bushfire&natural
HAZARDSCRC

A YEAR IN REVIEW

2015-2016

Australian Government
Department of Industry, Innovation and Science

Business Cooperative Research Centres Programme

FRONT COVER: Photos by South Australia State Emergency Service, Carolina Luiz and Holger Maier

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Rural fire brigades use the CRC bushfire outlooks to aid their local education initiatives. Photo: NSW Rural Fire Service

A RESEARCH PROGRAM FOR BUSHFIRE AND NATURAL HAZARDS

Our vision is to be the preferred and trusted source of research and knowledge for natural hazards

National research

The Bushfire and Natural Hazards Cooperative Research Centre is conducting research to build a disaster-resilient Australia.

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

Across all natural hazards

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

Developed by members

The research program has developed under the direction of the researchers and end-user agencies. The research has three major themes covering 12 clusters of project which span the priorities of those working in a multi-hazard environment.

To be used by our members

Now in its fourth year of operation, researchers and end-user partners are working closely together to ensure that the research is embedded into the planning, policies and operations of partner organisations.

For the benefit of the Australian community

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

Research partners include universities, the Bureau of Meteorology and Geoscience Australia, and several international research organisations.

This combined effort is helping to build disaster resilient communities across Australia.

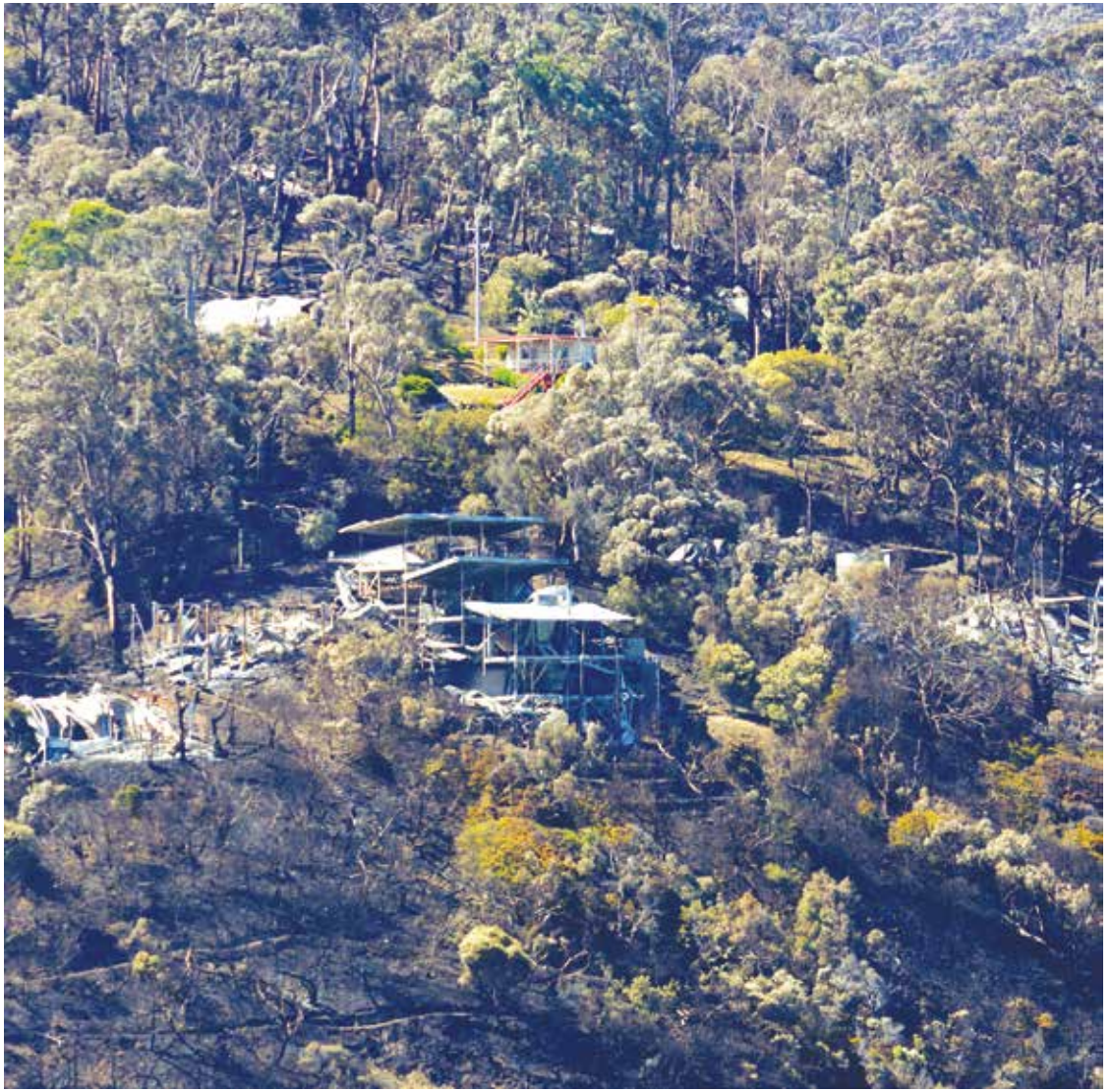


Photo: Keith Pakenham, CFA

UTILISATION CASE STUDIES

EDUCATE THE CHILD, EDUCATE THE COMMUNITY

Primary schools students across New South Wales are now front and centre in state-wide bushfire plans, based on research that identified the importance of involving children in active bushfire preparations for the benefit of the whole community.

CRC research is supporting bushfire education for primary school students in NSW, with the New South Wales Rural Fire Service utilising findings, along with the knowledge, skills and experience of researchers to develop a bushfire education kit.

The 'Guide to Working with School Communities' is being rolled out to all schools through the NSW Rural Fire Service.

The Guide follows the earlier publication of an ebook, available nationally, and based on the same principles that if you educate children on hazards safety, their families and the wider community will also benefit.

This line of research, led by the CRC's Dr Briony Towers of RMIT University, has provided fundamental insight into how children learn about bushfires and how they share those learnings with their families. Collaboration with the NSW Rural Fire Service is continuing, and the team will evaluate the guide over upcoming fire seasons to gather data to measure its impact on community safety over successive seasons.

NSW Rural Fire Service Commissioner Shane Fitzsimmons launches the Guide to Working with School Communities *at Warrimoo Public School in the Blue Mountains. Photo: Ben Shepherd, NSW Rural Fire Service.*

The team ensures that collaboration is at the heart of the research at every stage, with researchers and end-users involved in all aspects of the study, from undertaking the research to developing utilisation plans and writing journal papers. This collaboration will produce enhanced benefits when the research reaches maturity and is embedded across the country.

The broader CRC project on child-centred disaster risk reduction has been highly active on the international scene, with project co-leader Prof Kevin Ronan (CQUniversity) representing the CRC on the United Nations Integrated Research on Disaster Risk committee, as well as presenting at the Third UN World Conference on Disaster Risk Reduction in Sendai, Japan, in 2015. Prof Ronan is assisting in the development of a science and technology research plan to support the *Sendai Framework for Disaster Risk Reduction, 2015-2030*. This also includes involvement in the upcoming 2017 Global Platform for Disaster Risk Reduction in Cancun, Mexico. Dr Towers has also contributed to a World Vision project to deploy the *Lumkani* fire detector device to slums in Dhaka, Bangladesh. Her ongoing children's bushfire education research was selected by the UNISDR Scientific and Technical Advisory Group as a best practice case study.

ENHANCING EMERGENCY WARNINGS

With the multitude of warnings issued when an emergency hits, how can emergency services ensure their critical safety advice is heard and acted upon, rather than dismissed as noise? Research undertaken through the Queensland University of Technology is helping emergency services warn communities by actively testing the wording and structure of warning messages to better understand how messages are understood and translated into direct action. The team, led by Prof Vivienne Tippett, have sought to support broader initiatives in the communications and warnings space, not just for individual organisations, but also at the national level by providing reviews and assisting with the development of evidence based warning doctrine.

The researchers are collaborating closely with the industry, with the Inspector-General of Emergency Management Queensland, Queensland Fire and Emergency Services, Emergency Management Victoria, Victoria State Emergency Service, Country Fire Authority, New South Wales State Emergency Service, Country Fire Service, the Department of Fire and Emergency Services Western Australia and the Bureau of Meteorology all requesting reviews of their warning information.

Katherine Philp, Manager Regional Engagement at the Bureau of Meteorology, believes the research is providing valuable insights that will make a difference.

“We are working to constantly improve our communication, particularly during severe weather, so the observations and findings are of huge interest,” she says.

Local councils are also benefiting, with the Bundaberg Regional Council looking at the frequency of their warnings, the wording of the information they disseminate during an emergency, along with the delivery methods.

This research is informing emergency warnings for a storms, fires, floods and cyclones. Photo: cksydney, Flickr

“Improvements to existing pre-formatted warnings will be captured in the next review of the Bundaberg Local Disaster Management Plan and subordinate plans,” says Matt Dyer, the council’s Disaster Management Officer.

The council is also considering how to involve the community in future warning development and identifying how local citizens would best receive warnings that are practicable and timely.

“Minds have been expanded; opportunities have been glimpsed and a realisation had that there is an existing and emerging body of information that can be integrated into local arrangements,” Mr Dyer says.

“The Bundaberg Local Disaster Management Group is proud to model an example of how to build relationships across sectors to the greater disaster management good.”

SEQwater are also benefiting from the science, and have sought input from the team on how to improve their messaging about releasing water from dam’s during a flood, with a focus on achieving proactive action by the community.

Highlighting the wide-reaching implications of this research, ABC local radio in Wide Bay, Queensland, are also engaged with the research team, looking at ways they can improve their emergency broadcasting.

FIRE MAPPING WITH SATELLITES AND SMARTPHONES

This research is developing better ways to use satellites to map fires. Photo: Karin Reinke

This research is improving the accuracy of vegetation monitoring for flammability, as well as saving critical man hours, through the development of a beta smartphone application. Fuels3D, built on the Android platform, will allow land managers to rapidly collect imagery in the field, and uses computer vision and photogrammetric techniques to calculate measures of fuel and severity metrics.

There is great potential for the app to aid decision making believes Simeon Telfer from South Australia's Department of Environment, Water and Natural Resources.

"This project has engaged end-users through development of prototype products, workshops and circulating outcomes and published materials," Mr Telfer said.

"The Fuels3D mobile phone app has been of particular interest. This app has the potential to reduce fire fuel sampling times from hours per site to minutes. This helps to improve our knowledge of prescribed burn efficacy, inputs into fire behaviour modelling and information towards risk assessment and planning.

"These improvements will improve knowledge or risk and treatment options across landscapes and thereby improve resilience of communities," he said.

The research team, led by Prof Simon Jones of RMIT University, are also characterising fire landscapes using the latest satellite-based thermal earth observation systems for active fire surveillance and exploiting 3D remote sensing technologies to quantify and map changes in the landscape before, and after, a fire. The team brings together researchers from Australia, Germany and the Netherlands, with land managers, rural fire agencies and water utilities from across Australia.

HISTORY PROVIDES A LESSON IN PREVENTING FLOOD DEATHS

CRC research is now informing community flood warning campaigns, emergency services training and national policy initiatives, with a study led by Dr Katharine Haynes at Risk Frontiers, Macquarie University, investigating the circumstances of all flood fatalities in Australia from 1900 to 2015.

The study explored the socio-demographic and environmental factors surrounding the 1,859 flood fatalities over 115 years, finding distinct trends in relation to gender, age, activity and the circumstances of the death. These trends were analysed in the context of changes to emergency management policy and practice over time.

The NSW State Emergency Service has used the findings of the research for its FloodSafe community campaign and training, while the Queensland Fire and Emergency Services has used it to inform its *If It's Flooded, Forget it* campaign.

Hundreds of flood rescues have been conducted over the last two years across the country, says project end-user Dr Elspeth Rae from the NSW SES.

"As a consequence of risky behaviour, flood fatalities and rescues are a constant issue for emergency services. This study has highlighted the significant number of fatalities that have occurred as a consequence of flooding compared to other hazards, particularly as a result of driving through floodwater," Dr Rae said.

This research is informing education campaigns for flood safety. Photo: South Australia State Emergency Service

The results of this research are significantly contributing to investigations into preventing flood fatalities by the Prevention of Flood Related Fatalities Working Group of the Community Engagement Sub-committee of the Australia and New Zealand Emergency Management Committee. This working group was led by the NSW State Emergency Service and comprised policy makers, practitioners and researchers involved in flood risk management from Australia and New Zealand.

IMPROVING DECISION MAKING DURING INCIDENTS

How can incident management teams function to the best of their ability in challenging and high stakes environments? This research is developing practical techniques and strategies to help emergency managers to function in complex situations. These are being trialled by the South Australian Country Fire Service, Tasmania Fire Service and NSW State Emergency Service.

Emergency services have been engaged throughout, with information sought from 18 separate agencies ranging from state emergency services, urban fire, rural fire and local councils. This has allowed the research team, led by Dr Chris Bearman at CQUniversity, to gain a greater understanding of the issues around decision making and team monitoring. Agencies have allowed the research team to monitor both real and simulated emergency situations from within incident management centres, as well as providing feedback throughout the prototype stage, leading to better results.

Heather Stuart, Manager, Knowledge and Lessons at the NSW State Emergency Service believes this feedback is critical.

"The project is providing practical techniques and strategies to help people to function in complex emergency management environments now and into the future," she says.

"The interest in trialling the techniques developed by the research has shown the value of this project to the sector."

Incident management is being informed by new research. Photo: Country Fire Authority

MODELS FOR 'WHAT IF?' SCENARIOS

What if an earthquake hit central Adelaide? A major flood on the Yarra River through Melbourne? A bushfire on the slopes of Mount Wellington over Hobart?

'What if?' scenario modelling by the CRC is helping government, planning authorities and emergency service agencies think through the costs and consequences of various options on preparing for major disasters on their infrastructure and natural environments and how these might change into the future.

The CRC research is based on the premise that to reduce both the risk and cost of natural disasters, we need an integrated approach that considers multiple hazards and a range of mitigation options.

This project, led by Prof Holger Maier at the University of Adelaide, is completing a case study for Adelaide, and commenced further case studies for Melbourne and the whole of Tasmania.

Taking into account future changes in demographics, land use, economics and climate, the modelling will be able to analyse areas of risk both now and into the future, test risk reduction options, identify mitigation portfolios that provide the best outcomes for a given budget, and consider single or multiple types of risk reduction options, such as land use planning, structural measures and community education. CRC partners, along with local governments, have been engaged in the entire process, from direction on the hazards to include and feedback on process, to advice on how the modelling will be used when complete and by whom.

The modelling for Adelaide will be completed in 2017 and incorporates flooding, coastal inundation, earthquake, bushfire and heatwave, as well as land-use allocation. Expected impacts of these hazards have been modelled from 2015 to 2050 with an annual time step under different plausible future scenarios that were developed by end-users, showing the change in risks in different localities. Melbourne and Tasmania will follow next, incorporating bushfire, flood, coastal inundation and earthquake risk in Melbourne, and bushfire, coastal inundation and earthquake risk for Tasmania.

With the costs of natural hazards rising, mitigating risk is key. Here the NSW Rural Fire Service is undertaking a hazard reduction burn at Ku-ring-gai in Sydney's north. Photo: Adam Streichler NSW Rural Fire Service

This is the only approach that compares different natural hazards and their mitigation options, while also taking into account long term planning. The ultimate aim is to develop a decision support framework and software system that is sufficiently flexible to be applied to large and small cities around Australia, helping planners from local councils through to state treasury departments answer the vital question on mitigation options that balance cost and impact: 'what is the best we can be doing?'

This project is an outstanding example of the collaborative process that the CRC is all about, and incorporates findings from other CRC work on recognising non-financial benefits of management and policy for natural hazards, for example, the economic, social and environmental benefits of prescribed burning, the vulnerability of buildings to hazards, such as how they can be made more resilient through cost-effective retro-fitting for improved safety, and the benefits and understanding of community resilience efforts like improved warnings, community engagement, education, volunteering and community resilience.

Since the 2009 Black Saturday bushfires, spontaneous volunteering has been on the rise. Photo: BlazeAid

‘UNOFFICIAL’ VOLUNTEERS

How people volunteer to keep their community safe from natural hazards is changing. As our work and life commitments change, many people do not have the time to dedicate to traditional ways of volunteering with an emergency service, undergo the required training and develop the ability to respond to potentially dangerous situations. But they still want to help, and they still want to volunteer.

Research from this project has influenced key national initiatives, with findings from the study used extensively for the development of the National Spontaneous Volunteer Strategy by the Australia and New Zealand Emergency Management Committee. The strategy provides advice to emergency service agencies on what they need to be aware of, and what they need to consider and plan for when working with spontaneous volunteers. Important issues such as legal obligations and social media are also covered, with the work of the project team integral to the Strategy’s completion.

With research showing that the nature of volunteering and citizen involvement in disaster management is fundamentally changing, advice from the RMIT University team led by Prof John Handmer is regularly sought by individual agencies and organisations in the development of guides and policies around volunteering and spontaneous volunteers. In particular, the research is already having practical impact on policy and planning, for example by informing a Volunteering ACT guide to managing volunteers in emergencies, and contributing to Volunteering Victoria’s Outcomes Framework for Spontaneous Volunteer Management. Emergency services, including the Department of Fire and Emergency Services Western Australia (DFES), Emergency Management Victoria (EMV) are also using the findings. Be Ready Warrandyte, a community group in one of Melbourne’s high bushfire risk suburbs, has also drawn extensively on the research to help educate and support their local community, while the Australian Institute for Disaster Resilience is using the research to shape a handbook on spontaneous volunteering.

DFES’s Director of Human Resources, Karen Roberts, says the department is changing their approach to create the appetite to effectively harness the support the community is offering.

“Our long term volunteering strategy includes establishing an agency position on non-traditional volunteering. The learnings and knowledge generated by this research will be critical to informing our policy,” Ms Roberts says.

EMV’s Paul Davis agrees, saying that the research is helping to shift the narrative around emergency volunteering from one of crisis and decline, to one of transformation and opportunity.

“This is where we must focus our energy and efforts, as communities change so must we,” says Mr Davis, EMV’s Manager of Volunteer Development and Change.

“Failure to accept and adapt to the changes means running a very real risk of falling behind as new voluntary and community-based organisations pursue their own ways to get involved in disaster management, powered by new technology, start up business models, very clear purposes and smart volunteer value propositions.

“There is much to learn from this research and a collaborative approach with these new organisations offers a way to augment our own capacity and possibly achieve better community outcomes,” Mr Davis says.

The project has provided an important and comprehensive resource to benchmark best practice in supporting and integrating spontaneous volunteerism for emergency service agencies across Australia. The scope and relevance of the project will provide a valuable framework of knowledge for the future.

A YEAR IN REVIEW

ACHIEVEMENTS AND OUTCOMES

Over the year the ongoing development of the research agenda included extensive engagement with end-users, researchers and the broader community with a stake in natural hazards management.

Under the watch of a new International Science Advisory Panel, the research program was reviewed to identify and map the progress for utilisation opportunities. A process towards refreshing the research program in 2017 was established. Research highlights include:

- **Bushfire Information System** – developed and tested for operational prediction of live fuel moisture content and fire occurrence.
- **Structure from Motion technique** – developed and tested in a beta smartphone application to allow the rapid and quantitative characterisation of the 3D structure of fuels of fire prone environments
- **Disaster resilience for schools** – to provide Australian emergency management agencies with a strategic, evidence-based approach for school programs that reduce risk and increase resilience.
- **Bushfire education kit** – 'Guide to Working with School Communities', a New South Wales Rural Fire Service schools kit based on research to help children understand bushfire preparation and safety.
- **National Fire Danger Rating** – development of the science behind a new system for the National Emergency Management Projects program.
- **Tsunami warning** – national program reviewed for the Australian Tsunami Advisory Group of the Australia and New Zealand Emergency Management Committee (ANZEMC).
- **Emergency warnings** – focus group research and social media analysis examining community comprehension of messages that will lead to recommendations to improve phrasing and content.
- **Non-traditional volunteers** – identified key changes and impacts on the recruitment and use of volunteers by emergency organisations.
- **Multi-hazard mitigation planning** – to support decision making during bushfire, flood, earthquake and heatwave, applied to a South Australian case study.
- **Animal emergency management** – reviewed all national and state legislation, plans, policies and guidelines.
- **Flood fatalities** – report written for the Prevention of Flood Related Deaths Working Group of ANZEMC.

Photo: Ben Shepherd, NSW Rural Fire Service

WHAT OUR PARTNERS SAY

Mark Ashley, Executive Director, Bushfires NT

The research of the CRC helps us to work out how to better engage with communities, and how communities themselves can improve their resilience for natural disasters such as fire, flood and cyclone. It is about coming up with an integrated approach and ensuring that the government and the community work together to achieve effective outcomes.

- **Northern fire** – a new book brings together more than a decade of research on fire in the north of Australia. *Carbon Accounting and Savanna Fire Management* is edited by CRC researchers Dr Andrew Edwards and Adj Prof Jeremy Russell-Smith from Charles Darwin University, with contributions from many of north Australia's Indigenous and non-Indigenous bushfire experts and land managers.

OPPORTUNITIES AND LINKS

The multi-hazard program presents opportunities for the CRC to grow its collaborations and research links. This is evident in several ways, and includes:

NATIONAL INSTITUTE

The November 2015 launch of the new Australian Institute for Disaster Resilience commenced a partnership between the CRC, AFAC, the Australian Red Cross and the Attorney-General's Department. The new Institute was formed to deliver products and services around Australia that have been developed by, and for, the emergency management sector. The CRC has taken a lead role in the Institute's *Australian Journal of Emergency Management*.

UNITED NATIONS INTERNATIONAL STRATEGY FOR DISASTER REDUCTION

The CRC is the national coordinator for a United Nations-backed committee that promotes and supports disaster risk reduction research. The Integrated Research on Disaster Risk (IRDR) National Committee for Australia is sponsored by the United Nations International Strategy for Disaster Reduction, the International Council for Science and the International Social Science Council.

Researcher Prof Kevin Ronan represented the CRC at several IRDR workshops, Prof John Handmer was elected to the Scientific Committee, and the CRC hosted a panel discussion for the UN International Day for Disaster Reduction at the Australasian Natural Hazards Management Conference in Perth in October 2015 (pictured above). The session featured a panel of speakers

who explored Australia's contribution to natural disaster risk reduction at home and in our region, with a particular emphasis on aspects of Indigenous and local knowledge.

INTERNATIONAL RESEARCH

Natural hazards research findings continue to flow between Australia and New Zealand under an agreement signed between the CRC and the New Zealand Natural Hazards Research Platform.

Memoranda of Understanding have also been signed with the US Forest Service and Association for the Development of the Industrial Aerodynamics (ADAI, Portugal).

CONSULTANCIES

The CRC entered into a number of consultancies, mainly with its existing end-user partners. The Victorian Department of Environment, Land, Water and Planning further extended its contract research program that began with the Bushfire CRC, across several projects on fire behavior and fuels, planned burning, bushfire smoke dispersal and remote sensing. This work complements the work of the CRC under the Commonwealth Agreement.

MALAYSIA DISASTER MANAGEMENT

At the request of the Australian High Commission and the Academy of Sciences, the CEO, Dr Richard Thornton, visited Malaysia, accompanied by CRC researcher Martin Wehner of Geoscience Australia.

The aim of the trip was to link Australian researchers with researchers in Malaysia. In this case it was in the area of disaster management, and in particular floods. Presentations and discussions took place at the UTM (Universiti Teknologi Malaysia) in Johor; at UMT (Universiti Malaysia Terengganu) and at the Razak School of Government in Putrajaya. They also visited the newly created National Disaster Management Centre.

ASIAN COMMUNICATION

The first Asia regional workshop on Science, Health, Environment and Risk Communicaiton was held in Jakarta, Indonesia, in December 2015. Communications Manager David Bruce (above)participated for the CRC at the invitation of the organisers, led by the Association of Academies and Societies of Sciences in Asia and the Indonesian Academy of Sciences with the support of the Australian Academy of Sciences, to talk about how the CRC communicates its science to its partners and to the public.

STAFF LINKS

The CEO, Dr Richard Thornton, is a member of the National Flood Risk Advisory Group, a sub-group of the Council of Australian Governments (COAG) Australia and New Zealand Emergency Management Committee, which reports to the Law, Crime and Community Safety Ministerial Council. He was a Board member on the International Association of Wildland Fire and Chair of the Editorial Advisory Committee for the *International Journal of Wildland Fire* up to January 2016. He is also a member of the Forest Fire Management Group, a committee of Australian and New Zealand land management agencies reporting to the Forest Products Committee of COAG; a member of the Victoria University Industry Advisory Board for the Centre for Environmental Safety and Risk Engineering; a member of the CRC Association Board; and a member of the National Judging Panel for the Disaster Resilient Australia Awards.

The Research Director, Dr Michael Rumsewicz, is on the International Advisory Board of the University of Melbourne Centre for Disaster Management and Public Safety, and is a member of the Assessment Group for the New Zealand Natural Hazards Research Platform.

The Communications Manager, David Bruce, is a Board member on the International Association of Wildland Fire and is Chair of the Editorial Advisory Committee for *Wildfire*, the magazine of the International Association of Wildland Fire.

COLLABORATIONS AND CONNECTIONS

Collaborations between end-users and researchers include:

AFAC15

The CRC and AFAC co-hosted the annual conference in Adelaide in September 2015, along with the South Australia Country Fire Service, State Emergency Service and Department of Environment, Water and Natural Resources.

The CRC was prominent throughout the conference and in particular at the Research Forum, which attracted a record high 460 participants. CRC researchers featured throughout the whole conference program. The full conference attracted more than 1,500 people and the CRC shared a prominent display in the exhibition hall, engaged with the media and was promoted heaviliy on social media, with the conference trending nationwide on Twitter.

RESEARCH ADVISORY FORUMS

These forums were held in Brisbane in November 2015 in conjuction with Queensland University of Technology and in May 2016 in Hobart, hosted by end-user partners the Tasmania Fire Service and Tasmania Parks and Wildlife.

The two-day events provided the opportunity for CRC partners, project leaders and end-users to gain a complete overview of all of the research activities within the CRC, and through workshop activities continue the process of reviewing project progress, shaping the future direction of each project. Around 120 people attended each RAF, with roughly half researchers and half end-user representatives.

SOUTHERN AND NORTHERN AUSTRALIA FIRE MANAGERS FORUMS

The forums were convened by the CRC in Perth, with the WA Department of Parks and Wildlife and the WA Department of Fire and Emergency Services; in Cairns with the Queensland Fire and Emergence Services (QFES); and in Alice Springs with Bushfires NT (above).

These forums include participation from AFAC, the Bureau of Meteorology, many universities and all fire and land management agencies across the region to discuss issues of local and national relevance. The national Bushfire Seasonal Outlooks were formulated and released in conjunction with these forums. These Outlooks are used by fire and emergency service agencies to work with state and federal governments to prepare resources for the bushfire season.

NATIONAL RESEARCH AGENDA

A series of workshops were conducted with end-user stakeholders to explore major issues across hazards, resilience and the community. The purpose of the workshops was to identify the critical issues that could be addressed by research. The outcomes of these workshops will influence the future research program of the CRC and inform the development of a national natural hazards emergency management research agenda. The workshops were mostly conducted in collaboration with organisations that are major representative stakeholders, including AFAC, ANZEMC sub-committees and working groups, and the Bureau of Meteorology.

DISASTER MANAGEMENT

The CRC was a key partner in the annual Australian and New Zealand Disaster and Emergency Management conference on the Gold Coast in May 2016, coordinating a research stream that featured many CRC scientists and PhD students. The CRC has been a conference partner for the last two years, along with other not-for-profit organisations the Australian Institute of Emergency Services, the Australian and New Zealand Mental Health Association Inc. and the Association for Sustainability in Business Inc.

RESILIENT CITIES

The CRC Association conference in Brisbane in March 2016 featured a panel session on Resilient Cities that was recorded by ABC Radio National. QFES Commissioner Katarina Carroll represented the CRC on the panel, and discussed the important role research plays in ensuring Brisbane is resilient from natural hazards. The panel aired on the Big Ideas program on 4 April, and is available as a podcast from the Radio National website.

KOREAN WILDFIRE

The CEO, Dr Richard Thornton, attended the October 2015 International Wildland Fire Conference in Korea, which is supported by the United Nations International Strategy for Disaster Reduction, United Nations Food and Agriculture Organisation, and the US Forest Service. It was attended by around 400 people and provided an opportunity to network with many senior fire managers, particularly from the US, Canada, Europe and South Africa. The CRC and AFAC were sponsors of this event as Gary Morgan (former CEO of the Bushfire CRC) was on the organising committee.

FIRE AND FUELS

The CRC played a significant role in the Melbourne component of the International Association of Wildland Fire's (IAWF) Fire Behaviour and Fuels conference in April 2016. As the IAWF is an important association in the international fire community, support for the conference increased the CRC's global links. The conference was held concurrently in both Melbourne with 280 participants, and Portland, Oregon, with 350 participants. The CRC was promoted at both venues and a large proportion of the papers presented in Melbourne were by CRC researchers.

RURAL FIRE

The CRC was prominent at the Forest and Rural Fire Association of New Zealand Conference in Blenheim, New Zealand, in August 2015. The conference heard from CRC researcher Dr Michael Eburn (ANU) on the legal implications of workplace legislation and from former Bushfire CRC CEO Gary Morgan on how to apply the research outputs that are currently available.

"WHAT OUR PARTNERS SAY"

Suellen Flint, Director Community Engagement, Department of Fire and Emergency Services, Western Australia

The interaction between DFES personnel involved in this program and the CRC's northern training project has been extremely positive and reconfirms the agency's initial support for the project. There is a strong sense among north Australian fire and emergency managers, land holders and remote community leaders that this is an idea whose time has come.

Other partner conference support:

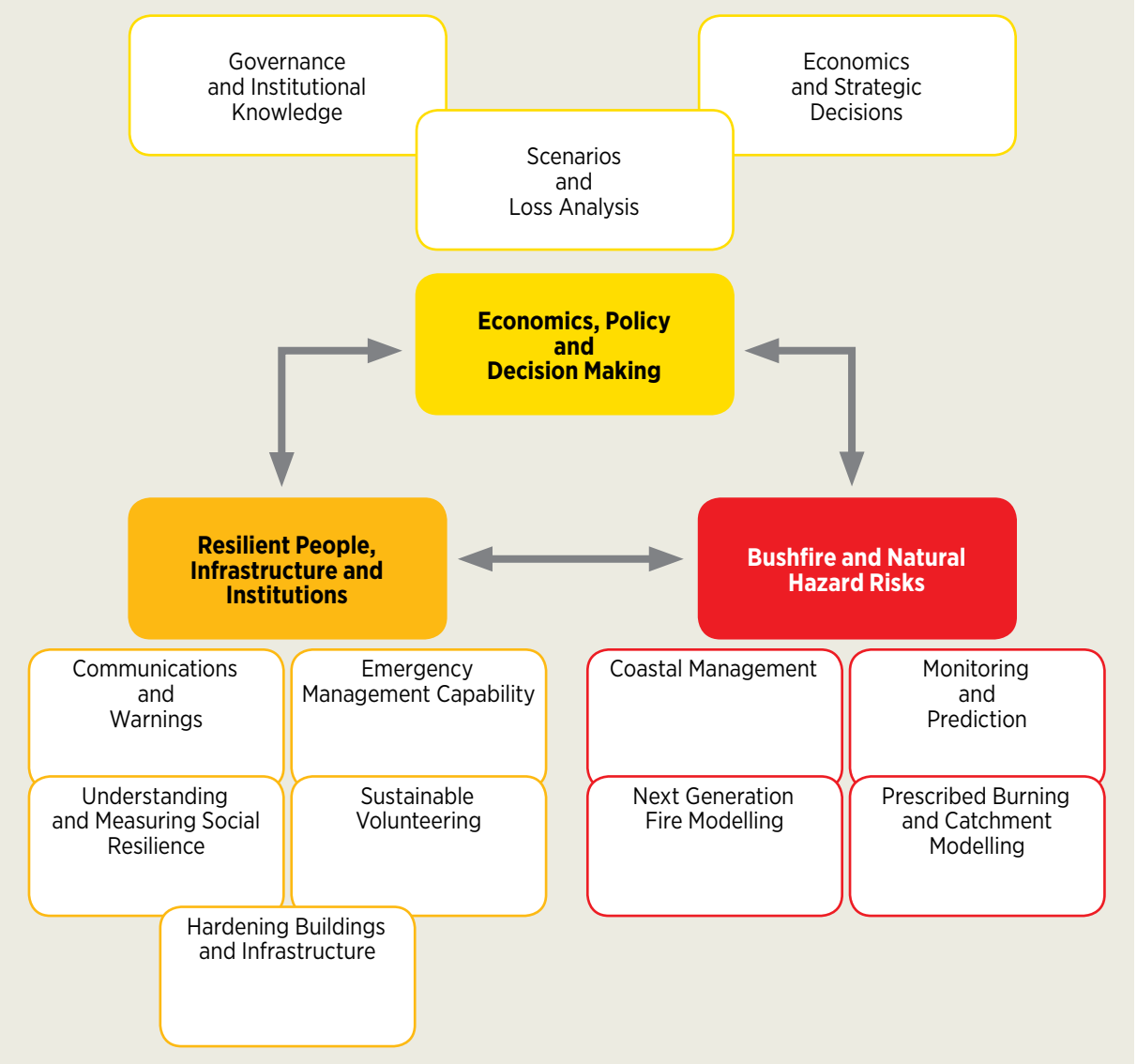
- Emergency Management Conference, Melbourne, July 2015
- 8th Australasian Natural Hazards Management Conference, Perth, October 2015
- Emergency Media and Public Affairs conference, Melbourne, May 2016
- Floodplain Management Conference, Shoalhaven, May 2016
- NSW Rural Fire Service community engagement conference, Albury, May 2016
- Plus many rural fire and emergency service regional conferences in NSW, Queensland, South Australia, Western Australia, Tasmania and Victoria.

AWARDS AND COMMENDATIONS

Bushfire and Natural Hazards CRC researchers were recognised for their work:

- A/Prof Kevin Tolhurst was recognised for his long and outstanding career as a fire scientist by the International Association of Wildland Fire. A/Prof Tolhurst, (pictured right with IAWF Vice President Alen Slijepcevic), from the University of Melbourne, was given the Ember Award for sustained achievement in wildland fire science. He also received a Queens Birthday Honour, becoming a Member of the Order of Australia (AM).
- Andrew Gissing, Dr Katharine Haynes and Lucinda Coates from Risk Frontiers at Macquarie University received a highly commended award for their presentation at the 2016 Floodplain Management Australia conference. Their paper, 'An Analysis of Human Fatalities from Flood Hazards in Australia 1900-2015', was based on their comprehensive study of all flood related deaths that have occurred in Australia since 1900.
- PhD student Houzhi Wang was awarded the best paper prize after presenting his research at the Australian Combustion Symposium in Melbourne in December 2015. Houzhi presented his paper on the effects of smouldering combustion on the initiation and spread of bushfires. Houzhi is completing his PhD at the University of Adelaide.
- The Tasmania Fire Service was recognised at a national level for its Bushfire-Ready Neighbourhoods program, which is support by CRC science. The program was awarded in the emergency services category of the 2015 International Association of Public Participation Awards. The program was also granted a 2015 Resilient Australia Award, recognied as a best practice initiative that builds disaster resilience in Australia. The program focuses on building a shared responsibility approach to bushfire preparedness and was developed in collaboration with the University of Tasmania and the Bushfire CRC.
- Prof Kevin Ronan from CQUniversity was awarded the Bushfire and Natural Hazards CRC 2015 Outstanding Achievement Award (pictured on page 22 with CRC CEO Dr Richard Thornton). The award was in recognition of research leadership to advance the international standing of the CRC, with Prof Ronan's project work and his work on the United Nations Sendai Framework for Disaster Risk Reduction.
- Prof Ronan, along with his colleague, Dr Kirrilly Thompson, were also recognised by CQUniversity for their outstanding research efforts and commitment. The pair were acknowledged as part of the Vice Chancelor's Awards for Outstanding Researchers.

RESEARCH



The primary activities this year have been the consolidation of the research program, review of progress to date, and commencement of processes towards refreshing the research program in 2017.

The conduct of active research and data gathering across all projects and postgraduate work was reinforced by outputs including:

- Seven book chapters
- 57 journal papers
- 79 conference papers
- 92 reports

The research program (the full program is online at www.bnhcrc.com.au/research) broadly takes in the policy objectives of the COAG-endorsed National Strategy for Disaster Resilience and is structured around three themes:

- Economics, policy and decision-making
- Resilient people, infrastructure and institutions
- Bushfire and natural hazard risks

As of July 2015, 38 projects were underway. An additional bushfire risk research project commenced later in the year.

Integrated project teams of researchers and end-users ensure the projects continue to be informed by and remain focused on the needs of our partner organisations. Ongoing and active engagement between researchers and end-users is crucial to the success of each project.

End-user representatives are essential to long-term project success through:

- Framing of research questions, development of a common language within the Integrated Project Team, on-going review of the research questions, facilitating access to data/information/people to support project goals, identification of potential use of research outputs, and the development of a roadmap taking the research through to utilisation.

"WHAT OUR PARTNERS SAY"

Greg Nettleton, Chief Officer, South Australian Country Fire Service

CRC research utilisation has contributed significantly in decision making and community and firefighter safety during South Australia's most recent bushfires. Fire spread modelling, using the Phoenix Rapidfire model, allowed CFS to issue timely warnings to Adelaide's peri-urban communities during the Sampson Flat bushfire in January 2015. Residents in the fire-affected area were well prepared because CRC research was embedded in materials and planning tools designed to inform and prepare communities.

- Providing advice to the project, as it develops, on how the research can be made more valuable to end-users.

The number of end-user participants varies from two to 15 across the projects.

The end-user representatives on projects, wherever possible, involves representation from:

- Across the country, namely states and territories
- Across agencies focused on various hazards, namely fire and emergency services agencies
- Across different types of participants, such as policy departments, operational agencies and non-government organisations.

The spread of representation is important to the success of the CRC in delivering nationally valuable research outcomes.

Photo: Geoff Cary

EDUCATION

A key goal of the CRC is to build the capacity and capability of the sector to undertake high quality research through highly skilled researchers. With an eye to the future, the CRC is building this capacity by developing a new cohort of researchers, offering an education program to attract postgraduate students working on natural hazards science.

At the end of this reporting period the CRC had 79 PhD students, more than doubling its target of providing support to 34 PhD students for the life of the CRC.

The CRC is also on track to meet the target of 28 student completions by June 2018, with seven students already completing their PhD studies.

Of these, three completed in 2014/15 and four completed in 2015/16.

Students are involved as either scholarship recipients or as associate students – both have the opportunity to engage with industry leaders and gain an understanding of the sector though their involvement with the CRC. Each scholarship recipient is required to have an end-user sponsor who has indicated the project has relevance to the industry and that their organisation is interested in the outcomes.

End-users also provide the opportunity for placements, where students are immersed in an organisation to gain an understanding of how research is used in an emergency management context.

To support the students, the CRC runs a variety of events centred on learning and networking. The annual conference and twice-yearly Research Advisory Forums and industry working groups (run by partner organisation AFAC) are key gatherings where students have the opportunity to present their findings. A number of students have also received CRC support to present their research at international conferences.

Students have been trained in presentation skills to promote their research using the Three-Minute Thesis format. Their presenations were incorporated into the programs at key industry forums and conferences.

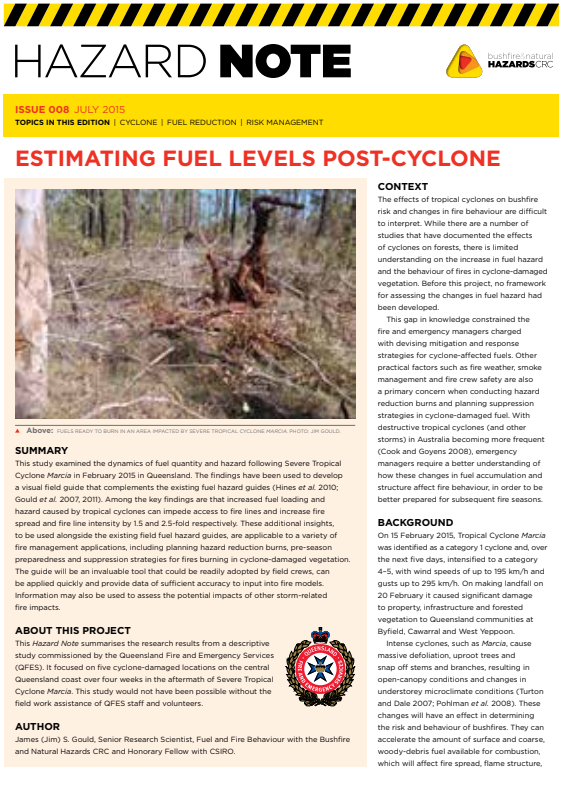
See page 37 for a list of all postgraduate students.

“WHAT OUR PARTNERS SAY”

Liam Fogarty, Director of Knowledge and Engagement, Department of Environment, Land, Water and Planning, Victoria

In terms of the maturity in the sector, so much of the science is now embedded and what we are now looking at now is what that actually means for the community, and to bring in other technologies such as intelligence technologies and a much more dynamic understanding of situations. And linking that to dynamic forward predicting models.

ENGAGING WITH INDUSTRY



HAZARD **NOTE**

bushfire and natural HAZARDS CRC

ISSUE 008 JULY 2015
TOPICS IN THIS EDITION | CYCLONE | FUEL REDUCTION | RISK MANAGEMENT

ESTIMATING FUEL LEVELS POST-CYCLONE

▲ **Above:** FUELS READY TO BURN IN AN AREA IMPACTED BY SEVERE TROPICAL CYCLONE *MARCIA*. PHOTO: JIM GOULD.

SUMMARY

This study examined the dynamics of fuel quantity and hazard following Severe Tropical Cyclone *Marcia* in February 2015 in Queensland. The findings have been used to develop a visual field guide that complements the existing fuel hazard guides (Hines *et al.* 2010; Gould *et al.* 2007, 2011). Among the key findings are that increased fuel loading and hazard caused by tropical cyclones can impede access to fire lines and increase fire spread and fire line intensity by 1.5 and 2.5-fold respectively. These additional insights, to be used alongside the existing field fuel hazard guides, are applicable to a variety of fire management applications, including planning hazard reduction burns, pre-season preparedness and suppression strategies for fires burning in cyclone-damaged vegetation. The guide will be an invaluable tool that could be readily adopted by field crews, can be applied quickly and provide data of sufficient accuracy to input into fire models. Information may also be used to assess the potential impacts of other storm-related fire impacts.

ABOUT THIS PROJECT

This *Hazard Note* summarises the research results from a descriptive study commissioned by the Queensland Fire and Emergency Services (QFES). It focused on five cyclone-damaged locations on the central Queensland coast over four weeks in the aftermath of Severe Tropical Cyclone *Marcia*. This study would not have been possible without the field work assistance of QFES staff and volunteers.

AUTHOR

James (Jim) S. Gould, Senior Research Scientist, Fuel and Fire Behaviour with the Bushfire and Natural Hazards CRC and Honorary Fellow with CSIRO.

CONTEXT

The effects of tropical cyclones on bushfire risk and changes in fire behaviour are difficult to interpret. While there are a number of studies that have documented the effects of cyclones on forests, there is limited understanding on the increase in fuel hazard and the behaviour of fires in cyclone-damaged vegetation. Before this project, no framework for assessing the changes in fuel hazard had been developed.

This gap in knowledge constrained the fire and emergency managers charged with devising mitigation and response strategies for cyclone-affected fuels. Other practical factors such as fire weather, smoke management and fire crew safety are also a primary concern when conducting hazard reduction burns and planning suppression strategies in cyclone-damaged fuel. With destructive tropical cyclones (and other storms) in Australia becoming more frequent (Cook and Goyens 2008), emergency managers require a better understanding of how these changes in fuel accumulation and structure affect fire behaviour, in order to be better prepared for subsequent fire seasons.

BACKGROUND

On 15 February 2015, Tropical Cyclone *Marcia* was identified as a category 1 cyclone and, over the next five days, intensified to a category 4–5, with wind speeds of up to 195 km/h and gusts up to 295 km/h. On making landfall on 20 February it caused significant damage to property, infrastructure and forested vegetation to Queensland communities at Byfield, Cawarral and West Yeppoon.

Intense cyclones, such as *Marcia*, cause massive defoliation, uproot trees and snap off stems and branches, resulting in open-canopy conditions and changes in understorey microclimate conditions (Turton and Dale 2007; Pohlman *et al.* 2008). These changes will have an effect in determining the risk and behaviour of bushfires. They can accelerate the amount of surface and coarse, woody-debris fuel available for combustion, which will affect fire spread, flame structure,

SUBSCRIBE | All *Hazard Notes* are available at www.bnhcrc.com.au/hazardnotes Share on:

The CRC has extensive engagement activities with large and small-to-medium enterprises.

The overall strategic plan for the CRC, as well as the specific strategies for Research Utilisation and for Communications, includes industry engagement as a prime objective.

Industry engagement highlights include:

- The CRC participated in its second annual conference with AFAC in Adelaide in September 2015 with a trade display of 112 exhibitors from the broader industry, the majority of which were enterprises active in both New Zealand and Australia. The conference also attracted significant corporate sponsorship, including a long-term principal sponsor relationship with global vehicle manufacturer Scania and sponsorship of the Knowledge Lounge by international fire protection equipment maker Dräger.
- The CRC participates and supports a calendar of engagement events that includes several emergency management and operations conferences, regional volunteer events and industry specific conference and activities. All these events involve significant participation from local and regional industries.

- The Fire Protection Association Australia (FPAA), which represents more than 5000 enterprises, is a contributing member of the CRC and actively promotes CRC research to its members.
- *Fire Australia* is a quarterly magazine published jointly by the Bushfire and Natural Hazards CRC, AFAC, and FPAA and is distributed to all members of these organisations and to the broad fire and emergency services sector.
- *Hazard Notes*, the CRC's research briefing papers, are publically available online and are distributed through an extensive email database that includes industry, associations, rural fire brigades, SES units, and regional councils. They are also shared on social media.

ENGAGING WITH INDUSTRY

COMMUNICATING THE RESEARCH

The communications priorities over the last 12 months were:

- Building a public and industry profile in targeted events, publications and in the general media.
- Providing training to researchers and postgraduate students to be better communicators and presenters of their research in different forums.
- Creating and distributing publications and products on CRC research.
- Developing a comprehensive website with access to publications and other research activities.
- Expanding a social media presence to reach a wide range of audiences.

This year was marked by an increase in the exposure of the CRC through research-focused events, publications and online activity. The chief benefit of promoting this research was the direct connection made with people interested in the outcomes of the research program, and to encourage them to get involved, be engaged, and follow the progress of the CRC.

To support this exposure, the CRC provided researchers and PhD students with the opportunity to improve their presentation skills. The importance of this skill is often overlooked in organisations seeking a higher profile with partners and the public. For the annual conference, all presenters were offered one-on-one support to prepare their presentations. More than 30 students were given training and an opportunity to present to a large audience in the Three Minute Thesis format – a short and focused format that forces the presenter to order their thoughts on their research in a logical, accessible way.

Evidence of the success of this has been in the increased end-user participation at the project level, and the increase in followers on social media and subscribers to CRC publications.

For the media, the CRC research is highly topical and relevant across hazards such as fire, flood, storm, earthquake and cyclone. With experts across all of these areas, the CRC is well positioned to provide expert media comment that supports agency partners.

Peak times centre around the CRC's *Southern Australia Seasonal Bushfire Outlook*, the Research Forum and annual conference, major hazard events (prominently bushfires and cyclones over the summer months) and the *Northern Australia Seasonal Bushfire Outlook*.

Numerous television, radio and website interviews have focused on the science emerging from various projects. All these media items are linked to the CRC website. Media coverage was generated through the efforts of the communications team and in conjunction with university and research partners in newspapers, TV, radio and online.

COMMUNICATING THE RESEARCH

Industry and trade media are key media partners, with the CRC contributing regular articles on the latest research findings and developments in *The Australian Journal of Emergency Management, Asia Pacific Fire* (UK based), *Wildfire* (US based), the New South Wales Rural Fire Service's *Bush Fire Bulletin*, the Victorian Country Fire Authority's *Brigade*, and many other partner publications. CRC research was also cited in numerous publications by the Climate Council.

See page 43 for a list of key media mentions.

Partners and the broader community are kept in touch with research developments and other ongoing activities in a monthly enewsletter, *Hazard News*. The research briefing paper series, *Hazard Notes*, are plain-language summaries that are regularly published on project and cluster level research activities along with video interviews of researchers and partner participants.

Social media is a key communication tool, with Facebook, Twitter, YouTube, Linked In and SoundCloud used regularly to engage with the community. An active engagement strategy throughout the year has seen both the popularity and interactivity of the CRC's social media channels increase. Collaborating closely with our partners, both research organisations and emergency services, has seen the reach of CRC posts on social media extend considerably.

The CRC's YouTube channel continues to grow, with new videos added from important CRC events, such as our annual conference and the International Day for Disaster Reduction, as well as project updates for end-users that are linked to *Hazard Note* editions. These videos are embedded on the CRC website, partner websites (including the United Nations) and shared via other CRC social media platforms.

GOVERNANCE AND FINANCE

Board members (back row from left) Commissioner Craig Lapsley, CEO Dr Richard Thornton, Prof Alistar Robertson, Stuart Ellis, Lee Johnson, (front row from left) Kathy Gramp, Naomi Stephens, Dr Laurie Hammond, Katherine Jones and Karl Sullivan.

The Bushfire and Natural Hazards CRC is an incorporated not for profit public company limited by guarantee. The company was registered in May 2013 and began formal CRC operations on 1 July 2013.

BOARD MEETINGS

DATE	CITY
July 2015	Darwin
October 2015	Teleconference
December 2015	Hobart
February 2016	Brisbane
May 2016	Melbourne

GOVERNING BOARD MEMBERS

NAME	ROLE	KEY SKILLS	INDEPENDENT/ORGANISATION	APPOINTMENTS/ RESIGNATIONS	ATTENDANCE
Dr Laurie Hammond	Chairman	Governance and strategy	Independent	Appointed August 2013	5 out of 5
Mr Stuart Ellis	Director	Industry based skills	AFAC	Appointed June 2013	5 out of 5
Ms Kathy Gramp	Director	Finance and governance	Independent	Appointed December 2013	5 out of 5
Mr Lee Johnson	Director	Industry based skills	Independent	Appointed December 2013	5 out of 5
Commissioner Craig Lapsley	Director	Industry based skills	Emergency Management Victoria	Appointed December 2013	3 out of 5
Ms Katherine Jones	Director	Industry based skills	Attorney-General's Department	Appointed November 2015	3 out of 3
Prof Alistar Robertson	Director	Research	Independent	Appointed December 2013	4 out of 5
Mr Tony Sheehan	Director	Industry based skills	Attorney-General's Department	Resigned November 2015	2 out of 2
Ms Naomi Stephens	Director	Industry based skills	Office of Environment and Heritage, NSW	Appointed December 2013	4 out of 5
Mr Karl Sullivan	Director	Industry based skills	Insurance Council of Australia	Appointed November 2015	3 out of 3

GOVERNANCE

The Governing Board met five times throughout the year, with each meeting held in a different capital city. Each meeting was held in conjunction with an informal stakeholder partner event to enable the Board to meet with members, end-users, researchers, students and other key stakeholders. The Board is chaired by an independent director, Dr Laurie Hammond. The Chief Executive Officer is Dr Richard Thornton.

The Board has two commitees that each meet at least twice a year:

- **Audit Risk and Compliance Committee** – oversees corporate governance, audit responsibilities, finance, compliance and risk management.
- **Research and Utilisation Committee** – ensures research conducted meets the strategic aims of the CRC and the needs of end-users, and is responsible for providing strategic advice on the overall development of the CRC's postgraduate program and new educational initiatives. The committee also advises on the strategy for research adoption.

The CRC is in a sound financial position and met all of its key financial goals during the year. It is well placed to continue delivering research for the remainder of the program.

The company audit was conducted by Deloitte Touche Tohmatsu and no adverse issues were identified. The auditors provided an unqualified audit report. The Audit Risk and Compliance Committee met regularly during the course of the year and actively managed the CRC's audit and compliance program.

2015/16 saw an increase in turnover from the previous period as the research program continued to accelerate. This acceleration in research was reflected in research expenditure with an increase of 27 percent from $9.90m last year to $12.60m this year.

STAFF

NAME	POSITION/ROLE	TIME
Dr Richard Thornton	Chief Executive Officer	1.0
Dr Michael Rumsewicz	Research Director	1.0
Mr David Bruce	Communications Manager	1.0
Mr Trevor Essex	Company Secretary/Business Manager	0.3
Leanne Beattie	Executive Assistant	1.0
Desiree Beekharry	Projects Officer	0.5
Lyndsey Wright	Contract Research and Education Manager	1.0
Nathan Maddock	Senior Communications Officer	1.0
Vaia Smirneos	Communications Officer (Events)	1.0
Matthew Hayne	Research Utilisation Manager	0.5
Loriana Bethune	Research Utilisation Officer	1.0
Kate Eagles	Financial Controller	0.3
Anna Nikitina	Finance Officer	0.3
Freya Jones	Communications Officer	0.2

PARTICIPANTS

PARTICIPANT NAME	PARTICIPANT TYPE	ORGANISATION TYPE
Attorney-General's Department	Essential	Australian Government
Bureau of Meteorology	Essential	Australian Government
Geoscience Australia	Essential	Australian Government
ACT Emergency Services Agency	Essential	State Government
ACT Territory and Municipal Services	Essential	State Government
Fire and Rescue NSW	Essential	State Government
NSW Rural Fire Service	Essential	State Government
NSW State Emergency Service	Essential	State Government
Office of Environment and Heritage, NSW	Essential	State Government
Bushfires NT	Essential	State Government
NT Fire and Rescue Service	Essential	State Government
Inspector-General Emergency Management, Qld	Essential	State Government
Queensland Fire and Emergency Services	Essential	State Government
Country Fire Service, SA	Essential	State Government
Department of Communities and Social Inclusion, SA	Essential	State Government
Department of Environment, Water and Natural Resources, SA	Essential	State Government
Department of Planning, Transport and Infrastructure, SA	Essential	State Government
Metropolitan Fire Service, SA	Essential	State Government
SA Fire and Emergency Service Commission	Essential	State Government
SA State Emergency Service	Essential	State Government
Tasmania Fire Service	Essential	State Government
Tasmania State Emergency Service	Essential	State Government
Country Fire Authority, Vic	Essential	State Government
Department of Environment, Land, Water and Planning, Vic	Essential	State Government
Emergency Management Victoria	Essential	State Government
Inspector-General for Emergency Management, Vic	Essential	State Government
Metropolitan Fire and Emergency Services Board	Essential	State Government
Victoria State Emergency Service	Essential	State Government
Department of Fire and Emergency Services, WA	Essential	State Government

PARTICIPANTS

PARTICIPANT NAME	PARTICIPANT TYPE	ORGANISATION TYPE
Department of Parks and Wildlife, WA	Essential	State Government
New Zealand Fire Service Commission	Essential	International
Australian National University	Essential	University
Charles Darwin University	Essential	University
CQUniversity	Essential	University
Deakin University	Essential	University
James Cook University	Essential	University
Macquarie University	Essential	University
Monash University	Essential	University
Queensland University of Technology	Essential	University
RMIT University	Essential	University
University of Adelaide	Essential	University
University of Melbourne	Essential	University
University of New England	Essential	University
University of NSW	Essential	University
University of Southern Queensland	Essential	University
University of Sydney	Essential	University
University of Tasmania	Essential	University
University of Western Australia	Essential	University
University of Wollongong	Essential	University
Victoria University	Essential	University
Western Sydney University	Essential	University
AFAC	Other	Industry
Australian Red Cross	Other	Industry
Fire Protection Association Australia	Other	Industry
Flinders University	Other	University
RSPCA Qld	Other	Industry
University of Canberra	Other	University
Volunteering Queensland	Other	Industry

STUDENTS

STUDENTS

SCHOLARSHIP STUDENTS

NAME	UNIVERSITY	PHD COMMENCEMENT	ANTICIPATED COMPLETION DATE	PROJECT NAME	CLUSTER ALIGNMENT
Timothy Ramm	Tasmania	Feb-15	Aug-18	Advancing long-term planning and decision analysis to improve the resilience of communities against changing coastal risk	**Coastal management**
Andrew Clarke	Central Queensland	Feb-16	Aug-19	An evaluation of key fire safety messages and their efficacy when applied under varying degrees of stress	**Communications and warnings**
Avianto Amri	Macquarie	Jul-14	Dec-17	A cross cultural investigation of child-centred disaster risk reduction and climate change adaptation in Indonesia and Australia	
Kamarah Pooley	QUT	May-15	Dec-18	Preventing youth misuse of fire in New South Wales: An empirical evaluation.	
Matthew Henry	Central Queensland	Jan-16	Jul-19	Comprehensive school safety: developing a framework for the Australian school setting	
Mayeda Rashid	Central Queensland	Jul-15	Dec-18	Child-centred disaster risk reduction: achievements, challenges and scope	
Melanie Baker-Jones	QUT	Feb-14	Aug-17	Web 2.0 in disaster and emergency: a risk assessment of tortious liability	
Miles Crawford	Massey	Jun-15	Nov-18	How risk informs emergency management: A study of the interface between risk modelling for tsunami inundation and emergency management measures	
Rachel Westcott	Western Sydney	Mar-14	Oct-17	The interactions between emergency responders and animal owners in bushfire: improving community preparedness and response outcomes	
Stephen Sutton	Charles Darwin	Jan-15	Jun-18	Cultural drivers of disaster response behaviour and their cross-cultural applicability	
Charles Newland	Adelaide	Mar-14	Oct-17	Improved calibration of spatially distributed models to simulate disaster risk	**Economics and strategic decision**
Graeme Riddell	Adelaide	Feb-14	Oct-17	Methods to develop long term, efficacious risk mitigation policies	
Roozbeh Hasanzadeh Nafari	Melbourne	Jul-14	Feb-18	Flood damage assessment in urban areas	

STUDENTS

NAME	UNIVERSITY	PHD COMMENCEMENT	ANTICIPATED COMPLETION DATE	PROJECT NAME	CLUSTER ALIGNMENT
Heather Bancroft	Melbourne	Jun-14	Dec-17	The impact of individual factors, the operational and organisational resources and demands on mental health outcomes	**Emergency management capability**
Sarah Hall	Deakin	Apr-14	Nov-17	Fire and emergency service workers operating on call: the effect on stress and sleep	
Caroline Wenger	ANU	Jun-14	Dec-17	Flood management in a changing climate: integrating effective approaches	**Governance and institutional knowledge**
Graham Dwyer	Melbourne	Mar-14	Nov-16	We have not lived long enough: sense-making and learning from bushfire in Australia	
Susan Hunt	ANU	Feb-14	Aug-17	The National Strategy for Disaster Resilience: getting it right from top to bottom	
Amila Prasanna Dissanayake	RMIT	Jul-15	Jan-19	Resilience models for steel bridges exposed to accidental and bushfire	**Hardening buildings and infrastructure**
Farook Kaledher	RMIT	Jul-13	Jan-17	Synthetic damage curves for concrete girder bridges under flood hazard	
Korah Parackal	James Cook	Mar-15	Sep-18	An analytical technique for determining the redistribution of structural load effects with increasing wind loads	
Maryam Nasim	RMIT	Jul-15	Jan-19	Investigation into the behaviour of a U-slab bridge due to flood	
Mitchell Humphreys	James Cook	Feb-16	Aug-19	Internal pressure fluctuations in industrial type sheds	
Ryan Hoult	Melbourne	Mar-13	Nov-16	Seismic assessment and design philosophy of reinforced concrete in Australia	
Alexander Holmes	Monash	Mar-15	Mar-17	Investigating the effects of soil moisture, temperature and precipitation extremes on fire risk and intensity in Australia	**Monitoring and prediction**
Ashley Wright	Monash	Mar-14	Oct-17	Improving flood forecasting skill using remote sensing data	
Bryan Hally	RMIT	Feb-15	Aug-18	Attribution of active fire using simulated fire landscapes	
Gabriella Raducan	RMIT	Mar-14	Nov-17	Impacts of bushfire on water quality	

STUDENTS

NAME	UNIVERSITY	PHD COMMENCEMENT	ANTICIPATED COMPLETION DATE	PROJECT NAME	CLUSTER ALIGNMENT
James Furland	Tasmania	Aug-15	Sep-18	Characterising fire behaviour in Tasmania's wet forest types though improved models	
Mercy Ndalila	Tasmania	Feb-15	Jul-18	Pyrogeography of Tasmania - understanding how vegetation type and bushfire history influence fuel types and smoke emissions	
Narsimha Garlapati	ANU	Feb-15	Aug-18	Mapping forest fuel load and structure from airborne LiDAR data	
Yang Chen	Monash	Aug-13	Feb-17	Modelling forest fuel hazard change over time using LiDAR technology	
Christopher Thomas	UNSW (ADFA)	Sep-14	Aug-17	An investigation of the dynamics of fire interactions using a coupled fire atmosphere model	**Next generation fire modelling**
Michael Story	Wollongong	Mar-16	Aug-19	Empirical analysis of spotfire and ember behaviour during extreme fire weather conditions	
Rachel Quill	UNSW (ADFA)	Jan-14	Jul-17	Spatial-statistical characterisation of wind fields over complex terrain for bushfire modelling applications	
Rahul Wadwhani	Victoria	Jan-15	Jun-18	Refinement of the sub models of pyrolysis and firebrand transport and undertaking experiments to validate those for a physics-based bushfire prediction model	
Grigoris Goldberg	Charles Darwin	Dec-14	May-18	Remote sensing of tree structure and biomass in north Australian mesic savanna	**Prescribed burning and catchment management**
Heather Simpson	Wollongong	Jul-15	Dec-18	Productivity and effectiveness of suppression resources and tactics on campaign fires	
Houzhi Wang	Adelaide	Sep-14	Sep-17	Initiation of biomass smouldering combustion	
Katherine van Wezel	Charles Darwin	Mar-15	Aug-18	Including women in fire management on Waanyi and Garawa lands	
Megram (Clare) Yu	Sydney	Mar-15	Sep-18	Modelling the effect of fire on the hydrological cycle	
Emma Singh (nee Phillips)	Macquarie	Jan-14	Oct-17	Disruption of critical infrastructure during natural disasters	**Scenario and loss analysis**
Thomas Kloetzke	Queensland	Jul-15	Jan-19	Measurement analysis and simulation of surface wind fields during land falling tropical cyclones	

STUDENTS

NAME	UNIVERSITY	PHD COMMENCEMENT	ANTICIPATED COMPLETION DATE	PROJECT NAME	CLUSTER ALIGNMENT
Bill Calcutt	Wollongong	Feb-14	Jul-17	Better understanding the primary motives for volunteering in Australian emergency services	**Sustainable volunteering**
Billy Haworth	Sydney	Aug-13	Feb-17	Volunteered geographic information, community engagement and bushfire preparation	
Fiona Jennings	RMIT	Aug-14	Jan-18	Community volunteering and disaster recovery	

ASSOCIATE STUDENTS

NAME	UNIVERSITY	PHD COMMENCEMENT	ANTICIPATED COMPLETION DATE	PROJECT NAME	CLUSTER ALIGNMENT
Tom Fitzgerald	Sydney	Aug-13	Dec-16	What is the acceptable risk in the coastal zone: perspectives on coastal hazards and decision making	**Coastal management**
Cathy Cao	Western Australia	Apr-11	Aug-16	Effective communication of household bushfire risk through web-based geovisualisation: considerations in content, representation and design	**Communications and warnings**
Kaitlyn Porter	QUT	Feb-16	Dec-18	What role could pharmacists play in optimising medicine management in humanitarian aid crises	
Ken Strahan	RMIT	Aug-13	Aug-17	Household decision making in bushfire self evacuation	
Lauren Kosta	Melbourne	Dec-13	Dec-16	Parenting after a disaster: experiences since Black Saturday	
Gretel Evans	Melbourne	Mar-14	Aug-17	The persistent past: flood, fire and migrant memories of natural disasters in Australia	**Economics and strategic decisions**
James Ricketts	Victoria	Mar-14	Mar-17	Understanding the nature of abrupt regional shifts in a changing climate	
Darryl Dixon	Charles Sturt	Jul-12	Feb-17	Emergency service exposure to asbestos	**Emergency management capability**
Sean Morling	RMIT	Jul-14	Dec-17	Developing a spatial approach to model sediment transfer in catchments affected by bushfire	
Daniel May	ANU	Mar-15	Sep-18	Taking fire: the political and cultural influence of indigenous burning in settler societies	**Governance and institutional knowledge**
Tetsuya Okado	Macquarie	Oct-12	Apr-17	Post disaster recovery following recent natural hazard events and risk reduction measures in Australia and Japan	

STUDENTS

NAME	UNIVERSITY	PHD COMMENCEMENT	ANTICIPATED COMPLETION DATE	PROJECT NAME	CLUSTER ALIGNMENT
Alan Green	Wollongong	Feb-14	Feb-17	Effective methods for improving the bushfire resilience of buildings	**Hardening buildings and infrastructure**
Anita Amirsardari	Melbourne	Jan-14	Jan-17	Assessing the seismic performance of reinforced concrete gravity moment resisting frames in Australia	
Bambang Setiawwan	Adelaide	Jul-13	Feb-17	Quantifying the seismic and site amplification characteristics of Adelaide's regolith	
Douglas Brown	Sydney	Mar-10	Oct-16	Bushfire risk perception. A study of the perceived vulnerability of domestic architecture in Australian bushfire prone areas	
Andrea Massetti	Monash	Mar-16	May-20	Towards an improved flood forecasting system using data assimilation	**Monitoring and prediction**
Antara Dasgupta	Monash	Jul-15	Jul-19	Towards an improved flood forecasting system using data assimilation	
Chathura Wickramsinghe	RMIT	May-15	May-18	Multi resolution, high temporal fire monitoring and intensity mapping using Himawari-8 advanced Himawari imager data	
Grant Pearce	Canterbury	Mar-14	Dec-17	NZ fire climate severity: relationships between climate circulation seasonal fire danger and fire occurrence	
Nicholas Read	Melbourne	Jan-14	Jul-17	Bushfire ignitions in Victoria	
Philip Stewart	Queensland	Apr-13	May-17	Changing fire regimes in the great sandy region of south eastern Queensland	
Sean Walsh	Melbourne	Jun-16	Nov-19	Combining fire, micro climate and vegetation models to predict the outcomes of hazard management practices in fine spatial resolution	
Vaibhav Gupta	RMIT	Jul-11	Jul-16	Remote sensing of fire severity in Australian dry sclerophyll forrest	
Wasim Chaivaranont	UNSW	Mar-14	Dec-17	Estimating wildfire fuel load from remotely sensed data	
Yang Zhang	UNSW	Sep-14	Mar-18	Understanding spatial patterns of wildfire occurrence in south eastern Australia	
Aeen Ashkani	Swinburne	Apr-14	Apr-19	A study on the key design factors that improve the experience of the elderly in temporary emergency shelter and village facilities	**Scenario and loss analysis**

STUDENTS

NAME	UNIVERSITY	PHD COMMENCEMENT	ANTICIPATED COMPLETION DATE	PROJECT NAME	CLUSTER ALIGNMENT
Diana Kuchinke	Federation	Dec-10	Dec-16	Effects of fire on the woodland birds of western Victoria	**Prescribed burning and catchment management**
Joji Abraham	Federation	Jan-15	Jun-18	Fire & heavy metals: when wild and controlled fires transform unrehabilitated mining waste	
Nicholai Popov	Wollongong	Feb-13	Nov-17	The impact of leadership development on organisational citizenship behaviour and social capital: An intervention using self determination theory	**Sustainable volunteering**
Vivien Froner	Wollongong	Sep-12	Sep-18	Leading with self determination theory	
Gemma Gray	Melbourne	Mar-14	Dec-16	Spontaneous volunteers in the emergency management sector: case study Queensland Mud Army and Christchurch Student Army	
Megan O'Donnell	ANU	Jan-13	Dec-16	Project effects of prenatal bushfire stress on life history traits in humans	**Understanding and measuring social resilience**
Oludolapo Taiwo Fakuade	Macquarie	Oct-12	Sep-17	Integrated disaster preparedness and response as a process for enhancing resilience.	

COMPLETED STUDENTS

NAME	UNIVERSITY	PHD COMMENCEMENT	COMPLETION DATE	PROJECT NAME
Alex Walkow	Deakin	Jan-12	Dec-15	Sleep restriction across a simulated firefighting deployment: the impact on acute stress response
Brianna Larsen	Deakin	Jan-12	Oct-15	Simulated self-paced fire suppression
Grace Vincent	Deakin	Feb-12	Oct-15	Fighting fires and fatigue
George Carayannopoulos	Sydney	Jun-11	Jul-16	Whole of government and crisis management, understandings coordination in a time of crisis
Rene van der Sant	Melbourne	Jun-11	May-16	Aridity index as a predictor of the hydrogeomorphic response of burnt landscapes
Veronique Florec	Western Australia	Jul-11	May-16	Economic analysis of prescribed burning for wildfire management in the south west of Western Australia
Steve Curnin	Tasmania	Jan-12	Jul-15	Spanning boundaries to support effective multi-agency coordination in emergency management

IN THE MEDIA

BUSHFIRE AND NATURAL HAZARDS CRC MEDIA MENTIONS, 1 JULY 2015 TO 30 JUNE 2016

- **28 August**, ABC TV Adelaide news, coverage of research on earthquake modelling for Adelaide by the *Using realistic disaster scenario analysis to understand natural hazard impacts and emergency management requirements* project.
- **21 August**, *Herald Sun* article on the *Child-centred disaster risk reduction* project.
- **31 August – 3 September**, coverage of the annual Bushfire and Natural Hazards CRC and AFAC conference on ABC TV news, Channel 7 news Adelaide, 891 ABC Adelaide, ABC Rural South Australia Country Hour, ABC Adelaide website and *The Adelaide Advertiser*.
- **1-2 September**, coverage of the *Southern Australia Seasonal Bushfire Outlook* on Channel 7 news, Channel 9 news, Channel 10 news, ABC TV news, SBS TV news, Sunrise, ABC TV News Breakfast, *The Australian, The Sydney Morning Herald, The Age, The Adelaide Advertiser, The Weekly Times*, ABC's The World Today, 666 ABC Canberra, 5AA Mornings Adelaide and Australia-wide ABC *Country Hour*.
- **18 September**, the CRC and its *Southern Australia Seasonal Bushfire Outlook* quoted in articles appearing in *The Daily Telegraph, Herald Sun, The Courier Mail* and *The Mercury*.
- **5 October**, the CEO discusses prescribed burning research on Radio National.
- **9 October**, CRC PhD student Heather Bancroft discusses the effect of bushfires on the mental health of firefighters on ABC WA *Country Hour*.
- **16 October**, research into a new fire danger rating system covered in *The Sydney Morning Herald* and *The Age*.

- **20 October**, *Canberra Times* article on ACT firefighters participating in the PhD research of CRC student Heather Bancroft on the effect of bushfires on the mental health of firefighters.
- **27 October**, research after the Sampson Flat fire in South Australia is covered on Channels 7, 9 and 10 in South Australia, as well as the ABC Adelaide website.
- **9 November**, updated *Southern Australia Seasonal Bushfire Outlook* for South Australia and Tasmania covered on Channels 7 and 9, Sky News, *The Adelaide Advertiser, The Mercury, The Examiner*, ABC Tasmania and ABC Rural South Australia Country Hour.
- **14 November**, updated *Southern Australia Seasonal Bushfire Outlook* covered on the *Weekend Australian* website.
- **24 November**, opinion piece by CRC PhD student Graham Dwyer appears on *The Age* website.
- **27 November**, ABC Adelaide online news coverage of the Pinery bushfire quotes the CEO discussing the worrying trend of Australian fire seasons starting earlier and lasting longer, and the need for communities to be prepared for fire for longer each year, not just in January and February.
- **13 December**, *Sydney Morning Herald* again covers the *Southern Australia Seasonal Bushfire Outlook*, with the NSW RFS Commissioner warning communities not to be complacent after rain.
- **1 January**, CEO a guest on ABC News Radio Mornings, discussing the need to build back smart from bushfires, floods and cyclones.
- **2 January**, CRC research released by CFS after the Sampson Flat fire in 2015, appeared on nightly TV news in South Australia.
- **3 January**, *Adelaide Advertiser* coverage of CRC research released by CFS after the Sampson Flat fire in 2015. CEO also quoted ABC online news discussing the need to build back smart from bushfires and that research is showing that most people are not prepared for a bushfire, but they are choosing to leave when threatened, rather than stay and defend.
- **9 January**, opinion piece by the CEO on the role national research is having on the safety of Australian communities across all hazards appears in *The Weekend Australian*.
- **13 January**, opinion piece by the CEO on the need to shift policy to a mitigation focus appears in *The Australian Financial Review*.
- **20 January**, article discussing fire risk across the country appears in *The Australian* with comments from the CEO.
- **2 May**, *The Mercury* reports on the Senate Inquiry into the bushfires in Tasmania's World Heritage Area, citing the CRC's *Southern Australia Seasonal Bushfire Outlook 2015-2016* as warning of higher than normal bushfire risk in parts of Tasmania.

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“WHAT OUR PARTNERS SAY”

Trent Curtin, Assistant Chief Fire Officer, MFB, Victoria

MFB places a high value on evidence-based decision making. The support provided by research conducted in the CRC helps MFB, and the emergency management sector as a whole, support new innovations, improvements in operational concepts, leadership and decision making. MFB continues to be engaged in the definition and development of the research projects and expects great benefits from implementing key research outcomes.

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