Natural Hazards Research Australia

ANNUAL PROGRESS REPORT 2022–23

Natural Hazards Research Australia's staff work from Burramattagal, Dharawal, Dharug, Dja Dja Wurrung, Gadigal, Turrbal/Yuggera, Wadawurrung, Wangal and Wurundjeri Countries. We thank and acknowledge the Traditional Custodians of these lands and all the lands where we work, live and walk, and pay our respects to Elders past, present and emerging. We recognise that these lands and waters have always been places of teaching, research and learning, and that sovereignty has not been ceded. We are committed to strengthening reconciliation and building resilience through respectful and empowering relationships with First Nations communities, peoples and partners.

Publisher: Natural Hazards Research Australia

August 2023

Citation: Natural Hazards Research Australia (2023) Annual Report 2022–23

Accessible at naturalhazards.com.au/corporate-documents.

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Natural Hazards Research Australia is funded by the Australian Government and Participants.

Australian Government

Introduction

Natural hazards have a seemingly endless capacity to challenge us, not only in Australia but globally. Australia's recent history of flood, fire, storm and heat have been matched by devastating events around the world.

The role of Natural Hazards Research Australia is to develop the knowledge and insights to better manage the impacts of natural hazards, as they combine with changes in climate, demographics, technology and other societal-wide factors. As conditions around us are changing at an alarming rate, so must we change and be innovative in what we think and what we do.

This Annual Progress Report 2022-23 presents our achievements in building upon our strategic direction with a growing network of Participants and a targeted national research program.

We have been working closely with the Australian Government on ensuring our growing research program remains aligned to our strategic direction. The involvement of Brendan Moon, the Coordinator General of the National Emergency Management Agency, at both the 2022 and 2023 Natural Hazards Research Forums, provided us with important guidance and support. In his 2023 Forum talk, he offered three questions that, in plain language, address the fundamentals of our strategy:

1. How do we prepare communities to adequately respond to hazards and disaster events when they don't know what's coming, don't understand their risk, and aren't alerted early enough?
2. How do we develop a nationally consistent approach to common emergency management challenges across the states and territories?
3. How do we catalyse communities to put climate and sustainable development at the centre of their actions?

The Annual Progress Report 2022-23 shows exactly how we are starting to answer these questions.

We have moved beyond simply describing the problems, by building a network to work together on the solutions. This is what the Natural Hazards Research Australia does best – developing research that is useful, usable and used. Our research outputs are more than high-quality academic products – they are in the hands of those who are making decisions and creating policies in government, business and the community.

Our purpose is to provide a national natural hazards research capability – one that addresses the complex and difficult questions surrounding natural hazards. Our Be Ahead of Ready workshops this year were a further prompt for the sector to be more innovative in defining research that meets the challenge. As more Participants join the Centre, the research becomes enriched by both the depth and diversity of those who contribute.

Our strategy is based on utilisation and engagement on a national scale. Everything we do is driven by the Participants in the Centre and the communities they represent. The research is all shaped, developed, monitored and supported by those who will ultimately use it, giving it the best possible chance of being relevant and useful from the start. Our model is flexible, so that our funding decisions are responsive to the changing needs of the environment.

As the world seeks a better understanding of how to manage frequent and severe natural hazards, the Centre and its Participants take on that challenge for Australia. Together, that journey is well underway, and this Annual Progress Report 2022-23 is an informative account of our second year.

Iain MacKenzie, Chair, Natural Hazards Research Australia

The 2022–23 financial year was the second year of Natural Hazards Research Australia, which saw the Centre move from its establishment into delivery phase. As the Centre's new CEO, it has been impressive to witness the enthusiasm and ambition amongst Participants, researchers and staff to realise the Centre's mission that research will be useful, actionable and supportive of better decision making to save lives and protect communities.

The Centre supports and fosters a collaborative research eco-system consisting of end-users and researchers to bring about new knowledge that is useful, useable and ultimately used. The Centre has continued to grow its networks, building upon those established by the Bushfire and Natural Hazards Cooperative Research Centre. Our two Natural Hazards Research Forums were an amazing success, bringing together a large diversity of organisations to exchange ideas and knowledge. The Centre now runs regular events to communicate the work of its research program.

The Centre's core research program has continued to expand, with 50 projects now approved by the Centre's Board that are at various stages of development. These projects reflect the Centre's end-user driven approach to research, which aligns with our *10-Year Research Strategy and Biennial Research Plan 2023–25*. Our end-user driven focus is key to ensuring the research needs of Participants are central to the Centre's decision making and that our research program remains relevant to policy and decision-making priorities. The research program is all-hazards in focus and leverages the multidisciplinary skills of research providers to build the solutions needed to keep Australian communities and landscapes safe from natural hazards.

Our research program has also demonstrated its agility and responsiveness to meet emerging needs, for example through our program of post-flood research. This research is already assisting decision makers to better understand community responses to the devastating flooding experienced in 2022.

Through the Centre's education programs, we have continued to build the capability of the future workforce in emergency management and disaster resilience sectors. Well done to all our postgraduate and associate scholars and Early Career Research fellows for their contributions across the year.

With the launch of the Centre's *REFLECT Reconciliation Action Plan* in October, the Centre has demonstrated its commitment to promoting reconciliation within the organisation and, where possible, across the natural hazards research community. We've made some significant progress and this will continue to be a focus for the Centre.

Looking forward to 2023-24 financial year, there are many opportunities for the Centre to continue to inform policy and decision making. It is vital that our research program remains future-focused on the vital questions that enable the safety, sustainability and resilience of communities as Australia's natural hazard risk continues to worsen.

As a Centre, we will be focused on ensuring the performance of our research program, its translation and the evaluation of its impact. I look forward to working with Participants, researchers and staff to continue to lead the Centre's work in achieving this vital purpose. Well done to all for their efforts throughout the year.

Andrew Gissing, CEO, Natural Hazards Research Australia

WE CREATE RESEARCH THAT IS USEFUL, USABLE AND USED

DEFINED BY USERS

FRAMED BY NATURAL HAZARDS

CONTEXTUALISED BY THEMES

INFLUENCED BY A RANGE OF FACTORS

Overview

Natural Hazards Research Australia (the Centre) is Australia's research centre for natural hazards resilience and disaster risk reduction. The Centre began on 1 July 2021 and is now working closely with the Australian Government and other participating organisations across Australia to deliver a strategic research agenda for the nation and actively promote research utilisation.

The Centre is focused on undertaking research that promotes natural hazard resilience and reduces disaster risk, to support the needs of a variety of critical stakeholders – including emergency service agencies, government, industry and communities – in mitigating impacts of, responding to and recovering from disasters caused by natural hazards.

It is built on the strong foundations of its predecessor Cooperative Research Centres, the Bushfire CRC and the Bushfire and Natural Hazards CRC.

The Centre is both a leader and a catalyst for expansion of natural hazards research in Australia, ensuring that research is informing national and regional policy and capability, and improving public safety, resilience and sustainability.

Overall, the Centre is tracking well against its *Strategic Plan 2021-2031* with further expansion of the research program, engagement and utilisation planned for 2023-24.

This report covers the period 1 July 2022 to 30 June 2023 and was supplied to the Australian Government in July 2023.

Vision

That communities will be safer, more resilient and sustainable in the face of natural hazards.

Mission

To work with partners and the community on research that is useful, actionable and supportive of better decision-making to save lives and protect communities.

Key achievements

The Centre is on track to deliver on each of the strategic themes outlined in the Strategic Plan 2021–2031:

Governance and management

THE CENTRE WAS FORMALLY AND PUBLICLY LAUNCHED IN OCTOBER 2022

18 STAFF ACROSS 3 NODES
QUEENSLAND
NEW SOUTH WALES
VICTORIA

The Centre has enhanced its governance and management by developing and implementing new polices including risk management, fraud and corruption, procurement, sponsorship and information security.

To enhance the management of its overall research portfolio, the Centre has introduced a new project management system.

To enable the Centre to better measure the impacts of its research program an evaluation framework has been drafted.

MORE IN 2023-24

An evaluation framework to measure research impact will be finalised and implemented.

Partnerships

The Centre is working in the broad emergency management and disaster resilience sector, with Participants drawn from all states and territories, federal, state and local governments, key industry bodies, the private and not-for-profit sectors, and other organisations with a stake in protecting Australian communities.

The network is growing, with collaborative relationships being fostered with key partners and stakeholders around the country and abroad.

NETWORK HAS EXPANDED TO 27 FORMAL PARTICIPANT ORGANISATIONS

The Centre has continued to share knowledge and experience through international collaborations and exchanges including links with Europe, North America and New Zealand.

MORE IN 2023-24

Several organisations are in the advanced stages to formally join the Centre over the next 12 months.

Above: CEO Andrew Gissing at 2022 Natural Hazards Research Forum.

Research and implementation

New project proposals were evaluated and reviewed by the Research and Implementation Committee before Board endorsement. All projects are aligned to the *Biennial Research Plan 2023–25* and have identified translation and implementation pathways co-developed and agreed with relevant Participants.

23 NEW PROJECTS APPROVED BY BOARD = 50 ACTIVE PROJECTS

The Board approved the 2023-2025 Biennial Research Plan, which provides a strategic guide to the research activities and targets over the next two years.

ESTABLISHED INTERNATIONAL ADVISORY PANEL AND END USER ADVISORY PANEL

REFLECT RECONCILIATION ACTION PLAN LAUNCHED AND BEING IMPLEMENTED

The Centre is progressing a Research Data Management Project with support from the Australian Research Data Commons to establish a data management framework and data catalogue for sharing bushfire research data that will include multi-hazard research data in the long term.

2 NATURAL HAZARDS RESEARCH FORUMS – OCTOBER 2022 AND MAY 2023

40+ EVENTS REACHING 10K+ PEOPLE

MORE IN 2023-24

The next Natural Hazards Research Forum will be in May 2024.

Future rounds of research investment will be announced.

Capability

50 SCHOLARSHIPS AND FELLOWSHIPS AWARDED = 30 POSTGRADUATES, 17 ASSOCIATES, 3 EARLY CAREER RESEARCHER FELLOWS

Educational and training courses that translate research outputs are being developed into professional development for stakeholders, covering fields including extreme fire behaviour and prediction, and decision making in emergency management.

The inaugural Disaster Challenge in 2022 promoted innovation, capacity and networking opportunities among the postgraduate entrants in addition to the working group of Participant representatives who provided intellectual rigour to the challenge.

To provoke thought leadership across the sector, a new initiative saw participants from the sector invited to contribute their 'big ideas' on improving policy and capability in natural hazards. A series of national Be Ahead of Ready workshops in April and May culminated in an open session at the Natural Hazards Research Forum in Melbourne.

MORE IN 2023-24

Disaster Challenge 2023 is well underway with new winners announced in October 2023.

The Centre will meet with First Nations representatives from the higher education sector to learn about how best to overcome barriers faced by First Nations researchers within the sector.

Research-informed advice

RESEARCH IS INFLUENCING POLICY DECISIONS

Throughout the year, stakeholders sought strategic evidence-informed advice from key staff at the Centre to shape key policies.

Centre staff presented research findings, outcomes and research-informed advice at many conferences, workshops and meetings, across Australia and across a range of subject matter.

177 MEDIA APPEARANCES
WEBSITE VISITS INCREASED 166%
SOCIAL MEDIA 6,900+ FOLLOWERS, 28K+ ENGAGEMENTS
34 VIDEOS = 4K+ VIEWS

Regional, national and international media frequently sought comment from the Centre on natural hazards issues.

All information and outputs on the Centre's research portfolio and related activities are publicly accessible online.

A range of communications products developed to suit the needs of the Centre partners and the public are being distributed, including publications, reports, briefing papers, videos, webinars, case studies and tools for operational people in partner organisations.

An annual calendar of engagement activities is fostering greater collaboration between researchers, governments and the emergency management sector as well as supporting the needs of communities across Australia.

MORE IN 2023-24

A roundtable in partnership with Suncorp is planned for September, with senior government, NGO, research and corporate leaders to discuss a national strategy to help financially vulnerable communities better manage their natural hazards risk through assisted relocations.

The Be Ahead of Ready project will promote thought leadership about future big ideas in natural hazards will be completed.

Above: Dr Marco de Sisto presenting to Centre students at 2023 Natural Hazards Research Forum.

Strategic alignment

Natural hazards have forever been a feature of the Australian landscape whether they are floods, bushfires, cyclones, storms, earthquakes, tsunami, heatwaves or other hazards. For tens of thousands of years, First Nations peoples have understood that hazards are a natural and inevitable part of life on this continent and, today, learning how to live with them and minimise their negative impacts is an essential part of Australian life.

Recent years, beginning with the 2019–20 bushfire season, have illustrated the impacts of compounding natural hazards and their intersection with longer-term stressors such as the COVID-19 pandemic. For example, some Australian communities experienced the impacts of repeated floods while managing the COVID-19 pandemic.

The financial costs of natural hazards are growing, placing greater pressures on the resilience and sustainability of communities. The Royal Commission into National Natural Disaster Arrangements concluded that natural hazard emergencies are expected to become more complex, more unpredictable and more difficult to manage.

Based on an environmental scan of current risk, capability and policy trends (including themes from recent natural hazards and inquires), and feedback from Centre Participants and other subject matter experts, the Centre established and continues to update a set of research and key capability areas and themes, documented in ongoing Biennial Research Plans.

When the Centre commenced in July 2021, it had a rare opportunity to collaboratively develop a program of research that would deliver on its guiding vision that communities will be safer, more resilient and sustainable in the face of natural hazards.

The achievement of this vision is multi-faceted, as articulated in the following strategic documents:

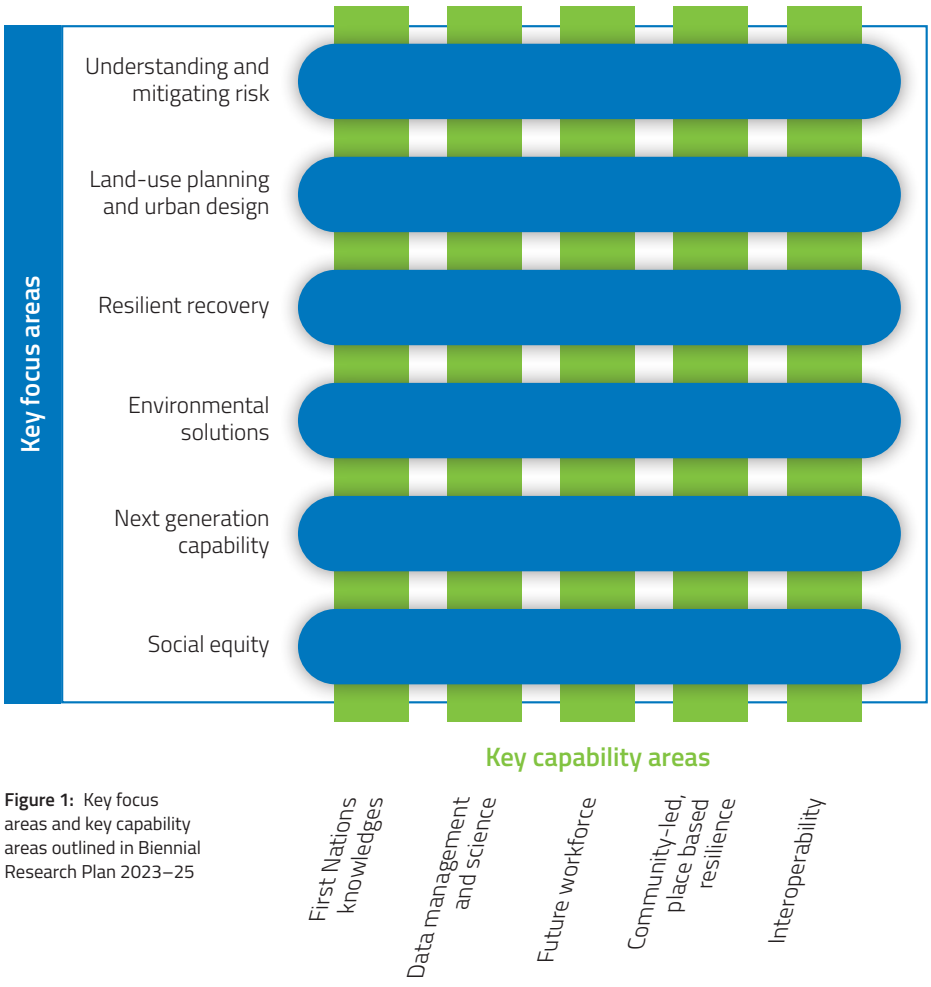


Figure 1: Key focus areas and key capability areas outlined in Biennial Research Plan 2023–25

Strategic Plan 2021–2031

The Centre developed the *Strategic Plan 2021–2031* as the overarching corporate vision and strategy. This is a big-picture document that outlines the vision, mission, partners, principles, plans and strategic themes of the Centre.

This plan identifies five key strategic themes for the Centre to focus on over the 10-year funding period:

- Governance and management
- Partnerships
- Research and implementation
- Capability
- Research-informed advice

National research priorities

The *National research priorities for disaster risk reduction and community resilience to the impacts of natural hazards* assesses Australia's natural hazards research priorities – building on what was already known about disaster risk reduction in 2021 and identifying any knowledge gaps. Eight overarching research themes were used as a guide for a series of collaborative workshops with key stakeholders in 2021. Working with these key stakeholders from government, emergency management agencies, private sector organisations and not-for-profit companies, the Centre co-developed the research priorities that can be used to inform research to deliver valuable outcomes over a decade.

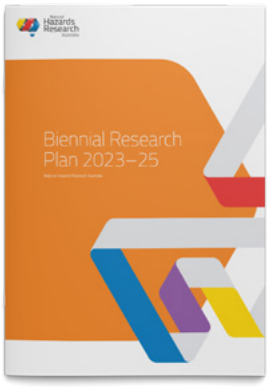
These research priorities are national in scale. They can (and should) be used by organisations beyond the Centre for developing or investing in research projects and programs, and for developing collaborative research initiatives. They identify important research areas by stakeholders who have participated in their development. They do not attempt to cover all possible research related to natural hazards, disaster risk reduction and national resilience.

10-Year Research Strategy 2022

The *10-Year Research Strategy* details the themes and factors influencing the Centre's research focus. It informs decisions about which kinds of research projects are funded in the short-, medium – and long-term. As a strategic document, it highlights what the Centre will achieve over 10 years rather than what specific research will be undertaken. The *10-Year Research Strategy* outlines a need for balance across mitigation, response and recovery, across different types of hazards and projects of different lengths and types.

The *10-Year Research Strategy* will be reviewed every five years and was heavily influenced by the *National research priorities*, the National Disaster Risk Reduction Framework, the findings and recommendations of the Royal Commission into National Natural Disaster Arrangements (and similar inquiries) and the evolving threats of natural hazards in a changing climate. As of 30 June 2023, the Centre was two years into this cycle.

Biennial Research Plan 2023–25



The Biennial Research Plans outline the Centre's research activities and how they will deliver the outcomes described in the Centre's *10-Year Research Strategy 2022* and *Strategic Plan 2021–2031.*

The current *Biennial Research Plan 2023–25* (published June 2023) provides an overarching strategic guide for the Centre's research activities and describe the Centre's research focus areas. It provides a two-year outlook and will be reviewed annually to ensure that the Centre continues to meet the needs of its Participants and stakeholders while building on the pre-existing research direction of the Centre.

The Plan outlines key focus and capability areas reflecting the shifting drivers and priorities of the sector as it responds to the unfolding and changing risks of natural hazards. The focus areas are illustrated in the diagram below, showing how they interlink with capabilities, and are outlined in detail within the plan.

Research Data Management Framework

- The Centre maintains a *Research Data Management Framework* to ensure that the Centre can support and contribute to accessible national data and knowledge collections. Ultimately, all funded or affiliated research projects will be expected to contribute to accessible, sustainable national research or operational data collections with ongoing agreed access, visibility to others, custodianship, governance and standardized data dictionaries.

This Framework focuses on the creation, curation and accessibility of research data sets and how the Centre will achieve this.

End-user driven research

- The Centre engages with its Participants to ensure the research program is driven by the needs of government, emergency services, industry and the community. All projects have identified translation and implementation pathways that have been co-developed and agreed with relevant end-users before the commencement of each project.

Scan to read these documents or visit:
naturalhazards.com.au/about-us/corporate-documents

Governance and management

Staff

Centre staff are located in Victoria, NSW and Queensland. Notable arrivals this year included a new Chief Executive Officer Andrew Gissing and a new Chief Science Officer Prof Deborah Bunker.

Staff also farewelled Research Strategy Director Dr John Bates in September 2022. John significantly contributed to the establishment of the Centre, including leading the development of strategic documents that are now the basis of all research projects in development.

The Centre has also continued to encourage any new positions to draw from a national pool of applicants, reflecting the need to work closely with partners around Australia.

The Centre does not have a headquarters, but rather three research nodes in Victoria, NSW and Queensland, with potential for expansion to some other states, to ensure that partners and researchers in all states and territories have the same opportunities to connect with the Centre and its research program.

Each node has a manager as the main point of contact for most project end-users and researchers, with responsibility for stakeholder engagement, partnership development, project management, education and training.

Finance and business support is provided through the Australasian Fire and Emergency Service Authorities Council.

Right: Centre's Chief Science Officer, Professor Deborah Bunker

Above: Most Centre staff attended AFAC22 in August 2022.

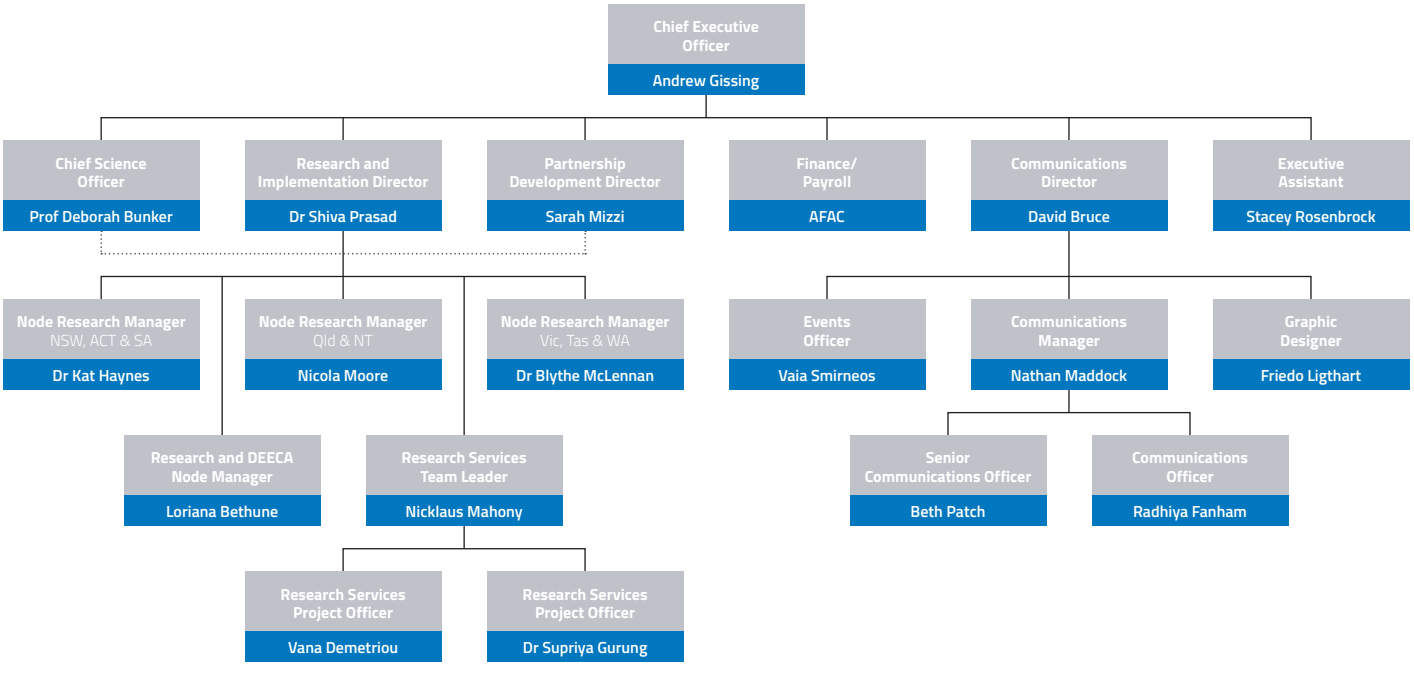


Figure 2: Corporate structure, 2022–23 financial year

Board

The Board of eight independent members met five times over the reporting period, with a strong focus on establishing and growing the research program and formalising Participant support.

The Annual General Meeting was held on the 28 November 2022, where Dr Katherine Woodthorpe AO retired as Chair. In her three-year term, Katherine led the successful transition of the Bushfire and Natural Hazards CRC to Natural Hazards Research Australia and in the process secured 10-years funding for the new Centre.

The Deputy Chair, Iain MacKenzie, was appointed as the new Board Chair. Iain has been at the centre of the evolution of emergency and disaster management over many years as a Deputy Commissioner at Queensland Fire and Rescue Services, as Queensland's inaugural Inspector-General for Emergency Management leading reviews into several large natural hazard disasters and most recently as Senior Advisor to the former Federal Minister for Emergency Management.

New appointments to the Board in 2023 were Oliver Costello and Dominique Hogan-Doran SC. The Company Secretary is Trevor Essex, Director of Corporate Services, AFAC.

	Board	Staff
Gender		
Male	5	6
Female	3	12
Aboriginal or Torres Strait Islander	1	0
Cultural and linguistic – first language		
English	7	17
French	1	
Nepali		1
Geographic – residential		
Victoria	2	11
New South Wales	2	5
Queensland	2	2
Tasmania	2	

Table 1: Diversity of Board and staff

Iain MacKenzie (Chair)

Adj Prof Tim Moltmann

Dr Greg Ayers

Doug Smith

Oliver Costello

Kate Vinot

Dominique Hogan-Doran SC

Sandra Whight

Board committees and panels

Research and Implementation Committee

The Research and Implementation Committee provides the Natural Hazards Research Australia Board with strategic advice on the overall development of the Centre's research and implementation programs, consistent with the Commonwealth Funding Agreement.

This committee met three times in this period.

The committee's membership is Greg Ayers (Chair), Adj/Prof Tim Moltmann and Kate Vinot, who are all Board directors. The following are co-opted members from the Centre Participants:

- Ricky Archer, CEO, North Australian Indigenous Land and Sea Management Alliance
- Anthony Bradstreet, Director Strategy and Programs, NSW Rural Fire Service
- Mal Cronstedt, Independent Member
- Jennie Fluin, Manager Science Partnerships, Department of Environment and Water, South Australia Government
- Hannah Wandel, Acting First Assistant Coordinator-General of Programs and Policies, National Emergency Management Agency
- Rob Webb, CEO, AFAC
- Melissa Pexton, Deputy Commissioner, Strategy and Emergency Management Command, Department of Fire and Emergency Services, Western Australia.

Risk, Audit and Compliance Committee

The Risk, Audit and Compliance Committee provides the Natural Hazards Research Australia Board with assurance that there are adequate processes in place regarding matters of risk, audit and compliance.

The committee met three times during the period.

This committee's membership is Adj Prof Tim Moltmann (Chair), Oliver Costello, Dominque Hogan-Doran SC and Kate Vinot, as Board Directors.

Education and Training Committee

The Education and Training Committee provides the Natural Hazards Research Australia Board with advice on the strategic directions that the Centre should take to support and promote training and education to improve resilience to natural hazards.

This committee met twice in the period.

This committee's membership is Sandra Whight (Chair), Oliver Costello and Doug Smith as Board Directors, and the following Participant members:

- Clare Russell, Director, Research Partnerships and Initiatives, RMIT University
- Prof Cheryl Desha, Professor, School of Engineering and Built Environment, Griffith University
- Paul Seager, Asst Commissioner, NSW Rural Fire Service
- Bhiamie Williamson, Research Fellow, Monash University

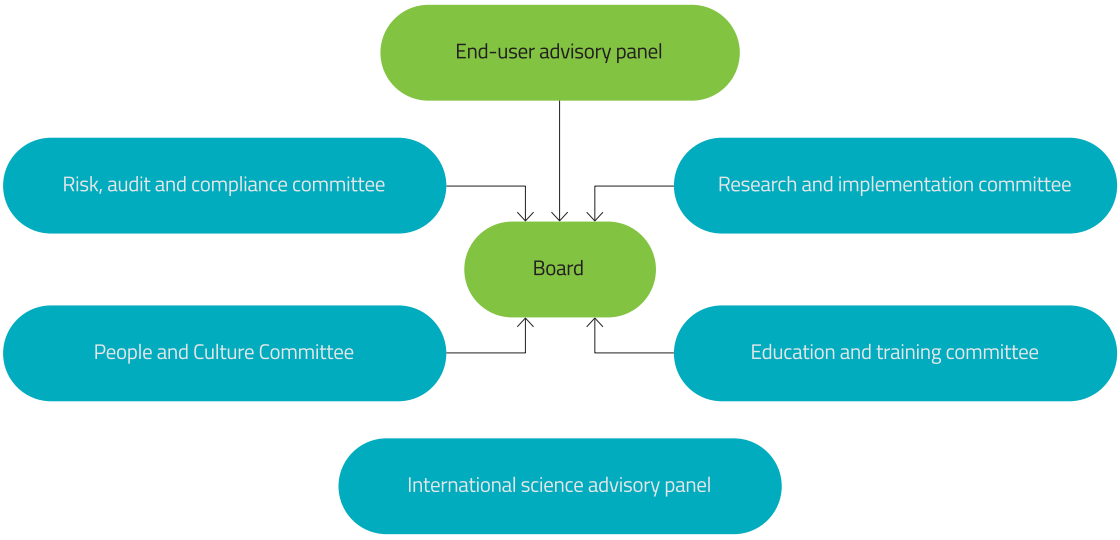


Figure 3: Board committee and panel structure

International Research Advisory Panel

The International Research Advisory Panel provides advice to the Research and Implementation Committee of the Board on the quality and progress of the Centre's research program. During the year, the Panel provided feedback on the Centre's new *Biennial Research Plan 2023–25*. This helps improve research quality through providing an international perspective on research trends, collaboration opportunities, as well as professional and research development opportunities. The International Research Advisory Panel met twice in the period.

The Panel has representatives from the global research community with expertise relevant to the physical, social and political sciences that reflect the Centre's research program. Members of the Panel have knowledge and experience relevant to natural hazards and disaster risk reduction. The panel comprises:

- Dr Amy Cardinal Christianson, Fire Social Scientist, Northern Forestry Centre (Canada)
- Professor Roland De Marco, Pro Vice-Chancellor (Research and Innovation), Fiji National University (Fiji)
- Dr Mark Finney, Research Forester (Rocky Mountain Research Station), USDA Forest Service (US)
- Associate Professor Susanna Jenkins, Earth Observatory of Singapore, Nanyang Technological University (Singapore)
- Professor Jessica Lamond, University of the West of England (UK)
- Dr Sarah McCaffrey, Research Forester, US Forest Service, Rtd. (US)
- Dr Richard Smith, Research Strategy and Science Investment, Earthquake Commission (NZ)
- Professor Thomas Wilson, Chief Science Advisor, National Emergency Management Agency (NZ)

End-User Advisory Panel

The End-User Advisory Panel provides the Board with strategic advice on the development of the Centre's research, education and utilisation programs, consistent with the Commonwealth Funding Agreement. It is the primary end-user advisory body of the Centre.

The Panel met twice this year to receive updates on the activities of the Centre, to raise any concerns, and to provide direction on research strategy and use. This ensures that senior personnel from end-user Participants of the Centre remain informed and engaged.

The panel is chaired by the Chair of the Board and consists of representatives of all of the Centre's Participants.

The Board provides reports to the Panel and presents the research plan and strategy to it for feedback prior to formal Board approval.

The End-User Advisory Panel first met on 18 October 2022 to endorse its terms of reference. It met again on 10 May 2023 to provide feedback on the *Biennial Research Plan 2023-25*.

People and Culture Committee

At the May 2023 Board meeting, the Board approved the creation of a People and Culture Committee with the membership of Kate Vinot (Chair), Oliver Costello, and Sandy Whight. Since February 2023 the Committee had existed as a working group. The first meeting is planned for July 2023.

This Committee oversees strategies to manage and enhance the Centre's workforce, including attraction, retention, remuneration and conditions; performance management; development and succession-planning of staff; equity and diversity; workplace relations; staff, health, safety and wellbeing; and organisational culture.

Centre policies and processes

The Centre holds and manages substantial financial and intellectual resources on behalf of its members. Strong governance and management processes are in place to ensure confidence in the use of those resources. Throughout the year, the Centre has enhanced its governance and management by developing and implementing new policies, including:

- Risk Management Policy and Procedure to guide the Centre's risk management culture and overall management of risk
- Fraud and Corruption Policy to set standards and provide guidance on how to control fraud and corruption, including within contracts with research providers
- Procurement Policy to govern the Centre's procurement practices
- Sponsorship Policy to guide the Centre's sponsorship decision making and evaluation
- Information Security Policy to guide the control of information security risks

An Information Security Review was also commissioned to improve the management of information security risks at the Centre. It provided a series of recommendations to enhance the Centre's information security, with implementation now underway.

To provide for the safety of its staff working flexibility from home, the Centre implemented a Work from Home Safety Checklist. The Centre has also drafted a Performance and Development Planning Policy and Procedure and a Family and Domestic Voilence Leave Policy, both for implementation in 2023/24.

To enhance the management of its overall research portfolio, the Centre has introduced a new project management system known as TurnKey with support from the Autism CRC.

Measuring performance

To enable the Centre to understand the impacts of its research program, significant effort has been invested to draft an evaluation framework. This framework will be finalised and utilised in 2023/24 to understand how the Centre is achieving its *Strategic Plan 2021–2031*, as well as lessons that can be implemented as part of the Centre's continuous improvement. The monitoring and evaluation logic is outlined in Figure 4.

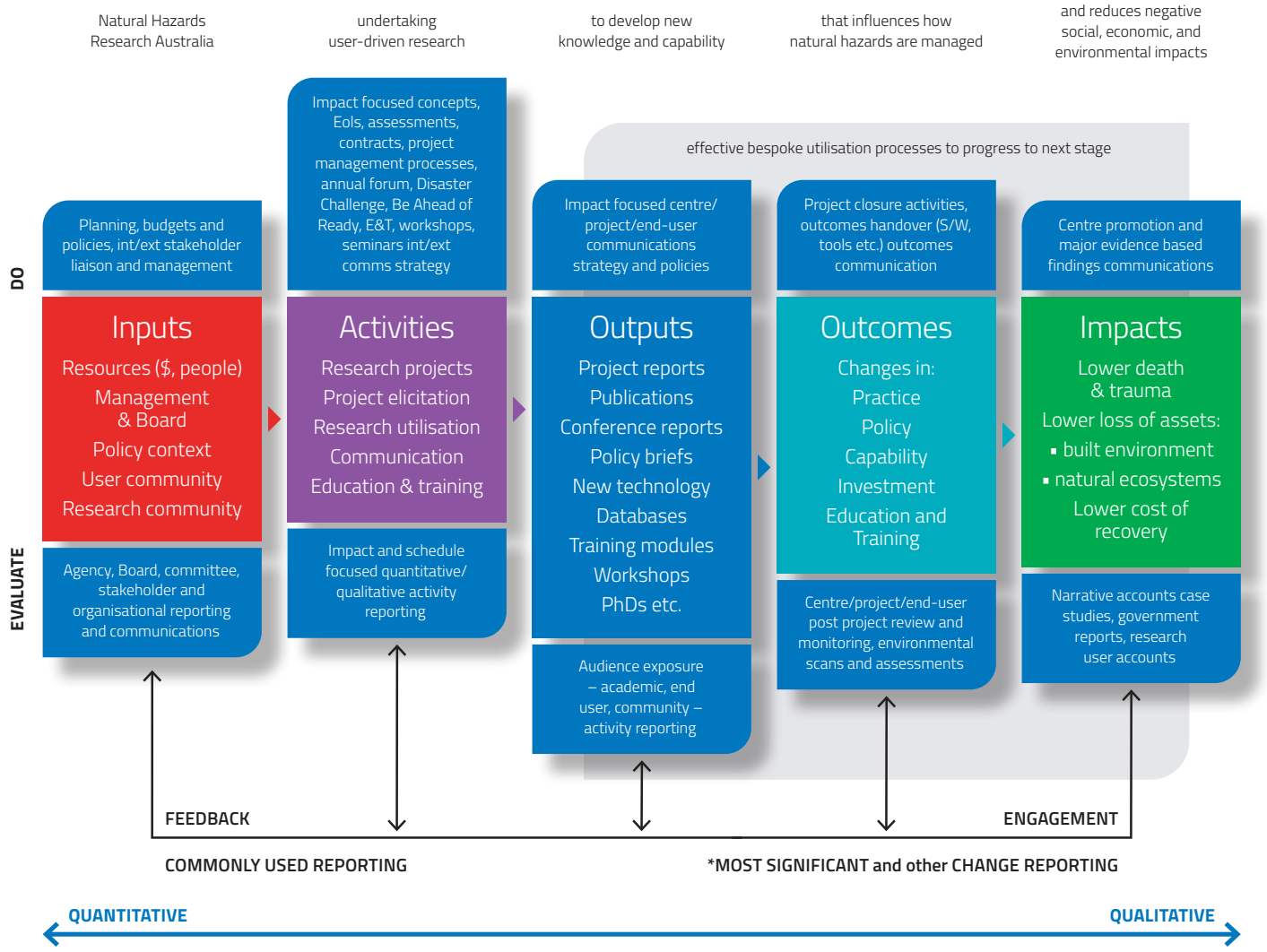


Figure 4: Monitoring and evaluation logic

Partnerships

Participants

The Centre is an aggregator and enabler of research capabilities, insights and projects, delivering the maximum value to investing Participants. As a collaborative research organisation, the focus is on real-world problems and the delivery of usable knowledge through products and networks to help address those problems.

The Centre is working with Participants to co-design research projects that deliver value and meaningful outcomes for the sectors and stakeholders that they represent. To do this strategically, the Centre draws on the science, expertise and networks developed over eight years of the Bushfire and Natural Hazards CRC and the 10 years of the Bushfire CRC before that.

The Centre works in the broad emergency management and disaster resilience sector, with Participants drawn from all states and territories, federal, state and local governments, key industry bodies, the private and not-for-profit sectors, and other organisations with a stake in protecting Australian communities. The network is growing, with collaborative relationships being fostered with key partners and stakeholders around the country and abroad.

Figure 5: Signed Participants as of 30 June 2023

All Centre Participants are offered an opportunity to formally meet with at least one member of the Centre's executive team and other relevant staff, to provide them with an update on the Centre's activities, to understand the Participant's knowledge needs, and to support them to develop either new research ideas or link them into the relevant contributors from the Centre's research portfolio.

- The Centre had 27 formal Participants at the end of this reporting period, in addition to its Federal partner, the Department of Industry, Science, Energy and Resources. It is anticipated that the Centre will enter into formal agreements with several other governments and agencies early in the 2023-24 financial year.
- Signed Participants (as of 30 June 2023) are shown in Figure 5.

The Centre cultivates and supports relationships with many stakeholders in addition to its formal Participants, either strategically at a whole-Centre level or on individual projects or other activities. In the last year, we have had collaborations with:

- Australian Research Data Commons
- Queensland Reconstruction Authority
- Powerlink
- NSW Bushfire and Natural Hazards Centre
- Environment Protection Authority Victoria
- Department of Health, Victoria (via Phoenix Australia)
- Suncorp

In the last year, the Centre has increased its engagement with representatives from several relevant Australian Government departments and their agencies. There was a focus on engagement with the following entities:

- National Emergency Management Agency (NEMA)
- National Resilience Taskforce
- Department of Climate Change, Energy, the Environment and Water
- Australia Climate Service
- Australian Building Codes Board
- Bureau of Meteorology
- CSIRO
- Geoscience Australia

In recognition of the growing interest by several broader stakeholders in the research program, the Centre has established regular meetings with representatives from the insurance, local government, police, philanthropic sectors and others, to ascertain their knowledge needs and begin to chart a path forward for future collaboration opportunities.

In addition, the Centre's research program has started to deliver tangible outcomes and outputs that are gaining interest with new sectors, which will form the focus of broader engagement activities and formalised participation in the Centre over the coming year.

Scan to see our growing network of Participants and research providers or visit:
naturalhazards.com.au/about-us/our-network

Participant contributions	2021-22	2022-23	Total
Cash	$2,575,000	$2,695,000	$5,270,000
In-kind total	$1,729,000	$2,229,000	$3,958,000

Table 2: Participant contributions for the past two financial years. All figure rounded to the nearest '000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ALTOMETER

Australian
National
University

Australian Government
Bureau of Meteorology

Charles Sturt
University

COLLABORATIVE
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Research providers

The Centre's research providers play a critical role in the delivery of quality research. The Centre has research providers, including tertiary institutes and consulting bodies across many jurisdictions, as well as state and federal government agencies that provide research.

Over the last two years, the Centre's research providers have grown to 43. It is anticipated that the Centre will continue to expand its formal agreements with other research providers in the 2023-24 financial year.

International engagement

In addition to the Centre's International Research Advisory Panel, the Centre has continued to share knowledge and experience through international collaborations and exchanges.

The Centre is a partner in FirEUrisk. FirEUrisk is a European collaboration featuring 38 international partners to drive a multi-perspective strategy to enhance understanding of extreme wildfires. The Centre's Chief Science Officer Prof Deborah Bunker provided a presentation on the work of the Centre at a FireEUrisk symposium in early 2023.

This year, the Centre also participated in a French Government Bushfire Research and Industry Symposium and a Brazil-Australia Joint Science and Technology Committee meeting.

In addition, the Centre exchanged knowledge with:

- New Zealand National Science Challenges – Resilience to Nature's Challenges
- Canadian Forest Service
- UK Met Office
- International Association of Wildland Fire

The Centre's Chair attended the United Nations Framework Convention on Climate Change (COP 27) in Egypt in November 2022.

The Centre sponsored, co-developed and participated in the Emergency Media and Public Affairs Conferences in both Australia and New Zealand.

The Centre hosted a webinar featuring US researcher Professor Gavin Smith in February regarding buy-back programs and arranged a roundtable with NEMA to explore experiences in the United States and New Zealand.

Contracted research organisation in-kind commitments	2021–22	2022–23	2023–24	2024–25	2025–26	Total
In-kind total	$81,000	$486,000	$1,359,000	$634,000	$578,000	$3,138,000

Table 3: Contracted research organisation in-kind commitments. All figures rounded to the nearest '000

Research and implementation

The Centre continues to develop a research program to meet its mission. As the Centre's research matures, a strategic and targeted effort ensures that the outputs are useful, useable and used.

The research themes provide a broad framework for the research program:

- Communities and workforces of the future
- Sustainable, safe and healthy natural landscapes
- Resilient built environment
- Resilient communities
- Situational awareness
- Operational response and innovation
- Evidence-informed policy, strategy and foresight
- Learning from disasters

These themes and the associated influencing factors were developed through consultation with end-users and research organisations. The Centre continues to engage with its Participants to ensure its research program is driven by the needs of government, emergency services, industry and the community to maximise relevance and value.

A portfolio of projects

The Centre's research is managed as a portfolio, where the composition of the portfolio is influenced by the Centre's research focus, as outlined in the Biennial Research Plan.

The ongoing research portfolio is developed and managed through strong engagement with Centre Participants, guidance from research organisations and leadership from the Centre.

To ensure the portfolio remains relevant and capable of investing in research in a timely manner, there are two formal investment rounds each financial year, in October and April. The Centre's Board and Research and Implementation Committee regularly review the research portfolio.

The portfolio of 50 core projects are listed in Attachment 2. These projects are at various stages in their life cycle including some which have been recently completed and now commencing utilisation.

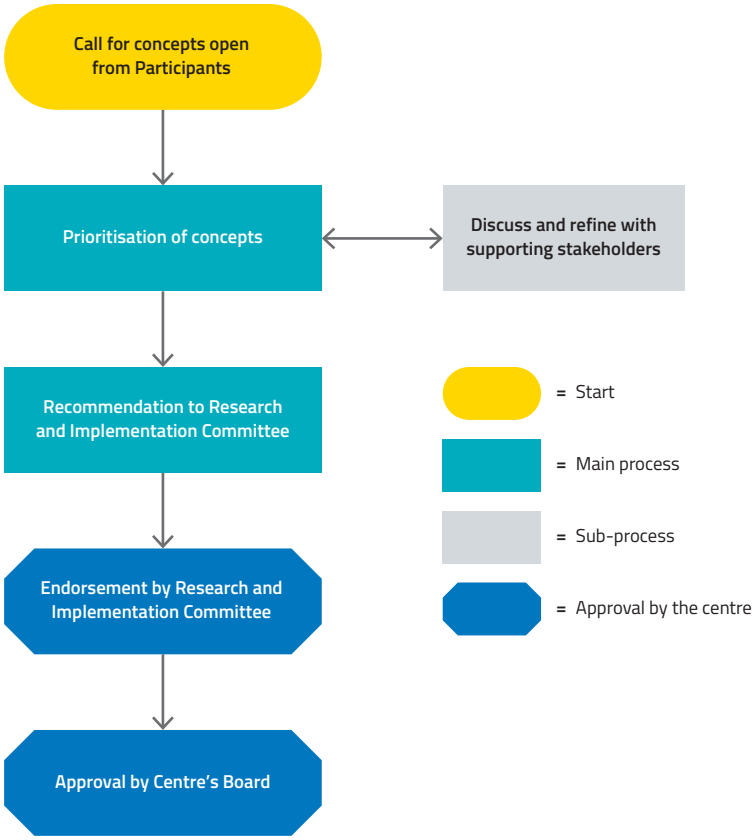


Figure 6: Project proposal process

Project governance

The Centre's projects are managed by the Centre's research team using a formal governance structure and systems.

All projects:

- have an agreed and documented project plan
- have identified research and end-user project leaders
- have clear end-user expectations and performance measures
- have a timeline that includes performance review stage-gates
- have a project management group
- are linked to a Translation and Implementation panel
- have regular reporting obligations
- be reviewed by the Research and Implementation Committee

Development of new projects

New project proposals are evaluated and reviewed by the Research and Implementation Committee then endorsed by the Centre's Board. All projects have identified translation and implementation pathways that have been co-developed and agreed with relevant end-users before the commencement of each project. These pathways are subject to regular review and updated as required.

Research data management

The Centre is progressing a Research Data Management Project with support from the Australian Research Data Commons to establish a data management framework and data catalogue (metadata exchange) for sharing bushfire research data (including multi-hazard research data in the long term) as the outcome of research undertaken through Centre projects and, where practical, from projects previously undertaken by the Bushfire and Natural Hazards CRC. This will include engagement with and collaboration across all the ARDC Bushfire Data Commons streams. This project will interface with the Centre's bushfire information database scoping study.

Be ahead of ready – foresight for policy and capability

To provoke thought leadership across the sector, a new initiative saw a wide range of participants from the sector invited to contribute their 'big ideas' on improving policy and capability in natural hazards. A series of national Be Ahead of Ready workshops in April and May culminated in an open session at the Natural Hazards Research Forum in Melbourne. The workshops were about foresight and ensuring that we are all at least one-step ahead of having to be ready to respond to any given natural hazard.

What are the 'big ideas'? What are the barriers to overcome for them to be realised? What do we need to achieve these goals? The contributions from some 180 stakeholder participants in the Centre and beyond are being analysed and are expected to build on the foundations of the Centre's earlier National Research Priorities. The work will also be published as a thought leadership piece to inspire further big thinking in research and practice.

Academic publications

Academic publications	Number
Research reports	14
Published journal articles	15
Book chapters	3
Conference presentations	113
Media interviews	177
Other	

Table 4: Academic publications as of 30 June 2023.

A full list of research reports, journal articles and book chapters can be found in Attachment 3.

Completed or near-completed research projects

While still early in the Centre's research development journey, the Centre successfully delivered several projects throughout 2022–23 and is near completion of others.

A full list of current core research projects can be seen in Attachment 2.

Community experiences of the 2022 eastern Australian floods

As part of the Centre's capability to undertake research following damaging natural hazard events, work was commissioned alongside Queensland Fire and Emergency Services and NSW State Emergency Service to explore community experiences of Australia's most damaging floods, as measured by insurance losses.

The research undertaken by Macquarie University, the University of Southern Queensland and the Queensland University of Technology has provided vital insights on preparedness, response and the early stages of recovery to help reduce future flood risk.

A total of 192 flood-impacted residents were interviewed using an approach that invited residents to share their flood story. A further 430 residents participated in an online survey.

Lead researcher A/Prof Mel Taylor, Macquarie University, said the personal experiences of those impacted by the floods are captured by the research.

"Each person's experience is unique and the power of this research is that it captures the lived experiences – before the floods, during the floods, and the early recovery stage – of so many people who have been through some of the worst flooding on record in Australia, and some people multiple times."

The research provides vital context to assist emergency management organisations, government departments, local councils, community organisations and community members in better understanding the complexities of community experiences before, during and after severe weather.

The results of the research are already being used to inform strategies to improve flood safety and policy across Australia including informing an external review of the 2022 flood response commissioned by the Insurance Council of Australia.

"The research provides a wealth of data that will be utilised by stakeholders, across all hazards, to develop policies and approaches to address gaps, and improve community preparedness, safety, and recovery… The important insights gained through this research project will inform future preparedness, response and recovery work undertaken by NSW SES."

Carlene York, Commissioner NSW State Emergency Service

Further research has now been commissioned to explore community experiences of flooding in Tasmania, Victoria and South Australia.

"Accurately gauging, considering, and applying community experience and perspective is an important part of contemporary emergency sector agencies and the services they deliver. The current research demonstrates that community members directly impacted by the 2022 rainfall and flood events have valuable insights that they are willing to share, together with an optimism that lessons learned from their tragedy can genuinely contribute to the evolution of prevention, preparedness, response, and recovery policy. QFES looks forward to seeing the uptake and application of these important findings and to expanding research partnerships on further community-focused topics."

Greg Leach, Commissioner Queensland Fire and Emergency Services

The work is being extensively translated and communicated across stakeholders including briefings and presentations to Central Coast Council, NSW State Emergency Management Committee, NSW Department of Primary Industries, Resilience NSW, ANU Institute for Climate, Energy and Disaster Solutions, Transport NSW, NSW SES, QFES, Queensland Reconstruction Authority. Insurance Council of Australia, Floodplain Management Australia Conference, AFAC National Warnings Group, Emergency Management Public Affairs Conference and the International Sociological Association World Congress. Further briefings are planned in the coming months.

Scan to learn about all of our research projects or visit:
naturalhazards.com.au/research/research-projects

Floodwater contamination

This research, undertaken after the October and November 2022 flooding across Victoria by the Environment Protection Authority, collected samples of floodwaters to further understand the level of risk to human health and the environment. Samples were tested for bacteria (E. coli, an indicator for faecal contamination) and a range of trace elements (such as metals and metalloids) and contaminants – organic chemicals such as artificial sweeteners, endocrine disrupting chemicals, pesticides, perfluoroalkyl and polyfluoroalkyl substances (PFAS), petroleum hydrocarbons, pharmaceuticals and personal care products, phthalates and volatile organic compounds. Initial results indicate that E. coli levels and other contaminants such as trace metals, volatile organic compounds, pesticides, phthalates and per-and polyfluoroalkyl substances (PFAS) are generally below levels of concern. The results of this research will be shared nationally to inform communities and emergency services of the potential dangers of entering floodwater.

Identifying water bodies

During active fire events, aerial firefighting units are dispatched by the National Aerial Firefighting Centre (NAFC), which uses a variety of data sources to identify locations for helicopters and fixed wing aircraft to access water. For effective decision making, current and accurate information is critical. This project identified how existing Geoscience Australia (GA) Digital Earth Australia (DEA) satellite-based data products could be tailored to better suit the needs of NAFC. The project identified additional attributes that would add value to the existing DEA Waterbodies product for users in the emergency management sector.

A workshop with emergency management agencies provided insights into how current waterbody datasets are used and what additional waterbody attributes are needed. A localised prototype workflow was developed and implemented to better identify several waterbody properties (the surface area of water in the waterbody and the most recent date that water was observed) that assisted users plan the placement of aircraft for an upcoming fire season.

Measuring cyclonic winds

SWIRLnet is a network of portable anemometers deployed to measure surface weather conditions in the built environment during tropical cyclones in Queensland. The network has been operational since 2013 and has captured data on six occasions since. The Centre's SWIRLnet project sought to streamline the data acquisition and analysis procedures behind the SWIRLnet platform to enable better real-time reporting of data, documenting of analysis procedures, archiving of historically recorded data and development of an open-access archive of observations.

The project has achieved these goals with a new automated analysis procedure. The public interface for open-access to real-time SWIRLnet data has also been upgraded, and an automated data download capability added. The open-access high-frequency observations archive is now being completed, with wind speed, direction, pressure, temperature and relative humidity data capture during previous deployments being uploaded to the archive and an open-access journal publication is being drafted for submission to Royal Meteorological Society's Geoscience Data Journal.

Above: Post-flood NSW and Queensland research team.

Mobile bushfire radar

The Centre supported research to test the capability of using mobile radar to detect fire plumes during tests on prescribed burns. Tests were conducted in Western Australia in late 2022 and a workshop convened in Nambeelup in May with stakeholders from the Bureau of Meteorology, Monash University, Department of Biodiversity, Conservation and Attractions WA, the Department of Fire and Emergency Services WA, CFA, NSW Rural Fire Service, and the Department of Environment and Water SA, AFAC, CSIRO and UQ. The Centre was represented by researcher Dr Mika Peace (Bureau of Meteorology). The workshop consisted of presentations on radar and fire related activities. Data collected was reviewed. The team workshopped the technical and logistic aspects of the project, the operational needs and next steps.

Community-led recovery

This research undertaken by the University of Melbourne has provided guidance and tools for Community Recovery Committees and supporting organisations, building on work conducted after the 2019-20 Black Summer bushfires. The project had three aims: to determine what Community Recovery Committee members consider a recovery group to be; to test and validate a self-assessment tool that allows Community Recovery Committees to identify the boundaries and focus of their group and to identify support needs; and to conduct a social network mapping exercise as a proof of concept for assessing the representativeness of Community Recovery Committees.

The research explored four case studies in four different states across regional, urban, interface and remote communities who had experienced either a flood or bushfire, along with surveying disaster recovery workers. Two tools were developed for Community Recovery Committees to use: a self-assessment tool to help Community Recovery Committees figure out how to establish themselves and operate over time; and a social network mapping tool for communities.

The research team and the Centre are now assessing the next steps for implementing these tools and making them more widely accessible for other Community Recovery Committees.

"This project informs how we can define CRC functions and its role in community recovery operations. It does this by exploring similarities and differences in CRC definitions in various contexts. We acknowledge there is no single formula for community-led recovery and there are many contributors and unique contexts that feed into CRC development."

Melinda Nicholls, Manager of Research and Evaluation, Emergency Recovery Victoria

"I am hoping this is the start of a tool-building movement, that these tools will be built and stored somewhere as a knowledge sharing hub, that will be able to help us move forward in those crunchy moments…there is a lot of things for us to do in that moment so any assistance for us, beforehand preferably, if the community is up for it, but definitely in that moment, I think is really invaluable."

Melanie Bloor, Resilient Uki, New South Wales

Above: Mobile radar experiment being conducted in Western Australia. Photo courtesy of the Department of Biodiversity, Conservation and Attractions, WA.

Fire ember transport

This research has been completed and built on Bushfire and Natural Hazards CRC research to develop a software interface between the development version of Spark Operational and the ember transport parameterisation model.

As a result, the fire model software Spark is now able to show predictions of ember transport, which improves the ability of fire agencies to understand bushfire spread.

"This work has moved forward the science applied to the prediction of fire spread through spotting, from conceptual models and nomograms to a model with a sound theoretical basis and experimentally demonstrated through coupled fire-atmosphere numerical weather prediction modelling…This work has also demonstrated the use of the Spark simulation framework to accommodate complex new science. The integration of new science into systems which could be used in operations has been a bottleneck for progress, often more difficult, time consuming and expensive than doing the science itself. Although this integration has not been easy and is not fully complete or sufficiently validated, this 'integration' has been much quicker than is normally the case."

John Bally, Fire Prediction Business Manager, AFAC

Predictive maps

This project is defining the role of fire predictions in agency communications with the public during an emergency. It is overseen by a Steering Committee comprising representatives from the AFAC Predictive Services Group, the AFAC Warnings Group from all Australian states and territories, and the Bureau of Meteorology. The first phase of the research, focused on understanding the status quo with the use of maps for public information and warnings, has been completed. To achieve this fire-affected residents nationally were asked through a survey about how they use, comprehend, perceive, and act upon maps, including fire spread prediction maps. 3,007 people took part. In addition, 95 research interviews for more specific details were undertaken in West Gippsland, Victoria; the Huon Valley, Tasmania; the southern ACT; and the Snowy Monaro; New South Wales. The research is now moving into phase 2, where national predictive map concepts are being developed and tested.

Capability development

Together with Resilience NSW, the Centre worked with stakeholders across the NSW emergency management sector to develop a series of capability targets aligned with the NSW Capability Development Framework. The project utilised previous research to develop a capability maturity assessment tool completed through the Bushfire and Natural Hazards CRC. The research was endorsed by the NSW State Emergency Management Committee and will assist the sector to understand its capability maturity. Feedback on the capability targets confirmed that they were reflective of appropriate metrics for the emergency management sector and provided a strong foundation for continuous improvement.

Schools in Fire Country

This project builds on the findings from the Bushfire and Natural Hazards CRC research to design, trial and evaluate a pilot community-centred, place-based participatory program and refine an approach for scaled implementation in high-risk locations across Victoria. Further research utilisation opportunities are being created:

- Expanded delivery of the initiative via $650,000 grant from NEMA to support program delivery.
- Development of a NESA accredited professional development course for NSW Rural Fire Service Project Firestorm that has just received $200,000 in funding from the NSW Office of the Chief Scientist to support course delivery.
- Design and implementation of a participatory action research project focused on student participation in school bushfire planning, funded by Lord Mayors Charitable Trust.
- Development of the Triple Zero Classroom learning package for NSW Rural Fire Service.
- Development of Triple Zero Kids Challenge lessons on flood, storm and tsunami for NSW State Emergency Service.
- Development of school education materials on the new Fire Danger Rating System for the NSW Rural Fire Service.

Black Summer research program

In January 2023, the Centre launched a summary of the findings of its Black Summer research program. The wide-ranging Black Summer research program was undertaken by Natural Hazards Research Australia and the Bushfire and Natural Hazards CRC in the years since the 2019-20 fire season, with funding from the Australian Government and partners. The program drew on the expertise of Australia's best fire and climate scientists, human geographers, land managers and public health and recovery experts at 28 research institutions, First Nations organisations and fire and land management agencies.

Publication of the report – *Understanding the Black Summer bushfires through research: a summary of key findings* from the Bushfire and Natural Hazards CRC – presented a summary of findings from 23 projects within four multi-discipline research themes, covering knowledge gaps that arose from Black Summer: fire predictive services, cultural land management, community-centred disaster risk reduction, and bushfire data and reconstruction. The report presents an integrated view of the way forward from the fires, including what new capabilities can be implemented and how Australia can best learn from this extreme fire season.

The findings can now be used as a scientific basis by governments, fire and emergency management agencies, industry and community organisations to influence decisions and create safer communities and landscapes in the face of future bushfires. In early 2023 this research was further promoted through two public webinars: on culture, people and recovery, and on bushfire prediction and behaviour and a hazard note.

"The Black Summer research program took a targeted approach to address real problems and provides useful insights into the key issues that arose out of Black Summer bushfires. It gives guidance regarding what more needs to be done in our never-ending search for knowledge. This valuable work complements the Royal Commission into National Natural Disaster Arrangements alongside other reviews and inquiries, and seeks to take a longer-term view to meeting our future needs. It brings together operational insight and research to deliver a sound evidence base that can be used to prepare for future events."

Rob Webb, CEO, AFAC

"The program supported Indigenous-led community collaboration and experience sharing across state and territory borders that was ground-breaking and may prove pivotal in driving the next steps towards more effective partnerships between Indigenous communities and the emergency management sector at scale in remote Australia."

Ricky Archer, CEO, Northern Australian Indigenous Land and Sea Management Alliance

Commissioned research

In conjunction with the core research program, the Centre also operates an extensive commissioned research program, which provides one client or organisation to work exclusively with the Centre to develop and produce research or research informed activities that often fulfill a specific or niche business need for that organisation. In the last year, the Centre has undertaken commissioned research for Powerlink and Resilience NSW.

In addition to these ad hoc commissioned projects, the Centre continues to coordinate two large multimillion dollar commissioned research portfolios for the Victorian Department of Energy, Environment, Climate Action, as well as for the Victorian Country Fire Authority. The Centre provides end-to-end support for those programs including developing research, coordination of research activity and delivery of research outputs in partnership with a range of research providers.

For DEECA, there are nine active projects that cover areas including ecosystem resilience, native wildlife management, smoke exposure and planned burning and climate change impacts.

For CFA, there was one active project in this period, on the effectiveness of bushfire risk reduction.

Building on a strong evidence base

The Centre continues to build on the former Bushfire and Natural Hazards CRC's research, networks and capabilities. Throughout the year the Centre has continued to foster the utilisation of research funded through the Bushfire and Natural Hazards CRC with many success stories. Some examples include:

Inquiries and Review Database

Launched in October 2019, the Inquiries and Reviews Database gives emergency services the upper hand in learning from the past to create a better future by allowing users to search and compare recommendations through keywords and themes. The database contains inquiries and reviews that have been completed since 2019, bringing the total number of inquiries accessible to 324, dating back to 1886 across all states and territories. Importantly, all 4360 recommendations from the 192 natural hazard inquiries conducted since 2003 can now be custom searched, identifying important topics to focus on. The database had just over 2000 visits in the year, with around 200 users downloading content.

Supporting disaster recovery

Recovery Capitals, or ReCap, supports wellbeing after disasters with evidence-based resources for people and organisations engaged in recovery. Online resource materials include:

- A Guide – A snapshot of evidence-based findings and key considerations for recovery workers.
- Recovery Stories – told by those who have experienced disasters.
- Applying ReCap – resources including activities, podcasts and presentation slides.
- Background materials – Reports, academic publications and other background materials.

The Recovery Capitals resources were co-developed with 21 government and non-government emergency management and recovery agencies and service providers across Australia and New Zealand in 2021 and embedded into practice including by Red Cross as the lead end user organisation. Soon after, they received the 2021 Resilient Australia National Mental Health and Wellbeing Award and the 2022 EMPA Award for Excellence in Emergency Communication. They have now been widely circulated and adopted beyond the original stakeholders.

Helping people to care for their animals during disasters

The Managing Animals in Disasters CRC research, led by A/Prof Mel Taylor from Macquarie University, is generating further research utilisation opportunities for the Centre. The NSW State Emergency Service hosts resources from this research on its Get Ready Animals | NSW State Emergency Service website with resources to help NSW animal owners plan for their animals in emergencies. Hard copies of the resources have also been distributed at community events and pre-bushfire season activities.

Several NSW Government videos generated from this research have also been created that have been supported by NSW SES, Infrastructure NSW, NSW DPI, Greater Sydney LLS, Hawkesbury City Council, Agnes Banks Equine Centre.

Small Companion Animal Incident Management Project – Skills Impact also references the CRC research importance in its Australian Animal Care and Management Industry Sector *Annual Update 2021: IRC Skills Forecast and Proposed Schedule of Work*, to support the development of a TAFE unit in Companion Animal Emergency Management.

Developing community resilience

Backed by Bushfire and Natural Hazard CRC research at the University of New England, with support from agencies and governments around Australia, the Australian Disaster Resilience Index (ADRI) provides the first nationally standardised snapshot of the capacities for disaster resilience in Australian communities. Communities, government and emergency services can use the Australian Disaster Resilience Index to take informed and practical steps towards improving the disaster resilience of local communities before, during and after natural hazards.

Index access includes:

- **466 users that have created accounts on the system.** This is noteworthy as users are not forced to create an account to get information, only to access the more advanced functions like storing searches. This means the actual usage is much higher. User accounts are created on a regular basis; between 3 – 12 per month.
- **Users from more than 220 different organisations**, consisting of state and territory emergency organisations, numerous federal and state departments, 16 Australian universities, 97 organisations with a ".gov.au" URL, public good organisations including the Red Cross and St. Vincent de Paul Society, and a number of private and public companies. There are also several international organisations that created accounts.
- **More than 491k unique user sessions** – registered in the last three years.

An API (Application Programming Interface) that delivers the data used in the Index has been integrated into several other systems by external organisations. Some of these have resulted in formal data agreements. A total of 15 unique API keys have been issued to date, to a mix of emergency service agencies, state and federal departments, community support services, philanthropic organisations and academic institutions, and most of them are accessed by these users on a regular basis.

Developing the non-technical skills of emergency managers

The Learning and Development Group of the Australasian Fire and Emergency Service Authorities Council (AFAC) is drawing on CRC research for its Training Guides.

The recently published guide, *Embedding Non-Technical Skills into Emergency Management Training,* builds on the work of Dr Peter Hayes and Associate Professor Chris Bearman from CQUniversity. This work highlights the importance of non-technical skill development for emergency management practitioners. It provides guidance, tools and activities to help instructors and organisations better integrate non-technical skills into training and operations.

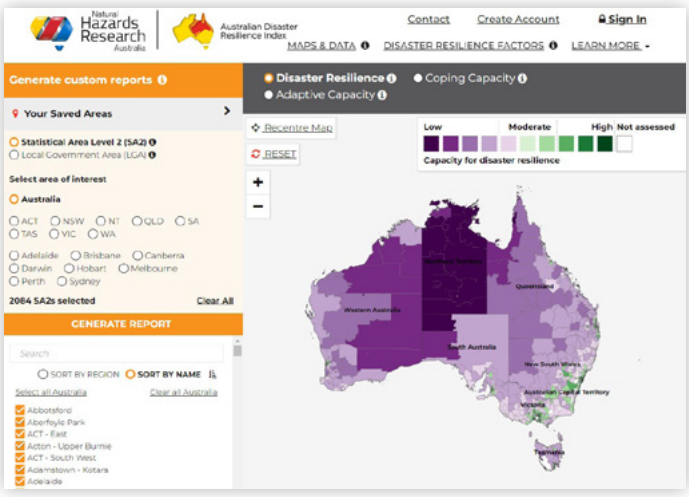
Hayes and Bearman co-authored the guide with the contributions from Queensland Fire and Emergency Services and NSW National Parks and Wildlife Service who provided their training materials to assist with the development of the industry case studies within the guide.

Hayes and Bearman's work on non-technical skills is also being utilised by QFES as an input to the EMNoTS (Emergency Management Non-Technical Skills) checklist for the organisation's Incident Supervision/Crew Leader training program.

Emergency law online

The Australian Emergency Law blog, supported by Natural Hazards Research Australia and others, is an online discussion forum on the law that applies to or affects Australia's emergency services and emergency management. The blog, produced by Dr Michael Eburn, formerly Assoc Prof at Australian National University, arising out of his research funded in the Bushfire and Natural Hazards CRC. It provides a popular educational tool to discusses legal principles and policy and has had 2.6 million hits since it started in early 2009.

With 128 posts averaging 21,400 monthly hits in the last year, the blog is further distributed to 7325 subscribers by direct email and through Facebook (5100 followers), Twitter (122 followers) and Newstex, an international distribution service for professional blogsites and commentary. The blog has consistently ranked second or third on the 30 Best Australian Law Blogs and Websites and is listed in the Global Top 200 Law Blogs.



Above: The Australian Disaster Resilience Index website.

Self-leadership skills

The CRC *Positive mental health in young adult emergency services personnel project* developed a framework and resources to minimise the short and long term impacts of exposure to potentially traumatising events. For use at an individual, local or organisation-wide level, the resources also promote mental health and wellbeing more generally among young people in the emergency services.

These resources are now being used by the consultancy Obvious Choice to create a suite of eLearning modules for Emergency Management Victoria to develop leadership capability for disaster risk, in members of Australia's emergency management community. The modules are intended for use across the country for the advancement of leadership skills in planning, preparedness, response, and recovery to disasters.

Community engagement – volunteer toolkits

Community engagement frameworks and tools that are used by agencies were evaluated by the Bushfire and Natural Hazards CRC *Mapping Approaches to Community Engagement for Preparedness in Australia* project.

These tools are now being further adapted by lead researcher Dr Barbara Ryan, from the University of Southern Queensland, to develop community engagement training for Queensland SES volunteers. This includes an updated community engagement toolkit based on the findings of this research, and monitoring and evaluation tools that will be supported by a short training course.

These tools will be central to helping Queensland SES volunteers progress from an informal information delivery model of community engagement to a more targeted and collaborative approach to working with their communities.

Enhancing decision making for risk reduction

UNHaRMED is a spatial decision support system (DSS) for planners and policy makers to assist in the reduction of risk from multiple natural hazards. The 'what if?' scenario modelling developed through this CRC research out of the University of Adelaide and the Research Institute for Knowledge Systems is helping government, planning authorities and emergency service agencies think through the costs and consequences of various mitigation options to prepare for major disasters and the potential impact on their infrastructure, and things the community values and how these impacts might change into the future. As part of the WA Climate Adaptation Strategy, $2.3 million has been allocated to implement UNHaRMED over the next three years. This will include improvements to the usability of the software, end user training and the creation of joint hazard case studies.

UNHaRMED is also currently being used for several studies within the SA Department for Environment and Water.

Capability

A key aim of the Centre is to develop Australia's ongoing and future research capacity through the upskilling of the next generation of qualified researchers. One way the Centre achieves this is by offering development opportunities through a robust education program and other initiatives.

Education program

The Centre's education program provides four main types of support – postgraduate scholarships, associate scholarships, Early Career Researcher development and industry fellowships.

- The postgraduate scholarship program provides access to full and top-up scholarships over three and a half years, and access to industry expertise and support. There are currently 30 Postgraduate Students.
- The associate student program is specifically designed for students conducting research in relevant areas but not already directly involved with the Centre. This research is likely to be of significant interest to Participants. There are currently 17 Associate Students.
- The fellowships support the career development of late-stage PhD students, Early Career Researchers and researchers employed in industry. The Early Career Researcher Fellowship has had one completion and has three current fellows.

Industry internships are also in the final stages of development, with the first internship to be undertaken with NSW Parks and Wildlife Service in the second half of 2023.

Postgraduate research

- Postgraduate research is aligned with the Centre's research themes and each postgraduate student is matched with industry sponsorship from within the disaster risk reduction and emergency management sectors. This ensures an avenue and interest in the research from within the Centre's Participant base and continues to build maturity within organisations around using research to inform practice.

CASE STUDY: BUILDING THE COUNTRY'S FUTURE RESEARCH CAPACITY

At the 2022 Natural Hazards Research Forum in Brisbane, October 2022, the Centre held its first student engagement session. Centre postgraduates presented to each other and heard from 2022 Early Career Research Fellow Dr Phillipa McCormack (University of Adelaide) about her ECR experience and bushfire mitigation and law research. Postgraduates also heard from two doctoral degree holders – Dr Josh Whittaker (NSW Rural Fire Service) and Dr Jennie Fluin (Department of Environment and Water SA) – who are now accomplished professionals after making a successful leap from academia to industry.

This student engagement was expanded at the 2023 Natural Hazards Research Forum, at RMIT University in May, which brought people together from natural hazards research, industry, government and community to share knowledge and learn from each other. A key focus of this year's program was postgraduate and Early Career Research, which featured across the three days with dedicated student presentations, posters, research workshop engagement and networking opportunities. Postgraduate and Early Career Researchers also gave short presentations on their research throughout the Forum, to the nearly 400 hundred delegates in attendance.

The Centre also hosted a dedicated a half-day student session that brought all Centre-funded postgraduate and Early Career Researchers together, supporting and enhancing the wide range of impact-focused higher education research being completed across the sector. Featured as part of this session were:

- a presentation from former Bushfire CRC PhD student Dr Marco de Sisto from RMIT University on how to give your research impact
- a 'research speed dating' opportunity for students to meet each other and share their ongoing projects
- a presentation from the Centre's communication team members Bethany Patch and Radhiya Fanham on how to communicate effectively for impact-focused research
- a workshop on climate science for natural hazards researchers, led by John Clarke from CSIRO
- this ongoing engagement with higher education students helps build, support and sustain the country's future research capacity in the natural hazards sector.

Table 5: Postgraduate students, 2022–23 financial year

Name	Institution	Project Title
Cameron Atkinson	University of Tasmania	Creating resilient and sustainable critical infrastructure using evidence informed policy
Shauntelle Benjamin	University of New England	Why do people decide to drive through floodwater?
Louise Buckley	Deakin University	Cross-cultural relationships in natural resource management
Audrey Cetois	University of Queensland	Focusing on the intersection of community resilience and energy resilience
Sarah Cooley	University of Melbourne	Response, resilience and recovery of Tasmania's endangered pencil pine using a multi-archive paleoenvironmental record
Zoe D'Arcy	RMIT University	Towards fire-adaptive communities in the Australian landscape
Anna Durkin	RMIT University	Landscape architecture design and development of natural systems wastewater treatment and landscape design
Ahmad Hassan	Victoria University	Physics-based modelling of field-scale junction fire
Christy Hung	University of Sydney	Determining changes in eucalyptus litter during decomposition
Fadia Isaac	Federation University	A cognitive behavioural treatment for insomnia and nightmares in survivors of bushfire
Suki Jaiswal	University of New South Wales	Impact of bushfire smoke on eye surface
Saimum Kabir	University of Melbourne	Flood risk reduction in a dynamic urban context exploring the urban-water-resilience nexus
Matthew Kyng	Victoria University	Parameterisation for a simplified short-range firebrand model from physics-based modelling
Jiyu Liu	University of New South Wales	Assessing post-fire forested ecosystem by using Spaceborne LiDAR over south-eastern Australian
Brigit Maguire	University of Sydney	Strengthening the experiences of people who are deaf or hard of hearing during extreme weather events and other disasters
Michael Meadows	RMIT University	Correcting vertical errors in a global Digital Elevation Model, to derive a "bare earth" terrain surface for improved flood modelling in data-scarce regions
Louise Mitchell	University of Sydney	Multi-agency collaboration in disaster recovery after bushfire
Kiam Padamsey	Edith Cowan University	Smoke exposure profiles of bushfire fighters in the southwest ecoregion of Western Australia
Phoebe Quinn	University of Melbourne	Exploring the role of civic technologies in community decision making in the face of climate change and disasters
Wavne Rikkers	University of Western Australia	Fighting the fires within: breaking down the barriers to mental help-seeking amongst first responders
Nina Rogers	University of Tasmania	Exploring leadership for municipal climate change adaptation planning and implementation
Rebecca Ryan	University of Wollongong	Developing novel geochemical and spectroscopic techniques to extend existing bushfire records
Catherine Ryland	University of Wollongong	Planning for bush fire protection
Mohamed Sharaf	Victoria University	Parametric study of the transition from a surface fire to a crown fire through physics-based modelling
Kate Simmonds	University of Melbourne	Impact of fires on temperate rainforests in northern New South Wales
Heather Simpson	University of Wollongong	Productivity and effectiveness of suppression resources and tactics on large fires
Jady Smith	University of the Sunshine Coast	Mitigating fire through water management in the wildland urban interface
Hafiz Suliman Munawar	University of New South Wales	Machine learning for humanitarian disaster relief efforts through employing rule-based verification on drone's aerial imagery
Alex Tanfield	University of Canberra	The effect of disrupted social connection on wellbeing during prolonged disasters
Simeon Telfer	RMIT University	Remote sensing of fuel to improve fire behaviour predictions in Mallee and Heathy shrublands

Associate students

While the Centre's Associate Students do not receive funding, their research is directly aligned with the Centre's research themes and they are invited to attend Centre events, including the Natural Hazard Research Forums, dedicated student engagement sessions and more.

Associate Students are also able to apply for additional support from the Centre, such as travel grants to present their research and build networks at important industry events.

Table 6: Associate students, 2022–23 financial year

Institution	Name	Project Title
Curtin University	Sumayyah Ahmad	An investigation of spontaneous volunteers' social media engagement in emergency disaster management
University of Canberra	Susan Atkinson	Understanding people's communication needs in a natural disaster crisis
Massey University of New Zealand	Annal Dhungana	Effective communication of uncertainty around modelling in hazard and risk models
University of British Columbia	Sarah Dickinson-Hoyle	Restor(y)ing fire-adapted territories: wildfire recovery, Indigenous leadership and restoration in Secwepemcul'ecw
Charles Sturt University	Russell Dippy	The human capacity demands of an emergency manager in Australia
University of the Sunshine Coast	Harikesh	An empirical and dynamic tool for predicting forest fire spread using remote sensing and machine learning technique
University of Tasmania	Victoria Heinrich	Use of weather and climate information: risk perception and decision-making in Antarctica, the sub-Antarctic and Australia
Central Queensland University	Tony Jarrett	Agency experts supporting bushfire disaster resilience education for primary school students: a case study in NSW
Griffith University	Sheriden Keegan	Enabling governance for sustainable and resilient regional food system development in Australia
Griffith University	Haydn McComas	Working together or working apart? Interoperability and organisational culture across RESLEM agencies and organisations during major disaster responses
Griffith University	Heba Mohtady Ali	How can hospitals improve their resilience and ensure business continuity during disasters?
University of Queensland	Danielle O'Hara	Conflict in disaster recovery
University of Auckland	Douglas Radford	An integrated modelling approach for the planning of collaborative and adaptive wildfire risk-reduction activities
University of the Sunshine Coast	Ryan Smith	Developing bioclimatic urban planning and design policy for the public realm
Griffith University	Yunjin Wang	Urban green space is a critical component for children living in urban areas to enrich their mental and physical development
Australian National University	Anna Williams	Exploring community resilience to cascading disasters in Australia
University of Queensland	Eleanor Williams	The effectiveness of rapid evidence in fast-paced policy contexts

Development of Early Career Researchers

The Centre has two fellowship opportunities targeted at those in academia and industry, respectively. Both fellowship types recognise the value that can be achieved by supporting Early Career Researchers and practitioners to expand their networks, create strong local and international collaborations, and to have the opportunity to compare the challenges for natural hazards research in different geographic, societal, cultural and climatic settings.

Fellowships are open to Early Career Researchers up to five years post-PhD, excluding periods of parental leave, other family caring duties or ill health.

Two new Early Career Research Fellows, Dr Kate Brady (University of Melbourne) and Dr Amelie Jeanneau (University of Adelaide) commenced in 2022-23, while Dr Phillipa McCormack's (University of Adelaide) 2022 fellowship was completed and extended with new funding in 2023.

FADIA ISAAC, POSTGRADUATE SCHOLAR, FEDERATION UNIVERSITY

Project: *A multi-component cognitive behavioural therapy for the treatment of insomnia and nightmares in survivors of bushfires presenting with post-traumatic stress disorder*

Fadia Isaac from Federation University is investigating the links between sleep disturbance and the trauma experienced by people during a bushfire. Her PhD is implementing a sleep-specific, online, self-paced psychological treatment trial for sleep disturbances in those affected by bushfires, including insomnia, nightmares or trauma symptoms for both community members and emergency responders. Based on the success of the trial, the intervention will be implemented more widely, ensuring that others will benefit from this online treatment that helps reduce stigma and increase self-governance around mental health. The intervention could also be developed as an evidence-based free resource, both nationally and internationally.

Highlighting her excellent communication skills, Fadia won Cooperative Research Australia's Early Career Researchers Competition in June 2023.

DR AMELIE JEANNEAU, 2023 EARLY CAREER RESEARCH FELLOW, UNIVERSITY OF ADELAIDE

Project: *Interdisciplinary collaborative platform for reducing future bushfire risk and increasing community resilience*

Dr Amelie Jeanneau is a Postdoctoral Researcher for the School of Architecture and Civil Engineering at the University of Adelaide and completed her PhD in environmental modelling in 2020. Dr Jeanneau's fellowship is identifying the challenges, knowledge and successes faced by fire managers around collaborative planning and implementation of bushfire risk reduction strategies to build more resilient management practices. Dr Jeanneau travelled to Portugal to meet with experts in community-centred methods for landscape-scale bushfire risk reduction strategies and will assess whether the concepts used in Portugal can be applied in an Australian context. To implement her learnings, Dr Jeanneau will deliver a workshop with Australia practitioners to define best practices for effective collaborative risk reduction strategies.

Above: Early Career Research fellow Dr Phillipa McCormack (University of Adelaide) presenting at IAWF's Fire & Climate 2022 conference.

DR PHILLIPA MCCORMACK, 2022 AND 2023 EARLY CAREER RESEARCH FELLOW, UNIVERSITY OF ADELAIDE

2022 project: *Bushfire mitigation and hazard reduction in Australian law*
2023 project: *Wildfire law and policy network*

Dr McCormack is a Postdoctoral Research Fellow at the University of Adelaide and completed her PhD in biodiversity law in 2018. She used her 2022 Centre fellowship to establish new collaborations between US and Australian fire law scholars by presenting at the International Association of Wildland Fire's Climate and Fire Conference 2022 in Pasadena, California, and Melbourne, Australia. Dr McCormack is building on her previous fellowship to create a community of researchers and interested stakeholders who share the goal of developing more adaptive, future-oriented bushfire laws, policies and strategies. She plans to design and launch a new website that collects and presents existing knowledge and expertise about law and policy for adaptation-oriented bushfire prevention, preparation, response and recovery, and will use the new website as a hub for a Wildfire Law and Policy Network. The Network will help to enhance the effectiveness and climate-adaptiveness of Australia's bushfire mitigation and hazard reduction laws by creating a space to test ideas about legal reform, translate cutting-edge science into legal and policy impact, and support the development of early – and mid-career researchers in legal and governance research.

DR KATE BRADY, 2023 EARLY CAREER RESEARCH FELLOW, UNIVERSITY OF MELBOURNE

Project: *Fostering international collaborations and improving science communication for disaster recovery*

Dr Kate Brady is a Community Resilience Research Fellow at the University of Melbourne, as well as Disaster Recovery Technical Adviser at Australian Red Cross. After completing her PhD in disaster recovery in 2020, she was the lead end-user on the Bushfire and Natural Hazards CRC's Recovery Capitals project and a researcher on the CRC's Community-led recovery Black Summer project and Centre-funded extension project, Community-led recovery: evidence, dimensions and supports for Community Recovery Committees. Dr Brady's fellowship is strengthening connections with international research partners and developing new collaborations relating to disaster recovery research, including opportunities to contribute to new research projects, translate international research findings to the Australian context and improve knowledge translation approaches and outputs. To achieve this, Dr Brady has met with research collaborators in North America who are excelling in their chosen area of research, identifying what is working for them and what lessons can be used in the Australian context, while also sharing the latest Australian disaster recovery research.

Disaster Challenge 2022: innovative ideas up for the challenge

The Disaster Challenge, hosted by Natural Hazards Research Australia, is a national challenge to encourage new ideas, new thinking and new research. With support from universities and emergency management organisations, the Disaster Challenge invites the best and brightest minds in our universities to put their creative talents into helping solve the trickiest problems that surround how we deal with floods, bushfires, storms, cyclones and other natural hazards.

In 2022 and 2023, industry-backed Working Groups were established to guide the Disaster Challenge and were actively engaged in proposing the wicked problem, promoting the Disaster Challenge within their sector, considering all proposals, mentoring finalists and selecting the winners, who received a cash prize and other support.

The first Disaster Challenge Final was held in October 2022 at the Centre's Natural Hazards Research Forum in Queensland.

Disaster Challenge 2022 wicked problem: How can disaster preparation engage with the unengaged, the moving or the hard to reach?

Above: CEO Andrew Gissing with 2022 Disaster Challenge winners Dr Kamarah Pooley and Mark Owens at 2022 Disaster Challenge Final.

The Disaster Challenge 2022 achieved its goal of unearthing innovation in Early Career Research. The winning team of Dr Kamarah Pooley (Fire and Rescue NSW) and Mark Owens (Country Fire Authority) developed the concept of using wi-fi portals to engage with communities about disaster preparedness.

In addition to promotional opportunities throughout the year, the pitch has gained broad support by the Centre's Participants and was successfully approved in June 2023 as a fully-funded Centre project.

Pilot testing will take place to test the technology and assess its effectiveness in delivering disaster preparedness information to tourists and tourism workers.

Additionally, a 2022 Disaster Challenge finalist, Jyoti Khatri K C, was mentored by the Australian Red Cross during the Disaster Challenge and is now working in a paid position with them on culturally and linguistically diverse community resilience – a role she received directly through her exposure from the Disaster Challenge.

The 2023 Disaster Challenge is being hosted in Victoria and is midway through completion, with a Final planned for October as part of the UN International Day for Disaster Risk Reduction.

Disaster Challenge 2023 wicked problem: In the midst of disruption, chaos and calamity, how can resources from across society be accessed and connected in new and innovative ways to improve disaster response and link those who have the resources and supports with those that are most in need?

Professional development courses

The Centre is progressing the development of courses to translate research into professional development for stakeholders, including:

- **Translation of observed and modelled extreme bushfire behaviours to improve fire prediction and fireground safety**

  A range of professional development modules and educational materials are being translated from this project to provide Fire Behaviour Analysists (FBANs), Fire Meteorologists and Decision Support Meteorologists with professional development beyond their current certified training.

  Online modules include a focus on fire generated vortices and low level jets, as well as a face-to-face workshop component to apply the new knowledge. The project is linked with the AFAC Predictive Services Group, whose members can use the modules as part of their annual refresh training and workshops with FBANs. The Bureau of Meteorology has indicated the same for its meteorologists. The initial project is due to be completed before the 2023/24 fire season with further opportunities to expand the resources using other fire science research underway.

- **Decision making in emergency management**

  This project is developing new and enhanced training and learning products to further increase decision-making skills in the emergency management sector. The project is being undertaken by a combined research team from CQU, La Trobe University, Charles Sturt University, Robert Gordon University (Scotland) and Cardiff University (Wales).

Scan to learn more about the Disaster Challenge or visit:
disasterchallenge.com.au

Research-informed strategic advice

The Centre provides trusted advice and insights based on research to inform efficient planning and decision making of government, communities, emergency services and the business sector. This goes to the very heart of the Centre's Mission to support better decision-making by working closing with partners and the community on research that saves lives and protects communities. The ultimate outcome of this is, as per the Centre Vision, an Australian community that is safer, more resilient and sustainable in the face of natural hazards.

Throughout the year, stakeholders sought strategic evidence-informed advice from key staff at the Centre to shape key policies, including:

- Membership of the Disaster Ready Fund Assessment Panel. This involved contributing to recommendations of nearly $400 million in joint federal-state investment in more than 180 disaster readiness projects around the country.
- Membership of the NSW Department of Planning and Environment's Technical Advisory Group on high-risk flood prone development proposals consistent with the NSW Flood Inquiry.
- Appearance before the Senate Select Committee on Australia's Disaster Resilience to provide evidence-informed testimony on the challenges facing Australia's future disaster management workforce and possible solutions.
- Publication of a 5-point plan in the *Canberra Times* to inform strategic policy for Australia's future disaster resilience.
- Participation in NSW Treasury project to develop cost-benefit analysis tools for natural hazard mitigation arising from the NSW Flood Inquiry.
- Membership of the Project Control Group to update the climate change considerations in the Australian Rainfall and Runoff Guidelines.
- Advice to the NSW Reconstruction Authority on State Resilience Strategy and State Risk Assessment.
- Submission to the Finance and Public Administration Legislation Committee regarding the *Emergency Response Fund Amendment (Disaster Ready Fund) Bill 2022*.
- Submission to the review of Queensland Disaster Management Arrangements – Queensland Inspector General Emergency Management.
- Submission regarding the development of NSW Department of Planning and Environment's Shelter-in-Place Guideline.
- Meeting with the Secretary of Home Affairs to outline strategic directions of the Centre.
- Research briefing to the National Resilience Taskforce to inform future policy recommendations.
- Briefing to a visiting delegation from the Science and Technology Directorate of the US Department of Homeland Security in July.
- Briefings to the NSW State Emergency Management Committee, WA State Emergency Management Committee and ACT Multi-Hazard Advisory Council on applications for current natural hazards research.
- Participation in a grant assessment panel for the NSW Bushfire Commercialisation Fund for the NSW Office of the Chief Scientist and Engineer.
- Participation in the Australian Fire Danger System Working Group.
- Participation in the NSW Overarching Bushfires Evaluation Advisory Group.
- Attendance at Adapt NSW Households Research Project Advisory Group, hosted by Office of Energy and Climate Change, NSW Treasury.
- Participation in WA In-Band On-Channel Research Subcommittee.
- Briefings of a range of federal parliamentarians.
- Provision of regular briefings to AFAC Board, AFAC Council and AFAC collaboration groups.

In addition, Centre staff presented research findings, outcomes and research-informed advice at the following conferences, workshops and meetings:

- Disaster and Emergency Management Conference, July 2022
- Keynote at National Water Safety Summit, August 2022
- Keynote at AFAC22 Conference, August 2022
- Volunteering Australia's Volunteering Research Papers Initiative, September 2022
- Qld IGEM Disaster Management Research Advisory Panel meetings and Disaster Management Research Forum, October 2022
- Emergency Management Public Affairs Conference, October 2022 (NZ) and May 2023 (Aust)
- Engineers Australia Risk Engineers Society webinar, October 2022
- University of Western Sydney Environmental Health course, October 2022
- NSW SEMC Capability Development Sub-Committee meeting, November 2022
- NSW SEMC Community Engagement Sub-Committee meeting, November 2022
- University of Newcastle Flood Resilience Workshop, November 2022
- Insurance Surveyors Discussion Group, November 2022
- International Universities Climate Alliance, November 2022
- UBS Investors Conference, November 2022
- Keynote at Information Systems for Crisis Response and Management, Asia Pacific Regional Conference, November 2022
- Home Affairs Industry Summit, November 2022
- Spatial Futures Workshop, November 2022
- Catastrophe and Reinsurance Symposium, February 2023
- Keynote at Munich Re forum for Motor Clubs, February 2023
- Keynote at Unimutual Conference, March 2023
- Floodplain Management Australia National Conference, May 2023

Communications

Communications activities are shaped by the Centre's key result areas as endorsed in the *Strategic Plan 2021-2031*, to: undertake leading research, create knowledge networks, build partnerships, create a national research capability, provide a trusted and independent voice and translate research into action.

With the Centre having completed its establishment, this reporting period was an important time for communications and promotion to establish a trusted voice and demonstrate research in progress. Awareness and engagement with the network were supported by:

- the design and distribution of key Centre publications, including a monthly online newsletter and research briefing papers
- a media strategy based on expertise and credibility
- a social media strategy focused on engagement
- hosting and participating in targeted events, initiatives and collaborations.

Media

The Centre is frequently sought for comment from a range of regional, national and international media. Through the CEO and experts across many disciplines, the Centre is well-positioned to provide media comment that supports agency partners.

Through the Australian Science Media Centre, the Centre is a key supporter of the promotion of Australian science. This places the Centre's natural hazard research in prominent view of science journalists around Australia and internationally. International media reach out for expert opinion, emphasising the Centre's position as an authority on natural hazards research. Through the Australian Science Media Centre, two training opportunities were offered to Centre researchers and postgraduate scholars: media training and social media training for women in STEM.

Peak media times throughout this reporting period centred around the Centre's Natural Hazards Research Forums (October 2022 and May 2023), the release of key research findings, targeted research-based approaches to specific media, partner conferences and major hazard events (bushfires, floods, storms and cyclones), which are enhanced by strong ongoing links with ABC Emergency and other key media outlets.

For 2022—23, Centre research appeared 177 times in the media, across print, radio, TV, online and podcasts. Detailed below are six key media appearances.

In recognition of the Centre as a thought leader, two opinion pieces by CEO Andrew Gissing were successfully placed:

- On the one-year anniversary of the beginning of the Queensland and northern New South Wales floods, a five-point plan for reducing natural hazard risk in Australia was published in *The Canberra Times*. Follow up interviews proceeded with ABC Kimberley Breakfast and 2CC Canberra Drive.
- On the 20th anniversary of the 2003 Canberra bushfire on 18 January 2023, *The Conversation* ran an opinion piece on the benefits research has bought to Australian bushfire response over the last twenty years. It was republished by *The Guardian* and other outlets. Follow-up radio interviews were undertaken with ABC Canberra Mornings and 2CCC Canberra Live.

The Centre uses its media profile to promote its research findings and help recruit participants for its research projects. Two examples of this are:

- recruiting members of the public to share their experiences after the 2022 eastern Australia floods (New South Wales and Queensland)
- recruiting bushfire map users to inform future map requirements (Gippsland, Victoria; Huon Valley, Tasmania; the southern ACT; and the Snowy Monaro, New South Wales).

In these instances, the research required either flood – or bushfire-affected people to share their experience with a researcher. On each occasion, an extensive media campaign was undertaken in the targeted areas to raise awareness of the research and the need for people to contribute. Researchers as subject-matter experts were the spokespeople and media coverage was successfully achieved in each instance across a combination of local radio, local newspapers, local TV and online, leading to a boost in recruitment.


OPINION

A significant policy shift will save

ANDREW GISSING

AUSTRALIA has copped the full force of nature in recent years and this onslaught will continue.

An anniversary is not required to remember the deluge and devastation that started on the east coast this week 12 months ago. Picture Getty Images

We need to break the cycle of responding

Above: An excerpt from flood research in Canberra Times.

- The inaugural 2022 Disaster Challenge was popular with the media. Following the 2022 Disaster Challenge Final on 13 October, the winning concept, which involved using wi-fi captive portals to reach tourists and tourism workers with disaster preparation information, received extensive media coverage, predominantly through ABC Radio. Winning team members Dr Kamarah Pooley (NSW Fire & Rescue Service), Mark Owens (CFA) and Centre CEO Andrew Gissing were featured on BBC Radio, ABC NSW Statewide Mornings, ABC Radio Statewide South Australia afternoons, ABC Radio Illawarra Drive and 2CC Canberra Drive, as well as in *Cosmos* and the Campus Morning Mail.
- Popular disaster podcast *Me, Myself & Disaster* dedicated an episode on 7 May 2023 to emergency management volunteering. As a leading expert on the topic in Australia, Centre Node Research Manager Dr Blythe McLennan joined the episode to discuss the shifting landscape, workforce challenges (past and present) and new opportunities for emergency management leaders.

Website

The Centre's website contains all information about its vast research portfolio and related activities, including publications, news and events.

Content is managed by the Communications team, with technological support supplied by Webplace.

All public communication is directed to the website as the Centre's key communications tool. As the Centre has grown its research portfolio throughout 2022–23, in addition to hosting many events supplemented with online resources, traffic to the website has increased considerably.

The Centre also runs the Disaster Challenge website to specifically contain all information relating to the Disaster Challenge. This website reflects branding that is independent of the Centre's overall identity, to differentiate it from the Centre's other research-focused activities.

NATURALHAZARDS.COM.AU

Centre website	2022–23	2021–22	increase
Page views	176,148	66,245	166%

Table 7: Centre website page views

Industry-focused publications

A range of communications products are being regularly developed to suit the needs of the Centre partners and the public. These include publications, reports, briefing papers, videos, webinars, case studies and tools for operational people in partner organisations.

The Centre distributed a monthly online newsletter, which was read 10,619 times (on average 885 times per edition).

Hazard Notes continue the tradition that began in the Bushfire CRC as a research briefing paper, publicly available online and distributed through an extensive email database that includes staff in partner organisations, government, SMEs, small rural fire brigades and State Emergency Service units, and regional councils. They are also widely shared and engaged with on social media.

Centre staff are also on the Editorial Advisory Board and the Editorial Committee of the *Australian Journal of Emergency Management*, published by the Australian Institute for Disaster Resilience, and contributes regular content based on Centre research.

The Centre also regularly contributed to many well-known external publications and widely circulated external newsletters, including:

- Fire Australia magazine
- Australian Emergency Services Magazine
- Asia Pacific Fire magazine
- Brigade magazine (Country Fire Authority)
- Bush Fire Bulletin (NSW Rural Fire Service)
- Phoenix magazine (Victoria State Emergency Service)
- AFAC newsletter
- AIDR newsletter
- Collaborative Research Australia newsletter
- Wildfire magazine (US)

Social media

Coverage in traditional media is amplified through the social media channels of the Centre and its partners. Social media provides an important channel to reach individuals and groups in addition to the regular Centre networks, including the general public, regional communities, volunteer brigades and units, local government, politicians and international researchers.

The Centre has an engaged audience of 6,936 followers connected across Facebook, Twitter, LinkedIn and YouTube. Across the 12-month period, these channels saw 694,570 impressions for 28,263 engagements. All measures have strengthened significantly throughout 2022 and 2023, as shown below.

Videos

→ Short, timely online videos were produced throughout 2022 and 2023 to promote the importance of science to coincide with broader public awareness activities. This included National Water Week, World Tsunami Awareness Day, National Reconciliation Week and International Women's Day. Videos were also made for Centre events and research outputs. All were posted on YouTube, the Centre's website and social media accounts. The total number of videos produced was 34, with 4,076 views for a watch time of 444.2 hours.

@Natural Hazards Research Australia

@Natural Hazards Research Australia

@HazardsResearch

@HazardsResearch

2022–23 most watched video

Centre social media	2022–23	2021–22	increase
Audience	6,936	3,207	116%
Impressions	703,501	336,833	109%
Engagements	28,893	16,816	72%

Table 8: Centre social media reach, financial year 2022–23

	Number of events	Number of attendees (in person and online)
Conferences	12	8440
Knowledge-sharing forums	17	1660
Industry training courses	10	298
Workshops	4	279

Table 9: Centre-hosted and supported events, training opportunities and attendees, 2022–23 financial year

EVENT CASE STUDY: NATURAL HAZARDS RESEARCH FORUMS

The Centre launched its flagship event, the Natural Hazards Research Forum, in Brisbane in October 2022. The Forum was attended by 300 delegates, representing 120 different organisations drawn from research, fire and emergency services, industry and government. This event has assisted in strengthening ties across Australia's emergency management sector and the Australian research community. The 2022 Forum coincided with the International Day for Disaster Risk Reduction and an address by a UN representative was provided to acknowledge this.

The 2022 program included engagement, discussion, knowledge sharing and road-mapping of natural hazards research from the Centre and other natural hazard research and operational experts. Sessions covered disaster risk reduction and resilience, learning from recent disasters (including the 2022 eastern Australia floods and Black Summer), evidence-informed policy and strategy, community resilience, healthy landscapes, situational awareness, operational response and innovation, workforces of the future and much more.

The program also included:

- a formal launch of Natural Hazards Research Australia and its research programs
- the launch of our *REFLECT Reconciliation Action Plan*
- the Disaster Challenge Final, where the three finalist teams presented their solutions to the wicked problem of 'engaging a transient sector of the community with disaster preparation information'.

The second Natural Hazards Research Forum was hosted in May 2023 in Melbourne, with RMIT University, attracting almost 400 people. The 2023 Forum built on the discussions and outcomes of the first event to focus on the Centre's ongoing program of research projects. Across the three days, attendees heard 55 keynote and research presentations and were included in a series of workshops covering vital issues in natural hazards science and disaster resilience.

Keynotes profiled special topics from speakers such as Coordinator-General for Emergency Management Brendan Moon (National Emergency Management Agency); A/Prof Mel Taylor (Macquarie University) launching findings from the 2022 Queensland and New South Wales floods project; Dr Briony Towers (Leadrrr) and Neil Munro (Country Fire Authority) on how to tailor children's bushfire education for modern learning; Tiffany Crawford (City of Melbourne), Kelly Gee and Judith Bruinsma (Western Sydney Regional Organisation of Councils) on urban heat impacts, adaption and mitigation; and a panel of First Nations researchers covering how research is shaping cultural land management and helping heal Country.

Workshops offered enhanced engagement across the program, with several streams covering 'Be Ahead of Ready: building our future on today's research', land-use planning and resilient recovery, flood and extreme weather risk mitigation, bushfire and prediction risk mitigation, and next-generation capability. These workshops gave attendees the opportunity to become more involved with the research – learning more about the work being done, meeting the people involved and contributing firsthand to the needs and impacts of research outcomes.

Closing the Forum was a special session in partnership with the University of Melbourne, with resilience expert Prof Daniel Aldrich from Northeastern University (United States) on social infrastructure's critical role in reducing disaster impacts.

The Forum was also an important opportunity to bring the Centre's postgraduate and Early Career Researchers together, with a dedicated half-day session that covered how to give research impact, effective communication and climate science.

Constructive and supportive feedback from attendees includes:

- "These forums are essential for the success of the NHRA to enable ongoing dialogue between researchers and end-users as well as ensuring that key issues and research areas are seen in the system as a whole and not in isolation."
- "The quality of the speakers was excellent and there was adequate time allowed for presenters to provide more in-depth presentations."
- "This was the most holistic and meaningful inclusion of First Nations people I have experienced at a conference."

Events

The Centre has an annual calendar of engagement activities to foster greater collaboration between researcher, government and the emergency management sector and to support the needs of communities across Australia.

This includes events that are hosted by the Centre, as well as participation and contributions to many reputable events hosted externally throughout the emergency management and disaster risk reduction sector.

The following are highlights of Centre participation and support for events:

Above: CEO Andrew Gissing delivering a keynote at AFAC22.

Conferences

AFAC22 conference

The Centre was the Industry Supporter for the AFAC22 conference in Adelaide in August 2022, hosted by the Australasian Fire and Emergency Service Authorities Council. The CEO delivered a keynote address and the Centre promoted its program in a prominent booth in the exhibition space. More than 3000 emergency personnel attended, with over 200 trade exhibitors.

Disaster and Emergency Management Conference

The Disaster and Emergency Management Conference was held on the Gold Coast in July 2022, with the Centre as a supporting partner and on the program committee. Presenters with Centre connections included Dr Mika Peace on the use of data at the Bureau of Meteorology, Board member Iain MacKenzie posing tough questions and solutions to Australia's response to disasters, and Ricky Archer from NAILSMA on building trusted partnerships with First Nations natural hazard practitioners across Australia. A booth in the exhibition hall provided a central point for networking and meeting with conference delegates, of which there were more than 500.

Compound Events in Australia conference

At the Canberra Shine Dome in July 2022, the Centre supported one of a series of Fenner Conferences for the Environment, for the ARC Centre of Excellence for Climate Extremes and Australian Academy of Science, called 'Compound events in Australia – strategic planning for multivariate risk'. Hosted by the Australian Meteorological and Oceanographic Society, the event brought together scientists and industry with government and emergency services representatives for strategic discussions about compound natural hazard events in Australia.

Asia-Pacific Ministerial Conference on Disaster Risk Reduction

The Centre partnered with the Australian Government at the Australian Pavilion for the Asia-Pacific Ministerial Conference on Disaster Risk Reduction, held in Brisbane in September 2022. Centre staff were at the pavilion to showcase research in community recovery, warnings and communications and cultural burning to more than 3000 delegates from 40 countries. The Bushfire and Natural Hazards CRC's *Recovery Capitals* project on community recovery was a feature of one of the information sessions. Dr John Bates, then-Research Strategy Director of the Centre, led the interactive lunchtime session with input from John Richardson from Australian Red Cross and Prof David Johnston from Massey University.

Above: Federal Emergency Management Minister Murray Watt speaking at the Asia-Pacific Ministerial Conference on Disaster Risk Reduction, 2022.

Queensland Inspector-General of Emergency Management's Disaster Management Research Forum

This one-day Forum in Brisbane in September 2022 was widely participated in by Queensland stakeholders. The Centre was represented by CEO Andrew Gissing, then-Research Strategy Director Dr John Bates and Node Research Manager Nicola Moore.

Emergency Media and Public Affairs Conference, Australia

The Centre supported this annual conference in June 2023 – the only event tailored to emergency communicators – with sponsorship and representation on the conference committee (Senior Communications Officer, Beth Patch). Held in Brisbane, the sold-out conference featured presentations by Chair Iain Mackenzie and researchers A/Prof Mel Taylor and Dr Kate Brady.

Emergency Media and Public Affairs Conference, New Zealand

The Centre sponsored the Wellington EMPA conference in October 2022. Communications staff David Bruce and Nathan Maddock represented the Centre at the conference, promoting the new research of the Centre and building networks with both agency and research contacts to 150 delegates.

Floodplain Management Australia conference

The Centre was represented at this conference in Sydney in May 2023. Researcher A/Prof Mel Taylor, Node Research Manager Dr Kat Haynes and CEO Andrew Gissing conducted a workshop on the findings from the research on the community experiences of the 2022 floods in New South Wales and Queensland, with 30 attendees. A/Prof Taylor and Dr Haynes also spoke on the same topic at the conference, with 70 people attending their talk. The Centre had a booth in the trade display through the conference, with most interest focused on the community flood research.

Local Government Association of Queensland's Disaster Management Conference

Held during National Reconciliation Week in May 2023 in Brisbane, the Centre partnered with the North Australian Indigenous Land and Sea Management Alliance and the Carpentaria Land Council Aboriginal Corporation to host a panel and workshop. The panel discussed ways to involve and empower First Nations people in building integrated approaches to disaster management and community disaster resilience in Queensland, and the role that research can play as an enabler and a supporter. Queensland Fire and Emergency Services' Acting Deputy Commissioner Joanne Greenfield also presented on the panel to showcase the outcomes from the long-term relationship that QFES has with CLCAC through their Indigenous Ranger Program.

Knowledge-sharing forums

A Look Inside Natural Hazards Research Australia webinar

Held in November 2022, this knowledge-sharing webinar was targeted at researchers and industry/sector partners. Hosted by the Node Research Managers with support from the Communications and Research Services teams, the webinar covered how Centre projects operate and answered questions from 38 delegates.

Rising to the Challenge webinar

A knowledge-sharing webinar with US academic Prof Gavin Smith from North Carolina State University was held in February 2023, attracting 275 people. Prof Smith shared his expertise in implementing retrofitting, house raising and buyout programs in the US, focusing on program design and key implementation opportunities and challenges. Immediately prior to the public webinar, the Centre hosted a discussion between Prof Smith, the National Emergency Management Agency and key state/territory stakeholders.

International Women's Day webinar

On International Women's Day, 8 March 2023, the Centre hosted an online panel discussion with key female leaders from the natural hazards research sector and 72 attendees, discussing the documentary *Picture a Scientist* and the key issues and solutions to gender equity in the Australian academic context.

Above: Screenshot of all-female International Women's Day webinar, 2023.

Community Experiences of the 2022 Eastern Australia Floods webinar

In June 2023, this webinar showcased key post-flood findings that are providing vital insights on preparedness, response and the early stages of recovery to help reduce future flood risk. 140 attendees heard from researcher A/Prof Mel Taylor (Macquarie University) and research team members A/Prof Fiona Miller (Macquarie University) and Prof Kim Johnston (Queensland University of Technology). Node Research Manager Dr Kat Haynes MC'd the event.

Understanding the Black Summer Bushfires Through Research webinar series

This series of two webinars in March 2023 presented key findings from select Black Summer research projects. Webinar 1 covered culture, people and recovery, while Webinar 2 covered bushfire prediction and behaviour. These webinars presented an integrated view of the way forward from the Black Summer fires, including why the fire season was so devastating, what new capabilities can be implemented, and how Australia can best learn from its worst fire season on record. 179 attendees joined across the series to hear directly from research leaders on these topics.

Board and stakeholder engagement

The Board conducted four stakeholder events in 2022—23, in Canberra, Hobart, Adelaide and Perth. The events gave representatives from federal and state government departments, emergency service agencies, research institutions, the private sector and not-for-profits the opportunity for direct engagement with the Centre's Board and staff and to learn about the ongoing development of the research program. Approximately 220 people attended these workshops.

Workshops

WA Mobile Fire Radar workshop

In this industry training opportunity, the Centre supported research to test the capability of using mobile radar to detect fire plumes during tests on prescribed burns. Tests were conducted in Western Australia in late 2022 and convened a workshop in Nambeelup in May 2023, with stakeholders from the Bureau of Meteorology, Monash University, Department of Biodiversity, Conservation and Attractions WA, the Department of Fire and Emergency Services WA, Country Fire Authority Vic, NSW Rural Fire Service and the Department of Environment and Water SA. The Centre was represented by researcher Dr Mika Peace (Bureau of Meteorology) and 27 people attended.

Disastrous Writing workshop

This two-day, face-to-face University of Melbourne workshop was hosted by Centre researcher Dr Kate Brady in June 2023, with support from the Centre. The workshop brought together 22 researchers and practitioners for intensive writing workshops, interspersed with networking activities to facilitate collaborations between attendees.

Industry training

Lessons Management Forum

The Centre sponsored this AFAC event, held in Canberra in June 2023. As the research partner, the Centre hosted the closing panel session and ran a workshop. The panel of Prof Steve Dovers (Australian National University) and Board Director Dominique Hogan-Doran SC discussed how best to influence policy change, chaired by CEO Andrew Gissing. Communications Manager Nathan Maddock conducted a workshop on communicating complexity, attended by 30 people.

Be Ahead of Ready

A series of national online Be Ahead of Ready workshops in April and May culminated in an open session at the Natural Hazards Research Forum in Melbourne. This new Centre initiative saw a wide range of participants from the sector invited to contribute their 'big ideas' on improving policy and capability in natural hazards. Contributions were received from some 180 stakeholder participants in the Centre and beyond online and a further 400 participated during the Forum.

Commitment to reconciliation

As a national research centre for natural hazard risk reduction and resilience, the Centre is committed to promoting reconciliation within the organisation and throughout the natural hazards research community where possible. Through the development of a Reconciliation Working Group and *Reconciliation Action Plan*, the Centre is implementing reconciliation in its processes, programs and partnerships.

Reconciliation Working Group

This management-level group met four times during this reporting period.

The group's chair is the Centre's Senior Communications Officer, Bethany Patch.

Members include CEO Andrew Gissing; CSO Prof Deborah Bunker; Board members Oliver Costello and Sandra Whight; staff representatives Dr Kat Haynes, Nicklaus Mahony and Friedo Ligthart; and First Nations members Ricky Archer (CEO, North Australian Indigenous Land and Sea Management Alliance), Tammy Small (Manager of Indigenous Advancement, University of Wollongong) and Bhiamie Williamson (Research Fellow, Monash University).

Established in February 2022, the Centre's Reconciliation Working Group meets quarterly to guide the ongoing development of reconciliation initiatives, including overseeing the implementation of the Centre's first *REFLECT Reconciliation Action Plan* (*RAP*).

Reconciliation Action Plan

The Centre's *Reflect RAP* was launched in October 2022 at the Centre's Natural Hazards Research Forum. It outlines the Centre's plan for embedding First Nations recognition within partnerships, programs and processes, including:

- laying the foundations for a culturally safe research environment that promotes and supports First Nations leadership and knowledge
- informing and expanding the Centre's First Nations-led processes, programs and research activities
- strengthening the Centre's relationships with First Nations peoples and communities, especially in the research and natural hazard management sector
- exploring and committing to new reconciliation-building activities within the Centre
- guiding the Centre's awareness-raising activities about the crucial contributions and leadership potential of First Nations peoples.

There are 63 deliverables listed in the *Reflect RAP*, grouped around four key pillars – relationships, respect, opportunities and governance. A total of 27 deliverables were successfully implemented this reporting period, with the Centre's Board, executive leaders and staff responsible for completing the remaining deliverables.

The *Reflect RAP* was extended in April 2023 for six months, with all remaining deliverables due to be completed by December 2023.

Above: The Centre's *REFLECT Reconciliation Action Plan (2022).*

Reconciliation activities that have progressed this reporting period include:

- Aboriginal Cultural Competency training for staff in November 2022, hosted by Koorie Heritage Trust, including an assessment of cultural learning needs within the organisation
- staff attendance at other First Nations-related professional development and partnership-building events
- promoting a commitment to reconciliation through Centre networks, including acknowledging this in all corporate documents and communicating frequently with staff, Board and stakeholders about reconciliation progress
- enhanced inclusion and recognition of First Nations scientific contributions at each stage of research project development
- engaging Traditional Custodians to facilitate a Welcome to Country and smoking ceremony at major events, and inclusion of an Acknowledgement of Country at all other Centre events
- commissioning a set of three message sticks by First Nations artist Uncle Marcus Ferguson in September 2022 that are carried by staff to meetings and events as a symbol of good intentions through open knowledge sharing
- a National Reconciliation Week digital and video campaign in May 2023 to celebrate the Centre's First Nations research project teams
- A National Reconciliation Week workshop as part of the Local Government Association of Queensland's Disaster Management Conference. The Centre joined with the North Australian Indigenous Land and Sea Management Alliance and the Carpentaria Land Council Aboriginal Corporation to host a workshop in Brisbane to discuss ways to involve and empower First Nations people in building integrated approaches to disaster management and community disaster resilience in Queensland, and the role that research can play in enabling and supporting this.

Above: Yuggera man Tommy Bundamba-Ya conducting a smoking ceremony at the Centre's *REFLECT Reconciliation Action Plan* launch, as part of the 2022 Natural Hazards Research Forum.

First Nations research projects

One of the Centre's reconciliation goals is to ensure that research about First Nations peoples, or of importance to First Nations peoples, if either led or co-led with a First Nations representative. The following First Nations-led/co-led projects are currently underway:

- *Connecting Indigenous people and the emergency management sector – effective partnerships* (led by North Australian Indigenous Land and Sea Management Alliance)
- *Cultural land management research and governance in south-east Australia* (led by Jagun Alliance and Deakin University)
- *Scoping operationalisation for Aboriginal land management* (led by NSW Department of Planning and Environment)
- *Healing Country through Wolgalu/ Wiradjuri-led land management* (led by Brungle-Tumut Cultural Natural Resource Managers and the University of Wollongong)
- *Cross-cultural relationships in natural resource management: understanding the nature and experiences of partnership and collaboration* (postgraduate research led by Deakin University)

Other projects were approved for funding by Board in April 2023 and are currently in development:

- *Effect of cultural burning on soil health* (proposed by South Australia's Department of Environment and Water)
- *Disaster resilience in Indigenous communities* (proposed by the Australian Institute for Disaster Resilience)
- *Lived experiences of First Nations emergency and land management and resilience personnel* (proposed by AFAC)

Awards

Early Career Researchers Competition

Centre postgraduate student Fadia Isaac won Cooperative Research Australia's 2023 Early Career Researchers Competition in June 2023. The competition tests communication skills by asking PhD students and Early Career Researchers to explain their research in five minutes to a non-specialist audience. (Addendum – Fadia won the final, which took place in July 2023.)

Australian Podcast Awards

The *After the Disaster* podcast, drawing on Bushfire and Natural Hazards CRC expertise, was nominated as a finalist in the Best New Podcast category at the 2022 Australian Podcast Awards. *After the Disaster* draws on research funded by the CRC to provide trustworthy information and guidance on how to recover from a disaster in a safe and companionable format so that anyone can access support for disaster recovery. Led by Dr Kate Brady at the University of Melbourne and Australian Red Cross, the 15 part series was produced by the ABC and supported by the Australian Red Cross and Bushfire Recovery Victoria.

Above: Early Career Researcher Fadia Isaac receiving her ECR award with Marnie Hughes-Warrington and Jane Dwyer at Cooperative Research Australia's 2023 Collaborate Innovate.

Attachments

Attachment 1: Progress against Biennial Research Plan 2022-2023 milestones

Milestone	Agreed end date	Actual/anticipated end date	Current % complete	Progress comments – work undertaken and impact of any delay
Biennial Research Plan 2023-25 Approved by the Centre Board	30-Jun-23	30-Jun-23	100%	An environmental scan was completed and presented to the Research and Implementation Committee. Consultation then occurred with Participants and other expert stakeholders. The draft Plan was tabled at the End User Advisory Panel on the 10th of May 2023. The Plan was approved by the Board in June 2023.
All funded research complying with the Centre's research data framework	Ongoing	Ongoing	100%	Provisions included in all relevant Centre project contracts
Outcomes, findings and insights from all completed QDRP projects shared in a timely manner	Ongoing	Ongoing	-	No project grants were applied for.
Online data catalogue available online (searchable)	30-Jun-23	30-Jun-24	25%	The project was delayed due to staff illness and the requirement to rescope it to better align with the development of a comprehensive data framework (including data governance principles) and a metadata bushfire data catalogue. A RFQ was issued to market to assist in completing the project in late May 2023 and successful provider appointed. The expected completion date for the data framework and pilot data catalogue is December 2023.

Milestone	Agreed end date	Actual/anticipated end date	Current % complete	Progress comments – work undertaken and impact of any delay
Representation on relevant committees or working groups for relevant end-user research initiatives	Ongoing	Ongoing	100%	The Centre continues representation on: → AFAC Research Committee → Relevant AFAC Collaboration Committees → Resilience Valuation Initiative → NSW Treasury Cost Benefit Working Group → NSW Department of Planning and Environment Technical Advisory Group → NSW Chief Scientist Advisory Group → Australian Journal of Emergency Management Editorial Advisory Board and Editorial Committee → Program Committee AFAC Lessons Management Forum → Conference Committee Emergency Media and Public Affairs conference → WA Interagency Bushfire Operations Committee Research Subcommittee → Industry Advisory Committee for Master of Disaster, Design and Development at RMIT → Advisory Panel for the Victorian Office of Bushfire Risk Management → Qld Bushfire and Biodiversity Consortium – State Steering Committee → Qld Bushfire and Biodiversity Consortium – Fire Science Reference Group → Qld Disaster Management Research Advisory Panel → NSW Bushfire and Natural Hazards Research Centre Steering Committee → ANZ Disaster and Emergency Management Conference Committee → Australian Academy of Science National Committee for Information and Communication Sciences (NCICS) → International Association of Wildland Fire (Wildfire Communications Committee Chair) → Australasian Journal of Information Systems (Section Editor) → Information Technology and People (International Journal – Senior Editor) → International Journal of Information Management (Distinguished Editorial Board Member) → Fire (social science editor) → Project Control Board DCCEEW Australian Rainfall and Runoff Project → Advisory panel for the NSW Governments Overarching Bushfires Evaluation → Advisory panel for AdaptNSW Households Research Project. NSW Office of Energy and Climate Change. → Advisory panel for a new ARC Centre of Excellence 2024 bid to reimagine extreme event scenarios, such as cyclones, flash floods and wildfires. → Technical Committee on Data Collection during Wildfire Evacuations for the Resilience and Adaptation to Climatic Extreme (RACE) Wildfires Project funded by National Research Council Canada.
Participation of university research collectives and initiatives in Centre activities	30-Jun-23	30-Jun-23	100%	→ NHRA sits as an observer on the Queensland Disaster and — Resilience Institute Program Board Meeting. → Key members of Queensland Disaster Research Alliance attended the Natural Hazards Research Forums in October 2022 and May 2023. A key member is represented on the NHRA Education and Training Committee. → NSW Government launched the NSW Bushfire and Natural Hazards Research Centre in January 2023. Two representatives from NHRA sit on the steering group.

Milestone	Agreed end date	Actual/anticipated end date	Current % complete	Progress comments – work undertaken and impact of any delay
October research project investment round complete and approved by the Centre's board	31-Dec-22	31-Dec-22	100%	October research round completed. 23 project concepts were submitted. The following new projects were approved by the NHRA Board: → Identifying and defining landscape dryness thresholds for fire → Capturing uncertainty in bushfire spread prediction using Bayesian modelling and real bushfire observations → Long-range flood outlook for strategic preparedness → Healing Country Through Wolgalu/Wiradjuri led Land Management and scoping and operationalisation of Aboriginal Land Management at a landscape wide scale → Why fly? How do we know that aerial operations are effective and efficient → Incentivising resilient reconstruction: Evaluating the role of the Resilient Homes fund in enhancing physical and financial resilience following 2022 floods → Developing an integrated predictive capability for extreme rainfall and inundation → Safety of alternative and renewable energy technologies → national Volunteer Sustainability Blueprint for Emergency Management
April research project investment round complete and approved by the Centre's Board	30-Jun-23	30-Jun-23	100%	The April research round completed, 26 project concepts were submitted. The following new projects were approved by the NHRA Board: → Lived experiences of First Nations emergency and land management and resilience personnel → Disaster resilience in Indigenous communities → Adaptation for heatwave resilience → Best practice for tracking potentially traumatic event exposure → Understanding intangible flood costs and impacts → Communicating flood risk → Effectiveness of land-use planning flooding controls during 2020-22 floods → Utilisation of transformative scenarios in a climate-challenged world → Effects of cultural burning on soil health → Wi-fi captive portal videos for tourism disaster preparedness → Fight Fire Fascination program evaluation
Endorsement of the cumulative distribution of project investment across the research portfolio by the Centre's board	30-Jun-23	30-Jun-23	100%	This is a regular feature of discussion at Research and Implementation Committee and Board meetings. The board formally endorsed the cumulative distribution of project investment across the research portfolio at its May 2023 meeting.
All projects approved for development before 30 June 2022 contracted and initiated	31-Dec-22	31-Dec-23	90%	All projects have been awarded, awaiting finalisation of research services agreements for five projects. Delays are primarily being experienced as research providers negotiate contract terms once being awarded projects.

Milestone	Agreed end date	Actual/anticipated end date	Current % complete	Progress comments – work undertaken and impact of any delay
All projects approved for development before 31 Dec 2022 contracted and initiated	30-Jun-23	31-Dec-23	60%	Work is still being completed to contract projects. Further additional resources have been allocated and process efficiencies have been identified. Delays are primarily being experienced as research providers negotiate contract terms once being awarded projects.
Annual review of project portfolio by Research and Implementation Committee	30-Jun-23	30-Jun-23	100%	The project portfolio is presented at each Research and Implementation Committee meeting. The Committee met three times during the year.
Monitoring and reporting capability functional in the project management system	30-Jun-23	30-Jun-23	100%	Project monitoring and reporting capability has been completed. The system is now capable of including a project page that captures project details, project plan, key stakeholders, financial data, milestones, in-kind commitments, payment milestones, risks and status update functionality. Projects can now be monitored through the creation of dashboards, and reports. All Tranche 1 to Tranche 5 projects have been uploaded and are being monitored on Turnkey.
Monitoring, evaluation and reporting on progress for research projects implemented in reporting to Research and Implementation Committee	30-Jun-23	30-Jun-23	100%	Regular monitoring, evaluation and reporting on progress for research projects implemented in reporting to Research and Implementation Committee.
Number of post-graduate research students receiving scholarships (30)	30-Jun-23	30-Jun-23	100%	30 active postgraduate students are receiving student scholarships. In addition, the Centre has 17 associate students.
ECR Fellowships awarded (2)	30-Jun-23	30-Jun-23	100%	3 ECR Fellowships have been awarded.
Disaster challenges held per year (2)	30-Jun-23	30-Jun-23	100%	First Challenge successfully completed in October 2022. The 2023 Challenge is now being held. The final Challenge event to be held on the International Day of Disaster Risk Reduction in October 2023.
First work placement achieved	30-Jun-23	30-Jun-23	75%	Work placement has been designed and agreement is in place with NSW DPE to host the Centre's first work placement. EOI for the work placement opportunity to be issued.
Research translation workshop held	30-Jun-23	30 Jun-23	100%	A workshop on the translation of post flood social research findings was completed at the May 2023 Natural Hazards Research Forum.
International research conference held	30-Jun-23	30-Jun-23	100%	Our first Natural Hazards Research Forum was held in October 2022 and was attended by around 300 delegates. Our second Natural Hazards Research Forum was held in May 2023 and was attended by around 400 delegates.

Milestone	Agreed end date	Actual/anticipated end date	Current % complete	Progress comments – work undertaken and impact of any delay
Research and utilisation workshops held (10)	30-Jun-23	30-Jun-23	100%	The following research and utilisation workshops have been completed: → End user research workshop with Tasmanian stakeholders, Hobart, September → Research student workshop, Brisbane, October → Research briefing on flood related research for Commissioner of NSW SES, Sydney, October. → *Getting to know Natural Hazards Research Australia* workshop focused on explaining the Centre's processes to end-users, online, November. → End user research workshop South Australian stakeholders, Adelaide, December and June → End user research workshop Western Australian stakeholders, Perth, February → End user research workshop ACT stakeholders, Canberra, May → Post flood social research utilisation workshop held at Floodplain Management Australia workshop, May → Research writing workshop hosted with the University of Melbourne, May → Be Ahead of Ready Workshop Series x 12 → Research Prioritisation workshop with South Australian Stakeholders from multiple agencies → First Nations workshop LGAQ conference → Stakeholder workshop on RUI Bushfire project → Stakeholder workshop on what makes a good fire simulator → Stakeholder workshop on enhancing decision making in emergency management Further workshops and briefings were facilitated within funded research projects.
Subject matter workshops and symposia held (10)	30-Jun-23	30-Jun-23	100%	The following subject matter workshops and symposia held: → Pyro-geography research seminar with Uni of Tasmania, August → An introduction to the NHRA lifelines project, November → Workshop on Soil Health and Fire, December → Workshop held with NEMA stakeholders regarding post-disaster home buy-outs featuring Professor Gavin Smith, February → A webinar was held on US experiences of home buy-outs led by Professor Gavin Smith, February → Two webinars were held to promote the findings of the Black Summer research program, March → Two NSW/QLD post flood social research stakeholder briefings → Workshop held with National Resilience Taskforce, May → Mobile radar workshop, May → A webinar was held to promote NSW/QLD post flood social research findings, June Further events and workshops were sponsored and supported by the Centre.
Scenario based exercise held	30-Jun-23	30-Jun-23	100%	The Be Ahead of Ready workshop series utilised a scenario exercise approach

Attachment 2: Current core research projects

Project	Summarised outcomes targeted
Translation of observed and modelled extreme bushfire behaviours to improve fire prediction and fireground safety	Provision of the new modules as post PUA training professional development options Increased situational awareness and fire ground safety – interoperable language and concepts/ shared understanding Improved risk communication
Predictions in public: understanding the design, communication and dissemination of predictive maps to the public	Gain an overview of the existing public information and warnings products across jurisdictions Develop a preliminary set of evidence-based guidelines for predictive/e map design
Connecting Indigenous people and the emergency management sector – effective partnerships	Strengthen the collective Indigenous understanding and position on engagement in EM in Northern Australia, providing a stronger and better-informed foundation for future work practice and partnerships
Cultural land management research and governance in south-east Australia	Strengthening collaborative governance and research involving Indigenous land and fire managers and state, territory, and local government agencies
Community-led recovery: evidence, dimensions and supports for Community Recovery Committees	Develop a shared understanding of the roles of Community Recovery Committees (CRCs) Test and validate a self-assessment tool built for CRCs Measure representativeness of CRC membership using a social network approach, to help inform future recovery policy.
Identifying water sources for aerial firefighting	Explore the suitability of Sentinel 2-based waterbody insights.
Bushfire information database – scoping study	Provide an evidence base and recommendations that can be used to support the development of a National Bushfire Information Database
Understanding the resilience of lifelines for regional and remote communities	Increased knowledge about Australia's lifeline characteristics, interconnections, vulnerabilities, strengths, needs and opportunities for improving resilience, of relevance to practitioners and researchers. Understanding of the primary research needs and opportunities around lifeline resilience in Australia to strategically inform future work at NHRA and other organisations.
Research data management	Establish a research data management initiative for sharing research data as the outcome of bushfire research undertaken through NHRA projects, and where practical, from projects previously undertaken by the BNHCRC.
Awareness, education and communications for compound natural hazard events	Improved shared understanding of the threats posed by compound disasters informed community engagement programs and agency capacity to the ensure the public understand compound disasters, associated risks and how to prepare for them Demonstrated the need to provide integrated community engagement and warning systems to develop awareness of the risks associated with compound disasters Enhanced communications planning in the context of disaster recovery
Improved predictions and warnings for flash flooding	Better understand how to prepare systems, people, and public messaging and warnings to reduce impact from flash flood and enhance community resilience.
Integrated solutions for bushfire-adaptive homes	Provide a better understanding of the causes of the failure rates of homes What measures would best reduce failure rates Understand social levers that could be better utilised to influence and support communities to better protect homes from bushfires.
Decision making in emergency management	High capacity for effective and appropriate crisis decision making in the Australian and New Zealand emergency management sectors across all levels. Decision-making capacity to be supported by well designed and implemented training and learning products that build on existing programs and tools A common, national approach to decision making across services and multi-agency training to support cross agency decision making

Project	Summarised outcomes targeted
Bushfire risk at the rural–urban interface	Improved understanding of how community led / centred action can be engendered and supported within communities living at the RUI to reduce risks in and around the APZ Identification of the key site and vegetation characteristics that affect bushfire behaviour within the RUI, including garden plant flammability and garden arrangement / landscaping Development of informed fire behaviour modelling that captures interface and garden fuels, fire spread and ember production in RUI zones Identification and evaluation of potential mitigation measures for stopping and reducing the spread of fire into the RUI.
Sector partner engagement to enhance severe weather impact predictions	Understand the requirements of the emergency management sector for impact-based forecasting services and/or products with the goal of gaining an enhanced understanding of how this prediction capability should be developed to improve decision making and the types of information required by different user groups.
Modelling impacts of sequential cascading natural hazards on the built environment	Improved ability to estimate direct costs of infrastructure damage and to assess the financial benefits of infrastructure betterment in the context of current and future climates Capability to estimate infrastructure restoration timeframes to inform emergency management planning and risk assessment
Natural hazards and resilience in complex urban systems	This project will lead to greater understanding of the multidimensional disaster impacts arising from natural hazard events for communities located in major urban areas in Australia, and the ways in which these impacts may change over time under the influence of climate change and rapid urbanisation.
What makes a good fire simulator?	Define the development of Spark and ensure that it meets the needs of its users. Existing simulator users will also use it to evaluate current practice and use, justify changes to simulators, guide the development of new versions of simulators, justify new simulation methods of work and aid in interpreting predictions and outputs
Storing and sharing qualitative social data	Build a strong foundation and clear pathways for the Centre and its researchers to implement the effective collection, use, curation and sharing (where feasible) of qualitative social research data.
Community risk assessment	Better understand the value in having a systematic approach to community-based risk that takes advantage of the latest computational and risk modelling advances.
Fire case studies	Build on the Bureau's reputation for preparing high-value case studies by developing a defined methodology.
Identifying and defining landscape dryness thresholds for fires	Review and describe the range of landscape dryness products that have been developed, are in use or may potentially be applied in Australia. Compile and characterise operational uses for land dryness indices in Australia including the AFDRS. Evaluate landscape dryness products (weather and satellite derived) and describe their sensitivity and specificity in identifying when and where mission critical events may or may not occur. For dryness products that have potential for supporting decision making, identify thresholds for mission critical events and make recommendations on their strengths and limitations. Develop approaches for mapping landscape dryness to deliver operational intelligence. This may entail developing a new dryness index or calibrating or restructuring indices to account for vegetation productivity or drying rates.
Capturing uncertainty in bushfire spread predictions using Bayesian modelling and real bushfire observations	A developed Bayesian ROS model for forest (and grass a second priority), giving FBANs an additional, powerful tool to understand expected ROS probabilistically (which currently does not exist). ROS database that could be regularly updated and shared with fire agencies and researchers. Quick access to the history of ROS available to FBANs to understand how a particular fire sits in the context of previous fires

Project	Summarised outcomes targeted
Long-range flood outlook for strategic preparedness	Build a suite of national probabilistic long-range flood outlook and inundation products as a proof-of-concept for evaluation and testing. The products will be generated using computationally efficient flood inundation mapping, cutting edge statistical methods and state of the art climate, hydrology and earth observation data.
Healing Country Through Wolgalu/ Wiradjuri led land management	Run on-Country activities to revitalise and share cultural knowledge and to develop resources that tell Wolgalu/Wiradjuri histories and knowledge of Country. The project will better understand what Wolgalu/Wiradjuri Caring for Country looks like today.
Scoping operationalisation for Aboriginal land management	Provide the foundational understanding necessary for implementing landscape ALM. With that foundational understanding, government support for implementation can be provided, and an accompanying research program to document learning and problem solving, along the lines of a living lab model, can be developed.
Why fly? How do we know that aerial operations are effective and efficient?	Understand and build the existing user profile of Australia's aviation fleet across different landscapes. Understand the profile of the purposes for which the fleet is deployed and how effective that purpose has been. This study aims to apply a statistical and geospatial analysis over the data contained within the Arena database, where over 10 years of data can be analysed.
Evaluating the Resilient Homes Fund	Examine the extent to which resilient reconstruction incentivisation programs can reduce flood risk to homes and increase their insurability, by addressing the following two questions: → How does a resilient reconstruction program enhance the physical and financial resilience of homeowners and communities? → What are the key components of successful implementation of a resilient reconstruction program?
Developing an integrated predictive capability for extreme rainfall and inundation	Enhanced use of ensemble numerical weather prediction. Quantitative rainfall estimation from STEPS radar nowcast application. Development of a prototype probabilistic inundation model. Case study analysis building on a related NHRA flash flood project. Investigation of potential improvements to current forecast approaches using combinations of the above forecast applications. Assessment of the value in integrating the applications in a single predictive service model.
Safety of alternative and renewable energy technologies	Investigate the risks related to fire propagation within and between stationary energy storage systems (from household to commercial scale) due to external factors related to bushfire, heatwaves, storms, and floods (such as fire impingement, temperature extremes, impact/ shock, and water ingress) that are not considered in current best practice standards.
Reimagining emergency management volunteering: more than just words	Explore opportunities and collaboratively develop a sustainable volunteer system to better support EM volunteers (the people), volunteering (the activities) and volunteerism (the culture). The project will leverage the volunteering research undertaken under the BNHCRC.
Lived experiences of First Nations emergency and land management and resilience personnel	identify systemic and behavioural drivers of cultural load and cultural conflict for First Nations staff and volunteers, and develop recommendations for interventions based on identified gaps to improve participation of First Nations people.
Disaster resilience in Indigenous communities	An evidence-based policy framework for guiding Indigenous disaster resilience policy and practice across Australia, Building trusting relationships between Indigenous communities and peak organisations An Indigenous disaster resilience community of practice New evidence and authoritative guidance as a knowledge base regarding Indigenous peoples and disaster resilience Recognition of the critical roles Indigenous community organisations play in disaster resilience, and Increased confidence in Indigenous communities to respond to disasters.

Project	Summarised outcomes targeted
Adaptation for heatwave resilience	Increased understanding of the health impacts of extreme heat and poor air quality will directly inform heat health planning and enable jurisdictions to better prepare for these events when they occur. A better understanding of the full costs and impacts of heat events will enable agencies and health departments to better plan, prepare and respond to heat events. Only once the full costs are known can we properly invest to reduce risks. Detailed understanding of the barriers and opportunities of including the consideration of extreme heat into the national construction codes will begin an important process and conversation of how we can best adapt to heat within Australia.
Best practice for tracking potentially traumatic event exposure	An understanding of current national and international risk management systems and practices that support psychological wellbeing and safety. A gap analysis of what is required in this space to better monitor long term mental health impacts within the Australian emergency services and resilience sector An understanding of how climate change, compounding and cascading disasters are adding to the mental health load of emergency service and resilience sector workers An assessment of whether it is favourable and feasible for the Australian emergency services sector to collectively share the development of a new psychological wellbeing and safety risk management system
Understanding intangible flood costs and impacts	This study will provide robust evidence, and a methodology that could be consistently applied, for the incorporation of intangible damages into economic assessment of floods (and potentially other natural hazards).
Communicating flood risk	This project will improve communication of flood risk to people in at risk areas, including expected intensity and conditions, insurance information, improved flood risk messaging (such as language, ratings, terminology etc), messaging suitability and social acceptance, and implementation of changes into planning frameworks, community messaging and warning systems.
Effectiveness of land-use planning flooding controls during 2020–22 floods	This research will develop a baseline understanding of the implementation of planning flood controls to new buildings and modifications across different states in Australia over the last 10 years, to assist in refining flood planning systems and processes.
Utilisation of transformative scenarios in a climate-challenged world	Further develop the translation and utilisation of the transformative scenarios in a climate challenged world resources with the development of professional development modules, and user-friendly train the trainer applications. It will be a joint project with the NHRA and the AFAC Climate Change Group, which brings together key individuals from jurisdictional emergency management agencies, the Bureau of Meteorology and thought leaders in the climate and disaster field. This group will play an important advisory and testing role throughout the project process.
Effect of cultural burning on soil health	Provide a quantitative assessment of how soil physical and chemical properties respond to cultural burning and hazard reduction burns. Provide similar quantitative assessments across a range of Australia environments.
Wi-fi captive portal videos for tourism disaster preparedness	This pilot study will empirically evaluate the effectiveness of using wi-fi captive portal videos to prepare tourists and tourism workers for disasters. This project was proposed by Fire and Rescue NSW and is the development of the 2022 Disaster Challenge winning research pitch.
Fight Fire Fascination program evaluation	This project will empirically evaluate the effectiveness and impact of the Fight Fire Fascination program in Queensland, including assessing the efficacy of the program against objectives, content, delivery and training, as well as determining the impact of the program on fire play and other behaviours.

Project	Summarised outcomes targeted
Detecting fire plumes with mobile radar	To provide an overview of proposed support by NHRA towards a multi-agency collaboration on the exploratory use of a mobile radar during prescribed burns and possibly wildfires in WA. This Project will: → test the capability of mobile radar to detect fire plumes during prescribed burns and possibly wildfires in WA → develop an unrestricted data set to be managed in the NHRA's data catalogue, and → facilitate the strengthening of researcher and practitioner networks through cross-agency and cross-jurisdiction collaboration.
SWIRLnet Data Acquisition, Analysis, Storage and Dissemination Procedures	The objective of this project is to streamline the data acquisition and dissemination procedures currently enacted during SWIRLnet deployments and to make the data more accessible.
Schools in fire country	This project has built on the findings from Bushfire and Natural Hazards CRC research to design, trial and evaluate a pilot community-centred, place-based participatory program at a school, then refine an approach for scaled implementation in high-risk locations across Victoria.
Fire ember transport	This research has been completed and built on Bushfire and Natural Hazards CRC research to develop a software interface between the development version of Spark Operational and the ember transport parameterisation model.
Community experiences of the 2022 Australian floods – Queensland and New South Wales	This research explored the community experiences of the 2022 floods in Queensland and New South Wales. The research provides vital context to assist emergency management organisations, government departments, local councils, community organisations and community members in better understanding the complexities of community experiences before, during and after severe weather. The results of the research are already being used to inform strategies to improve flood safety and policy across Australia.
Community experiences of the 2022 Australian floods – Tasmania	This community-based research extends the work already completed in Queensland and New South Wales to Tasmania. It is informing improvements to the flood warning system and community disaster preparedness programs.
Project: Community experiences of the 2022 Australian floods – Victoria and South Australia (case studies)	This community-based research extends the work already completed in Queensland and New South Wales, and underway in Tasmania, to Victoria and South Australia. Distinct case studies in various locations will explore: → the experiences of First Nations peoples, → the experiences of those who are culturally and linguistically diverse → specific issues around population responses in areas impacted with moderate and longer lead times to floodwaters.
Flood contamination sampling and analysis – regional Victoria	Undertaken after the October and November 2022 flooding across Victoria, this research collected samples of floodwaters to further understand the level of risk to human health and the environment. Samples were tested for bacteria and a range of trace elements. Initial results indicate that *E. coli* levels and other contaminants such as trace metals, volatile organic compounds, pesticides, phthalates and per-and polyfluoroalkyl substances (PFAS) are generally below levels of concern. The results of this research will be shared nationally to inform communities and emergency services of the many dangers of entering floodwater.

Attachment 3: List of research reports, journal articles and book chapters

Research reports

Natural Hazards Research Australia

Adams C, Seehaber M, Yuan F & Sharma R (2023) Identifying water sources for aerial firefighting, 19.2023, Natural Hazards Research Australia

Gissing, A & George S (2023) Business involvement in disaster management, 15.2023, Natural Hazards Research Australia

Kepert J (2023) Ember transport for bushfire simulation: Final report – integrating a parametric ember transport scheme into Spark bushfire simulator, 12.2023, Natural Hazards Research Australia

Natural Hazards Research Australia (2023) Community experiences of the January – July 2022 floods in New South Wales and Queensland: Summary Report, 17.2023

Natural Hazards Research Australia (2023) Understanding the Black Summer bushfires through research: a summary of key findings from the Bushfire and Natural Hazards CRC, 10:2022

Neale T, Miller G, Begg C, Dootson P, Kuligowski E, Griffin A, Dwyer G & Gardner A (2023) Role and value of predictive service products,11.2023, Natural Hazards Research Australia

Taylor M, Miller F, Johnston K, Lane A, Ryan B, King R, Narwal H, Miller M, Dabas D & Simon H (2023) Community experiences of the January-July 2022 floods in New South Wales and Queensland – final report: policy-related research findings, 16.2023, Natural Hazards Research Australia

Taylor M, Miller F, Johnston K, Lane A, Ryan B, King R, Narwal H, Miller M, Dabas D & Simon H (2023) Community experiences of the January-July 2022 floods in New South Wales and Queensland – Technical report: interview coding and summary survey data, 20.2023 Natural Hazards Research Australia

Bushfire and Natural Hazards CRC

Chong J.X.D., McLennan B.J. & Dunlop P.D. (2022) Emergency Services Workforce 2030 – Changing Work Literature Review, 733.2022, Bushfire and Natural Hazards CRC

Filkov A, Duff T & Penman T (2022) Determining threshold conditions for extreme fire behaviour – final project report, 735.2022, Bushfire and Natural Hazards CRC

McLennan B.J., Chong J.X.Y. & Dunlop P.D. (2022) Emergency Services Workforce 2030, 669.2022, RMIT University, Curtin University, Bushfire and Natural Hazards CRC

McLennan B.J., Chong J.X.Y. & Dunlop P.D. (Eds.) (2022), Emergency Services Workforce 2030 – Changing Landscape Literature Review, 732.2022, Bushfire and Natural Hazards CRC

Salkin O (2022) Victorian bushfire case studies – Black Summer final report, 734.2022, Bushfire and Natural Hazards CRC

Sharples J.J., Hilton J.E., Sullivan A.L. & Badlan R.L. (2023) Fire coalescence and mass spot fire dynamics: experimentation, modelling and simulation – final project report, 736.2023, Bushfire and Natural Hazards CRC

Journal articles

Natural Hazards Research Australia

Benjamin S, Parsons M, Apthorp D & Lykins A (2022) Why take the risk? Exploring the psychosocial determinants of floodwater driving, *Frontiers in Psychology*, 13

Ryan R, Dosseto A, Lemarchand D, Dlapa P, Thomas Z, Simkovic I & Bradstock R (2023) Boron isotopes and FTIR spectroscopy to identify past high severity fires, *Catena*, 222

Rogers N, Adams V & Byrne J (2023) Factors affecting the mainstreaming of climate change adaptation in municipal policy and practice: a systematic review, *Climate Policy*

Bushfire and Natural Hazards CRC

Dootson P, Kuligowski E & Murray S (2023) Using videos in floods and bushfires to educate, signal risk, and promote protective action in the community, *Safety Science*, 164

Gissing A, Hamilton K, Smith G & Peden A.E. (2023) Vehicle-related causes of flood fatalities, *Natural Hazards Science*

Hassan A, Accary G, Sutherland D & Moinuddin K.A.M. (2023) Physics-based modelling of junction fires: parametric study, *International Journal of Wildland Fire,* 32, 336-350

Innocent J, Sutherland D, Khan N, Moinuddin K.A.M. (2023) Physics-based simulations of grassfire propagation on sloped terrain at field scale: motivations, model reliability, rate of spread and fire intensity, *International Journal of Wildland Fire,* 32, 496-512

Innocent J, Sutherland D, Khan N, Moinuddin K.A.M. (2023) Physics-based simulations of grassfire propagation on sloped terrain at field scale: flame dynamics, mode of fire propagation and heat fluxes, *International Journal of Wildland Fire*, 32, 513-530

Khan N, Sutherland D & Moinuddin K.A.M. (2023) Simulated behaviour of wildland fire spreading through idealised heterogeneous fuels, *International Journal of Wildland Fire*, 32, 738-748

Lankaputhra M, Johnston F, Otahal P, Jalil E, Dennekamp M & Negishi K (2022) Cardiac autonomic impacts of bushfire smoke – A prospective panel study, *Heart, Lung and Circulation*, 32(1): pp 52-58

Mills G, Salkin O, Fearon M, Harris S, Brown T & Reinbold H (2022) Meteorological drivers of the eastern Victorian Black Summer (2019–2020) fires, *Journal of Southern Hemisphere Earth Systems Science*, 72, pp 139-163.

Quinn P, Williamson B & Gibbs L (2022) Indigenous-informed disaster recovery: Addressing collective trauma using a healing framework, *Progress in Disaster Science*, 16

Sutherland D, Mahmood R.A., Hilton J.E. & Moinuddin K.A.M. (2023) Implementation of spatially-varying wind adjustment factor for wildfire simulations, *Environmental Modelling & Software*, 163

Taneja R, Wallace L, Hillman S, Reinke K, Hilton J, Jones S, Hally B (2023) Up-Scaling Fuel Hazard Metrics Derived from Terrestrial Laser Scanning Using a Machine Learning Model, *Remote Sensing*, 15(5):1273.

Wadhwani R, Sullivan C, Wickramasinghe A, Kyng M, Khan N, Moinuddin K.A.M. (2022) A review of firebrand studies on generation and transport, *Fire Safety Journal*, 134

Book chapters

Bushfire and Natural Hazards CRC

Filkov A.I , Cawson J, Swan M.H & Penman T.D. (2022) Wildland Fire, in Meacham B.J. & McNamee M (eds) *Handbook of Fire and the Environment*, pp 235-271

Ralls D, Lahana L, Towers B & Johnson L (2022) Reimagining Education in a Pandemic: Children and Young People as Powerful Educators, in Turok-Squire R (ed) *COVID-19 and Education in the Global North*, pp 1-35

Taylor M, Johnston K & Ryan B (2022) A community engagement approach to natural hazard communication, in Coombs T.W. & Holladay S.J. (eds) *The Handbook of Crisis Communication, 2*: pp 327-344

Above: Dr Daniel Aldrich at the 2023 Natural Hazards Research Forum.

Find supporting research documents and the portfolio of projects on our website **naturalhazards.com.au**

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