Research funding identified from 2009 – 2021

$283m

Storm surge — Flooding — Cyclone — Earthquake — Bushfire

$283m

Prevention & preparedness — Response — Recovery

$283m

Commonwealth Government — State Government — Local Government — Universities — Research organisations — Not-for-profit

4. Natural disaster research

Key points

From 2009 to 2014 most of the funding for natural disaster research was allocated to **bushfire research**.

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 (e.g. rationalisation of building codes, nationwide elevation data) rather than individual short term projects.

This chapter is an overview of the key natural disaster research activities that have happened or are planned to happen in Australia between 2009 and 2021. This analysis covers:

- The range of stakeholders involved in research activities
- The distribution of research activities by type of natural peril
- The distribution of research activities by research theme
- The sources of funding for the research activities identified.

Potential research gaps and areas where research could be restructured or better organised are also identified.

4.1 Research organisations

Natural disaster research is conducted across all levels of government and across a range of research institutions, universities and other organisations. The following section provides a brief summary of the research undertaken by key organisations. More detail on each organisation and the research programs can be found in Appendix C.

Australian Government

Various Australian Government departments and agencies have different roles and responsibilities related to natural disasters and conduct research accordingly. The Australian Government is the main funder of natural disaster related research, providing direct funding to CSIRO, the Attorney-General's Department, Geoscience Australia and the Bureau of Meteorology. The Government provides indirect funding to universities through the Australian Research Council (ARC) grants and Cooperative Research Centres (CRCs).

This central funding role creates an opportunity for the prioritisation of the research agenda, which would enable effective decision-making to address the nation's highest risk areas through investments in resilience.

CSIRO is Australia's national science agency and conducts a range of research into natural disasters, making a substantial contribution to the field. CSIRO explores all hazards, with links to other research organisations such as the BoM through the Centre for Australian Weather and Climate Research (CAWCR). The significant scaling back of the research activities of the Climate Adaptation Flagship, where much peril related research was conducted, is part of a major restructure to streamline the organisation and shift the focus to present day challenges in the natural disaster area.

The Federal Minister for Justice is responsible for national emergency management and disaster resilience. As a result, the Attorney-General's Department is responsible for the national co-ordination of emergency management. Within the department, the National Security Resilience Policy division and the Emergency Management Australia (EMA) division have natural disaster related responsibilities. The department provides the National Emergency Management Projects (NEMP) grant program to fund programs of work that contribute to the National Disaster Resilience Strategy.

Geoscience Australia is a prescribed agency within the Industry portfolio and plays an important role in natural disaster research through the provision of data and direct involvement in undertaking research. The main areas of direct research are programs in vulnerability, resilience and information. Geoscience Australia also engages with other research institutions to produce collaborative outputs such as the BoM, CSIRO and the Bushfire and Natural Hazards CRC.

The BoM is Australia's national weather, climate and water agency. The Bureau plays a key role in disseminating data and information related to natural disasters. The development of natural hazard warning systems and associated knowledge also plays a significant role in the research community. The provision of historical weather and peril data by the BoM is vital for a lot of researchers. The Australian Tropical Cyclone Database and the Southern Hemisphere Tropical Cyclone Data Platform are inputs for many models developed by academics as well as insurers. The Australian Daily Rainfall Gridded Data and Intensity-Frequency Duration curves are widely used for flood modelling.

Other government departments and agencies involved in research include the Department of Human Services and the Department of Defence.

The Department of Human Services has collaborated with the CSIRO in the past on the Emergency Response Intelligence Capability and is responsible for intelligence gathering and situation reporting during emergency events. The Department of Defence provides support to other federal and state agencies in geospatial intelligence including unclassified imagery, tailored mapping and geospatial data.

State and Territory Governments

State and territory governments are involved in natural peril related research through a variety of channels. The delivery of services is a key role of the states and territories and thus they are the end users of much of the applied research. Individual state emergency service organisations conduct varying degrees of research as do peak bodies such as the Australian Fire and Emergency Service Authorities Council and the Australian Council of State Emergency Services. State and territory governments also contribute to research by participating in the Bushfire and Natural Hazards CRC and by funding specific resilience and mitigation projects through the Natural Disaster Resilience Program (NDRP). State and territory governments also assist local councils to build their capabilities in assessing approaches to natural disaster risk management[4].

Local Governments

Local governments play an important role in natural disaster research through the provision of flood mapping and related data, participation in post-disaster assessment and analysis and being central to land use planning. Local governments have the best knowledge of local circumstances and are closely in contact with the community and the devastation that can occur as a result of a natural disaster. The research conducted by local governments varies considerably depending on their financial capacity and the relevance of research to their specific geographical area. More information on local government involvement in research is included in Appendix C.

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4   For example, the NSW Office of Environment and Heritage currently provides decision-making support to local government through grants for preparation of coastal studies, coastal zone management plans, and the investigation, design and implementation of management actions to reduce coastal erosion risks.

Bushfire and Natural Hazards Cooperative Research Centre

The Bushfire and Natural Hazards Cooperative Research Centre (BNHCRC) is the largest funder of natural disaster related research in Australia. Launched in December 2013 with $130 million in funding over eight years, the BNHCRC is an important contributor to the research landscape. The Australian Government contributed $47 million to the centre with the remainder coming from more than 45 program partners. CRCs are funded through the Department of Industry.

National Climate Change Adaptation Research Facility

The National Climate Change Adaptation Research Facility (NCCARF) was established in 2008 to direct national research into the risks associated with climate change. NCCARF commissioned approximately $40 million across more than 100 projects during the operational phase between 2008 and 2013 (NCCARF, 2012). A portion of the research related directly to natural disasters with one of the research priorities focused on emergency management.

Terrestrial Ecosystem Research Network

The Terrestrial Ecosystem Research Network (TERN) was created in 2009 to provide the infrastructure and networks to allow ecosystem scientists to collect, store and share data across disciplines. TERN enables wide access to ecosystem science data for research through the TERN Data Discovery Platform. The data licensing policy maintains open access under different licensing arrangements through a suite of appropriate licenses. TERN data is used in the natural disaster research community including coastal data sets for understanding floods and cyclones and vegetation data to model bushfire risk.
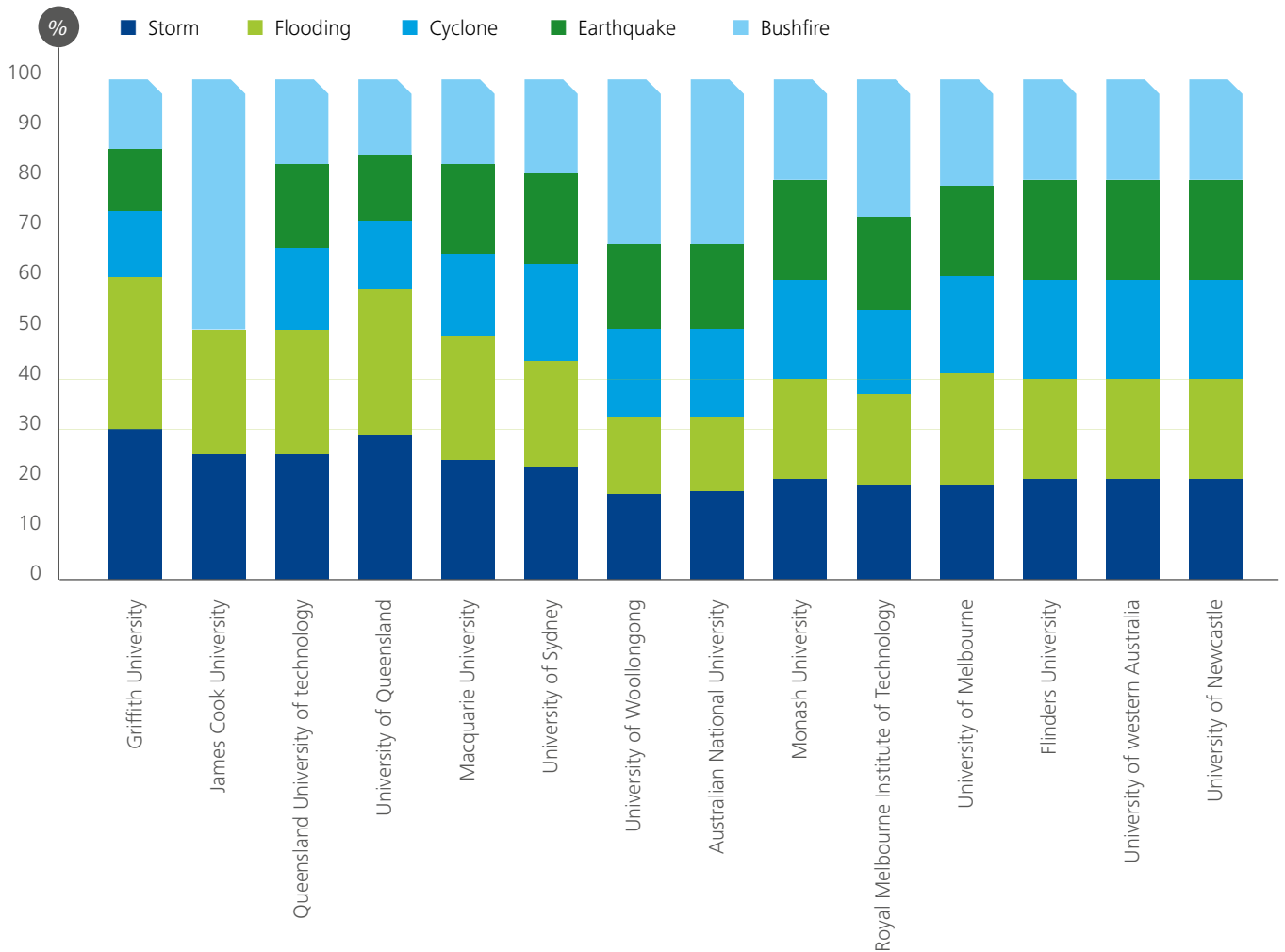
Universities

The primary source of funding for university research is through the Australian Research Council (ARC) National Competitive Grants Program. There is approximately $19.8 million in university funding for the 2009-2021 period related to storm surge, flooding, cyclones, earthquakes and bushfires. Universities conduct a broad range of research with multiple specialist platforms and networks across the natural disaster field. The researchers within universities also conduct much of the research funded through research organisations such as the BNHCRC and NCCARF. Universities also collaborate with government organisations such as CSIRO, Geoscience Australia and the BoM.

Table 4.1: Research areas within the Bushfire and Natural Hazards CRC

Economics, policy and decision-making	Resilient people, infrastructure and institutions	Bushfire and natural hazard risks
Governance and institutional knowledge	Communication and warnings	Monitoring and prediction
Economics and strategic decisions	Emergency management capability	Next generation fire modelling
Scenario and loss analysis	Sustainable volunteering	Prescribed burning and catchment management
	Understanding and measuring social resilience	Coastal management
	Hardening buildings and infrastructure	

Source: BNHCRC (2014)

Chart 4.1: University research by type of natural disaster

Source: Deloitte Access Economics (2014)

Chart 4.1 summarises the distribution of research activities across the range of natural hazards within select universities in Australia. Where research has been conducted on natural disasters in general and not a specific peril, this has been allocated across all peril types.

The data suggests certain universities are focused on a particular type of disaster. For example, the University of Wollongong and the Australian National University are more focused on bushfire; the University of Queensland and Griffith University are focused on floods; while James Cook University is primarily focused on cyclones. Unsurprisingly, the data reveals that universities tend to focus on the natural hazard more common to their geographic location. For example, South East Queensland with flooding, the ACT with bushfires and Northern Queensland with cyclones.

Private organisations

Private organisations engage in research for their own purposes, for other organisations on a user-pays basis, or for the benefit of the community. Some examples of private organisations conducting or funding research in the natural disaster area include the Insurance Council of Australia (ICA), Risk Frontiers and the Australian Disaster Management Platform which is a collaboration between IBM and the University of Melbourne.

Box 8: Insurance Council of Australia – pragmatic data provision

The Insurance Council of Australia (ICA) is the representative body for the insurance industry in Australia. The ICA relies on hazard data supplied by state and local governments to provide guidance to the community and governments on insurance availability and affordability as well as the need for mitigation. Insurers and reinsurers also rely substantially on natural hazard data to price policies effectively, particularly in hazard prone areas. As some of the fundamental data inputs are common across the industry, the ICA plays a role in creating a central source of information helping to avoid some overlap. This central role arose due to the immediate practical need to have flood data for use in the underwriting process.

ICA Data Globe

The ICA Data Globe provides data on a wide range of perils including flood, earthquake, bushfire, storm surge and cyclone. Its main function is to provide the ICA with a mechanism to demonstrate to governments the linkages between hazards in an area and the pricing or availability of insurance products, as well as areas that are suffering from a lack of hazard mapping. The data collected is also made available to insurers to supplement their own data sets for underwriting purposes. The data is collected from government agencies and other stakeholders that are typically the statutory authority responsible for that data.

The Data Globe is a central source of multi hazard data at a national level and is presently shared with the Queensland Government, while several other governments are in the process of executing the required licenses to join.

National Flood Information Database

The National Flood Information Database (NFID) provides an address level flood exposure data set. The ICA commissioned Risk Frontiers and Willis Re in 2008 to develop the database using existing government flood mapping as a result of a project to increase the availability of flood insurance cover. The NFID provides participating insurers with flood depth information on approximately 10 million addresses and is used by the majority of insurers as an input to the pricing of flood risks.

The NFID has been expanded continually since its inception, as additional local government flood studies have been acquired, and is planned to continue until 2017. The NFID is made available through the ICA Data Globe, enabling flood frequency and depth to be visualised at individual addresses, where raw flood data has been supplied by a local or state government.

Property Resilience and Exposure Program

The Property Resilience and Exposure Program (PREP) is intended to operate as a formal mechanism to assist industry and government to reduce information asymmetry regarding hazards and the built environment. Under the PREP, local governments are encouraged to share data with the ICA in return for resilience mapping to be used as an input to local development control decisions and mitigation measures. By providing the ICA with available hazard mapping as well as building control data, councils are able to engage with the ICA regarding perceived affordability issues in their community.

This program has been piloted and is being prepared for general release in 2014.

The research conducted by private organisations is wide, varied and can be commercially sensitive. This means it can be difficult to ascertain what research is being conducted or already exists. Notably, private sector involvement has not been included in the quantitative analysis presented in the remainder of this chapter due to difficulties in ascertaining the magnitude of funding.

Box 8 on page 51 does, however, outline some of the activities currently offered to insurers and reinsurers or being developed by the ICA.

There are situations whereby the private sector has specialised skills and expertise that could be better leveraged as part of a co-ordinated effort to improve natural disaster research in Australia. For example, a partnership between the Property Council of Australia and the Investment Property Databank. The partners are currently reviewing the applicability of the UK Eco-Portfolio Analysis Service for Australia. This is a benchmarking service that identifies and highlights the potential environmental risks in a real estate investment portfolio. The service aims to provide a transparent assessment of the vulnerability of a particular property.

Other organisations

Other organisations such as the Australian Building Codes Board (ABCB), the Australian Red Cross and the Regional Australia Institute also conduct or fund research.

The ABCB is responsible for the National Construction Code and conducts research to ensure building standards reflect the latest evidence captured on the effects of extreme weather events on new buildings.

The Australian Red Cross commissions individual research projects on the social and psychological effects of natural disasters on individuals and communities and participates in the BNHCRC. The Red Cross is also a partner in the five-year University of Melbourne ARC Linkage Grant Beyond Bushfires project, as well as working closely with a number of other research institutions.

The Regional Australia Institute conducts a research agenda that focuses on issues affecting regional areas including natural disasters.

4.2 Research by natural peril type

From 2009 to 2014 most of the funding for natural disaster research was allocated to **bushfire research** despite the annualised cost of this disaster being relatively low when compared to the other main perils.

Based on available data, our findings suggest that the amount of research into **flooding and cyclones,** relative to their average cost of damage, is **small**.

These findings are based on the current fund allocation by natural disaster and comparing it to the average annual costs of natural disaster from 1967 to 1999.

Australia experiences a range of natural disasters including bushfires, floods, storm surges, earthquakes and cyclones. These events cause great financial hardship for individuals and communities, disrupt lives and can also result in loss of life. As outlined in *'Building our Nation's Resilience to Natural Disasters'*, the costs of these disasters can be measured to some extent through the insured value of property but should extend to broader costs that include the loss of life and the social and psychological impacts on individuals and communities.

Theoretically, the cost of research into natural disasters should be easier to identify. However, in practice it is difficult to accurately collate data on the magnitude of the funding for research in this field. Australian Government organisations tend to have the most available information on funding arrangements for data. However, even then it was difficult to categorise the funding into the type of disaster and research and the profile of expenditure. In some cases, it was unclear how total funding for a particular project was allocated to different disasters. In these cases it was assumed to be equally funded across bushfires, storm surges, earthquakes and cyclones.

Consequently, the analysis of allocation of funding across disasters and types of research presented here has some weaknesses and should be treated with caution. More transparent data on funding and allocation across natural disasters would assist with better co-ordination of the research and identify where there may be gaps in the research agenda.

With these caveats in mind, our analysis identified a total of $283 million in public funding over the period from 2009-2021. Chart 4.2 shows how this funding has been allocated to each of the natural disasters over that period. The shape of the funding over time most likely reflects the typical four-year cycle of budget allocations and does not necessarily represent a policy decision to reduce funding into natural disasters in the future. Research that has been conducted on natural disasters in general, and not a specific peril, has been allocated across all disaster types.

In the 'Building our Nation's Resilience to Natural Disasters' paper it was estimated that consistent Australian Government pre-disaster funding was approximately $50 million per annum. This figure included all spending on pre-disaster resilience and included the total spending and investment on mitigation measures. While the figure varies year to year, it is estimated that approximately $32 million was funded in 2012/13 on natural disaster research. As

research only makes up a portion of the total spending on pre-disaster programs, such as the National Emergency Management Projects and the National Partnership Agreement on Natural Disaster Resilience, the lower figure is to be expected.

It is useful to consider if funds are allocated appropriately. As a starting point, we examine the average cost of disaster relative to the total annual costs and compare it to the current funding arrangements. Table 4.2 highlights the average annual cost of disasters and associated proportion by type of disaster.

Table 4.2: Average annual cost of natural disasters

Disaster	Average annual cost (1967-1999)	Proportion of total
Earthquake	267.4	7.06%
Cyclone	1,439.4	38.01%
Flooding	1,745.2	46.09%
Bushfire	334.9	8.84%

Source: BITRE

Chart 4.2: Current funding by disaster types ($m), 2009-2021
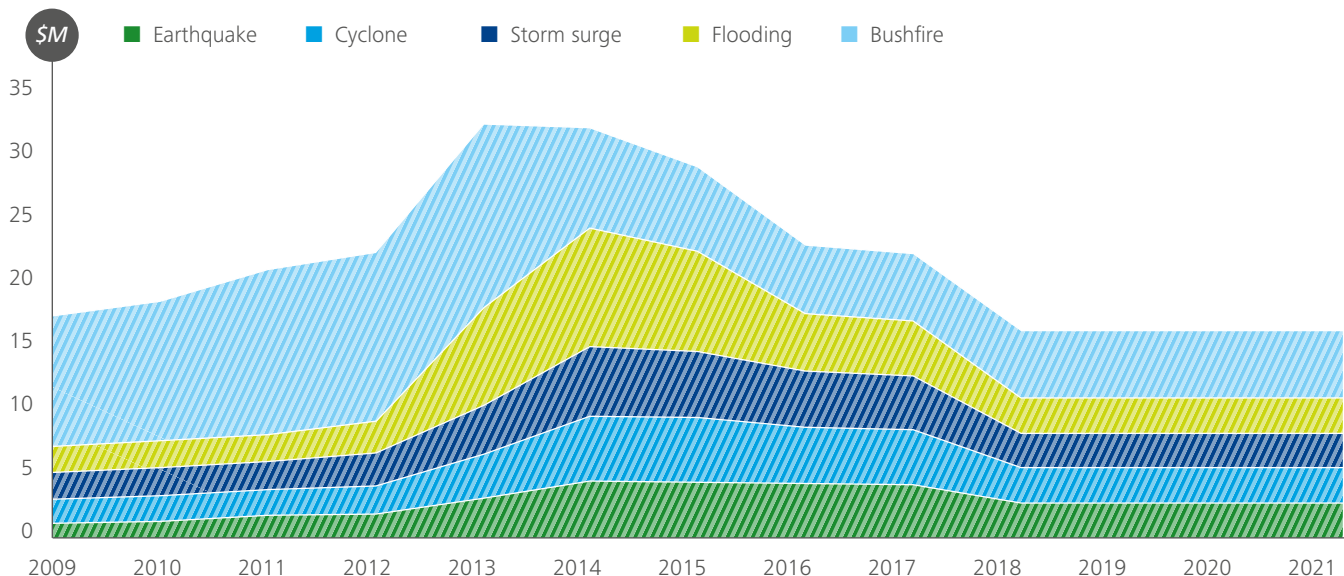
Source: Deloitte Access Economics research of publicly available funding information (2014) and consultations

A summary of funding by disaster types relative to these costs is presented below. Storm surge has been omitted from this analysis as no data relating to annual costs was available.

At face value, the data in Table 4.2 on page 53 suggests that, based on the annual costs of the disaster, research undertaken for **flooding and cyclones,** relative to the average cost of damage by these disasters, is **small**.

It is important to acknowledge that the annual costs listed in Table 4.2 are based on the available quantifiable value and may not fully reflect aspects such as loss of life. This should be accounted for in terms of funding and may explain some of the discrepancies between the average annual costs and the current funding arrangements.

Average annual costs may also be skewed by large, single year events such as the 1989 earthquake in Newcastle and Cyclone Tracy in 1974. There is a need to have a better long-term view of risk so that research and data capture can be properly prioritised.

More importantly, however, this is not necessarily the appropriate way to consider the optimal prioritisation of research funding. As discussed in Chapter 6, the allocation of funding for research should be informed by the opportunities for the greatest impact on communities, balancing the need for competitive funding, to incentivise innovative research ideas, alongside targeted funding that responds to known issues and challenges.

Chart 4.3: Proportion of current funding by disaster types

- Current proportion of research funding
- Proportion based on annual cost
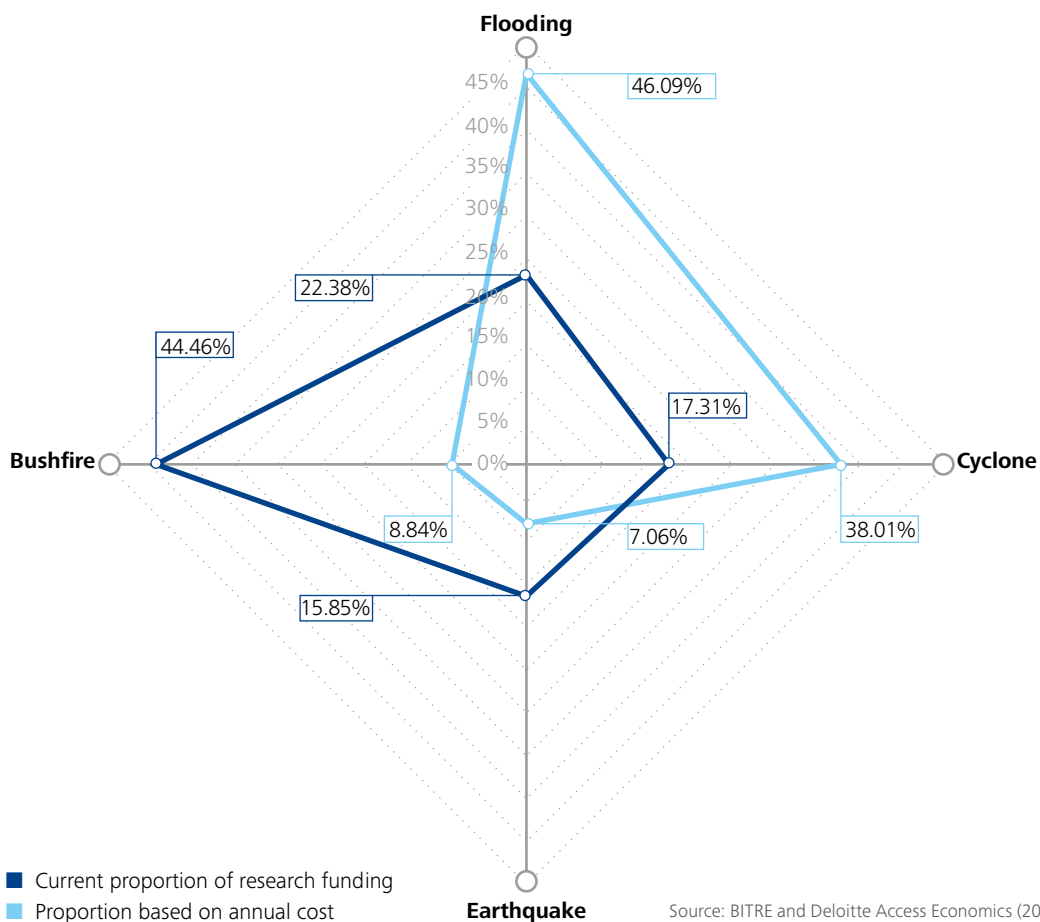
Source: BITRE and Deloitte Access Economics (2014)

4.3 Categories of natural disaster research

There has been relatively little research on the **effect of mitigation** and the **social and psychological impacts** of disasters relative to other areas.

Some types of research sit well with the private sector, some sit well with the public sector, while others could benefit from greater **co-operation**.

In addition to the types of disaster, consideration must also be given to the types of research that should be undertaken, for example mitigation, coping with disaster or value at risk.

Some natural disasters may yield more benefits from mitigation measures, where others may benefit more from research on coping after the event. The appropriate mix of research depends on the nature of the disaster but also on the current stock of research.

In examining the funding allocated to types of natural disaster research, in cases where uncertainty existed, the estimated funding was allocated equally across the seven types of natural disaster research. These are: risk management; presence of hazard and detection system; value at risk; extent of vulnerability; effect of mitigation; coping with natural disasters; and policy, strategy and decision support. A summary of the funding by research type from 2009-2021 is presented in Chart 4.4.

The category of coping with natural disasters includes the social and psychological impacts research referred to later in this chapter as well as other research on community preparedness, resilience and recovery.

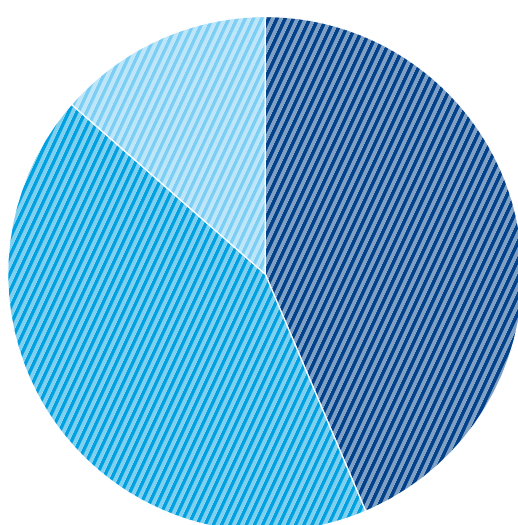Chart 4.4: Funding by research types ($m), 2009-2021
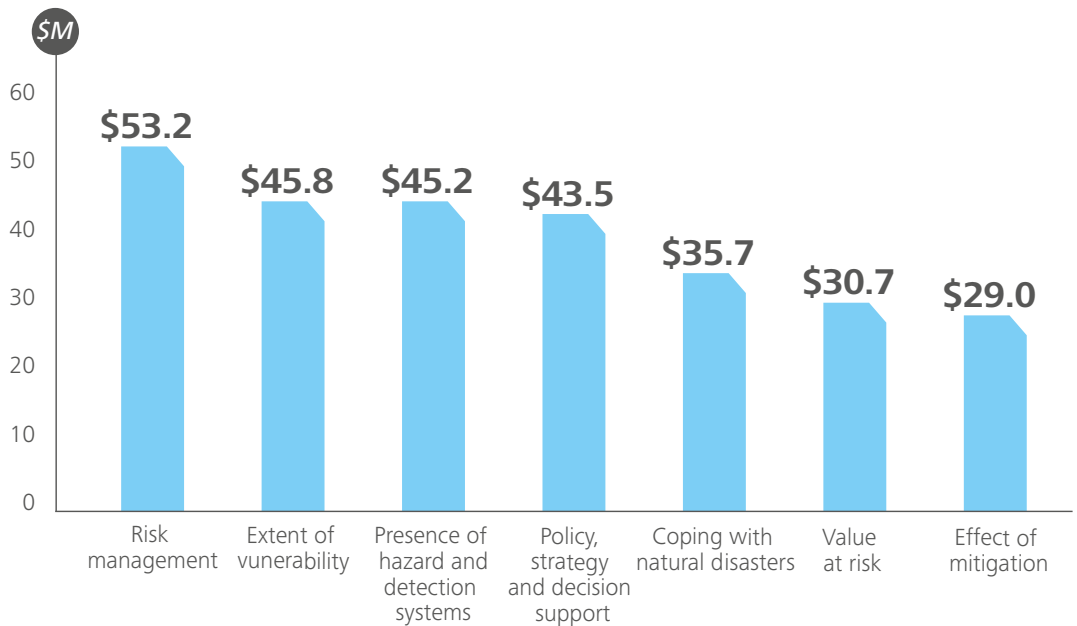
Source: Deloitte Access Economics (2014)

The data in Chart 4.4 suggests that the **three areas** which received the **least funding** are: **the effect of mitigation, value at risk and coping with natural disasters**. In *'Building our Nation's Resilience to Natural Disasters'*, the potential benefits of mitigation were highlighted. The data suggests that mitigation remains an underfunded area of research.

Research into the effect of mitigation is important in guiding resilience activities on the ground. Effective resilience measures mean fewer people and communities are affected by natural disasters. Targeted investment in risk reduction, while having a large up-front cost, provides a large return over the long-term. Adequate research in this area can help ensure taxpayer funds are utilised more effectively.

Research activity by the stage of disaster, being: prevention and preparedness (pre-disaster); response; and recovery (post-disaster) was analysed. It showed that the majority of funding is allocated to projects focused on the prevention and preparedness and response stages (Chart 4.5).
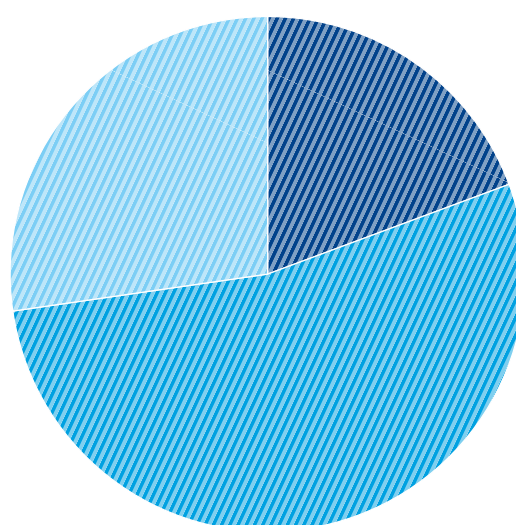
It is estimated that the total national budget for Fire and Emergency Services exceeds $4 billion. This budget includes the capturing of data and the contribution to research. While we have captured the emergency service organisations contributions to the Bushfire and Natural Hazards Cooperative Research Centre (BNHCRC) and research undertaken through the National Emergency Management Projects, we were not able to quantify all of the direct research and data capture undertaken. This research is predominantly focused on response and recovery and would alter the allocation of funding towards these stages.

Just looking at university research activity, there is a greater focus on the response stage as outlined in Chart 4.6. The focus on emergency services and disaster response in some research activities leads to a greater funding proportion.

It is difficult to ascertain whether the proportions of current funding are adequate in addressing the current needs for natural disasters since the appropriate mix will depend on the nature of the disaster and potential benefits of the research.

Chart 4.5: Allocation of funding

- Prevention and preparedness
- Response
- Recovery

Source: Deloitte Access Economics (2014)

Chart 4.6: Allocation of funding – university research

- Prevention and preparedness
- Response
- Recovery

Source: Deloitte Access Economics (2014)

It is important to acknowledge that the data behind these proportions are from public institutions. Thus the current data may not be an accurate representation of the population of the actual research since private enterprises such as insurance firms have undertaken research in areas such as value at risk which is not reflected in the data.

The social and psychological impacts of natural disasters is an area where there is limited Australian research. The Beyond Bushfires study, a partnership between the University of Melbourne and industry partners including the Australian Red Cross (Box 9), as well as work on community wellbeing by Victoria University and the University of South Australia, illustrates some research is being conducted but more needs to be done.

Outside of these institutions, there appears to be minimal research into the social and psychological impacts of natural disasters.

Current research tends to focus specifically on Post-Traumatic Stress Disorder with little focus on other social and psychological impacts. Research conducted on how to assist emergency services to inform communities on psychological preparedness for a disaster is limited. A major gap in this area is a formal analysis of the costs and benefits associated with the soft measures of mitigation such as preparedness programs and community education. Such research could potentially inform the effectiveness of soft measures relative to physical measures.

Box 9: Beyond Bushfires: a study into community resilience and recovery

Beyond Bushfires is a five-year study into the medium to long-term impact of the 2009 Victorian bushfires on mental health, wellbeing and the social relationships of individuals and their communities. The study is a partnership between the University of Melbourne, the Australian Red Cross and a variety of organisations with a concern for mental health in the community. The study was launched in response to a need for evidence-based research into the patterns of impact and recovery over time.

The study will conduct surveys, interviews, focus groups and community visits. Approximately 3,000 children, adolescents and adults will be surveyed from 16 different communities that suffered varying impacts from the bushfires. A small group of study participants will participate in detailed interviews, while all participants will take part in three 30-minute phone or online surveys.

A key differentiator of the research is the investigation into the connection between individual impacts and community recovery over a long time frame. The study has been funded by a five-year grant from the Australian Research Council. According to Dr Lisa Gibbs of the University of Melbourne's School of Population Health, "We hope to establish some mental health and wellbeing strategies that individuals, communities and agencies can rely on if they ever face future natural disasters again" (University of Melbourne, 2011).

Residents battle a fast moving grassfire while several fires are burning throughout Victoria. February 2014.

The New South Wales Rural Fire Service conducting a controlled back-burn in the Blue Mountains West of Sydney, 2014

4.4 Funding sources

Funding comes from a variety of sources but needs to be **co-ordinated** to support long-term research rather than individual short term projects. For example, rationalisation of building codes and nationwide elevation data.

Competition is beneficial for the quality of research and to support innovation.

However, there is a need to co-ordinate research completed by the **public and private sector**, with appropriate data confidentiality protocols in place.

Co-ordination within government **could be improved**, encompassing the research activities of the Australian Government, state and territory governments as well as emergency management authorities.

Research is relatively well co-ordinated (especially now with the CRC and CSIRO 'system of systems' initiative) but **data co-ordination is lacking.***

Historically, research into natural disasters has been fragmented with many different organisations looking into different peril types under different funding arrangements. The establishment of key organisations such as the BNHCRC and NCCARF, has helped to co-ordinate the research across perils to some extent. Co-ordination ensures available funds are efficiently utilised and can reduce duplication. The issue of co-ordination not only stems from within and across governments but also from the government to the private sector.

However, better co-ordination does not necessarily imply that research should not overlap, in fact, overlapping research can be beneficial i.e. researchers should leverage the works of other researchers to improve their knowledge. Research outcomes derived from different methods can also improve the reliability of the conclusions. Thus, while co-ordinating funds is important, from the government's perspective there is also a need to make them competitive to ensure researchers can build on the work of others and have a strong incentive to produce quality research.

The issue of co-ordination between governments and the private sector is more difficult due to possible competitive advantages derived by private firms from research and data. Protocols for sharing information need to be considered so that private sector research can benefit the wider community without eroding its competitive advantage.

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*   Refer to the CSIRO 'system of systems' initiative p.20
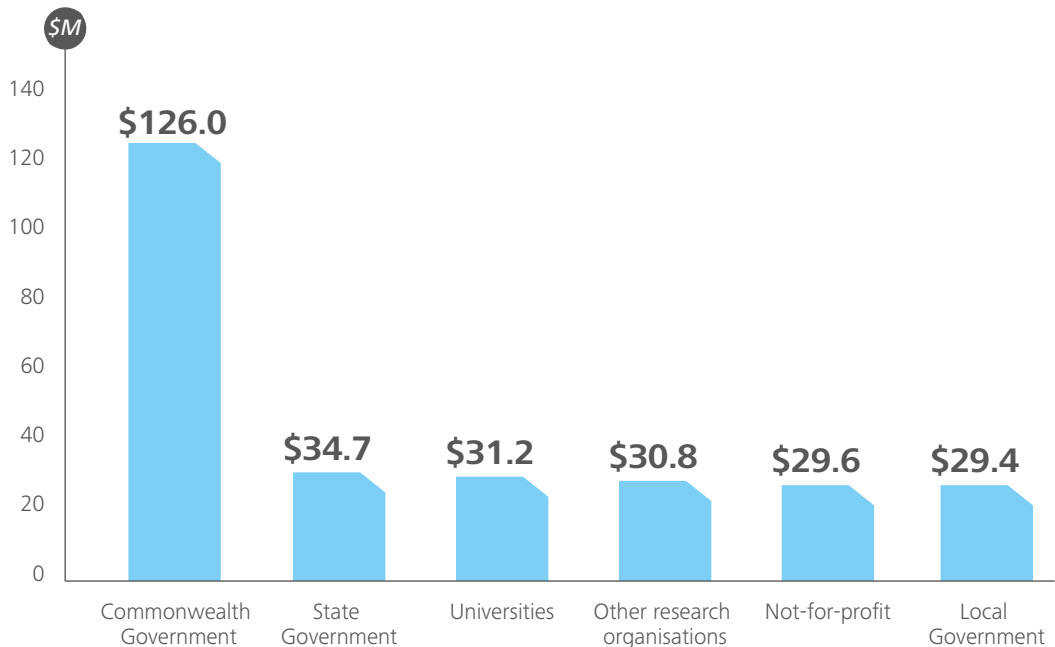
4.4.1 Government funding

Our analysis has found that from 2009 to 2021 around 45% of research is directly financed by the Australian Government. If we include university funding our figures suggest the Government contributes around 56% of total funding. The state governments fund around 12% of the total amount. Chart 4.7 summarises the funding provided by various entities from 2009 to 2021 and suggests the Australian Government is the primary financier of natural disaster research.

It is important to acknowledge that the funding outlined above is based only on publicly available data. It does not capture investments made by the private sector into natural disaster research.

4.4.2 Private sector funding

The main organisations represented in our analysis are government funded institutions. While consultations revealed some private sector research, there is limited visibility of what research is being conducted or the cost involved. Due to much of the research and its cost being commercially sensitive, without an expansive survey it was not possible to obtain estimates of current funding levels.

Chart 4.7: Funding by source ($m), 2009-2021

Source: Deloitte Access Economics (2014)