated value represents the heat load and accounts for both the event duration and its strength over time.

This raises the question: knowing the peak EHF intensity and heat load for a given event, can the severity of the risk to human life be anticipated?

Heat-related fatality risk potential

Defining heatwave categories

Having identified objective measures of heatwave severity, their potential link to heat-related fatalities are investigated from analysis of two data products. The PerilAUS archive (Coates *et al.* 1996) provides a list of 224 historical occurrences of heat-related deaths in Australia. The record includes the number of fatalities reported along with dates and locations. In addition, gridded records of daily minimum and maximum temperature available from the Australian Bureau of Meteorology since 1911 (5 km resolution Bureau of Meteorology dataset, Jones, Wang & Fawcett 2009) are used to compute EHF estimates for the 12-day period prior to the reported fatalities (a period of time long enough to cover most events durations). Both the maximum EHF over the period (EHF$_{max}$) and the 12-day accumulated heat load (EHF$_{sum}$) are used to characterise the conditions that led to the fatalities. These two indices are computed from the average daily EHF value in the 10 km x 10 km boundary that contains the PerilAUS record location.

Figure 1 shows the 224 records, marked as dots and coloured in terms of the total number of fatalities reported on that day and in that location. The records are sorted by increasing order of the 12-day accumulated EHF (EHF$_{sum}$, x-axis, Figure 1a) and 12-day maximum EHF (EHF$_{max}$, Figure 1b). The y-axis is the conditional exceedance frequency of that same quantity. From such a representation the relevance of the two metrics relating to the number of fatalities is clear: the most lethal records (warmer-coloured dots) are mainly to the right of the two figures (representing higher intensity heatwaves). It is also worth noting the cluster of points on the zero line as they represent fatalities for which the EHF definition would not have indicated the presence of a heatwave event.

The vertical dashed lines represent various threshold values selected to group the data in different categories. The numerals next to them indicate the average death toll for all points situated to the right of that line. Note that one of the records reported over 300 fatalities (the February 2009 Victoria event, see Figure 4). The average for the last group of points is inflated as a consequence. Nonetheless the increasing trend in the mean number of deaths per occurrence suggests that both quantities are good indicators of heat-related fatalities (as the
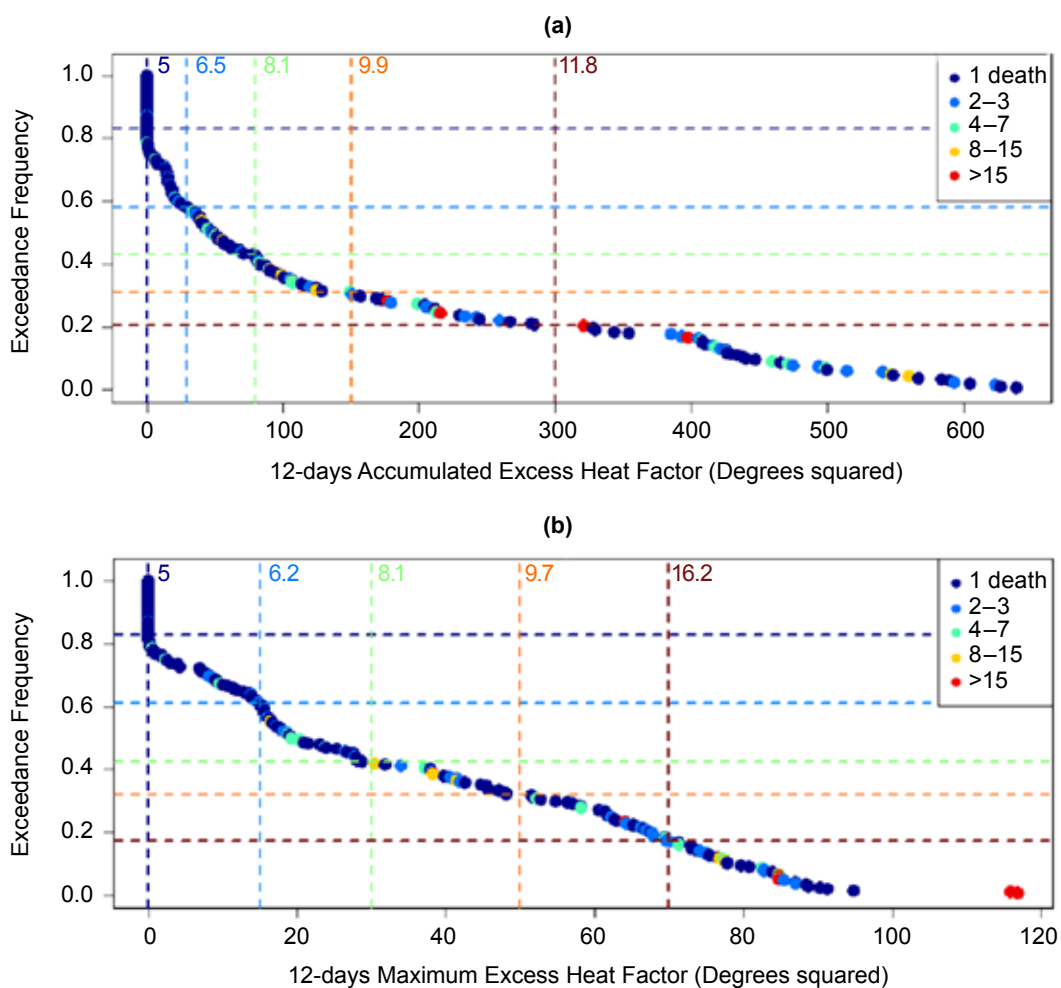
Figure 1: Conditional exceedance frequency as a function of (a) the accumulated EHF over the 12-day period prior to each reported fatality and (b) the maximum EHF over that period.

threshold values increase so does the number of fatalities per occurrence). One could therefore design a categorisation of events based on either one of these indicators for heatwave severity with regards to potential fatalities. Combining both metrics acknowledges that the most severe events will be characterised by both a large peak maximum (EHF_{max}) and a sustained period of high EHF (EHF_{sum}). The combined classification scheme is provided in Table 1 along with key statistics for each category. It can be noted in Table 1 that the trend towards increasing numbers of fatalities per occurrence is greater than when the two indicators are treated separately. For each category, the equivalent (Nairn & Fawcett 2015) severity class is also reported for comparison based on the threshold EHF values for Melbourne and Adelaide.

Application to the three worst events since 1900

To illustrate how the classification from Table 1 can be used to characterise specific events, three of the most lethal cases since 1900 in south-east Australia are analysed. For each, footprints of EHF_{max} and EHF_{sum} values are first computed from the 5 km resolution Bureau of Meteorology dataset over the duration of the events. These are used to assign a category for each of the 5 km cells following the Table 1 scheme. Figures 2, 3 and 4 show the resulting category maps, along with records of fatalities (black dots, scaled in terms of the number of deaths). Unlike continuous maps of EHF_{max} or EHF_{sum} values, these are direct representations of the risk gradient and can help illustrate the event to local populations. For comparison with the (Nairn & Fawcett 2015) severity categories, refer to their Figure 17 that covers the same event as in Figure 4. In both cases, most of south-east Australia is under the highest threat category.

Heat-related fatality curve

To enable projection of heat-related fatalities based on estimates of both peak EHF and accumulated heat load during a heatwave event, a vulnerability function is derived using census population data from 2001 and 2011 to normalise the records. Analysis is focused on the past ten years of records available in Victoria and South Australia. These represent the most accurate data in terms of geolocation. For the ten biggest events of the last decade, the total population exposed to each of the categories listed in Table 1 is computed, linearly interpolating between records from 2001 and 2011. The

Table 1: Criteria for the classification of heatwave events and statistics per category. Equivalent classes from the Nairn & Fawcett (2015) scheme are reported using the Melbourne and Adelaide threshold definitions.

Category	EHF_{sum}	EHF_{max}	Mean number of fatalities	Percentage of record covered	Equivalent NF15 class for Melbourne	Equivalent NF15 class for Adelaide
CAT0	> 0	> 0	5	82.6	low-intensity	low-intensity
CAT1	> 30	> 15	6.7	55.4	low-intensity	low-intensity
CAT2	> 80	> 30	8.6	38.9	severe	low-intensity
CAT3	> 150	> 50	10.4	28.6	severe	severe
CAT4	> 300	> 70	18.5	12	extreme	severe

Figure 2: Map of Table 1 heatwave severity categories for the January 1939 event.

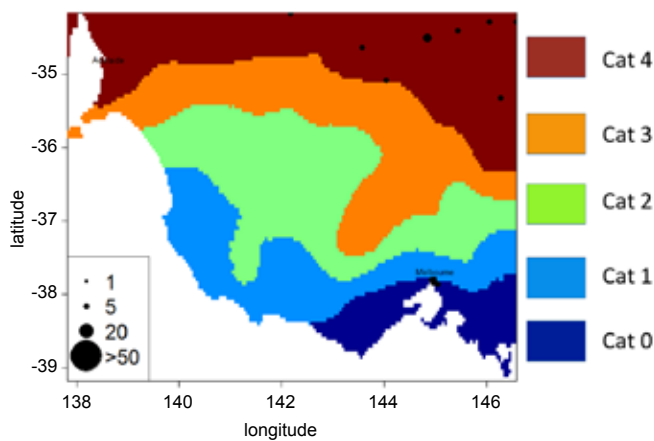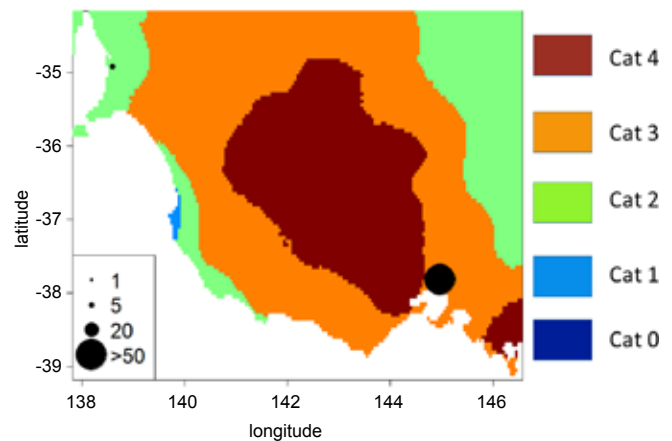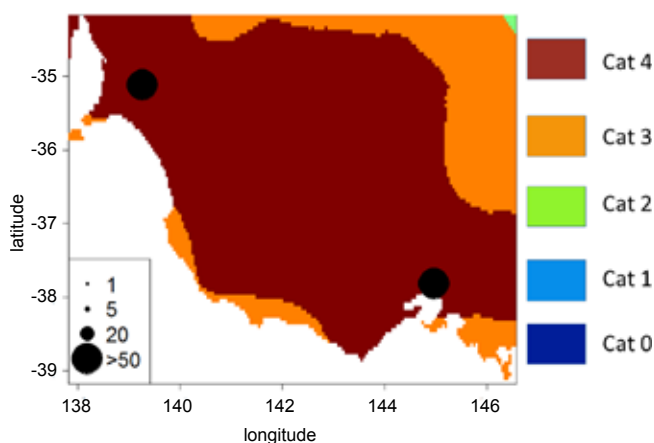Figure 3: Map of Table 1 heatwave severity categories for the January 1959 event.

Figure 4: Map of Table 1 heatwave severity categories for the February 2009 event.
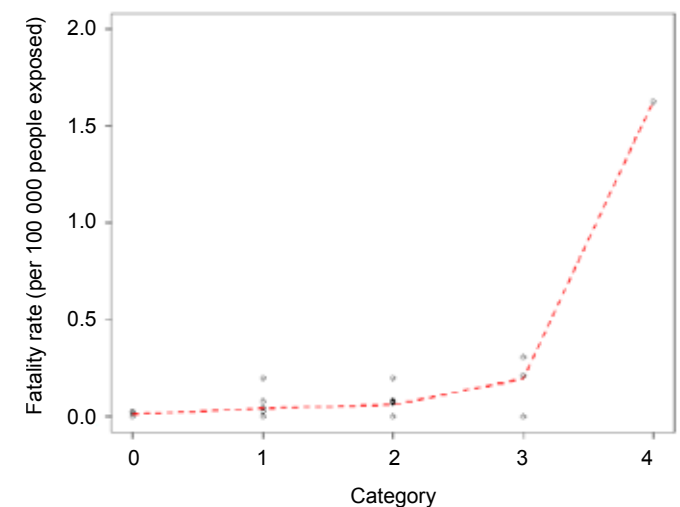

Figure 5: Rate of fatalities per 100 000 people (y-axis) as a function of the heatwave category they are exposed to (x-axis). Individual dots represent distinct events while the red dashed line is representative of all-events combined.

corresponding fatalities reported in that same exposed area are totalled and normalised by the total population exposed to derive a death rate by category. Figure 5 represents the expected number of fatalities per 100 000 people exposed for each category.

From knowledge of both peak and accumulated EHF estimates during a given event one can compute the associated category and apply the relationship from Figure 5 to project an expected number of fatalities.

Building a synthetic heatwave scenario

Hazard footprint

Using the methods described, a catalogue of historical events impacting south-east Australia since 1911 was assembled (see examples from Figures 2-4). To limit the number of events, only cases for which at least one 5 km grid cell in the domain has experienced a minimum of three consecutive days of positive EHF are considered. The 466 occurrences were characterised in a map of both the peak EHF during the duration of the event and its accumulated value. A detailed analysis of the key components of heatwave footprints in the region was undertaken with the aim of extrapolating the data from this catalogue beyond what has been experienced since 1911. For this purpose, the 466 peak and accumulated EHF footprints were decomposed using principal component analysis (PCA). The key idea at the core of PCA is that the footprints in the catalogue can be projected onto a family of vectors called empirical orthogonal functions (EOFs) that explain the variability observed since 1911. Mathematically the EOFs form a basis of orthogonal vectors and allow decomposition of the field of interest (i.e. either the peak EHF, EHF_{max} or its accumulated value EHF_{sum}) using a set of event-specific coordinates $z_i(k)$. For instance, for the case of EHF_{max}, any event 'k' in the catalogue can be reconstructed starting from the mean footprint (MFP, see Figure 6) in the following way:

Equation 4:

$$EHF_{max}(k) = MFP + \sum_{i=1}^{n_{eofs}} z_i(k)\, EOF_i$$

Figure 6: Mean footprints for EHF_{max} and EHF_{sum} over the catalogue of 466 events since 1911.

Figure 7: Top six Empirical Orthogonal Functions for the peak EHF magnitude and the accumulated EHF.

Images provided by author.

The n_{eofs} is the total number of EOFs, which equals the number of grid points in the domain. With the EOFs ordered in terms of importance (based on the percentage of variance explained, see Figure 7) this decomposition enables analysis of the key patterns of variability (i.e. that explain more variance) among the 466 events in the catalogue. Furthermore, this reconstruction can easily be truncated to keep only the leading vectors. This provides a very practical way in which PCA can help generate synthetic events that are consistent with the observed historical variability.

For this study, the first six EOFs (i.e. set n_{eofs} to six in Equation 4) for both EHF_{sum} and EHF_{max} were used. By

Figure 8: Synthetic event representing a coastal event affecting densely populated areas around Melbourne and Adelaide.

assigning values to the associated EOF weights (z_i in Equation 4) from analysis of their historical distributions, synthetic scenarios can be created to represent unseen cases that are consistent with the most typical observed patterns in the region. The leading six EOF fields used for this exercise are presented in Figure 7.

To illustrate the outcome of this method a synthetic event (Figure 8) was designed to simultaneously impact the cities of Adelaide and Melbourne. It corresponds to synoptic situations where a high pressure system is preventing any relief from cooler maritime air masses.

Projected fatalities

For the scenario shown in Figure 8, an estimate of the expected number of fatalities can be derived using the vulnerability curve from Figure 5. For this purpose, f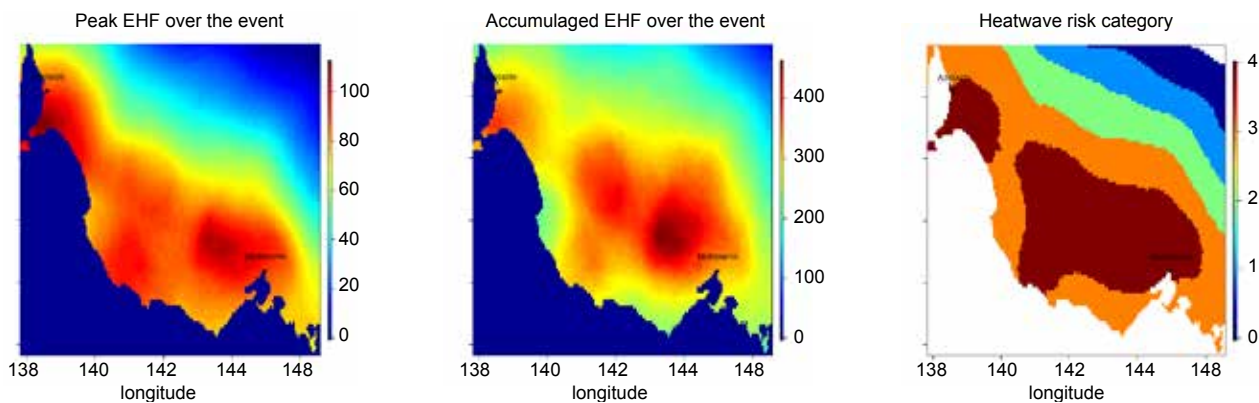atalities are simulated within each of the 5 km resolution cells that cover the domain from knowledge of the total population within a cell, and the heatwave category to which the population is exposed.

Using a binomial distribution, the number of deaths can be simulated to provide a picture of the geographical spread of fatalities. For this scenario, a total of 86 fatalities is expected in the region (see Figure 9) with both Adelaide and Melbourne sharing a significant proportion of the total. The large majority of cases are
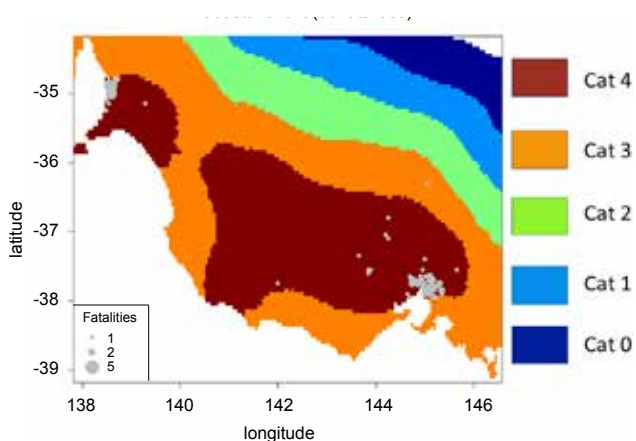

Figure 9: Simulated fatalities for the Figure 8 scenario (grey dots).

within the area under category 4 risk while some fatalities occur under the category 3 footprint.

Conclusions

The EHF heatwave intensity framework was used in combination with an archive of heat-related fatalities in Australia to provide alternative indicators of heatwave severity. This led to the definition of four severity classes that may be helpful in characterising and communicating the potential of fatalities from heatwaves. These categories were depicted on a chart to show the risk of three important historical events affecting Victoria and South Australia.

The Bureau of Meteorology database of minimum and maximum temperature records dating from 1911 was used to assemble a catalogue of 466 historical heatwave events in south-east Australia. Each event was characterised by both peak and accumulated EHF estimates and PCA was applied to extract the key modes of variability. A synthetic scenario was constructed to represent a realistic event in metropolitan regions in Australia.

To quantify the effect of the scenario beyond the hazard threat, a vulnerability curve was defined to estimate the number of human fatalities that might be expected as a function of both the heatwave risk category and the population density. The method was applied to project the number and location of fatalities associated with the synthetic scenario.

It is worth mentioning that, as all estimates in this study are based on reported fatalities, and because of under-reporting and the likelihood of wrongly categorising deaths to other health-related issues rather than heat stress, fatality projections should be interpreted as lower-bound estimates. A more optimistic view would also acknowledge that communities and governments learn from past experience and improve their level of preparedness. In that sense, fatality rates from the last decade (Figure 5) might not accurately reflect the current level of awareness of the population and the ability of government services to cope with the threat. It is clear that to factor these two opposite views, some level of

uncertainty around the estimates of Figure 5 needs to be modelled in future attempts to characterise heat-related fatality curves.

Study to date has focused on human fatalities attributed to heatwaves. A natural follow-up would be to look at non-lethal heat-related injuries. Following the framework introduced in this report, additional data, such as ambulance calls or hospitalisation records, would allow the development of complementary vulnerability curves and enable in-depth analysis of the effects of heatwaves on human health. Similarly, the fatality curve could be refined to capture the death-rate-by-age band or other characteristics of the degree of resilience of the local population. This would allow a better representation of the areas at risk.

Such considerations would be valuable input to assess the capability of emergency response services to cope. This framework might answer questions such as whether medical staff in local communities can handle the projected heat-related hospitalisations during extreme heat events.

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About the authors

Dr Thomas Loridan is a lead scientist at Risk Frontiers specialising in atmospheric hazard modelling with a particular emphasis on tropical cyclones. He holds a PhD from King's College London where he studied models of the urban boundary layer. In the past five years his work has led to the development of various techniques to simulate the variability in severe winds observed from cyclones across the world's most active basins. More recently his research has also focused on developing risk metrics for heatwaves in Australia.

Lucinda Coates is a Catastrophe Risk Scientist at Risk Frontiers. Areas of interest include risk reduction and climate change adaptation assessment among the community, trends in Australian natural hazard fatalities, vulnerability verses resilience and evaluations of risk perception and risk communication. Lucinda has worked on a number of projects for the Australian emergency management sector and government and private organisations.

Dr Daniel Argüeso is a Postdoctoral Research Fellow at University of Hawai'i at Manoa. His research includes improvement of tropical cyclone forecast using lightning. He has a background in atmospheric physics and climate modelling. He has investigated features of present and future climate in different regions using regional climate models. He also works on urban climate, tropical convection, sea-breeze, heatwaves and extra-tropical cyclones

Dr Sarah Perkins-Kirkpatrick is a climate scientist studying heatwaves. She has a PhD from UNSW Australia and is currently an Australian Research Council DECRA fellow at the same institution. Sarah has undertaken work investigating the measurement of heatwaves, their observed changes, future projections from climate models, and the human contribution behind these changes. Sarah received a NSW Young Tall Poppy award in 2013 for science communication, was shortlisted for a 2014 Eureka science prize as part of the UNSW Extremes Team and was recently named one of UNSW's 20 rising stars who will change the world.

Professor John McAneney is Managing Director of Risk Frontiers and has expertise in probabilistic modelling, quantitative risk assessment and cost benefit and real options analyses. He has over 130-refereed publications on various aspects of weather risk, boundary layer physics and natural peril risks.

ABSTRACT

The management of major emergencies is strongly influenced by the decisions made during the event. Decisions guide the distribution and subsequent deployment of assets, the removal of people from harm's way, how objectives are established and a myriad of other actions. Decision-making is therefore an important skill for emergency managers that permeates every emergency event and every level of disaster management. The vast majority of decisions made during an incident are effective enough in both process and outcome, but the drive for continual improvement and the need to manage more extreme events requires decision-making to become sophisticated and to achieve even higher levels of reliability.

So how well are emergency management organisations integrating acknowledged developments in the understanding of decision-making? Where are the opportunities for continual improvement? What are some of the challenges that the expert decision-maker is required to balance across an event?

This paper examines key concepts that have progressed the understanding of decision-making. A review of preliminary interactions with end-users of the Bushfire and Natural Hazards CRC (CRC) research project 'Practical decision tools for improved decision-making in complex situations' considers how Australian and New Zealand are using this knowledge to make decisions. Opportunities for improvement and the approaches being taken to evaluate cognitive decision tools for end-users are identified.

An assessment of the opportunities to improve strategic decision-making in emergency and disaster management

Dr Benjamin Brooks and Steven Curnin, University of Tasmania, Chris Bearman, Central Queensland University, Dr Christine Owen, University of Tasmania, and Sophia Rainbird, Central Queensland University, examine opportunities to further integrate advanced approaches to decision-making in emergency management.

Background

Decision-making in emergency is challenging and stressful due to the dynamism, complexity, uncertainty and temporality that occurs in this environment (Danielsson & Ohlsson 1999). In this paper, the term emergency management is in the context of the decision-makers selected from Australian and New Zealand emergency services agencies who work in the response phase at a management level. In Australia and New Zealand events are termed 'level 3' incidents and invariably involve a multi-agency approach. This is not unique and is comparable to other safety-critical, high-consequence environments such as the military and pre-hospital medicine (Baker, Day & Salas 2006, Wildman *et al.* 2011)

The Australasian Inter-Service Incident Management System (AIIMS) is a system for incident management used by fire agencies, State Emergency Services (SES) and other organisations. AIIMS is based on three principles:

- Management by objectives – an incident controller works with an Incident Management Team (IMT) to determine the desired outcomes (objectives) to be achieved.
- Functional management – this is based on a structure of delegation with five functional areas of control, planning, public information, operations and logistics.
- Span of control - this relates to the number of groups or individuals who can be successfully supervised by one person. Up to five reporting groups or individuals is considered desirable, allowing the supervisor to monitor those groups and individuals.

A simplified description of decision-making in AIIMS is a cyclical interaction between intelligence, planning, operations officers and units and the incident controller (see Figure 1). This is described below in association with the key management system 'products' that inform and guide decision-making (in bold).

The Incident Controller sets the incident objectives. The Intelligence Officer confirms the Incident Controller's incident objectives and key questions for decision-making; collects and analyses information for the IC; processes that information into a suitable form for analysis; and organises, collates, disseminates and displays intelligence in the form of a **Common Operating Picture (COP).** *The Planning Officer obtains the intelligence products to support the development of an* **Incident Action Plan (IAP).** *They conduct risk management activities (monitors current and emerging risks); undertakes* **Options Analysis (OA)** *involving alternative incident objectives and strategies and collects, collates and stores incident records. The Operations Officer implements the IAP and advises the IC about emerging risks, the current control situation. The Incident Controller approves the IAP including setting priorities for action and monitors IAP over time against objectives.* (Derived from interpretation of AFAC 2013).

Decision-makers in these environments use a range of techniques to support decision-making efforts. Mental shortcuts or heuristics aid in the decision-making process (Mishra, Allen & Pearman 2013). Decision-makers rely on their expertise (Erkisson 2006) and often apply intuitive processes (Kowalski-Trakofler, Vaught & Scharf 2003). While human flexibility and adaptability is significant, human cognition is subject to bias, errors and limitations (Kahnemann 2011). These are amplified in complex, uncertain, politicised, and temporally-constrained environments, and this does require balancing from a number of perspectives.

Strategic decision-making is a balancing act

Balancing decision styles

Decision-making comes in different 'styles'. Flin, O'Conner & Crichton (2008) indicate there are four decision styles: creative, analytical, procedural and intuitive. In practice these decision styles differ in terms of the amount of conscious effort required and the processes applied can also vary. At different phases of an emergency event some or all of these decisions styles may be necessary.

Decision-makers at a high level have considerable relevant experience and may, through pattern-matching, intuitively identify appropriate responses to that pattern (Kowalski-Trakofler, Vaught & Scharf 2003). Nevertheless, intuition can also be considered a source of bias and potentially lead to mistakes (Eva *et al.* 2010). The determination of whether intuitive judgments can be trusted requires an examination of the environment in which the judgment is made and of the opportunities the decision-maker has had to learn the regularities of that environment.

Procedural decision-making involves use of rapid tactics that follow some type of rule. One type of rapid decision-making is fast and frugal heuristics (Gigerenzer 2004). Fast and frugal heuristics are a cognitive heuristic that relies on a few relevant predictors to simplify and speed up the decision-making process (Gigerenzer 2004). Decision-makers follow a series of sequential steps prior to reaching a decision. According to Marewski and Gigerenzer (2012), fast and frugal heuristics are built around three rules:

- **search rule** – one that specifies in what direction information search extends in the search space
- **stopping rule** – one that specifies when information search is stopped
- **decision rule** – one that specifies how the final decision is made.

Analytical decision-making is the closest to the 'classical' model of decision-making. In situations where there is time to make a thorough analysis of alternatives, the strengths and weaknesses and to compare the value or utility of the outcome, such an approach is warranted. Typically this approach is necessary when the decision has significant consequences, such as the evacuation of a major population centre.

As situations become more novel or unique decision-makers step into the realm of needing to be creative. Unfortunately, in emergency management, this can occur under the most extreme circumstances when all known tactics have failed and life and property are under immediate threat.

Decision-makers need to match decision styles to the decision context. For example, if the decision-maker is establishing whether to evacuate a town that may flood, then they are likely to be drawing data from flood modelling, local observations that feed into rational approaches to decision-making, while also managing

Figure 1: A simplified model of the AIIMS decision-cycle.

political and community interactions. An Urban Search and Rescue (USAR) commander making a decision where to locate a team base may be making intuitive calculations about the exposure to different risks to identify the lowest risk option. Regardless of the style, the literature on decision-making suggests that they need to produce decision outcomes, and also consider the decision process. They should be 'thinking about their thinking'. This is one definition for 'meta-cognition'. A meta-cognitive process includes being aware of the decision style as well as managing for bias and typical errors.

Balancing risks and strategies

Risk assessment is an important part of emergency management. Formally, it is a process that measures probability and severity for individual risks, identifies control options and draws conclusions about the acceptability of the residual risk. If only the task were this simple in practice! The emergency manager is generally managing multiple risks as well as making decisions on which of one or several risks should be accepted relative to another, associated with particular tactics or tasks. The combination of risks and tactics with the different types of pressure that impinge on decision-making (lack of time, uncertainty, finite resources, fatigue), tend to make resultant calculations difficult. As demonstrated in the following vignette of a decision being made by a USAR commander:

During the deployment of the Australian USAR team to Fukushima, the team leader needed to manage four key risks associated with after-shocks, tsunamis, extreme cold and radiation exposure. He needed to manage these risks while making decisions about where to locate the Base of Operations (BOO). At any particular site available for the BOO the residual risk combination is different, and this risk combination also affects the ability to meet the objectives of the deployment. So locating the BOO on high ground, away from buildings on a baseball pitch reduced the risks associated with tsunami and building collapse from after-shocks but increased the risk associated with exposure to extreme cold. Being significant distance from the search and rescue area reduced the available time for operations. (Research project participant).

An analytical approach to this particular decision would require the assessment of the four risks for probability and severity of outcome, the control options available, and the residual risk. It would need to be applied for each possible BOO, and considered relative to the deployment objectives. This might be described as 'benefits'. The result is some sort of risk-benefit assessment. This decision process is not accommodated in current risk assessment flowcharts, as demonstrated in the Dynamic Risk Assessment flowchart (Figure 2). A standard risk assessment matrix might help, but only with the formulation of the probability by (severity of) outcome calculation when all of these outcomes could lead to

multiple fatalities that reduces the variability in the calculation to differences in probability.

The reality is that this is not the way risk-related decisions are typically made once they reach this level of complexity. Decision-makers will often intuitively approximate this process. To continue the vignette:

Intuitive assessment of risks provides an approximation of the risk level, and management options. Step-wise comparison with deployment objectives can then occur. Exposure to extreme cold can be managed, whereas risks of after-shocks and tsunamis was outside of the team's control, also with catastrophic consequences. The deployment was also quickly in a recovery mode reducing the time pressure on operations. The risk assessment therefore points to locating the BOO at the baseball field, accepting and managing the risk of exposure to the cold. (Research project participant)
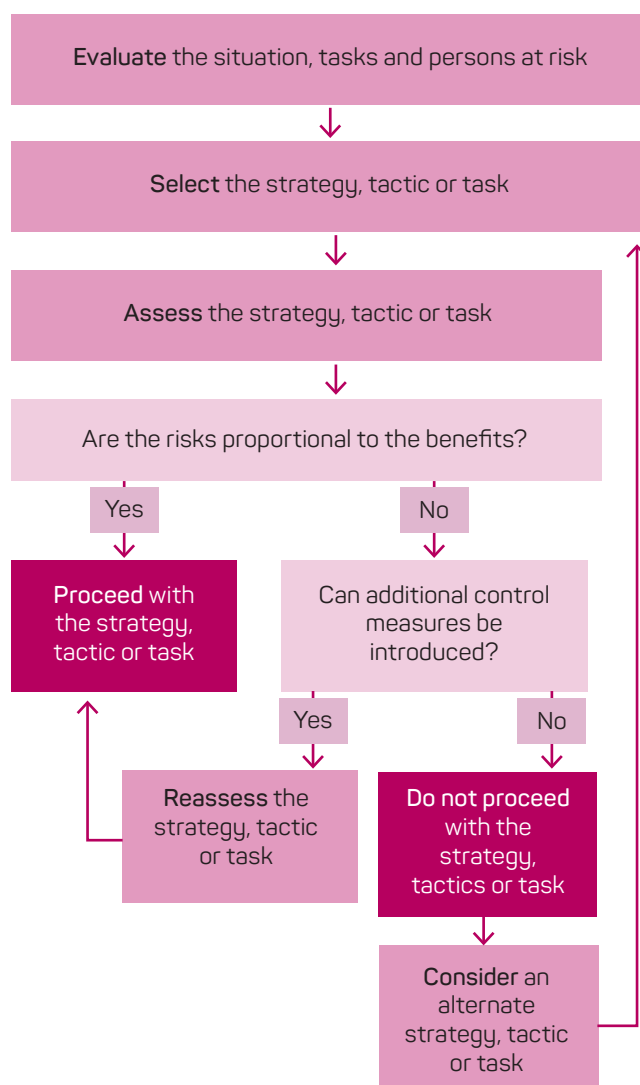

Figure 2: Dynamic risk assessment (adapted from the NSW Rural Fire Service *Crew Safety and Welfare Manual* 2012)

A number of other types of balancing arise from this short vignette of a decision. Due diligence requires organisations to record and provide explanations of decisions. What is the balance of record-keeping and the effective support of decision-makers? While an individual may have the legislative responsibility for making decisions, decisions are typically canvassed from a team. How should the decision-maker balance deciding with collaborating? Emergencies can occur over extended periods of time and change dynamically during the event. There are not always discrete decision-points. How does the decision-maker balance the need to make sense over hours and days while also making decisions throughout?

Balancing record-keeping with effective decision-making

When the outcomes of emergencies include significant loss of property and, in particular, loss of life, commissions of inquiry and royal commissions are often the result. During those investigations decisions are scrutinised, and the scrutiny has a tendency to assume that the analytical style of decision-making was both possible and preferable. These legal environments rely on interrogation of witnesses and witnesses rely on recalling evidence. Subsequently, the recording of decisions becomes particularly important.

While this is necessary in terms of meeting due diligence and record-keeping requirements of any modern organisation, the way decisions are recorded and the type of information recorded can influence the actual decision and subsequent actions. Kahnemann and Tversky's work on cognitive biases and errors (see Kahnemann 2011) suggests that formalising a decision can 'anchor' the decision-maker to that decision and, even in the face of contradictory evidence, they will often hold to the original decision. Allowing the record to reflect information or other triggers that would change the decision is a straightforward way to overcome this problem. The requirement to record a decision may lead some people to act hastily (to support perceptions of control) or delay decisions (to avoid making incorrect decisions). From a decision-science perspective there is a range of things that could be recorded, such as how the decision-maker has managed the possibility of bias or error. There are other competency, cultural and legal challenges to implementing such a change. In order to record issues around decision bias and styles the decision-maker needs to feel confident in meta-cognitive (thinking about thinking) decisions. 'Small target' legal approaches suggest that the more information provided in a decision record, the greater the opportunity for that information to be misconstrued during an inquiry. Command-and-control cultures demand certainty of leaders so recording information that might change the decision could be considered a weakness. The balance between recording decisions and making effective decisions continues to be a challenge while these issues remain.

Balancing decision-making and sense-making

Sense-making involves 'turning circumstances into a situation that is comprehended explicitly in words and that serves as a springboard into action' (Weick, Sutcliffe & Obstfeld 2005). Sense-making could be viewed as an 'overlay' on decision-making where the individual engages in iterative cycles of analysis, action and reflection. Although the concept of sense-making has been around since the 1980s, its qualitative difference to decision-making has grown in relevance and importance to emergency management in the last 10 years. Weick notes that 'sense-making in crisis conditions is made

Table 1: Evidence if implementation of decision concepts in the incident management system from a sample of organisations.

Decision concept	Where recognised in incident management system	Coverage in surveyed Australia/ New Zealand organisations
Decision styles: awareness of and an ability to work across the spectrum from intuitive to classically rational decision approaches as the context requires.	Commander's intent, some organisational decision models.	Less than 15%
Monitoring themselves and their teams for evidence of bias or decision errors (linked with decision styles).	Meta-cognitive strategies.	Less than 15%
Sense-making: recognition of the dynamic nature of the process, and the need to not just decide, but to make sense.	Commander's intent, some decision models, individual heuristics, some IAP structures.	50%
Record-keeping: balancing the need to record decisions for future reference with the effect recording has in creating bias in decision-making.	Decision logs.	Less than 15%
Creating psychologically safe decision environments that build and maintain trust in teams.	Embedded in broader organisational value statements.	50%

more difficult because action that is instrumental to understanding the crisis often intensifies the crisis' (Weick 1988, p. 305).

There is also a delicate trade-off between dangerous action, which produces understanding, and safe inaction, which produces confusion. In this regard, sense-making is intimately linked with action because action directly impacts on 'the psychology of control, effects of action on stress levels, speed of interactions and ideology' (Weick 1988, p 315).

Some of the key properties of sense-making in incident response point to the importance of the incident commander. 'Who is he or she as a person? Over the course of a lifetime, what social constructs have created and shaped him or her? How does he or she communicate with others? What type of retrospective learner is he or she?' (Renaud 2010, p. 45).

Balancing the imperative for control with the need for psychological safety of teams

A final balancing act relates to the fact that incident management is hierarchical, and incidents must be controlled. At the IMT level this control rests in the hands of an Incident Controller. Above the IMT this position tends to be replicated with a single point of command or control. It is possible that this level of control can conflict with issues of building team environments where people feel free to speak up when they feel decisions are incorrect. Edmondson (1999) refers to this as 'psychological safety'. Edmondson suggests that in order to build psychological safety leaders (those in 'control') need to demonstrate vulnerability, to articulate the unknown and unfolding nature of the 'problem' (in this case the incident), to frame it as a learning problem and to make sure that everyone in the team commits 100 per cent to the process. Under these circumstances, team members are more likely to speak up about the evidence that indicates the objectives are not being met, or the problems with the Incident Action Plan.

Evidence from the CRC research project

This research involved 18 agencies in Australia and New Zealand that contributed data and discussed issues around decision-making. Semi-structured interviews were conducted with chief officers, deputy chief officers, principal rural fire officers, senior officers, state coordination personnel, regional coordination personnel, and incident management team personnel. These personnel represented the rural fire authorities, urban fire brigades, rural fire agencies, land management agencies, SES, council officers with responsibility for search and rescue, and the Red Cross. Subsequent to the interviews the team collected documentation and reviewed policies, procedures and training approaches.

Research results are summarised in Table 1. It is important to note that Table 1 only identifies the degree to which the formal incident management system captures particular decision characteristics. Although not reported here, it is acknowledged that individual decision-makers identified tools, checklists, tips, heuristics (rules of thumb) and decision models that they had collected as part of their experience, training and professional development to support decision-making.

Discussion

This paper identified several decision concepts that have emerged in the literature and identified opportunities to improve the standard of decision-making. Analysis has assessed participating end-users in this CRC project to determine the degree to which they had embedded these concepts in operational environments. Organisations build psychologically safe environments where team members can speak up, and where decision-makers are engaging in 'sense-making'. There is less effort being put into recognising when shifts in decision styles occur, in monitoring for bias and errors through meta-cognitive processes, or in managing the effect that recording has on 'anchoring' or fixing a decision-maker to a particular course of action.

Table 2: Concepts and associated tools being tested in the CRC project.

Decision concept	Tool being tested or approach taken
Awareness of and an ability to work across the spectrum from intuitive to classically rational decision approaches as the context requires them to.	Training course to understand decision styles linked with several meta-cognitive tools.
Balancing the need to record decisions for future reference with the effect recording has in creating bias in decision-making.	Modified decision logs to record decisions that map uncertainties and trigger change decisions.
Monitoring themselves and their teams for evidence of bias or decision errors.	Checklist for biases and decision errors.
Creating psychologically safe decision environments that build and maintain trust between teams.	Training course and a simple tool to apply the steps of psychological safety identified by Edmondson (1999).

Way forward

The focus of this CRC project is to develop and test cognitive tools. These tools help to integrate knowledge about human performance (related to issues such as information processing and recording) and the management within an organisational culture that fosters a supportive environment for the decision-maker. The aim is to discover whether the decision-maker can be effectively supported. These tools will be demonstrated during training courses and tested during exercises and emergency events where possible over 2016 and 2017. Taking into account the results, Table 2 describes the tools to be tested in the coming 12 months.

As the results of this testing emerge the tools that are considered usable by the participants, and why, will be identified. Usability in this regard relates to three concepts of efficiency, effectiveness and user satisfaction (ISO 1998). If the evidence indicates that the tools are usable then end-users can be confident there is value in integrating the tools within the formal incident management system.

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About the authors

Dr Benjamin Brooks is a human factors researcher and Senior Research Fellow in the Australian Maritime College at the University of Tasmania.

Steve Curnin is a research fellow at the Tasmanian Institute for Law Enforcement Studies at the University of Tasmania.

Chris Bearman, Central Queensland University, is a researcher and project leader for the Bushfire and Natural Hazards CRC decision-making, team monitoring and organisational learning project.

Dr Christine Owen is an organisational behaviour and learning researcher at the University of Tasmania.

Sophia Rainbird is a post-doctoral researcher and anthropologist specialising in movement, risk and resilience at the Central Queensland University.

ABSTRACT

While the occurrence of extreme events generally cannot be prevented, their negative effects can be lessened by reducing risks and improving the capacity of people and communities to deal with them. Improving community resilience helps reduce the effects of natural hazards and is increasingly becoming a goal of communities, organisations and governments.

To meaningfully determine, coordinate, plan and prioritise the most effective measures to improve resilience, a baseline assessment of a community's strengths and weaknesses is required. This paper quantitatively assesses the status of community resilience in two remote indigenous communities, Ngukurr and Gunbalanya in the Northern Territory. A quantitative assessment is used to explore community perceptions of disaster resilience within the study areas as well as the methods of assessment and appropriateness of the assessment methodology.

Evaluating resilience in two remote Indigenous Australian communities

Philip Morley, University of New England, Jeremy Russell-Smith, Kamaljit K. Sangha, Stephen Sutton and Dr Bev Sithole, Charles Darwin University, examine two communities in the Northern Territory to assess resilience.

Introduction

Populations have always been susceptible to extreme events. While the occurrence of these events generally cannot be prevented, the risks can often be minimised and the impacts on affected communities and property reduced. For people and communities, the capacity to cope with, adapt to, learn from and, where needed, transform behaviour and social structures in response to an event and its aftermath all reduce the effects of a disaster (Maguire & Cartwright 2008). This can broadly be considered as resilience. Improving resilience at various scales and reducing the effects of natural hazards has become a key goal of governments, organisations and communities.

In 2010, the Council of Australian Governments adopted resilience as one of its key guiding principles. The *National Strategy for Disaster Resilience* (Attorney-General's Department 2011) outlines how Australia should improve social and community resilience with the view that resilient communities are in a much better position to withstand adversity and to recover more quickly from extreme events. The *Sendai Framework for Disaster Risk Reduction* (UNISDR 2015) also uses resilience as a key concept and similarly calls for a people-centred, multi-hazard, multi-sectoral approach to disaster risk reduction. While there are obvious benefits from a resilience approach, a distinct need arises to be able to assess and monitor a community's ability to prevent, prepare, respond to and recover from disasters.

In recognition of this need for assessment numerous tools have been developed (e.g. Shaw, Tackeuchi & Jonas 2010, Cutter *et al.* 2010, Arbon *et al.* 2012, Cohen *et al.* 2013, Sands 2015, Khalili *et al.* 2015). Approaches and scales vary from a top-down assessment method of community resilience across a whole country (e.g. Cutter, Burton & Emrich 2010) through to participatory local-level workshops (e.g. Arbon *et al.* 2012). Top-down assessments over a large area provide a standardised measure for comparison between communities. Theoretically this provides a knowledge base and justifiable system for decision-making in regard to planning and resource allocation by organisations such as state-based emergency services and state and federal governments. In addition, these consider resilience factors that occur at larger scales such as the spatial dependencies between places, communities and regions (Cutter *et al.* 2008, Frazier *et al.* 2013).

Alternatively, community-based assessments generally use a workshop approach with key community leaders and stakeholders. Often relying on subjective local knowledge makes comparison between communities difficult.

However, they have an increased capacity for analysing and assessing greater levels of local knowledge, cultural practices and divergent interests or values within a community (Eriksen & Brown 2011, Singh-Peterson, Salmon & Goode 2015). By emphasising the role of local communities, this process can increase community engagement, risk awareness and resilience-thinking as well as help provide more informed local-level decision-making. It is primarily their capacity for facilitating local social learning and change that community-based approaches have been widely promoted (Singh-Peterson, Salmon & Goode 2015).

The Community Disaster Resilience Scorecard

The Community Disaster Resilience Scorecard was developed by the Torrens Resilience Institute (Arbon *et al.* 2012, Arbon 2014) as a tool to identify and assess community resilience to disasters and extreme events. The suggested methodology is to use a number of workshops with key community members to assess and discuss resilience factors leading to a framework for future action.

The Scorecard has four main sections or components that are represented by the overarching questions:

1. How connected are the members of your community?
2. What is the level of risk and vulnerability in your community?
3. What procedures support community disaster planning, response and recovery?
4. What emergency planning, response and recovery resources are available in your community?

Each section contains four to seven questions that are either answered via self-assessment or from information sources such as Australian census data. A scoring system for each question uses points ranging from a low of one through to a maximum of five. Each question's points are then combined cumulatively to produce a score for the section. A rating is then allocated by converting this score to a percentage of the possible maximum for the section as follows:

- less than 25 per cent - Red Zone – indicates a significant issue or weakness to be addressed as a priority
- 26-75 per cent - Caution Zone (yellow) – represents that some aspects need monitoring or strengthening
- greater than 75 per cent - Green zone – identifies that a community has strength within this area of resilience.

The same percentage scale is used with the sum of the sectional scores to provide a single overall rating for the community's state of disaster resilience. Descriptions range from 'likely to suffer greatly in a disaster or have great difficulty recovering' through to 'extremely resilient' (Arbon *et al.* 2012, Arbon 2014).

The Resilience Scorecard was piloted in four Australian communities (Arbon *et al.* 2012) and was subsequently used to examine resilience in coastal south-east Queensland (Singh-Peterson, Salmon & Goode 2015) and rural Victoria (Mason *et al.* 2016). This paper adds to this sample by providing an assessment of two Northern Territory remote indigenous communities and examines the Scorecard's viability to assess resilience in these areas.

Study areas

The Ngukurr community is located approximately 300 km south-east of Katherine on the Roper River, 70 km inland from the Gulf of Carpentaria in the Northern Territory. The area's population of 1056 people (ABS 2011) is predominately indigenous. They collectively refer to themselves as Yugul Mangi people, a collective term meaning 'we all one'. The area has a rich history with evidence of habitation by Aboriginal groups for more than 40 000 years. There are currently seven traditional language groups plus English and Kriol (Bird *et al.* 2013).

Gunbalanya (historically referred to as Oenpelli) is an Aboriginal community in west Arnhem Land located approximately 300 km east of Darwin. Gunbalanya is a similar size and dynamic to Ngukurr. Its population is approximately 1200 and the main languages spoken are Kunwinjku, Burarra and Kriol. Both communities are considered significant townships in Arnhem Land. They have a school, health services, supermarket, police station, sports club and community arts centre.

During the November to April annual wet season, the respective local river systems swell beyond capacity. Flooding causes both communities to become isolated for up to three months. Accessibility during these periods is restricted to infrequent barge services and the use of light aircraft on a charter basis.

Both communities are subject to the *Northern Territory All Hazards Emergency Management Arrangements* (NTES 2011) under which the responsibility for disaster preparedness, response and recovery planning is conducted by a Local Counter Disaster Planning Committee. A key task of the committee is to develop and maintain a Local Counter Disaster Plan that is approved by the Northern Territory Counter Disaster Council. The plans provide an assessment of the threats most likely to affect the community as well as the roles and responsibilities of agencies, stakeholders and key personnel. Location-specific control and coordination arrangements are provided with specific emergency response and recovery procedures (NTES 2011).

Method

The scorecard system uses a number of information sources including self-assessment, census data and various government planning documents. The optimal process described involves meeting with a

Table 1: Scoring of community resilience.

Question / Indicator	Gunbalanya	Ngukurr
	Score (1 Low - 5 High)	
1. How connected are the members of your community?		
1.1 What proportion of your population is engaged with organisations?	1	1
1.2 Do community members have access to a range of communication systems that allow information to flow during an emergency?	2	2
1.3 What is the level of communication between the local governing body and the population?	1	1
1.4 What is the relationship of your community with the larger region?	2	2
1.5 What is the degree of connectedness across community groups?	2	2
Section 1 Score/Rating	**8 (Red)**	**8 (Red)**
2. What is the level of risk and vulnerability in your community?		
2.1 What are the known risks of identified hazards in your community?	3	3
2.2 What are the trends in relative size of the resident population and the daily population?	5	5
2.3 What is the rate of the population change in the last 5 years?	4	3
2.4 What proportion of the population has the capacity to independently move to safety?	2	2
2.5 What proportion of the resident population prefers communication in a language other than English?	1	1
2.6 Has the transient population been included in planning?	1	1
2.7 What is the risk that your community could be isolated?	1	1
Section 2 Score/Rating	**17 (Caution)**	**16 (Caution)**
3. What procedures support community disaster planning, response and recovery?		
3.1 To what extent and level are households within the community engaged in planning for disaster response and recovery?	1	1
3.2 Are there planned activities to reach the entire community about all-hazards resilience?	1	1
3.3 Does the community actually meet requirements for disaster readiness?	1	1
3.4 Do post-disaster event assessments change expectations or plans?	1	1
Section 3 Score/Rating	**4 (Red)**	**4 (Red)**
4. What emergency planning, response and recovery resources are available in your community?		
4.1 How comprehensive is the local infrastructure emergency protection plan?	3	3
4.2 What proportion of population with useful skills emergency response/recovery can be mobilised?	1	1
4.3 To what extent are all educational institutions engaged in emergency preparedness education?	1	1
4.4 How are available medical and public health services included in emergency planning?	3	3
4.5 Are readily accessible locations available as evacuation or recovery centres and included in resilience strategy?	2	2
4.6 What is the level of food/water/fuel readily availability in the community?	2	2
Section 4 Score/Rating	**12 (Caution)**	**12 (Caution)**
TOTAL	**41 (Caution)**	**40 (Caution)**

Workshop participants at Ngukurr.

Image:Nathan Maddock, Bushfire and Natural Hazards CRC

representative working group of 10 to 15 people three times over a four to six week period (Arbon *et al.* 2012). This method was not achievable in this case study due to the remoteness of the towns and the availability of staff and community members.

Instead, as part of a separate research project focusing on resilience issues in indigenous communities, 14 residents of each town, including elders, attended a three-day resilience workshop in the Ngukurr area in June 2015. A number of these people have been engaged as either local researchers or as participants in various resilience projects that included interviewing over 200 residents about resilience issues (Sangha *et al.* 2016). With the strong understanding of the aspects of disaster resilience within their communities, a scorecard-based resilience assessment for the two communities was undertaken. The self-assessment questions were answered by participants with direct questioning or through discussion of various resilience issues. Scoring of questions based on external data occurred after the workshop although most of the issues had been discussed with participants.

Results

Overall, the findings (see Table 1) show that both communities were within the scorecard's 'caution' zone meaning that considerable work is warranted to identify strategies and build disaster resilience. The scoring of self-assessment questions throughout the process was generally the same for both communities.

Section 1: How connected are the members of your community?

The importance of both formal and informal communication networks was widely recognised as was the role of community connectedness in enhancing disaster resilience. As found by Singh-Peterson and colleagues (2015) there were a number of alignment issues between the information received, how that was represented by the actual indicators and by the scoring system. For example Question 1.1 uses census information as an indicator for connectedness. Both communities scored 1 in this instance. In a small isolated town the capacity to maintain a variety of community-based organisations is relatively small and a low response would be expected. In many cases such as with local sporting teams, while official membership may be quite low they may still receive considerable community support. In small rural communities of high familiarity extensive social interactions often occur such as when shopping in the town store. Similarly, as connections occur on numerous levels and in different ways including for ceremony, religion, sport, art and cultural festivals, many such interactions would not be recognised within the census data. While there is wide agreement that familial connections are weakening, especially for young people, indigenous culture still has strong kinship connections with extended families in regular contact and often living together.

Both communities have access to communication systems including digital television, regional radio stations, landline and mobile phone networks. While there are suitable systems in place, participants specifically discussed the lack of communication and location-specific information, including local weather warnings in the lead-up to and during extreme events. This would be due to the small size of both towns in reasonably isolated environments that would

limit the level of media interest and the amount of location-specific information available.

The scoring for governance uses a measure based on the International Association for Public Participation Spectrum (2005) that ranges from 'passive' to 'active' participation. The issue of governance was strongly discussed and participants clearly felt that their role was extremely passive including in emergency management where direction and support came from Darwin in a non-consultative, fly-in-fly-out manner. This approach often did not respect cultural protocols such as those found by Gray (2006) and Veland and colleagues (2010).

Government agencies and organisations such as medical centres are part of, or have, networks within the region. In the past, ties of kinship and ceremony built strong relationships over a larger area but, due to a range of factors, these networks are not as strong as they were. For many people the isolation due to flooding, lack of transport and distance reduces their capacity to be regularly involved in a larger regional setting. Locally there is some advertising, primarily on community noticeboards, of various activities and events within the area.

Overall, both communities scored 8 out of a possible 25 for the section. That rates both as 'red'. While this reflects the connectedness of the community in a broader context of information flows and government interaction, it does not reflect the connectedness between residents at the local scale.

Section 2: What is the level of risk and vulnerability in your community?

Overall, this section attracted a 'caution' rating with scores at both extremes. Local risks were well known and although cyclones dominated, risk from fire and smoke were also discussed. On the Scorecard, the recognition of multiple risks would generate a higher score but existing maps only cover flooding and, hence, a score of 3 was allocated.

While a significant factor of resilience for some areas, the difference between daily and resident populations in a small town is often negligible. In this case study, both towns scored 5. Conversely both towns scored 1 for the incorporation of transient populations in planning. As the number of people within this category is negligible it was not seen as problematic.

Census data was used to determine the capacity of residents to independently move to safety (see Question 2.4). Only 2.5 per cent of the population of each town indicated they required assistance for core activities (self-care, body movements or communication). However, in terms of evacuating out of town the 'number of motor vehicles per dwelling' indicates that 50 per cent of homes in Ngukurr and 55 per cent in Gunbalanya do not a have a motor vehicle (ABS 2011). The 'number of persons usually resident' figure shows that for Ngukurr 74 of 121 (60 per cent) and in Gunbalanya 83 of 150 (55 per cent) of homes have six or more people. Subtracting the number of people in smaller households from the

overall population shows an average of around 12 people per house for larger households (confirmed by participants). While a precise figure is not calculated, a proportion of households without a vehicle would coincide with these large households. Therefore, the capacity to self-evacuate by vehicle would be considerably less than half the residents of each town. Further, both towns are isolated by road for a few months each year and evacuation may only be possible by light aircraft, which can be problematic due to cultural considerations (Veland, Howett & Dominey-Howes 2010). While relatively few people require core assistance, the reduced capacity to evacuate from each town derives a score of 1. The same score was allocated to Question 2.7 that considers the possibility of isolation.

For many people in predominately indigenous communities, English is only one of the languages spoken. Around 90 per cent of residents do not normally speak English at home (ABS 2011). The scorecard method considers more than 35 per cent to be a rating of 1. In this case study communication levels were high and the level of English is still good, but there is a possible disjunction between residents and any English-only speaking authorities.

Question 2.3 examines population change. Both communities received scores that were moderate to good. In this instance, Gunbalanya scored 4 (6-12 per cent) as opposed to Ngukurr's score of 3 (13-19 per cent), which although slightly higher, does not affect the rating for the section.

Section 3: What procedures support community disaster planning, response and recovery?

This section highlighted numerous issues with each community scoring the lowest possible for each question. Planning for emergency situations at a household level was felt to be very limited due to other urgent priorities such as food availability, housing and family concerns. While there is a Local Counter Disaster Management Plan, few participants had seen it. It was mentioned that the plan was held at the local police station and if residents knew of it and were inclined to read it, many would not be comfortable doing so.

Many participants did not know that the local school was a designated public shelter. Local cultural protocols, norms and practices affect how these facilities are used during a natural hazard event. This was noted during Cyclone Monica (Veland, Howett & Dominey-Howes 2010). Participants discussed that although some buildings were marked as cyclone-proof other buildings that residents thought should be marked were not.

While there are a number of plans, procedures and structures in place, the assessment by residents for these actually meeting requirements for disaster readiness would be classed as an unknown and, thus, scored a 1. Similarly any post-event assessments from past emergency situations had not involved the local population and had not affected expectations.

A discrepancy occurred between the responses of workshop participants and those of a household survey. The survey responses showed a higher level of knowledge of current planning and shelter options. This may be due to participant selection or participants not speaking up during this part of the discussion.

Section 4: What emergency planning, response and recovery resources are available in your community?

Planning at a government and infrastructure-supply level uses a top-down, command-and-control approach and incorporates multiple hazards and structures. For example, local power supply in both towns is managed by the Northern Territory Power and Water Corporation that has identified risks and contingencies for both locations. Participants discussed that emergency management was conducted by the local police and by others on a fly-in-fly-out basis from Darwin. From both sources communication about the situation and consideration of cultural norms was considered poor. It was felt strongly that although local people, knowledge and skills were available, including a number of people willing to be trained, these resources were not used. However, Gunbalanya has a volunteer emergency services unit with six members and Ngukurr is listed on the Northern Territory Emergency Service website (2016) as having an 'Emergency response group' described as 'a group of organised volunteers with no formalised training'.

The Northern Territory Department of Health and the local medical clinics have emergency management plans that incorporate the broader region. However, when considering the size of the facilities and issues of accessibility there is an understandable limit to the capacity of available services. Given the size of both towns the local school is possibly the only evacuation and recovery centre. When the communities are isolated the level of food, water and fuel is generally adequate. However, food stores are often very low and a significant proportion of households could be classified as having daily or near-daily dependence on external supplies including, in some cases, locally obtained 'bush tucker'.

Overall results

In total, Ngukurr scored 40 and Gunbalanya scored 41 out of a possible 110 points. This gives both communities a rating of 'caution'. However, the scoring is unbalanced within some sections and a few questions poorly represent the situation.

Conclusion

The objective of this study was to assess the state of resilience in two small remote predominantly indigenous communities in northern Australia, as well as to determine the applicability of the Torrens Scorecard approach for these communities. Despite the inclusion of elders and a number of participants having previously been involved in disaster resilience activities in their area, the level of knowledge of local plans and procedures was limited. This highlights the importance of involving key participants. It must be noted that levels of poverty and social issues within each community are high and while participants were keen and discussed possible improvements, disaster resilience is understandably not a priority under the prevailing circumstances.

While it appears that many procedures are in place across a range of spatial scales from local through to Territory-wide, the level of communication to the population is very limited and non-consultative. There is a strong disconnection between the primarily Indigenous residents and people in positions of authority in both towns. This was highlighted in multiple discussions and is an issue found in numerous indigenous communities (see Gray 2006, Veland, Howett & Dominey-Howes 2010, Howitt, Havnen & Veland 2012, Veland et al. 2013). In this instance it was particularly shown by the fact that post-event assessments from past emergency situations had not included the local population and that, even with repeat invitations to take part in this workshop, most relevant officials did not respond and none were able to attend.

As also found by Singh-Peterson and colleagues (2015), there were issues of determining and accessing data as well as a number of questions not entirely relevant nor suited to small communities. Although both towns had a low score and significant issues in regard to disaster resilience, what was not represented were those differences attributable to the community's small size, self-reliance and the cultural background of the population. With little or no expectation of assistance from authorities the reliance is on one's self, friends and family. Under the predominate culture with these towns, this 'self'-reliance incorporates a large kinship network and translates into a community that informally appears to have a reasonable ability to cope with stress. However, with the small size and low socio-economic status of the population, recovery from abnormal situations can be anticipated to be slow and only to a very poor level that in other areas would be deemed unacceptable (as reported in Veland et al. 2013).

The scorecard method provides a rating system to connect a level of description and understanding to a numerical value. However the 'caution' rating ranges from a score of 34 to 98 and the potential difference between communities within this range belies the rating's value. Similarly, based on this rating method and the underlying scoring matrix, it appears unlikely that any community in Australia would be considered to be in the 'red zone' for overall scoring. However, there is no doubt that the scorecard method did provide excellent discussion points on numerous emergency management and societal issues as well as provide a reminder of topics that may be missed in an unstructured setting. Similarly, even when used with the changes and limitations involved in this study, it did identify a range of very significant issues that, if addressed, would greatly improve the resilience of these communities.

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About the authors

Philip Morley, Institute for Rural Futures, University of New England.

Jeremy Russell-Smith, Darwin Centre for Bushfire Research, Research Institute for Environment & Livelihoods, Charles Darwin University.

Kamaljit K. Sangha, Darwin Centre for Bushfire Research, Research Institute for Environment & Livelihoods, Charles Darwin University.

Bev Sithole, Aboriginal Research Practitioners Network (ARPNet), Research Institute for the Environment and Livelihoods, Charles Darwin University.

Stephen Sutton, Darwin Centre for Bushfire Research, Research Institute for Environment & Livelihoods, Charles Darwin University.

Can agencies promote bushfire resilience using art-based community engagement?

Dr Richard Phillips, RMIT University, Angela Cook and Holly Schauble, Country Fire Authority, and Dr Matthew Walker, RMIT University, describe an arts-based initiative to promote resilience in communities.

Introduction

Emergency management policy has shifted from an emphasis on bushfire response to community preparedness, but the latter still requires attention despite extensive public information initiatives (Rhodes *et al.* 2011, McLennan, Paton & Wright 2015). This problem is significant as both the threat of bushfires and the number of people exposed to bushfire risk continue to increase (Jolly *et al.* 2015, Foster *et al.* 2013).

Positive influences on community disaster preparedness include community cohesion and attachment (Anton & Lawrence 2016, Prior & Eriksen 2013), perceived trustworthiness of emergency management agencies and personnel (Christianson, McGee & Jardine 2011), interactive rather than passive delivery of information (McCaffrey 2004, Foster 2013), and informal social interactions and networks (Akama, Chaplin & Fairbrother 2014, McGee & Russell 2003, Brenkert-Smith 2010).

In Victoria, the CFA encourages preparedness using education and engagement programs. These programs include activities categorised as:

- warnings
- public information provision
- localised information provision
- localised community engagement
- community consultation, collaboration and development (Elsworth *et al.* 2009, p. 19).

Informing these approaches are concepts such as resilience and engagement (Coles & Buckle 2004, Stark & Taylor 2014).

Resilience in disaster preparedness refers to relationships and social structures that enable communities to prepare for or adapt to adverse conditions (Brown & Williams 2015). Johnson (2010) provides four types of community engagement approaches that have been used to increase bushfire resilience. These are:

- community information (e.g. agency websites, mobile applications communicating fire warning)
- community consultation (e.g. Victoria's 2016 Fire Operation Planning consultations)

ABSTRACT

Emergency management agencies are confronted with problems when communicating preparedness information to communities. Levels of community preparedness remain low despite the availability of education materials and bushfire safety programs. To address these challenges innovative approaches to engage communities are needed. This paper presents evidence from an arts-based community engagement initiative that promoted disaster resilience in a regional Victorian town. This approach allowed staff of the Country Fire Authority (CFA) to initiate conversations with local community members about bushfire safety. Some challenges identified with this approach related to CFA staff skill levels, appropriate organisational support, and response capacities of the local volunteer brigade. The question this paper raises is whether agencies can engage communities effectively using innovative activities.

- community participation (e.g. the 'community fireguard' educational program delivered to groups of households in a neighbourhood)
- ongoing relations engagement (e.g. Emergency Management Victoria's 2016 community-based emergency management planning initiative).

In 2014, the CFA received funding to explore new approaches to promote community resilience to bushfires and chose to investigate an arts-based approach. Huss and colleagues (2015) indicate that arts can enhance resilience by addressing trauma, 'building people's capacity for and interest in shared enterprise' (Matarasso 2007 p. 457) and fosters senses of community (Mulligan & Smith 2011). This study explored key stakeholder perspectives on the effectiveness of an arts-based initiative to enhance community bushfire resilience.

Methods

Design and setting

A qualitative interview study explored stakeholder perspectives on an arts-based youth community program delivered by the CFA in a small rural community in Victoria exposed to bushfire risk. The program involved 15 young people (5-16 years old) taking part in two two-hour workshops each week for three weeks during the summer holidays. Parents enrolled their children in the program after receiving information via the local newspaper, school newsletter, a direct mail-out to all households and word of mouth through local social networks.

During the workshops the young people used drawings and paintings to depict their knowledge of bushfires. Program facilitators also used body percussion, voice, and percussion instruments made from everyday objects (tin cans, sticks, plastic bottles filled with sand) to explore rhythm and sound. Ideas were used to compose short music pieces and a play was developed about bushfire preparedness that was performed at an Australia Day event that was co-hosted by the local community centre, State Emergency Services and the CFA.

Participants and recruitment

Parents of young people participating in the arts-based program, community leaders, CFA staff and program facilitators were purposively recruited (Kuper, Reeves & Levinson 2008). Parents of the young people taking part in the program were interviewed because the focus of the research was not experience of the program itself but community stakeholder perceptions of program delivery process and outcomes.

Data collection and analysis

Qualitative semi-structured interviews were used to explore participant views and experiences. In total, nine semi-structured telephone interviews were conducted. The nine participants comprised three parents of children attending the workshops, one community leader (who provided support for the program), one external program facilitator, and four CFA staff. Telephone interviews were conducted as participants were geographically dispersed across the region. Comparisons between telephone interviews and other techniques show no significant differences in outcomes (Sturges 2004). Interviews were audio-recorded, transcribed and thematically analysed based on methodology by Braun & Clarke (2006) by repeated reading of the interview transcripts. Participants were asked about their experiences of and perspectives on the arts-based program. Interviews took place between February to June 2015 and, on average, lasted 30 minutes.

Results

Participant accounts indicated the potential for arts-based youth programs to positively impact on community bushfire resilience (perceived benefits), and barriers or challenges to their doing so (perceived limitations).

Perceived benefits

Enhancing community-agency relationships

CFA staff said that the arts-based program had promoted a positive view of the CFA in the locality and had attracted new interest in the CFA by enabling conversations about bushfire safety and the role of the CFA.

We wanted to have conversations with parents in a casual environment. We would talk about the opportunity for the kids to do this [arts-based program] and did they think it was worthwhile. Then it would come around to the messaging, 'do you guys get that information about the Community Fireguard? (CFA 03)

I've been working with the brigade in the area for six months and having that [arts-based program] was an icebreaker for talking to people [that] I wouldn't have probably met. So it was handy in that way and to get their views on what they thought the [local volunteer] brigade was doing. (CFA 02)

Facilitating community networks

The program was perceived to have a positive impact on community networks. Parents valued the arts-based youth program because it gave their children opportunities for social interaction in a locality where opportunities are limited.

Facilitator - What was the reason - *why did you want to send them to it?*

Respondent - *Just to interact, get some social interaction... [and] when it's in town rather than travelling out of town, it's great.*

The arts-based program brought young people together at a time of year when opportunities for social interaction were limited. According to Resident 02 this was because parents in the locality would be engaged in seasonal employment. Furthermore, in the process of facilitating their children's participation in the program, adults could potentially reinforce their networks by meeting other parents. Encouraging such informal social interaction has been shown to support bushfire preparedness (Brenkert-Smith 2010).

Perceived limitations

Existing bushfire awareness

According to parents, their children's knowledge about bushfire had not increased by taking part in the youth arts-based program. Parents confirmed that their children already had some awareness about bushfires through other sources such as school and family (who worked or volunteered for other agencies). The general awareness about bushfires was also noted by a CFA member of staff.

> *When we starting talking to the kids and people, they had a fairly high degree of awareness of various fire messages. It wasn't totally new to them.* (CFA 02)

Parents, too, had not learnt anything new via their children's involvement in the program. For some participants bushfire is a feature of living in their rural town.

> *You're just aware of [bushfires] and everybody is so close-knit, everybody keeps an eye on everybody.* (Resident 04)

However, the extent to which bushfire awareness translated into preparedness was questioned by Resident 01 who stated that 'everyone is a bit blasé... you don't really think about [bushfires] until it happens'.

Local tensions

Participant accounts indicated some negative perceptions of the local volunteer fire brigade. While one parent was supportive and positive about their work, another expressed scepticism regarding their functionality and capabilities. In addition, community perceptions had also influenced the extent to which the local brigade participated in dissemination of arts-based program outcomes at the Australia Day event.

> *We didn't get [the local brigade] involved in the event because of the pushback in the community. But [they were] involved around the periphery of it. So they brought the truck down, the kids were able to squirt the hose.* (CFA 03)

CFA support for sustained community engagement initiatives

Accounts indicated that community engagement approaches required a shift in the CFA's more traditional way of working:

> *It's easy for the guys to jump on a truck, spray some water, the fire's out. You can actually see what you've delivered. When you move to community safety you don't see that result straight away...and that's the hardest thing you try and sell.* (CFA 14)

> *It's a certain narrow-mindedness. Not everybody, like [CFA 02], he didn't understand the engagement activity to begin with but he was very positive about it and just did his job... He just did it and learnt new things but that hasn't been typical from what I can see.* (CFA 06)

Further to this, one participant expressed some concerns about ongoing resourcing and support for the arts-based program.

> *Word is that they're going to close our CFA down. If they do that now after having us happy with having the CFA people around doing this music stuff, it will be a smack in the face. We're not some crash test dummy in that respect.* (Community Leader 01)

However, CFA participants (CFA 14, CFA 06 and Facilitator 01) confirmed that the approach was being tried in other localities in eastern Victoria to promote disaster resilience.

Discussion

This study examined stakeholder perspectives on an arts-based approach to promote community bushfire resilience. The study found both perceived benefits to the initiative (enhancing agency-community relationships, facilitating community networks) and a number of factors mitigating its sustained effectiveness (existing bushfire awareness, local tensions, perceived agency support). Findings from this study indicate that community engagement initiatives reveal complex social relations within a community and aspects of agency delivery that may hinder engagement activities.

This study corroborates previous research by Crow and colleagues (2015) showing that the relationship between emergency management agencies and communities is an important factor in promoting bushfire preparedness. Findings indicated the arts-based program offered opportunities for the CFA to initiate conversations with community members about the agency's role and about bushfire safety. This enhanced the local CFA's reputation with the community. This should be encouraged as two-way, face-to-face interaction with trusted sources is an effective communication method (McCaffrey 2004, Christianson, McGee & Jardine 2011, p. 48) and community trust in agencies is critical in disaster preparedness (Crow *et al.* 2015, Sharp *et al.* 2013). Similar engagement programs could be used in other

communities to help build bridges between agencies and residents. This study also showed that participants felt that their children's social and community networks were enhanced by taking part in the workshops, and improved social networks have been shown to be an important feature of disaster preparedness (Akama, Chaplin & Fairbrother 2014).

The study found that awareness about bushfires did not appear to be significantly enhanced by using an arts-based program as a vehicle for enhancing community resilience. This is underpinned by previous research indicating that residents in rural areas have relatively high levels of bushfire awareness and regard fires as a natural part of living in a rural environment (McGee & Russell 2003). Despite using interactive rather than passive forms of information provision (Foster 2013), the benefits of this initiative lie in strengthening community networks rather than explicit educational outcomes. This study indicates that issues of poor reputation and lack of trust hinder engagement between communities, the CFA, and the local volunteer brigade. These findings confirm existing research regarding the importance of public trust in agencies (Sharp *et al.* 2013).

This study used a qualitative design with a small sample size. While the findings cannot be statistically generalised, they offer insights into the particular exercise conducted and have the potential for theoretical transferability. Given the possibility of future implementation of similar programs, this study shows the importance of emergency management agencies responsiveness to local needs and the use of such programs to leverage opportunities for community-agency collaboration and communication. This approach highlights challenges both at the local level and within the organisation of the CFA and the importance of training and skills development for staff and volunteers involved in engagement activities. Findings illustrate the importance of agency awareness and management of local expectations when the program ends. While the program helped the CFA to address some of the localised challenges relating to perceptions of the agency, this sort of engagement requires skilled practitioners and time to develop effective relationships among agency staff, volunteers and residents.

The study design did not attempt to quantify levels of community engagement or resilience pre- and post-implementation of the arts-based youth program. Instead, the design allowed exploration and understanding of the contexts of implementation and the perceived benefits and challenges from the perspectives of a range of stakeholders. Further research could use quantitative or mixed-methods designs to evaluate the impact of program implementation using population-representative surveys. Given the arts-based program explored in this study was a short-term activity, it is possible that evaluation of longer-term and more sustained engagement practices between the CFA and community members would enable a more comprehensive assessment of effects on bushfire resilience.

Conclusion

Fire agencies need innovative and effective methods to engage communities and to promote community resilience. This small study investigated the feasibility of arts-based initiatives as a method of community engagement. The study indicated that such approaches have the potential to improve agency-community relationships and strengthen community networks. Arts-based approaches offer another option for agencies to consider as part of a range of engagement activities to help promote bushfire resilience and preparedness. Further research is recommended to quantify the effects of such programs on community resilience to bushfire risk.

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About the author

Dr Richard Phillips is a Research Officer based at the Centre for People, Organisation and Work, RMIT University. His research interests are community capacity building and community engagement.

Angela Cook works in Design and Community Development, Country Fire Authority in Victoria.

Holly Schauble was a Project Manager with the Country Fire Authority in Victoria.

Dr Matthew Walker is a Research Associate at the Centre for People, Organisation and Work, RMIT University.
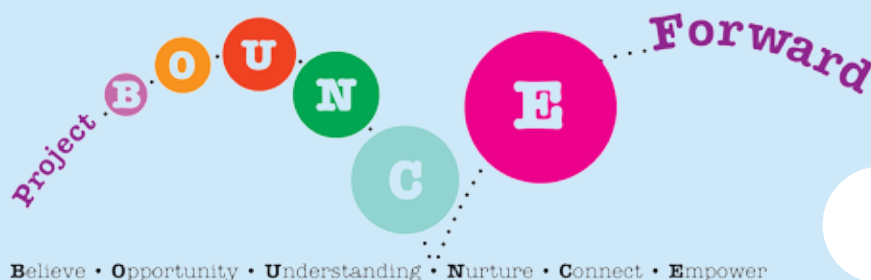
Project Bounce Forward

After the big floods of April 2015, Dungog Shire Community Centre provided emergency accommodation, food, clothing and other support to people in need. But, it was soon clear that recovery would be a longer journey.

For Dungog to truly recover, people needed to be connected and nurtured.

Project Bounce Forward was formed to help with information, links, resources, decision-making and emotional support to locals to 'Bounce Forward'. The Bounce Forward philosophy is that we don't go back to how things were before, but use the event to grow and taking a new, empowered approach to life. Project Bounce Forward is an 'outreach' model – if you can't come to us, we go to you.

See what Dungog is doing to bounce back: **www.dscc.net.au/project-bounce.**

Believe • Opportunity • Understanding • Nurture • Connect • Empower

Research

ABSTRACT

The recovery phase following an emergency event develops capacity for post-traumatic growth in affected communities. This endeavour to build and embed resilience among communities gives impetus to successfully negotiate current and future natural hazard events. An important component in this process is providing effective external support, which assists the physical rebuilding of assets and underpins emotional wellbeing. This paper describes current in-field experience where independent building professionals have contributed to the recovery phase of recent South Australian emergency events: the Sampson Flat bushfires in January 2015 and the Pinery crop fires in November 2015. Much has been learned about the needs of people experiencing such events with respect to their re-establishing of homes and built environment and navigating building regulations, planning applications and approvals.

Helping fire-impacted families in rebuilding: toward enhanced community resilience outcomes

Emilis Prelgauskas describes fieldwork to identify factors that affect people's ability to re-establish their built environment after disaster.

South Australian fire events

2015 began in South Australia with the largest near-capital city bushfire since Ash Wednesday in 1983. Seven small semi-rural communities affected by fires were within the Sampson Flat fireground that abuts Adelaide's north-eastern suburbs. The resulting fire scar was over 12 500 hectares, with a 222 km perimeter that burnt across undulating bushland for seven days before it was declared controlled: 27 homes and hundreds of outbuildings were lost.

2015 ended with the Pinery fire that crossed open crop country north of Adelaide's peri-urban fringe. In eight hours over 86 000 hectares were burnt, two lives were lost, and 88 homes and hundreds of outbuildings were destroyed.

A group of appropriately qualified professionals (planners, architects, engineers and heritage advisers) provided pro bono help to residents to rebuild after these disasters. The experience helped streamline the rebuild process and provided support to reduce the stress on homeowners. The access to professional, practical problem-solving skills and the development of alternative solutions (often required because rebuilding after bushfire does not necessarily fit standard, present-day regulatory protocols (ABCB 2010)) was a significant contribution during the recovery phase.

Architects responding to emergencies

The Australian architect profession has a long tradition of providing support during overseas emergencies, through agencies such as Emergency Architects based in Sydney, and Architects without Borders in Melbourne. These groups work to assist community rebuilding projects after disasters including in Sri Lanka in 2004 and in East Timor in 2011. Response draws on inspiration from parallel international disaster recovery initiatives of Japanese architect Shigeru Ban (Ban & Shodhan 2003) and others (Lewis 1985, Meinhold 2010).

Emergency events within Australia have triggered emergency housing schemes and investigations, including the emergency housing proposals after the Black Saturday bushfires in 2009 (O'Brien 2009) and other individual

recovery proposals (Godsell 2001, Moore & Edwards 2009, Architecture Australia News 2013).

The gap these building professionals sought to fill in 2015 in South Australia goes beyond earlier measures and was instigated to address an absence of credible independent advisory arrangements to assist individuals and families who had lost their homes. This local, practical on-fire-ground help post-emergency has been affirmed by the welcome presence of planners, architects and non-government organisations (NGO) attending recovery phase service providers and community reference group meetings.

Habitat for Humanity is one such NGO that deploys early. The organisation helps residents with the often overwhelming task of cleaning up fire-affected sites and provides emotional support, which is ongoing along the rebuilding timescale. This allows valuable, confidential feedback to be shared with the professional advisers regarding individual cases, to which targeted advice and bespoke solutions may be needed (AGO 2009, Schaube 2004, Ramsay & Rudolph 2003). Individual families or community groups may ask for help with these alternate solutions directly, or they can be referred by recovery centre staff.

The help offered

Like most professions the daily work of architects and planners in ordinary circumstances already involves inherent complexity and stress. Awareness of this by the professionals means an almost reflex recognition that people in extraordinary circumstances will need additional help and guidance to navigate regulatory requirements and contractual arrangements. Processes include building and construction rules, waste controls, insurance claims, and later, managing builders and trades people on-site. These are demanding activities even during a normal new build on a new estate or prepared urban consolidation site.

The experience by South Australian independent building advisers mirrors that found in other emergency events (Donovan 2013), in that special circumstances post-emergency cannot be effectively managed with only 'business-as-usual' normal regulatory protocols. Attempts to do so may be detrimental to desired outcomes and to the aims of the recovery phase overall. Using standard development terms (e.g. 'your application may be refused unless you provide…..') can imply that people in the fire ground are being blamed for the fire.

Communities, businesses, families and individuals affected by disaster events will variably manage the stress of a bushfire emergency and loss of assets and possessions according to their individual circumstances. All people working with them, including built-environment professionals, need to be cognisant of this.

Assimilating reactions to the fire event itself and coming to terms with the extent of the impact may be complicated by issues including perceived failure of fundamental personal tenets (e.g. loss of a home despite

developing what was believed to be a well-prepared bushfire survival plan). This may be one of a spectrum of influences affecting the decision whether, and how, to rebuild.

Some families want to 'do something' immediately. Others, or individual family members, may wish to delay and take a considered approach. Some will still feel overwhelmed and may need assistance through the recovery process to understand that things like body biochemistry is likely to be responsible for feelings of inability to assimilate information or make decisions. These reactions, often called the 'adrenaline phase' and the 'cortisol phase', are described in the all-hazards literature (Gordon 2009).

The time taken to think through the strategic and operational steps that lead to physical (and emotional) rebuilding will vary from weeks to months, even years. Some will decide never to rebuild. Others may just need time, and will take that next step when their situation is conducive to starting the rebuild project (Fahy 2014). Once a decision has been made to proceed, the rebuild process must be malleable enough to accommodate the conditions encountered. This flexibility is required because unlike normal build sites the site may need remediation before any work can commence. A stable, newly built access route onto and around the land, removal of debris from the build site and surrounds, and dealing with and removing on-site hazards (such as unsafe trees and asbestos) will be mandatory.

While a rebuild will often be located on the same site on the property, the new construction will almost certainly differ from the original. Changes to minimum regulatory standards over time require compulsory compliance with current standards. The Bushfire Attack Level ranking[1] may have been reassessed, material selections and construction systems may have evolved, and modern requirements for new energy efficiency, general and disability access, earthquake and bushfire resistance may have been written anew into regulation.

As work commences, various contractual arrangements may be involved. Sometimes 'progress' in the physical building process may not be quite what the homeowner had expected, and this can bring new stressors. For example insurance companies may authorise their officers to decide on materials used and to make payments directly to providers. In doing so, the owner loses control over important choices and may be denied input to such matters as quality of work and retention of ancestor artefacts (two examples provided in 'special needs' below). Alternatively a lump sum payment could leave the owners with a site and a heap of rubble and a cheque, with little or no guidance as to what comes next.

The standard day-to-day development control processes of regulatory authorities may be inadequate during recovery from disaster events. Their application and enforcement may be inappropriate without recognising the inherent special conditions and associated emotional

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1   Australian Standard 3969. At: www.as3959.com.au/bushfire-attack-level/.

Fire may be diverted by the efforts of fire crews but elements on building facades such as porous stone and old mortar can be effected by radiant heat and require repair.

Image: Emilis Prelgauskas

state of applicants. There is little common ground between a rebuild on a fire ground and a new building for which the standard regulations are intended. A critical point of difference is found in the human element, being the superimposed physical, emotional and psychological trauma experienced when home, outbuildings, assets, environment and animals are lost—and in the worst cases, relatives and friends. This calls for more people-focused and holistic processes.

Individual circumstances might involve incongruities that require straightforward, problem-solving skills to assist and develop the owner's positive outcome expectancy. A recent example concerned a stand of significant trees that once provided shelter to the adjacent, now destroyed, building. Burnt above and below ground, these trees required removal but the cost was prohibitive and replacing the building could not proceed. What had been an aesthetic asset became an unsightly encumbrance.

Property owners might turn their losses around by using the opportunity to build their bushfire preparedness knowledge and response capability. They could upgrade their home and outbuildings to a standard beyond minimum compliance. This might enable a 'stay and defend' option in future fire plans.

The propensity to change hazard-level assessment after a fire event can impose a new set of criteria, to which former standards are no longer translatable. This added complexity takes time, money and emotional energy to analyse.

Terminology can be problematic, which can be a barrier to good communication and understanding. A typical example is the term 'non-complying', which erroneously conveys the impression of being 'below par', rather than the reverse in that it actually invokes assessment of merit. People outside the industry could be forgiven for their confusion and need assistance to navigate the jargon. From the layperson's point of view, independent advisers who help put the language of regulation both

plainly and into 'bite-sized chunks', allow a difficult time to be tackled one step at a time.

Independent advisers – a different relationship with community

The purpose of independent professional advice is not to develop a rebuild proposal. The aim is to permit the landowners to have a broad view of all their options, including alternative solutions where conventional answers to construction are incongruous with the presenting circumstances.

Experience in-field in the Sampson Flat and Pinery fire grounds has demonstrated that the availability of independent professionals in the recovery process has delivered a number of positives. Individual advice to people or families is made available at their request, pro bono, and without resemblance to the usual owner-architect relationship. Independent advice clearly differentiated itself from commercial solutions that may have the appearance of vested interest, or from government processes, which some community members may find daunting.

Independent professionals offer reassurance that progress can occur at a family's own pace, when they are ready. There is no need to rush, as people will invariably assimilate the events that have affected their lives according to differing time frames, as each family reassesses its future. In parallel, trained professionals are mindful of the psychological care imperatives involved and the flux which necessarily exists between psychological well-being and progressing the rebuild. Some of the independent advisers who were part of the service providers group at Sampson Flat added to their core professional training by completing the Red Cross Psychological First Aid Certificate.

The task of independent advisers included describing to fire-impacted families the interrelationship of:

- Country Fire Service requirements (Bushfire Attack Level, and on-site firefighting infrastructure to give crews on-site resources for asset protection tasks in a future event)
- assessment for planning consent, including clearly defining the rebuild as post-emergency rather than as a new development
- certification and sources of engineering and compliance under building and construction rules and the list of information inclusions to meet current regulation
- accessory permits including the siting of powerlines and waste control measures.

Written communication is also important. The phrase 'rebuild post-bushfire emergency' in documentation is helpful to remind those removed from the affected community and tasked with processing paperwork, that the rebuild arises from a large-scale event where the homeowner was involved. In this instance, the owner is not the instigator or 'developer' for the rebuild in the

usual sense as would occur if choosing renovation or extension of a home.

Inherent in these discussions are conversations that canvass each family's bushfire action plan, as this will significantly alter the requirements for the replacement building. If the action plan is to 'leave early', normal building compliance levels suffice. If it is to 'stay and defend', a best-practice build with enhanced fire resistance and in-built firefighting capacity will be needed (ABCB 2010).

Documents

Part of the loss of the family home can be loss of documents such as land titles, previous building plans, and approval documents. Some can be retrieved from other sources (Land Titles Office, solicitor or bank, or local government archives). Nevertheless, some documents may not be retrievable. This may include items such as proof of owner qualifications (unpaid registration causing the owner's building license to lapse), without which approval to proceed can be delayed.

Other real world, in-field examples identified as disruptive to progress include:

- Requests to homeowners at rebuild application for approval for a 'site plan' as essential to move assessment forward. This document is often not generated as part of the building proposal itself, particularly where a rebuild is on the same placement as the destroyed original building. To solve this, the independent advisers provided an aerial view (obtained off Google Earth) of the entire property (the destroyed building site visible in the photograph) annotated with relevant regulatory information (contours, boundary setbacks, etc.).

- Administrative processes that are not flexible enough to adapt to a post-bushfire rebuild. The independent advisers helped applicants structure their submissions to avoid duplication of forms and fees; separating 'information' paperwork from 'compliance' documents. This occurs, for example, where property access for firefighting, built to the required standards of road grades and fill compaction, is needed to allow the rebuild and to improve site standards of bushfire safety, but is not intrinsically part of the 'rebuild' *per se*.

- The occasional requirement for non-affected parts of the site or building structure to be upgraded as well as the rebuild to meet current regulation requirements. This could include replacement of in-ground services unaffected by the fire (such as waste treatment and dispersal) and for the installation of non-combustible firefighting water tanks, complete with firetruck-compatible fittings and standpipe.

Owners may find these unexpected conditions onerous and costly. While there is merit in upgrades to improve safety and performance, this should be balanced against achieving a rebuild in a timely and considerate manner.

Access restrictions can arise when post-fire hazards are identified.
Image: Emilis Prelgauskas

Special needs

Individual situations across fire grounds in South Australia in 2015 revealed unique circumstances the independent advisers had to consider. Traditional stone buildings were affected differently by the intense fires. Post-fire, insurance assessors tend to emphasise a 'demolish and replace' conventional construction rebuild, perhaps in attempts to minimise inconvenience—the focus being the use of available insurance monies. In contrast, for some landowners, the original building holds multi-generational meaning and its value is greater than the monetary cost of replacement.

The most striking example of this was a farmhouse with a facade embedded with the ballast stones from the sailing ship that brought the family's forebears to South Australia. As such, a 'demolish and replace' recommendation was unacceptable. The independent advisers arranged pro bono advice from a structural engineer and a heritage architect about the potential and practical options for rebuilding the original as a whole, in part, or just rescuing the facade.

Even where 'asset protection' efforts by fire crews and fire bombers have been successful, fire-front heat load damage to traditional limestone and lime mortar structures can occur. On some sites, assessors suspected asbestos might be present, raising issues regarding access on work health and safety grounds. Protection for volunteers helping to clean up, building trades people, and the land owner is required and this adds to the rebuild budget for removal and disposal of hazardous materials. The independent advisers enlisted licensed assessors to provide definitive information for individual sites that allowed the process to move forward.

This opens up considerations as to how communities and disaster-affected people deal with a dramatic change in

circumstance where a previously legal building material is now a significant health issue.

On the nonsensical side

Individual experiences demonstrate just how far from the ordinary the fire ground experience is. People living on the fire scar can find communicating this to 'outsiders' challenging. This adds another layer of frustration and emotional impost. For example, at the Sampson Flat fire ground, the owner of a destroyed home contacted an overseas call centre to cancel a satellite entertainment system. The recommendation from the provider was to 'switch it off and switch it on again'. The call centre operator was unable to comprehend, even after repeated explanation of the devastation caused by the bushfire, that the reason the service was not needed was that there was no longer a house to which the dish could be connected.

Similarly, 'estimated' energy supply accounts were sent to fire-affected account holders for the post-fire period. With no building on-site, the advice back to the provider was that both the connection and the account were redundant. Negative external inputs such as these can detract from the progress made in recovery. Access to independent advisers, as well as community support, offers assistance and a buffer against such circumstances.

Resources offered for independent advisers

www.anbg.gov.au/bibliography/fire-plants.html

www.csiro.au/en/Research/LWF/Areas/Landscape-management/Bushfire/Fire-spread-models

www.apsvic.org.au/plant_fire_resistant.html

www.anpsa.org.au/fire.html

www.naturalresources.sa.gov.au/adelaidemtloftyranges/land/fire-management/sampson-flat-fire-recovery

www.rdv.vic.gov.au/fire-recovery-unit/planning-and-rebuilding

www.dss.gov.au/our-responsibilities/communities-and-vulnerable-people/publications-articles/spontaneous-volunteer-management-resource-kit

www.regionalaustralia.org.au/wp-content/uploads/2013/08/From-Disaster-to-Renewal.pdf

steelscreek.vic.edu.au/publications/

history.cass.anu.edu.au

Conclusion

This work represents the beginning of a longitudinal study of fire-affected communities. In-field researcher-practitioner observation and interaction with affected individuals and families via telephone, email, and face-to-face, individually and at community meetings are integral to the recovery process. In addition, outreach meetings scheduled specifically for various rebuilding matters has generated a large amount of data that has potential to inform future recovery processes.

Participating in local recovery committee meetings and discussions allows the sharing of insights and raises issues from contributing agencies in a professional, confidential setting. The independent advisers are entrusted with information not provided by homeowners to other agencies. Subsequently, issues that may have been missed can be identified and addressed. Human attachment to place is well documented in the natural hazard literature (Eriksen 2011, Paton 2013), and this is understood by building professionals. While the focus of the recovery process is rightly on the people, attachment to their natural environment adds complexity. Recovery is about people, and people are part of a complex whole – a community and a physical place.

The professions represented in the advisers group are ideally suited to working in a social science setting on fire grounds. The attributes of the professions' education begin with understanding the psychological implications of human response to spatial form, materials, colours, and context toward emotional comfort.

The independent advisers involved in the 2015 South Australian fires indicated they would be available to assist the impacted communities, fully expecting their assistance would be needed sporadically across weeks, months and years. The experience is that access to such expertise is a positive contributor to the recovery process. Paton (2013) indicates that positive outcome expectancy can be diminished by uncertainty, variable organisational trust, and suboptimal community engagement. The independent advisers provided much-needed, accurate information with professional credibility. They were able to help reduce community frustration fuelled by misinformation or inexperience of organisations or personnel. And as we 'learn by doing' the advisers add to their skills, knowledge and outreach capability, and acquire experience that will better equip them next time around.

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About the author

Emilis Prelgauskas is a veteran architect in private practice. He is part of the South Australian volunteer independent advisers on rebuilding integral to Local Recovery Committees. His working life includes being Sessional Commissioner to the Environment Resources and Development Court of South Australia's Building Rules Assessment Commission.

Research

ABSTRACT

Place attachment is conceptualised as the bonding of people to a place that influences their perceptions of those places. This research focused on verbal and visual experiences of residents' homes and surrounds to explore whether place attachment in a bushfire-prone community mediated perceptions of risk. The analysis draws from qualitative data that used a visual and mobile method called 'Photovoice', coupled with in-depth interviews, to investigate the relationship between place attachment and perceptions of bushfire risk in hazard-prone settings. Located in the Blue Mountains, west of Sydney, New South Wales, this research established that place attachment, as mediated by longevity in place and familiarity to place, provided the context for certain perceptions and experiences of bushfire risk. The information garnered from this research can be important for more effective bushfire risk communications that are targeted and tailored to account for residents' attachments to home.

Can place attachment mediate perceptions of bushfire risk? A case study of the Blue Mountains, NSW

Charishma Ratnam, Dr Danielle Drozdzewski and Dr Rosalie Chapple, UNSW Australia, consider attachments to place that helps people assess risk and communities rebuild and reconnect following disaster.

Introduction

Perceptions, experiences and assessments of bushfire risk form part of balancing risk and benefits in hazard-prone places such as the Blue Mountains, NSW (Slovic 2000). An appreciation of how elements of places are considered by people in areas under threat from natural hazards is an overlooked component of the most notable risk literature (Douglas 1992, Beck 1995, Slovic 2000). While risk-related research acknowledges person-place bonds, there is a gap in knowledge that must be bridged to better understand how these attachments to place influence action, and inaction, in risk-prone settings (Brenkert-Smith 2011, Diaz, Steelman & Nowell 2016). To address this gap, this paper considers how people perceive and experience places on various spatial and temporal scales, and how these experiences enabled (or not) both personal and contextual understandings of landscapes. Broadly, in this paper landscape definitions are drawn from Brenkert-Smith (2006) as encompassing physical, ecological and social meanings, which are mediated by the experiences of people living in them.

This research highlights how a focus on attachments to place enable a fuller spectrum of risk to be assessed, which also includes community rebuilding and community reconnecting with place (Billig 2006, Hughes 2014). This paper contributes to ongoing social research on bushfire risk communications (Steelman & McCaffrey 2011, Eriksen & Prior 2013, Diaz, Steelman & Nowell 2016). Considering attachments to the Blue Mountains visually were important to more nuanced understandings of people's connections to place in risk-prone environments

The concept of place attachment

The concept of place attachment is regarded as a complex and multi-faceted social construct (Anton & Lawrence 2014). It stems from the understanding that person-place bonds give rise to our connections to place, which are important in constructions of personal and group identities. Initially developed by Relph (1976) and Tuan (1977), the term emphasises that 'place' involves experiences, emotional connections and the construction of place. In a person's place-based experience, an attachment is formed as part of

knowing a specific place (Relph 1976). The concept of place attachment is essential in the way people are able to create a connection to their physical and social constructions of where they live. Place attachment has become closely tied to various community and individual perceptions, emotions and behaviours, particularly when these ties become threatened (Prior & Eriksen 2013).

Risk perception

There are many factors influencing perceptions of risk including behavioural and cultural theories of risk perception that intersect with the concept of place. Work by Douglas (1987, 1992) shows that risk perception is socially and culturally constructed. Furthermore, the perception of a hazard is a function of social learnings and cultural adherences (Douglas 1992). Beck (1995) suggests that risk awareness aims to make the unexpected consequences of a society's decisions foreseeable through preventative actions and arrangements. Slovic (2000) suggests that environmental risk is improved by understandings of risk and decision-making processes. Improving decision-making involves understanding probabilities of risk events, how hazards are perceived, as well as the balance of risks and benefits of planning (Slovic 2000). In Australia, we encounter natural hazard risks of floods, cyclones, droughts and bushfire. Of these events, bushfires are reported to be associated with the greatest sense of loss (Anton & Lawrence 2014).

This paper looked at how bushfire risk mediates people's attachments to place and home in the Blue Mountains region of NSW. The key objective was to explore place attachment and sense of home in an Australian community confronted by bushfire risk. Concomitant to this was the investigation of whether place attachment mediated perceptions of bushfire risk by residents of the Blue Mountains.

Methods and study area

In 2015, ten Blue Mountains residents were recruited to participate in this research. These participants were involved with a severe bushfire in the Blue Mountains in October 2013. During those fires, the majority of the participants were evacuated from the region given the serious threat. The 2013 fires burnt for ten consecutive days and destroyed 200 homes in Blue Mountains townships (Fitzgerald, Chapple & Blignault 2015).

The participants were aged between 18 and 54 and lived in the townships of Bullaburra, Wentworth Falls, Leura, Katoomba and Blackheath in the Blue Mountains region. An ethnographic approach was used for this research because the focus on everyday routines allowed for a nuanced way to explore meanings of place(s) in a spatial landscape (Wang & Burris 1997, Crang & Cook 2007, Till 2009). An ethnographic approach allows researchers to understand experiences and to interpret culture, society and environments through knowledge about place(s) (Pink 2001). Gaining insight into how participants interpret place informed the qualitative methodology

undertaken. The qualitative mixed methodology combined Photovoice[1] with a 'walk-along' interview, followed by a formal in-depth interview.

Visual methods provided different insights into how the participants perceived their attachments to home. Photovoice allowed participants to photograph their environment and encouraged discussion about community issues (Wang & Burris 1997). The traditional form of Photovoice was adapted for this research and included a walk-along interview component (Degen & Rose 2012). Participants were asked to determine their walking routes and take photographs of places and things they deemed significant parts of their home. Such places of meaning and attachment could be inside or outside their home (bedrooms, kitchen, backyard or areas in their surrounding suburb). Probe-style questions prompted participants to reflect on specific risk-related memories of the place(s) while they were walking and taking photographs on a tablet device. The walk-along method allowed observation of the participants' sensory experiences and memories of places while being mobile in and through places of significance (Waterton & Dittmer 2014). This meant participants explored the places and landscapes they were discussing while walking and allowed them to link their understandings of place and landscape for the researcher (Hein, Evans & Jones 2008). There was no limit to the number of photographs taken during the Photovoice part of the process. However, for the follow-up in-depth interview, participants were asked to select up to five photographs that they thought visually reflected their connections to place and home.

The second stage of semi-structured interviews helped create a narrative to extend the visual perspectives of place attachment and bushfire risk in the Blue Mountains captured in the walking interviews. Participants were encouraged to speak about experiences and observations of bushfires over time. The mobile and in-depth interviews were recorded, transcribed, coded and analysed in NVivo 10. Photographs were coded using NVivo 10 for combined analysis with the interviews.

Results and discussion

This research revealed how the use of visual aids and physical interaction extracted some nuances of place attachment connected to perceptions of risk.

Photographs taken during the Photovoice stage were specifically characteristic of participants' connections to place when considering bushfire risk-related perceptions and events. Participants stated they would only leave their homes during a bushfire event. Further, they stated they still had the intention of returning to the area post-fire. Many of the participants interviewed temporarily left the Blue Mountains during the 2013 fires, recognising an increased understanding of risk awareness. Such

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1 Photovoice is an analysis method combining photography with participant interaction (e.g commenting on photographed scenes that highlight research themes).

Figure 1: Mountain range in front of a participant's home that was fire-affected in the early 2000s.
Image: Participant 9

a heightened awareness of bushfire risk was similarly conveyed in the 'Fire Stories' project conducted by the Blue Mountains World Heritage Institute (Fitzgerald, Chapple & Blignault 2015). The attachment felt and experienced by participants was a driving factor for returning to the Blue Mountains after a bushfire event. Participants' longevity in the Blue Mountains contributed to creating a sense of place that overrode the risk associated by bushfires because the area was considered home before a place of risk. For example, when asked: 'how do you think living in a bushfire-prone area has influenced how connected you feel to your home?', one participant stated:

> I don't think the fact that there's a bushfire risk would change how we feel about living here.
> (Participant 1, Blackheath resident)

The mobile approach of walking revealed that moving through places prompted moments of familiarity and evoked memories and lived experiences (Figure 1). One participant, while walking out to the veranda that faced onto the vast mountains (and taking a photograph), stated:

> I think I feel more connected because I've nearly lost it a few times. You're always going to have a connection to your home, growing up. Coming home [after a bushfire event] and [your home] being there, you just feel so relieved and grateful.
> (Participant 9, Katoomba resident)

This research uncovered connections between participants' bushfire risk perceptions and their senses of place. There were strong connections to place and home in these considerations of bushfire risk. These linkages revealed attachments to place as people were prompted to walk through and photograph places deemed to be their 'home place'. For example, one participant stated:

> I'm not scared to be here, and I wouldn't consider moving because of [bushfires]... I love living here and it's just our space. (Participant 5, Bullaburra resident)

Another participant expressed an attachment to place when considering bushfires by stating:

> Bushfires just become the norm... then when you realise where it has hit, that's when you realise how connected you are to the place.
> (Participant 4, Leura resident)

While the bushfire risk prevails, residents have built a stronger sense of place and home, constructed by forging attachments to place, which were expressed through their movement in the mobile part of the method. Place attachment was evidenced as a contributing factor that encouraged residents to return to the area after bushfire threats and events.

Many participants conveyed that familiarity and longevity in a place provided more experience in handling bushfire threats and fire events. Being surrounded by risk, directly and indirectly, has contributed to participant awareness and acknowledgement of risk. Participants were asked: 'do you have a better understanding of bushfire risk after living in this area?' Many participants specifically mentioned the 2013 bushfire event as providing a key understanding of risk in their households:

> Previously, I had an academic knowledge of that. The Winmalee year, I had an experiential knowledge of it.
> (Participant 2, Katoomba resident)

Another explained: 'Before the [2013 bushfires], it was very scary. Even though we weren't directly affected, the whole of the community was affected and lots of people I knew were impacted' (Participant 5, Bullaburra resident).

The openness of the community to share stories and bushfire experiences enabled a better understanding of bushfire risk and the expansion of a more 'resilient fire-adapted community' (Paton 2007,

Figure 2: Fire retardant trees in a participant's backyard.
Image: Participant 2

Fitzgerald, Chapple & Blignault 2015, p. 20). The experiences expressed by participants stimulated how they can manage future bushfire events by preparing their homes. This includes clearing ground fuels around properties and establishing fire evacuation plans among households that are constantly revised (Lion, Meertens & Bot 2002, Paton 2007, Middleton & Leahy 2015).

While walking, participants pointed out parts of the house that were associated with their preparedness:

> The whole top shelf [of the wardrobe] is… just important documents… that's all we'll grab.
> (Participant 9, Katoomba resident)

Risk preparation of homes, particularly outside environments was a key point of discussion:

> The recent fire warning that happened in Katoomba; they said it would come up here. We were thinking 'the leaves in the gutter' so trying to work on making the house more fire safe and of how close we are to the bush as well. (Participant 3, Leura resident)

> We've cleared [parts] and changed things around so we can be more prepared if a fire came through. (Participant 10, Wentworth Falls resident)

Features of the garden in relation to the perception of risk it carried were photographed by one participant (Figure 2).

> These trees are actually fire retardant. So if one of our properties, either myself or my neighbour's went up, that would be a good fire break.
> (Participant 2, Katoomba resident)

Insights gained through this research can inform community engagement activities to improve bushfire risk awareness, preparedness and response. Building this engagement can be accomplished by augmenting the way information is delivered by government agencies, community fire units and local councils. While bushfire

risk remains, the strength of attachments by participants to place and the home prevails based on their longevity in, and familiarity with, the Blue Mountains. This was evidenced by participants walking through and visually and verbally identifying these places of connection.

Participants cleared debris from property structures and fenced off part of their backyard to minimise fire risk.
Image: Participant 10

Conclusion

An important outcome of this research related to how attachments to place were articulated through movement, narrative and visual images. These expressions showed that while the bushfire risk in the Blue Mountains remains, and will likely increase in the future, participants have built a strong connection to place that builds an acceptance of this risk. Their longevity in the Blue Mountains and familiarity with the place has enabled a better understanding of risk. Participants' experiences with bushfires have built resilience and preparedness in Blue Mountains communities. The longevity of residents in place highlighted that bushfire risk is part of living in the Blue Mountains. For the participants, it is a place of the home along with acceptance of it being a place exposed to bushfire risk and threat.

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About the authors

Charishma Ratnam is a PhD candidate in Human Geography at UNSW Australia. Her thesis focuses on issues of place attachment and settlement in the Sri Lankan refugee community in Sydney.

Dr Danielle Drozdzewski is a Senior Lecturer in Human Geography at UNSW Australia. Her research focuses on the interlinkages between place, memory and identity. She is interested in the use of innovative ethnographic research methods to understand place and mobilities.

Dr Rosalie Chapple was the co-founder of the Blue Mountains World Heritage Institute in 2004 and is currently a Research Associate and Board Director. She is also a lecturer in environmental studies at UNSW Australia.

Facebook 'Safety Check':
let friends know you're OK

https://www.facebook.com/about/safetycheck/

Facebook's 'Safety Check' feature gives Facebook users a way to check on family and friends during natural disasters.

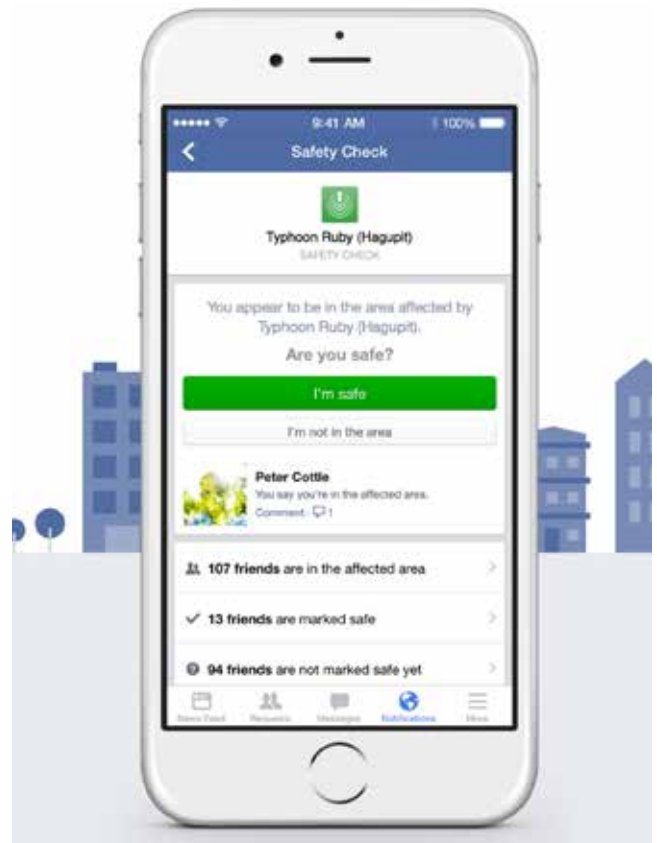During a disaster, Safety Check helps users:

- let friends and family know they are safe
- check on friends and family in an affected area
- share information about a friend or family member's status.

The feature uses the location information provided to Facebook. This includes:

- the city listed in the Facebook profile
- Facebook friends' nearby check-ins
- the city in which a user is connected to the internet.

If there is a major event in an area a user has checked in from, Facebook sends a push notification asking if they are okay. Users can specify that they are safe (which will post a status their friends can see) or say they are not in the affected area.

A simple I'm safe / I'm not in the area message (and optional comments) will be visible to people in the user's friends list.

Check Notifications

If it looks like you may be near a major crisis, we'll ask if you're safe.

Say That You're Safe

If you're OK, click or tap the "I'm Safe" button to let friends and loved ones know straight away.

Check on Others

We'll let you know when friends say that they're safe. You can also check a list of friends who may be affected by the disaster.

UPCOMING PROFESSIONAL DEVELOPMENT

The Australian Institute for Disaster Resilience is delivering a variety of upcoming courses in the next few months relevant to volunteers and those involved in community engagement.

Volunteer Leadership Program (VLP)
Held at the Vibe Hotel, Gold Coast, QUEENSLAND
4-5 November 2016

The VLP provides organisations in the Australian Emergency Management Volunteer Forum (AEMVF) to nominate their volunteer members for this funded residential training opportunity. As a participant, you will gain introductory knowledge and skills to enhance the practice of leadership as a volunteer, and more so, think about how you can effectively contribute to whole of organisation leadership. Importantly, there is time to meet others from the AEMVF network and learn through sharing experiences and knowledge as a volunteer

Would you like to attend this or future programs or find out more? If you volunteer in emergency management or a related sector, then write to enquiries@aidr.org.au to find out if your are eligible and your agency's nomination process.

Engagement matters: tools for disaster-resilient communities
TAFE NSW, Riverina Institute, Albury, NSW
4-5 May 2017

This is a two-day workshop with a difference. Focus on how you can achieve outcomes by selecting four areas to focus on for practical guidance from engagement practioners: You can choose form: identifying risks; sharing information; empowering communities; eliciting ideas; agreeing on expectations; challenging entrenched ideas; engaging children; and managing high-stakes situations. There will even be time to network with other practitioners from around the country including at drinks and dinner.

This event is going to be active, busy, and most of all engaging – register now and be ready!

All of AIDR's professional development products and events are advertised at www.aidr.org.au. You can also join AIDR's e-newsletter list to make sure you don't miss out on the next event.