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MAPPING AND UNDERSTANDING BUSHFIRE AND NATURAL HAZARD VULNERABILITY AND RISKS AT THE INSTITUTIONAL SCALE PROJECT FINAL REPORT 2017

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Business
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Finally we would like to thank the participants who attended our workshops and other members of the Emergency Management community who have so generously contributed their time and knowledge.



EXECUTIVE SUMMARY

The National Strategy for Disaster Resilience states “disaster resilience is the collective responsibility of all sectors of society, including all levels of government, business, the non-government sector and individuals” (COAG 2011).

Although there is broad agreement that investment in prevention and preparedness provides significant returns on investment in avoided damages and that planned recovery can minimise unavoidable damage and subsequent loss (Deloitte Access Economics 2013; Kelman 2013; Hallegatte 2015); current spending pattern do not reflect this. Australia’s capacity for disaster resilience is limited by this lack of investment and poor connectivity between the major institutions concerned.

Natural hazard disasters are systemic, potentially resulting in catastrophic impacts capable of breaching geographic, institutional, and operational thresholds. Such impacts often interact with other risks, causing knock-on effects, or risk contagion.

While some locations can successfully implement strategic planning for a limited number of natural hazard risks, at regional and government scales, a multi-hazard, multi-value approach needs to be taken. A key aspect of this is the ability to plan strategically, but act immediately. This requires an understanding of systemic risk across multiple time scales and differs to more conventional understandings based on the cause-and-effect nature of individual hazards, which often focus on response.

As events can be anticipated but not predicted, particularly if there is a series of events that cascade together, it is important to broaden the current focus. Clarity is also needed as to how current funding and resources can be best leveraged to build resilience and support longer term recovery. This is an important part of ensuring the future sustainability of emergency services organisations. To achieve this, it has been important to provide a practical basis to assist clarification in following areas:

- What values are important, who they are important to and why.
- The potential impacts of natural hazards on different values in the medium to longer term.
- Who owns these values and the risks associated with them.

The research undertaken by this project examined these areas through the following aspects:

- Exploration of the role and use of values in decision making as part of risk ownership.
- The development of an economic geography which analysed vulnerability of economic values to natural hazards using a sensitivity and exposure methodology, as well as incorporating economic diversity.
- The exploration of risk ownership as a systemic risk and the current arrangements surrounding this within a strategic decision-making context.



- The components needed in an operational context for strategic planning and risk ownership to be integrated into practice.

As our research was designed to be responsive to end user needs, we have had engagement with and input from our end users throughout the project. This has resulted in some adjustment of our focus, process and outputs to accommodate emerging needs as the project progressed.

The project has experienced some unanticipated outcomes during the process which have impacted aspects of the work. These have included:

- Lack of available data needed to fulfil the original brief.
- Limited resources to fulfil the complex needs technologically of a map that was able to show multiple values with hazard overlays.
- Changing needs and agendas within the end user group.
- Higher than expected engagement from end users with the project which resulted in a longer than anticipated feedback phase.

In relation to the economic work undertaken, there were two focuses, the development of the *Values at risk map* and the application of economics to decision making in the area of risk ownership. The original intention of the map, was to develop GIS maps showing (monetary and non-monetary) social, environmental and economic values, which would then be combined with hazard data to identify areas where specific groups of values may be at risk. The map was produced and assessed by end users who determined it to be of limited use in their own working contexts. However, it was determined it could be useful in a research or used in an experimental context for end users. The research findings from the work undertaken in these maps and the economic implications for management of natural hazards have been synthesised in the *Mapping and understanding bushfire and natural hazard vulnerability and risks at the institutional scale: Research synthesis report*.

The risk ownership research included: A desk top review, scenario based research workshops, the development of institutional maps and the co-development with end users of a process based framework. The key purpose of this area of research was to identify how risk ownership was currently allocated in strategic planning and implications of this for the management of natural hazards. This research was used to inform the development of the risk ownership framework. End user feedback supported its alignment with the National Emergency Management Guidelines (NERAG) as a mechanism for assisting integration with current operational activities. A summary of key findings from these research activities are detailed in the *Risk ownership summary: Key research findings*.

The completion of this project has seen the delivery of all scheduled deliverables and it has received further funding to support development of risk ownership professional development training to support understanding and utilisation of the risk ownership framework.



END USER STATEMENT



Ed Pikusa, BNHCRC Lead User Representative

This project has greatly improved understanding the complexity of risk ownership in the emergency management sector.

The resulting framework is designed to assist practitioners better understand the ownership of risk across a diverse and complex sector, and the identification of 'unowned risks'.

It is very encouraging that jurisdictional end users have recognised the value of this approach, and are seeking to include it within their risk planning frameworks.

Adoption and Utilisation activities for this framework will continue, and I encourage other end users to seek opportunities to better understand the ownership of risk across their organisations and sectors.



PRODUCT USER TESTIMONIALS



Author: Greg Christopher, Senior Officer, Emergency Risk
Date: 29 March 2017
Subject: Risk Ownership Framework for Emergency Management Policy and Practice

Endorsement

The Risk Ownership Framework for Emergency Management Policy and Practice (the Framework) is underpinned by comprehensive research. Key tenets of the Framework include:

- If a risk is not owned, it is unlikely to be managed
- There is potential for a range of values to be impacted by emergencies, both tangible and intangible, and
- Mapping and attributing ownership of these values identifies the organisations and people that have a stake in managing the risks to these values from emergency events.

The Framework includes a companion process to the emergency risk assessment process that ensures that the values (tangible and intangible) are resilient to the effects of emergencies. It provides a better understanding and acceptance of who is responsible for the associated risk management activities / treatments.

The Framework supports a collaborative approach for prioritising investment for emergency mitigation, focussing on a broad range of stakeholders with responsibilities for managing emergency risks. It is also applicable to all types of emergencies and therefore consistent with the 'all communities / all emergencies' model.

Importantly, the Framework provides clarity for shared responsibility, which is an important element of managing emergency risks. It not only makes sense of the dynamic nature of risk ownership for emergencies, it provides a method for identifying disparate risk owners at different stages.

Emergency management well recognised as being complex, it involves the integrated and cooperative allocation of resources from a range of agencies / organisations. The companion process identifies risk owners beyond the agencies that have traditional emergency management roles. The outputs of this activity have the potential to guide priority projects and programs for mitigation and enhance community resilience.

Key elements of the Framework's risk ownership process have been mapped to the risk assessment process in the National Emergency Risk Assessment Guidelines (NERAG). Even though this provides important linkages to the NERAG a process, greater application of the risk ownership process is expected if the key concepts are integrated into NERAG. Accordingly, future revision of the NERAG should incorporate the risk ownership process.

I commend the Risk Ownership Framework for Emergency Management Policy and Practice to agencies / organisations involved in emergency risk management. It makes sense of the complexity of risk ownership and has the potential to significantly improve the outcomes of emergency risk assessments, and enhance community resilience. The key concepts of the Framework have already influenced the development of the draft Victorian Emergency Risk Management Framework.



Chris Irvine, Senior Planning and Education Officer, State Emergency Service, Department of Police, Fire and Emergency Management, Tasmania

"The project team actively considered end-user needs and effectively collaborated with end-users to deliver outputs that were of direct benefit to the emergency management sector and wider community."

"The Risk Ownership Framework for strategic emergency management and practice provides activities that integrate into the National Emergency Risk Assessment Guideline process to improve the consideration of values, analysis of risk ownership, and the identification of viable treatment options".

INTRODUCTION

Understanding and uptake of risk ownership and greater understanding of how economics could be applied to values in strategic planning, were identified during this project as critical components in enabling resilience actions and supporting future investment.

The area of focus for this research was strategic risk and it covered areas of prevention and preparedness before events and recovery after events (Figure 1). We did not include the response phase during events, as this uses a different type of decision making. Strategic management includes mitigation incorporated into planning and preparation, designed to reduce the impacts of natural hazard risks. Resilience was also included as a key contributor to recovery and was viewed as any set of actions that did not alter the risk itself, but could influence levels of exposure, sensitivity and vulnerability.

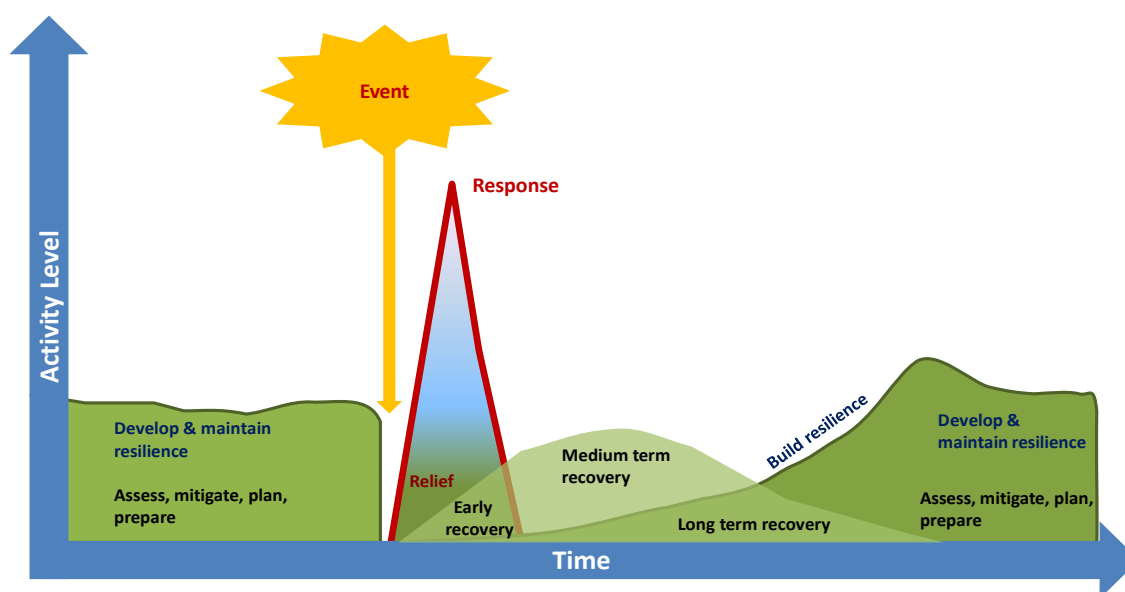


FIGURE 1: PROJECTED RESOURCE REQUIREMENTS FOR EFFECTIVE INTEGRATED NATURAL HAZARD RISK MANAGEMENT TASKS ACROSS TIME SCALES (YOUNG ET AL. 2015, ADAPTED FROM AEMI 2011).

The project mapped a broad range of economic, social and environmental values, and related these to natural hazards within Victoria.

Using a matrix, we mapped five key institutions; local, state and federal government, industry and business and civil society across the four values categories: Social, environmental, built infrastructure and economic.

Ownership was examined from two perspectives:

- Ownership of the value (asset).
- Ownership of management of natural hazard risk activities.



This was undertaken using the RAP Criteria which asked the following questions:

- Who is responsible for the risk?
- Who is accountable for the risk?
- Who pays for the risk?

This research aimed to benefit decision makers in the Emergency Management Sector (EM Sector). We did this through working closely with our end users and representatives from other institutional areas such as local, state and federal government, the community and private sectors, to determine more effective ways for identifying different economic, social and environmental values and how they were at risk from natural hazards. We also explored ways to clarify areas of risk ownership to improve the long-term management of natural hazard risk.

The project goal was to support more effective strategic decision making through the allocation of risk ownership. The risk ownership framework was based on emerging EM Sector needs in these areas that were identified as part of our research.





BACKGROUND

Currently, government spending on natural disaster response is more than 20 times spending on mitigation. When natural disasters are large and combine in unpredictable ways, they also cross domains; moving from the private to the public realm, and shifting from a local, to a state or national concern. Many climate-related natural hazards are increasing and the number of people living in hazard-prone areas is also increasing. This raises the potential of future, unmanaged risks.

Although the spending mismatch between response and mitigation is well understood, we face potential deficits in important social and environmental values. This is because they may not be adequately accounted or compensated for in decision-making processes. Communities and the environment are vital components of liveability and sustainability, but their underlying values are not well understood. If a risk is owned (in that who is responsible for managing the values under threat can be clearly identified), then we can assess this imbalance. If the risk is unowned, these values may be more likely to be damaged and degraded, or lost.

Values underpin the foundations of decision making. Our internal values shape the decisions we make and determine how and what we value around us (Schwartz 2012). Yet often the things we value around us only become visible when they are lost. To date, there has been little clarity as to the interactions between different types of values, and the role that they play in decision making within and across institutions.

Preventing future loss of values and the associated costs from uncertain but potentially severe natural hazard events can be difficult, but is necessary in order to make the case for investment. It is also important for understanding more fully the implications of the trade-offs associated with different mitigation options to improve strategic decision making and clarify complex or incomplete arrangements in relation to ownership.

The increasing intensity of some natural hazards, changing demographics and environmental conditions is placing many of these values at greater risk. This is driving the need to better understand which values are most vulnerable and their worth. To ensure effective management of natural hazards, it was found to be important to identify who has ownership of these values and the risks that threaten them. Also, how both the risks and ownership of these can change across longer term timeframes.

This project has built on previous work undertaken in 2012-2014 as part of the National Climate Change Research Facility project, *Valuing adaptation under rapid change* (Jones et al. 2013). Part of this work explored social, environmental and economic impacts of cascading natural hazard events related to climate change. It examined what values were impacted in different community contexts and how the risks and risk ownership changed across institutional domains in short, medium and long-term timeframes.



OUR APPROACH

Our project team specialises in end user based research which is able to be applied in specific end user contexts.

End user based research differs to more conventional forms of research. Rather than the discovery of theory driven ideas that are peer reviewed, this research provides an evidence base using theory and combines other forms of knowledge. Its key focus is the needs of the end user and how they will be using the research in their day to day decision making and the systems that support this. To understand this, researchers need to think from 'inside' the end users context. This is a collaborative process that starts during the conceptualisation of the project and requires end user input and knowledge exchange throughout the whole process (Figure 2).

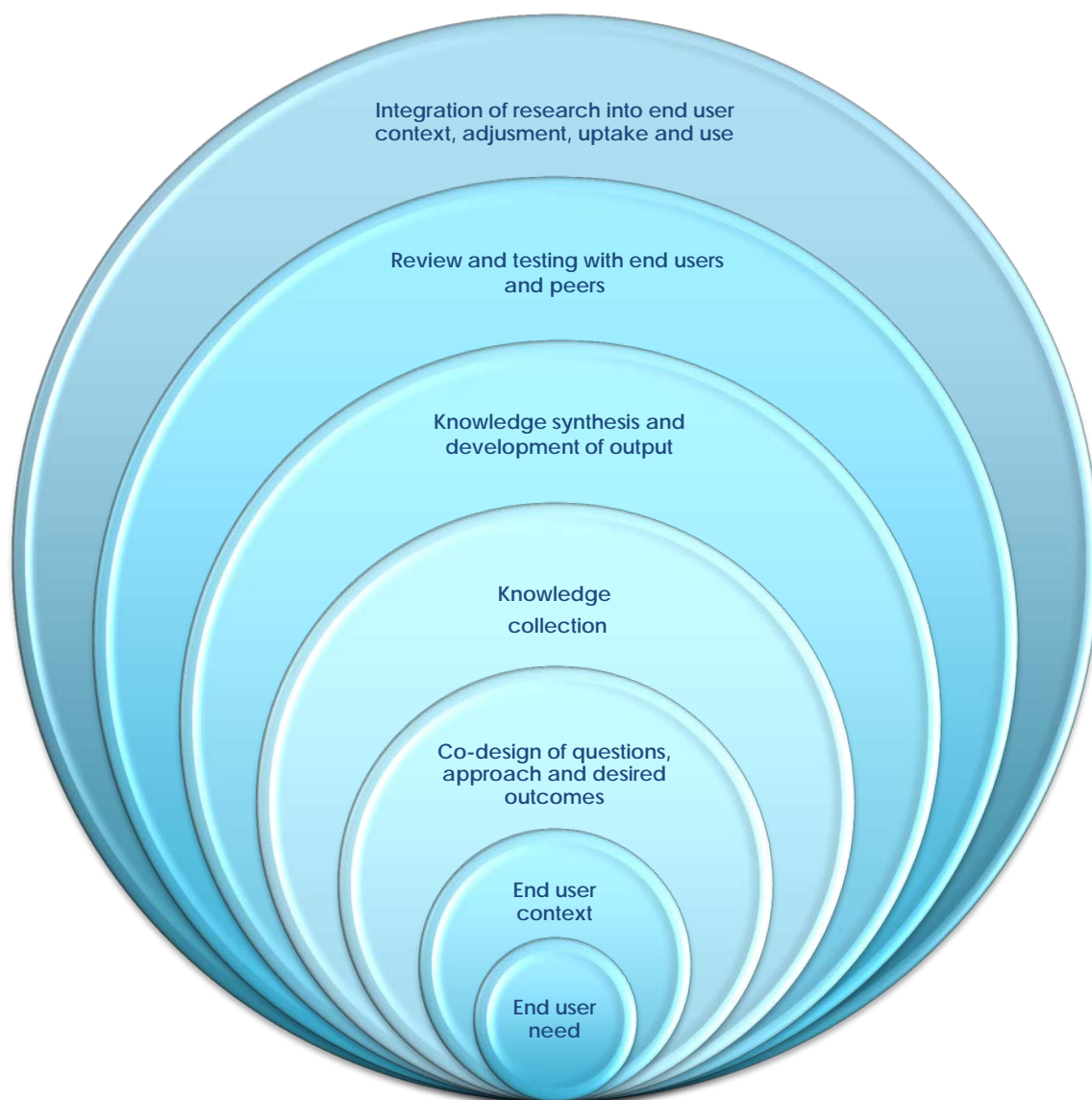


FIGURE 2: KEY TASKS FOR END USER BASED RESEARCH

Ongoing consultation, evaluation and response to feedback is built into the research process to support this aim (see Figure 3).

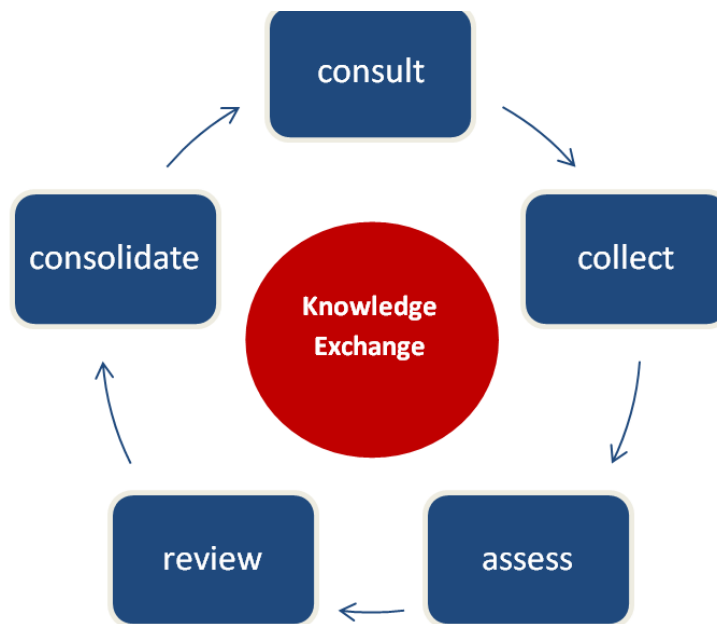


FIGURE 3: COMMUNICATION FRAMEWORK FOR END-USER BASED RESEARCH

In the last 12 months of our process, we moved from consulting, to working actively with our stakeholders to support development of key outputs for this project.

The outputs were tailored towards the decision-making context of our end users and the collation and integration of end-user knowledge has been a key aspect of our research during this project.



END USERS



The end-user working group formed a core part of our research process and contributed directly into the project. There have been some changes in representatives in the group over the last three years due to changes within organisations. The final working group has been represented by the following members:

- Mr Patrick Schell, Senior Project Officer, Community Planning, Rural Fire Service, New South Wales
- Mr Greg Christopher, Senior Officer, Emergency Risk, Risk and Resilience, Emergency Management Victoria (EMV)
- Mr Michael McKitterick, Senior Policy Officer, Inspector General for Emergency Management, Department of Justice and Regulation, Victoria
- Mr Hamish Webb, Director Knowledge and Engagement Fire and Emergency Management Division, Land, Fire and Environment, The Department of Primary Industries and Environment (Victoria)
- Mr Chris Irvine, Acting Assistant Director, Emergency Management, Tasmania State Emergency Service
- Mr Ed Pikusa, Principal Flood Management Officer, Department of Environment, Water and Natural Resources, South Australia
- Ms Pauline Cole, Project Manager, State Recovery Office, Department for Communities and Social Inclusion, South Australia

Another group of 'inform and advise' stakeholders from both public, community and private organisations was kept up to date with project progress. Some of these stakeholders have also contributed specific knowledge and areas of expertise to support our research.



KEY MILESTONES



The project has delivered on all its deliverables to the Commonwealth (Table 1). A number of research outputs were achieved during this project which are detailed in Attachment A Project outputs and milestones.

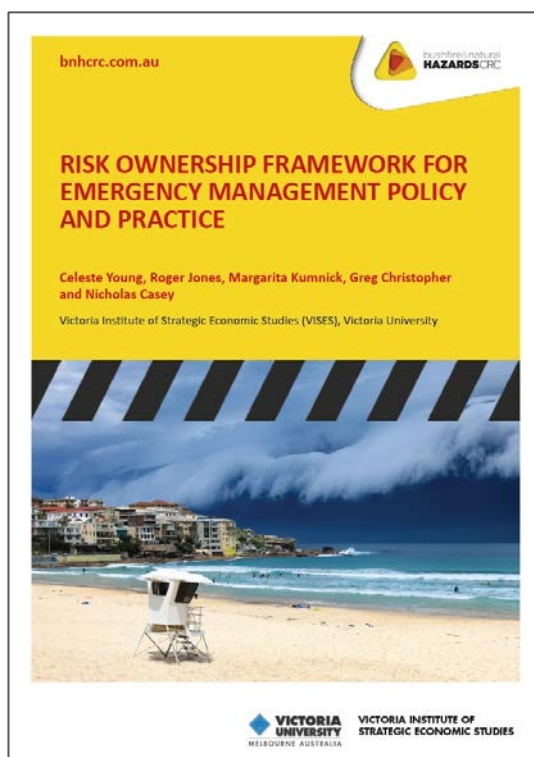
Year	Due Date	C'wealth Milestone	Project Milestones
1	15-Apr-14	CM 2.04.1a	Delivery of data gap analysis
1	30 April to 1-Jan-15	CM 2.04.1b	Develop draft 'Values at Risk' map
2	21-Dec-14	CM 2.04.2a	Research Paper 1 'Institutional framework for values' suitable for publication submitted to Bushfire and Natural Hazards CRC
2	1-Feb-15	CM 2.04.2b	Delivery of draft 'Values at Risk' map
3	15-Mar-16	CM 2.04.3	Delivery of final risk ownership map
4	7-Jan-17	CM 2.04.4a	Delivery of Final documents: 'Research report', 'Institutional risk ownership framework' and 'Values at risk' map
4	30-Jan-17	CM 2.04.4b	Research Paper 3 'Project summary and key findings' suitable for publication submitted to Bushfire and Natural Hazards CRC

TABLE 1: COMMONWEALTH DELIVERABLES

A summary of key research outputs are shown in the following section.

RESEARCH OUTPUTS

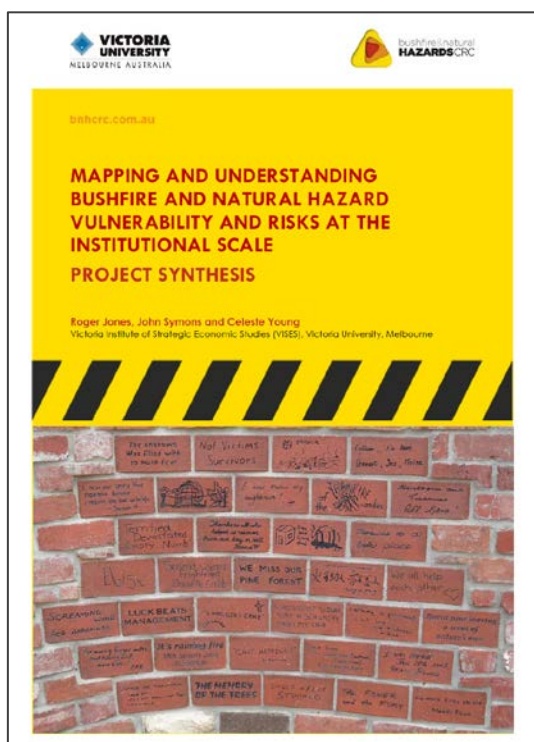
RISK OWNERSHIP FOR EMERGENCY MANAGEMENT POLICY AND PRACTICE



The *Risk ownership framework for emergency management policy and practice* provides the key understandings, concepts and process components needed to be able to implement risk ownership as part of assessment and planning processes. The process framework is aligned to current risk planning processes, in particular the *National Emergency Risk Assessment Guidelines* (NERAG). Key tasks and components provided can either be integrated into current risk assessment and planning processes or used separately to achieve specific outcomes that support risk ownership.

Its aim is to support better strategic management of risks associated with natural hazards and add value to current processes.

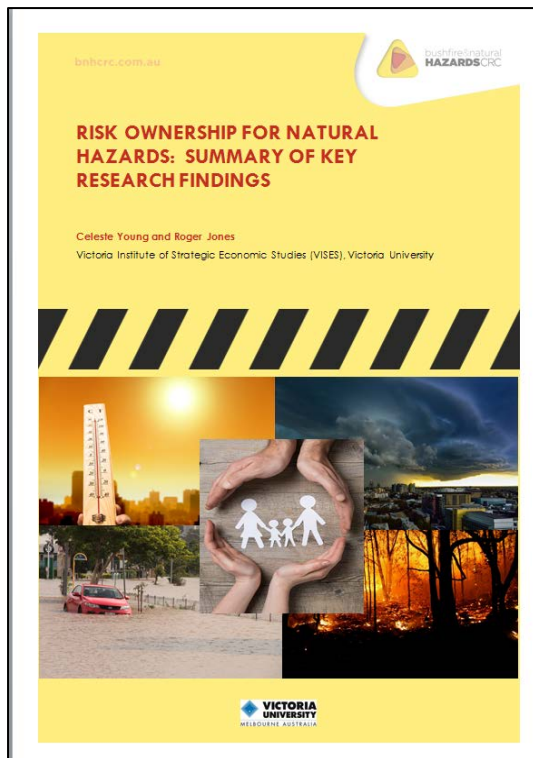
MAPPING AND UNDERSTANDING BUSHFIRE AND NATURAL HAZARD RISKS AT THE INSTITUTIONAL SCALE: PROJECT SYNTHESIS



This synthesis covers two of the main themes explored during the project:

1. The development of a platform for mapping vulnerability. This describes how we mapped multiple values onto bushfire and riverine flood creating an economic geography of vulnerability to natural hazards for Victoria.
2. The economics of risk ownership describes the development of an economic framework to support the risk ownership framework. It blends strategic decision making based on assessments of values at risk, and the evaluation of potential actions with diverse economic methods designed to support those assessments.

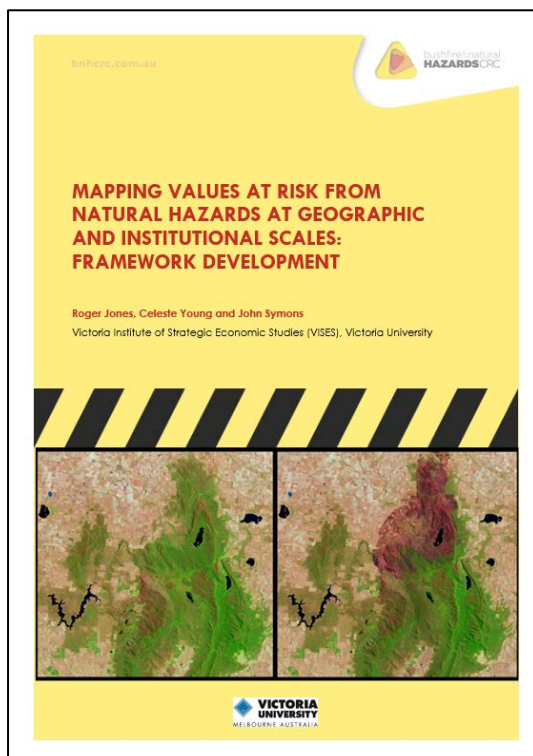
RISK OWNERSHIP FOR NATURAL HAZARDS: KEY RESEARCH FINDINGS SUMMARY



The *Risk ownership for natural hazards: Summary of key research findings* summarises the key points from research undertaken into risk ownership. It provides an overview of key findings and also a summary of each research activity undertaken. It includes summaries of the following activities:

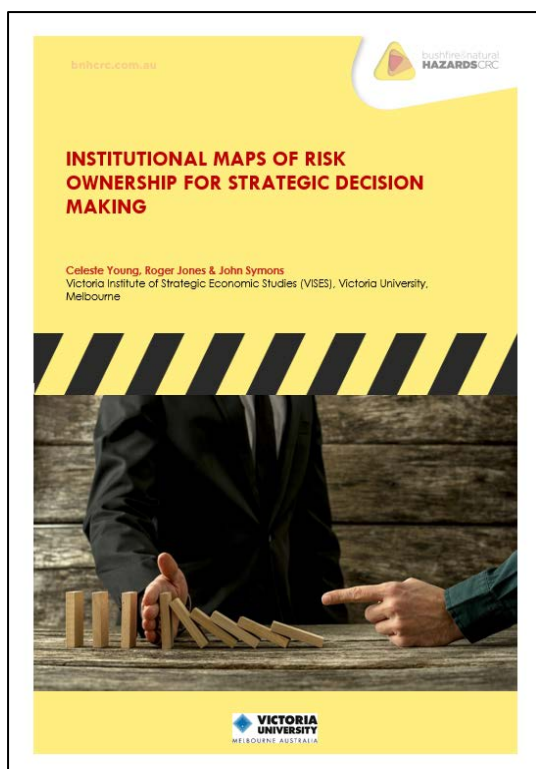
- A desk top review of allocation of risk ownership using public documents.
- Scenario based workshops.
- Institutional maps of risk ownership for strategic decision making
- The development of the *Risk ownership framework for emergency management and policy*.

INSTITUTIONAL FRAMEWORK PAPER



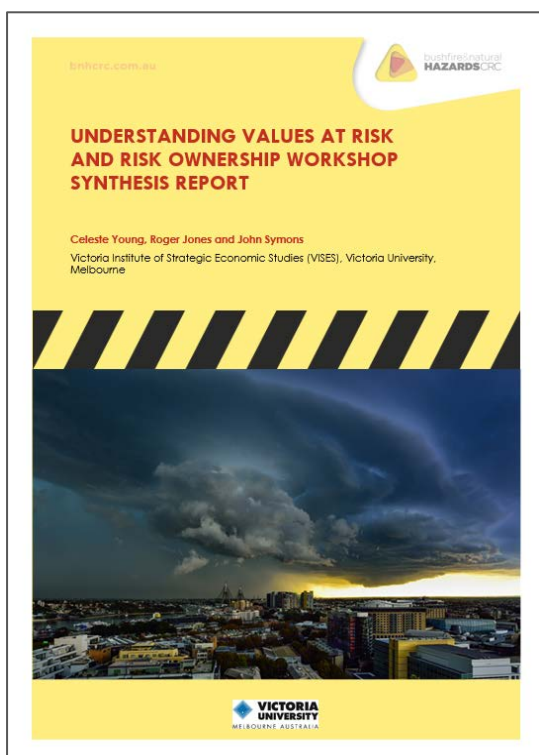
Mapping values at risk from natural hazards at geographic and institutional scales: framework development includes: (1) the major institutions affected by natural hazard risk: local, state and federal government, community and business and industry; (2) incorporating monetary, social and environmental values ranging from tangible to intangible; (3) the understanding of risk ownership through the owner of the resource at risk and the delegated risk manager; (4) the crossing of institutional domains, using risk ownership as a vehicle; and (5) how risk ownership is designated, understood and exercised as a proxy for risk governance.

INSTITUTIONAL MAPS OF RISK OWNERSHIP



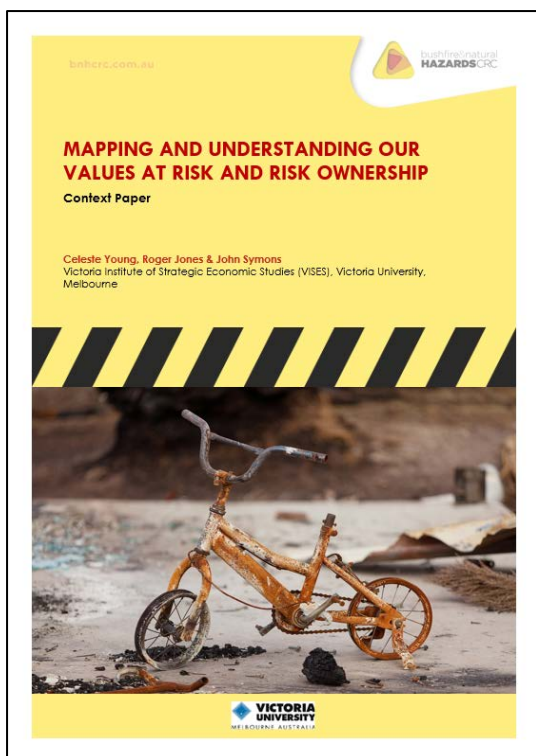
Institutional maps of risk ownership for strategic decision making aims to provide a starting point for strategic risk management across different institutions in relation to risk ownership. It describes institutional maps of risk ownership that have been developed through the research process and compares these to allocations in state emergency management plans. Their purpose is to provide an insight into the current balance of risk ownership delegations across institutions in the Australian context, to support strategic management of risk.

UNDERSTANDING VALUES AND VALUES AT RISK AND RISK OWNERSHIP WORKSHOP SYNTHESIS



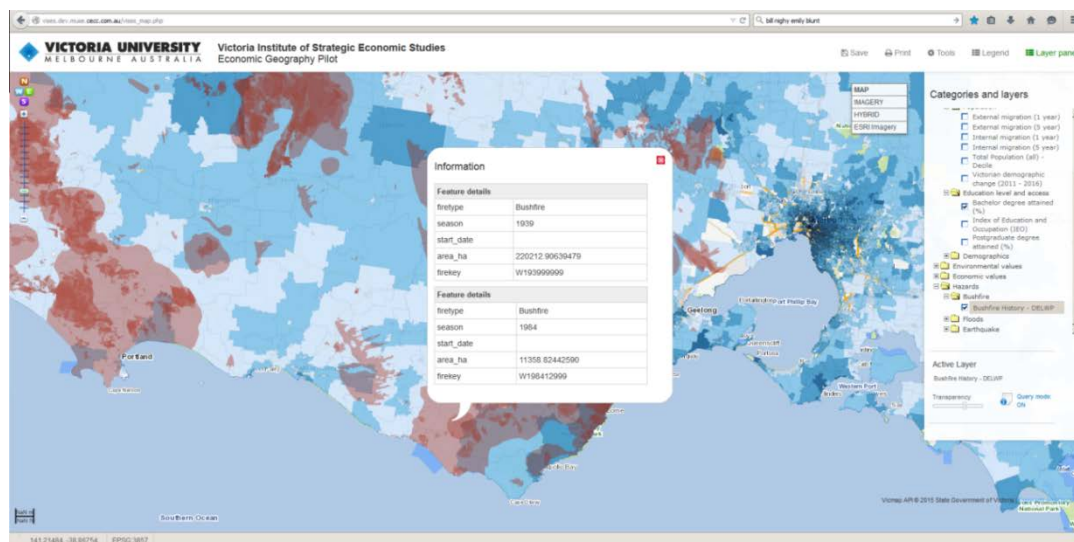
Understanding Values a risk and risk ownership workshop synthesis report was developed following the workshops. This report outlines frameworks that assist the understanding of strategic risk decisions and the systemic nature of the different types of risk associated with risk ownership. It contains: (1) outcomes from the mapping and decision-making exercises undertaken; (2) key process steps and questions for the values-based decision making risk ownership framework in development; (3) feedback from end users in relation to the *Values at risk map*; (4) needs, barriers and opportunities; and (5) future research and implementation areas for the project.

WORKSHOP CONTEXT PAPER



Mapping and understanding our values at risk: Context paper was developed prior to the workshops and circulated to the participants to ensure that there was a common understanding amongst participants attending the workshops of what was to be explored during the workshop and the key questions. Key areas outlined in this paper are: (1) systemic risk; (2) the role of values; (3) vulnerability; and (4) the role of institutions and propagation of risk ownership across institutional domains.

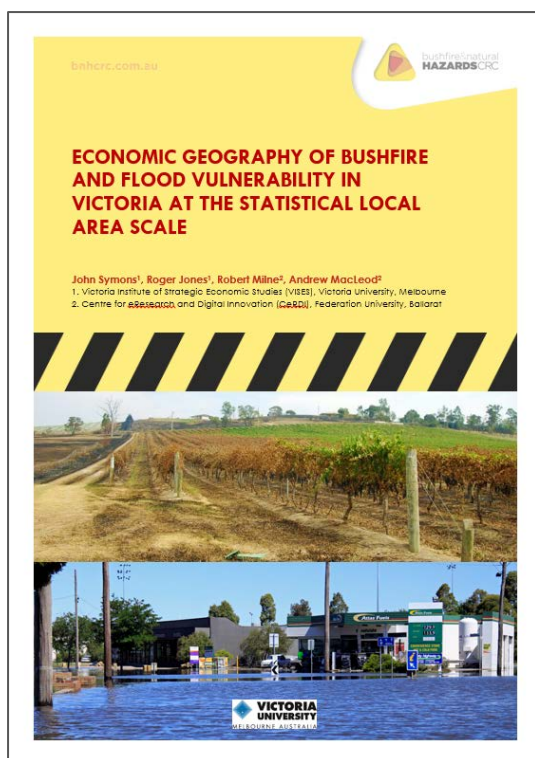
VALUES AT RISK MAP



Development of this mapping facility has been completed. Consultation with end users about its potential future use identified that although the map was of interest, its key purpose was most likely as a research tool to formulate and test questions. End users felt that their key data-related need was for sense-making of data, so that they could better understand and use their existing data in support of strategic decision making. The map address is http://vises.dev.muse.cecc.com.au/vises_map.php.



ECONOMIC GEOGRAPHY



The *Economic geography of bushfire and flood vulnerability in Victoria at the statistical local scale*, identifies industry sectors in Victoria and those statistical local areas with the highest vulnerability to bushfire and flood, based on the exposure of 2011 industry output to historical fire and flood data. Vulnerability is high in some sectors (e.g., agriculture) and regions, mainly rural areas, where up to 50% of annual output can be vulnerable. Metropolitan areas are largely insensitive to these risks and peri-urban areas contain some vulnerable areas. An additional assessment of total economic output and diversity highlighted the vulnerability to these hazards of rural areas, which may impact recovery.

For a full list of publications, articles and reviews undertaken see Attachment C.



UTILISATION OF RESEARCH



As many aspects of this work required understandings that are different or new concepts for the EM Sector, the key aim of this project has been to work with the agencies to build awareness and understanding of the work as it has been undertaken.

COMMERCIALISATION AND UTILISATION

The key aim of this research was to produce a framework which supported implementation of risk ownership into current planning activities. This product has been delivered in the final stages of the project. The BNHCRC has further funded the project to develop professional development training to support the utilisation of this framework. Key activities we have undertaken to support the potential commercialization of the training and further utilisation are:

- Meeting with Australian Institute of Disaster Resilience (AIDR), 12 December 2016 to discuss the possibility of the frameworks document being included as a support document to the NERAG.
- Proposal to the BNHCRC for further funding to support the development of risk ownership training.
- Submission of briefing paper for risk ownership training for The Risk Assessment, Measurement and Mitigation Subcommittee (RAMMS), August 2016, championed by end user Chris Irvine, State Emergency Service, Department of Police, Fire and Emergency Management, Tasmania, to ask for endorsement from the committee for the professional development training for risk ownership.



The key utilisation has been through uptake of the concepts of the research into policy and practice areas through the following outcomes:

- Key concepts and principals have been applied by EMV during their development of the State Emergency Risk Management Framework.
- Our EMV end user, Greg Christopher has expressed his intention to use the work produced to inform part of the review for the State Level Emergency Risk Assessment.
- EMV have also stated an intention to test the framework to further clarify enhancements needed for it to be applied as part of the NERAG and NERAG practice guide.
- Key concepts and materials produced by the project are being considered for use as part of a Municipal Risk project being developed by the Tasmanian SES.

A number of outreach activities have also been undertaken where the research has been used and the outcomes from these are discussed in the, End-user engagement, Impact and Tracking sections below.

EDUCATION AND TRAINING

We are currently in the process of developing professional development training. Testing and promotion of this training will be undertaken through leveraging existing VU and BNHCRC networks. Other activities include:

- Delivery of training workshop for Enterprise for Risk Management Summit in Canberra, 26 – 28 April 2017 (confirmed).
- Delivery of professional development training for AFAC 2017 Conference in Canberra, 4-7 of September, 2017 (proposal submitted).
- A policy briefing for the Commonwealth Department for the Environment in Canberra, 27 April 2017.

Education in relation to key concepts has been part of the research process and has been undertaken through a number of end-user engagement activities which are detailed below and also in Attachment B.

END-USER ENGAGEMENT

Throughout the project we have worked closely with our stakeholders and incorporated their input which has been a key part of ensuring the usability and robustness of our research.

We achieved this through a number of activities during the research process which include:

- Regular stakeholder meetings and informal discussions with both the working group and practitioners in the EM Sector.
- Invited presentations to government agencies and industry and community forums.
- Presentations of aspects of the work at a number of conferences and other universities, both nationally and internationally.



- Stakeholder feedback workshops and meetings.
- Co-development of workshops and research activities.
- The co-development of four research workshops.
- Mentorship of a team member by Liam Fogarty to support better understanding of the EM Sector and the context in which the work was being undertaken.
- Facilitation by EMV of two feedback workshops during the project, one to provide feedback on the *Values at risk map* and the other to provide feedback on the draft risk ownership framework.
- Meetings with experts in the EM Sector field to obtain feedback in relation to the draft risk ownership framework.

We have also continued to distribute and share our research and the research of others within the CRC research group with our broader stakeholder group in government and industry based networks. For a full list of activities see Attachment B.

OPPORTUNITIES

There are a number of opportunities for this work both in the research and commercial areas and activities to support this have been detailed in Education and training. Future opportunities include the following:

- Further use of the economic work in government areas to support assessing economic vulnerability to natural hazards.
- Possible testing of the risk ownership framework in a community context by EMV.
- To establish and deliver professional development in the area of risk ownership across the EM Sector nationally.
- To obtain funding to undertake further research in needed to support development of practice in these areas.
- The integration more formally of risk ownership into the NERAG process.
- To support better risk management outside of the EM Sector in areas such as climate change adaptation and regional planning which require strategic risk management.

IMPACT

As the scope of the research was to develop a product for utilisation, the full impacts of this work are likely to be longer term. This is because full integration of the research product will require considerable cultural change in some Emergency Management Sector organisations.

In terms of use of research undertaken, the greatest impact has been in relation to building greater understanding of strategic decision making and risk ownership across the working group other stakeholders in the broader area of risk management in both public and private organisations.

The broader impact has been assessed through response when our work has been presented and is illustrated by the following examples:



- The inclusion of risk ownership concepts into a strategic risk management framework by EMV.
- Request to promote the Australian Journal of Emergency Management (AJEM) risk ownership article on the NCCARF practitioner's blog.
- Invited presentations through the duration of the project to present work from the project at both public and industry conferences and forums.
- Annual updates of research being given to the Commonwealth Department for Environment.
- Requests for publications and inquiries regarding the research documents or articles from researchers following presentations.
- Interview of team researcher by the Mandarin an online government publication.
- The inclusion of a summary of risk ownership research in the RAMMS subcommittee meeting agenda for consideration in August 2016 and a request from the committee for further information following this meeting.
- The use of the economic work undertaken as a basis for a vulnerability assessment of climate change impacts for the Department of Environment, Land, Water and Planning in Victoria.
- Positive responses to published work in particular the article *Owning the future: Risk ownership and strategic decision making* published by Australian Journal of Emergency Management (AJEM). This was the most clicked link in the October e-newsletter (after the main AJEM link) with 96 clicks, 23% of the total clicks for the whole newsletter).

TRACKING

Research has primarily been used to build awareness and understanding of the research undertaken through engagement and outreach activities during the research process. These have been recorded and reported through end user project meetings and the BNHCRC reporting tool.

We have not been able to fully identify uptake of documents or articles as they have been widely distributed across multiple networks and we were unable to access the analytics from many of these or the VU websites. The analytics available are limited but give an indication of impact to date. The tracking shown in Table 2 (overleaf) was obtained from the BNHCRC project webpage.

Tracking of impact from other websites is shown in the Table 3 overleaf.



Page	Page views	Unique page views
PROJECT PAGE	248	179
BIBLIOS AND REPORTS		
Institutional maps of risk ownership for strategic decision making	33	26
Understanding values at risk and risk ownership workshop synthesis report	11	10
Annual project report 2015-2016	37	25
Risk ownership and natural hazards, 2015 conference	68	56
Whose risk is it anyway?	216	172
Annual project report 2014-2015	23	21
Annual report 2014	83	64
The problem solution framework	37	30
PRESENTATIONS		
2016 RAF Hobart presentation	18	16
2014 RAF presentation	100	82
2015 RAF presentation	32	31
AFAC15 conference presentation	17	14
AFAC16 presentation	8	7
OTHER		
Economics and strategic decisions cluster overview video	18	16
Hazard note: what can economics offer emergency services	161	133

TABLE 2: RESEARCH IMPACT BNHCRC WEBPAGE STATISTICS, MARCH 2015 - MARCH 2017

Page	Host/publisher	Impact
ARTICLES		
Owning the future: Risk ownership and strategic decision making	Australian Journal of Emergency Management (AJEM)	481 page views, including 438 unique page views.
Understanding grief can help us adapt to climate change.	The Conversation	6389 views, 81 tweets, 1814 Facebook shares, 54 in shares.
RESEARCH NETWORKS		
Owning the future: Risk ownership and strategic decision making	Researchgate	27 views, 1 citation
Whose risk is it anyway desktop review.	Researchgate	63 views
Engaging beyond grief and fear for effective adaptation Poster	Researchgate	30 views
Understanding values at risk and risk ownership workshop synthesis report	Researchgate	62 views

TABLE 2: RESEARCH IMPACT OTHER WEBSITE SOURCES



WHERE TO NEXT

The project has received further funding from the BNHCRC to develop professional development training to support uptake of the risk ownership framework in practice and policy areas. This training will be targeted at three levels:

- Executive
- Policy
- Practice

It is proposed that the framework process will be tested by end users as part of the activities undertaken to develop the training.

We aim to continue promoting the framework developed through this work and to explore the possibility of delivering, the professional development training product, nationally.

We will also continue to use and expand upon economic work in government areas as part of assessing economic vulnerability to natural hazards.

In terms of further research, this project highlighted the need for more targeted research in this area to support greater understanding related to specific areas of risk ownership, values and measurement of these and progress in these areas. We will continue to seek funding in these areas to further this research.





ATTACHMENT A: PROJECT SCHEDULE AND MILESTONES

Year	Due Date	C'wealth Milestone	Project Milestones	
1	1-Feb- 14		1.1	Delivery of project plan
1	1-Apr-14		1.2	Gap analysis of data available and data needed
1	30-Mar-14		1.3	Establishment of project committees and stakeholder groups, and core agreements in relation to project expectations and working agreements
1	30-Mar-14		1.4	Establishment of High Level Advisory Group with national and international experts
1	30-Mar-14		1.5	Develop assessment criteria for values at risk
1	30-Mar-14		1.6	PhD candidate identified and proposal submitted to CRC – subject area to be decided with end-user consultation
1	30-Mar-14		1.7	Delivery of Quarterly Report to CRC
1	15-Apr-14	CM 2.04.1a	1.8	Delivery of data gap analysis
1	30-Jun-14		1.9	Delivery of Quarterly Report to CRC
1	30-Jun-14		1.10	Delivery Annual Report to CRC
				Q4 payment
1	30 April to 1-Jan-15	CM 2.04.1b	1.11	Develop draft 'Values at Risk' map
1	30-Jun-14		1.12	PhD commencement
2	30-Sep - 14		2.1	Delivery of Quarterly Report to CRC
2	21-Dec- 14	CM 2.04.2a	2.2	Research Paper 1 "Institutional framework for values" suitable for publication submitted to Bushfire and Natural Hazards CRC
2	7-Jan-15		2.3	Delivery of Quarterly Report to CRC
2	1-Feb-15		2.4	Finalisation of draft 'Values at Risk' map
2	1-Feb-15	CM 2.04.2b	2.5	Delivery of draft 'Values at Risk' map
2	1-Mar-15		2.6	Desk-top review of materials for risk ownership
2	30-Mar-15		2.7	Development of 4 x 1 day workshops key stakeholders and end users to ascertain risk ownership and current institutional structures
2	30-Mar-15		2.8	Delivery of Quarterly Report to CRC
2	30-Jun- 15		2.9	Delivery of 2 x 1 day workshops
	30-Jun-15		2.10	Delivery of Quarterly Report to CRC
2	30-Jun-15		2.11	Delivery of Annual Report to CRC
2	30-Jun-15		2.12	PhD project proposal approved by internal university technical committee
3	31-Aug- 15		3.1	Complete delivery of 4 x 1 day workshops
3	7-Sep-15 7-Jan-16		3.2	Develop institutional maps of risk ownership



Year	Due Date	C'Vealth Milestone	ID	Project Milestone
3	30-Sep-15		3.3	Delivery of Quarterly Report to CRC
3	21-Dec-15		3.4	Research Paper 2 'Ownership of values at risk' suitable for publication submitted to Bushfire and Natural Hazards CRC
3	7-Jan-16		3.5	Delivery of Quarterly Report to CRC
3	15-Mar-16		3.6	Finalise risk ownership map with stakeholders
3	15-Mar-16	CM 2.04.3	3.7	Delivery of final risk ownership map
3	30-Mar-16		3.8	Delivery of Quarterly Report to CRC
3	30-Jun-16		3.9	Delivery of Quarterly Report to CRC
3	30-Jun-16		3.10	Delivery of Annual Report to CRC
4	1-Aug-16		4.1	Development of institutional framework for resilience in collaboration with key stakeholders and end users (Interaction during this phase will be through targeted focus groups)
4	1-Sep-16		4.2	Writing of Draft Report
4	1-Sep-16		4.3	Delivery of Draft Report, Draft Framework and updated 'Values at Risk' map for review by end users and key stakeholders
4	1-Nov-16		4.4	Review workshops x 2 with end users for feedback
4	30-Sep-16		4.5	Delivery of Quarterly Report to CRC
4	15-Nov-16		4.6	Incorporate reviewers' amendments into Draft Framework and Draft Report
4	15-Dec-16		4.7	Final review and feedback of Draft Framework and Draft Report by end users and key stakeholders
4	7-Jan-17		4.8	Finalise Final Report and Framework
4	7-Jan-17	CM 2.04.4a	4.9	Delivery of Final Documents: Research Report, Institutional Risk Ownership Framework and 'Values at Risk' map
4	7-Jan-17		4.10	Delivery of Quarterly Report to CRC
4	7-Jan-17		4.11	Delivery of Final Report to CRC
4	30-Jan-17	CM 2.04.4b	4.12	Research Paper 3 'Project summary and key findings' suitable for publication submitted to Bushfire and Natural Hazards CRC
				Q3 Payment

TABLE 4: MAPPING AND UNDERSTANDING BUSHFIRE AND NATURAL HAZARD VULNERABILITY AND RISKS AT THE INSTITUTIONAL SCALE, PROJECT OUTPUTS AND MILESTONES



ATTACHMENT B: OUTREACH AND ENGAGEMENT ACTIVITIES

INVITED PRESENTATIONS

2016 - 2017

- Young, C.K., Mapping and understanding vulnerability and risk at the institutional scale project overview, DEWNR, South Australian Government, Adelaide, 6 July 2016.
- Young, C.K., Eyes Wide Open - Owning strategic risk and resilience in a changing landscape, Enterprise Risk Management (ERM) for Government Conference: Moving Beyond Compliance, International Quality and Productivity Centre, Canberra, 27-29 April 2016.

2015 - 2016

- Young, C.K., Whose Risk is it Anyway? Understanding the role of values and risk ownership, DELWP Community Forum, Montrose, Department of Environment, Land, Water and Planning, Victoria, Melbourne, 5 December 2015.
- Young, C.K., Building Organisational Resilience to Systemic Risk, 3rd Annual Australian Risk Management Summit, Melbourne, 18 August 2015.
- Young, C.K., The problem solution framework: Implementing systemic risk solutions, Inner Melbourne Climate Adaptation Network, Melbourne, 29 September 2015.
- Jones, R.N., Keynote, Risk modelling: General needs and WGII experience, IPCC Workshop on Regional Climate Projections and their Use in Impacts and Risk Analysis Studies, National Institute for Space Research (INPE), São José dos Campos, Brazil, 15-18 September 2015.

2014 - 2015

- Young, C.K., Beyond ERM: Building organisational resilience to systemic risk, Enterprise Risk Management (ERM) for Government Conference, Canberra, 27-29 April 2015.
- Jones, R.N., Young, C.K., Project overview, AFAC Annual Meeting of Financial Officers, Melbourne, 14 April 2015.
- Jones, R.N., Young, C.K., Invitation to present work being undertaken to Environmental Change Institute, Oxford University, Oxford, 18 May 2015.



PRESENTATIONS

2016 - 2017

- Young, C.K., Building resilience to natural hazards: strategic decision making for risk ownership, 6th International Conference on Building resilience, Auckland, New Zealand, 7 September 2016.
- Young, C.K., Jones, R.N., Owning the future: risk ownership for strategic decision making, AFAC 2016, Brisbane, 30 August - 1 September 2016.
- Young, C.K., Communicating dangerous knowledge, key points for engaging with end users, Presentation, Climate Adaptation 2016, Change, Challenge, Opportunity, Adelaide, 5-7 July 2016.

2015 - 2016

- Young, C.K., Jones, R.N., Project summary, BNHCRC Research Advisory Forum, Hobart, 11-12 May 2016.
- Young, C.K., Beyond ERM: Building organisational resilience to systemic risk, enterprise risk management (ERM) for Government Conference: Moving Beyond Compliance, Canberra, 27-29 April 2016 (invited).
- Jones, R.N., Young, C.K., Risk ownership and natural hazards: across systems and across values, presentation, AFAC15, New Direction in Emergency Management, Australasian Fire and Emergency Service Authorities Council (AFAC), Bushfire and Natural Hazards Adelaide, 1-3 September 2015.
- Young, C.K., Communicating dynamic risk for decision making, Communicating our Science, Australian Meteorological and Oceanographic Society, Brisbane, 15-17 July 2015.
- Jones, R.N., Break-out Session Forecasting, Characterising and Communicating Extreme Weather and Climate Events, Research to Community –Australian Meteorological and Oceanographic Society, Brisbane, 15-17 July 2015.

2014 - 2015

- Jones, R.N., Young, C.K., Presentation of project, BNHCRC Research Advisory Forum, Sydney, 8-9 April, 2015.
- Young, C.K., Convened session, Beyond risk - engaging for action, European Climate Change Adaptation Conference, Copenhagen, 9-11 May 2015.
- Jones, R., Young, C.K., Symons, J., Presentation, the institutional economics of rapid and unpredictable climate change, Engaging for Action, European Climate Change Adaptation Conference, Copenhagen, 9-11 May 2015.
- Jones, R., Project overview, BNHCRC Research Advisory Forum, Adelaide, 18-20 March 2014.



POSTERS

2016 - 2017

- Jones R.N., Young.C.K., Symons, J., Project summary mapping and understanding vulnerability and risk and the institutional scale, AFAC Conference 2016, Brisbane, 30 August - 1 September 2016.
- Young. C.K., Communicating risk in a connected world: Perceptions and possibilities, Getting the Balance Right, AFAC Conference 2016, Brisbane, 30 August - 1 September 2016.
- Young, C.K., Working from the inside out: implementation based research, Poster, Climate Adaptation 2016, Change, Challenge, Opportunity, Adelaide, 5-7 July 2016.

2015 - 2016

- Young, C.K., Poster presentation, Resilient cultures and the role of innovation in building capacity, new directions in emergency management, AFAC Conference, Adelaide, 1-3 September 2015.

2014 - 2015

- Young. C.K., The role of innovation in bridging the policy research divide. European Climate Change Adaptation Conference, Copenhagen, 9-11 May 2015
- Young. C.K., Poster presentation, Beyond grief: engaging for action, NCCARF Conference: Climate Adaptation 2014 Future Challenges, Gold Coast 30 September-2 October 2014. *Received highly commended poster award.*

OTHER RELATED ACTIVITIES

2014 - 2017

- Feedback workshop for the Values at Risk Maps facilitated by Emergency Management Victoria, 9 December 2016.
- Meetings for specific feedback EMV, VMIA and CFA, December 2016.
- Young, C.K., invited participant, Round table Australian and New Zealand School of Governance, 12 August 2016.
- Young. C.K., mentorship arrangement with a key end user to support greater understanding of the policy and practitioner context. 2016.
- Jones R.N., invited participant workshop on financing adaptation Climate Change Business Network/Green Cross, 28 July 2016
- Young, C.K., Project Group Member, Theme 4, to support the development of the Resilient Melbourne Strategy, City of Melbourne, 100 Resilient Cities Program, July 2015 – Feb 2016.
- Young, C.K., Invited Judge, Fire Awareness Awards, Victoria, 2015, 2016.
- Feedback workshop for the Values at Risk Maps facilitated by Emergency Management Victoria.



- Development and execution of 4 research-based workshops in collaboration with end users and the BNHCRC staff, August 2015
- Undertaking Strategic Risk and Consequence Exercise & Training Day with Emergency Management Victoria, 4 November 2015
- Young, C.K., Research Reference Group Committee Member for Australian Centre for Financial Studies, Insurance Program Area. 2015–2017.
- Young, C.K., Paper the problem-solution framework, a guide to adaptation for practitioners, was distributed within the CRC, 2014.
- Young, C.K., Communication and policy framework advice for the DELWP, Victoria, Melbourne, 2014-2015.



ATTACHMENT C: PAPERS, ARTICLES AND REVIEWS

PAPERS

Young, C.K., Jones, R.N., 2016, Owning the future: risk ownership and strategic decision- making for natural hazards, Australian Journal of Emergency Management, Volume 31, Issue 4.

Young, CK., Jones, R.N., 2016, Building resilience to natural hazards: strategic decision making for risk ownership. refereed paper, 6th International Conference on Building resilience, Auckland, New Zealand, 2016.

Jones, R.N., Young, C.K., Symons, J., 2015, Risk ownership and natural hazards: across systems and across values, refereed paper presented at AFAC15: New Direction in Emergency Management, Australasian Fire and Emergency Service Authorities Council (AFAC), Bushfire and Natural Hazards CRC, Adelaide.

RESEARCH REPORTS

Jones, R.N., Young, C.K., Symons, J., 2016, Mapping and understanding bushfire and natural hazard vulnerability and risks at the institutional scale, research synthesis report. Bushfire and Natural Hazards CRC, VISES, Victoria University, Melbourne.

Young, C.K., Jones, R.N., Kumnick, M., Casey, Christopher, G., 2017, Risk ownership framework for emergency management policy and practice, Bushfire and Natural Hazards CRC, VISES, Victoria University, Melbourne.

Young, C.K., Jones, R.N., 2017, Risk ownership for natural hazards: Summary of key research findings, Bushfire and Natural Hazards CRC, VISES, Victoria University, Melbourne.

Symons, J., Jones, R.N., Milne, R., McLeod, A., 2016, Economic geography of bushfire and flood vulnerability in Victoria at the statistical local area scale. Bushfire and Natural Hazards CRC, VISES, Victoria University, Melbourne.

Young, C.K., Symons, J., Jones, R.N., 2016, Institutional maps of risk ownership for strategic decision making, Bushfire and Natural Hazards CRC, VISES. Victoria University Melbourne.

Young C.K., Jones, R.N., Symons, J., 2016, Mapping and understanding our values at risk and risk ownership: workshop synthesis report. Bushfire and Natural Hazards CRC. VISES, Victoria University, Melbourne.

Young, C.K., Jones, R.N., Symons, J., 2015, Mapping and understanding our values at risk and risk ownership: workshop context paper. Bushfire and Natural Hazards CRC. VISES, Victoria University, Melbourne.

Jones, R.N., Young, C.K., Symons, J., 2015, Mapping values at risk from natural hazards at geographic and institutional scales: framework development. Bushfire and Natural Hazards CRC. VISES, Victoria University, Melbourne.

Young, C.K., Symons, J., Jones, R.N., 2015 Whose risk is it anyway? Desktop review of institutional ownership of risk associated with natural hazards and



disasters. Bushfire and Natural Hazards CRC. VISES, Victoria University, Melbourne.

ARTICLES AND INTERVIEWS

Young, C.K., Citizen's juries: panacea for policy 'ills' or transforming government? *Bang the Table*, 8 February 2017, <http://www.bangthetable.com/citizens-juries-panacea-policy-ills-transforming-government/>

Young, C.K., City calls on jury of its citizens to deliberate on Melbourne's future. *The Conversation*, 19 July 2016, <https://theconversation.com/city-calls-on-jury-of-its-citizens-to-deliberate-on-melbournes-future-59620>

Young, C.K., Understanding grief can help us adapt to climate change. *The Conversation*, 5 March 2015, <https://theconversation.com/understanding-grief-can-help-us-adapt-to-climate-change-37518>

Davidson, D., (interview, Young, C.K.) Will the SA nuclear citizen's jury scare governments away? *The Mandarin*, 7 November 2016, <http://www.themandarin.com.au/72297-will-sa-nuclear-citizens-jury-scare-governments-away/>

REVIEWS UNDERTAKEN

Young, C.K., 2016, Paper, Australian Journal of Emergency Management.

Young, C.K., Jones, R.N., 2015, Papers, AFAC15: New Directions in Emergency Management, Australasian Fire and Emergency Service Authorities Council (AFAC) (one each).

Young, C.K., 2015, Review, BNHCRC research report.



REFERENCES

Australian Emergency Management Institute (AEMI) 2011, Community recovery. Australian Emergency Management Handbook Series, Handbook 2. Attorney-General's Department, Canberra, ACT.

Council of Australian Governments (COAG) 2011, National Strategy for Disaster Resilience: building our nation's resilience to disasters. Attorney-General's Department, Canberra, ACT.

Deloitte Access Economics 2013, Building our nation's resilience to natural disasters. Australian Business Roundtable for Disaster Resilience and Safer Communities, Deloitte Access Economics, Barton, ACT.

Hallegatte S 2015, The indirect cost of natural disasters and an economic definition of macroeconomic resilience. World Bank Policy Research Working Paper (7357), Washington DC.

Jones RN, Young CK, Handmer J, Keating A, Mekala G, Sheehan P 2013, Valuing adaptation under rapid change. National Climate Change Adaptation Research Facility, Gold Coast, Queensland.

Kelman I 2013, Disaster mitigation is cost effective. Briefing Note, World Development Report 2013.

Schwartz SH 2012, An overview of the Schwartz theory of basic values. *Online Readings in Psychology and Culture*, 2(1).

Young CK, Symons J, Jones RN 2015, Whose risk is it anyway? Desktop review of institutional ownership of risk associated with natural hazards and disasters. Bushfire and Natural Hazards CRC, Melbourne, Victoria.



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