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Australian Government  
Department of Industry,  
Innovation and Science

**Business**  
Cooperative Research  
Centres Programme



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# Index

- 3 A statement on research priorities for natural hazards emergency management in Australia
- 4 Foreword
- 5 Introduction
- 6 Research on natural hazards
  - About the Bushfire and Natural Hazards CRC
- 8 Major issues
  - Shared responsibility and community engagement
  - Communicating risk and understanding the benefits of mitigation
  - Climate change
  - Predictive services, data and warnings
- 14 Using this statement on research priorities

These research priorities were considered and noted by the Australia-New Zealand Emergency Management Committee in June 2017.





**This report finds that the total economic cost of natural disasters is growing and will reach \$39 billion per year by 2050. These costs include significant, and often long-term, social impacts, including death and injury and impacts on employment, education, community networks, health and wellbeing. More than nine million Australians have been impacted by a natural disaster or extreme weather event in the past 30 years. The number of people affected annually is expected to grow as the intensity and, in some areas, the frequency, of events increases.**

**Without mitigating action, the total cost of natural disasters in each state is expected to increase by more than 2.5 times between now and 2050, after adjusting for inflation. As previous reports from the Roundtable showed, targeted investments in physical (such as infrastructure) and community (such as preparedness programs) resilience measures are predicted to significantly lessen this increase in costs.**

**AUSTRALIAN BUSINESS ROUNDTABLE FOR DISASTER RESILIENCE AND SAFER COMMUNITIES,  
BUILDING RESILIENCE TO NATURAL DISASTERS IN OUR STATES AND TERRITORIES, NOVEMBER 2017**



# A statement on research priorities for natural hazards emergency management in Australia

This publication on the major research issues in natural hazards emergency management:

1. Communicates research priorities for Australia identified by the emergency management sector for the decade 2017 to 2027.
2. Promotes greater collaboration between researchers, practitioners, policy developers and funders.
3. Contributes to building a strong and interconnected evidence base in natural hazards science, based on the highest needs of the sector.

These research priorities represent the consensus view of industry experts and are based on extensive consultation and discussion. This is the first time an exercise of this scale focussed on natural disasters has been conducted in Australia. It is the first time the collective knowledge of the industry has been drawn together and recorded in such a manner.

**By synthesising this information, it will be easier for researchers, policy makers and practitioners at all levels to plan and prioritise their work, to enable a nationally coordinated research capacity to address the major issues of our day and to support the uptake of that research into practice.**

This publication is the beginning of a process, not an end. A national discussion within the emergency management sector has identified themes for research priorities, but this is not intended as either a final or comprehensive list. As new themes and research priorities are identified in coming years, they will be included in this document, and published on the Bushfire and Natural Hazards CRC website.

## A suite of publications on national research priorities

### 01 Statement

National research priorities for natural hazards emergency management - issues, priorities, directions

### 02 Theme specific publications

A summary of workshop outputs to guide future research activities

# Foreword

## **Australians have faced natural disasters ever since we started placing the things we value on Australian soil.**

The hazards have always existed, and they always will, whether they are floods, bushfires, cyclones, earthquakes, tsunami, storm surge, or drought. They are a natural, inevitable and essential part of living in the Australian environment.

The disasters we face today, although natural at the core, are really man-made, and reflect the culmination of our decisions of where and how we live.

In most cases we cannot tame these natural hazards. What we need to do is change the ways in which we live with the hazards on the Australian continent. The complexity of this challenge is growing, as populations continue to expand into higher risk areas such as our forests and along coastlines, combined with the pressures for cheaper building and infrastructures costs, and more flexible urban planning.

The Australian Government's Productivity Commission in its 2015 inquiry into disaster funding arrangements made strong recommendations that the focus for emergency management has to switch to one focused on mitigation. Mitigation is always a better option than response and recovery, as not only does it ultimately reduce the dollar costs, it also reduces misery and suffering following the disaster. The National Strategy for Disaster Resilience stresses that communities need to become more resilient and understand the need for shared responsibility.

The Sendai Framework for Disaster Risk Reduction, of which the Australian Government is a signatory, charts the global course over the next 15 years. During the consultations and negotiations that led to its finalisation, strong calls were made to develop practical guidance to support implementation, ensure engagement and ownership of action by all stakeholders, and strengthen accountability in disaster risk reduction.



Photo: Queensland Fire and Emergency Services

But what does resilience and mitigation mean in practice, and which responsibilities need to be shared? Who is sharing this responsibility? Is it the government with its policies, our emergency services, or community members? Or is it all three of these levels, to varying degrees, in varying situations?

It has only been through concerted research efforts, over many years covering many disciplines, that fundamental changes have been made to make people safer and better equipped to deal with natural hazards. This outcome has only been possible as the result of the vision and the investment from all levels of government and the emergency management sector, combined with the dedication and application of the research sector.

This publication is looking at the core of these questions for natural hazards emergency managers - to develop national priorities for future research investment. The Bushfire and Natural Hazards CRC is conducting research that is aligned with many of these priorities. But we must continue to identify what we do not know. National research has had an impact on the safety of Australian communities – but only because we have been asking the difficult and complex questions.

**Dr Richard Thornton**

CEO, BUSHFIRE AND NATURAL HAZARDS CRC



# Introduction

The Australian Business Roundtable for Disaster Resilience and Safer Communities found in 2016 that the economic costs of disasters in Australia are expected to increase from \$9 billion to \$33 billion per year by 2050 and that the social costs of natural disasters in 2015 were at least equal to the physical costs.

It is well understood that effective planning and mitigation of risks are essential tasks for governments, businesses and households. However, as a society, there is an overinvestment in post-disaster reconstruction and an underinvestment in mitigation that would limit the impacts of natural disasters in the first place. Natural disaster costs have become a growing, unfunded liability for governments<sup>1</sup>.

A focus on disaster resilience throughout Australian communities requires an integrated, whole-of-nation effort that includes enhanced partnerships and a shared responsibility between government, business and the community. It also includes a better understanding of the risk environment and disaster impacts, and an adaptive and empowered community that acts on this understanding<sup>2</sup>.

The current national rates of mortality and economic impact are neither acceptable nor sustainable. Business as usual is not an option.

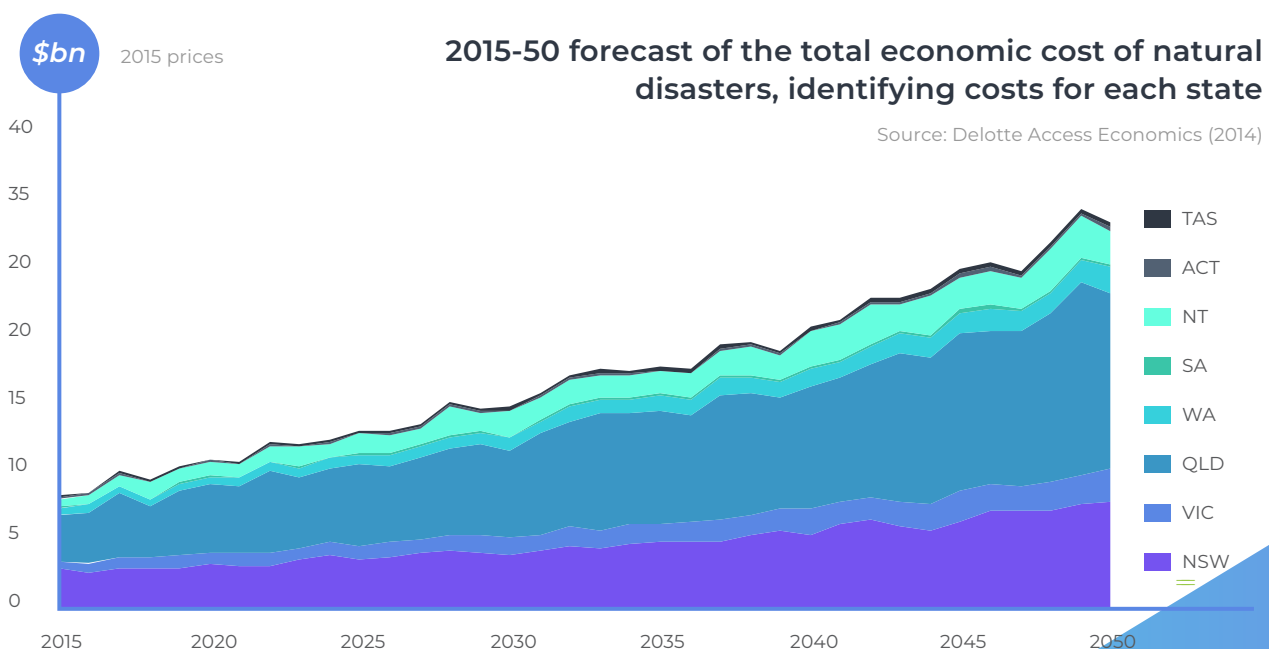
There is a general need to move away from the traditional model of fire and emergency service delivery to a model where emergency management professionals are integrated with, not simply working for, communities<sup>3</sup>.

## As a nation, we have a moral and economic obligation to mitigate against the impact of natural hazards.

As members of the emergency management sector we have a responsibility to identify the major issues that need to be addressed to build safer and more resilient communities.

As members of the research community, we have a responsibility to apply our skills, knowledge and creativity to identifying potential solutions and bringing them to fruition.

- 1 Productivity Commission 2014, Natural Disaster Funding Arrangements, Inquiry Report no. 74, Canberra. JEL code: H77, H84.
- 2 National Strategy for Disaster Resilience: Building the resilience of our nation to disasters, 2011.
- 3 *Strategic Directions for Fire and Emergency Services in Australia and New Zealand 2017-2021*, AFAC, September 2016.





# Research on natural hazards

## **Australian research has made a vital contribution to the safety and well-being of our communities in the presence of natural hazards.**

In the aftermath of recent large bushfires, research has underpinned changes to the way we communicate with threatened communities and expect them to share responsibility for their safety. Research has given us the ability to more accurately forecast the behaviour of cyclones, storms, floods and fire weather. Research is underpinning our understanding of the physical and psychological stresses experienced by emergency services personnel, and how to address them. Research is giving us the tools to understand how today's decisions affect the impacts of tomorrow's events.

Australian research institutions – including universities, the Bushfire and Natural Hazards CRC, CSIRO, Geoscience Australia and the Bureau of Meteorology – have a demonstrated capability and capacity to support the needs of the emergency management sector.

In 2015 the Bushfire and Natural Hazards CRC identified more than 500 projects that had been initiated in the preceding 10 years on studies related to the emergency management sector.

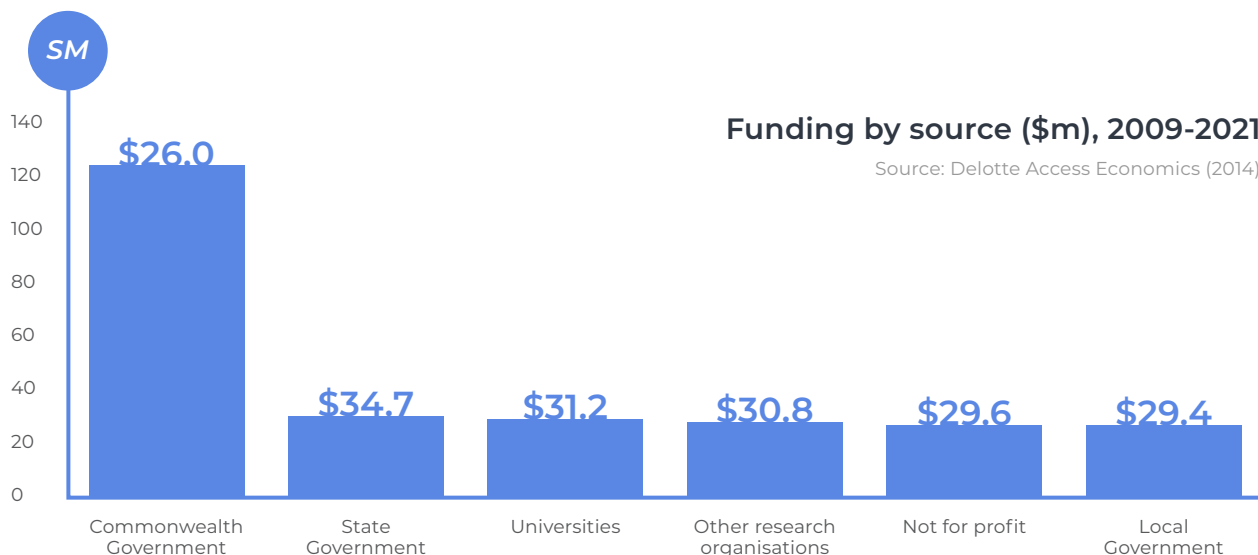
These were funded through various sources including the Australian Research Council Discovery and Linkage Grant programs, the Cooperative Research Centres program, state departments of environment, emergency response agencies, and internally funded research projects at CSIRO, Geoscience Australia and the Bureau of Meteorology. This is in addition to university-based activities, local capabilities and post-graduate research projects.

The Australian Business Roundtable for Disaster Resilience and Safer Communities estimated the research spend on this sector in Australia (2009-2021) was \$283 million, or approximately \$23.6 million a year, and noted that there "... has been relatively little research on the effect of mitigation and the social and psychological impacts of disasters relative to other areas. Funding comes from a variety of different sources, but needs to be co-ordinated to support long-term research ... rather than individual short term projects. Government is the primary source of the bulk of research funding for natural disaster research<sup>4</sup>.

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<sup>4</sup> Australian Business Roundtable for Disaster Resilience and Safer Communities, *Building an open platform for natural disaster resilience decisions*, July 2014.





Despite this national capacity for research, the emergency management sector is no different from many other sectors in Australia in its limited ability to both engage with researchers and to use the latest and best research. The sector often finds it difficult to access this research capability across the many research institutions which can lead to duplication and wastage of effort where different organisations fund similar research at multiple institutions.

At the same time researchers often find it difficult to engage with the sector because of the time involved in developing relationships, the lack of a common language, and the complexity of the issues being addressed.

When high quality and relevant research is successfully completed, the subsequent translation of that research into a form that the emergency management sector can put into practice can be problematic. The barriers to uptake are many and varied, but include the ability of organisations to assess, analyse and evaluate what the research means for their business; interpreting research and managing the changes needed; and the ability and confidence of participants to make meaning of the research reports and outputs<sup>5</sup>.

**In recognition of these potential obstacles, the process to identify national priorities for research in natural hazards emergency management has been coordinated by the Bushfire and Natural Hazards CRC in close collaboration with its partners and many other groups and individuals.**

## ABOUT THE BUSHFIRE AND NATURAL HAZARDS CRC

The Bushfire and Natural Hazards CRC coordinates a national research effort in hazards, including bushfires, flood, storm, cyclone, heatwave, earthquake and tsunami.

From July 2013, \$47 million over eight years in Australian Government funds under the Cooperative Research Centres Program have been matched by support from state and territory government organisations, research institutions and NGOs.

The centre draws together all of Australia and New Zealand's fire and emergency service authorities with the leading experts across a range of scientific fields to explore the causes, consequences and mitigation of natural disasters.

Research partners include universities, government organisations, and several international research organisations.

The CRC research program has developed under the direction of end-user partners. Now in its sixth of eight years of operation, researchers and end-user partners are working closely together to ensure that the research is embedded into the planning, policies and operations of partner organisations.

The CRC will continue to promote and develop research on national priorities.

The aim is to facilitate a process of bringing together the national research capability with the emergency management sector leaders to ensure they work together on the questions that will make the biggest difference to alleviating the human and economic costs associated with natural disasters in Australia.

<sup>5</sup> Dr Christine Owen, Dr Noreen Krusel and Lorian Bethune, Report on Research Utilisation Review, April 2016, <http://www.bnhcrc.com.au/file/6249/download?token=11bDlv8m>.



# Major issues

## **What are the most significant natural hazard emergency management issues Australia faces over the next 10 years?**

This was the question posed to the Australian emergency management sector in a series of workshops hosted by the Bushfire and Natural Hazards Cooperative Research Centre from 2015 to 2019. Each workshop was facilitated by a peak agency body to give it the imprimatur needed to be an authoritative statement of end user priorities. Participants in the workshops included those with specific expertise or operation experience across a range of aspects of emergency management.

The outcomes presented here represent a consensus of industry experts and are based on extensive consultation – this is the first time an exercise of this scale focussed on natural disasters has been conducted in Australia. It is the first time the collective knowledge of the industry has been drawn together and recorded in such a manner.

This publication collects the top-level outcomes of these workshops and presents them as Major Issues. In doing so, it presents a broad set of national research priorities in natural hazards emergency management by identifying end user motivated national priorities.

The workshops provided an exploration of major issues that would benefit from the support of research at a national level. There was no attempt to solve any of the issues or problems raised nor was there any discussion on the details of specific research.

The workshop participants discussed issues they believed were relevant to the specific theme under discussion. These issues were then matched with questions, which formed the basis of the national research opportunities. This publication draws together the Major Issues – the high priority recurring themes uncovered during the workshop process.

**A series of theme specific publications that summarise the outcomes of each workshop and provide a more thorough guide for research activities in Australia over the next decade and beyond can be found here: [www.bnhcrc.com.au](http://www.bnhcrc.com.au).**

The process to identify the national research priorities for natural hazards spanned a diverse range of topics from specific physical hazards through to the societal, organisational, and governmental contributors to resilience. Four major issues arose repeatedly as key to advancing the state of natural hazards emergency management in Australia. These were:

- Shared responsibility and community engagement
- Communicating risk and understanding the benefits of mitigation
- Impacts of climate change
- Predictive services, data and warnings



The workshop themes are broadly linked under the four pillars of **Natural, Social, Economic and Infrastructure**.

**Natural Pillar** – a focus on the natural environment and the understanding of the physical processes, impacts and mitigation of sudden onset hazards such as bushfire, floods, cyclones, storms, heatwave, earthquake, landslide, and tsunami, and long term hazards such as droughts and climate change.

**Social Pillar** – a focus on people and the need to ensure that individuals, communities, business and government have the information and capabilities needed to enhance their resilience to disasters. The breadth of themes within this pillar is broad, and includes aspects of cultural resilience, community engagement, organisational capabilities, and psychosocial impacts of disasters and recovery.

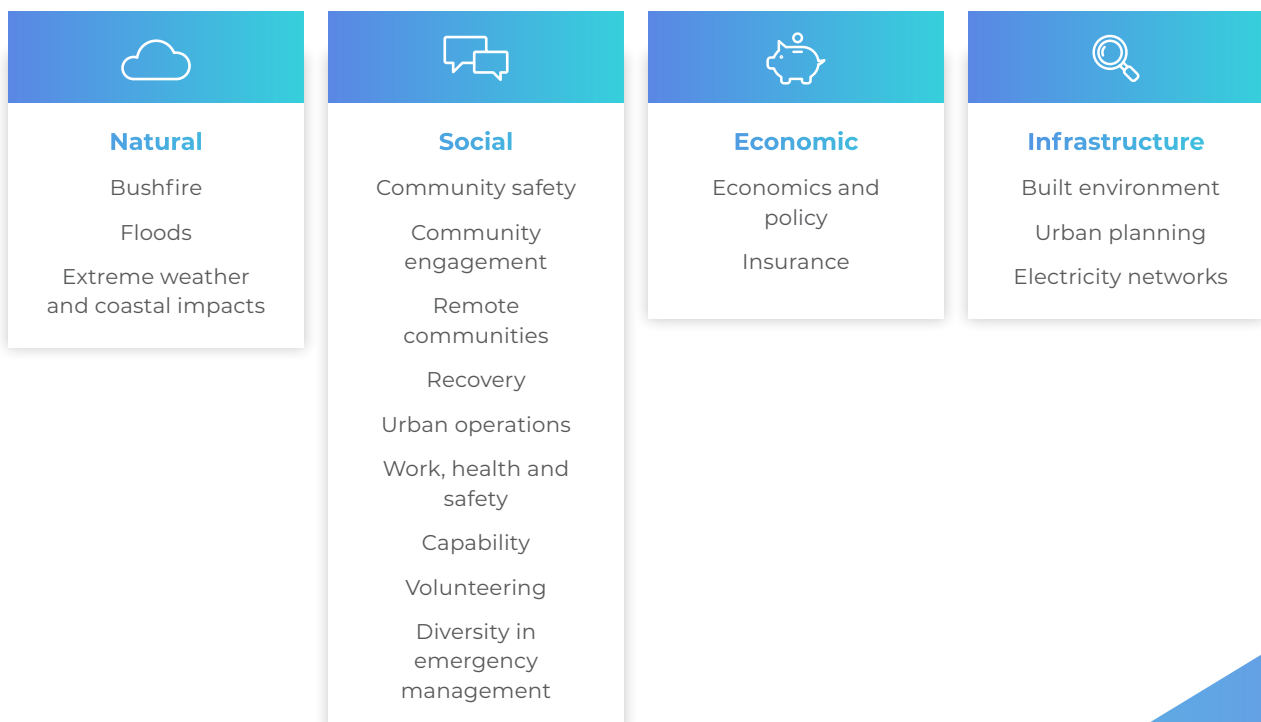
**Economic Pillar** – a focus on the economic impacts, both tangible and intangible, of disasters on individuals, businesses and government and means for mitigating those impacts.

**Infrastructure Pillar** – a focus on physical assets, ranging from residential homes and structures and where they are built through to critical infrastructure such as roads, telecommunications, banking, electricity and water supply.

The workshop themes conducted to date are shown below with each pillar.



Photo: Photo: New South Wales State Emergency Service



# Shared responsibility and community engagement

## **Traditional notions of risk management focus on government and emergency management agencies taking responsibility for identifying, quantifying and mitigating risks.**

However, those directly threatened by natural hazards have the most to lose, and hence, also the most to gain in managing risks.

Applying a resilience-based approach requires cooperation across all sectors of society, with many of the actions needed to improve Australia's disaster resilience sitting well outside the emergency management sector. The ability to prepare for, respond to, and recover from disasters relies on capabilities and policies across a range of sectors and across all levels of community, business and government. To 'mainstream' emergency management, then, is to consider how all sectors interact in order to enhance disaster resilience and support existing and developing capability in this area. A collaborative approach encourages community (individuals and business) and government (local, state and federal) to understand and value risk similarly and potentially work together to mitigate risk and establish acceptable risk levels.

Communities are able to identify those assets, physical, social and environmental, that are central to their everyday lives and essential to the functioning of their community. When provided with relevant and accessible risk information, they are often in the best position to identify ways of managing those risks. Promoting and enabling community centred approaches to risk management can be challenging for government, yet it is central to the idea of sharing responsibility. Providing an understanding of risk ownership to communities is a critical component of motivating community activity for preparedness, to help communities to understand and respond appropriately to warnings, and to subsequently recover from disasters.

Key issues that need to be informed by new knowledge and research to advance shared responsibility and community engagement are:

- Ensuring government and agencies enable communities to manage their own risks.
- Ensuring government collaborates with community to break down silos and build trust and effective partnerships.
- Developing community engagement models that can most effectively build capability and partnerships in support of enhanced disaster resilience.
- Building community engagement capacity within and across sectors.
- Ensuring emergency management sector organisations build effective partnerships with each other and the community across prevention, preparedness, response and recovery.



Photo: Damien Ford, New South Wales Rural Fire Service



# Communicating risk and understanding the benefits of mitigation

**It is generally accepted that targeted investment in mitigation activities will reduce the long term social, economic, environmental and physical costs of disasters.**

Currently there is a lack of evidence that demonstrates the value of government and business investment in risk mitigation for communities and individuals. This is because there is no direct 'line of sight' between behaviour change, risk mitigation and the cost of disasters.

Developing a better understanding of the likelihood and consequences of disasters, and the effective communication of those risks, is considered an essential foundation for motivating community, business and government to prepare themselves for potential disasters.

Being able to quantify the social, economic and environmental benefits of undertaking mitigation activities is essential to building and communicating a compelling case for appropriately resourced and implemented mitigation. At the same time, a better understanding of the social, economic and policy environment within which decisions are made will enable risk-reduction proposals to be presented in a compelling manner that will increase the likelihood of resourcing and implementation support at the individual, community, business and government levels.

Key issues that need to be addressed to advance investment in mitigation are:

- Improving access to data, from both public and private sources, to enable comprehensive risk analysis to be undertaken and to support new operational capabilities.
- Better quantification of the potential long term costs and benefits of mitigation.
- Improving communication between government, the private sector, and community on the costs and benefits of enhanced investment in mitigation.
- Understanding how risk information is perceived and processed by decision-makers, including individuals, communities, business and government, and ensuring that risk communication becomes an effective driver for action.
- Better identification of the ownership and impact of risk, and therefore identification of those with the responsibility to act to mitigate hazard impacts.
- Understanding how investment in changing behaviour at different levels, including political, government agencies, business, community and individual, supports improving disaster resilience.
- Encouraging new partnerships and enhancing existing partnerships between government, business and community to deliver change.



# Climate change

## **Australian communities face multiple meteorological hazards, such as cyclones, floods, bushfires and heatwaves.**

The potential impact of many severe weather and ocean events (including sea level rise) is increasing due to climate change increasing the severity, frequency and geographic range of these events. Understanding the changing hazard potential and risk is critical to the resilience of communities, businesses, government and the environment, and the ability to plan for disasters. A clear understanding of exposure to hazards and the likelihood and potential consequences informs all mitigation activities.

It is also expected that with climate change Australia will see more cumulative or multiple emergency events, such as days of heatwave followed by a bushfire. More needs to be done to understand the impact of cumulative events to enable governments and agencies to build policy and resilience that will prepare them to respond to these types of events. Proper preparation for an event relies not just on the current best estimate of the event's magnitude, but also on the consideration of plausible alternative scenarios and their relative likelihood.

Key issues that need to be addressed on climate change are:

- The effects of climate change on hazard profiles in Australia.
- Building mitigation activities directly into recovery processes as a response to and recovery from emergency events and climate change.
- Influencing decision makers and the public to incorporate climate science into operations.
- Calculating the impacts at different levels (individual, community, economy) of multiple and cumulative disaster events.



Photo: Ben Shepherd, New South Wales Rural Fire Service



# Predictive services, data and warnings

## Warnings and information during emergencies are critical elements of modern emergency management.

In Australia, there has been significant progress in legislation, policy, operational practice, research and the use of technology. A national focus to better engage and empower communities has propelled change and continuous improvement.

Forecasts and warnings are now more comprehensive, updated more frequently and cover more locations. Accuracy of weather forecasts is continually improving, driven by advancements in scientific knowledge and implementation, better observations and more powerful computers.

Predictive services are a key contributor to mitigation activities including fuel reduction burns, community warning and information activities (such as cyclone, flood, fire and heatwave warnings), and response activities (such as fire behaviour analysis).



Photo: Tim Allan

Key issues that need to be addressed to provide more effective predictive services are:

- As demand for information grows, meeting the expectations in terms of accuracy, availability to community, clarity and communication to potential users.
- Improving early warnings of the possibility of a severe event, or even multiple events close together in time, to better inform response action, including events that have low probability but very severe impacts.
- Combining community exposure and vulnerability data with hazard predictions in order to make quantitative predictions of the potential impacts of an event.
- Identifying technologies that government and the emergency management sector should invest in for more effective warnings and warning dissemination - including technical, visual and spatial options.
- Improving the use of social media as a 'two-way' conversation with communities and to share innovation and good practice across agencies.
- Understanding how government and the emergency management sector can enable greater national consistency of warning frameworks across jurisdictions.
- Building better partnerships between government and the emergency management sector with third parties to improve the development and dissemination of warnings, including an increased focus on providing more accessible, sharable and easily republished warnings.

# Using this statement on research priorities

**This publication is the starting point for a revitalised connection between researchers, practitioners and policy makers, on the need to fund research in natural hazards emergency management and translate that research into practice.**

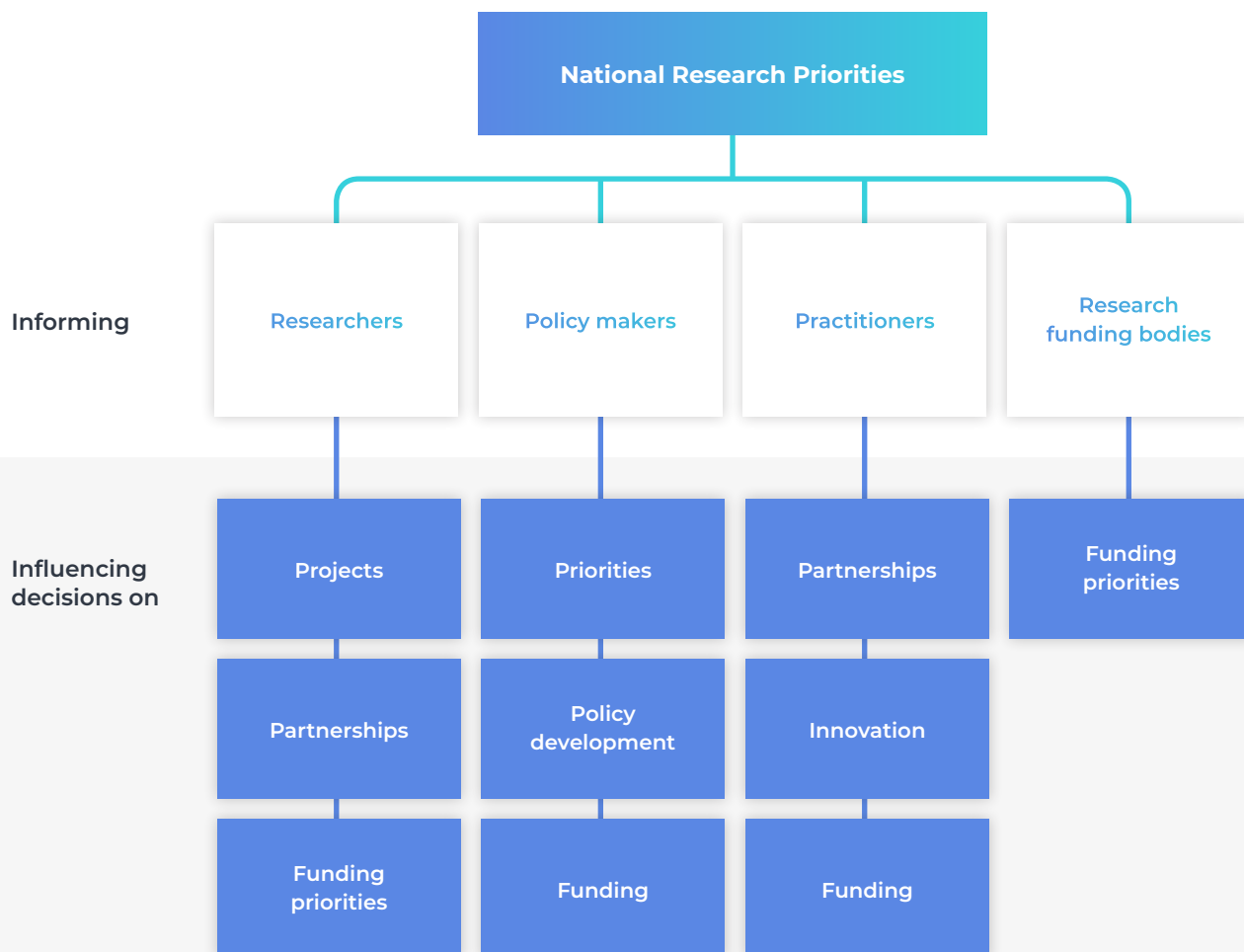
As illustrated above, its purpose is to inform key stakeholders, influences decisions, and provide support across a range of functions. It provides an agreed set of high priority topics to guide conversations, build relationships, and develop project opportunities.

The major issues identified in this document, and its supporting suite of publications, align with the priorities from the Sendai Framework, which are guiding the Australian Government on future planning in disaster risk reduction.

Researchers, practitioners and policy makers will use the information in different, intersecting ways, and together will help build a safer, more resilient Australia.



Photo: xxxx



## Supporting

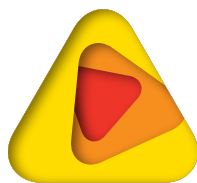
Better evidence for policy development and decision making

Better application of funding

Safer and more resilient communities

Australia's commitment to the Sendai Framework for Disaster Risk Reduction





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