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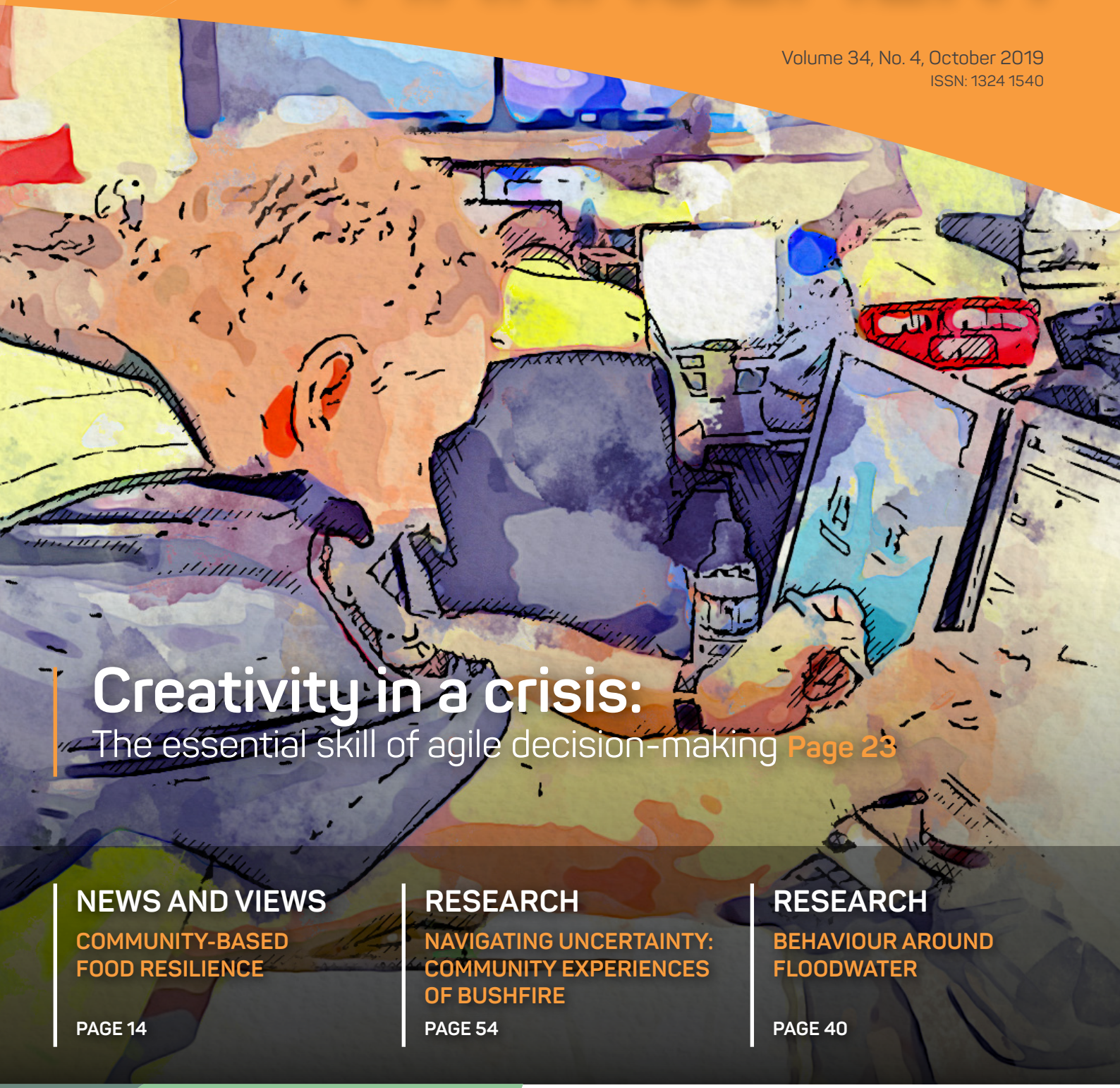

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Australian Institute for Disaster Resilience

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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 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, Australian Institute for Disaster Resilience or its partners.

Aboriginal and Torres Strait Islander peoples are advised that this publication may contain images of deceased people.

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Cover image: Future emergency managers will need to be more creative in their approach to disasters.

Image: WA Department of Fire and Emergency Services, modified by Catrin Harris

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Contributions in the Research section of the *Australian Journal of Emergency Management* are peer reviewed to appropriate academic standards by independent, qualified reviewers.

Foreword

Lord Mayor Sally Capp

A resilient city is crucial for our community, particularly as Melbourne grows at such a rapid pace. Melbourne is Australia's fastest growing city and is expected to be Australia's largest city within a decade. Significant opportunities and challenges arise with this tremendous growth.

As our city grows, our urban landscape continues to evolve. Apartment and office towers are shooting up faster than at any time before. However, it is no secret that some of these new buildings have faults. One of the most pressing human-caused disasters is flammable cladding that has been identified on buildings across the country. Not only does this issue highlight the dangers of combustible cladding, it also shines a spotlight on human behaviours that increase risk in high-rise living. Overcrowding of individual apartments, tampering with smoke alarms and stockpiling flammable materials on balconies were all found to be commonplace in many buildings.

The City of Melbourne, along with other councils across Victoria, is working with the Victorian Government to identify and mitigate the dangers from flammable cladding, but there's no doubt that a strong national approach is needed.

However, it's not just our built environment that needs to be taken into consideration when planning for the resilience of our city. We need to be more prepared than at any time in our history to deal with unpredictable and intense weather events.

Melbourne is experiencing more frequent and more extreme weather such as intense rainfall and heatwaves. Climate change is impacting on the city now and is going to have an even greater impact on our city in future decades – whether that is heatwaves or extreme storms.

The City of Melbourne has a strong track record of proactively managing climate change and we aim to take a national leadership role. We have a nation-leading urban forest strategy, which ensures the proactive management of the tree canopy throughout the City of Melbourne. This helps to reduce the urban heat island effect, particularly during heatwaves, and improves resilience by reducing stormwater flows during intense storms and heavy rainfall. We are using natural infrastructure such as green spaces and parklands to improve the management of shock events, such as extreme heat, but also flooding.

Increasing the tree canopy reduces the heat experienced in an area and planting the right species of vegetation can also decrease stormwater run-off. Part of this preparation includes urban planning that takes rising sea levels into account, particularly in urban renewal projects around what were previously waterfront industrial areas. Sea level rises will be a considerable issue for the City of Melbourne, with significant amounts of land adjoining the Yarra River within our boundaries. The increase in sea levels is expected to intensify flooding in some low-lying areas.

We are considering these changes in nature within our planning and development and will continue working closely with other government agencies to respond immediately to the threat of climate change. This is critical work as we come to understand the interdependencies between our urban areas and natural habitats such as the edges of the Yarra River.

The pressures of climate change and population growth are serious challenges for our resilience and livability. The only way to ensure we grow well as a city is to expertly plan for the future and ensure we focus on remaining a sustainable city.

Sally Capp

Lord Mayor of Melbourne

Broome 6.6 magnitude earthquake: lessons identified

Mark Williams and Justin Whitney, Department of Fire and Emergency Services Western Australia, and Adrienne Moseley, Geoscience Australia

On 14 July 2019, a magnitude 6.6 earthquake occurred 210 km off the coast of Broome. This event, equal to the largest recorded in Australia, has provided an important learning opportunity.

When the earthquake occurred, Geoscience Australia issued an earthquake notification. The event was deemed 'potentially tsunamigenic', however, further analysis led to the Joint Australian Tsunami Warning Centre issuing a national No Threat tsunami bulletin (Figure 1). No deaths or injuries were recorded and reports indicated only minor damage to buildings. Given the low frequency and potentially high impact of earthquakes on Broome, this event was a rare opportunity for the emergency management sector to improve its understanding of this hazard.

Data collection tools and analysis methodologies for earthquakes have evolved. In May 2018, Geoscience Australia relocated the Earthquakes@GA website to the cloud, including the *Felt an Earthquake?* tool. This significantly enhanced the website's accessibility and capacity to crowdsource information related to seismic events. Improvements went beyond data collection. Geoscience Australia is trialling ways to produce maps and data in near-real-time that summarise people's experiences, their actions and the extent of damage. The Geoscience Australia ShakeMap (Figure 2), shows the modelled ground motion and shaking intensity following the Broome earthquake. This is one of the near-real-time products being trialled to improve data visualisation and analysis.

The Broome earthquake allowed the Department of Fire and Emergency Services Western Australia (DFES) to trial the new Geoscience Australia products. DFES conducted an analysis of the event using the data collected by Geoscience Australia, department incident management system records, media reports, social media and eyewitness accounts. The analysis provided important insights into how communities responded to the earthquake and where and how these actions might be improved or harnessed.

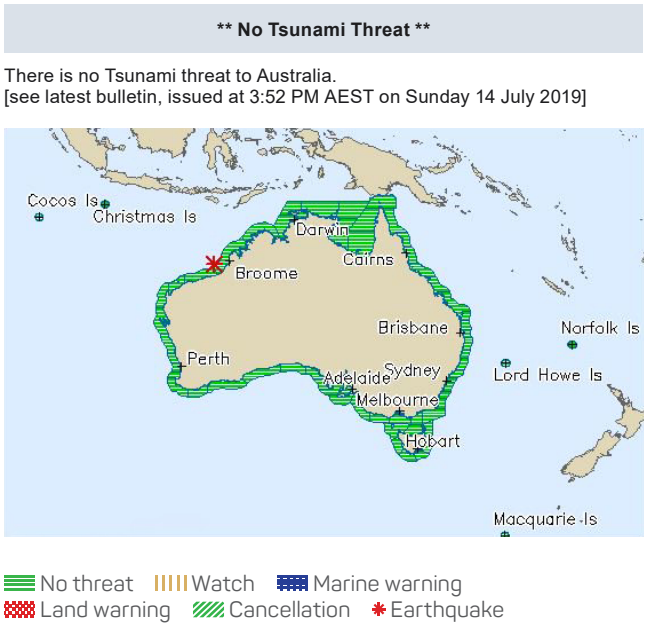


Figure 1: The Joint Australian Tsunami Warning Centre No Threat bulletin for the event.

Image: Bureau of Meteorology

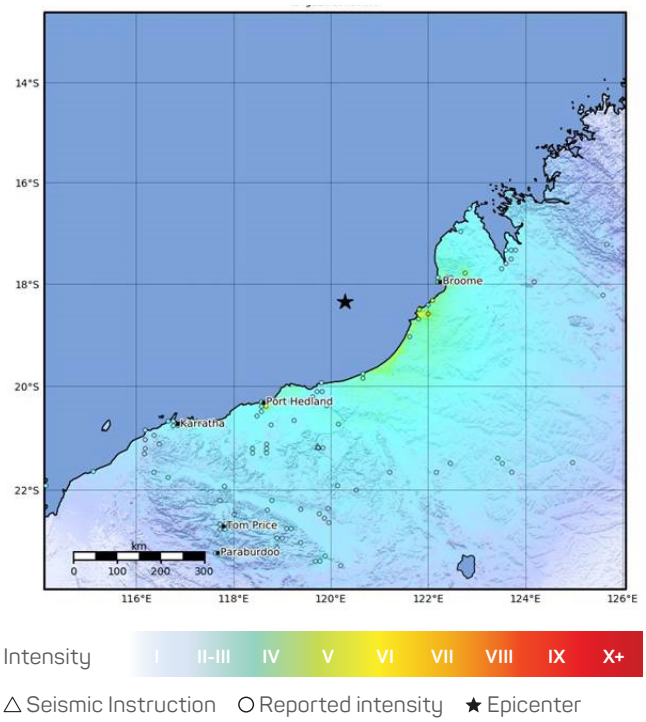
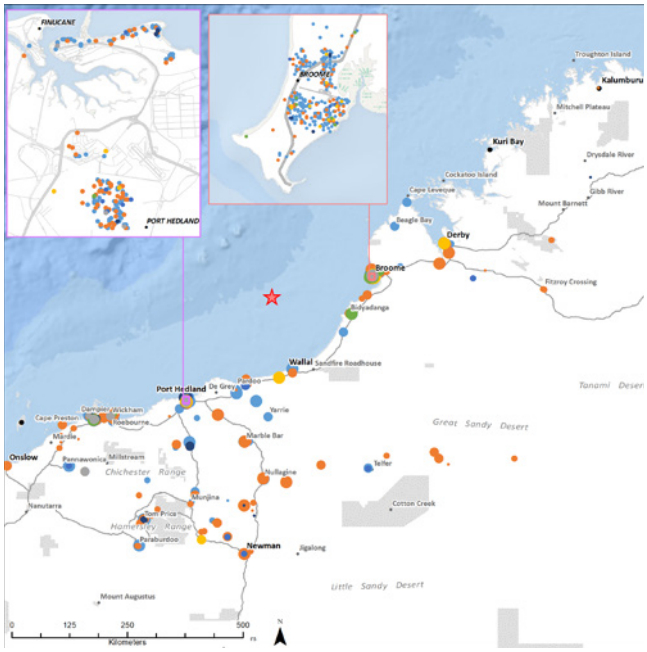


Figure 2: The Geoscience Australia ShakeMap shows the extent of shaking, using Modified Mercalli Intensity, for the July 2019 earthquake.

Image: Geoscience Australia

Understanding responses through Felt Reports

Geoscience Australia received 1364 'Felt Reports' from within the region. Approximately 77 per cent of those reports were from Broome, Port Hedland and Karratha (Figure 3). Of note, 56 per cent of respondents reported that they moved away from their location when they felt the earthquake and 36 per cent did nothing. Of the 56 per cent who moved, 87 per cent were initially inside a building and tended to move outside (49 per cent) or to an internal doorway (37 per cent). Neither of these actions is considered a suitable earthquake response, with the current recommendation being for people to 'Drop, Cover and Hold'. When examining the percentage of individuals who reported this recommended response, our findings show a very small minority (1.25 per cent). Although Broome, the closest populated area to the epicentre, exhibited a marginally higher response (3 per cent), it was still very low. While the intensity of the ground motion may have been insufficient to trigger many 'Drop, Cover and Hold' responses, these figures suggest a potential gap in earthquake awareness.



Legend

★ Earthquake Epicentre

Felt reports

● Checked ● Did nothing ● Didn't know
● Dropped and covered ● Moved ● Stayed ● Unkown

Figure 3: Felt Reports recorded for the Broome earthquake summarise where people were at the time of the earthquake, how intensely they felt it and what actions they took (according to seven action categories).

Image: DFES and Geoscience Australia

While DFES promotes 'Drop, Cover and Hold' messages for earthquakes, it is apparent this is not reaching intended audiences. Instead, misinformation based on historical legacies and urban myth (such as doorways being stronger) prevail and lead to less appropriate responses and unnecessary risk to life.

Messaging and response

Irrespective of the No Threat tsunami bulletin, beaches in Broome were closed and several coastal areas self-evacuated. Approximately 200 members of the Bidyadanga Community (closest community to the epicentre 180 km south of Broome) chose to evacuate. Analysis suggests the decision to self-evacuate was based on several triggers. It was reported that community members observed a rapid retreat of the tide. Other people attributed the long and strong ground movement to tsunami. There is also strong evidence suggesting that oral tradition in the region recounts a powerful tsunami hitting the Kimberley coast in the 17th century, generating waves that travelled up to 35 km inland.[2]

Self-evacuation triggered by recognising natural signs should be encouraged as alerts and warnings may not reach everyone in time. The initiative to evacuate demonstrates a level of community awareness within the region. Emergency managers can benefit from capturing and considering the historical, cultural or local factors that may assist appropriate responses to emergency events and evacuation. This can also be leveraged to maintain community awareness and reinforce appropriate and proportionate actions.

These are two of several important lessons DFES has drawn from the Broome earthquake, thanks to information from DFES Kimberley Region staff and the products Geoscience Australia is developing. DFES has identified areas to improve, while demonstrating that the overarching systems function satisfactorily. Geoscience Australia has also benefited from seeing how their information products are (or may be) used by emergency managers. The way DFES applied these products was highly valid and useful, yet novel and unintended in the original product design. As the data collection tools and products evolve, and our ability to analyse this data matures, there is great capacity to understand emergency events as they happen to help preparedness for future ones.

The authors acknowledge Glenn Hall and Lee Vallance (DFES Kimberley Region) for their insights. Further information email: intelligence@dfes.wa.gov.au.

1 Shake Out: Recommended Earthquake Safety Actions 2016. At: www.shakeoutbc.ca/downloads/ShakeOut_Recommended_Earthquake_Safety_Actions.pdf.

2 Bryant E, Walsh G & Abbott 2007, *Cosmogenic Mega-Tsunami in the Australia Region: Are They Supported by Aboriginal and Maori Legends?, Geological Society, London, Special Publications 273, no. 1, pp.203–14. doi.org/10.1144/GSL.SP.2007.273.01.16*

Why climate outlooks are so important

Jonathan Pollock, Felicity Gamble and David Jones, Australian Bureau of Meteorology

Climate outlooks, also called long-range forecasts, tell us what rainfall and temperature patterns are expected in the weeks, months and seasons ahead. As such, they are powerful tools to help make decisions related to weather and climate variability.

Climate outlooks indicate whether it is likely to be wetter or drier than usual, or hotter or colder. They can alert us to a difficult fire season or if a summer of floods is possible. Decisions on activities affected by weather and climate variability, from workforce planning and agricultural practices, to severe weather season preparation or even when to take a holiday, can be assisted using climate outlooks.

Australia's first climate outlooks (see Figure 1) were created using known relationships between the atmospheric indicators of the El Niño – Southern Oscillation. They then moved to using a mix of atmospheric and oceanic indices in the mid-1990s.

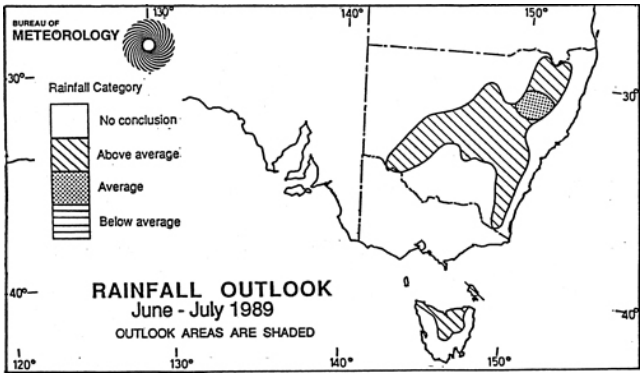


Figure 1: The first climate outlook issued by the Bureau of Meteorology provided an outlook for June and July 1989.

Image: Australian Bureau of Meteorology

In 2013, the Climate Outlooks Service made arguably its greatest leap when its statistical modelling was replaced with a computer 'dynamic' model that modelled physical changes in the Earth's atmosphere, oceans, ice and land through the solving of millions of equations per second.

This was soon followed by better, high-resolution modelling in 2018, whereby forecasts out to three months ahead could be made at 60 km resolution, rather than the previous 250 km resolution. This provided more localised forecasts.

In the last few years, the Bureau has closed the forecast gap between weather and climate information with the addition of weekly and fortnightly climate outlooks (Figure 2). This service was released in August 2019. For the first time, rainfall and temperature outlooks were available for the weeks directly after the seven-day forecast. One- and two-week outlooks now complement the existing one-month and three-month outlooks.

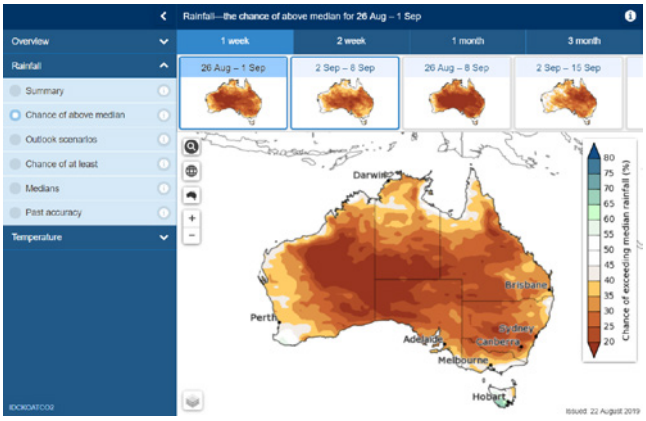
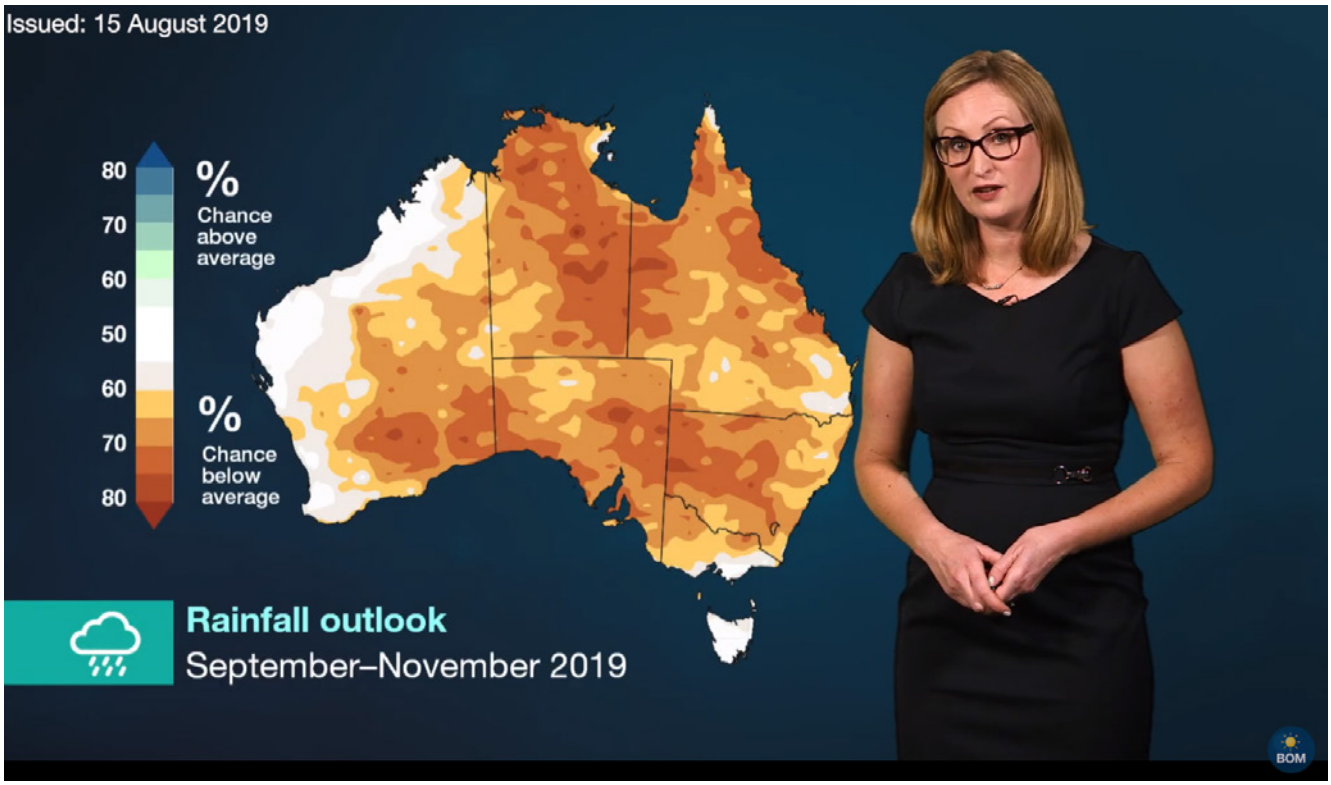


Figure 2: The Bureau's new weekly and fortnightly forecasts were released in August 2019.

Image: Australian Bureau of Meteorology

The weekly and fortnightly outlook information also features *how much* above or below average temperatures are likely to be across the country as well as the likelihood of rainfall totals. An additional three-month outlook period is also included. This means users can look one month further ahead than was previously possible.



The Bureau's outlook videos explain the long-range forecast for the upcoming three months.

Source: Australian Bureau of Meteorology

More outlooks, more often

The new range of information coincides with more frequent updates for all climate outlooks. The one- and two-week outlooks are issued on Mondays and Thursdays. The one- and three-month outlooks are issued every Thursday; twice as often as previously. So, people can access changes in the outlook sooner and be confident forecasts are based on the latest information.

Better decisions

By providing climate outlooks across time periods, the Bureau now allows for information to be applied to a wide variety of decisions. Which climate outlook to use depends on the kinds of decisions being made.

For example, farmers may want to know what the rainfall will be like over the next six weeks to decide when to sow pasture. If the climate outlook indicates it's likely to be drier than average, they may decide to postpone.

Fire and emergency management agencies are very interested to know what temperatures may be like in the coming weeks. This assists with decisions on whether or not to undertake a prescribed burn or to roster extra staff on or prepare more resources.

Tailoring forecasts for emergency management

The Bureau's climate model provides for a wide range of forecast possibilities. It is now possible to produce weekly and seasonal forecasts of heatwaves, fire weather and tropical cyclone potential. The Bureau is working closely with the emergency management sector to bring new and improved forecasts online to assist with practical decision-making.

The Bureau is keen to receive feedback on any of the outlook features. The Bureau's Climate and Water Outlook video provides a summary on recent and coming weather trends

Access to the Bureau's climate outlooks is via the Climate Outlooks website or users may subscribe to receive climate outlooks via email www.bom.gov.au/climate/outlooks/#/overview/summary.

Community-based bushfire management in Victoria

Fiona Macken, Safer Together

Community-based bushfire management is a project in the Victorian Safer Together program. It takes a community-development approach to bushfire risk reduction and builds respectful, trusting relationships to identify mutual values, local assets and strengths and strategies to reduce bushfire risk.

Community-based bushfire management (CBBM) is a model of community development, with bushfire risk reduction as its ultimate objective. The CBBM model of community engagement departs from traditional bushfire education models of providing information and takes a community-development approach. The Safer Together program is a multi-agency collaboration created following the Lancefield-Cobaw fire in 2015.[1] A post-fire report made recommendations relating to agency interoperability of land and fire management. This included that agencies and local governments work closely with community members in management and planning issues, as well as bushfire risk reduction.[2]

Based on previous positive experiences of community-based approaches by the Country Fire Authority, the Department of Environment, Land, Water and Planning and others, CBBM was chosen due to the community's critical role. Each community (and the approaches they choose to take to bushfire risk reduction) are unique. As CBBM is community-led, it allows intense collaboration with community members on matters related to bushfire.

Currently, there are 20 CBBM communities involved with the Safer Together program. The characteristics of each vary, as do the values, priorities and approaches identified by community members and participants. These communities are assisted by a team of eight facilitators. CBBM operates under principles of:

- inclusivity – all those who are interested in joining in CBBM should be welcomed
- openness and transparency – there are no hidden agendas
- respect – participation must be based on respect for others; their experiences and perspectives
- honesty – all stakeholders must engage in good faith on the basis that everyone is trying to do their best to strengthen relationships, build understanding, find effective solutions and work for the benefit of the community
- flexibility – CBBM adapts to suit the needs of those involved
- clarity of purpose – activities should have clearly stated aims and an explanation of what is involved so people can make their own decisions
- positivity and constructiveness – participants must have the right attitude
- evidence-based – decisions and actions need to be based on plausible explanation and evidence, recognising that community experience and knowledge are valid forms of evidence.

While CBBM is an effective means to reduce local bushfire risk and increase community resilience, it is not a model of engagement that is suitable for all communities. As such, CBBM communities are chosen in accordance with three principles:

- community readiness to embrace and participate in CBBM
- agency and local government readiness to embrace and participate in CBBM
- high level of local bushfire risk.

CBBM focuses on the development of trusting relationships. This means all those involved in the process (community members, emergency management participants, local government and community group representatives as well as others) must genuinely listen to each another, respect diverse views and be willing to learn from one another. By valuing group diversity, a richer understanding of local issues and participant concerns can be developed. This, in turn, helps to identify the values and priorities of the group. By working this way, CBBM participants determine suitable local plans and processes to reduce bushfire risk.

1 Safer Together. At: www.safertogether.vic.gov.au.

2 Inspector-General for Emergency Management Final Report. At: www.ffm.vic.gov.au/history-and-incidents/lancefield-cobaw.

Despite groups identifying activities to reduce their local bushfire risk, other groups have focused on having meaningful local conversations that strengthen relationships and trust. Enhanced relationships lead to greater community resilience, particularly in the face of challenges such as bushfire.

A most notable example is the St Andrews Conversations project.[3] In 2017, a Social Network Analysis of the St Andrews Conversations project revealed the CBBM process created significant trust and meaningful relationships for those directly involved in the project. This analysis also revealed that participants believed the project had reach and impact on the community beyond those directly involved in the project.

Other reviews of CBBM in 2017 and 2019 revealed significant positive effects associated with the process. In 2017, the review identified several positive outcomes:

- The development of trusting relationships.
- The commencement of local bushfire risk-reduction initiatives.
- Evidence of community leadership to address bushfire risk.

The 2019 review revealed many similar findings to the 2017 review. Some additional outcomes include:

- that the CBBM community-led approach is fundamental to the project's success
- strengthening and re-defining relationships across and within the community and between agencies has built networks and trust
- an effective multi-agency partnership approach is perceived by participants as important and participants identified a change in the way CBBM communities and agency staff collaborate
- leadership and support from regional Country Fire Authority and Victorian Government managerial staff is important
- an increase in community involvement in bushfire management because CBBM operates in different ways for participating communities and achievements are based on locally defined goals and activities
- an increase in community awareness of bushfire risk in communities participating in CBBM
- investment of local government resources as well as local government connections with other agencies and communities.

People involved with CBBM recognise it is a fundamental shift in the way emergency management agencies and local government interact with communities. CBBM moves away from informing the community and builds connections to reduce bushfire risk. While the reviews of the program articulate the success of the approach to bushfire risk reduction, quotes from participants reveal different perspectives.

What's key is helping residents understand the part they can, and must play, to build a safer community.

[CBBM] *is exciting. This is the way I have been hoping and encouraging CFA to engage for years.*

Did you notice that everyone was listening to each other?

We'll work together because we don't want to miss an opportunity to change things.

What I liked about the group dynamics was the respect people showed each other.

With the right knowledge the community will accomplish far more than fire services ever could alone.

This is actually about life and death – we need to work together to prevent deaths.

CBBM requires a willingness from the community to embrace the concepts and participate in the process. Likewise, emergency management agencies and local government must be ready and willing to participate. Communities must also be exposed to a suitable level of bushfire risk. To be successful, CBBM requires a skilled facilitator who understands the nuances required to make this a successful process. Facilitators often do well when they remove the uniform and participate as a neutral entity who does not have allegiances or agendas.

Evaluation has shown the benefits of CBBM. These positive effects are far-reaching and are testament to the effectiveness of a community-based approach. Community members respond positively to having decision-making and leadership powers. Most importantly, the development of trust and respect has widespread benefits within communities generally.

The Victorian Government funded the Safer Together program. The author acknowledges the invaluable work and contributions of all community members involved in CBBM as well as the project team and the Safer Together staff and CBBM facilitators.
For further information, contact f.macken@cfa.vic.gov.au.

3 St Andrews Conversations video, at www.youtube.com/watch?v=TQy29Uf_bXs&t=6s.

'We Just Want to Help': engaging the not-for-profit sector

Dr Fiona Roberts, Monash University, Melbourne, Victoria

Much has been written of the importance of emergency management organisations involving communities in risk-reduction measures before an emergency and working with them after a disaster event to recover. Having the local community involved generally leads to favourable post-disaster outcomes.

However, there is little evidence of long-term successful collaborations that are not underpinned by government funding and do not take a top-down approach. Without established networks in place, there are significant difficulties for emergency management organisations to enter vulnerable communities and immediately gain trust, knowledge and motivate collective action.

A study undertaken by Monash University has found that not-for-profit organisations may be the key to entry into communities as these organisations are generally trusted and are long-term 'gatekeepers' of communities. Further, this research identified evidence of significant and constructive resilience-building actions undertaken by the not-for-profit sector.

Study methodology

The research was undertaken within the Monash University Disaster Resilience Initiative, following Monash's ethics and research codes of practice protocols. The primary research question was 'What is the potential role of nonprofit organisations in building community resilience to disasters?'.

The approach was an applied research project using resilience theory in the disaster setting, the *Sendai Framework for Disaster Risk Reduction 2015–2030* and social capital theory to build the research scaffolding. The scaffolding informed the analysis and results to identify 'what matters most to building community resilience to disasters'.

The Lions Club established the Need for Feed initiative in 2006 to coordinate fodder for livestock in communities in Victoria.

Image: Fiona Roberts

Case studies were used to illustrate organisation actions, strengths, barriers and enablers in the disaster context. Qualitative research methods identified key themes. Lions Clubs, Rotary Clubs and Neighbourhood Houses Victoria were the subjects of the case studies. The actions of these organisations were investigated before, during and after the 2009 Black Saturday bushfires, the 2011 Victorian floods and the Hazelwood mine fire of 2014.

Findings summary

Not-for-profit organisations do not operate for member profit, but function to achieve the organisation's purpose. Organisations such as the Lions Club, Rotary Club and Neighbourhood Houses Victoria have long histories of local community involvement, with missions focused on service to their community by volunteer members. While not established to respond to disasters, they have been heavily involved in communities recovering from disaster events and their actions, detailed in the cases, demonstrate potential to help communities. However, the literature identified in this study did not indicate much involvement by these groups in emergency management planning nor resilience-building exercises.

The study results illustrated that not-for-profit organisations contribute significantly to local communities during and after disasters. Actions include providing quick access to local assets (machinery ownership or skills, community kitchens), providing physical assistance (water, toilets, food, clean-up or shelter) through to contributing long-term recovery actions lasting years (establishing and funding Mens' Sheds, tool libraries or community activities).

The strengths of these organisations were found to enhance community resilience in the disaster setting. Rotary Clubs, Lions Clubs and Neighbourhood Houses are long-term local contributors to community development. These organisations are embedded in their communities, they have extensive community networks and connections and people know and trust them. They often support the most vulnerable people and they are empowered to action, independent of government, to help their communities. With an underpinning drive to help, they have the potential to be sustainable contributors to communities before, during and after emergency situations.

The emergency management perspective was investigated through a review of policy documents. These policies encouraged community engagement and recognised its importance in building community resilience. Emergency management stakeholders who were interviewed recognised that the not-for-profit sector had significant strengths like community connections, local knowledge and could motivate volunteers to assist and often provided creative solutions to issues.

The study demonstrated the usefulness of not-for-profit organisations before, during and after emergencies.

The Rotary Club in Victoria organises training for members and volunteers in chainsaw safety.

Image: P. Clancy

While incorporating these organisations into emergency management planning and response has its challenges, emergency management policy that includes not-for-profit organisations in sharing some responsibilities is valid and could potentially strengthen community resilience.

The study identified that the not-for-profit organisations were frustrated, 'they just wanted to help', but barriers blocked effective participation. The research identified possible enablers to resolve many of these barriers, including building resilience into the funded mandate of not-for-profit organisations and incorporating not-for-profit organisations into the emergency management operating structure. Giving a voice to representatives of not-for-profit organisation during planning at local and regional levels means they must be 'at the table'. Training in communication, emergency management roles and responsibilities; building tools and skills to help community resilience and facilitation requires adequate funding for government representatives and the not-for-profit sector to facilitate effective engagement and empowerment.

'We just want to help' epitomises the intent of contributions from not-for-profit organisations to support community resilience. Actions by these organisations reveal how they provide vital support and assist communities to respond effectively before, during and after disasters. Used more effectively, and because they want to help, not-for-profit organisations could generate savings through risk-reduction measures and hasten recovery from disasters.

The full report of this study is available from the Monash University electronic archive: 'We Just Want to Help' – Community Resilience to Disasters, Profit in Nonprofits. Contact fiona.roberts@monash.edu.

Queensland's leadership and crisis management education

Jane Zsombok, Queensland Fire and Emergency Services

A Queensland initiative, Operational Leadership and Crisis Management Masterclass series, is delivering beneficial outcomes for managers of disasters.

Disaster management training, education and capability development is a key element of Queensland Fire and Emergency Services (QFES) responsibilities and commitment to Queensland disaster management stakeholders.

The masterclass series develops and enhances the capability of disaster managers and supports the effective performance of their roles. Masterclass sessions extend learning and build on other Queensland disaster management training. Participants include those with roles as Local Disaster Management Group Chair, Local Disaster Coordinator, Local Recovery Coordinator or District Disaster Coordinator. To date, 48 per cent of attendees have been from local government, which is indicative of the critical role local governments perform in disaster management.

During 2019, QFES delivered three sessions:

- Meteorology for Disaster Managers Masterclass
- High Consequence Decision Making Masterclass
- Leadership in Disaster, Crisis and Adversity Masterclass.

The Meteorology for Disaster Managers Masterclass was facilitated by meteorologists from the Bureau of Meteorology and attended by 239 stakeholders across 12 locations during April and May. QFES worked in collaboration with the Bureau of Meteorology to design and develop the one-day sessions. Participants were given expert insights into weather and weather forecasting to support their decision-making during response operations. Participants said:

> [My] *Knowledge of meteorology has been greatly improved.*
>
> *Improved my knowledge, content is very relevant for my role.*

The High Consequence Decision Making Masterclass and the Leadership in Disaster, Crisis and Adversity Masterclass were designed and customised for the Queensland disaster management sector by QFES and the Australian Institute for Disaster Resilience. These masterclass sessions were facilitated by subject-matter experts and provided a blend of practitioner experience and academic knowledge.

The High Consequence Decision Making Masterclass focused on making critical decisions in situations of uncertainty, defensible decision-making and mitigating the effects of uncertainty in making evidence-based decisions. The masterclasses were delivered through 10 one-day sessions over June and July, reaching 227 participants who are in decision-making roles.

The Leadership in Disaster, Crisis and Adversity Masterclass focused on leadership using coordination, collaboration and relationships to help managers improve and leverage networks and relationships as well as crisis communication and engagement. This masterclass was conducted during July and August via 10 one-day sessions and was attended by 232 participants from disaster management roles. Participants indicated high levels of satisfaction and skills enhansement from training:

> *Excellent training which has challenged my way of thinking.*
>
> *Validated many current practices and provided many new tools applicable to emergency managers.*
>
> *Encouraged higher order thinking which resulted in deep learning.*

A key element of the QFES training strategy is to provide access for the sector across Queensland's vast geographical size. This was a critical factor in the delivery methodology. Masterclass sessions were conducted in Brisbane, Bundaberg, Cairns, Gympie, Longreach, Mackay, Rockhampton, Roma, Toowoomba and Townsville.

The masterclass series is a component of training provided under the Queensland Disaster Management Training Framework that is managed by the Emergency Management Training Command of QFES. Further sessions in the masterclass series are planned for 2020.

For further information, contact the QFES Emergency Management Training Command via email at DMTraining.Feedback@qfes.qld.gov.au.

Planning for food contingencies: a call to action

Dr Kimberley Reis and Associate Professor Cheryl Desha, Griffith University and Dr Allision Rifai, Queensland Office of the Inspector-General Emergency Management

Griffith University researchers have partnered with the Office of the Inspector-General Emergency Management to develop a community-of-practice across Queensland to build community-based food resilience at the local level.

Severe weather events pose significant risks to food supply chains that rely on transport infrastructure such as road and rail. Empowering individuals and communities to exercise choice for their self-reliance and take responsibility for the risks they live with is a priority action in Australia's *National Strategy for Disaster Resilience*.[1] This requires local resilience-based planning that anticipates actions across the prevention-preparedness-response-recovery spectrum.

Gaining knowledge of the community's long-term needs and tools for managing their risk to exposure is central, as are creating partnerships that are inclusive of communities with the relevant agencies and organisations.[1] As disaster risk management practitioners, we know this is important. However, do we relate this imperative to our relationship with food?

This call to action for community-based food resilience is based on findings from consultations in 2011 and 2018. Consultations were conducted with practitioners concerned with building community self-reliance around food provision. Despite the span of almost a decade, both cohorts provided similar and valuable insights; identifying immediate practical needs identified from working directly in disaster resilience and local food initiatives.

The first set of findings were drawn from interviews conducted immediately following the Queensland floods in 2011.[2] Analysis resulted in five findings, as well as insights and recommendations, to aid policy practitioners seeking to develop food-related disaster resilience at the community level.[3] The second set of findings arise from two jointly-hosted practitioner workshops held in 2018.

Synthesising the 2018 workshop insights with the 2011 findings, a straightforward, five-step action plan for practitioners 'closes the loop' on meaningful community action for local food contingency planning. Figure 1 shows the five-step plan.

Action 1: Facilitate shared control and responsibility with those who want it

'Individuals and communities are the starting point to build disaster resilience and the way to work with communities is to connect with what is already there.'[4] It is important to tap into the human desire to

1 Council of Australian Governments 2011, *National Strategy for Disaster Resilience: Building the resilience of our nation to disasters. At: https://archive.homeaffairs.gov.au/emergencymanagement/Documents/national-strategy-disaster-resilience.pdf.*

2 Reis K 2013, *Food for thought: The governance of garden networks for building local food security and community-based disaster resilience, Doctoral Dissertation, School of Environment, Griffith University, Brisbane. At: https://experts.griffith.edu.au/publication/n2c9e7057b149f20de74d0bf5c84e0aad.*

3 Reis K 2019, *Five things government can do to facilitate local food contingency plans, Journal of Environmental Management and Planning. doi-org.libraryproxy.griffith.edu.au/10.1080/09640568.2018.1540772*

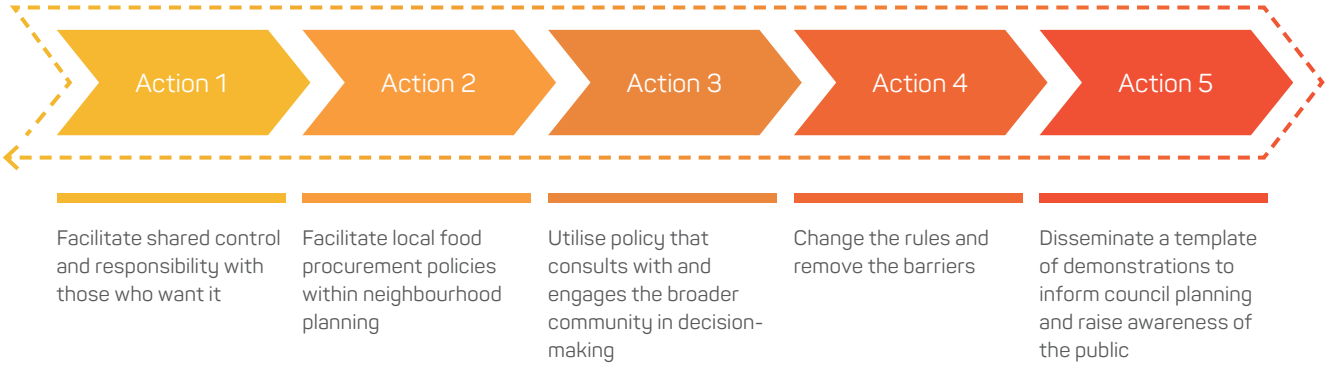


Figure 1: Actions to close the loop for enabling local food contingency planning.

Source: Reis 2019

express goodwill, connect with existing capacities in the community and harness the power of successful precedents. There is no need to reinvent the wheel, rather, community members need to know that they have permission to participate and express their goodwill.

Action 2: Facilitate local food procurement policies within neighbourhood planning

'Engaging a community in how it can prepare for, respond to and recover from emergencies is more likely to result in decisions and outcomes the community is confident about and will act upon, and this in turn will support the work of emergency management organisations.'[4] An increasing number of local food procurement policies can provide options for neighbourhood planning processes that address local conditions, needs and aspirations. Examples for local food procurement strategies include:

- People's food plan (Australian Food Sovereignty Alliance 2013)[5]
- Food-sensitive planning and urban design (Heart Foundation 2011)[6]
- A Future for Food (Public Health Association Australia 2012)[7]
- Paddock to Plate (Campbell 2009)[8].

Action 3: Utilise policy that consults with and engages the broader community in decision-making

Knowing that 'one-size' solutions do not address the needs of all contexts and circumstances, the key approach to emergency and disaster management is engagement with communities. The Community Engagement Model for Emergency Management, detailed in Australian Disaster Resilience Handbook 6[4], is guided by three overarching principles:

- Gauge the capacities, strengths and priorities of local communities such as their knowledge, experiences and existing networks.
- Acknowledge that communities are different and have varied perceptions of risk.
- Partnering with communities to support existing networks is contingent on mobilising the 'strategies that empower local action'.

Action 4: Change the rules and remove the barriers

An acknowledgment of the different perceptions of risk within communities necessitates 'identifying and addressing barriers to engagement'.[4] This includes internal barriers within government that produce policy and behavioural inflexibility to community innovation, participation in and distribution of locally-sourced food. This requires relaxation of legislative and policy constraints during and after severe weather events. For example, farmers being locked into exclusive contracts with corporations whereby food is physically available but contractually unavailable. Organisations need to be 'flexible enough to use knowledge to adapt to emerging situations. Learning may be difficult, but it is often unlearning that we really struggle with'.[9]

Learning organisations require 'purposefully modifying behaviour to reflect new knowledge and insights', which entails 'amending the existing way of doing things'.[9] Local councils have demonstrated creative capacities to do that in relation to 'street-curb' gardens. Once considered as 'guerrilla gardening' (the illegal activity of gardening on public land such as footpaths) gardening is now a legitimate activity through the creation of Verge Garden Guidelines. These guidelines allow individuals and communities to grow edible produce between the property boundary and the road kerb, for example, Brisbane City Council (2019).[10]

Action 5: Disseminate a template of demonstrations to inform council planning and raise awareness of the public

'Stakeholders need to be encouraged to share their potential lessons.'[9] Identifying and showcasing projects is an essential tool to raise public awareness of what can be done. Disseminating the achievements of local food visionaries and early adopters has good potential for building momentum. A focus for this is to build a business model for accessing locally available food. This includes local communities and businesses having business-based approaches to local food contingency plans. Formalising these arrangements can facilitate shared control and responsibility with those who want it – thus closing the loop.

Research details: *Enabling Community Action for Local Food Contingency*. At: www.griffith.edu.au/cities-research-institute/research/digital-earth-and-green-infrastructure/food-contingency.
For further information, contact Dr Kimberley Reis: k.reis@griffith.edu.au.

4 Commonwealth of Australia 2013, *Australian Disaster Resilience Handbook 6: National Strategy for Disaster Resilience: Community Engagement Framework, Australian Institute for Disaster Resilience. At: https://knowledge.aidr.org.au/media/1761/handbook-6-national-strategy-for-disaster-resilience-kh-final.pdf.*

5 Australian Food Sovereignty Alliance 2013, *People's food plan: A common-sense approach to a fair, sustainable and resilient food system. Revised edition following community input. At: https://afsa.org.au/wp-content/uploads/2012/11/AFSA_PFP_WorkingPaper-FINAL-15-Feb-2013.pdf.*

6 Heart Foundation 2011, *Food-sensitive planning and urban design: A conceptual framework for achieving a sustainable and healthy food system, Melbourne: VicHealth and VEIL. At: www.healthyplaces.org.au/userfiles/file/Design%20elements/foodsensitive_planning.pdf.*

7 Public Health Association Australia 2012, *A Future for Food 2: Healthy. Sustainable, Fair. PHAA Food and Nutrition Special Interest Group. At: www.phaa.net.au/documents/item/562.*

8 Campbell A 2009, *Paddock to Plate: policy propositions for sustaining food and farming systems. The Future Food and Farm Project Propositions Paper. Australian Conservation Foundation, Melbourne. At: https://apo.org.au/sites/default/files/resource-files/2009/10/apo-nid19512-1149991.pdf.*

9 Commonwealth of Australia 2013, *Australian Disaster Resilience Handbook 8: Lessons Management, Australian Institute for Disaster Resilience. At: https://knowledge.aidr.org.au/media/1760/handbook-8-lessons-management-kh-final.pdf.*

10 Brisbane City Council 2019, *Verge gardens. At: www.brisbane.qld.gov.au/environment-waste/natural-environment/plants-trees-gardens/verge-gardens.*

Increasing involvement of people with disability

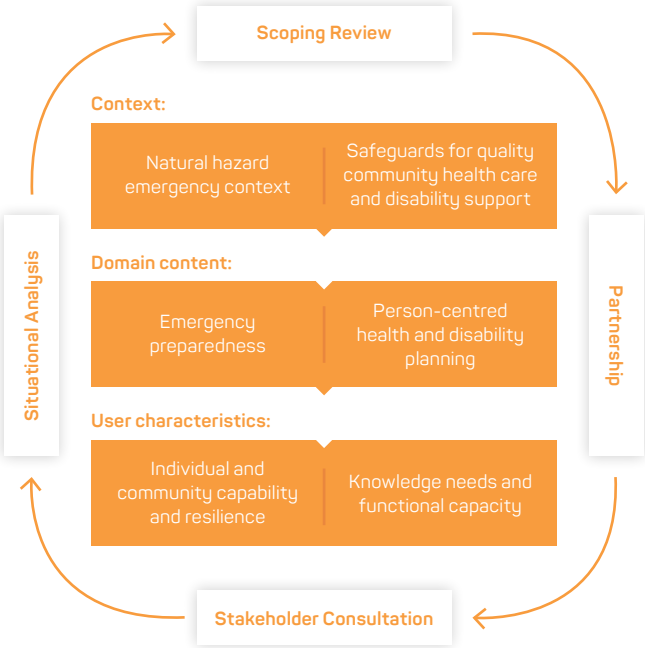
Dr Michelle Villeneuve, The University of Sydney

People with disability rely on different levels and types of function-based support. Access to this support can be compromised during and after a disaster.

People with disability are disproportionately affected[1] and experience higher rates of injury and death as well as face increased challenges during disaster response and recovery[2,3,4,5]. The *Sendai Framework for Disaster Risk Reduction 2015–2030* calls for 'a more people-centred preventative approach to disaster risk'. Australia, as a signatory to the framework must find ways to assist people to prepare for emergency events triggered by natural hazards. This includes people with disability and their support networks.

The Person-Centred Emergency Preparedness (PCEP) is a strengths-based process tool for people with disability and their service providers to develop emergency preparedness through self-assessment, targeted actions and advocacy relevant to the support needs they will have in an emergency. The PCEP was co-designed with 115 stakeholders from the disability, community and emergency services sectors. It was field-tested with people with disability in New South Wales and their community health and support providers. The project included a technical advisory committee that informed and guided the co-design process. Figure 1 illustrates the co-design methodology.

Methodology Development (Phase 1)



Methodology Field Test (Phase 2)

Process Goal

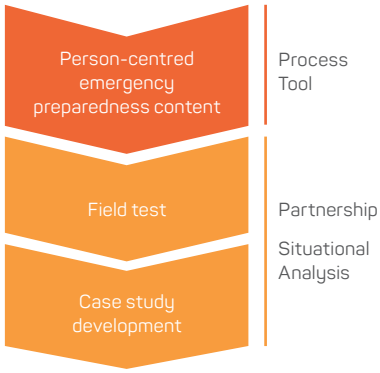
Co-design a tool and learning resources to develop capacity in community health and disability support providers for person-centred emergency preparedness WITH people with disability and chronic health conditions.

Intended Outcome

Community health and disability support providers will have knowledge, skills, and tools to engage in person-centred emergency preparedness.

Impact

People with disability and chronic health conditions will have a plan and communicate it with their social network.



PCEP tool and video-based learning resource

A freely available online person-centred emergency preparedness process tool and framework. Learning resource contains: tools and instructions, process guidelines and toolkit for implementing it, case studies that illustrate implementation.

Figure 1: Co-design of the Person-Centred Emergency Preparedness Toolkit took place in two phases: Development and Field Test.

1 Stough LM & Kelman I 2018, *People with Disabilities and Disasters. In Handbook of Disaster Research (pp. 225–242). Cham: Springer.*

2 Garlick D 2015, *The Vulnerable People in Emergencies Policy: Hiding vulnerable people in plain sight. Australian Journal of Emergency Management, vol. 30, no. 1, pp.31–34. At: https://ajem.infoservices.com.au/items/AJEM-30-01-10.*

3 Hisamatsu M 2013, *Panel discussion on disaster resilience and disability: Ensuring equality and inclusion. In Co-organized by UNDESA, UNISDR in collaboration with Indonesia and Norway and the Nippon Foundation. UN Headquarters, New York.*

4 Kailes JI & Enders A 2007, *Moving Beyond "Special Needs." Journal of Disability Policy Studies, vol. 17, pp.230–237. doi.org/10.1177/10442073070170040601*

5 Tatsuki S 2012, *Challenges in Counter-disaster Measures for People with Functional Needs in Times of Disaster Following the Great East Japan Earthquake. International Journal of Japanese Sociology, vol. 21, pp.12–20. doi.org/10.1111/j.1475-6781.2012.01158.x*

The PCEP enables people with disability to self-assess their emergency preparedness through the identification of capabilities and function-based support needs in eight areas: communication, management of health, assistive technology, personal support, assistance animals, transportation, living situation and social connectedness.

The PCEP classifies function-based needs that people with disability have in emergencies. Focusing on function enables more effective planning. For example, identifying risks for a person with spinal injury does not provide any information related to their support needs or how they will manage in an emergency situation. However, identifying disaster risk in terms of need for electricity to recharge batteries on a powered wheelchair and the importance of accessible transportation assists with effective problem-solving about how an individual will manage to shelter in place or evacuate safely.

The PCEP supports implementation of priorities outlined in the *National Strategy for Disaster Resilience* and the *National Disaster Risk Reduction Framework* by:

- defining person-centred responsibilities of people with disability to reduce their risks
- optimising the capability of service providers to contribute to disability-inclusive risk reduction through person-centred planning.

Person-centred preparedness conversations help people with disability to be involved in planning how they will respond in an emergency situation. Field tests showed that conversations about emergency preparedness can support people with disability to take steps towards increasing their preparedness. An open-access user guide and series of three videos illustrate how to implement the PCEP. The user guide contains quizzes and case examples to help people get started. As a person-centred planning tool, the PCEP supports community service staff to work with people with disability to:

- increase capacity for emergency preparedness
- reduce negative consequences of emergencies
- improve recovery.[6]

When an individual's needs do not match the level of support available, community service providers are encouraged to work together with individuals, their family and other people in the community, including local emergency managers, to address those discrepancies through collaboration.

Acknowledgment

This project received funding from the NSW Community Resilience and Innovation Program, funded under the Joint State and Commonwealth Natural Disaster Resilience Program.

Eight elements of the PCEP framework

Communication: getting and giving information by speaking or using some other medium (sign language, picture exchange, voice output device). It includes the use of Augmentative and Alternative Communication (*AAC). It is also the means of sending or receiving information such as telephone or computers.

*AAC are communication methods used to supplement or replace speech or writing for those with impairments in the production or comprehension of spoken or written language.

Management of health: medical management of conditions include medicines, nutritional or health treatment, management of wounds, catheters or ostomies, access to medical supplies and equipment and their maintenance, operating power-dependent equipment to sustain life.

Assistive technology: any device, system or design that allows a task to be performed that can increase safety or make tasks easier.

Personal support: assistance received for personal care or support with activities of daily living. It can include practical and emotional support.

Assistance animals and pets: trained and registered animals that provide help people to participate in personal and public life activities with confidence and independence (e.g. mobility guide, hearing assistance, diabetic or seizure alert). A pet or companion animal also provides support but are not classified as assistance animals and pets.

Transportation: includes independent travel and travel with others (e.g. family, personal support, carers) and includes transport of assistive technology and assistance animals.

Living situation: covers where people live and the context of their home situation including who they live with, the type of building, how long they have lived there, its accessibility, safety, security and adequacy of the physical environment and the geographic location.

Social connectedness: are personal and professional relationships. Personal (family, friend, neighbour) and professional (service provider, community leader) relationships can vary in closeness (e.g. acquaintance vs. close friend) and can be with individuals who are similar in status or with individuals of varying status and power.

Adapted with permission from Villeneuve, Sterman and Llewellyn (2018).

6 Villeneuve M, Sterman J, Llewellyn GL 2018, *Person-Centred Emergency Preparedness: A process tool and framework for enabling disaster preparedness with people with chronic health conditions and disability. Centre for Disability, Research and Policy, University of Sydney, NSW 2006. At: www.collaborating4inclusion.org/prepare-nsw/.*

What is the chance of an extreme event happening again next year?

Catherine Jolly and Janice Green, Bureau of Meteorology

After heavy rainfall or large flood events, newspaper headlines tend to use dramatic language and are too brief to tell the whole story. What does it all mean? How big are these events and how often are they likely to occur? Is there a more accurate way of communicating probability?

Engineers Australia led a review of the Australian Rainfall and Runoff guidelines and recommended some changes in terminology used for probability. The Bureau of Meteorology is adopting this terminology to describe the probability of heavy rainfall for forecasts and observations.

What is changing

The updated terminology uses Annual Exceedance Probability (AEP) displayed as a percentage. It emphasises that there is an equal probability of an event of a specified size occurring or being exceeded in any given year.

Previous terminology using Average Recurrence Interval (ARI), such as in '1-in-100-year event', is now discouraged as it suggests an elapsed time between each event. For example, after hearing that a location had experienced a 1-in-100-year event, you might be forgiven for thinking, 'I won't live to see another one of those in my lifetime'. However, statistics show there is a 26 per cent chance that a 1-in-100-year event could occur during a 30-year timeframe.

The table shows how the new terminology relates to the old. The shading represents the preferred new terminology for particular probabilities.

What it means

One way to describe this is that a 1-in-100-year event has a 1 per cent chance of happening in any given year, while a 1-in-1-year event has a 63.2 per cent chance of happening in any given year. For rainfall and flooding, these values are usually based on observations and therefore related to the climate of the region.

The probability of a specific rainfall amount or flood height occurring in a given year is not dependent on what has happened in recent years. It is possible for an event to occur more than once and such events can be clustered. It does not matter if there was a 1-in-100-year event two years ago, the chance of it occurring in the current year is still 1 per cent.

	New terminology		Old terminology
Frequency	Number of exceedances per year	Probability of event in any given year	Avergae recurrence interval
More likely	EY	AEP(%)	ARI (years)
	1	63.2	1
	0.69	50	1.44
	0.5	39.35	2
	0.22	20	4.5
	0.2	18.1	5
	0.11	10	10
	0.05	5	20
	0.02	2	50
Less likely	0.01	1	100

How to use the new terminology

The rainfall for a storm can be compared with the design rainfall estimates to determine the probability of the event. Flood flows can be compared with a flood frequency analysis.

Annual Exceedance Probability will be generally used for rainfall events with a probability of 50 per cent AEP and less.

The correct way to use the new terminology is to refer to the probability range that event falls within and the relevant storm duration.

> *The recent rainfall event had an annual exceedance probability of between 5 per cent and 10 per cent for the 3- to 12-hour durations.*

> *There was 26.6 mm in an hour during an afternoon storm yesterday. The probability of this occurring in any given year is between 2 and 1 per cent AEP.*

Terminology and definitions

Annual Exceedance Probability (AEP) – the probability of an event being equalled or exceeded in any given year, usually expressed as a percentage.

Average Recurrence Interval (ARI) – the average time period between occurrences equalling or exceeding a given value.

Exceedances per Year (EY) – number of times that an event is likely to occur or be exceeded within a year.

Intensity-Frequency-Duration (IFD) – These are statistical rainfall values used in the design of infrastructure in Australia, also known as Design Rainfall estimates. These design rainfall values are the amount of rain falling over different storm durations compared to historical records in the local area to determine the probability.

Probability – The chance of an event occurring based on statistical analysis of historical records, usually expressed as a percentage.

For other audiences, these statements can be simplified to the more frequent probability:

> *The recent rainfall event had less than a 10 per cent chance of occurring for durations shorter than 24 hours.*
>
> *The 26.6 mm of rain in an hour during an afternoon storm event has less than a 2 per cent chance of happening in any given year.*

So perhaps, future newspaper headlines will tell us what we actually need to know.

For more information, visit www.bom.gov.au/water/designRainfalls/index.shtml.

Disaster, emergency management and resilience terminology is in the Australian Disaster Resilience Glossary at https://knowledge.aidr.org.au/glossary/.

Taking preparedness action to scale

Jacqui Pringle, Australian Red Cross

Getting someone to think about, value and take action to prepare themselves for an outcome that is often not immediate or guaranteed, is hard. How about getting three million people across Australia to think about, value and take action to prepare themselves for an emergency, within a five-year timeframe?

That's the challenge that has faced Australian Red Cross since 2015 when an organisational strategy reset delivered a new outcome to its domestic emergency services program: three million people in Australia are equipped to prepare for and recover from a disaster by 2020.

Over the past four years the organisation has reviewed its existing disaster preparedness activities. In addition to our 'business as usual' direct delivery of face-to-face preparedness programs such as Emergency Rediplan[1] and the Pillowcase Program[2], we have collaborated internally and externally to explore alternative activities, tools and processes to better understand what works and what doesn't work when scaling preparedness action.

We've experimented with different types of technology to understand if we can design solutions that will allow us to reach more people and broaden our impact. Activities have included development of the Get Prepared app as part of our shared value partnership with general insurer IAG, development of tech prototypes through hackathons run in partnership with design agencies such as IBM and use of online testing platforms to test prototypes developed through these activities with potential users to determine opportunities for further development. We've explored virtual reality, digital execution, IoT, voice technology, facial recognition software and data sharing and protection software.

We have explored how we can better work through existing networks by identifying and engaging with groups and organisations for targeted promotion of preparedness action. We've partnered with Airbnb and promoted our preparedness products through the Red Cross Blood Service, the Uber app, the Resilient Sydney initiative, the Queensland carer network and, with financial incentive, through the national Carer Network. And we've experimented with various channels, messages and activities to optimise the promotion of our products through our national preparedness campaign.

Human-centred design

These activities have been undertaken applying 'human-centred design' principles to the way we work. This effectively means putting the user at the centre of all we do, which for Red Cross and our partners means undertaking audience and market research and better applying insights to inform what it is we are trying to achieve, working alongside community members to design the steps we need to take to get there, and testing products and ideas with the people most likely to use them.

Insights

- Unless someone is facing an emergency or has experienced one, people just aren't thinking about emergencies, let alone considering they should prepare for them.
- Even if people are thinking about an emergency and consider taking preparedness action a valuable thing to do, value does not equate to action.
- Even if we design great solutions, it is equally important to be able to motivate people to use them.
- If we are going to motivate people who have not experienced an emergency to take preparedness action, it needs to be relevant and reflect a person's context and needs.

Learnings

The user comes first

Action cannot be forced from the top down. Putting people at the centre of what we do is critical if we are to succeed in motivating action. The most scalable solutions are those that most effectively solve a critical problem or offer an attractive opportunity/experience

1 Emergecny RediPlan. At: www.redcross.org.au/prepare.

2 Pillowcase Program. At: www.redcross.org.au/get-help/emergencies/resources-about-disasters/resources-for-parents-and-teachers/pillowcase-project.

Red Cross worked with community members to design what was needed for effective preparedness actions.

Image: Red Cross

specific to an individual and their context. One size does not and will not fit all. So, we need to understand our users, their context, needs, attitudes and beliefs and continue to design solutions that meet their needs.

Communities with lived experience of emergencies are the experts

To successfully help individuals to prepare for and recover from emergencies we need to understand the emergency experience as an end-to-end journey and understand the challenges from the perspective of those travelling the path. Understanding the challenges that people faced, and including people with lived experience in the design of solutions, help us to ensure that the actions we are encouraging people to take beforehand will address the common pain points that people experience afterwards.

We need to understand what motivates people to take sustained action

Our insights show us that there are enablers and impediments to people taking preparedness action. While these will be very different depending upon the person and their circumstances, understanding and leveraging these insights will help us to motivate action.

Enablers:

- lived experience of an emergency
- perception that there is an imminent and proximate risk
- a health scare
- witnessing a family or friend experience an emergency
- having a responsibility for others
- gender (middle-aged women are more likely to take preparedness action)
- having a condition that is likely to be exacerbated by an emergency.

Impediments:

- lack of time
- perception that there is not a proximate risk
- inability to take action (real or perceived)
- having other, more pressing priorities
- perception that one is already prepared.

Using evidence to inform decision-making is critical

Having measures for success in place so we were clear on exactly what we were trying to achieve and how we were tracking at any given time was critical. These insights informed next steps and when we needed to discontinue a concept due to lack of interest or uptake.

Working with people who think and do things differently inspires great things

One agency will not scale preparedness action alone. All the progress achieved to date has been significantly influenced by the input and actions of collaborators. What works, what doesn't and what we might test next has been informed by many people who bring different perspectives, questions, tools, experiences and ideas to the table.

Conclusion

Red Cross has significantly increased the reach of its messages and activities to millions of people.

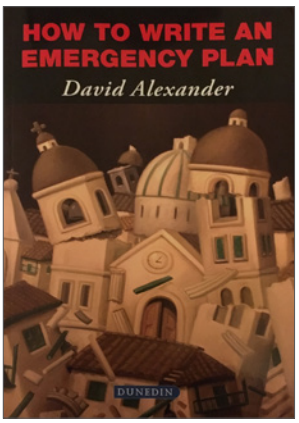
A key ongoing challenge is how we define being 'equipped'; a critical requirement of having a measurable target. Preparedness is not a finite state. It's subjective; what is appropriate for one individual may not be appropriate for another and we often ask people to do things or take actions that are not easily quantifiable.

Balancing the need to fulfil a numerical target with ensuring that we develop solutions that are most appropriate to the needs of communities and that will have affect continues to be a challenge. However, it is one that has forced us to think deeply about how we work and what our activities are achieving. Most importantly, it has helped us to support a greater number of community members in preparing for emergencies than would otherwise have been the case.

Given the seemingly inevitable effects of climate change, increased population densities and exposure to risk, the Red Cross experience provides a salient message for all organisations involved in preparedness programs; namely, the importance of putting the human at the centre of all we do and working collaboratively, not only within, but also external to, the emergency management sector. In doing so, we most effectively maximise our investment and collective effort to contribute to better prepared Australian communities.

How to Write an Emergency Plan

Reviewed by Adjunct Associate Professor Brett Aimers, James Cook University



Published by Dunedin Academic Press

Author: David Alexander, University College, London, United Kingdom

ISBN: 9781780460130

In his third related publication, *How to Write an Emergency Plan*, David Alexander once again provides an engaging and principles-based book, suitable for the novice and experienced emergency, disaster or crisis practitioner.

This book, while authored in the United Kingdom, is broadly applicable to those in a planning role, irrespective of their location, the maturity and funding of their systems and processes or the specific nature of a hazard or context they may be focused on (transport infrastructure or human health, for example).

How to Write an Emergency Plan provides the reader with an appreciation of the need for and importance of planning; before, during and after an emergency, disaster or crisis. In doing so, Alexander places an emphasis on the processes involved in planning versus the applicability of a rigid, untested document.

This book touches on a number of topical or emerging themes for a contemporary emergency, disaster or crisis planner, which include the importance of identifying lessons, the value of training coupled with practical experience and the rapidly shrinking degree of tolerance for the absence of plan.

In this book, Alexander not only considers the range of traditional circumstances, scenarios and hazard types (or sources) including natural hazards (fire and flood, for example) but extends to those that are less frequent, yet increasingly appearing on the risk profiles of governments. These include critical infrastructure failure, animal emergency diseases and human (public) health emergencies. In doing so, the book underlines the importance of acknowledging that while a type or classification of emergency, disaster and crisis may yield some common characteristics or indicate a consistent response, they are each different or unique and should be treated as such.

Pleasingly, *How to Write an Emergency Plan* explores the contemporary process of identifying lessons and their translation to recommendations and practice. The value of a lessons-management approach cannot be underestimated and should feature as a component of all emergency, disaster or crisis management systems, plans and arrangements.

An equally important concept for the emergency planner is explored in this book is that of resilience and, in doing so, has identified four interfaces (pillars) of resilience, being:

- social
- technological
- psychosocial
- physical.

As an experienced planner, I find this approach to understanding and considering resilience, from an emergency, disaster or crisis perspective, a refreshing one.

Not satisfied with delivering a useful resource for an emergency, disaster or crisis planner, in his conclusion, Alexander looks forward and provides the reader with an insight as to how the role of a planner may be perceived under a variety of more than probable scenarios.

I congratulate David Alexander on producing an very valuable resource and commend its reading to those with an emerging or established emergency, disaster or crisis planning role.

Based on a paper presented at AFAC19 – the annual conference of AFAC and the Bushfire and Natural Hazards CRC.

New human capabilities in emergency and crisis management: from non-technical skills to creativity

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ABSTRACT

Unprecedented future disaster events will require emergency managers to be creative in their thinking. The backbone of creativity is divergent thinking; cognitive thoughts that do not converge on one correct answer but diverge to a range of possible options. Preliminary research with emergency services organisations, not-for-profit organisations and the critical infrastructure sector identified an increase in creative output when personnel are given a set of constraints, both resources and context, in which to 'think divergently'. Consequently, future challenges for decision-makers in emergency and crisis management is identifying when creativity is required and how to use constraints to enhance creativity when organisational cultures demand compliance. This paper provides an overview of creativity in the context of decision-making and what this means for future leaders in the sector.

Introduction

When the 9-11 Commission handed down its final report, they identified the set of failures associated with the event. They wrote: 'We believe the 9-11 attacks revealed four kinds of failures: in imagination, policy, capabilities, and management' (National Commission on Terrorist Attacks upon the United States 2004, p.339). This was not the first, nor the last report following a major event to indicate the need for different ways of thinking for preparing and responding to such unprecedented events. The Royal Commission into the Black Saturday Bushfires in Victoria noted that 'the state-level emergency management arrangements still faltered because of confusion about responsibilities and accountabilities and some important deficiencies of leadership' (Victorian Bushfires Royal Commission 2010, p.8). Arguably, one of these failures in leadership was a failure to recognise and respond to the magnitude of the event; a similar failure of imagination identified in the 9-11 Commission report but with respect to a natural disaster.

In a report published in 1993, a year after Hurricane Andrew hit Florida, the United States General Accounting Office wrote:

> *The response to Hurricane Andrew raised doubts about whether FEMA is capable of responding to catastrophic disasters and whether it had learned any lessons from previous disasters. One could simply substitute Katrina for Andrew, and unfortunately, the same conclusions would be valid today. And that is very disturbing.*
>
> (Committee for Homeland Security and Governmental Affairs 2006, p.2).

The committee investigated why local, state and federal agencies were not able to work together as one cohesive unit.

> *The excuse that we have heard from some government officials throughout this investigation has been that Katrina was an unforeseeable ultra-catastrophe. While Katrina was, indeed, the worst natural disaster in our country in modern times, it had been anticipated for years and was specifically forecast for days.*
>
> (Committee for Homeland Security and Governmental Affairs 2006, p.4).

Other types of crises have suffered from similar problems. Haiven (2010) considered the Global Financial Crisis and financial crises in general as 'crises of both capital's imagination and of the social imagination more broadly' (p.1). Imagination, it seems, is – or at least should be, an important component of emergency and crisis response and recovery regardless of the industry or the origin of the event itself.

In recent times, one of the most significant changes in capability has been for emergency services organisations to embrace opportunities to 'build agility'. This is particularly important when facing non-routine and novel events. Contributing to this, previous research (Brooks *et al*. 2016) has explored cognition in the context of decision-making, developing training and aide memoires to support personnel in areas such as the management of cognitive biases and maintenance of situational awareness. The research supporting this work identified other problems related to developing options analysis and predicting consequences for out-of-scale events. This has led research end users to question how they can prepare future leaders for the new norm. For human factors research to adapt and remain relevant in this changing environment, the simple answer is: we need to build new human capabilities.

The future will demand that leaders think outside the box and use higher cognitive skills such as creativity and divergent thinking to address failures of imagination. Processes in creativity include thinking skills that are conducive to taking new perspectives on problems, pivoting among different ideas, thinking broadly and making unusual associations. These will be required to ride the wave of change. However, it is not enough to explore creativity solely from the perspective of a single sector. Emergency and crisis management necessitates a joint capability that transcends the public, private and not-for-profit sectors. Importantly, it is the managerial function charged with creating the frameworks within which communities can reduce vulnerability to hazards and cope with disasters (FEMA 2007). This differs to crisis management, which is organisationally focused and can have a material impact on an organisation's shareholder value, reputation, ability to deliver services to the community and, potentially, the viability of the organisation. Both require input from the highest levels to respond to and manage the actual and potential ramifications. Thus, emergency and crisis management are intrinsically linked. Society requires a collaborative, tri-sector approach to solve 'wicked' problems. We need to understand how to enhance creativity and if it differs between sectors. If it does differ, how can the positive and creative attributes be transferred between sectors so they can learn from each other? This paper explores these challenges and seeks to answer two key questions: How creative do emergency and crisis management personnel need to be, and can they be trained to be more creative?

Assistant Commissioner Rob McNeil during Australia's SAR deployment to Fukushima. In highly novel situations, decision-makers need to combine divergent and convergent thinking to achieve the best outcomes.

Image: courtesy Rob McNeil

Background

One of the most highly cited guides to understanding non-technical skills (Flin, O'Connor & Crichton 2008) identified a generic set of seven non-technical skills categories for higher-risk occupations, namely situation awareness, decision-making, communication, teamwork, leadership, managing stress and coping with fatigue. Two of these skills are centred on managing cognition (situational awareness and decision-making), three are social (communication, leadership and teamwork) and the final two relate to wellbeing (managing stress and fatigue). Managing these skills has led to training approaches such as Crew Resource Management in aviation and Bridge Resource Management for commercial shipping.

Emergency and crisis management arrangements in Australia and New Zealand have facilitated an industry-wide approach to adopting similar standards relevant to the sector. An emergency and crisis management professionalisation scheme was based on the three core capabilities developed using an evidence-based approach (Owen *et al*. 2016) and are shown in Figure 1. A review of the key components by Owen and colleagues (2018) revealed significant alignment and prominent additions. The key cognitive skills identified in other domains are present (decision-making, situational awareness), the social skills are included (background conditions for teams, encouraging others) as are the skills associated with thinking and wellbeing. Where this approach departs from, and potentially improves on, non-technical skills is with respect to individual 'qualities' or values (i.e. 'modelling ethics and inclusiveness' and 'recognises own strengths and limitations'). The inclusion of these more 'personal' skills reflects the challenges of working in incident management and the exposure to the major consequences of incidents on a regular basis.

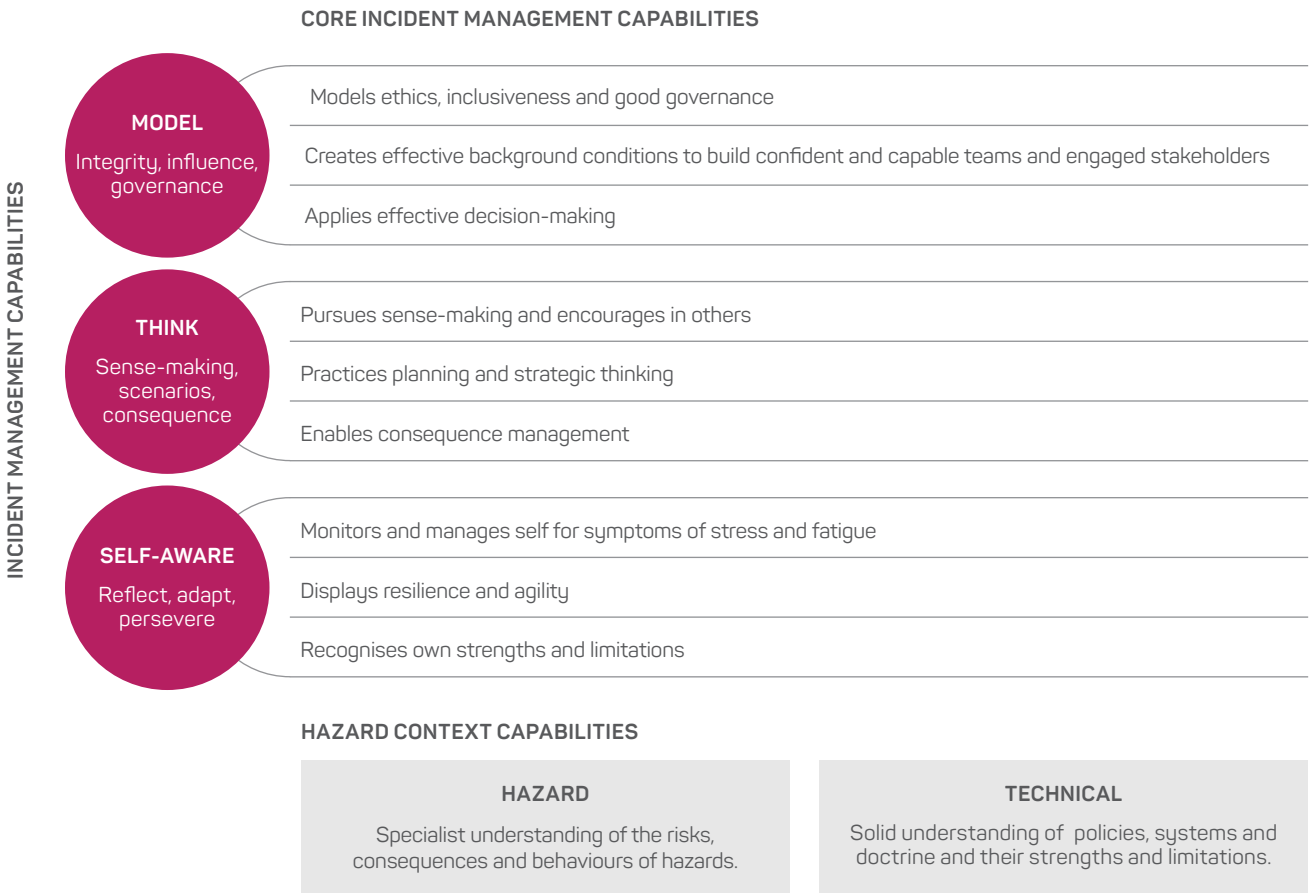

Figure 1: Core incident management capabilities.

Source: Owen *et al.* 2018

Hayes and Omodei (2011) identified the competencies required for wildfire Incident Management Team members, and Butler, Honey and Cohen-Hatton (2019) built a set of behavioural markers for United Kingdom Fire and Rescue Service incident commanders. This includes the articulation of a set of skills that are human-centric and non-technical. However, the typical emergency and crisis management response to providing professional development for non-technical skills has been piece-meal at best. While the Australasian Inter-Service Incident Management System (AIIMS) includes basic human-factor modules, this is not as coherent a response as the Crew Resource Management or Bridge Resource Management programs. AIIMS was developed for a particular segment of emergency and crisis management (e.g. natural hazards) and does not include other sectors involved in emergency and crisis management such as police, local governments, the critical infrastructure sector and environment agencies. The response should not be limited to training. Non-technical skills assessment needs to be embedded in operations as part of assurance activities to demonstrate the system is operating as intended. There is still significant work to do in emergency and crisis management to develop and maintain non-technical skills and to operate in complex teams during response and recovery stages.

Improvements to extended non-technical skills are unlikely to be sufficient, especially if the incident being managed increases in scale and novelty and becomes a disaster or an organisational crisis. Under these circumstances, new skills that support human performance are likely to be related to creativity.

Creativity

Research on creativity has its origins in psychology (Guilford 1950). Subsequent research identified the traits of creativity and the creative process (Hennessey 2010). This early work concentrated specifically on the individual and understanding the nature of their creativity, with an emphasis on identifying the component parts that should be included (Torrance 1966). Later, empirical research started exploring why some groups are more effective than others. This research focused on creativity as an outcome of teamwork (Hackman & Morris 1975). Researchers referred to creativity as an outcome product or a service that was conducted by research teams within an organisational environment (Amabile *et al.* 1996). In organisational contexts, creative solutions may be expressed in both tangible and intangible forms such as strategies and ideas (Oldham & Cummings 1996; Woodman, Sawyer & Griffin 1993). This marks a shift

in creativity research that was historically confined to psychology and then branched into management and organisational studies. In the latter disciplines, creativity can be defined as the development of novel and useful ideas in any domain (Amabile *et al*. 1996).

Team creativity

The foundations of contemporary creativity theory in the context of organisations is underpinned by two main theoretical frameworks. These are the interactionist model (Woodman, Sawyer & Griffin 1993) and the componential model (Amabile 1988, Amabile *et al*. 1996). The Woodman, Sawyer and Griffin (1993) interactionist model identifies the various social and organisational influences on creativity and separates these into three levels: individual, group and organisation. At the individual level, elements of creativity include personality, creative behaviour, cognitive abilities, intrinsic motivation and knowledge. At the group level, creativity is affected by the composition, characteristics and processes of the group. Both the individual and group levels are influenced by social and contextual features. At the organisation level, creativity is dependent on the individual and the composition of individuals in a group as well as the structural elements of the organisation, including communication and information arrangements (Woodman, Sawyer & Griffin 1993).

The componential model of creativity associates individual creativity to the social and contextual features of the organisation (Amabile 1988). Therefore, creativity within organisations tends to develop novel and useful solutions by virtue of an individual's creativity (Amabile 1983, Staw 2009). Complementing this, group and team creativity is a collection of individual work undertaken interdependently on a collective task (Woodman, Sawyer & Griffin 1993, Zhou & Shalley 2008). Therefore, team creativity is a function of aggregated individual creativity and of team creativity-relevant processes, which include goal setting, participation in team problem-solving and synthesising ideas (Taggar 2002). Notably, team creativity relies on the individual's creative ideas that derive from knowledge repositories and cognitive abilities as well as on the team's capabilities to recognise and apply such ideas (Baer *et al*. 2008). Amabile and Pratt (2016) posit that creativity is reliant on individuals and teams generating novel ideas and that the two are, therefore, intrinsically linked. Consequently, individual and team creativity in the componential model require three distinct yet complementary components to be creative, being:

- skills in the task
- creativity-relevant processes
- an intrinsic motivation to do the task (Amabile 1988, Amabile & Pratt 2016, van Knippenberg & Hirst 2015).

Individuals and teams require cognitive skills to be creative, but to maintain creativity they also have to be intrinsically motivated (Amabile *et al.* 1996, Hon 2011). Intrinsic motivation safeguards against distractions and encourages exploration (Amabile *et al*. 1996, Shalley & Perry-Smith 2001). In addition, individuals and teams that are intrinsically motivated are more likely to take risks that encourages radical creativity (Amabile *et al.* 1996). Radical creativity can be defined as generating completely novel paradigms as opposed to incremental creativity that involves expanding on or making improvements to current paradigms (Audia & Goncalo 2007, Gilson & Madjar 2011, Unsworth 2001).

The basis for creative performance includes the individual's expertise and factual knowledge and their technical skills for doing work and advancing their knowledge (Amabile 1988, Amabile & Pratt 2016). The creativity of an individual in a team requires the basic resources at the organisational level (Amabile & Pratt 2016; Woodman, Sawyer & Griffin 1993). Therefore, teams require adequate resources from the organisation to aid creativity. This comprises of sufficient infrastructure within and external to the organisation and access to necessary information (Amabile & Pratt 2016). An important organisational characteristic when fostering a creative environment is allowing the time for teams to explore creative solutions and implement those solutions effectively (Lawson 2001). Given the complex nature of most problems facing contemporary organisations, there may be a requirement for skills in multiple domains for the most novel and useful ideas (Amabile & Pratt 2016).

The componential model of creativity includes creativity-relevant processes, or the skills required for creative thinking (Amabile 1988, Amabile *et al*. 1996). Creativity-relevant processes include cognitive styles, perceptual styles and thinking skills. These attributes allow individuals and teams to take new perspectives on problems, think broadly and pivot among ideas. Creativity requires the generation of ideas that are divergent, but this does not necessarily lead to generating a lot of ideas (Amabile 1988, Audia & Goncalo 2007). When an individual's or a team's thinking is narrowly focused on the refinement of an existing non-creative idea, this may not result in the generation of divergent ideas. Conversely, once an individual or team has generated a creative idea, future creative efforts may be framed from the perspective of the initial idea (Audia & Goncalo 2007).

Important elements in any creativity-relevant process is the ability to think divergently and to refine the creative ideas for the selection of solutions. This requires convergent thinking (Sowden, Pringle & Gabora 2015). To foster creativity needs a harmonious relationship between divergent and convergent thinking. Consequently, it is important that individuals and teams recognise when to decouple from divergent thinking and switch to convergent thinking (Sowden, Pringle & Gabora 2015). Managing extremely divergent ideas that assist making unusual associations may be risky (Amabile & Pratt 2016, Audia & Goncalo 2007). In addition, developing creative self-efficacy in the individual or team can contribute to shunning conformity that may increase the novelty of ideas (Amabile & Pratt 2016; Gong, Huang

& Farh 2009). Novelty and value are critical features of creativity-relevant processes. However, although they are complementary, they are separate skills and both must be present for creativity to occur in decision-making (Sommer & Pearson 2007).

Linking creativity and decision-making

A creative decision is defined as:

> *...a decision that is both a novel contribution and of value to a decision context. A novel decision is unusual, uncommon, unconventional or unique from past decisions and reflects responses to new or unique choices for solving a problem in a crisis. In regard to crisis management, a valuable or effective decision occurs when potential crises are averted or when key stakeholders believe that the short- and long-term successes of crisis management efforts have outweighed the failures.*
>
> (Sommer & Pearson 2007, p.1236).

Sommer and Pearson (2007) argue that novelty and value are complementary but separate characteristics and both must be present for creativity to occur. Solutions that are of high-value but not novel have presumably already been evaluated and either implemented or discarded. This is why individuals or teams might need to come up with other creative solutions.

Divergent thinking

Much of what is understood about creativity, particularly in how it is measured, comes from studying divergent thinking. The backbone of creativity assessment is divergent thinking (Kaufman, Plucker & Baer 2008) that can be defined as cognitive thought that leads in various directions. This suggests that it does not converge on one correct answer but diverges to a range of possible answers. Four aspects of divergent thinking are frequently measured, which is more complex than Sommer and Pearson's (2007) articulation of creativity in decision-making:

1. Fluency – the number of responses to a particular stimulus.
2. Originality – the uniqueness of the responses.
3. Flexibility – the number and uniqueness of the categories of response, adapting and changing the meaning, use or interpretation of something.
4. Elaboration – extending or adding detail to the responses.

The dominant test of divergent thinking is the Torrance Tests of Creative Thinking (TTCT) that is 'by far the most commonly used test of divergent thinking and continues to enjoy widespread international use' (Kaufman, Plucker & Baer 2008, p.25). Table 1 lists the various tests within the TTCT and shows how associated skills and knowledge might be functionally valuable in emergency and crisis management.

Table 1: Categories of creativity in the Torrance Test and application to emergency and crisis management.

TTCT subtest	Application to emergency and crisis management
Asking – ask as many questions as possible about a picture.	Asking questions is a crucial component of maintaining psychological safety and gathering opinions in high-consequence and highly complex decisions. This translates to gaining as many views as possible from team members.
Guessing causes – list possible causes for a pictured action.	Cause and effect are important concepts in emergency and crisis management. Although hazards such as fire and flood do not obey human boundaries they do act within the laws of nature, including cause-and-effect relationships.
Guessing consequences – list possible consequence for a pictured action.	Consequences are often, wrongly or rightly, the way success is determined in emergency and crisis management. Understanding all possible consequences is important in the preservation of life and property and, therefore, in the associated management of risk.
Product improvement – make changes to improve a product.	Improving actions and plans in emergency and crisis management is a valuable component of the decision-making cycle.
Unusual uses – think of different uses for an ordinary item.	The improvised use of assets in emergency and crisis management, particularly during unexpected situations offers value.
Just suppose – list the possible ramifications of an improbably situation.	Listing ramifications of improbable situations includes worst-case-scenario planning. It is qualitatively different because it identifies multiple unlikely scenarios with a range of ramifications, not just the worst-case scenarios.

Using these elements to create a model of divergent thinking linked to the products of managing an incident, disaster or crisis, shows there is significant benefit from divergent thinking. Asking questions is important in building situational awareness and supporting a 'common operating picture'. Many elements contribute to developing options and integrating them within an Incident Action Plan (causes, consequences, different uses of assets and improbable situations and

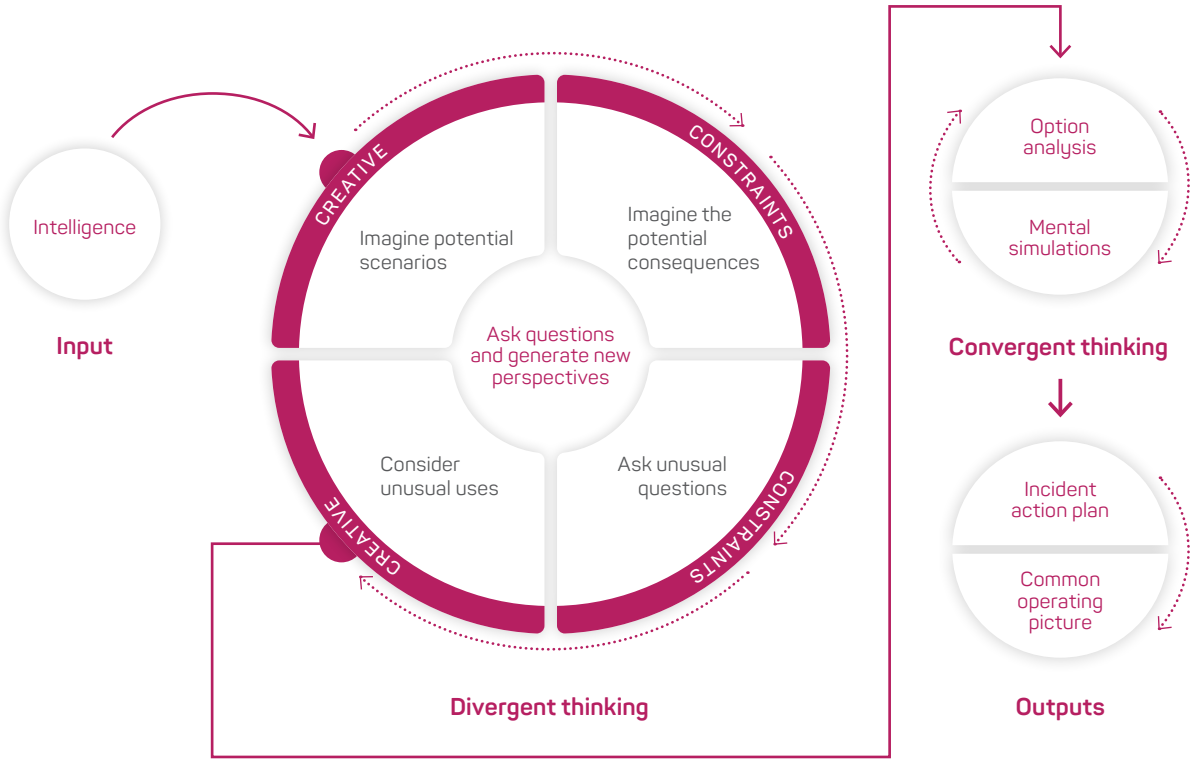

Figure 2: A method to develop creative solutions in disasters and crises.

ramifications). Monitoring risk and revision of the plan improves activities and processes.

This study revealed a tenfold increase in creative output when emergency and crisis management personnel were given a set of constraints (resources and context) in which to think divergently (Curnin & Brooks, forthcoming). Rosso (2014) identified that some theorists find that creative individuals and teams can benefit from constraints. A study by Medeiros Partlow and Mumford (2014) asked participants to develop advertising campaign materials. The study found that task objective constraints resulted in better creative problem-solving when participants were motivated. However, imposition of multiple constraints led to poorer creative problem-solving. This suggests there is still work required to understand how constraints support or impede creativity.

In the context of emergency and crisis management, creativity can be bound by several constraints. These include hierarchical structures, standard operating procedures, bureaucratic expectations and legal prescription that influence the creative process. However, these is a move away from prescriptive standard operating procedures during non-routine events within some emergency services agencies. For example, the Tasmania Fire Service provides six operational priorities for leaders to consider when bushfires are uncontrolled (Tasmanian Government 2013). These options are not sequential in nature and allow personnel to consider multiple options simultaneously due to the interconnected nature of priorities. This type of approach is consistent with the elements associated with divergent thinking. Nevertheless, it remains to be seen if the sector and importantly, commissions of inquiry that predominantly favour a traditional decision-making method, will accept this creative approach.

When a team has considered the creative constraints and has thought divergently to produce creative output, they then must hone it in order to make it fit-for-purpose. This process is the change from divergent to convergent thinking. Convergent thinking is a deliberate process that involves screening, selecting, evaluating and refining options. In emergency and crisis management this could include performing these deliberate tasks for the best- and worst-case scenarios, the most likely scenario or anything in-between.

Finally, the team should perform a 'reality test' on the preferred option(s) to establish feasibility. This is akin to the mental simulation identified in the Recognition Primed Decision-Making Model (Zsambok & Klein 1997). It is also necessary to work within the management system, informing the Common Operating Picture and developing the products the systems required, such as Options Analyses and the Incident Action Plan.

Conclusion

There is still significant work required in emergency and crisis management to develop and maintain what might be described as 'foundational' non-technical skills during

response and recovery phases. Skills include cognitive, social and wellbeing skills as well as ethical or value-based competencies. As the 'new norm' includes larger, more complex, multi-hazard and multi-jurisdictional incidents, the skills associated with creativity might be added to this group. While the 'norm' might be new, an old example by Weick (1993) can demonstrate the challenges to building creative skills in emergency and crisis management:

> *On 5 August 1949, a wildfire overran sixteen firefighters in Mann Gulch on the Helena National Forest in Montana in the United States. Only three survived the supervisor and two members of an eighteen-person 'smokejumper' crew that had parachuted into a small valley or gulch near the fire. These deaths were a shocking loss to the firefighters' families and friends. The tragedy was also a severe blow to the Forest Service, which had not experienced a fatality during a decade of 'smoke-jumping' and was extremely proud of its elite firefighters. Repercussions from this incident were severe and long lasting (Rothermel, 1993). In his seminal study of the Mann Gulch fire, Weick (1993) notes:*
>
> *'Dodge's invention of burning a hole in a fire should not have happened. It should not have happened because there is good evidence that when people are put under pressure, they regress to their most habituated ways of responding. This is what we see in the 15 people who reject Dodge's order to join him and who resort instead to flight, a more overlearned tendency. What we do not expect under life-threatening pressure is creativity'.*
>
> (Weick 1993, p.638–639).

Equally, other disasters highlight this challenge. They also indicate why any form of divergent thinking needs to be brought back to reality by convergence with the key systems and products of incident response and recovery.

The CRC project associated with this research has explored the skills associated with divergent thinking. It was clear that each of the six divergent thinking sub-skills had a role in emergency and crisis management decision-making. The challenges include identifying when creativity is required, how to use constraints to enhance creativity and other challenges related to previous training, risk aversion and organisational cultures that stipulate compliance. Workshops conducted with participants from across emergency and crisis management in this area produced the comment:

> *I've spent my whole career learning how to operate within this system, but now you want me to think outside it? I'm up for the challenge, but it's going to take more than a workshop to achieve the outcome.*

The work continues.

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Measuring environmental losses from natural disasters: a case study of costing bushfires in the Northern Territory

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ABSTRACT

Natural hazards cause sustained loss to the environment, yet the economic costs are largely not accounted for due to a lack of market measures. This research applies methods of global and national costing and proposes an integrated framework that incorporates marketable and non-marketable losses including those to the environment. These methods are applied to bushfires in the Northern Territory for estimating the cost of loss of ecosystem services as a surrogate. These fire events affect 20 per cent of the total land area annually (based on 18 years average from 2000–2018) and cost ~$150 million per annum. Losses were greatest on the Indigenous lands, followed by pastoral and conservation areas. It is calculated that the effect of bushfires on 'loss of wellbeing' for the remote Indigenous population is, conservatively, $272 million per year. An understanding of the costs of loss of environment is essential to develop emergency management policies that are effective in enhancing the resilience of communities.

Introduction

Disasters that arise from natural hazards present serious concerns, not only for people, but also to the natural environment. This is due to the significant increase in their frequency, intensity and impact on global populations over the past 50 years (World Risk Report 2017, Centre for Research on the Epidemiology of Disasters [CRED] and United Nations Office for Disaster Risk Reduction [UNISDR] 2018).

Australia is highly exposed to extreme natural hazards particularly cyclones, floods and bushfires (Guha-Sapir, Santos & Borde 2013, UN and ECLAC 2014). Approximately 80 per cent of Australia's population reside in coastal areas and much of this area is directly exposed to cyclones and floods with inland areas experiencing a history of severe bushfires (Ladds *et al.* 2017, Sangha, Edwards & Russell-Smith 2019a). On average, the total cost of disaster-related losses is estimated at $1.75– $3.26 billion per annum in 2013 values as detailed by Ladds and colleagues (2017) or $18.2 billion per annum in 2016 values as detailed by the Australian Business Roundtable for Disaster Resilience and Safer Communities (ABRDR&SC 2017). Most of these costs account for marketable losses of direct and indirect goods and services but exclude the loss of environmental assets and their benefits to people.

Measuring a true cost of these disasters, particularly including loss of environmental assets and their benefits, remains a challenge. In a recent report, CRED and UNISDR (2018) highlighted that the reported losses account for part of the story and 63 per cent of the disaster-related reports to the EM-DAT (the international Emergency Management Database managed by CRED) contain very little accounting for environment losses, if any. That report stressed the need to evaluate environmental costs.

Current methods for measuring loss from disasters largely rely on insurance data (e.g. insurance losses of infrastructure or crop and livestock production) with very little account of environmental assets and their benefits (Handmer, Ladds & Magee 2018). To fully understand the cost of disasters, accounting measures need updating to include people's wellbeing and the related losses that are outside the typical market economy.

Determining bushfire-related environmental loss is critical to understanding the total economic costs and to plan for disaster management and resilience policies. In Australia, the northern landscape is imbued with Indigenous cultural and spiritual values (Archer *et al.* 2019). When bushfires destroy these values, current techniques (applied by emergency service organisations) typically fail to consider or document their loss because there is no loss of infrastructure. Understanding community values concerning the natural environment and incorporating them into policy-decision-making is a first step. Hence, developing appropriate accounting techniques to estimate disaster-related losses from a wellbeing perspective is essential.

This paper offers an integrated framework to account for environmental—largely non-marketable (and other tangible or marketable)—losses. Various cost-valuation techniques from the trans-disciplinary field of 'Ecological Economics' are also applied. Environmental benefits such as clean air or regulation of water supply and their losses are considered as non-marketable because these are not traded in the typical market. A costing framework is presented to underpin these losses. A case study is used to cost bushfires-related losses for the Northern Territory (NT). The NT experiences bushfires that are expansive and frequent, yet no costs are estimated as losses from these bushfires are mainly non-marketable. Such losses are assessed in terms of loss of wellbeing for remote Indigenous populations. Incorporating the loss of environmental values and wellbeing could help evaluate total disaster-related losses to inform disaster management policies and enhance resilience.

Economic costing frameworks

The key global frameworks used to assess the losses attributed to disaster events include the United Nations Economic Commission for Latin America and the Caribbean (UN ECLAC) (2014) and the World Bank (2010).

The UN ECLAC (2014) framework includes three domains:

- Direct damages (stocks) and losses (flows) (marketable and tangible): these are physical and include public infrastructure; public, business and private buildings; crops and farmland.
- Indirect losses (occurring as a consequence of the disaster) (marketable and tangible): relate to business disruption and loss of public services including transportation, health and education.
- Non-marketable losses (non-marketable and intangible): relate to social (fatalities, injuries), psychological (health impacts) and environmental losses.

Direct damage assessment is measured from insurance losses, which are used to calculate total damage applying factors or 'multipliers' (simple factors for particular types of disasters). The ECLAC approach is to estimate the cost of repairing or replacing damaged infrastructure as well as the effects on various social and economic sectors, such as education, health and balance of payments. However, the loss of environmental services to wellbeing is not estimated yet well acknowledged (UN ECLAC 2014).

In Australia, a similar framework is followed, as reported in the assessments conducted by Handmer, Ladds and Magee (2018), ABRDR&SC (2017), Bureau of Transport Economics (2001) and others. Direct losses are estimated using insurance data, and indirect losses (e.g. loss of public or private service) from other sources of data and or applying the factors of Insurance Loss Ratio (Joy 1991) or multipliers for death and injury. For example, the Insurance Loss Ratio for bushfires and storms is 35 per cent; meaning the insurance losses from bushfires and storms represents 35 per cent of the total losses. Similarly, the Insurance Loss Ratio for tropical cyclone, floods and earthquake represent 20 per cent, 10 per cent and 25 per cent, respectively, of the total costs. In other words, a factor of 3 for bushfires and storms, 5 for cyclones, 10 for floods and 4 for earthquake is typically used to calculate the total costs. In Australia, the Insurance Loss Ratio is equivalent despite significant variations in how people value resources in different parts of the country.

Direct damages and indirect losses are considered tangible or marketable while social, psychological and environmental losses are considered intangible or non-marketable. The UN ECLAC (2014) and Australian frameworks amalgamate direct and indirect intangible losses under intangible. In contrast, the World Bank (2010) framework measures the economic losses from disasters for direct and indirect costs, each involving marketable and non-marketable losses:

- Direct costs:
  - Marketable: public infrastructure; public, private and business buildings; crops, livestock and fences.
  - Non-marketable: health, death, loss of ecosystems and their services, and cultural assets.
- Indirect costs (as a consequence of disaster):
  - Marketable: business disruption, communication and network and computer disruption, loss of work and public services, residential and non-residential clean-up.
  - Non-marketable: poor health; loss of public amenity; loss of water, electricity and gas services; sewerage treatment and volunteer services.

Table 1 shows the application of the World Bank (2010) framework, with some modifications, for distinguishing marketable and non-marketable losses within direct and indirect categories to consider how each loss impacts on people's wellbeing.

Overall, total disaster costs = Direct (marketable ($) + non-marketable losses ($ and non-$ measures)) + Indirect (marketable ($) + non-marketable ($ and non-$ measures)) losses.

Case study: costing bushfires in the NT

Bushfires are an ecological driver of the mesic savannas and arid lands of central and northern Australia and fire management has been practised by Indigenous people for millennia (Russell-Smith *et al.* 2003). Traditional fire management involved burning the land for various reasons as people moved around (Yibarbuk *et al.* 2001). These fires were set incrementally throughout the seasons particularly during lighter winds and in moist or uncured fuels. They were generally small (<1 km^2) and patchy and were more or less even across the landscape (Garde *et al.* 2009). This practice of burning led to:

- breaking up of continuous ground layer fuel loads, thus restricting the spread of unintended fire
- a mosaic of different seral stages of post-fire vegetative regeneration, providing a variety of food and habitat and enabling the persistence of fire-sensitive biota (Letnic *et al.* 2004).

These practices have largely ceased with the collapse of Indigenous populations (Burrows, Burbidge & Fuller 2006). As a result, contemporary unmanaged fire regimes have become dominant with extensive severe bushfires occurring during hot and dry windy weather (Russell-Smith *et al.* 2013). However, traditional fire practices are being revived, particularly in the north of the Territory.

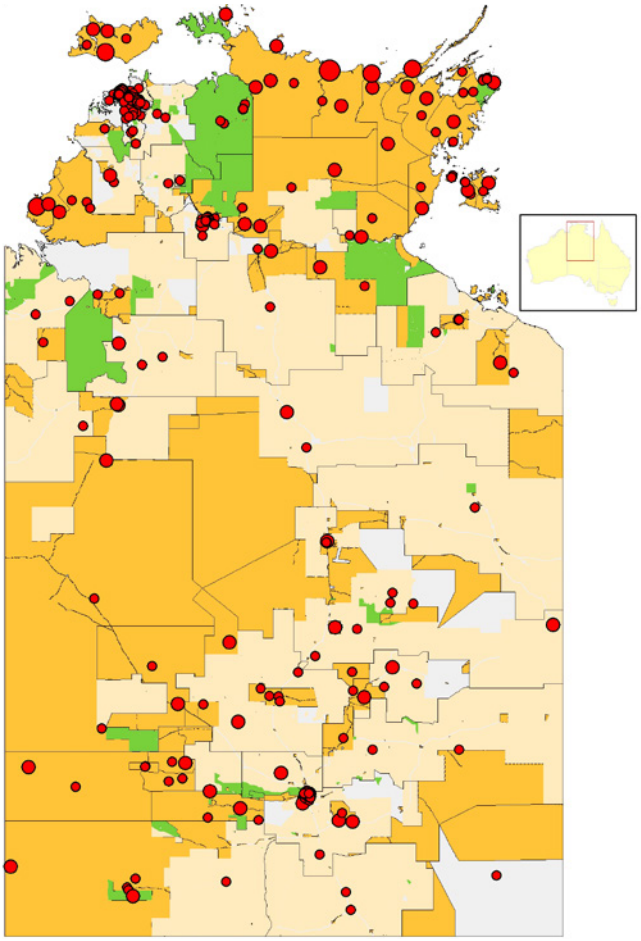
The NT population is approximately 246,000 with 27 per cent being Indigenous. More than 50 per cent of Indigenous people live in remote areas (35,414 people) (ABS 2016) and are spread across the NT landscape (Figure 1), some retaining knowledge and skills to manage fire (Russell-Smith *et al.* 2013).

Although the current Emissions Reduction Fund scheme offers opportunities to manage fires, these are limited to areas above 600 mm rainfall isohyet in northern Australia, covering an area of 1.2 million km^2. However, the frequency of bushfires, particularly late dry-season fires, and the damage they cause to biodiversity and water resources as well as to Indigenous cultural and sacred sites, is enormous (Figure 2) (Russell-Smith *et al.* 2013, Letnic *et al.* 2004). So far, there has been no accounting of bushfire-related losses in the NT, which are assessed here.

Methodology

Burnt area estimations

In order to quantify the effects of bushfires, fires greater than 1 km^2 were considered as having a negative effect. This threshold has been applied in assessment of fire regime change with regard to addressing the needs of fire-vulnerable fauna and flora with restricted home ranges and dispersal capacity in northern savannas (Evans & Russell-Smith 2019). It is also commensurate with the mean size (63.9 ha) of traditional fires



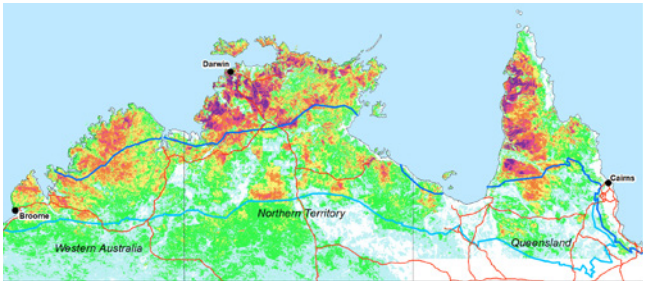
Legend

Indigenous population
- 1-100
- 101-500
- 501-1000
- >1000

Land tenure classes
- Indigenous
- Crown lease
- Conservation
- Grazing

Figure 1: Indigenous communities and dominant land uses in the Northern Territory.

Source: ABS 2016, CAPAD 2016 and Aboriginal land entitlements under ALRA (1976).



Number of times burnt (2000-2018)

- 1-3
- 4-6
- 7-9
- 10-12
- 13-15
- 16-19

Figure 2: Average fire frequency 2000–2018 across northern Australia with 600 mm rainfall and 1000 mm rainfall isohyet regions.

Source: North Australia and Rangeland Fire Information website (www.firenorth.org.au/nafi3/)

Table 1: Framework to measure the effects of disasters on people's wellbeing for various direct and indirect losses.

Natural Disaster impacts on human wellbeing	Economic indicator	Details and sources
Direct Marketable losses: private, business and public buildings, infrastructure, farmland, etc.	Insurance costs or loss of production using market value.	BTE (2001), Handmer, Ladds and Magee (2018) and Ladds and colleagues (2017). Example: In Australia, loss of pastoral production is estimated for dry pastures at $30/ha, irrigated $370/ha and fences 5000/km^2 (BTE 2001).
Direct Non-marketable losses: health injury and/or death	Loss of work opportunity over a person life span estimated by applying 'Value of a Statistical Life' concept. Alternatively, because human live is priceless, listing the number of deaths is an adequate indicator itself to inform the policies.	Handmer, Ladds and Magee (2018) Example: $4.2m is applied for loss of a statistical life, $853,000 for serious and $29,600 for minor injuries (Office of Best Practice Regulation 2014). The number of deaths can be listed without applying any monetary measure, following CRED and UNISDR (2018), World Disasters Report (2018) and World Risk Report (2017). Serious and minor injuries could be costed (as above) as individuals may have a chance to resume normal life after the recovery process.
Loss of ecosystems and their services: loss of clean air or water, aesthetic value of the landscape, or the production potential of farming lands	Affected area of all ecosystems, and related loss of ecosystem services that are important for people's wellbeing. It involves evaluating how people value their natural systems and applying marketable and non-marketable tools.	Loss of ecosystem services can be estimated using: 1. TEEB-ESV global database (2019) offering monetary values for ecosystem services from different ecosystems across the globe 2. studies by de Groot and co-authors (2012) evaluating greater than 600 ecosystem services or Costanza and co-authors (1997) evaluating greater than 100 ecosystem services 3. applying pertinent values from local studies or surveys. Example: Loss of wetlands in the United States of America due to hurricanes estimated at US$33,000/ha (2007 values) (Costanza *et al.* 2008).
Loss of cultural assets	Insurance losses or reconstruction costs for man-made structures. If an asset is part of a natural landscape, then measuring the monetary and non-monetary loss of the asset's service. Numbers of visitors and related travel losses can also reflect the value of lost asset.	Replacement methods or reconstruction costs can indicate the loss of natural and cultural assets. For loss of nature-related cultural sites, cost of managing natural and cultural lands or the value of lost services (tourism benefits) from the natural and cultural assets (World Bank Group and GFDRR 2017). There are also Willingness To Pay (WTP, to restore a service or good) or Willingness to Accept (WTA, the loss of a good or service) methods that are typically applied to evaluate natural and cultural losses. However, validity depends on the socio-economic, geographical and cultural perceptions of communities (Sangha *et al.* 2017). Example: In 2015 in Nepal, an earthquake damaged 750 cultural monuments, causing an estimated loss of US$600 million over two years (World Bank Group and GFDRR 2017).
Indirect Marketable losses: disruption of businesses, communication and network and public services	Cost of materials and services to restore businesses services using surveys and reports, or the extra costs incurred to meet the public or private needs. Insurance Loss Ratio or multipliers to understand the total costs for different kinds of natural disasters.	BTE (2001), Joy (1991) and Handmer, Ladds and Magee (2018). Example: In Australia, the total average cost of cyclones, storms and bushfires and other disasters estimated using Insurance Loss Ratio is estimated at $3.65 billion per year (2013 values).
Indirect Non-marketable losses: health, public amenity, electricity, gas, water services	Cost of restoring health, public amenity and other services. Indirectly, the number of people who lose access to the public amenities and services or the cost of restoring government services (including compensation to the public) during disruption of electricity, gas and water services can serve as a useful indicator.	ABRDR&SC (2017), Handmer, Ladds and Magee (2018) applied multipliers and the Insurance Loss Ratio to estimate the total cost and provide no measure of individual non-marketable losses. In addition, WTP/WTA or surveys can be applied to assess the negative health effects of disasters. These costs can be estimated in monetary and non-monetary units. Example: Cost of loss of an urban park can be measured from the number of people who visited the park or its reconstruction costs.

documented from historical aerial photography in an arid setting (Burrows, Burbidge & Fuller 2006). A fire history archive from North Australia Fire Information[1] covering the NT between 2000 and 2018 was used to create layers of individual fires as defined by mapped events attributed with unique dates. These fires were classified into four size classes (0>1 km², 1–10 km², 10–100 km² and >100 km²).

Bushfire cost estimation

Bushfires are a threat to the NT and also across northern Australia. The loss of ecosystem services (defined as the benefits humans derive from their ecosystems (Millennium Ecosystem Assessment 2003)) from the fire-affected landscape was estimated using the burnt area extent and applying three scenarios to each of the three fire-size classes (excluding less than 1 km² fires).

A step-wise approach included:

1. Estimating the fire frequency from 2000–2018 for bushfires varying in size from >1 km², 10 km² and >100 km² area. This means that fires >1 km² also include fires of sizes >10 km² and >100 km², similarly fires >10 km² size include >100 km² size fires but exclude fires of size <10 km².
2. Categorising the burnt area under three main land tenures of Indigenous, conservation and pastoral, using data from the National Native Title Tribunal, *Aboriginal Land Rights Act (Northern Territory) 1976* for Indigenous, Collaborative Australian Protected Areas Database (CAPAD 2016) for conservation, and NT cadastre dataset for pastoral land use.
3. Dividing the NT into low (less than 600 mm) and high (greater than 600 mm) rainfall regions as the Emissions Reduction Fund scheme is applicable only to the latter and not the former.
4. Estimating the costs for loss of ecosystem services from the burnt area for each land-use category, following the rationale that healthy ecosystems deliver ecosystem services that contribute to human wellbeing (Millennium Ecosystem Assessment 2003, 2005; de Groot *et al.* 2012; Costanza *et al.* 2014).

To estimate the value of loss of ecosystem services from bushfire-affected landscapes, the cost of managing those ecosystem services was assessed (following de Groot *et al.* 2012 and Millennium Ecosystem Assessment 2003) for each of the selected land uses (Indigenous, conservation and pastoral). Following a study by Sangha and colleagues (2017), the cost of managing the flow of ecosystem services was estimated at $780 per km² (in 2018 value) that was used for the total burnt area. For conservation, the loss of ecosystem services was assessed applying a value of $865 per km² derived from the cost of managing national parks across northern Australia (Sangha, Edwards & Russell-Smith 2019b). For pastoral lands, loss of pasture production was considered applying a conservative value of $264 per km² for gross income from a large north Australian dataset (Russell-Smith & Sangha 2018) using pasture, cattle production and financial income data from Australian Bureau of Agriculture Resource Economics and Sciences (ABARES) (2017) and others.

Specific Indigenous bushfire costs

Bushfire costs for Indigenous lands were assessed applying a substitute value of welfare expenditure that the Australian Government spends on Indigenous people in the NT (Sangha *et al.* 2017). The Steering Committee for the Review of Government Service Provision (2017) reports on Indigenous expenditure for six main welfare sectors, each with 3–4 sub-sectors. Of those, only three relevant welfare sectors were selected:

- developing safe and supportive environments
- healthy lives with a sub-sector on public and community services
- enhancing economic participation.

The average total welfare expenditure for an Indigenous person in the NT is $68,186 per annum (2015–16 value), but that amount for the selected sectors and sub-sectors was estimated at $30,695 per person per year (in 2018 values).

The rationale for this approach is that Indigenous people derive substantial wellbeing benefits from being connected to country (i.e. traditional land) and the selected welfare sectors of economic, health and safe and supportive environment services directly relate to country. It is assumed that bushfires affect the wellbeing of Indigenous people by compromising their economic opportunity, health and safe and supportive environments (Sangha, Gerritsen & Russell-Smith 2019).

The cost of bushfires in the NT was estimated only for the remote Indigenous population of 35,414 applying a substitute value of 25 per cent of welfare expenditure on three sectors and subsectors, thus, $7,673 per person per year from a welfare cost of $30,695 per person per year (following a conservative scenario of 25 per cent used in Sangha, Gerritsen & Russell-Smith 2019). In doing so, our approach remains conservative for considering only 25 per cent of loss of benefits for three welfare sectors as Indigenous people, particularly in remote locations, obtain multiple benefits by being connected to country (Burgess *et al.* 2009, Social Ventures Australia 2016). Details of this methodology are published by Sangha and colleagues (2017) and Sangha, Gerritsen and Russell-Smith (2019). All values are reported in AUD (in 2018) except stated otherwise.

Results

For the NT, the average (2000–2018) total area burnt by greater than 1 km² fires was ~250,000 km², comprising 20 per cent of the entire landscape (Figure 3). There was marked contrast between high and low rainfall regions. Under low rainfall conditions, 83,000 km² (5 per cent of

1 North Australia Fire Information website. At: www.firenorth.org.au/nafi3/.

the region) was affected compared to 166,000 km² (15 per cent of the high rainfall region). Notably, bushfires greater than 1 km² occurred on almost 98 per cent of the entire burnt area (Figure 3, Table 2).

To assess the bushfire costs, three scenarios were applied for the loss of ecosystem services from bushfire-affected areas, each of size greater than 100 km², greater than 10 km² and greater than 1 km² for respective dominant land uses (Indigenous, conservation and pastoral) (Table 3). The three scenarios were selected to consider the effect of relatively small (but larger than the prescribed burns that are typically less than 64ha), medium and large bushfires.

For extremely large fires of size greater than 100 km² (using long-term average fire frequency from 2000–2018), the total costs of bushfires were estimated at $95 million per year (Table 3, Scenario 1). In relation to land-use, bushfires on Indigenous lands cost $72.3 million per year, pastoral $16.5 million per year and conservation $6 million per year. Each value corresponds to the management costs required to maintain the flow of ecosystem services from Indigenous and conservation lands and the loss of pasture production from pastoral lands.

For bushfires of size greater than 10 km² (Table 3, Scenario 2, which also includes fires of size greater than 100 km²), the total costs were estimated as $132 million per year where the loss was the most for Indigenous land ($100 million per year), followed by pastoral ($21 million per year) and conservation ($11 million per year).

Assuming all bushfires of size greater than 1 km² (including fires of size greater than 10 km² and greater than 100 km²) affect ecosystem services and hence people's wellbeing, the total costs amount to $148 million per year (Table 3, Scenario 3). The bushfire costs for the loss of ecosystem services from Indigenous lands alone were estimated at $113 million per year, followed by loss of production worth $22 million per year from pastoral lands, and loss of ecosystem services worth $13 million per year from conservation lands (Table 3).

Of the three scenarios, Scenario 1 is the most conservative for considering the costs of extremely large bushfires. Given that Indigenous people reside across the remote areas where bushfires occur almost every year and impact on people's wellbeing, it is appropriate to consider Scenario 2 or 3 for fire extent greater than 10 km² or greater than1 km², that cost $132 million per year or ~$150 million per year, respectively.

Indigenous bushfire costs

When costs are assessed for the loss of services and benefits from large bushfires for Indigenous people living in remote areas, the losses are quite high. The costs were estimated for 35,414 people who live remotely in the NT and visit country once a week (ABS 2016). Applying a substitute value of $7,673 per person per year for loss of wellbeing benefits from healthy country due to bushfires, the total cost is estimated at $272 million per annum (Table 4).

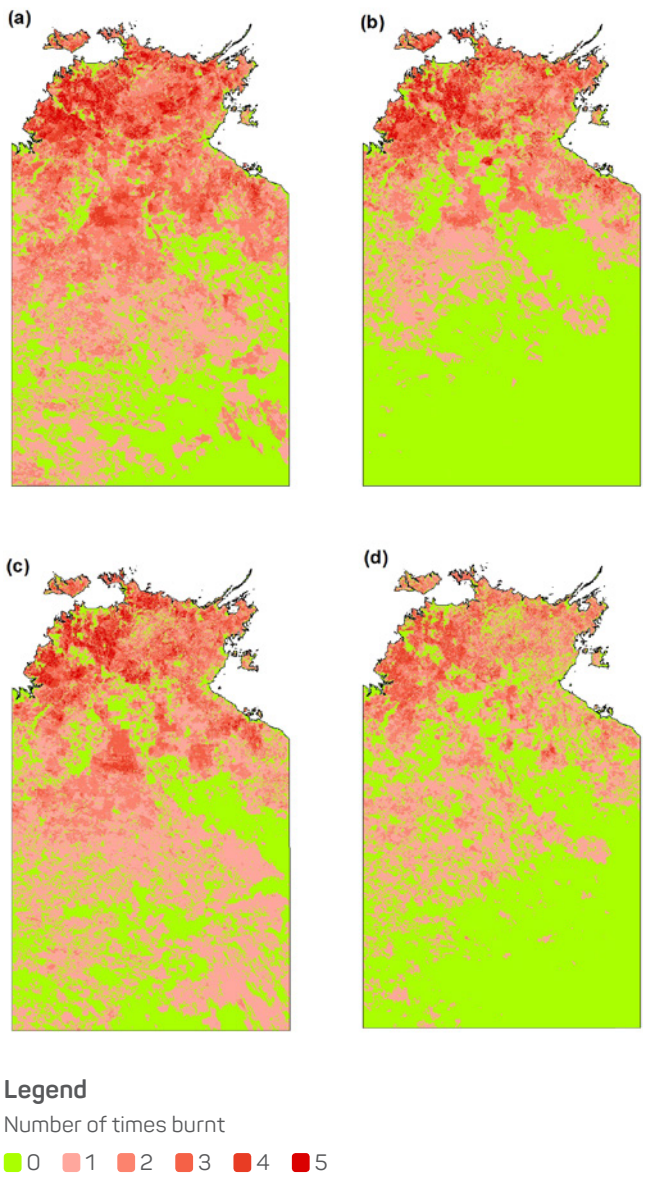


Figure 3: The average long-term (2000–2018) fire frequency across the NT for the period (a) 2000–2004, (b) 2005–2009, (c) 2010–2014 and (d) 2015–2018.

Discussion and conclusion

Extensive bushfires burn 20 per cent of the natural landscape in the NT. Costs vary between $95 million and $150 million per year depending on fire extent. To date, there has been no accounting for bushfire-related losses because, unlike southern Australia, there are limited human or infrastructure losses and no measures have been available to account for loss of natural systems nor Indigenous wellbeing. The most well-known sources that report disaster costs in the NT have accounted only for cyclones and storms and not any other disasters. These sources include national-level studies by the ABRDR&SC (2017), Handmer and colleagues (2018), and Ladds and colleagues (2017). This study assesses the broader social and environmental bushfire costs in the NT.

Table 2: Long-term average (2000–2018) burnt area from bushfires varying in extent from less than 1 km² to greater than 100 km².

Average burnt area (km²) from 2000–2018	Less than 600 mm rainfall zone				Greater than 600 mm rainfall zone				Total burnt area (km²) of the entire NT landscape
	Indigenous	Conservation	Grazing	Total burnt area (km²)	Indigenous	Conservation	Grazing	Total burnt area (km²)	
NA/No fires	356,222	3,822	341,586	701,629	130,410	16,928	156,902	304,240	1,005,869
<1 km²	598	11	221	830	2,880	444	882	4,206	5,037
1–10 km²	2,299	37	946	3,282	13,656	2,171	4,283	20,110	23,392
10–100 km²	6,945	91	3,781	10,817	28,888	5,290	13,378	47,556	58,373
>100 km²	47,419	387	20,621	68,427	45,363	6,719	41,986	94,067	162,494
% total burnt area	9%	1%	4%	5%	14%	21%	10%	15%	20%

Table 3: Bushfire costs for the NT for >600 mm and <600 mm rainfall zones (2018 AUD) applying three scenarios for fire extent >100 km², >10 km² and >1 km² using long-term averages from 2000–2018.

Regions	Greater than 600 mm rainfall zone	Less than 600 mm rainfall zone	Total loss (millions)
Scenario 1: burnt area >100 km²			$95.04
Indigenous	$36,986,826	$35,382,804	$72.37
Conservation	$334,852	$5,811,531	$6.15
Grazing	$5,443,908	$11,084,314	$16.53
Scenario 2: burnt area >10 km²			$132.18
Indigenous	$42,404,013	$57,915,811	$100.32
Conservation	$413,413	$10,387,273	$10.80
Grazing	$6,442,112	$14,616,027	$21.06
Scenario 3: burnt area >1 km²			$147.91
Indigenous	$44,197,534	$68,567,498	$112.77
Conservation	$445,137	$12,264,935	$12.71
Grazing	$6,691,752	$15,746,842	$22.44

Table 4: Bushfire costs of fires greater than 10 km² in size on Indigenous lands for Indigenous people in the NT.

Indigenous land	Indigenous population	Loss of wellbeing benefits due to bushfires ($ per year, 2018 values)
631,863 km² in total	Total population 58, 238 (ABS 2016)	Assuming Indigenous people in remote locations directly benefit from having connections with country (Social Ventures Australia 2016, Sangha *et al.* 2017, Sangha, Edwards & Russell-Smith 2019b), there are substantial cost savings for welfare expenditure for keeping Indigenous lands healthy and functional apart from biodiversity, reduced green house gas emissions and other benefits.
Bushfires >10 km² size burn 128, 615 km² almost every year	35,414 living in remote locations	Applying a substitute value for only 25% of welfare expenditure savings on three sectors and sub-sectors: a safe and supportive community, economic participation, healthy lives–public and community services ($7,673 per person per year) the total bushfire costs were estimated as $272 million per year.

The ABRDR&SC (2017) suggested a total cost of $50 million per year (average from 2007–2016). Using those cost estimates, cyclones and bushfires together cost $200 million per year. Conversely, the loss of wellbeing benefits from bushfires for the Indigenous population is ~$272 million per year (Table 4). If the environmental and Indigenous wellbeing losses are considered together, the cost estimates are ~470 million per year.

This assessment should be considered an under-estimate as:

- Fire mapping archives do not discern fires that burn over multiple dates and so some large fires have not been accounted for (they have been classified as multiple abutting fires). While these larger fires are less numerous than smaller ones, they make up a major proportion of the total area affected.
- Only management costs are considered for maintaining the flow of ecosystem services from Indigenous and conservation estates and gross income losses for pastoral estates. There are significant biodiversity and soil-erosion losses that have not been accounted for.

The effects of large bushfires and the associated losses will occur over a longer-term, especially when fires are extensive and severe. This requires further assessment in relation to fire severity that is beyond this study.

The case study presented here covers only non-marketable losses as there was no loss of infrastructure or other marketable goods or services. However, a mixed set of costs including marketable and non-marketable losses (i.e. dollar and non-dollar measures) are recommended as presented in the framework (Table 1). The proposed framework is an initial attempt that can be improved on in collaboration with emergency management organisations. In the future, total economic cost assessments can include multiple forms of information to appropriately inform decision-making.

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ABSTRACT

There is little disagreement that entering floodwater is risky, whether in a vehicle or on foot. There is usually little or no visibility of what is under the surface and even shallow water with moderate flow can make vehicles unstable or sweep people off their feet. In addition, floodwater will often contain contaminants and debris. Therefore, the safest course of action is to avoid entering floodwater. Indeed, the most pervasive risk communication message is 'If it's flooded, forget it'. This clear, unambiguous message is good at getting people's attention, but it is unclear whether it actually changes behaviour. Research with Australian public, floodplain management professionals, State Emergency Services (SES) personnel, and other emergency management experts has identified a number of challenges to floodwater safety and risk communications. Using a combination of research evidence and expert opinion, this paper discusses four pressing challenges and highlights some of the approaches being taken to help address them.

Based on a presentation at the Australia New Zealand Disaster Management Conference 2019 and a paper presented at AFAC19 – the annual conference of AFAC and the Bushfire and Natural Hazards CRC.

Behaviour around floodwater: challenges for floodwater safety and risk communication

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Introduction

Flooding is a significant cause of death and accounts for the second highest number of fatalities due to natural hazards in Australia, after heatwaves. Analysis of Australian flood-fatality data has shown that males, and children/young adults (under 29 years of age) are overrepresented in these statistics (79 per cent, and 43 per cent, respectively) (Haynes *et al.* 2017). The two activities linked to the highest proportions of flood deaths are driving through floodwater and recreating in floodwater. Further research on vehicle-related flood fatalities in Australia (Ahmed *et al.* 2019) found that 96 people died in 74 incidents during 2001–2017, with older males (aged 50–59 and 70–79) being the highest-risk group.

Literature reviews on public risk perception and behaviour in floodwater have shown that decisions to enter floodwater are multifactorial and complex (Becker *et al.* 2015, Ahmed, Haynes & Taylor 2018). Therefore, risk communication and behaviour change are equally challenging. Research on the evaluation or effectiveness of risk communications in relation to flood is limited, with the work of Hamilton and colleagues (2017) being a rare example. This paper draws attention to the challenges in floodwater safety and risk communication and document the approaches that have been taken, and are currently planned, to address them.

Overview

This paper is based on a panel discussion held at the Australia and New Zealand Disaster and Emergency Management conference (ANZDMC) in June 2019. All authors (except Haynes) were panel members and provided perspectives on the set of challenges based on research, operational, organisational and personal experiences. Selection of the four challenges

arose from findings from recent Australian research data and issues already identified as problematic for flood-risk communication.

Each challenge is discussed by outlining the challenge with attention given to central questions and relevance for flood-risk communications. A summary of research evidence quantifies and details the issue and expert opinion expands on the context and approaches used, or planned to be used, to address the challenge.

This research is undertaken in collaboration with SES end user organisations from across Australia and was approved by the Macquarie University Human Research Ethics Committee (Reference number: 5201700133). As this research is still underway, most of the data presented are early findings and not published in academic literature. Data analysis and reporting is ongoing, with published outputs available on the Bushfire and Natural Hazards CRC project webpage.[1]

Expert opinion was provided by the co-authors, representing three SES agencies, the Australian Broadcasting Corporation (Australia's national emergency broadcaster), Flood Management Australia (the peak body for floodplain management) as well as local government.

The four challenges addressed:

- What is floodwater?
- Why are people entering floodwater?
- Is it OK for emergency services and other professionals to enter floodwater?
- Water is fun!

The intention here is not to solve the challenges presented, but to outline the complexities of each area. Questions are raised and recent data are provided to contextualise and quantify what is known. Expert opinion identifies what has been, or is being, done to address various aspects. The expert opinion was scoped loosely during conference preparation discussion where the challenges were shortlisted. The content presented here was provided in a single 90-minute panel session and is not exhaustive. In addition, as the challenges are interrelated, some editing of content has been undertaken to allocate discussion points to only one challenge area to avoid repetition.

Challenge 1: What is floodwater?

- Central questions: What do we actually mean by 'floodwater'? Is all floodwater dangerous? Do 'experts' and the public have a shared mental model of what floodwater is? When does rainwater on the road become a flood?
- Relevance for communication: One person's 'flood' is another person's 'puddle'. If people are advised not to enter floodwater, do they think this message applies if the water they are confronted with does not match the imagery in flood-risk communication materials? Do those communicating flood risk to communities have a shared understanding of what is 'floodwater'? How consistent is risk messaging?

Research evidence

Having a clear definition of 'floodwater' is essential when conducting research on people's behaviour around floodwater and their potential responses to flood-risk communication. Use of a definition helps ensure that research participants are recalling comparable situations when questioned. In initial searches, no agreed definition of 'floodwater' was found for the context of floodwater on a road or a flooded road. To scope this issue, the research team conducted an opportunistic survey with attendees at the 2017 Floodplain Management Australia conference to ascertain the consensus between floodplain management experts (primarily from local government, emergency services organisations and flood consultants). Thirty-nine delegates completed a survey and, although 44 per cent (n=17) had formal definitions of 'floodwater' in their organisations, there was limited consensus. Definitions were used in different contexts and for different purposes. However, 72 per cent (n=28) felt it was important to have a national or state-level definition of 'floodwater' in the context of public risk communication and education.

Reviewing the definitions provided, and in consultation with NSW SES, a definition of 'floodwater on a road' was agreed for use in research on driving through floodwater (Figure 1).

Definition of floodwater on a road (used for research)

- Water across the road surface.
- Little to no visibility of the road surface markings under the water (i.e. uncertainty of road quality and integrity and possibly depth).
- Water on normally dry land - flowing or still.

Figure 1: Floodwater on road definition.

A sample of SES personnel (n=1203) and public participants (n=2196) were shown four photographs of water over a road. Participants were asked whether the roads shown in the photographs were 'flooded' and to indicate why they thought it was (or was not) flooded. This allowed for the collection of words used by people and experts to describe the attributes of floodwater and the cues being identified. This provided a useful lexicon for analysis and possible use in risk communications. Figure 2 shows the consolidated word clouds generated from this research. References to many attributes in the scenes provided were common, such as water depth. However, SES personnel were more likely to mention water flow and details about the context, for example road type (causeways), water characteristics (wash from other vehicles), flood markers, points of reference, depth indicators and drainage.

1 Bushfire and Natural Hazards Cooperative Research Centre. At: www.bnhcrc.com.au/research/floodriskcomms.

Figure 2: Word clouds describing attributes of floodwater on roads.

Expert opinion

In the panel session, it was acknowledged that defining floodwater is complex. Not being able to see what is below the surface of even shallow or benign-looking floodwater means entering any type of floodwater is dangerous.

There was consensus that communities could be empowered to make decisions about safety by having the right information and knowledge to identify dangerous features of floodwater. This approach has been used in communication campaigns to date. These include not knowing what is below the surface or in the water ('Know the dangers', Queensland Fire and Emergency Service; 'You don't know what you're getting into', VICSES) and understanding the impact of water flow on vehicle stability ('15 to Float', VICSES).

In terms of the location or context of flooding, there was discussion about economic and other drivers that impact on communities. Specifically, consideration was given to agricultural and rural communities that could be flooded for long periods or on multiple occasions and need to keep businesses running. Although this did not directly affect the definition of floodwater, it influenced how communities might view and respond to floodwater on roads. It also influenced how road closures could be managed to balance public safety with economic functioning. Issues were discussed relating to the consistency of messaging and response to floodwater in large states like Queensland. The effects of slow-moving floodwaters means messaging must be adapted for different areas.

For road closures, decisions about when a road is closed, or not, was also discussed. Although some jurisdictions have clear directives relating to the depth of floodwater required to close a road, there was discussion about how realistic the procedures are for closing and opening roads in a timely way, particularly given this is largely a manual operation. Finally, there was consideration of the impact on road safety of mud and debris left on roads after floodwater has subsided. This raises interesting questions that reframe the challenge to 'When does a road stop being 'flooded'? and 'When is a road safe to use again'? Just because the water is no longer there, does not mean the road is safe for use. These points reflect some of the pressures on road managers to reopen roads following a flood.

Challenge 2: Why are people entering floodwater?

- Central questions: Why is it that, despite advice and warnings, people are still entering floodwater? What are people doing? What are the consequences of entering floodwater? Why are people disregarding risk messages?
- Relevance for communication: If we know what people are doing, or why they are entering floodwater, we can find additional levers to influence their behaviour. Only by knowing what people are doing when they enter floodwater do we know what we are asking people to 'forget' in the message 'If it's flooded, forget it'. How can we make risk messaging compelling?

Research evidence

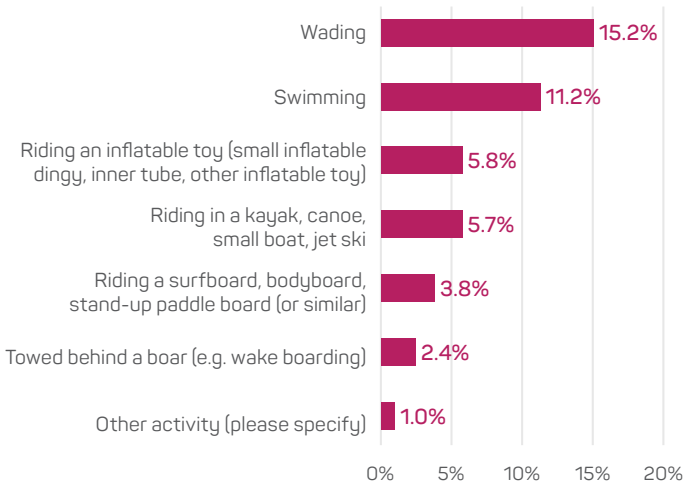
Recent survey research (n=2196) using the floodwater on road definition (Figure 1) showed that 54 per cent of respondents had driven, or been driven, through floodwater in the previous five years. Of these, 82 per cent had driven through floodwater only once (41 per cent) or two–three times (41 per cent). However, a small proportion (7 per cent) had driven through floodwater more than six times. Those who were more likely to have driven through floodwater included males, those who rated their driving ability as high and those who drive more than 15 hours per week. These findings suggest that confidence, experience and opportunity are linked to this behaviour.

In addition to driving through floodwater, 28 per cent of respondents had engaged in activities in floodwater on land and 19 per cent had engaged in activities in flooded rivers. These data refer to 'ever' having engaged in such activities and included a wide range of activities such as wading, swimming, kayaking and riding on inflatables. Figure 3 shows data relating to activities in floodwater on land and shows the breakdown of the reasons why people were wading in floodwaters.

Regarding flood-risk communication, one of the most interesting observations from data in Figure 3 is the range of reasons given for wading in floodwater. Detailed breakdowns provide insights into why people take this risk. In this example, only around one-third were entering floodwater for leisure reasons and, therefore, advising people not 'to play' in floodwater might feasibly be ignored, or discounted, by two-thirds of this group in this situation.

Another aspect related to the consequences of driving through floodwater. Survey respondents who had driven through floodwater in the previous five years were asked to provide details about one of these events. This

Activities in floodwater on land



Reason for wading in floodwater (n=334)

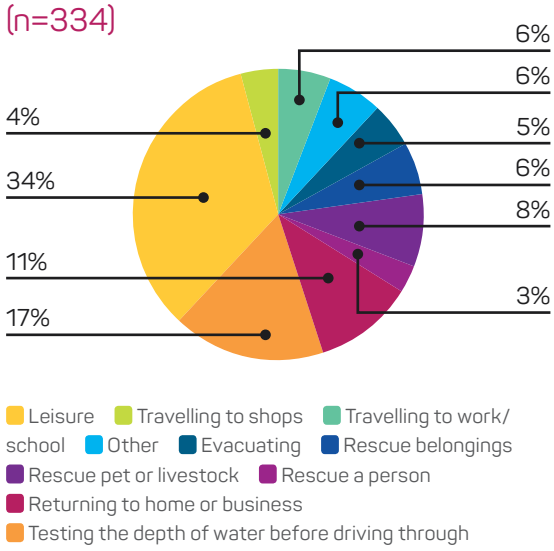


Figure 3: Activities in floodwater on land and reasons for wading in floodwater on land.

Note: Survey: n=2196. Respondents could indicate more than one response.

included information such as the depth and flow of water, the type of road and location, the feelings of others in the vehicle about the risk and the reasons for driving through floodwater. Included was a question about the outcome of driving through the floodwater; summarised in Figure 4.

Figure 4 shows information of obvious relevance for risk communication. A majority of respondents who drove through floodwater reported no (vehicle-related) consequences of their actions. Consequently, firm and definitive messages of 'never drive through floodwater' are unlikely to resonate with these individuals as the message conveyed will conflict with the personal experiences they draw on to process these messages. Figure 5 shows comments provided by SES respondents. These responses capture some of the challenges faced when discouraging people from driving into floodwater, which were reiterated by the expert panel members at the conference.

Did you succeed in driving through floodwater on this occasion?

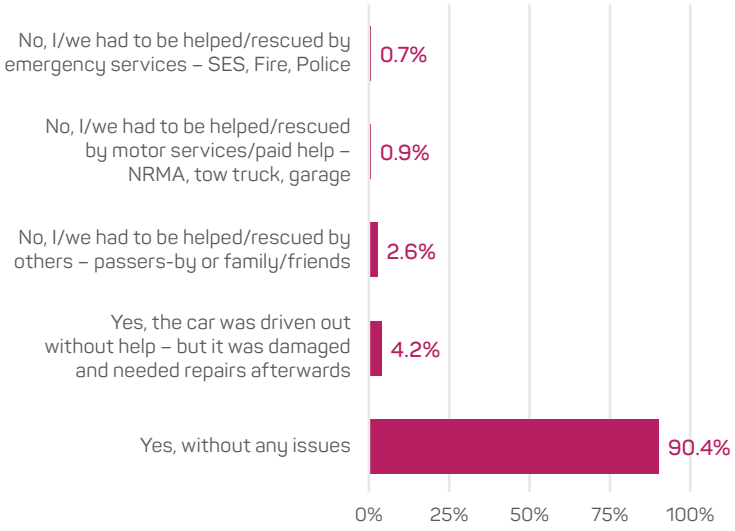


Figure 4: Outcomes of driving through floodwater (n=1172).

> **We're not going to say we're going to stop people from driving through floodwaters because that's unrealistic and it's not suitable for areas of our state.** But if we can get people to better analyse this situation and make decisions based on that particular risk at the time then and we have people that go, "You know what, I'm gonna turn away from this. This time around I'm not going to go through," then that's a win for us.

> **Do you try and help them survive (if stuck in floodwater) or do you say, "Well, no, you shouldn't have done it in the first place?"**... I think most government departments, most emergency services will, turn and turn around and say, "I don't want you to do this at all."... I think it's probably a lot of internal conversations about what is the right thing and **actually it's where does the risk lie, because if someone turns around and say, "Well, this agency told me that if I did those things, I would minimise my risk of being injured or dying," if someone dies, what happens? I don't know. I wish I could give you an answer.**

Figure 5: Quotes from emergency management professionals regarding people driving through floodwater.

Expert opinion

It was acknowledged that a blanket message is helpful and providing a strong, consistent message was important for the emergency services organisations. However, messaging was not a 'silver bullet'. Queensland Fire and Emergency Service had tested the 'If it's flooded, forget it' message and found that awareness was high (86 per cent of people tested). This suggested there was 'cut through' to audiences. However, concern was raised that people tended to 'opt out' of the message, for example feeling that it didn't apply to them when they lived in 'one road in-one road out' situations. Harmonising messages was highlighted in the context of emergency broadcasting where efforts had been made, unsuccessfully, to achieve nationally consistent community service announcements.

It was suggested that people *do understand* the risks associated with floodwater but they weigh these up against other risks. An audience member suggested that perhaps the risks associated with driving through floodwater were not regarded as high in comparison to other road-related risks such as speeding and drink driving that result in larger numbers of fatalities. Therefore, warnings about driving through floodwater were more readily dismissed.

The use of localised and area-specific messaging and new technologies could be used to combat apathy and lack of engagement in flood-risk messaging. Localised and tailored messaging during a flood can be challenging for broadcasters who need to keep content interesting for their audiences who live across large areas. However, directing people to social media and online information is a workable approach. In Queensland, local governments have been successful with community engagement through posting timely local information onto online 'dashboards' and using webcams in local black spots.

Difficulties in visualising and personalising flood risk was another reason why people ignore risk messaging. A solution to this might lie in the use of virtual reality or augmented reality. The 'wall of water' simulation of floodwater used by The Weather Channel in 2018 to visualise the effects of Tropical Cyclone Florence[2] was an innovative use of this technology that gripped the public interest. This approach is being implemented in flood risk campaigns in Western Australia and NSW. The Department of Fire and Emergency Services in Western Australia is using a suite of newly developed messages in community engagement initiatives. These messages were developed using research and a behavioural-economics approach that has been demonstrated to be powerful for influencing human behaviour. The messages are being incorporated into an augmented reality flood exhibit in the Education and Heritage Centre. In NSW, a similar visualisation technique is being used as part of a campaign in the Hawkesbury-Nepean Valley to visualise flooding in local areas. The NSW SES 'The Risk is Real' campaign uses local landmarks to reinforce the message that flooding can happen 'here'.

Challenge 3: Is it OK for emergency services and other professionals to enter floodwater?

- Central questions: What is the advice to emergency services personnel (and other professionals) about entering floodwater? Why do they enter floodwater? To what extent do they think about the consequences? Does this behaviour influence the public's views of entering floodwater?
- Relevance for communication: If the public is told never to enter floodwater, does seeing emergency services personnel, journalists and other professionals, driving or wading in floodwater undermine the risk message? Do contradictory cues affect how messages are processed and acted on?

Research evidence

The negative influence of seeing journalists and others entering floodwater has long been a subject of conjecture. Such risky actions reinforce a negative behaviour (Figure 6) that contradicts official advice and could influence the public; normalising the behaviour and reducing the perception of risk. Campbell (2014) investigated this issue in a Churchill Fellowship project and the effect of conflicting cues on protective action is the subject of current research by the BNHCRC (Dootson *et al.* 2019).

Figure 6: A still image from a Channel 9 Today Show online video reporting bad weather in Sydney, NSW (27 Nov 2019) and showing professionals standing in and driving through floodwater (journalist, police, bus driver).

When flood events occur, people are frequently exposed to images in the media of emergency services personnel and other professionals driving, standing in and moving

2 Today Show on YouTube. At: www.youtube.com/watch?v=eVQloikYxRo&feature=youtu.be (4:27)

around in floodwater. Generally, SES personnel are discouraged from driving through floodwater and most emergency services agencies have operating procedures or specific guidance in this area. Surveys of SES personnel in one jurisdiction (n=637) indicated that 35 per cent (n=223) of the respondents had driven through floodwater in an SES vehicle (as a driver) in the previous two years, with a small proportion (5 per cent, n=32) driving through floodwaters seven or more times. In this study, respondents were asked to provide details about a specific and recent incident of driving through floodwater. Figure 7 shows their responses about the factors that influenced their decision to drive through floodwater.

Figure 7 illustrates that, although urgency of the journey and a desire to complete one's duty are included in the list, confidence, familiarity and risk assessment are strong influencing factors. Only a quarter of respondents (25 per cent, n=46) were undertaking emergency response activities under 'lights and sirens' at the time they drove through floodwater. The public might attribute the urgency of operational situations to be the reason for this behaviour and may feel it is justified. However, organisational perspectives of work, health and safety duty-of-care, cost of vehicle repairs and organisational reputation are pertinent to consider.

Expert opinion

SES personnel are directed not to enter floodwater and are taught dynamic risk assessment and other approaches to manage the safety of crews and to reduce unnecessary risks. However, they are not exempt from prosecution. It is acknowledged that operational requirements and expectations that personnel would do their duty added to pressures to drive through floodwater at times. It was also noted that in situations where, in particular, a child might be at risk of drowning, SES personnel might enter floodwater and pay less attention to their own safety. One panel member made an interesting point that it was regarded as 'OK' for firefighters to go into fires but 'not OK' for SES personnel to go into floodwater as part of their duties.

Aspects of personal safety were extended to the behaviour of journalists, where consideration of safety could be neglected in pursuit of the best footage. However, this situation is changing due to a 'safety before story' approach being adopted and managers reinforcing safety messages for staff. Australia's work, health and safety regime and the threat of litigation and negative financial effects of workplace injuries could ultimately be the most powerful drivers of change. As a result, risk assessment processes are being tightened, training and education is being improved and journalists are increasingly being called-out by the public when their actions are less socially acceptable. This is supporting positive changes in this area.

Challenge 4: Water is fun!

- Central questions: Water-based activities have a significant place in Australian culture, so how can 'floodwater' be reframed in a compelling way to make people want to stay away from it? Why is it harder to 'sell' the flood hazard, compared to the bushfire hazard?
- Relevance for communication: Australians are proud of 'making good from bad'. In floods, communities want to remain positive and upbeat. How can the message of not entering floodwater be enforced without breaking community spirit? We have a water culture where parks and dams can be places for recreation. But in flood, the message is not to recreate in these places.

Top 10 factors contributing to SES personnel's decisions to drive through floodwater
(from a list of 18)

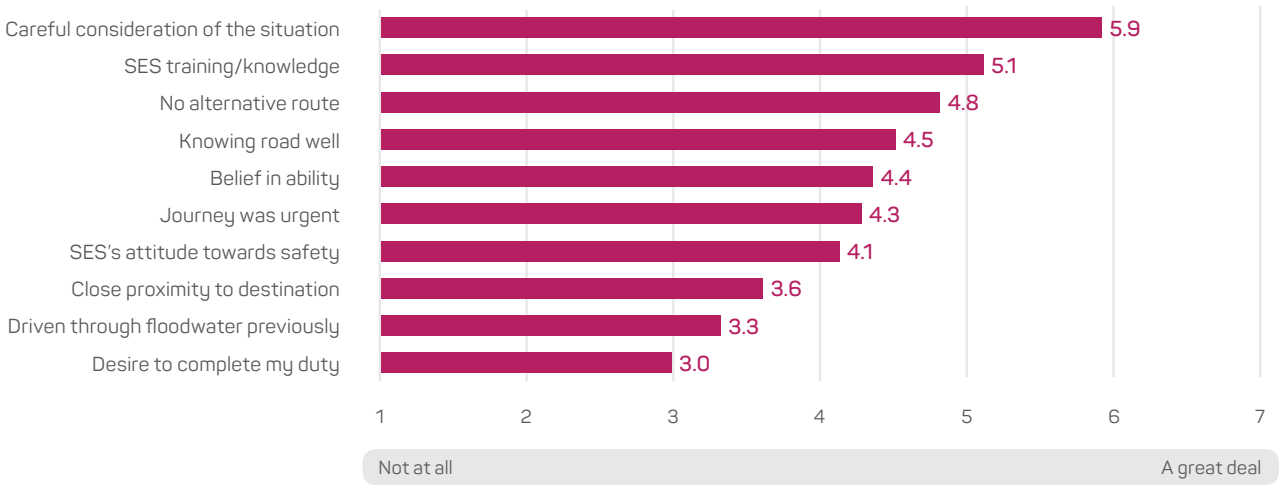


Figure 7: Factors contributing to decisions to drive through floodwater (SES personnel, n=695). Mean ratings of the degree of influence of each listed item are shown (ranging from 1 'not at all' to 7 'a great deal').

> So every time it rains, you see people on that surfboard in the flooded streets or the floating down the hill or in a tube, **all those things and the media loves it.** It looks great on a front page of a paper or on the six o'clock news and it looks fun, so **there is a direct emotional link to fun and turning that bad situation into a good situation by embracing it.** And so frightening that is very, very difficult... I don't want to be killjoy. It's a real fine line because I think there were some images or footage in the (region) where we had paddocks, paddocks and paddocks flooded... and so the parents were in a four-wheel drive, dragging the kid behind the vehicle on a boogie board. **Yes, it looked like loads of fun. Is it dangerous? Probably. Am I being killjoy by saying don't do it? Yeah, I am.**

Figure 8: [Flood]water is fun! Media images of people in floodwater and quotes describing some challenges of promoting the message to stay out of floodwater.

Research evidence

The research evidence for this challenge emerged from qualitative interviews with emergency management personnel. Figure 8 shows a quote that expresses the dilemma for those responsible for public safety and speak to the deep-rooted aspects of this challenge. Mainstream media channels and members of the public broadcasting videos on social media with images of people 'having fun' (despite the inconvenience or hardship of the flood) exacerbate the issues for emergency services organisations when warning people not to enter floodwater.

Expert opinion

Members of the panel recognised this as a challenge, albeit more abstract than the other three. People have an affinity and familiarity with water, especially for recreation. Haynes and colleagues (2017) showed that young adults and children factor disproportionately in the flood fatalities related to recreating in floodwater. Thus, they are a significant target audience for risk messaging in this area.

To offset 'fun policing' and improve message uptake, approaches taken have linked into the 'larrikin culture' and used humour as a way to convey risk messages. Examples include the 2013 VICSES 'poo' campaign ('If you knew what was in it, you wouldn't go in it') and the 2017 NSW SES 'Don't be a #Floodwit' social media campaign.

Generally, communication campaigns to discourage playing in floodwater focus on what is in floodwater as a way to discourage people from wanting to go into it (e.g. 'You don't know what you're getting into' by VICSES). Other approaches focused on younger children and included games and animations, such as the 2019 Wollongong City Council 'Don't Play in Flood Water'[3] animation and the VICSES FloodSafe game.[4] VICSES is developing a campaign that will target teens, 'Don't flirt with floodwater'.

Two approaches directed at adults to tackle the 'water is fun' challenge involve drawing attention to parents, and society in general, to emphasise that everyone has a part to play in modelling good behaviour regarding floodwater. Adults need to set a good example to children. The panel discussed the power of narratives and the use of victim and survivor stories to personalise the negative effect of entering floodwater and the ways it affects those who make poor decisions. For example, 'Near Misses From Real Floodwater Stories' by NSW SES[5] in 2017 was based on true stories told by the actual person and re-enacted in videos. These stories provide insights into the consequences of entering floodwater.

Conclusions

This paper considered four significant challenges to floodwater safety and risk communication. While other important areas, such as the risks of flash flooding and sheltering behaviour in floods remain unexamined, they were considered for inclusion. This paper documents the issues facing communicators of emergency messages using research data to consider issues and expert opinion. These challenges highlight the complexity of flood-risk communication that must work at-scale and across different geographic and social contexts. These may run counter to cultural norms, such as playing in and around water. Despite these challenges, many campaigns have been implemented and approaches taken that have been engaging. There are also new and innovative approaches on the horizon that augur well for improved public safety during floods.

3 Don't Play in Flood Water. At: www.youtube.com/watch?v=CboTuISSt9E.

4 Floodsafe game. At: https://static.ses.vic.gov.au/floodsafe-game/index.html.

5 Near Misses From Real Floodwater Stories. At: www.ses.nsw.gov.au/news/all-news/2017/near-misses-from-real-floodwater-stories/.

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ABSTRACT

Cyclones cause significant damage to property, infrastructure and housing. Fortunately, property owners can undertake structural upgrades to reduce damage. However, installation of structural upgrades in cyclone-prone regions such as North Queensland has been relatively low. This paper explains why some people do, and others do not, install structural upgrades. Research to date has identified psychological factors that may predict mitigation behaviour for other natural hazards, but there are few studies that investigated cyclone-specific mitigation behaviour. This paper addresses this gap and identifies the psychological factors that promote mitigation behaviour for structures and presents a method of segmenting groups based on these psychological factors. Implications for risk communication messages to promote the adoption of household-level structural upgrades are discussed.

Based on a presentation at AFAC19 – the annual conference of AFAC and the Bushfire and Natural Hazards CRC.

Personalising the message: promoting cyclone protection in North Queensland

Mitchell Scovell, Dr Connar McShane, Dr Daniel Smith and Dr Anne Swinbourne, James Cook University, Townsville, Queensland.
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Introduction

In Australia, tropical cyclones caused over $6 billion in insured damage between 2006 and 2016 (Harwood, Smith & Henderson 2016). Housing is particularly vulnerable as cyclones can cause significant structural damage (Smith, Henderson & Ginger 2015). However, some of this damage is preventable if appropriate structural measures are in place, for example, cyclone shutters can be installed to reduce window damage caused by cyclones (Smith, Henderson & Ginger 2015). Despite these benefits, installation of cyclone shutters is low in high-risk areas such as North Queensland (Harwood, Smith & Henderson 2016). This paper identifies some of the psychological factors that explain why people choose to invest or not in cyclone shutters. A method of segmenting risk communication messaging is investigated with the aim of improving the uptake of structural damage mitigation measures.

Past research has identified a range of psychological factors that help predict mitigation behaviour for natural hazards (Koerth, Vafeidis & Hinkle 2016; Bubeck, Botzen & Aerts 2012; Kellens, Terpstra & de Maye 2013; Smith *et al.* 2016; Kanakis & McShane 2016). Psychological factors are considered better predictors of mitigation behaviour than demographic factors (Lindell & Hwang 2008; Peacock 2003, Ge, Peacock & Lindell 2011). In particular, psychological factors within two popular psychological models, the Protective Action Decision Model (PADM) and the Protective Motivation Theory (PMT), have been found to be reliable predictors of mitigation behaviour (Bubeck *et al.* 2013; Poussin, Botzen & Aerts 2014; Grothmann & Reusswig 2006; Terpstra & Lindell 2013; Ge, Peacock & Lindell 2011). Although the conceptualisation of factors within these models differs, most studies have found that perceived threat (threat appraisal) and perceived ability to respond to the threat (coping appraisal) are significant predictors of mitigation behaviour.

By identifying the psychological factors that relate to cyclone mitigation behaviour, effective risk communication messages can be built on these findings (Kellens *et al.* 2013). However, using a one-size-fits-all approach to risk communication means some people may not receive or heed the information (Fekete 2012). People-centred risk communication messaging, which acknowledges the psychological differences between groups, outperforms traditional approaches of giving everyone the same message (Haer, Botzen & Aerts 2016). One way to implement a people-centred approach is to understand how groups differ based on psychological predictors of mitigation behaviour and tailoring messages to address these

differences. Creating a 'typology' or 'cluster' groups based on psychological factors has been successfully applied to gain good understanding of how different groups respond during bushfires (Strahan, Whittaker & Handmer 2018) and adaptation to coastal flooding (Koerth *et al.* 2014). This study uses a similar approach to identify the differences in peoples' perceptions towards cyclones and cyclone shutters and how these differences relate to intentions to undertake structural changes to their homes.

Windborne debris failure of a window without opening protection in Yeppoon, following Tropical Cyclone Marcia.
Image: Courtesy Smith, Henderson & Terza (2015)

Method

Participants

Respondents were recruited using social media platforms of Facebook and Twitter. Links to an online survey were promoted and were also shared through other social and professional networks. Information about the survey was disseminated via broadcast media platforms throughout North Queensland (i.e. TV, radio and newspapers). People who were living in coastal North Queensland between Cairns and Rockhampton were able to respond.

This survey was part of a larger research project that assessed many different factors. However, the focus of this study was to investigate home owners' structural mitigation behaviours. As such, only home owners who provided information about their cyclone mitigation behaviours or intentions were included in the analysis.

Respondents were asked to report their gender, age, relationship status, years spent in North Queensland, income and their highest level of formal education. They were also asked to specify if they had any dependent children and if they had experience with cyclone-related property damage.

After removing ineligible responses, the final response sample size was 339, with 112 (33 per cent) males and 227 (67 per cent) females. The average age of respondents was 47 years with a standard deviation of 11.9 years and a range of 18 to 76 years. The median household income category was $80,000–$125,000. A bachelor's degree was the most commonly reported highest level of education (31 per cent). The average number of years living in North Queensland was 25.5 years with a standard deviation of 17.3 years and a range of 1 to 75 years. Most frequently, respondents reported that they were married (68 per cent) and 50 per cent had at least one dependent child.

Materials

Shutter installation

A shutter installation variable was used to assess cyclone mitigation behaviour as all home owners can install shutters and their primary use is to mitigate cyclone-related property damage. The shutter installation variable was created by combining scores from two other variables: shutter installation behaviour and intention to install shutters.

First, behaviour was assessed by asking respondents if they had installed cyclone shutters since building or buying their property. If respondents indicated they had not installed cyclone shutters, they were asked to indicate how likely they were to install them in the coming five years. Intention to install shutters was measured on a seven-point Likert scale with higher scores indicating a higher intention to install shutters.

There were minimal responses to some levels of the seven-point intention scale so scores were combined to create three ordered categories (i.e. a low, moderate and high intention group). The shutter installation variable was the outcome variable used in the subsequent analysis and was scored as follows:

1. low intention to install shutters
2. neither likely nor unlikely to install shutters
3. likely to install shutters
4. already installed shutters.

Examples of commercial shutters for window protection.
Image: Smith, Henderson and Ginger 2015

Table 1: Scoring of psychological factors.

Factors	Statements
Response Efficacy	
Efficacy (damage)	Shutters are effective for reducing property damage and associated costs.
Efficacy (safety)	Shutters are effective for increasing family's safety.
Utility	Shutters are useful for other purposes besides protecting property.
Increases value	Shutters increase property value.
Response Cost	
Monetary cost	Shutters are expensive to install.
Time and effort	Shutters take a long time and a lot of effort.
Knowledge/skill required	Shutters take a lot of skill and knowledge to get installed.
Cooperation required	Shutters require a lot of help/ cooperation from others.
Visual Appeal	
Visual appeal	Shutters are visually appealing.
Self-efficacy	
Self-efficacy	Requires the ability of the respondent or a family to organise for the shutters to be installed.

Mitigation and resource perceptions

Risk perception was assessed based on five questions. Using a similar operationalisation to Peacock and colleagues (2005), questions assessed perceptions of:

- damage likelihood
- the extent to which people's daily lives and ability to work would be affected
- the extent to which their mental and physical health would be negatively affected.

Other psychological factors based on the PADM/ PMT were also assessed, as shown in Table 1. Variable conceptualisation was adapted from the study by Terpstra and Lindell (2013) but was defined using PMT terms (i.e. response efficacy and response cost). The 'factors' in column 1, Table 1 were created by summing and averaging the scores of subscales of risk perception, response efficacy and response cost. All subscales were scored on a 7-point Likert scale, with higher scores indicating stronger agreement with each statement.

Procedure

Ethical approval was obtained through the James Cook University Human Research Ethics Committee (#H7007). The survey was available online using the Qualtrics platform and took approximately 25 minutes to complete. Most of the respondents were recruited online between the 30 June and 9 November 2017. The survey was first diseminated via social media platforms such as Facebook and Twitter and a Facebook page was created providing information about the study and a link to the survey.

Table 2: Results of an Ordinal Regression Analysis

Psychological factors	Coefficient	*p*
Response efficacy	0.436	0.001
Response cost	-0.315	0.004
Self-efficacy	0.007	0.923
Visual appeal	0.343	<0.001
Risk perception	0.277	0.022

Note: In total, the variables explained 24 per cent of the variability in the model (Nagelkerke $R^2 = 0.24$).

Results

Psychological factors that predict shutter installation

Ordinal regression was used to determine the psychological factors that predict shutter installation. As shown in Table 2, response efficacy, response cost, visual appeal and risk perception were all significant predictors of shutter installation (all $p<0.05$). Self-efficacy, however, was not. In total, the variables explained 24 per cent of the variability in the model, which suggests that the significant predictors in the model are important for explaining shutter installation behaviour.

Cluster analysis

K-means cluster analysis was used to divide respondents into groups based on their standing on four psychological variables. The psychological variables used in the cluster analysis were risk perception, response efficacy, response cost and visual appeal. The four variables were converted to Z-scores before analysis. Three cluster groups were chosen for the k-means analysis. Figure 1 shows each cluster group's standing relative to the mean on each factor used in the cluster analysis. The numbers on the y-axis represent standard deviation units (or Z-scores).

As seen in Figure 1, cluster groups were given names to represent the average perceptions of the group. The first group was labelled 'proactive' because, compared to other groups, they perceived the highest levels of risk, the highest level shutter efficacy and visual appeal, and perceived a moderate level of response cost. The second group, 'pessimists', perceived slightly less risk

than the proactive group but perceived the lowest level of efficacy and visual appeal of shutters and the highest level of response cost. The last group, 'denialists', perceived the least risk, a moderate level of shutter efficacy and visual appeal and the least response cost.

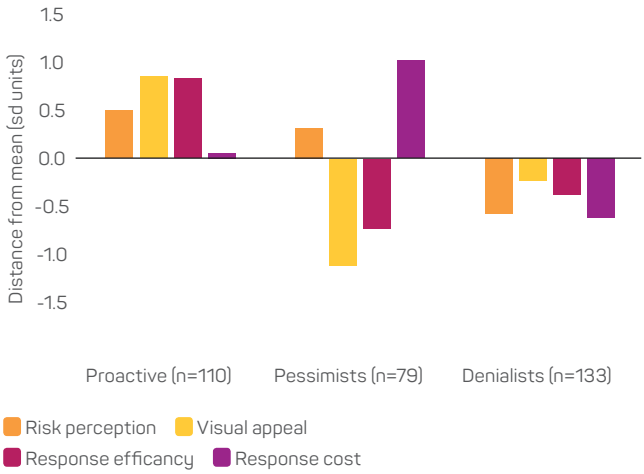

Figure 1: Cluster group relative standing on perceptual factors.

Table 3: The association between cluster groups and shutter installation behaviour.

Cluster groups	Unlikely	Neither likely or unlikely	Likely	Already installed
Proactive group count	43	37	20	10
Proactive expected count	65	30	11	4
Proactive % within shutter installation response	23%	42%	63%	77%
Pessimist group count	63	12	3	1
Pessimist expected count	46	22	8	3
Pessimist % within shutter installation response	33%	14%	9%	8%
Denialists group count	83	39	9	2
Denialist expected count	78	36	13	6
Denialist % within shutter installation response	44%	44%	28%	15%

Clusters and mitigation behaviour

A chi-square test was used to determine the relationship between cluster groups and shutter installation intention. The results of the chi-square test show there was a significant association between cluster groups and shutter installation ($x^2(6)=41.98$, $p<0.001$).

Table 3 shows the number of people in each cluster group who have also installed cyclone shutters (group count). The expected count represents the projected number of respondents if there was no association between variables. The percentage of people from each cluster group who responded to each shutter installation option is also shown. Table 3 shows that most respondents who said they had already installed shutters belonged to the proactive cluster group. Similarily, the majority who were likely to install shutters in the future were also part of the proactive cluster group. Conversely, most of the respondents who said they were unlikely to install shutters in the future were either in the pessimists or denialists cluster groups.

Table 4: Table showing factors that differentiated cluster groups.

Significant	Not Significant
Years in North Queensland (p=0.02)	Gender
Income (p=0.03)	Age
Education (p=0.01)	Dependent child
Cyclone Experience (p=0.02)	Marital status

Clusters and demographic factors

Analysis identified demographic factors that differentiated cluster groups. Three types of statistical analysis were used depending on the scale of measurement. One-way analysis of variance was used for scale variables (e.g. age), Kruskal-Wallis H test for ordinal variables (e.g. income) and chi-squared for nominal variables (e.g. gender of respondent). Table 4 shows the variables that were significantly associated with cluster groups ($p<0.05$) and those that were not ($p>0.05$).

Tukey post-hoc tests indicated that those in the proactive group (M=28.46, SD=18.18) had lived in North Queensland significantly longer than those in the pessimists group (M=21.43, SD=15.05). There was no significant difference between any other cluster pairs. The denialists group had the highest levels of income and education. Conversely, the proactive group had the lowest level of formal education and almost the lowest levels of income. The results also showed differences in types of cyclone experience. The pessimists group were more likely to have not experienced a cyclone, the denialists group were more likely to have experienced a cyclone causing no property damage and the proactive group were more likely to have experienced a cyclone that caused moderate property damage.

Participants needed for study of cyclone mitigation behaviour

NEWS FROM THE CRC 17 AUG 2017

Do you currently reside in coastal north Queensland between Cairns and Rockhampton?

Mitchell Scovell, a CRC Associate Student at James Cook University, is currently seeking participants for his PhD research into factors influencing cyclone mitigation behaviour.

Participants will be asked to fill out a questionnaire about their perceptions of cyclone threats, their thoughts on specific mitigation behaviours and mitigation behaviours that they have performed or intend to perform.

Mitchell's PhD research aims to uncover how preparation for cyclones in north Queensland is influenced by the differences in people's understandings of cyclone risk. Understanding how people think about cyclones will help improve risk communication messaging and help agencies encourage protective behaviour in order to reduce physical and emotional cyclone damage.

Recruitment article posted by the Bushfire and Natural Hazards CRC.
Image: Bushfire and Natural Hazards CRC (2017)

Discussion

This study identified the psychological factors that predict cyclone mitigation behaviour to develop groupings of people based on these factors. It was found, in accordance with the theory behind the PADM/PMT, that perceived risk, mitigation efficacy and low resource costs were significant predictors of behaviour. The perceived visual appeal of structural mitigation, an uncommonly investigated factor in previous research, was found to be one of the strongest predictors of mitigation behaviour. However, self-efficacy was not a significant predictor of shutter installation. This finding suggests that the perceived ability for a home owner to organise the installation of cyclone shutters does not inhibit mitigation intention or behaviour.

Respondents were categorised into three groups based on attitudes towards cyclones and structural mitigation. The proactive group, who scored highly on both threat and coping appraisal (using PMT terminology), were more likely to have installed shutters or were more likely to endorse installing them in the future. This contrasts with the denialists and pessimists groups who perceived lower levels of threat and coping appraisal. These two groups were less likely to have installed shutters and less likely to intend to do so in the future. In other words, protective behaviour is more likely to occur when people have high levels of both threat and coping appraisal. The difference in behaviour and intention between these groups provides further support for the usefulness of the PMT/PADM in predicting variations in behaviour. Future research could investigate if similar psychological clusters can be identified in different cyclone-prone regions (outside of North Queensland) and in relation to other natural hazards (e.g. floods).

This study shows that it is possible to differentiate cluster groups using demographic information. This finding has important practical implications. For example, governments and insurance companies interested in delivering tailored risk messaging can segment people using demographic data without having to assess attitudes towards cyclones and structural mitigation. However, it is important to highlight that while the results show that differentiating cluster groups based on demographic information is possible, more research is needed to explain why specific links were found. Future research should focus on whether it is possible to accurately identify psychological clusters using demographic factors. This research would allow stakeholders to confidently disseminate tailored messages based on demographic information.

Types of cyclone experience was also shown to differentiate cluster groups. The proactive group was more likely to have experienced moderate property damage from a cyclone compared to other groups. This suggests that previous experience with cyclone and damage helps people realise the damage potential of a cyclone as well as the importance of structural mitigation. This reasoning explains why people who have experienced a cyclone that did not cause property damage were more likely to have 'denialist' attitudes. Experience with a cyclone that results in no damage may lead to people discounting cyclones as a threat and, therefore, thinking that structural upgrades are not necessary.

Finally, the pessimists group was more likely to have not experienced a cyclone. Without direct experience, attitudes towards cyclones can only be formed from what they have seen or heard from other people. As such, they may have only heard about the destructive potential of cyclones (commonly reported in news media) without hearing about effective methods for mitigating damage. People in the pessimists group may think that cyclone damage cannot be avoided. These findings suggest that until property damage from a cyclone has been experienced first-hand, people are less likely to understand and acknowledge the benefits of structural mitigation. It is important and beneficial to find ways to give people the experience of a cyclone and its destructive potential without experiencing the event or the damage.

Communicating with cluster groups

The findings suggest that risk communication messaging aimed at promoting structural mitigation should be

tailored to the target audience. As the pessimists group already acknowledge cyclones as a threat, they could be provided with information about the benefits of structural upgrades and how the long-term benefits of upgrades outweigh the upfront costs. The denialists group may benefit from messages that explain the damage potential of cyclones. The proactive group already have perceptions that are indicative of mitigation behaviour, so messaging should provide cues to make investing in structural mitigation easier. For example, insurance companies or governments could provide contact information for contractors who can install structural upgrades. Future research could investigate if this targeted approach to risk communication improves the uptake of structural upgrades in cyclone-prone regions.

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ABSTRACT

This research examined how people directly affected by a catastrophic event respond to that event, individually and as a community. It shifts from concepts of 'community-led' or 'recovery' after an event to a more pragmatic view of community disaster recovery. A catastrophic bushfire near Forcett, in Tasmania's south-east in 2013 is used to examine people's dependence on community and place to help then navigate the event. A constructivist grounded theory approach was used to identify a model of 'Navigating Uncertainty'. This covers three phases of 'Losing the familiar', 'Restoring the familiar' and 'Living with change'. These phases illustrate how people experience the perilous situation where lives were threatened and homes, communities and livelihoods damaged or destroyed. In such situations, people's decision-making and action are often underpinned by individual and collective values.

Navigating Uncertainty: community experiences of bushfire

Dr Fiona Jennings, practitioner and researcher, East Gippsland, Victoria.

Submitted: 12 May 2019. Accepted: 6 July 2019.

Introduction

On 4 January 2013, a fire started at Inala Road on the outskirts of Forcett, on the peninsular across from Hobart in Tasmania. The fire continued south along the Arthur Highway towards Port Arthur, devastating the small communities in its path. The Forest Fire Danger Rating and Forest Fire Danger Indices were Very High to Severe in the south-eastern districts. There were numerous fires burning across Tasmania including the fires in Forcett, Lake Repulse and Bicheno. By 3:00 pm, the fire rating reached Catastrophic level in five locations. The Forcett fire caused the most damage, burning 23,960 hectares and destroying 193 dwellings with another 186 buildings destroyed or damaged (Department of Premier and Cabinet 2013).

No deaths were attributed to this fire, however, the catastrophic fire conditions affected people's lives significantly. Animals perished, homes, livelihoods and the vegetation were damaged or destroyed. Throughout the bushfire, many of the communities were inaccessible as roads were closed and remained closed for seven days. Residents who remained in the area after the fire carried out various activities. For example, one family that had retreated into the waters of the bay and taken shelter under a jetty, were transported by Ambulance volunteers to the Dunalley Hotel at around 11:00 pm. Many people, like this family, were cared for by local people. Makeshift beds were organised on the floor of the hotel and food and water were provided. A registration point was established on the hotel balcony to record the people who had evacuated to that location.

The next morning, despite the isolation and with the fire still burning, some community members located a barbeque and fed over 100 people. The local charity shop was accessed to provide clothes for people. Over the next five days, the hotel kitchen provided daily meals to residents and visitors to the area who were stranded by the event. Residents who had habitable dwellings accommodated neighbours, friends and relatives who had lost their homes.

It became evident that people who lived in these communities possessed a diverse range of skills, good knowledge and experience that they could muster and provide during this time. Although the fire threatened life and left a trail of destruction, social structure and processes became evident. A sense of governance built on communal norms, together with a strong connection to place and social processes, gave meaning and purpose. These social structures and processes are considered in this research.

Literature review

The literature review has been the topic of debate throughout the evolution of grounded theory. In constructivist grounded theory, the initial literature

Figure 1: Map of Frederick Henry Bay and Norfolk Bay showing the extent of the fire on the western land areas, known as the Forcett fire.

Source: Tasmanian Government Department of Premier and Cabinet 2013

review provides a reflective account of the ideas exposed. It is the second review that integrates relevant existing knowledge with the new theory. The initial literature review presented in this paper considers social systems and coping.

The term 'coping' is used in the literature, however, despite its frequency, the term is complex especially when it comes to people's wellbeing. Wisner and colleagues (2004) claim "coping is in essence a strategy reactive to events beyond the immediate control of the individual, household or 'community'" (p.120). Handmer (2003) maintains that the capacity to cope and adapt to change is a valuable concept and a shift from vulnerability, which is often perceived as 'the susceptibility to loss and the capacity to recover' (p.56). The capacity to cope with the unforeseen or unanticipated could be considered as 'pro-*active adaptation*', hence, the struggles and activities of people affected by adverse circumstances and their ability to cope are often overlooked (Handmer 2003). As such, the capacity of a social system to 'cope' may remain unnoticed and understudied. Furthermore, consideration of vulnerability is often measured using resources within the context of socio-economic structures because it is perhaps easier to recognise by outside institutions (Wisner *et al*. 2004).

A critical aspect of coping is that when people's circumstances deteriorate, an individual's reaction may prove to be ineffective (Wisner *et al*. 2004). In the 1972 Buffalo Creek disaster, 132 million gallons of coal black water broke a makeshift dam and engulfed the 'tightly knit' community of 5000 people. It destroyed the homes of 4000 people and 125 people were killed. The catastrophic event significantly affected the community's emotional shelter; 'the surrounding community is stripped away and can no longer supply a base of support' (Erikson 1976, p.154).

Methodology

This research project was approved by the RMIT University Science Engineering and Health, College Human Ethics Advisory Network.

This study involved 40 people from the small communities of Forcett, Copping, Boomer Bay, Dunalley, Connelly's Marsh and Murdunna, as well as the towns of Bream Creek and Marion Bay. The study also included external support volunteers and representatives from local and state governments and non-government services.

A constructivist grounded theory method of analysis was used to gain an understanding of how people respond to the bushfire. The aim of grounded theory is to generate an original theory that is grounded in the data and not to impose a priori theory or framework. It is the theorising and interpretive work of people that results in a theory; interpretation developed from the researcher's perspective.

Grounded theory studies often begin with sensitising concepts, described as tools that 'provide a place to *start* inquiry, not to *end* it' Charmaz 2014, p.31). In this study, the sensitising concepts 'community-led recovery' stimulated the initial data generation, however, it was important to remain flexible and open to participants' experiences and views to allow the discrete storytelling of their involvement. A reflective account of data analysis that included how the data was transcribed and coded, and the strategies used, strengthened the analysis. This included theoretical sensitivity, memo writing and theoretical sampling that illustrated the technique and procedures used in the data analysis and category construction.

During analysis, the codes that best represented the multiple viewpoints, actions and experiences were used to build subcategories. Once the categories and their properties were defined and links made between categories, they were sorted and examined against the literature with inferences made about the empirical experience, which is the deductive part of grounded theory.

In this study, the word 'navigating' was used to define the 'process' that people pursued during the unaccustomed event. The word 'uncertainty' represents 'context' of the event and circumstances. 'Navigating Uncertainty' is an interpretive conceptual understanding of community members' involvement in the Forcett fires of 2013.

Findings

The theoretical outcome of this research, 'Navigating Uncertainty' is built around community members' main concerns and what they did to resolve those concerns. The findings imply that community members experienced three phases; 'Losing the familiar', 'Restoring the familiar' and 'Living with change'.

Figure 1: The grounded theory of 'Navigating Uncertainty'.

Losing the familiar

Leading up to the bushfire, the main concern that community members faced was the bushfire hazard, which diminished a context that was familiar, routine and safe. The ferocity of the bushfire created a level of uncertainty and disrupted their everyday activities.

Knowing about the fire

When community members became aware of the fire, their level of awareness was influenced by indications of the actual bushfire, the interpretation of cues and signs against their own reality and then were acted on. This included past bushfire experience, the weather conditions on the day and surrounding topography to determine a level of risk.

This study showed there were varying degrees of awareness, which were linked to actions. Some community members were aware of a fire but were blasé, believing the bushfire was not a threat and therefore were not concerned and payed little attention. Conversely, others were more active and assessed and acted on the fire threat by making predictions, using intuition, monitoring the event, planning and increasing their preparations.

Comprehending the gravity

Comprehending the gravity involved interpreting and reinterpreting what was happening to verify the seriousness of the fire hazard. The language used by community members to account for the fire behaviour illustrated their feelings of the experience. In this study, community members felt overwhelmed by the unpredictability of the fire's behaviour; seeing 'a ball of fire travelling across the water', 'fire jumping out of the sky', or a 'snowstorm of embers'. These words have a profound impact on the senses. Boylan, Cheek and Skinner (2013) noted that residents who chose to remain in the area 'stated that they were not prepared for the ferocity, heat, noise and speed of the bushfire' (p.33).

Safeguarding responsibilities

Safeguarding self, family and others was a priority and a high proportion of community members acted on their understanding of vulnerability and duty to others. This process involved checking that other residents had evacuated, were safe, or the knowledge of who was staying or leaving. A few community members knew areas they felt were safe and told others to seek shelter. They assembled in areas where there were groups of other people, fundamentally near the water, on the local jetties or on boats. Community members relied on advice from trusted local sources. For example, a local fisherman told one community member to watch the wind and the boats. If the boats changed direction, they recommended it would be time to leave.

Locating family and others

Communication during the event was hampered by the bushfire. Numerous community members who evacuated on advice from family, the police or of their own accord, thought they would be back 'in no time' and everything would be back to normal. When community members were separated from family and friends, their distress and anxiety increased. They conjured up scenarios, with many deliberating on memories of other events like the 1967 Tasmanian and 2009 Victorian Black Saturday bushfires where there was great loss of life. Staying connected was extremely important. Gibbs and colleagues (2016) show that separation from loved ones during and directly after fires is highly stressful and a risk factor in subsequent mental health problems.

Restoring the familiar

During the bushfire, community members' concerns were about the bushfire and the destruction, damage and disparity that directed their efforts on restoring everyday life. A sense of normality offered a level of certainty, stability and safety.

Hot, windy conditions fanned up to 40 fires throughout Tasmania in 2013 with the main fire started near Forcett that caused significant damage to local townships, particularly Dunalley where more than half of the town's buildings and a primary school were destroyed.

Image: Warren Frey

Recognising the disparity

Recognising the disparity entailed the comprehension of what had happened, the unfamiliar milieu, silence and devastation. Community members outside the fire zone struggled to grasp the information they received and yearned to know what had happened, which generated a powerful desire to see the burnt areas with their own eyes. This involved returning to the burnt-out areas to fully comprehend the extent of the information they had received, because hearing the detail didn't suffice; it made no sense and was unbelievable. To view the setting helped make it factual and helped community members interpret the situation. They described this experience as if their home had been placed in a different setting because very little was familiar. The walk or drive down the main street of Dunalley was, for one community member, the most 'bizarre ten minutes' of their life.

Restoring affairs

Restoring affairs involved re-establishing interactions and the familiar systems and relationships, place and way of life. To return to place was important. Community members felt a strong desire to return and recreate networks. Community members who had experienced the event and trauma first-hand, cared for others who were distressed or required support. One community member witnessed the effects of trauma through their interactions with others. They recognised an impairment of decision-making and they felt this was due to shock. Decision-making was impaired or delayed. While some community members attended to personal requirements, others managed practical matters such as clearing roads of debris to give emergency vehicles access. Residents adjusted their actions to the identified demand by recognising problems, prioritising tasks and then matching their capabilities and the resources available.

Fulfilling roles

Fulfilling roles involved meeting a need, demand, desire or custom. This study showed this was matched to capability, capacity and available resources. Existing roles changed and community members undertook additional responsibilities that were determined by their changing priorities. The efforts required to manage the event often went beyond the capacity of community member's normal existence, their day-to-day routine, role or usual duties.

Seeking the familiar

Many community members sought things that were familiar and valued seeing familiar faces, even the faces of residents whom they did not know but had seen. Some community members who lost homes chose to remain in the community close to extended family and to place. It was something they understood, and it was familiar. Others felt it was difficult to leave the area for work commitments. The community members whose homes were destroyed by fire yearned to return to place.

Sign on the highway towards the bushfire-ravaged area.

Image: Fiona Jennings

Exceeding expectations

Exceeding expectations involved the contribution of a large portion of self, to deal with the extra demands, moral obligations, changing roles and the added complexity of the event. Community efforts were a seven-day-a-week commitment and anytime of the day. The work often continued until the job was done. Priorities shifted and demands changed. The varying expectations for community members mirrored what was required; give that little bit more, juggle the extra job, make an effort, put in the hard yards. The extra demands generated by the fire were emotionally and physically demanding. This cumulative effect depleted energy and many people struggled with their emotions and felt exhausted. This study showed that much of this was kept private.

Living with change

Navigating such a significant life event defined each community member's experience in its entirety; their meaning and approach, unique and personal. Their involvement in the event influenced the individual as well as the community's recovery.

Comprehending change

Comprehending change involved reflecting on the overall event and its consequences and to attach and construct an interpretation. A few community members felt that the bushfire had exposed the best and the worst in people; egocentricity and altruism. Community members felt there was a common goal for a while and that it brought their sleepy villages together. Some recognised turning points when the altruistic behaviour and feeling of a common goal began to wane and previous lifestyles re-emerged. Residents' lives were exposed visually. When financial and material aid surfaced, individual values that related to equity and the distribution of benefit caused fractures in the sense of common purpose.

Adapting to change

Adapting to change involved an individual's approach or attitude to what was encountered. The position or stance community members adopted influenced how they adapted to change and moved forward. An individual's perspective, and the subsequent emotions and behaviours that came with that, helped them with the process of living with change. Many survival skills used were attributed to life experiences such as camping, living in rural areas where electricity could be unreliable and the willingness to make do with what you have, along with a reliance on others.

Finding place

Finding place involved looking at the 'bigger picture' to factor in other aspects of a significant life event; acknowledging the loss, damage and trauma as well as the renaissances. Erikson (1994) researched communities affected by disasters and identified two forms of trauma:

- individual (a blow to the psyche)
- collective (a blow to the tissue of social life).

The enormity of these trauma experiences affects meaning and the world is looked at in new and different ways (Eyre 2006).

The Forcett fire forced community members to step outside their comfort zones to connect, help and support each other and appreciate humanity. It created opportunities for different relationships with others, developing friendships and healing disagreements and disparities. One community member pointed out how they were different from their neighbour but during the emergency they worked with them to clear adjacent properties to protect their homes. In this process, they got to know each other and are now good friends. Community members who were relatively new to the area believed that the bushfire had 'sped up the processes' of them being 'accepted' by the community. It was generally recognised that being directly involved contributed to the development of friendships, strengthened relationships and a sense of belonging. This process contributed to finding place, gaining hope for the future, validating their efforts and confirming why they live where they live.

Discussion

'Navigating Uncertainty' assists in understanding the disorientation and subsequent reorientation people experience after extreme events. The Forcett fire was a significant life event that disrupted people's normal frameworks and social systems through the sudden loss of routine and familiar settings. Cox and Elah Perry (2011, p.400) note that 'the illusion of permanence, predictability and stability that is established through routines and the structuring of familiarity was unmasked'.

Interestingly, these types of reactions to an unfamiliar environment appear to be comparable to the theory 'culture shock', a term founded in social and experimental psychology on cross-cultural transition and adaptation. The literature on the psychology of culture shock draws attention to the cognitive and behavioural outcomes when people are suddenly exposed to a completely unfamiliar setting and feel largely overwhelmed by it. People may experience responses such as confusion, anxiety, bewilderment and disorientation. The earlier formations of culture shock were regarded as a 'negative, passive reaction to a set of noxious circumstances' (Ward, Bochner & Furnham 2003, p.270). Over time, these theories have evolved and people's reactions to unfamiliar cultural environments is recognised as an active process in dealing with change (Ward, Bochner & Furnham 2003).

In the Forcett fire, normative systems that were drawn on were valued by residents. Residents valued opportunities to connect with people they knew or were familiar with in places they were accustomed to. The uncertainty generated by the bushfire disrupted people's normative frameworks, which intensified the significance of familiarity. The disruption to normality meant personal relationships and shared histories became paramount during disorder (Ingold 2005).

The psychological and social processes provided meaning and purpose in a context of uncertainty and disruption, which contributed to the structures and processes that supported social stability. This happened at multiple levels of individual, family, group and community levels. There was meaning in the rebuilding of physical structures as it was about restoring familiarity, routine life, the sense of community, culture and traditional practices that provided certainty and social stability. Contemporary mental health literature has described recovery as a natural process of self-righting where people generally, unconsciously, act on the 'difficulties and distress that interrupt the status quo of daily life' (Australian Health Ministers' Advisory Council 2013, p.21).

Implications

Findings from this study offer implications relevant to people living in fire-prone areas as well as emergency management planners. 'Navigating Uncertainty' illustrates three phases that encapsulate before, during and after. The properties 'comprehending the gravity', 'recognising the disparity' and 'comprehending change' demonstrate the active process of adapting to change. The findings assist in understanding how people directly affected respond to new and unresolved problems during a disaster event.

Limitations

A limitation on this study is the length of time that has elapsed between the Forcett bushfires in January 2013 and the interviews, which were conducted in August 2015.

Conclusion

This study aimed to understand the experiences and perspectives of people living in the small communities affected by the Forcett bushfire in 2013. A constructivist grounded theory method was used to construct an interpretive understanding of the inherent psychological and social processes employed to deal with the event. A grounded theory method underpinned by symbolic interactionism assisted in preserving participants' language, actions and meaning throughout the research. This study found that under massive disruption residents relied on processes and systems that were familiar to them that fostered a sense of stability and helped sustain them through a period of uncertainty and change. This knowledge enhances understanding of community disaster recovery.

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About the author

Dr Fiona Jennings was directly affected by the Forcett bushfire and worked with the Tasmanian Government to coordinate the social recovery program for 18 months. Her PhD thesis was supported by RMIT University and the Bushfire and Natural Hazards Cooperative Research Centre.

ABSTRACT

Issues of marginalisation specific to gender and sex minorities include the loss of safe spaces, religious stigmatisation, physical and verbal abuse and the lack of disaster risk reduction policies to adequately address their needs. The majority of work regarding gender has focused on vulnerabilities and outcomes for women, heavily influenced by a Western perception of gender as being binary; women and men. This concept fails to incorporate the diversity of gender identities, particularly those in non-Western settings. Current disaster risk reduction policies and frameworks fail to recognise the experiences, needs and capacities of sex and gender minorities. It has been argued that some socio-economic development agencies consider sex and gender as requiring containment and control, rather than being acknowledged or embraced and contributing positively to society. Gender and sex minority groups can play an equal role in supporting their communities. A review was completed that consolidates current global literature on the experiences of sex and gender minorities affected by disaster events. This information may be used to guide disaster risk reduction policy, acknowledge the experiences and needs of people with different sexualities and gender identities, and improve outcomes for these people.

Based on a paper presented at the Australian and New Zealand Disaster and Emergency Management Conference, June 2019.

Pride and prejudice: LGBTIQ community responses to disaster events worldwide

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Introduction

It is widely acknowledged that sex and gender minorities experience social and political marginalisation in most societies. The extent of this is highly variable, differing across countries, states and geopolitical regions. It is dependent on applicable laws, politics and social values (Gorman-Murray *et al*. 2017). Such marginalisation results in forms of discrimination such as psychological and physical abuse, sexual assault, exploitation, shunning, forced heterosexual marriage and conversion therapy (Kahn *et al*. 2018). This can lead to social and political isolation and a higher prevalence of mental health issues (Kahn *et al*. 2018, Yamashita, Gomez & Dombroski 2017). Having legal rights and protection does not necessarily translate into exercising those rights, so discrimination may be present where gender and sex minorities have legal protection from discrimination (Sauer & Podhora 2013). According to Gorman-Murray and colleagues (2017), gender minorities face higher levels of discrimination than cisgendered minorities (where biological sex matches gender identity and sexual orientation is not heterosexual). This is because their gender identities do not fit neatly into the traditional gender-binary model, which emphasises biological sex and physical gender representations.

The vulnerability of a population, especially in times of emergency and crisis, can exacerbate aspects of marginalisation. This can amplify existing vulnerabilities and social issues. Studies by Gorman-Murray and colleagues (2017) identified several issues specific to gender and sex minorities, including the loss of safe space, stigmatisation, physical and verbal abuse and the failure of disaster risk reduction (DRR) policies to adequately address the specific needs of these minorities, leading to further exclusion and marginalisation. Additionally, the vulnerability of these groups is intersectional and influenced by other factors such as race, class, income and dis/ability (Stukes 2014, Haskell 2014, Alburo-Canete 2014).

Marginalised groups often develop their own support systems and coping mechanisms using available resources (McKinnon, Gorman-Murray & Dominey-Howes 2016, Gorman-Murray *et al*. 2017). Although ways to improve resilience may be universal, such as emotional regulation, other activities such as building family and school relationships and community bonding may not be appropriate due to social rejection (Beasley, Jenkins & Valenti 2015). During emergencies, specific tools and approaches that people employ will determine their level of resilience.

Research benefits and contribution

The majority of work regarding gender and disaster has focused on women, heavily influenced by the Western perception of gender existing as a binary;

women and men (Gaillard *et al*. 2017). This traditional concept of gender is limiting and fails to incorporate the diversity of gender identities, particularly those in non-Western settings (Petchesky 2012, Gaillard *et al*. 2017, Gaillard, Gorman-Murray & Fordham 2017). Researchers agree that current DRR policies and frameworks fail to incorporate the experiences, needs and capacities of sex and gender minorities (Dominey-Howes, Gorman-Murray & McKinnon 2014; Gaillard, Gorman-Murray A & Fordham 2017). Gaillard, Gorman-Murray & Fordham (2017) identified that the *Hygo Framework for Action 2005–2015* and the *Sendai Framework for Disaster Risk Reduction 2015–2030* include gender as a significant consideration. However, the assumption is for the needs of women, and heterosexual women in particular (Gaillard, Gorman-Murray & Fordham 2017). It has been argued that some socio-economic development agencies consider sex and gender minorities as requiring containment, rather than being embraced as central to human experience and having the potential to positively contribute to society (McSherry *et al*. 2015).

The review showed there was a significant lack of research undertaken specific to gender and sex minorities in disasters. Dominey-Howes, Gorman-Murray and McKinnon (2014) reviewed five pre-2012 case studies and identified significant issues. To date, little seems to have progressed. This review aims to consolidate current literature on the experiences of sex and gender minorities to help guide the DRR policy, acknowledging the experiences and needs of people with diverse sexualities and gender identities.

Methodology

A comprehensive search was conducted using the MEDLINE (1985-7/10/2018) ProQuest (1938-7/10/2018), and PsychINFO (1946-7/10/2018) databases. A combination of the following terms were used: 'disaster'; 'sexuality'; 'non-binary'; 'lesbian'; 'gay'; 'homosexual'; 'homosexuality'; 'bisexual'; 'transsexual'; 'transgender'; 'transgendered'; 'intersex'; 'two-spirit'; 'two spirit'; 'pansexual'; 'polysexual'; 'queer'; 'genderqueer'; 'same sex relationship'; 'same-sex relationship'; 'sexual minority'; 'gender minority'; 'LGBT'; 'LGBTI'; 'LGBTQ'; 'LGBTIQ'; 'LGBTQI'; 'LGBTIQA'; 'LGBTQIA'; LGBTQ+'. All search terms were combined with Boolean terms and truncation symbols. Results were limited to peer-reviewed, English language publications. Reference lists of all relevant publications were reviewed to identify additional publications, including grey literature. The title and abstract of all records were reviewed by an independent author to identify potentially relevant publications. All relevant publications were read in full.

Results

The search returned 207 potentially relevant publications; 23 from the MEDLINE database, 35 from the PsychINFO database and 149 from the ProQuest database. There were 27 additional publications identified through searches of references lists. After duplications were removed, a total of 172 publications remained. All 172 publications were reviewed based on title and abstract and 127 publications were excluded. As a result, 45 publications were selected for full-text review. Three publications were excluded because gender and sex minorities were not the focus of the research. Four were excluded as they did not relate to disaster events. This left 38 publications selected for inclusion in the final review.

Discussion

Increasing discrimination and vulnerability

Gender and sex minorities face difficulties in gaining acceptance from societies worldwide (Stukes 2014; Dominey-Howes, Gorman-Murray & McKinnon 2014). Increased rates of discrimination in various forms have been experienced and described in disaster events. These are summarised in Table 1.

Urbatsch (2016), Stukes (2014), Haskell (2014) and Richards (2010) describe that attitudes towards homosexuality are linked with the condemnation of sex minorities by conservative religious groups. This was evident after the 9/11 World Trade Centre attacks and Hurricane Katrina. They noted that this is a reflection of the concept of divine retribution; human suffering being a consequence of sin. Urbatsch (2016) found a measurable increase in negative attitudes towards homosexuals after disaster events, if only temporary. The International Gay and Lesbian Human Rights Commission (IGLHRC) and SEROvie[1] (2011) found similar occurrences after the Haiti earthquake, where the gay community was accused of 'calling down the wrath of God'. Paine (2018) presented similar findings, stating some faith leaders held discriminatory attitudes towards LGBTIQ people, 'legitimising hateful and violent behaviour' towards them. Haskell (2014) argues these concepts create unique social challenges in emergency and crisis situations.

Negative attitudes and discrimination against gender and sex minorities manifest in various ways. This includes verbal abuse, noted by Yamashita, Gomez and Dombroski (2017), where a transgender person in Japan was called a 'cross-dressing deviant fag' by a volunteer. Of concern are reports of violence and sexual abuse, described by Knight and Welton-Mitchell (2013) after floods in Nepal, and Pincha and Krishna (2008) after the tsunami in India. Other noteworthy examples are described by IGLHRC and SEROvie (2011) after the Haiti earthquake; the rape of a lesbian by eight men and the beating by a crowd of an MSM[2] person who dressed as a woman to try and obtain food. Also reported was 'corrective rape' against female-identified people. D'Ooge (2008) describes a

1 A Haitian community organisation that provides services to sex and gender minority groups.

2 Men who have sex with men. This term is not necessarily indicative of sexual identity.

Table 1: Publications describing the vulnerability of and discrimination against gender and sex minorities in disasters.

Year	Location	Event	Publication author(s) and date
2001	USA (New York)	World Trade Centre 9/11 attacks	Eads 2002 Espinosa *et al.* 2010 Urbatsch 2016
2004	India	Indian Ocean tsunami	Pincha & Krishna 2008
2005	USA (New Orleans)	Hurricane Katrina	Leap, Lewin & Wilson 2007 D'Ooge 2008 Richards 2010 Petchesky 2012 Haskell 2014 Stukes 2014
2008	Nepal	Flood	Knight & Welton-Mitchell 2013
2009	Samoa	Tsunami	Gaillard *et al.* 2017
2010	Indonesia	Mt Merapi volcanic eruption	Balgos, Galliard & Sanz 2012 Gaillard *et al.* 2017
	Haiti	Earthquake	IGLHRC and SEROvie 2011 Petchesky 2012
2011	Australia (Brisbane)	Flood	McKinnon, Gorman-Murray & Dominey-Howes 2016 McKinnon, Gorman-Murray & Dominey-Howes 2017 Gorman-Murray *et al.* 2018
	New Zealand (Christchurch)	Earthquake	McKinnon, Gorman-Murray & Dominey-Howes 2016 McKinnon, Gorman-Murray & Dominey-Howes 2017
	Japan	Earthquake and tsunami	Yamashita, Gomez & Dombroski 2017
2012	Samoa	Cyclone Evan	Gaillard *et al.* 2017
2013	Philippines	Typhoon Haiyan	Ong 2017
2014	Nepal	Earthquake	Sthapit 2015

transgender woman being arrested and detained by police for four days after taking a shower in the women's bathrooms at an evacuation centre after Hurricane Katrina. Petchesky (2012) describes the sexual and gender-based violence against transgender people committed by aid workers after the Haiti earthquake.

Policy deficiencies

Dominey-Howes, Gorman-Murray and McKinnon (2014, 2016) and Cianfarani (2012) found that gender and sex minorities are largely absent from DRR policy. Dominey-Howes, Gorman-Murray and McKinnon (2016) note that in Australia, the exclusion of these groups is likely due to omission rather than deliberate discrimination. This suggestion is possibly applicable to other jurisdictions where sex and gender minorities are granted similar legal rights regarding protection from discrimination. However, Gaillard, Gorman-Murray and Fordham (2017) acknowledge there are other challenges in countries where activities perceived as non-conforming are illegal. Regardless of legal status, their needs remain invisible. ILGHRC and SEROVie (2011) found gender-restrictive policies in Haiti prevented all-male households from accessing relief supplies; women were prioritised. Yamashita, Gomez and Dombroski (2017) found in Japan that people in same-sex relationships had difficulty visiting partners in hospital and were unlikely to be informed of a partner's death and did not qualify for public housing due to restrictive, definitions of 'household' or 'relatives'. After Hurricane Katrina, Stukes (2014), Leap, Lewin and Wilson (2007) and Haskell (2014) describe the denial of resources and the physical separation of same-sex couples and families being a result of restrictive definitions of 'family', indicating they were not eligible or prioritised for housing assistance. Haskell (2014) also noted same-sex partners were not guaranteed hospital visitation rights and had no power to make medical decisions.

Balgos, Gaillard and Sanz (2012) and Gaillard, Gorman-Murray and Fordham (2017) found the *warias* of Indonesia (a group for which western definitions of gender cannot be easily applied) were effectively invisible after the volcano eruption, as evacuees were listed as either male or female. They generally found accommodation with friends rather than in evacuation centres. Similar findings are described in Dominey-Howes, Gorman-Murray & McKinnon (2014) and McSherry and colleagues (2015) regarding *baklas* of the Philippines (also falling outside western gender definitions) who were either denied relief supplies or experienced harassment when seeking supplies. This was also the case for the *aravanis* of India, as described by Pincha and Krishna (2008), where these people and their families were ineligible for government compensation, did not receive relief assistance, and were excluded from evacuation shelters.

Consequences

The consequences of discriminatory attitudes, combined with exclusionary policies, are significant barriers to

accessing disaster relief, directly affecting health and wellbeing. Gorman-Murray, McKinnon and Dominey-Howes (2014), Gorman-Murray and colleagues (2017) and Gorman-Murray and colleagues (2018) note the actual experience of discrimination is not required to develop a reluctance to access support, everyday experiences of discrimination are sufficient. Espinosa and colleagues (2010) found that after 9/11, gay and bisexual men were more likely to engage in risk-taking behaviours such as unprotected sex and substance use if their partner had died. Cruess and co-authors (2000), found that HIV+ gay men experienced negative physical and emotional health outcomes following Hurricane Andrew in 1992. Yamashita, Gomez and Dombroski (2017) also described people avoiding using public hygiene facilities in Japan, impacting the health of transgender evacuees. Sthapit (2015) and Knight and Welton-Mitchell (2013) found that Nepalese people whose identity documents indicated a different gender to how they presented were excluded from relief camps and were unable to receive medical care or enrol in school. Knight and Welton-Mitchell (2013) also mention the experience of one natuwa in Napal whose family was given fewer supplies than others due to their identity.

There have been documented cases of these people significantly altering their behaviour in order to access support and maintain safety. IGLHRC and SEROvie (2011), state that some men adopted a 'more masculine demeanour' to avoid harassment and increase their access to services. Leap, Lewin and Wilson (2007) described how a lesbian couple presented as sisters in order to access support. Cianfarani (2012) found that discrimination and access to services during disasters are significant concerns in Canada, although the lived experience of this has not been researched.

Destruction of safe spaces, communities and support

Research has detailed the importance of safe spaces for the wellbeing of all people, including gender and sex minorities. Dominey-Howes, Gorman-Murray and McKinnon (2014), Gorman-Murray and Dominey-Howes (2014), Gorman-Murray and colleagues (2014), Haskell (2014) and Gorman-Murray and colleagues (2017) note the increased vulnerability of these groups is exacerbated due to the destruction of privacy, personal spaces, and community centres; evacuation centres are particularly problematic. McKinnon, Gorman-Murray and Dominey-Howes (2017), Gorman-Murray and colleagues (2017) and Haskell (2014) describe that the loss of a home may equate to a loss of ability to avoid hostilities, and may mean a loss of ability to safely express personal identity. In the 2011 Brisbane floods, it was documented that the presence of disaster relief volunteers in a gay man's home was a difficult experience. Although they likely had good intentions, they disposed of items central to the owner's identity, contributing to feelings of marginalisation. Knight and Welton-Mitchell (2013) found the loss of safe spaces to be problematic in Nepal, where gender minorities faced additional discrimination when moving into new communities. Comparable occurrences are documented by McKinnon, Gorman-Murray and Dominey-Howes (2017) in New Zealand, where a gay couple moved their business to a new area and suffered homophobic abuse and vandalism. Similarly, Richards (2010), and Yamashita, Gomez and Dombroski (2017) note that disaster events force the coming-out of gender and sex minorities due to a loss of privacy, which adds to the trauma experienced.

The breakdown of communities was described by IGLHRC and SEROvie (2011) in Haiti, where the destruction of community centres and services had a significant impact on people who used them for health and social support. This was also documented by Leap, Lewin and Wilson (2007), after Hurricane Katrina, as large numbers of people were forced to relocate from their neighbourhoods. This intensified the already prevalent issue of housing insecurity, as the *Louisiana Equal Housing Opportunity Act* permitted discrimination based on gender and sexuality (Haskell 2014). Richards (2010) and D'Ooge (2008) found that tourism suffered after Hurricane Katrina and gay tourist areas were not prioritised in rebuilding efforts.

Of significance is the experience of people identifying as transgender. Yamashita, Gomez and Dombroski (2017) note that the disruption of access to materials that enables gender performance (cosmetics, clothing, medication) and the consequences of the perception of others are significant. One Japanese transgender evacuee avoided using hygiene and laundry facilities due to concerns regarding their perceived gender. Similar issues are described by Gorman-Murray and colleagues (2018), in Australia and New Zealand, regarding access to medication and transgender-specific health advice, as well as disruptions of transgender-friendly shared accommodation.

Organisational relationships

Relationships between emergency response organisations and gender and sex minorities can impact on use of those services. Stukes (2014) found there were few organisations openly supportive of LGBTIQ people during Hurricane Katrina. Gaillard and colleagues (2017) noted that organisations will 'include gender programs as a sign of accountability to western donors' and claim the mainstreaming of gender, but this is mainly restricted to cisgendered women. Sthapit (2015) found this was true during the 2010 earthquake in Nepal, with non-government organisations being primarily accountable to donors rather than communities they serve. Diverse family structures and gender roles of Nepal were ignored. In Haiti, IGLHRC and SEROvie (2011) found there was concern of homophobia being 'exported' via religious missionaries. In Australia, Dominey-Howes, Gorman-Murray and McKinnon (2016) found the New South Wales Government employs faith-based organisations to provide emergency-related services. Some of these organisations have actively campaigned for the right to discriminate against gender and sex minorities. Currently, faith-based discrimination against

gender and sex minorities in Australia is legal, although whether this actually occurs was not discussed. Paine (2018), an employee of Christian Aid, authored a paper about the organisation's attitude towards the rights of LGBTIQ people, which was historically exclusionary. The push to become more liberal was met with substantial internal resistance, as well as the concern that financial donors would withdraw. This was the case with World Vision USA when they employed people in same-sex marriages. In the face of this resistance, Christian Aid 'takes a moral position on the treatment of LGBTI[Q] people, [however] it does not seek to take a moral position on sexuality or gender identity' (Paine p.169).

Ong (2017) describes different relationships between aid organisations and communities affected by Typhoon Haiyan. In this case, gay foreign aid workers created safe spaces for local sex minorities. However, also described were problematic situations of gay foreign aid workers engaging in sexual relations with local people. Although these situations may have been mutually beneficial, they are generally frowned upon. Stukes (2014) describes in detail the contributions and successes of the (very few) LGBTIQ-friendly organisations that worked to improve outcomes after Hurricane Katrina.

Resilience factor

As described by Gaillard, Gorman-Murray and Fordham (2017), Gorman-Murray, McKinnon and Dominey-Howes (2016), Dominey-Howes, Gorman-Murray and McKinnon (2014) and Gorman-Murray and colleagues (2014), vulnerability and resilience are not mutually exclusive; they can be demonstrated simultaneously. Despite discrimination and exclusionary policies, sexual and gender minorities draw on informal networks for support, rather than accessing mainstream services. This was described in the United States of America (Leap, Lewin & Wilson 2007; D'Ooge 2008, Stukes 2014), Indonesia (Balgos, Gaillard & Sanz 2012), the Philippines (Ong 2017) and Australia (McKinnon, Gorman-Murray & Dominey-Howes 2016; Gorman-Murray *et al*. 2017; Gorman-Murray *et al*. 2018). Additionally, Ong (2017) and Beasley, Jenkins and Valenti (2015) note the importance of online communities for these minority groups to maintain a sense of community and connection. Dominey-Howes, Gorman-Murray and McKinnon (2014) suggest the importance of strong community connections between sexual and gender minorities during disasters is particularly worthy of attention in research and policy-making.

A survey conducted by the Queensland Association for Healthy Communities one year after the 2011 Brisbane floods showed over 50 per cent of respondents self-identifying as a sex or gender minority avoided official support services due to uncertainty or anxiety (Gorman-Murray, McKinnon & Dominey-Howes 2016). However, LGBTIQ community organisations do compensate for shortfalls in support provided by mainstream services, including finding safe accommodation and psychosocial support. This has been documented in the United States of America (Stukes 2014, Eads 2002), Haiti (IGLHRC and

Discrimination can lead to a higher prevalence of mental health issues compounded by social and political isolation.

Image: Eric Brumfield

SEROvie 2011, Petchesky 2012), and Australia and New Zealand (Gorman-Murray *et al*. 2014). Gorman-Murray and colleagues (2017) also note that during the Brisbane floods of 2011, people of diverse sexualities and genders would have preferred to access support through LGBTIQ groups but were unable due to geographical barriers such as distance and physical accessibility.

Contribution to DRR

People of diverse genders and sexualities support disaster relief efforts in a number of ways (Stukes 2014). Gaillard and colleagues (2017) and McSherry and colleagues (2015), regarding the *fa'afafine* of Samoa, and Balgos, Gaillard and Sanz (2012), regarding gender minorities in non-Western settings, identified that the capacity of these groups was a major factor in their ability to contribute to disaster relief activities. They were able to perform tasks traditionally assigned to both men and women, provided assistance to other people, and could allocate more time to relief activities (being less likely to care for children). Ong (2017) noted that after Typhoon Haiyan, local gay men were appointed to leadership positions in accountability and communications departments for large aid organisations. This may have been due to their ability to communicate effectively with various populations.

Inclusive policy

Given widespread exclusion of gender and sex minorities from DDR policy, little research has been conducted into how inclusive policy changes would benefit communities. In Indonesia, following the 2010 Mount Merapi eruption,

McSherry and colleagues (2015) found that the *baklas* had specific advantages in terms of social networking and the ability to support a range of activities, particularly as 'social agents'. This recognition and their engagement ultimately served to reduce discrimination and anti-*bakla* harassment. In West Hollywood, California (Wisner, Berger & Gaillard 2017) showed minority communities were directly involved in the development of local DRR policy. There has been a shift in perception from LGBTIQ people being vulnerable and 'at-risk', to being people with agency and the capacity to contribute to risk reduction activities. The appointment of a transgender woman to the position of chairperson of the public safety commission assisted in driving community empowerment and participation rates in DRR activities. Cianfarani (2012) also found that inclusive policy may assist in reducing vulnerability, and emergency management communities would benefit from building relationships with LGBTIQ organisations.

Recommendations

The steady growth of research in this area must continue

Although currently limited, research in this area is expanding and exploring issues relating to LGBTIQ experiences in disasters more deeply. This will assist in guiding DRR policy and practice to reduce vulnerability and improve the provision of appropriate services.

The needs and capacities of gender and sex minorities must be acknowledged in DRR policy

A policy shift towards gender inclusivity rather than gender equality that may reduce the vulnerability of gender minorities, especially in non-Western contexts. The removal of heteronormative policies, particularly regarding restrictive definitions of family and gender may significantly improve outcomes for these groups.

Disaster response organisations must provide inclusive services and build relationships with gender and sex minorities

This inevitably involves developing and maintaining an awareness of LGBTIQ issues and how service providers can work to reduce vulnerability. Significant resistance may be encountered in faith-based organisations and in jurisdictions where homosexuality is criminalised. Further research into improving inclusivity in these contexts may be beneficial.

LGBTIQ organisations need acknowledgment for their role in DRR

These organisations have demonstrated a willingness and capacity to contribute to emergency response. Prioritising the resumption and building of their services, while using already established networks to build DRR capacity, may allow the provision of targeted services, especially where there are barriers to accessing mainstream support.

Community engagement

Working with these communities may assist in the development and implementation of plans and policies for the provision of appropriate services. This may also assist to increase participation rates in DRR activities.

Future research directions

Research shows that gender and sex minorities may be affected by race, disability and socioeconomic status. Exploring this may lead to improvements in services for people particularly vulnerable. Additionally, widespread deficiencies in inclusive policy creates opportunities to explore how policy changes may improve outcomes.

Conclusion

People in gender and sex minorities face discrimination in society every day. During disaster events, they frequently experience discrimination, harassment, violence and denial of services. The destruction of safe spaces can contribute to greater marginalisation. This creates substantial barriers to accessing adequate support, which can lead to negative outcomes. These situations are compounded by exclusionary policy and poor relationships between emergency response organisations and the LGBTIQ community. Despite such challenges, these people demonstrate resilience and the capacity to make significant contributions to disaster risk reduction. The coexistence of vulnerability and resilience warrants acknowledgment in policy-making and by response organisations. While not an easy task, research in this field will assist in developing and guiding inclusive DRR policy.

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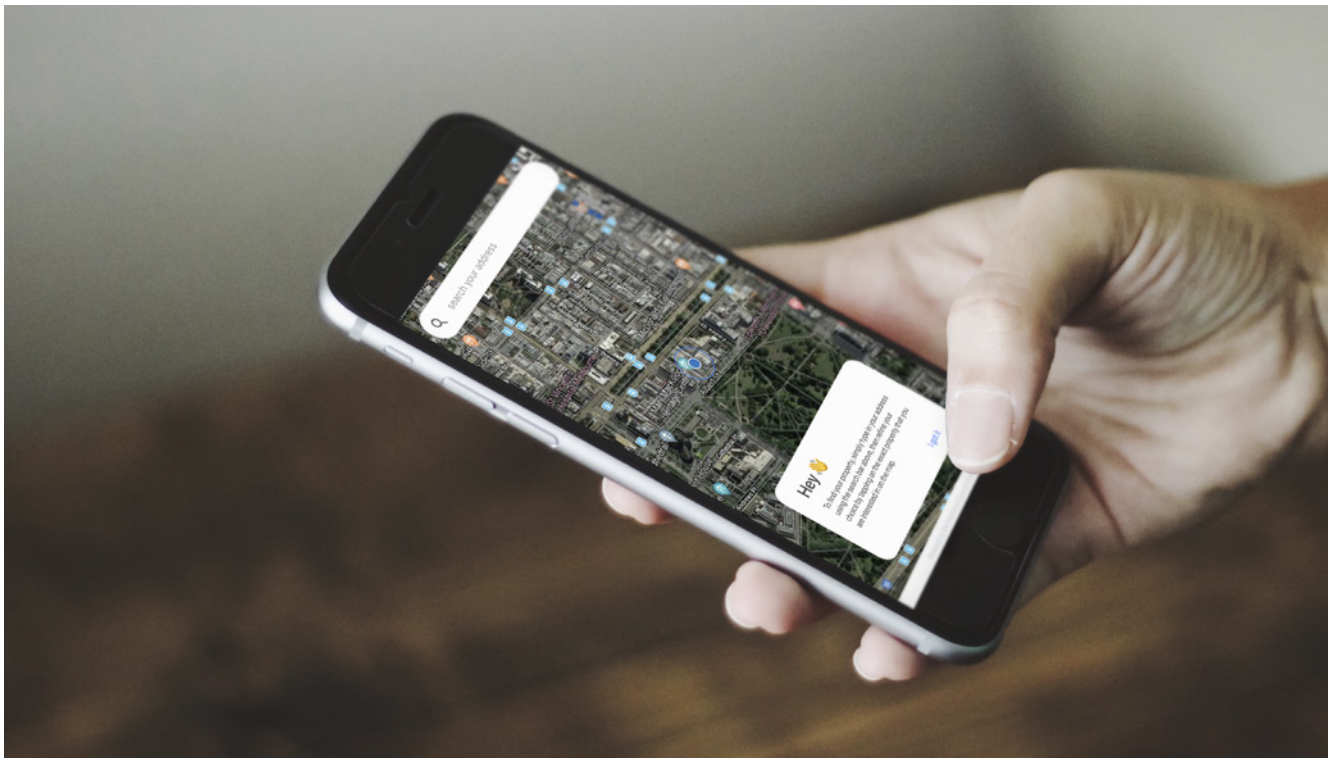

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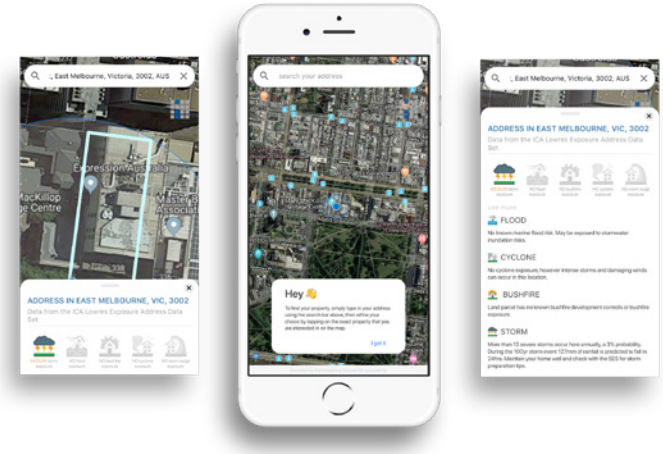

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