Postgraduate Research

Profiling research from the Bushfire and Natural Hazards CRC's education program

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Australian Government
Department of Industry, Science, Energy and Resources

AusIndustry
Cooperative Research Centres Program

Publisher: Bushfire and Natural Hazards CRC
Report no. 663

May 2021

BUILDING RESEARCH CAPACITY

Since 2013, the Bushfire and Natural Hazards CRC has been supporting the future generations of natural hazard and emergency management researchers – emerging leaders who will continue to ask the difficult questions and be prepared for complex answers.

In a world where natural hazards continue to increase in frequency and severity, it is more important than ever to provide decision makers with the skills and capacities they need to make critical decisions to keep our communities safe. The CRC's postgraduate research program is one important piece in providing that capability – through the evidence developed by the students' research and the roles that they take up after graduating.

The CRC has supported postgraduate students through a scholarship program and as associate students. Many of the 150 students from universities across Australia and New Zealand have received scholarships and other financial support, and all have benefited from the opportunity to network and engage with industry leaders and academic peers, gaining a deeper understanding of the emergency management sector, its opportunities and challenges.

The significant contributions that these students are now making is testament to the value of our student program, as well as to the commitment of each individual student. Each student project is linked to a theme in the CRC's core research program, with the postgraduate research providing a detailed insight into a specific issue in that theme.

At the time of print, 88 students have completed their studies, with the remaining students expected to finish over the next few years. This represents a huge wealth of knowledge for Australia and New Zealand and the rest of the world to draw on, both within our universities, but also within the sectors highlighted throughout the book, which our students are now contributing to.

I encourage you to take the time to look through this book and see the quality and depth of the contributions our postgraduate researchers have made over eight years of the CRC. I'm sure you will agree that these students have formed the foundations of a valuable research-informed and enabled workplace, the benefits of which will be obvious for years to come.

This book is supported by three other end-of-CRC publications: *Highlights and Achievements 2013–2021, Hazard Notes 2013–2021* and *Research Posters*. All are available on the CRC's website.

To access more information about the CRC's postgraduate program, visit www.bnhcrc.com.au/education.

Dr John Bates,
Research Director,
Bushfire and Natural Hazards CRC

Bushfire and Natural Hazards CRC students and former Bushfire CRC students at the 2016 Research Advisory Forum in Hobart.

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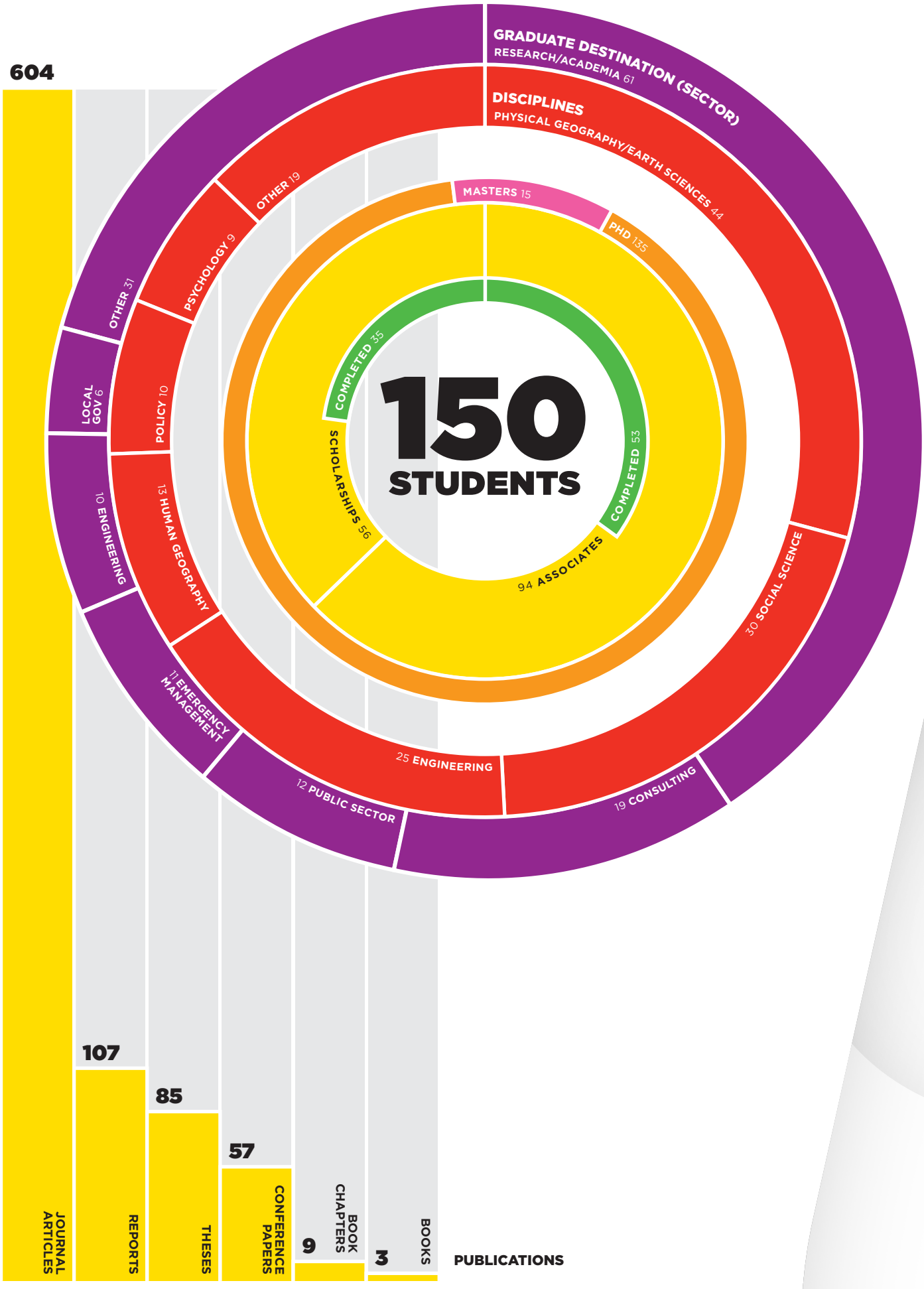
= Graduated


GRADUATE DESTINATION (SECTOR)
RESEARCH/ACADEMIA 61
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Disaster Resilience

DAVID BARTON
RMIT UNIVERSITY

Disaster in relation to attachment, loss, grief and recovery: the Marysville experience

PHD ASSOCIATE STUDENT
COMMENCED JANUARY 2010, COMPLETED JANUARY 2018

Current role: Director of Barton Trading Research and Consulting Group
Supervisors: A/Prof Paul Battersby and Dr Blythe McLennan

Dr David Barton was awarded his PhD from RMIT University in January 2018. As a resident of Marysville and a bushfire survivor himself, David's thesis explored the experiences of the survivors of the 2009 Black Saturday bushfires. David discovered widespread post-fire disempowerment and, with a focus upon attachment theory and behaviour, identified a new phenomenon now known as Post-Disaster Attachment Trauma. When combined, the findings related to post-disaster attachment behaviour, topophilia, disempowerment, solastalgia and Post-Disaster Attachment Trauma make for a powerful description and compelling explanation of what many Marysville bushfire survivors have experienced.

The research findings make their contribution to knowledge by discovering and explaining elements of individual and collective post-disaster experiences, particularly the role of attachment behaviour in recovery. The findings have implications for individual and collective resilience, recovery and mental health. They will benefit policy makers, therapists, government agencies and non-government organisations in the way they assist post-disaster individuals and communities in the future.

Still living in Marysville, David is the Director and Principal Research Consultant at Barton Trading Research and Consulting Group and is converting his thesis into a book.

HEIDI CHAPPELOW
UNIVERSITY OF NEWCASTLE

Community engagement for disaster risk reduction through embedding disaster risk reduction values

MASTERS ASSOCIATE STUDENT
COMMENCED FEBRUARY 2018

Current role: Disaster Readiness Community Officer at Singleton Council
Supervisors: A/Prof Graham Brewer

Heidi Chappelow's research is focusing on implementing cultural change for practical and enduring disaster risk reduction. She was engaged to conduct a Sustainable Development Goal gap analysis for the Newcastle State Emergency Service unit and was engaged by Hunter Joint Organisation to evaluate the Australian Council of Social Services 'Six Steps to Resilient Community Organisations' toolkit.

Heidi has produced a five-year climate action strategy designed to leverage strength and develop new skills in policy, culture, practice and partnerships. She presented at the 2019 Australian and New Zealand Disaster and Emergency Management Conference on the Gold Coast and presented 'Centralising environmental resilience in disaster risk reduction using the sustainable development goals' at the AFAC19 conference, which was then published in the *Australian Journal of Emergency Management* Monograph series.

Heidi currently works as a disaster readiness community officer at Singleton Council in the Hunter Valley, connecting communities with emergency services and council to support disaster preparedness in suburban and rural neighbourhoods including business, local government and NGOs through asset-based community development. She is also a social ecologist with Creative Human Initiatives and is collaborating with the National Bushfire Recovery Agency on establishing links between research and local government through forming a Hunter Recovery Research Network (working title).

RAVEN CRETNEY
RMIT UNIVERSITY

The post-disaster city: urban crisis politics and social change in community led earthquake recovery

PHD ASSOCIATE STUDENT
COMMENCED AUGUST 2013, COMPLETED MARCH 2017

Current role: Postdoctoral Fellow at the University of Waikato, New Zealand
Supervisors: Dr Libby Porter and Dr Wendy Steele

Dr Raven Cretney's thesis investigated the dynamics of urban crisis politics and community-led recovery in the context of the 2010 and 2011 Christchurch earthquakes in New Zealand. Raven's research took a dual approach towards the geographies of hope and crisis in the post-disaster urban environment, analysing the political nature of different forms of participation in disaster recovery at both the government and community level. As part of her research, Raven examined the New Zealand Government's approach to long-term disaster recovery, as well as the alternative forms of community-led recovery that are contributing to change how people interact with the urban environment and each other.

Raven is currently a postdoctoral fellow in environmental planning in the School of Social Sciences at the University of Waikato in New Zealand. She has also taught in the areas of human geography, environmental studies, development studies, and environmental politics and policy.

ZOË D'ARCY
RMIT UNIVERSITY

Towards fire adaptive communities in Australia

PHD ASSOCIATE STUDENT
COMMENCED MARCH 2020

Current role: Planning and Research Officer at NSW State Emergency Service
Supervisors: Prof John Fien

Zoë D'Arcy previously completed her Masters at RMIT University in Disaster, Design and Development as a CRC associate student and is now working at the NSW State Emergency Service as a planning and research officer. Her Masters project, *Community engagement in the post-disaster landscape,* evaluated the effectiveness of the Hotspots Fire Project in facilitating community-led disaster recovery and promoting community resilience in Carwoola, NSW. Her research project examined community needs in the post-fire environment, how the Hotspots Fire Project was adapted to meet those needs and ultimately how effective it was.

Zoë is currently completing her PhD with RMIT and the CRC on fire-adaptive communities, asking whether a shift towards an 'adaptive' approach to fire could reduce current and future vulnerabilities of Australian bushfire-prone communities.

Bushfires are predominantly understood in Australia in the context of emergency/disaster risk management. This approach embeds a prescriptive 'top-down' approach to community bushfire risk reduction. Fire knowledge and practice is often limited to hazard reduction burning, often not addressing either the ecological or cultural roles of fire in the landscape.

In the United States, the concept of 'fire-adapted communities' has become central to its government policies, social science research and practice. The concept aims to facilitate finding the right balance between ecologies that need fire and the people who are vulnerable to it. Learning networks help put knowledge gained by community fire managers about local fire ecologies, and working with communities, into practical use.

Zoë's PhD research is exploring whether there are lessons to be learnt from this approach and what an adaptive approach to fire might look like in Australian context. She also aims to identify and explain the motivations, roles and contributions from different actors/stakeholder groups (whether individual, agency/organisational or at multiple levels of government).

DOLAPO FAKUADE
UNIVERSITY OF CANTERBURY

Integrated response as a process for enhancing emergency management

PHD ASSOCIATE STUDENT
COMMENCED OCTOBER 2013, COMPLETED APRIL 2017

Current role: Director and Principal Consultant at Resilespur Consulting, New Zealand
Supervisors: A/Prof Tim Davies and Dr Erik Brogt

Dr Dolapo Fakuade's research explored integrated response as a process for enhancing emergency management. Dolapo investigated existing functions within communities that can be utilised for preparedness and response functions to enhance resilience. The result was the development of an integrated response framework that combines existing community functions that align with Incident Command System (ICS) structure and function domains of ICS.

Dolapo now runs her own consulting business in emergency management and community engagement in Christchurch, Resilespur Consulting, and is an advisory board member for the *Journal of Faculty of Economics and Administrative Sciences*, published by Ahi Evran University in Turkey.

GREG IRETON
UNIVERSITY OF MELBOURNE

Long-term impact of disasters on school children

PHD SCHOLARSHIP STUDENT
COMMENCED SEPTEMBER 2019

Current role: Enterprise Fellow at the University of Melbourne
Supervisors: Prof Lisa Gibbs and Prof David Forbes

Greg Ireton's PhD study is investigating the parent-reported changes in child behaviour and development at primary school commencement in communities affected by bushfire and flood compared to unaffected communities. Research on the longitudinal impact of bushfires on the academic achievement of school children identified that children attending schools in affected areas was clearly evidence in the immediate aftermath and subsequent years. This manifested as issues with toileting, as well as language, behavioural and developmental issues. Greg's research will enable a better understanding of these issues, how long they are apparent, and the supports and resources necessary to better enable early interventions to reduce long-term impacts on children.

Greg is currently an enterprise fellow in disaster recovery at the University of Melbourne and a disaster recovery adviser, providing a range of community disaster recovery roles on a pro-bono and professional basis. He has been involved in community recovery after many bushfires, flood, tornadoes and droughts.

MEGAN O'DONNELL
AUSTRALIAN NATIONAL UNIVERSITY

Effects of pre-natal bushfire stress on life history traits in humans

PHD ASSOCIATE STUDENT
COMMENCED JANUARY 2013, COMPLETED JANUARY 2017

Supervisors: Dr Alison Behie

Dr Megan O'Donnell's study examined the effects of two Australian bushfires—the 2009 Black Saturday fires and the 2003 Canberra fires—on maternal fire exposure and the accompanying stress, on babies' health and wellbeing, as well as the experiences of pregnant women during fires. Megan found that reproductive responses vary considerably between the populations studied and, potentially, in relation to the intensity of fire exposure. She found that average birth weights increased in the Canberra population, while remaining unchanged in the Black Saturday population. However, secondary sex ratio (the ratio of boys to girls born) decreased in the Black Saturday population, while remaining unchanged in the Canberra population. Mothers in both fires reported feeling stressed, with those mothers exposed to the Black Saturday fire reported higher perceived and objective stress. Mothers in both fires reported that public support and information were, at time, insufficient. Taken together, the findings indicate the functioning of finely tuned evolutionary mechanisms that adjust to environmental conditions where a threshold of severity is met, thereby protecting reproductive strategy from the influence of transient stressors.

Megan has worked in health research and for government in the areas of environmental protection, disaster response and public health.

TETSUYA OKADA
MACQUARIE UNIVERSITY

Post-disaster recovery following recent natural hazard events and risk reduction measures in Australia and Japan

PHD ASSOCIATE STUDENT
COMMENCED AUGUST 2012, COMPLETED OCTOBER 2017

Current role: Associate Lecturer at the University of Technology Sydney
Supervisors: Dr Katharine Haynes

Dr Tetsuya Okada's PhD research examined the human and societal factors that influence a developed society's ability to recover from extreme events and to reduce impacts from future events, and the efforts put in place to improve the long-term safety of people and infrastructure. Tetsuya explored socio-cultural differences during his thesis, such as individual behaviour, collective ideologies, social structures and policy, in four case study areas that are currently in post-event recovery phases but with different situations and cultural identities: the flood-impacted Lockyer Valley and St George regions in Queensland, and tsunami-impacted Tohoku and Fukushima regions, outside and inside the extreme caution zone against radiation, in Japan.

Dr Okada is now an associate lecturer and study supervisor at the University of Technology Sydney.

MITTUL VAHANVATI
RMIT UNIVERSITY

Post-disaster housing reconstruction as a means of enhancing disaster resilience of at-risk communities in India

PHD ASSOCIATE STUDENT
COMMENCED JANUARY 2012, COMPLETED MAY 2018

Current role: Lecturer at RMIT University
Supervisors: A/Prof Martin Mulligan and Dr Beau Beza

Dr Mittul Vahanvati investigated participatory owner-driven housing reconstruction projects to identify how they can lend themselves to long-term disaster resilience of communities, in the context of rural India. Her research findings show that although participation is important, it is equally important to give people a political voice and freedom of choice (capability), flexibility in recovery duration and capacity building for a longer time until the newly developed skills link with livelihood. Based on these findings, Mittul has proposed a framework with key factors ensuring the long-term reliability of reconstruction interventions globally.

Mittul's PhD research paper won the best research paper award in 2016 for RMIT University, where she now lectures in the Sustainability and Urban Planning department.

BIN XING
UNIVERSITY OF MELBOURNE

Prioritisation strategy for seismic retrofitting of reinforced concrete buildings in Australia

PHD ASSOCIATE STUDENT
COMMENCED FEBRUARY 2018

Supervisors: Dr Elisa Lumantarna

Bin Xing's research is looking at seismic retrofitting for the limited to non-ductial reinforced concrete buildings in Australia, which make up most of Australia's buildings. This study aims to develop a new methodology to evaluate the potential seismic risk of vulnerable existing reinforced concrete buildings to make informed decisions about vulnerable buildings in Australia, including the requirement of seismic retrofitting, upgrading of the design standards and codes, and the development of insurance policies.

Prior to pursuing his PhD, Bin worked as a civil engineer in China, a civil designer for the Robert Bird Group in Brisbane, an architect for G.P. Micalef Design and a structural engineer for JSC consulting engineers in Melbourne.

LIBERTY PASCUA
UNIVERSITY OF SYDNEY

Precarious places, precarious knowledges: a comparative analysis of disaster risk reduction education in Australia, the Philippines, and Vanuatu

PHD ASSOCIATE STUDENT
COMMENCED JULY 2016

Supervisors: Dr Alexandra McCormick

The main objective of Liberty Pascua's research is to unpack the processes involved in the construction and perpetuation of disaster risk reduction knowledge, highlight intersections, overlaps and disjoints, and examine their implications to the learning of disasters. Her research focuses on disaster-prone communities, such as those in Vanuatu and the Philippines which are first and third in the list of most vulnerable countries globally to natural hazards – with Port Vila in Vanuatu consistently ranked as the most exposed city in the world to natural hazards.

Liberty's research looks at the context of education and learning and the construction of knowledge as a political, cultural and social affair. An intimate, in-depth understanding of how learners in their communities use 'knowledges' in making sense of disasters is a valuable resource in informing policies on disaster risk reduction education and governance at the local, state, and international levels.

Liberty says her field work has shown her how much knowledge there is in homes, villages and individuals.

> "Nobody knows a place and its experiences better than those who have lived in the land," says Liberty. "There is less dependence on external help in these small communities because of developed coping strategies."

Liberty says the customary practices and agricultural techniques are helping the confidence of small communities to better deal with natural hazards. The links between these customary practices and mitigating against natural hazards can have a positive impact on policy adaptation and implementation.

Liberty has been published extensively in academic journals such as the *Journal of Geography*, the *Journal of Environmental Education*, *Evaluation and Program Planning*, and *International Research in Geographical and Environmental Education*. She also presented a Three Minute Thesis at the CRC's Research Forum in April 2018.

Economics, Mitigation and Value

MARTYN ELLIOT
UNIVERSITY OF THE SUNSHINE COAST

Economic evaluation of prescribed fire as a bushfire risk mitigation tool for south east Queensland

PHD ASSOCIATE STUDENT
COMMENCED DECEMBER 2016

Current role: Academic Tutor at the University of the Sunshine Coast
Supervisors: Dr Sanjeev Srivastava, Dr Tom Lewis, Dr Tyron Venn, Dr Michael Berry and Andrew Sturgess

Martyn Elliott's research aim is to economically evaluate prescribed fire as a bushfire risk mitigation tool for south east Queensland. To do this, Martyn is reviewing bushfire and prescribed fire policies' property rights and responsibilities, developing a prescribed fire cost model, designing prescribed fire scenarios and simulating the effect of prescribed fire on bushfire burn probabilities with Phoenix-SABRE. His research aims to estimate the value of select market and non-market resources at risk from bushfire estimate the fire effects of bushfire and prescribed fire on the selected resources and estimate the expected value of avoided bushfire losses due to prescribed fire.

Martyn currently works as an academic tutor in geospatial science at the University of the Sunshine Coast.

CONSTANZA GONZALES-MATHIESEN
UNIVERSITY OF MELBOURNE

Urban planning and resilience to bushfires

PHD ASSOCIATE STUDENT
COMMENCED JANUARY 2016, COMPLETED MARCH 2021

Current role: Researcher at the Universidad del Desarrollo, Chile
Supervisors: Prof Alan March

An accredited architect and urban planner, Constanza Gonzales-Mathiesen's PhD investigated ways that spatial planning can change its practices by identifying, mainstreaming and putting into action new considerations about bushfire risk management. Constanza's research is contributing to the understanding of ways of improving spatial planning capacity for bushfire risk management. Drawing on her research findings, Constanza co-authored a chapter in the 2020 book, *Understanding Disaster Risk: A Multidimensional Approach*, called 'Developing guidelines for increasing the resilience of informal settlements exposed to bushfire risk using a risk-based planning approach'.

Constanza now works as a researcher in the Faculty of Architecture at the Universidad del Desarrollo in Chile.

EIKE HAMERS
UNIVERSITY OF ADELAIDE

Flooding in South Australia – improved approaches for flood risk reduction by joint consideration of structural, land use planning and community resilience

PHD ASSOCIATE STUDENT
COMMENCED JULY 2018

Supervisors: Prof Holger Maier

Eike Hamers' project focuses on large-scale flood models and their ability to interact with land use models to assess future risk. This includes the evaluation of existing flood models on their suitability as large-scale model, adapting such a model and creating the computational framework to integrate the model into a land use one.

This research will help decision makers understand flood risk at a community scale and as part of a greater picture and assess the effectiveness of different hazard risk reduction portfolios.

SAIMUM KABIR
UNIVERSITY OF MELBOURNE

Flood risk reduction in a dynamic urban context exploring the urban-water-resilience nexus

PHD SCHOLARSHIP STUDENT
COMMENCED AUGUST 2018

Current role: Founding Editor/Admin at ContextBD, Bangladesh
Supervisors: Prof Alan March

The overarching goal of Saimum Kabir's study is to reduce community vulnerability to flood risks by enhancing the risk reduction capacity of the built environment.

At the macro scale, the study addresses the temporal dimension of risk by tracing the long-term impacts of past urban growth and water management policies and practices, and how they have influenced the present flood risk in the catchment. At the meso scale, the focus is on the location and spatial heterogeneity and their influence on the spatial risk distribution. At the micro scale, the study examines the trade-offs between urban form's transformation and flood risk mitigation at the catchment.

Saimum is an architect and academic, and before starting his PhD was an assistant professor in the Department of Architecture at the American International University in Bangladesh. He is also the founding editor of contextbd.com – a knowledge platform on architecture education and practice in Bangladesh.

VERONIQUE FLOREC
UNIVERSITY OF WESTERN AUSTRALIA

Economic analysis of prescribed burning

PHD SCHOLARSHIP STUDENT
COMMENCED JULY 2011, COMPLETED APRIL 2016

Current role: Research Fellow at the University of Western Australia
Supervisors: Prof David Pannell and A/Prof Michael Burton

Dr Veronique Florec began her PhD at the Bushfire CRC and completed in 2016 at the Bushfire and Natural Hazards CRC, developing an economic model for evaluating different prescribed burning strategies in south west Western Australia. The model incorporates both biological information related to bushfires and fire regimes, as well as economic information about prescribed burning, suppression and potential bushfire damages. Her PhD informed decision makers on the costs and benefits of different prescribed burning strategies, the return on their investment and the trade-offs between different options. Broadly, Veronique found that, in the long-term, not conducting any prescribed burning for several years in this ecosytem can be very costly, leading to large increases in damages and suppression expenditures. Results identify a threshold point (10 per cent of public land) up to which substantial economic benefits may be gained from increasing the area subjected to prescribed burning. But beyond this threshold, prescribed burning generates little additional economic benefits. Her research was featured in *Hazard Note 42 – Investing in prescribed burning: how much should we spend?* and has been published in the *International Journal of Wildland Fire* and the *Australian Journal of Emergency Management*. Veronique also presented her findings at the 2016 AFAC conference and the CRC's Research Forums in 2016 and 2018, and spoke at the PhD development day as part of the CRC's 2017 Research Advisory Forum about life after a PhD.

Veronique is a strong supporter of women in the areas of science and emergency management. In March 2018, she was part of eighty female scientists from around the world who journeyed to Antarctica as part of the Homeward Bound Voyage, which aimed to heighten the impact of women with a science background who can influence policy and decision making.

Upon completing her PhD, Veronique led the CRC's *Economics of natural hazards* project and was part of the research team on the *Quantifying catastrophic bushfire consequence* project for Energy Networks Australia. Through the *Economics of natural hazards* project, Veronqiue and her team developed the Value Tool for Natural Hazards and the Economic Assessment Screening Tool for natural hazards managers and policy advisors to estimate the value for money different investments in mitigation offer and how to include monetary values for intangible values when assessing mitigation benefits. Both are hosted on the CRC website.

Based on these two tools, Veronique developed and delivered a popular online training course than ran in 2021 for natural hazards managers and emergency management practitioners to build capacity within the sector to use economic analysis to inform decision making. This was complimented by a ten part video series to explain the core economic concepts and models that are relevant to natural hazards mitigation. The video series, hosted on the CRC's YouTube channel, covered the types of economics analyses available; their data requirements; how to evaluate mitigation options; estimating costs, benefits and value for money of mitigation; how to integrate intangible values; and how to deal with uncertainty.

THOMAS KLOETZKE
UNIVERSITY OF QUEENSLAND

Analysis and simulation of surface wind fields during landfalling tropical cyclones

PHD ASSOCIATE STUDENT
COMMENCED JULY 2015, COMPLETED JUNE 2019

Current role: Lead Meteorologist at Meteomatics, Switzerland
Supervisors: Dr Matthew Mason and Dr Richard Krupar III

Dr Thomas Kloetzke's project investigated near-surface wind fields during tropical cyclones that make landfall through observation and numerical studies. His research helped develop improved methods for estimating the risk these cyclones pose to buildings and communities, as very limited data exists on the structure of turbulent winds within the built environment during cyclones. Thomas' project addressed questions around the true structure of these wind fields and how they impact buildings and communities.

Thomas was part of a deployment team for Severe Cyclone *Debbie* in Queensland in 2017, gathering vital data for his PhD, while he presented his research at the CRC's Research Forum in 2016.

Thomas is now a Lead Meteorologist at Swiss weather service provider Meteomatics.

ROOZBEH HASANZADEH NAFARI
UNIVERSITY OF MELBOURNE

Flood damage assessment in urban areas

PHD SCHOLARSHIP STUDENT
COMMENCED JULY 2014, COMPLETED JANUARY 2018

Current role: Flood Hydrology and Hydraulics Lead at Arup
Supervisors: Prof Tuan Ngo and Prof Priyan Mendis

Dr Roozbeh Hasanzadeh Nafari completed his PhD in 2018 on flood damage assessment in urban areas. Roozbeh's research developed a validated flood damage assessment framework for Australia using historical data collected in mutiple natural hazards to inform disaster management policy in support of the development of risk reduction measures. His research addressed known issues and knowledge gaps around the lack of empirical data in Australia to calibrate damage models. Roozbeth's findings are a significant contribution to the flood damage assessment process by providing the input data for subsequent damage reduction, vulnerability mitigation and disaster risk reduction.

Roozbeh is now the technical lead of Flood Hydrology and Hydraulics at Arup.

PRANANDA NAVITAS
QUEENSLAND UNIVERSITY OF TECHNOLOGY

Planning for natural hazard mitigation

PHD ASSOCIATE STUDENT
COMMENCED OCTOBER 2015, COMPLETED OCTOBER 2019

Current role: Lecturer at Sepuluh Nopember Institute of Technology, Indonesia
Supervisors: Prof Douglas Baker and Mellini Sloan

Dr Prananda Navitas' research focused on the integration of hazard mitigation and land use planning. His research examined forms of knowledge used in decisions affecting policy and planning for urban development in south east Queensland. It assessed how current building standards are integrated into state and local government planning, and their effectiveness in mitigating bushfires. Prananda's research also developed an integrated framework for action to improve land use planning, development standards and the built environment decision making system to better manage risk and improve community disaster resilience.

Prananda now lectures in urban and regional planning at the Sepuluh Nopember Institute of Technology in Indonesia.

CHARLES NEWLAND
UNIVERSITY OF ADELAIDE

Improved calibration of spatially distributed models to simulate disaster risk

PHD SCHOLARSHIP STUDENT
COMMENCED MARCH 2014, COMPLETED FEBRUARY 2018

Current role: Transport Analytics Engineer at SMEC
Supervisors: Prof Holger Maier

Dr Charles Newland completed his PhD in 2018 on improved calibration of spatially distributed models to simulate disaster risk. His research improved the reliability and effectiveness of risk modelling by generating an automated procedure to benefit end-users.

Charles is now working as a graduate engineer in transport, planning and logistics at SMEC, where he utilises his PhD skills in spatial modelling, analytics and coding. He hopes to continue working in the engineering sector and introduce more land-use modelling into consultancy.

"My experience with the CRC always gave me a chance to see my research in action, and to meet, talk and laugh with fellow PhD students on the journey," Charles said.

LUCY OCKENDEN
UNIVERSITY OF MELBOURNE

Changes to urban planning's bushfire risk management approach in Victoria and future directions

MASTERS ASSOCIATE STUDENT
COMMENCED JANUARY 2017, COMPLETED DECEMBER 2018

Current role: Communications and Engagement Officer at the Department of Environment, Land, Water and Planning Victoria
Supervisors: Prof Alan March

Lucy Ockenden's research examined bushfire planning controls in Victoria between 2008 and 2018. Urban planning is playing an increasingly important role in disaster risk reduction and bushfire risk management, however bushfire planning controls in Victoria are yet to be documented in detail. Specifically, Lucy investigated how changes to planning scheme regulations have modified the level of comprehensiveness over time. Lucy's Masters study acts as a review of past and present policy, investigates if new regulations are needed to determine the comprehensiveness of Victoria's approach to bushfire risk management and identifies any gaps so that bushfire threats can be better addressed in the future. Settlement patterns and projected climate change impacts for Victoria are increasing the likelihood of bushfire exposure to human settlements.

Lucy currently works as a communications and engagement officer at the Victorian Department of Environment, Land, Water and Planning.

BEN OLLINGTON
UNIVERSITY OF MELBOURNE

Coexisting with fire: integrating resilient landscape design principles within broader urban place making policy for bushfire risk reduction in Australia

PHD ASSOCIATE STUDENT
COMMENCED OCTOBER 2019

Current role: Research Assistant at the University of Melbourne
Supervisors: Prof Alan March

Ben Ollington's research aims to develop an understanding of, and new approaches to, landscape design and planning in disaster risk reduction relating to bushfire. It will contribute to and integrate landscape-specific measures into disaster risk reduction and urban planning, particularly in the case of bushfire in Victoria.

The study began with an analysis of current policy and regulatory measures to determine their capacity for nature-based responses to risk reduction. Then, utilising emerging knowledge such as the idea of fire-adapted communities, the research will investigate potential measures that could be incorporated into planning policy to build social and ecological resilience. This will be realised through a design response in a spatial location with the hope of applying the framework to different locations over time. Ultimately trade-offs will occur, and these will be explored to determine whether the findings can be developed into a model/scenario/recommendation to be utilised across different localities.

Ben currently works as a research assistant for the Bushfire Design Guideline joint project between the University of Melbourne, CSIRO and Country Fire Authority.

JAMES RICKETTS
VICTORIA UNIVERSITY

Understanding the nature of abrupt regional shifts in a changing climate

PHD ASSOCIATE STUDENT
COMMENCED MARCH 2014, COMPLETED JUNE 2019

Current role: Research Scholar at Victoria University
Supervisors: Prof Roger Jones

Dr James Ricketts' PhD identified and related episodes of apparent abrupt shifts in regional climate in Australia. His research extends this methodology to global datasets and to modelled futures to better inform risk assessments. James automated testing for step changes, delineating a suite of statistical tests for exploring individual step changes and applying these to global temperature, zonal land and ocean records, as well as to climate model equivalents. James's analysis was then applied to two-degree grid scale observations and model outputs that are suited to a wide range of physical and biophysical models.

James has written two conference papers as part of the International Congress on Modelling and Simulation in 2015 and 2017. He now works as a research scholar at Victoria University's Institute of Strategic Economic Studies.

AYE THANDAR PHYO WAI
UNIVERSITY OF MELBOURNE

The role of urban planning in urban fire mitigation

PHD ASSOCIATE STUDENT
COMMENCED APRIL 2018

Supervisors: Prof Alan March

Urban fire is common in all cities, especially in developing countries, due to more concentrated settlement planning, lack of safety in buildings, increased population growth and poverty. Thandar Phyo Wai's research is assessing the process of fire and the relationships between urban fire and changes in urban planning, to investigate the causes of urban fire and the ways that urban planning plays a role in causes of fire, as well as how can it provide solutions to mitigate urban fire risk. The research will specifically aim to explore the role of urban planning to prevent and reduce urban fire risk in Mandalay City, Myanmar. There will also be a focus on the role of government and their collaboration with other parties regarding urban fire mitigation solutions and existing knowledge awareness on urban fire disasters. At the time of print, Thandar expected to submit his PhD in late 2021.

Education and Communications

SUMAYYAH AHMAD
CURTIN UNIVERSITY

An investigation of spontaneous volunteers' social media engagement in emergency disaster management

PHD ASSOCIATE STUDENT
COMMENCED FEBRUARY 2018

Current role: Research assistant at Curtin University and lecturer at the University of Western Australia
Supervisors: Prof Kristen Holmes

Spontaneous volunteers can assist emergency services in crisis situations by providing complementary expertise and resources. Sumayyah Ahmad's research analyses advances in technology and social media and how they have enabled spontaneous volunteers to participate in the crisis communication for major disasters.

Sumayyah's research highlights the subtleties of spontaneous volunteers' experiences, discovering and clarifying their nature and giving them a voice by recording their suggestions. While official responders have mixed feelings towards social media, spontaneous volunteers have taken the lead in utilising these platforms during disasters. This study will enable emergency services managers to understand the process of social media reinvention that can guide their own social media policies and approaches.

Sumayyah has presented her research findings at the Voluntary Sector and Volunteering Research Conference in Birmingham in 2019, to the Emergency Management Network in the Department of Premier and Cabinet SA, the Volunteering WA researchers' network, and at a webinar for the Islamic Circle of New Zealand and Australia. She currently works as a research assistant and instructor at Curtin University and teaches casually at the University of Western Australia.

AVIANTO AMRI
MACQUARIE UNIVERSITY

Connecting communities: integration of disaster preparedness measures at household, school and community level using a child-centred approach

PHD SCHOLARSHIP STUDENT
COMMENCED JULY 2015, COMPLETED JANUARY 2020

Current role: CEO of PREDIKT
Supervisors: Dr Katharine Haynes, Dr Christina Magill, Dr Deanne Bird and Prof Kevin Ronan

Vital disaster education for children is primarily designed for delivery in schools, but Dr Avianto Amri's research has produced a new board game to empower children at home. While recent studies have shown that disaster education programs increase children's awareness and knowledge, it does not always translate to changes at home in disaster preparedness. This new innovative education intervention enables children to engage with parents and build disaster resilient households.

The board game, PREDIKT, empowers children to engage in householder preparedness in a meaningful way, explains Avianto.

"PREDIKT provides the ammunition for teachers and parents to play and learn about disaster preparedness with children, in a fun and interactive way. It's not just the children learning. We've found that parents and teachers are challenged by the children, as their curiosity drives them to ask more questions related to disaster preparedness," Avianto said.

Initial results have shown that the education intervention is successful in motivating parents to discuss householder preparedness with their children. The resource, which is cheap and scalable, is currently being used by agencies and practitioners across Australia, Indonesia, Malaysia and Thailand. The game forms part of a broader toolkit, which includes worksheets, templates, tips and preparedness items for multiple hazard types, to further strengthen disaster preparedness through interactive learning. The developing body of knowledge around children and disaster risk reduction has shown the importance of engaging with children in meaningful ways. Participatory processes empower children to not only protect themselves and others in emergencies, but to become agents of change for their communities. Discussions are in progress to modify the board game and toolkit so that it can be used by people with visual impairment. This would make PREDIKT the first inclusive board game on disaster preparedness.

Avianto is very active in the disaster risk reduction space through his work with various organisations, including Plan International, UNICEF and IFRC, and was deployed to Nepal asked to assist with earthquake relief operations in June 2015. He also entered the CRC Association Early Career Researcher communication competition 2019 by completing a 30 second video explaining his research, which is available on the CRC website.

MELANIE BAKER-JONES

QUEENSLAND UNIVERSITY OF TECHNOLOGY

Web 2.0 in disaster and emergency: a risk assessment of tortious liability

PHD SCHOLARSHIP STUDENT
COMMENCED FEBRUARY 2014, COMPLETED SEPTEMBER 2017

Current role: Solicitor at Simpson Western Lawyers, New Zealand
Supervisors: Prof Bill Duncan

Dr Melanie Baker-Jones' thesis examined government accountability for emergency warnings over social media. As well as this specific focus on legal accountability, Melanie's thesis examined the role of governance and regulatory components in the risk management process, investigating the extent to which responsibilities for warning and the use of social media are incorporated into the regulatory system. Her research also investigated the emergency services' use of user-generated content on social media and the potential legal risks associated with this.

Melanie is now a solicitor at Simpson Western Lawyers in Auckland.

SHAUNTELLE BENJAMIN

UNIVERSITY OF NEW ENGLAND

Why do people decide to drive through floodwater? Utilising virtual reality to assess motivations and behaviour associated with driving through floodwater

PHD SCHOLARSHIP STUDENT
COMMENCED JANUARY 2017

Supervisors: Dr Amy Lykins and Dr Melissa Parsons

Shauntelle Benjamin's PhD is using the University of New England's state of the art virtual reality and eye tracking laboratories to experimentally test the psychological factors that might influence the decision to drive into floodwater. Shauntelle is also examining the protective effects of risk treatments such as warning signs, penalties and safety education, and will look at key questions such as what are the motivations (i.e. variables that affect behaviour) for decisions to drive into floodwater, what protective factors are associated with decisions not to drive into floodwater, does a driver's perception of risk influence decisions to drive into floodwater, and can interventions be tailored to different motivations, protective factors and risk perceptions?

Findings so far show that personality factors can influence who drives into floodwater. Agreeableness, extraversion and neuroticism, as well as cultural views, can predict whether an individual will drive into floodwater. The perception of peer pressure is another powerful factor.

KAREN BRADLEY

QUEENSLAND UNIVERSITY OF TECHNOLOGY

Strategies to develop a national incident management system for emergencies – improving the response to disasters by enhancing the Incident Command System

PHD ASSOCIATE STUDENT
COMMENCED NOVEMBER 2017

Current role: Acting Inspector of Training and Emergency Management at Queensland Fire and Emergency Services
Supervisors: Prof Vivienne Tippett

Karen Bradley's project will develop a comprehensive and inclusive major emergency management framework based on the Incident Command System, that can be applied across a number of jurisdictions and across multi-agencies for the response phase of an incident. This includes the level of inter-agency clarity across the concepts of command, control and coordination. This analysis will then be used to examine the processes for event handover, including identifying any boundaries of agency triggers for changeover and help identify the strengths and weaknesses of current incident command systems.

The aim of Karen's research is to develop an integrated framework for the response phase of modern-day disasters, including frontline emergency response agencies, that utilise the Incident Command System, and other non-traditional agencies that perform disaster management response functions.

Karen is currently the Acting Inspector of Training and Emergency Management at the Queensland Fire and Emergency Services.

CATHY CAO

UNIVERSITY OF WESTERN AUSTRALIA

Effective communication of household wildfire risk through WebGIS: considerations in content, representation and design

PHD ASSOCIATE STUDENT
COMMENCED APRIL 2011, COMPLETED MARCH 2017

Current role: Lecturer at Qingdao University, China
Supervisors: Dr Ilona McNeill

Dr Cathy Cao's PhD, which began under the Bushfire CRC and was completed in 2017 at the Bushfire and Natural Hazards CRC, focused on the use of GIS technologies for location-based, personalised public warnings. Cathy's research allowed residents to perceive their own risk more accurately while promoting the choice of appropriate decisions under stress. She developed a personalised public warning framework to convey location-based risk information along with household-specific action advice, with web-based software used to convey the important

bushfire information. Cathy's PhD has provided an important step forward in exploiting GIS technologies for location-based, personalised public warnings, to substantially facilitate the perception of personal related risk and decision making at the household level.

Cathy now lectures in the Department of Geography at Qingdao University in Shandong, China.

MILES CRAWFORD
MASSEY UNIVERSITY

How risk informs natural hazard management: a study of the interface between risk modelling for tsunami inundation and local government policy and procedure

PHD SCHOLARSHIP STUDENT
COMMENCED JULY 2015

Current role: Principal Risk Advisor at the Ministry of Foreign Affairs and Trade, New Zealand
Supervisors: Prof David Johnston and Prof Douglas Paton

Tsunami's are one of the biggest risks to Australia and New Zealand, but there is little attention to the threats they pose. Miles Crawford's research informs public policy by investigating the interface between risk and emergency management, to understand how risk informs government emergency management policies and procedures. Miles's research looks at how tsunami risk modelling informs New Zealand local government policies and procedures. His study uses tsunami risk scenarios originating from an earthquake along the length of the Hikurangi Subduction (off New Zealand's North Island) to research the way risk is understood, communicated, believed and used, as well as the existing factors that limit tsunami risk awareness and understanding. Miles has found that the risk modelling has helped local councils understand the risk they face and what they can do to improve their risk management policies and procedures.

Miles has presented his research findings at the CRC's Research Forum in 2017 and 2018 and has been published in the *International Journal of Disaster Risk Reduction*. He is now Principal Risk Advisor at the New Zealand Ministry of Foreign Affairs and Trade.

GRETEL EVANS
UNIVERSITY OF MELBOURNE

The persistent past: fire, flood and migrant memories of displacement and belonging

PHD ASSOCIATE STUDENT
COMMENCED MARCH 2014

Current role: Academic Tutor at the University of Melbourne and the University of Southern Queensland
Supervisors: A/Prof Sara Wills and Dr Alessandro Antonello

Gretel Evans' research engages with disaster studies, migration and environmental history by using oral history and memory studies to investigate migrants' memories of emergencies in Australia. She is especially interested in how natural hazards influence identity and belonging within the Australian community and environment. While her PhD is predominately focused on bushfire experiences of migrants, she is also interested in stories about flood from across Australia.

Gretel authored the chapter titled 'Shaped by fire: how bushfires forged migrant environmental understandings and memories of place' for the 2020 book, *Disasters in Australia and New Zealand: Historical Approaches to Understanding Catastrophe*. The chapter draws on her PhD research and focuses on migrants to bushfire-prone locations in regional Victoria and how their understandings of the Australian environment were challenged by their subsequent experience of bushfires. Gretel now tutors at the University of Melbourne and the University of Southern Queensland.

STEPHEN GLASSEY
UNIVERSITY OF OTAGO

Animal emergency management in New Zealand

PHD ASSOCIATE STUDENT
COMMENCED FEBRUARY 2018

Current role: Director of CQUniversity's Emergency Response Innovation Centre
Supervisors: Dr Mike King and Marcelo Rodriguez Ferrere

Stephen Glassey's research is examining the companion animal emergency management response to and following the April 2017 Edgecumbe flood on New Zealand's North Island. This includes a review of the legal frameworks that affect companion animal emergency management, a review of related after-action reports and other official documents, and analysing the perceptions of residents affected by the flooding with regard to the emergency response to establish positive and negative observations that may inform, acknowledge or improve emergency management practices and laws. This will be the first empirical study of companion animal emergency management in New Zealand and will provide a contrast to existing international case studies.

Prior to commencing his PhD, Stephen was Chief Executive Officer of Wellington Society for the Prevention of Cruelty to Animals from September 2015 to October 2017. He has over 20 years of emergency management experience, including working with the United Nations. Stephen is currently the Director of CQUniversity's Emergency Response Innovation Centre.

LESLEY GRAY
UNIVERSITY OF OTAGO

Preparing for the big one: disaster risk reduction for morbid obesity

PHD ASSOCIATE STUDENT
COMMENCED SEPTEMBER 2016

Current role: Senior Lecturer at the University of Otago, New Zealand
Supervisors: Prof David Johnston

Lesley Gray's PhD is the first research of its kind, as no research has previously been conducted relating to morbid obesity and disaster risk resilience or emergency management. With both Australia and New Zealand ranking highly for obesity in developed countries, this study is determining disaster risk reduction strategies for persons with morbid obesity. In conjunction with her PhD studies, Lesley is a senior lecturer in the Department of Primary Health Care and General Practice at the University of Otago School of Medicine and was made a fellow of the UK Faculty of Public Health in 2008.

TONY JARRETT
CQUNIVERSITY

Agency experts supporting bushfire disaster resilience education for primary school students: a case study in NSW

PHD ASSOCIATE STUDENT
COMMENCED JANUARY 2018

Supervisors: Prof Ken Purnell, Dr Katherine Haynes and Dr Helen Keen-Dyer

Tony Jarrett's PhD study is examining how a new teaching syllabus will impact on children during a natural disaster. The inclusion of an Inquiry Learning unit on bushfires for Year 5 and 6 geography students in NSW comes at a time when all governments are wanting to place an emphasis on prevention and mitigation as the personal and social costs of responding to and recovering from disasters grows rapidly. Tony's research will investigate what extent enablers and inhibitors impact effective, scalable and sustainable disaster resilience education.

Tony has been involved in education and community resilience in the sector for over a decade, and previously worked in community engagement at the NSW Rural Fire Service where he was a CRC end-user. Tony was instrumental in the delivery of bushfire safety and disaster resilience education programs across NSW.

LAUREN KOSTA
UNIVERSITY OF MELBOURNE

Parenting after Black Saturday: lived experiences since the 2009 Victorian bushfires

PHD ASSOCIATE STUDENT
COMMENCED DECEMBER 2013, COMPLETED DECEMBER 2018

Current role: Associate Lecturer at the University of Melbourne
Supervisors: Prof Louise Harms, Prof Lisa Gibbs and Dr David Rose

Dr Lauren Kosta has worked in research for several years, focusing on parenting in circumstances of adversity, previously working at the Royal Children's Hospital Melbourne and Murdoch Children's Research Institute with parents of infants and young children with complex health issues.

Lauren's PhD investigated the experience of parenting following the Black Saturday bushfires. Lauren spoke to parents who were living in an area affected by the fires in 2009, exploring what it has been like to be a parent since, what has been difficult, what has gone well, and what supports were (or were not) helpful. She found mothers and fathers faced complex parenting challenges in the years after these fires, as their efforts were often undermined by trauma, loss, and disruption. Her findings highlight important opportunities to support families after disasters.

Lauren is now an associate lecturer in the Department of Social Work at the University of Melbourne.

REVATHI NUGGEHALLI KRISHNA
MONASH UNIVERSITY

Coping with disasters by children and families who live in poverty

PHD ASSOCIATE STUDENT
COMMENCED MARCH 2016, SUBMITTED JANUARY 2021 AND AWAITING CONFIRMATION

Current role: Research Fellow at Monash University
Supervisors: Prof Kevin Ronan

With a background in clinical psychology, Dr Revathi Nuggehalli Krishna's research explored how children and families living in poverty cope during natural hazards. With case studies in Australia and India, Revathi looked at how both adaptive and maladaptive coping strategies will assist with lessons that can be translated into intervention efforts that builds resilience in coping with adversities like natural hazards. Prior to beginning her PhD, Revathi led a clinical team for a large, randomised control study testing psychosocial intervention to treat perinatal depression in India.

Revathi submitted her PhD in January 2021 and at the time of print was waiting on confirmation. She is now a research fellow at Monash University's Sustainable Development Institute.

KAMARAH POOLEY

QUEENSLAND UNIVERSITY OF TECHNOLOGY

An evaluation of Youth Justice Conferencing for youth misuse of fire

PHD SCHOLARSHIP STUDENT
COMMENCED JUNE 2015, COMPLETED MARCH 2018

Current role: Senior firefighter at Fire and Rescue NSW
Supervisors: Prof John Scott, Dr Kelly Richards and Dr Claire Ferguson

Dr Kamarah Pooley's PhD investigated Youth Justice Conferencing convened for young people who committed a fire-related offence in NSW. Her findings revealed that Youth Justice Conferencing with firefighter involvement contributed to a reduced risk of general recidivism while providing an avenue for delivering fire safety education to at-risk groups.

Kamarah presented her research findings at the CRC's Research Forum in 2017, as well as a Three Minute Thesis at Research Driving Change – Showcase 2017. She was awarded an Outstanding Doctoral Thesis Award for her research in 2018. Kamarah worked as a research assistant with the School of Justice at the Queensland University of Technology and then a senior research analyst with the Australian Institute of Criminology. She has been a senior firefighter with Fire and Rescue NSW since 2012, currently working with the Community Safety and Research Directorate to enhance community engagement for risk reduction.

"I feel very fortunate to have been supported by the CRC during my PhD candidature. I attended and presented at research forums and conferences around Australia, met some incredible people, accessed some very useful contacts, and made lifelong friends," Kamarah said.

MAYEDA RASHID
CQUNIVERSITY

Teacher-delivered, child participatory disaster resilience education program for children

PHD SCHOLARSHIP STUDENT
COMMENCED AUGUST 2015, COMPLETED JULY 2020

Current role: Partnerships Coordinator at DPV Health
Supervisors: Prof Kevin Ronan and Dr Briony Towers

Growing up in a small village in Bangladesh, Dr Mayeda Rashid has had firsthand experience with a lack of disaster preparedness as her village frequently dealt with floods.

> "I have a passion for children, I've always wanted to work with them while studying disaster risk reduction," Mayeda says.

Fifty-three children were involved in the first phase of Mayeda's research, where they were involved in designing an education program through focus group discussions.

"The program has been designed by children. They know what they want to learn and how they want to learn," Mayeda says. "Children want to share their learning with their friends and family members, which is really important because of the large number of children who do not attend school in Bangladesh."

Mayeda has also worked with practitioners from both government and non-government organisations in Bangladesh to better understand what their needs are for effective disaster education. She piloted her program in Tarua, her home village in Bangladesh.

Mayeda has presented her research findings at the CRC's Research Forum in 2018, as well as a Three Minute Thesis at Research Driving Change – Showcase 2017. She has also authored a chapter about child-centred disaster risk reduction in the book *Education in Times of Environmental Crisis: Teaching Children to be Agents of Change*, published in 2016.

Mayeda's thesis was ranked in the top 10 per cent globally in her field. As a result, she has been recognised as a Global Talent by the Department of Home Affairs under the Global Talent Independent program. Mayeda now works as Partnerships Coordinator at DPV Health for the Victorian Government's Community Activation and Social Isolation program.

Steve Sutton (left) receives his 2017 Special Recognition Award from CRC CEO Dr Richard Thornton.

STEPHEN SUTTON

CHARLES DARWIN UNIVERSITY

Cultural drivers of disaster response behaviour and their cross-cultural applicability

PHD SCHOLARSHIP STUDENT
COMMENCED JANUARY 2015

Current role: Director at SHIM Consulting, Adjunct Researcher at Charles Darwin University
Supervisors: Prof Douglas Paton, Prof Timothy Skinner and Dr Petra Buergelt

Steve Sutton's PhD thesis examines the components of the socio-cultural context of the Indonesian island, Simeulue, which had remarkably low level of fatalities during the Indian Ocean Boxing Day tsunami in 2004.

> "Simeulue, 150 kilometres off the coast of Sumatra, was the first location struck by the tsunami but reportedly lost only a handful of lives," Stephen said. "In neighbouring Sumatra, three per cent of the population died."

With a background in archaeology and Indigenous heritage, Steve's research is investigating the social and environmental factors that led to such an outcome.

"Most research into disaster risk reduction focuses on the losses arising from bushfires and natural hazards and how to avoid similar losses in the future," he said. "Very little research considers situations where losses have been avoided by effective practices. The really compelling thing about the story of Simeulue is the way the entire community responded to the disaster."

"I want to understand why this particular community prepared and what, if any, were the environmental or cultural signs," he said.

The key factors that contributed to the disaster response behaviour will then be considered in Australian cultural settings with a view to improving risk communication and community resilience.

Steve has been a great ambassador for the CRC, receiving the CRC Special Recognition Award in 2017. He has presented his PhD findings at the CRC's Research Forum in 2016 and 2017 and, in addition to his PhD, has led the CRC project *Northern Australia bushfire and natural hazard training*. This project created training units that provide practical support and reinforcement of capabilities emerging and needed in remote Indigenous communities in northern Australia. Comprising ten units designed for delivery at the Vocational Education and Training Certificate II level, the training units interweave a set of philosophical and practical understandings of the management of landscapes for bushfire and natural hazards in a changing climate with new economic stressors and opportunities, as well as the integration of Indigenous knowledge and experience with non-Indigenous approaches.

At the time of print, Steve was expecting to submit his thesis in mid-2021.

RIFKA SIBARANI
CHARLES DARWIN UNIVERSITY

Disaster risk communication the new media landscape: an exploratory case study of northern Tasmania and Lombok

PHD ASSOCIATE STUDENT
COMMENCED MARCH 2019

Supervisors: Dr Birut Zemits

Rifka Sibarani's ongoing research project focuses on exploring social media users' experience with risk communication in the changing new media environment. It aims to provide policy recommendations for local stakeholders for ways to improve engagement with local communities, especially within the current period of endemic misinformation on social media.

HAYLEY SQUANCE
MASSEY UNIVERSITY

Enhancing multiagency collaboration for animal welfare emergency management

PHD ASSOCIATE STUDENT
COMMENCED JUNE 2014

Supervisors: Prof David Johnston

Hayley Squances' project is completing case studies of flood and fire in New Zealand to explore the key issues that are impacting effective multi-agency collaboration for animal welfare emergency management. The outcome of Hayley's PhD will be the development of a comprehensive animal welfare emergency management framework which will enhance multi-agency collaboration who experience the human-animal interface in emergencies. This will inform the understanding of the operational, social, political and economic factors in New Zealand.

At the time of print, Hayley expected to submit her PhD in mid-2021. She worked for the Ministry for Primary Industries as the National Animal Welfare Emergency Management Coordinator for nearly five years before focusing on completing her PhD.

KEN STRAHAN
RMIT UNIVERSITY

Household decision making in bushfire self-evacuation

PHD ASSOCIATE STUDENT
COMMENCED AUGUST 2013, COMPLETED APRIL 2017

Current role: Managing Director of Strahan Research
Supervisors: Prof John Handmer and Dr Josh Whittaker

Dr Ken Strahan's thesis investigated the factors influencing household self-evacuation in two Australian bushfires – the Perth Hills fire in 2014 and the Adelaide Hills fire in 2015. His research explored the factors that influenced householders' decisions to evacuate, identified factors that predict self-evacuation and established the characteristics of self-evacuators. Ken's findings showed that environmental and social cues and warnings and householders' perceptions of the threat, of hazard adjustments and of other stakeholders, influenced self-evacuation decision making. His findings suggest that future research on those who wait and see during a bushfire should take account of their decisional rules of thumb and that design and targeting of Australian bushfire safety policy should better account for self-evacuator characteristics.

Ken led research for the CRC commissioned through the Victorian Government Safer Together program on the application of the archetypes his PhD findings identified. His research is being used by CFA to target their community engagement programs to meet the needs of the seven bushfire evacuation archetypes his research identified – threat deniers, responsibility deniers, dependent evacuators, considered evacuators, worried waverers, community guided and experienced independents – further catering to the needs of the community and providing them with specific bushfire information to suit their needs. He also was part of a team commissioned directly by the CRC to assess the value of disaster research.

After the 2019/20 Black Summer bushfires, Ken appeared on the ABC podcast *Science Friction* to explain how people respond to bushfire according to his research.

Ken is the Managing Director of Strahan Research and is currently working on research commissioned through the Department of Environment, Land, Water and Planning Victoria on fire ecology.

RACHEL WESTCOTT
WESTERN SYDNEY UNIVERSITY

Advancing public health in the context of natural hazards: normalising preparedness within a framework of adapted motivation theory

PHD SCHOLARSHIP STUDENT
COMMENCED JULY 2014, COMPLETED DECEMBER 2018

Current role: Director of Engine Room Solutions
Supervisors: Dr Melanie Taylor, Prof Kevin Ronan and Prof Hilary Bambrick

Dr Rachel Westcott's PhD discovered and recommend proactive strategies to strengthen and improve human safety and well-being in a changing climate of natural hazards.

Rachel investigated and developed best practice methods for preparedness and response practices in a bushfire – all aimed at making fire preparedness part of everyday life for those who live in at-risk areas. This normalising of preparedness makes becoming 'fire fit' a normal routine. Rachel undertook extensive interviews on the Lower Eyre Peninsula in South Australia, a location with a recent history of severe bushfires and a resourceful regional community.

Rachel presented her research findings at many industry events during her PhD, including a Three Minute Thesis at the CRC's Research Driving Change – Showcase 2017, as well as speaking on ABC Local Radio across Australia. She has also written a *Hazard Note* that outlines the practical processes and strategies behind fire-fitness, assisting people to safely negotiate natural hazards in an increasingly climate change affected environment by making fire-fitness routine and commonplace.

As a veterinarian, Rachel has had an avid interest in the ways animals are handled during a disaster and she participated in many aspects of the broader CRC project, *Managing animals in disasters*. In 2015, Rachel was recognised for her work with a Pride of Australia award after SA's Sampson Flat bushfire when her and her SA Veterinary Emergency Management team helped save and manage hundreds of animals during the fire.

Rachel currently runs her own business, Engine Room Solutions, which has research, emergency management and publishing divisions – with a focus on publishing PhD student papers – as well as running her own veterinary practice in the Adelaide Hills. She also coordinates the SA Veterinary Emergency Management team which she founded in 2009.

Extreme Weather

MONA (FATEMEH) ZIAEYAN BAHRI

UNIVERSITY OF NEW SOUTH WALES

Sensitivity of the empirical mode decomposition and its application to environmental data

PHD ASSOCIATE STUDENT
COMMENCED JULY 2013, COMPLETED MAY 2018

Current role: Associate Lecturer and Research Assistant at UNSW
Supervisors: A/Prof Jason Sharples

Dr Mona Ziaeyan Bahri's PhD study focused on time series analysis and its application to environmental data sets relating to natural hazards. To do this, Mona's research involved methods of time series analysis that are applicable to non-stationary and non-linear data. Her research findings have provided enhanced information on key climate drivers and how to better manage natural hazards in the future.

Mona is now an associate lecturer and research assistant with the University of New South Wales.

TOM FITZGERALD

UNIVERSITY OF SYDNEY

What is acceptable risk in the coastal zone: perspectives on coastal hazards and decision making

PHD ASSOCIATE STUDENT
COMMENCED AUGUST 2013

Current role: Director of the Coastal Management Collective, and Policy Specialist Adaptation and Risk, GNS Science, New Zealand
Supervisors: A/Prof Dale Dominey-Howes

Tom Fitzgerald is researching the management of coastal hazards, the governance of risk, and exploring how perceptions of risk acceptability may influence coastal management and planning decisions. He brings a broad range of experience to his PhD across a range of environmental management, town planning, policy analysis and development and coastal management positions in Australia, New Zealand and the United Kingdom.

The coast is in a constant state of flux. The most visible aspects of this change may be seen through the action of extreme hazards such as storms and cyclones, resulting in storm surges, flooding and erosion. In isolation, such events may not be so harmful, but with the increasing development of coastal communities, more and more people will be exposed to increasing risk. The main aim of Tom's PhD is to uncover the unacceptable risk in changing coastal zones, through case studies of Collaroy-Narrabeen in Sydney and the Kapiti Coast in New Zealand. It also looks at the political side of the coastal risk equation.

Tom runs his own environmental consultancy business, the Coastal Management Collective, in New Zealand. He also works as a policy specialist in adaptation and risk at GNS Science.

JESSICA HELLIER

UNIVERSITY OF MELBOURNE

Land use planning treatment of flood risk in cities

MASTERS ASSOCIATE STUDENT
COMMENCED NOVEMBER 2019

Current role: Development Planning Services Planner at Melbourne Water
Supervisors: Prof Alan March

Jessica Hellier is currently working for Melbourne Water in development planning, while also completing her Master of Urban Planning at the University of Melbourne. Jessica's research evaluates current land use planning policy in Melbourne, in terms of how well it defines and addresses flood risk. It uses qualitative, case-study research methods involving policy analysis and semi-structured interviews, focusing on the ways that current land use planning mechanisms address flood risk, and whether there are opportunities to treat this risk more comprehensively through the planning system.

KIM ROBINSON

UNIVERSITY OF TASMANIA

Developing a flash flood warning system for short duration catchments using rain fields data, 2D hydrodynamic modelling and best-practice emergency communication

PHD SCHOLARSHIP STUDENT
COMMENCED DECEMBER 2019

Current role: Senior Principal Hydrologist at WMAwater
Supervisors: Dr Stuart Corney, Dr Chris White, Dr Paul Fox-Hughes and Dr Gabi Mocatta

Currently, there is little to no flash flood forecasting available in Tasmania, which leads to poor situational awareness when extreme weather occurs across the state. Kim Robinson's research will lead to significant improvements in flash flooding forecast capability in Tasmania.

Kim has worked in the consulting industry with a focus on short-term flood forecasting for local, national and international clients. Through his work in developing flood forecasting system for clients such as Hydro Tasmania and TasWater, Kim has developed a thorough understanding of the current industry standards, areas of ongoing research and existing knowledge gaps. He is passionate about furthering flood forecasting techniques in Australia, which he aims to explore in his project.

MICHAEL STOREY
UNIVERSITY OF WOLLONGONG

Empirical analysis of spot fire and ember behaviour during extreme fire weather conditions

PHD SCHOLARSHIP STUDENT
COMMENCED MARCH 2016, SUBMITTED FEBRUARY 2021 AND AWAITING CONFIRMATION

Current role: Emissions Modeller at the University of Wollongong
Supervisors: Dr Owen Price and A/Prof Jason Sharples

Michael Storey's research analysed operational line scan mapping produced by the NSW Rural Fire Service and Victorian Department of Environment, Land, Water and Planning to understand spot fire behaviour, including distance from main fire front, number of spot fires, their size and their growth. Extreme bushfire behaviour predictions are based on a limited number of observations. Michael's PhD provides important tools to improve the understanding of spot fire and ember behaviour in dry forests of south east Australia, complementing and improving existing fire behaviour models.

Michael visited the Centre for Forest Fire Studies at the University of Coimbra in Portugal in 2017 to further his knowledge on topographic influence on extreme fire spread, and the behaviour of merging fires, as well as see firsthand the devastation caused by the fires in Portugal just prior to his trip, which took the lives of more than 60 people.

Michael submitted his PhD in February 2021 and at the time of print was waiting on confirmation. He is currently an associate research fellow at the University of Wollongong, working as an emissions modeller.

ASHLEY WRIGHT
MONASH UNIVERSITY

Improving flood forecast skill using remote sensing data

PHD SCHOLARSHIP STUDENT
COMMENCED APRIL 2014, COMPLETED SEPTEMBER 2017

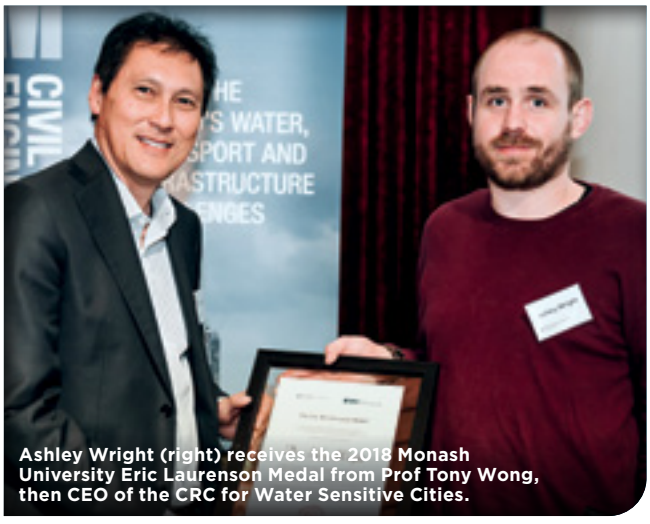
Current role: Senior Associate at PwC
Supervisors: A/Prof Valentijn Pauwels and Prof Jeffrey Walker

Dr Ashley Wright completed his PhD on flood forecasting in 2017. Ashley gathered historic rainfall data and developed modelling techniques to create a better understanding of rainfall in flood prone catchments. Greater understanding of the rainfall that falls on our catchments will lead to improved flood forecasting skill.

In 2018, Ashley won the Eric Laurenson Medal, which is awarded annually to a recent PhD graduate of Monash University who has written an excellent thesis, communicated their research findings to industry and has high research utilisation potential in water science, engineering or management.

"The award gives me confidence that my work is meaningful and of high quality," Ashley said.

Post-PhD completion, Ashley completed flood modelling work in Indonesia and Fiji with Monash University, before joining the CRC project *Improving flood forecast skill using remote sensing data* as a postdoctoral research fellow. Ashley is now a senior associate in insights analytics at PwC.



Ashley Wright (right) receives the 2018 Monash University Eric Laurenson Medal from Prof Tony Wong, then CEO of the CRC for Water Sensitive Cities.

Photo: Monash University

Fire Predictive Services

WASIN CHAIVARANONT

UNIVERSITY OF NEW SOUTH WALES

How does remotely sensed degree of curing and fuel load vary in grasslands and effect modelled fire spread?

PHD ASSOCIATE STUDENT
COMMENCED MARCH 2014, COMPLETED AUGUST 2018

Current role: Analyst at Bangkok Bank, Thailand
Supervisors: A/Prof Jason Evans

Dr Wasin Chaivaranot's research utilised new microwave-based vegetation indices, in combination with other visible and near infrared remote sensing techniques, to develop cost-effective ways of estimating fuel load and enhancing the result of estimations from remote sensing techniques. Wasin developed cost-effective ways of estimating fuel load and enhanced of estimations from remote sensing techniques, finding that careful consideration of fuel related parameters and variabilities across space and time is critical to estimating grassland fire spread.

Wasin is now an analyst at Bangkok Bank in Thailand.

YANG CHEN

MONASH UNIVERSITY

Modelling forest fuel temporal change using LiDAR

PHD SCHOLARSHIP STUDENT
COMMENCED AUGUST 2013, COMPLETED JUNE 2017

Current role: Research Scientist at CSIRO
Supervisors: Dr Marta Yebra

Dr Yang Chen's study used Light Detection and Ranging (LiDAR) to measure landscape-scale forest fuels to generate a time effective, feasible and objective method for forest fuel hazard assessment.

Currently, firefighters and land managers still rely on empirical knowledge to visually assess forest fuel characteristics of distinct fuel layers. The visual assessment method provides a subjective description of fuel properties that can lead to unreliable fire behaviour prediction and hazard estimation.

Yang's research investigated the application of the LiDAR technique in quantifying forest fuel properties, including fuel structural characteristics and litter-bed fuel load at a landscape scale. Her findings indicate that LiDAR allows a more efficient and accurate description of fuel structural characteristics and estimation of litter-bed fuel load. The results from her study can assist fire hazard assessment, fuel reduction treatment and fire behaviour prediction.

Yang is currently working at CSIRO as a research scientist socialising in deep learning and earth observation.

Photo: Marta Yebra

JAMES FURLAUD
UNIVERSITY OF TASMANIA

How do wet eucalypt forests burn? Managing Tasmania's most dangerous fuel type

PHD SCHOLARSHIP STUDENT
COMMENCED JUNE 2015, COMPLETED FEBRUARY 2020

Current role: Communications Coordinator at the University of Tasmania
Supervisors: Prof David Bowman and Dr Grant Williamson

Practical experience in Tasmania has shown that the PHOENIX RapidFire behaviour model – a dynamic, spatially and temporally explicit fire behaviour prediction model – is inappropriate for key Tasmanian vegetation types (tall wet eucalypt forests) that are ecologically different than their equivalents on the mainland of Australia (for which the fire prediction model was developed). Dr James Furlaud's PhD improved the understanding of fuels and fire danger in Tasmania's tall wet eucalypt forests, possibly Tasmania's most dangerous vegetation type. James has collected data on vegetation in tall wet eucalypt forests both in Tasmania and nationwide. He has used this data to understand how fuel load, structure, and fire danger vary both geographically and temporally across this forest type. He has investigated different fire behaviour modelling approaches from around the world to develop a conceptual framework for modelling fire behaviour in this complex vegetation type.

James has also led three projects funded by the CRC's funding for quick response program. He has completed immediate post-fire vegetation re-measurement of TERN plots burnt in the 2015/16 fire season, investigated the effects of fire at 12 permanent plots that burned in the 2019 Tasmanian fires, and is investigating the effect of fuel load and structure on fire severity across Australian wet eucalypt forests by measuring four of the eight plots in southern NSW that burned in the 2019/20 fires.

James has had his PhD research published in the *Journal of Ecology, Landscape Ecology* and the *International Journal of Wildland Fire*, and spoke at the International Association of Wildland Fire's Fire Behaviour and Fuels conference in 2019. He is currently the Fire Centre Research Hub's Communications Coordinator and research assistant for the School of Natural Sciences at the University of Tasmania.

SAM HILLMAN
RMIT UNIVERSITY

The utility of point clouds to estimate fuel hazards

PHD ASSOCIATE STUDENT
COMMENCED MARCH 2017

Current role: Application Developer at Forest Fire Management Victoria
Supervisors: Dr Karin Reinke

Sam Hillman's PhD is investigating the utility of point clouds for fuel hazard estimation. His project will explore the use of image-based point clouds generated from consumer-grade cameras and terrestrial laser scanners for describing cover, height and structure characteristics of below canopy vegetation.

Sam is also a seasonal firefighter and application developer for Forest Fire Management Victoria. In his role, he works in consultation with operational staff to develop mapping products for data collection and fuel hazard estimation. Sam was awarded the 2019 International Association of Wildland Fire scholarship, receiving US$3,000 toward his PhD.

VAIBHAV GUPTA
RMIT UNIVERSITY

Remote sensing of fire severity in Australian dry sclerophyll forests

PHD ASSOCIATE STUDENT
COMMENCED JULY 2011, COMPLETED DECEMBER 2016

Current role: Remote Sensing Analyst at NSW Department of Planning, Industry and Environment
Supervisors: Dr Karin Reinke

Dr Vaibhav Gupta's PhD investigated the application of two emerging and independent terrestrial remote sensing technologies to ascertain burn severity of prescribed burns in dry sclerophyll forests of south east Australia. His research identified metrics derived from hyperspectral and terrestrial laser scanning data that best describe change produced in the landscape in response to the prescribed burns.

Vaibhav is now a remote sensing analyst at the NSW Department of Planning, Industry and Environment.

BRYAN HALLY
RMIT UNIVERSITY

Improvement of fire detection outcomes using modelling techniques for estimation of background surface temperature

PHD SCHOLARSHIP STUDENT
COMMENCED MARCH 2015, COMPLETED AUGUST 2019

Current role: Researcher at RMIT University
Supervisors: Prof Simon Jones, Dr Karin Reinke and Dr Luke Wallace

Dr Bryan Hally's project developed new ways to provide quantitative analysis of the effectiveness of prescribed burning using terrestrial and airborne LiDAR techniques. Using a series of case studies of varying forest types, Bryan compared his measurements to existing vegetation assessment techniques to provide objective analysis of burn effectiveness. He then developed a model for the simulation of active fire landscapes which will validate a range of satellite remote sensors.

Bryan is currently working in the Geospatial Sciences department at RMIT University where he is a researcher, assisting in forest fuel attribution and forest structure projects. This included research on the CRC's *Fire surveillance and hazard mapping* project.

ALEXANDER HOLMES
MONASH UNIVERSITY

Investigating the effect of soil moisture, temperature and precipitation extremes on fire risk and intensity in Australia

PHD SCHOLARSHIP STUDENT
COMMENCED MARCH 2015, COMPLETED FEBRUARY 2018

Current role: Scientific Researcher at NSW Rural Fire Service
Supervisors: Prof Nigel Tapper, Dr Christoph Rudiger and Dr Imtiaz Dharssi

Dr Alexander Holmes' PhD investigated the effects of soil moisture, temperature and precipitation extremes on fire risk and intensity, providing fire and land management agencies with a better understanding of the mechanics behind soil moisture deficits and their influence on fire intensity. Evidence through the research showed that fire intensity increases logarithmically with decreasing moisture, Alex explained.

"The research showed that fire intensity increases logarithmically with decreasing moisture. This means that larger and more intense fires are likely to occur closer to population centres located around the coasts of Australia as climate change exacerbates drought conditions," he said.

As part of the CRC project *Improving land dryness measures and forecasts,* Alex's research was also used in establishing the high-resolution soil-moisture analysis system, JASMIN, which provides greater accuracy than previous models.

Alex now works as a scientific researcher at the NSW Rural Fire Service where he is responsible for producing computer programs and code to manipulate and create datasets, as well as analyse their physical properties. Part of this role includes researching potential improvements in the models used by the new National Fire Danger Ratings System.

NINA HOMAINEJAD

UNIVERSITY OF NEW SOUTH WALES

Unmanned Aircraft Systems for 3D bushfire mapping

PHD ASSOCIATE STUDENT
COMMENCED JANUARY 2020

Supervisors: Prof Sisi Zlatanova and Prof Norbert Pfeifer

The objective of Nina Homainejad's research is to utilise Unmanned Aircraft Systems for bushfire data acquisition. The data collected from the Unmanned Aircraft Systems will be merged with other layers of bushfire data collected prior to, and during, bushfire, such as aerial and ground point cloud and satellite data. A 3D model of the bushfire data will be generated from the different data sets and loaded into a web-based system for firefighters and emergency services to view. The purpose of this 3D model is to assist firefighters with a supportive tool for analysing bushfire behaviour.

As part of her research, Nina made recommendations on the most suitable categories of Unmanned Aircraft Systems for bushfire image and data acquisition and how the application of multiple categories of Unmanned Aircraft Systems in different airspaces could be achieved to replace traditional methods of bushfire image and data acquisition.

JASMINE INNOCENT

VICTORIA UNIVERSITY

Physics based simulations of grassfire propagation in patchy fuel beds and slopped terrain – a parametric study

PHD ASSOCIATE STUDENT
COMMENCED JUNE 2016

Current role: Applications Engineer at Kidde Australia
Supervisors: A/Prof Khalid Moinuddin

Jasmine Innocent's research focuses on grassland fire behaviour through sloped terrains and non-homogeneous fuel beds. This research will provide insight into fire behaviour that may then be used to improve operational models, improve prediction of real bushfires and subsequently mitigate the risks of bushfire impact. Practitioners currently use a rule of thumb that the rate of spread of fire doubles for every ten degrees of upslope, however there appears to be little empirical evidence for this other than the knowledge of experienced practitioners.

Jasmine is currently working as an applications engineer at the fire protection company, Kidde Australia Pty Ltd.

MATTHEW KYNG

VICTORIA UNIVERSITY

Parameterisation for a simplified short-range firebrand model from physics-based modelling

PHD SCHOLARSHIP STUDENT
COMMENCED JUNE 2020

Current role: Teaching Assistant at Macquarie University
Supervisors: Prof Khalid Moinuddin, Dr Nazmul Khan and Dr James Hilton

Matthew Kyng's PhD aims at incorporating a simplified firebrand model in the Spark fire behaviour model. The study will involve experimental/physical modelling scenarios for firebrand transport of varying number, mass, length, surface to volume ratio and so on, under various wind conditions; statistical analysis of the transport to determine some dynamic transport equations; obtaining firebrand creation probability and ignition probabilities from other PhD studies; incorporation of firebrand creation probability, dynamic transport and ignition probabilities into an operational model; and comparison of the fire parameters to experimental/physical scenarios.

Matthew currently works as a teaching assistant at Macquarie University.

ANDREA MASSETTI

MONASH UNIVERSITY

Remote sensing applied to bushfire

PHD ASSOCIATE STUDENT
COMMENCED MARCH 2016, COMPLETED JANUARY 2020

Current role: Quantitative Research Analyst at Sierentz Global Merchants, Switzerland
Supervisors: Dr Christoph Rudiger and Dr Marta Yebra

Drawing on his experience as an engineer in Italy and a remote sensing analyst in Portugal, Dr Andrea Massetti's PhD focused on integrating remotely sensed biophysical products, such as fuel load and moisture into predictive models for bushfire propagation. Current models to predict the rate of spread of a bushfire are based on experimental and field observations. These give a rate of spread for fire based on local environmental factors, such as wind terrain and fuel. However, these models lack accurate inputs for land cover and fuel conditions, as well as a detailed knowledge of fire propagation under complex conditions. Andrea's research is providing support for this and future development. He has had his research published in *Remote Sensing of Environment*.

Andrea currently works as a quantitative research analyst at Sierentz Global Merchants in Switzerland.

MERCY NDALILA

UNIVERSITY OF TASMANIA

The 2013 Forcett-Dunalley fire: a geospatial analysis of fire severity, smoke transport and emissions

PHD SCHOLARSHIP STUDENT
COMMENCED FEBRUARY 2015

Supervisors: Prof David Bowman and Dr Grant Williamson

Mercy Ndalila's research involves a geospatial analysis of the 2013 Forcett-Dunalley fire that burnt approximately 26,000 hectares in south east Tasmania. By examining geographic patterns of fire severity in different forest types using remote sensing techniques and analysing landscape factors governing this severity, Mercy will be able to provide fire managers with new information about extreme fire behaviour.

Mercy has 13 years' combined experience in biodiversity conservation and research and is also a volunteer firefighter with the Lenah Valley Fire Brigade, with an aim of gaining practical skills in fire management and to bring to life the theoretical principles of fire science.

GREG PENNEY

EDITH COWAN UNIVERSITY

Through the flames – quantitative analysis of strategic and tactical wildfire suppression

PHD ASSOCIATE STUDENT
COMMENCED JANUARY 2018, COMPLETED OCTOBER 2020

Current role: Superintendent at the Department of Fire and Emergency Services WA
Supervisors: Prof Daryoush Habibi

Dr Greg Penney is a Superintendent with the Department of Fire and Emergency Services in WA, with more than 16 years' operational and incident management experience, both as a firefighter and paramedic. His PhD research examined the critical components of bushfire suppression to improve firefighter safety and operational effectiveness during siege bushfire response. Greg's study adopted a fire engineering approach, incorporating both empirical and physics-based computer simulation to analyse suppression efforts with a significant focus on firefighter tenability.

Upon completion of his PhD, Greg has written *A Handbook of Wildfire Engineering: Guidance for Wildfire Suppression and Resilient Urban Design*. The Handbook draws on Greg's research and is designed to promote the emerging field of wildfire engineering and provide practical guidance to firefighters, incident management teams and urban planners to improve fire suppression operations, firefighter safety and resilience community design at the rural urban interface. For his research, Greg has been awarded with the Australian Institute of Health and Safety National Eric Wigglesworth Award.

RACHAEL QUILL

UNIVERSITY OF NEW SOUTH WALES

Statistical characterisation of wind fields over complex terrain with applications in bushfire modelling

PHD SCHOLARSHIP STUDENT
COMMENCED JANUARY 2014, COMPLETED MARCH 2017

Current role: Research Fellow at the University of Melbourne
Supervisors: A/Prof Jason Sharples, Dr Leesa Sidhu and Prof Graham Thorpe

Dr Rachael Quill investigated the variability of wind in the context of fire spread, completing her PhD in 2017. By adopting a statistical approach, Rachael analysed the variability of wind direction and strength, working towards a characterisation of wind over complex terrain which enables understanding of uncertainty around the drivers of fire spread. Better modelling of this uncertainty can feed directly into fire spread models, allowing fire behaviour analysts and managers to make more informed decisions. The application of these statistical analyses can be used

to evaluate the spectrum of wind prediction models used for bushfire modelling over rugged landscapes.

Rachael was active with the CRC throughout her PhD, presenting findings at the CRC Research Forum in 2016 and making it through to the University of New South Wales finals for the Three Minute Thesis competition in 2015. Rachael also presented her work overseas at conferences in France and Scotland, and wrote articles for *Wildfire* and *Fire Australia*. Her PhD findings featured in *Hazard Note 53 – Capturing the variability of wind for modelling the variability of bushfires*.

Rachael was chosen to represent the CRC as an early career researcher at the 2018 Science at the Science Dome, run by the Australian Academy of Science. She is now a Research Fellow at the University of Melbourne investigating wind farm power production, after previously lecturing in probability and statistics at the University of Adelaide.

SHAHRIAR RAHMAN
MACQUARIE UNIVERSITY

Development of a stochastic fire effect model in predicting the impacts of fire severity on vegetation

PHD ASSOCIATE STUDENT
COMMENCED APRIL 2016

Current role: Mapping City Expert at Cognizant
Supervisors: Dr Michael Chang

Shahriar Rahman is developing a stochastic fire effect model to predict the impacts of fire severity on the vegetation of selected national parks around Sydney. The model will integrate environmental parameters, geospatial fire information and climatic data as the model inputs, which will help to develop statistically reliable future environmental scenarios for the post-fire impacts on vegetation. He is also a mapping city and country expert at Cognizant.

NICHOLAS READ
UNIVERSITY OF MELBOURNE

Models for lightning-caused wildfire ignition

PHD ASSOCIATE STUDENT
COMMENCED JANUARY 2015, COMPLETED MAY 2018

Current role: Chief Technology Officer at Anditi
Supervisors: Dr Peter Taylor

Lightning-caused bushfire is a significant concern for fire management agencies worldwide. Unlike other ignition sources, lightning fires often occur in remote and inaccessible locations making detection and suppression particularly challenging.

Dr Nicholas Read's PhD investigated models for forecasting the day and location of lightning-caused bushfire ignitions. Nick's research produced models that take daily gridded weather and environmental variables and output daily gridded predictions for ignition likelihood. These outputs can be used operationally, as well as in conjunction with spread models such as Phoenix Rapidfire to improve long-term risk forecasts.

Nick is now Chief Technology Officer at Anditi, where he looks at how information can be leveraged from large-scale LiDAR data sets.

SAMI SHAH
AUSTRALIAN NATIONAL UNIVERSITY

Development of an integrated method to predict bushfire hazard

PHD ASSOCIATE STUDENT
COMMENCED FEBRUARY 2018

Supervisors: Dr Marta Yebra

With advancements in remote sensing, many factors affecting bushfires hazard, are now freely available at much larger spatial and temporal scales. Availability of these factors and advanced data integration and analysis techniques, such as machine learning algorithms, provide a great opportunity to develop a new bushfire hazard rating system. Sami Shah's research is looking at the development of a new method to predict bushfire hazard using remote sensing and GIS data using machine learning algorithms.

SESA SINGHA ROY
VICTORIA UNIVERSITY

Development of an interface using penalisation method for improving computational performance of bushfire simulation tools

MASTERS ASSOCIATE STUDENT
COMMENCED FEBRUARY 2017, COMPLETED OCTOBER 2019

Current role: Sessional Lecturer at Victoria University
Supervisors: A/Prof Khalid Moinuddin

Sesa Singha Roy's Masters aimed to improve the computational performance of the Fire Dynamics Simulator, a physics-based model developed by the National Institute of Standards and Technology in the United States, by reducing the wind development time required to run the simulator. Sesa's interface method has reduced the computation time for fire simulations in the Fire Dynamics Simulator by reducing the wind generation and wind development time, resulting in quicker fire spread predictions.

Sesa currently lectures at Victoria University and is pursuing her PhD at Monash University.

PHILLIP STEWART
UNIVERSITY OF QUEENSLAND

Changing fire regimes of the Great Sandy Region of south eastern Queensland

PHD ASSOCIATE STUDENT
COMMENCED APRIL 2013, COMPLETED JANUARY 2016

Current role: Principal Ecologist and Director at Biodiversity Conservation
Supervisors: A/Prof Patrick Moss

Investigating the changing fire regimes in the Great Sandy Region of south east Queensland, Dr Philip Stewart's PhD investigated the past, present and future challenges in the area. Philip investigated the linkages between fire regimes and how they impact the environment, vegetation and population dynamics, including changes in temperature and precipitation regimes, both spatially and temporally. His research offers a variety of regime management controls that can be implemented in the future.

Philip now works at the University of Queensland coordinating the undergraduate and postgraduate course in fire ecology and management. He is also the Principal Ecologist and Director of the consultancy firm, Biodiversity Conservation.

SIMEON TELFER
RMIT UNIVERSITY

Remote sensing of fuel to improve fire behaviour predictions

PHD SCHOLARSHIP STUDENT
COMMENCED JANUARY 2021

Current role: Fire Management Officer at National Parks and Wildlife SA
Supervisors: A/Prof Karin Reinke, Prof Simon Jones, James Hilton

Simeon Telfer's project is measuring bushfire fuel using remote sensing and the effects of fuel on fire behaviour. The research will focus on Coastal Mallee Heath type which has been identified by South Australian fire managers as difficult to predict with current fire behaviour models. Coastal Mallee Heath dominates Kangaroo Island, which was devastated by bushfire in 2020 and is also found in other southern coastal areas of South Australia and Western Australia. The fuel structure may be similar to other high fuel load heathlands around Australia and possibly other countries, however this will need to be determined by the research.

Simeon has worked in fire management with National Parks and Wildlife in SA for nearly 10 years. He specialises in fire behaviour analysis and has been deployed to major fires in most states and territories of Australia, as well as Canada. Simeon has delivered training in meteorology and fire prediction to fire behaviour analysts around Australia. He is a key end-user for several CRC projects, particularly those focusing on fire behaviour and using remote sensing to improve our understanding of bushfires.

CHRISTOPHER THOMAS
UNIVERSITY OF NEW SOUTH WALES

An investigation of the dynamics of fire-fire interactions using a coupled fire atmosphere model

PHD SCHOLARSHIP STUDENT
COMMENCED SEPTEMBER 2014, COMPLETED AUGUST 2018

Current role: Researcher at the University of New South Wales
Supervisors: A/Prof Jason Sharples

Dr Christopher Thomas' research revolved around the numerical models which allow for two-way interaction between a bushfire and the surrounding atmosphere, which is an essential tool in understanding the dynamic behaviour of fire. These models permit a more detailed appreciation of the physical processes underlying extreme bushfire development, however, there remain shortcomings with the technology. Christopher's research evaluated current modelling methodologies, particularly pertaining to spot fire development, quantifying the separate effects of radiation and convection, and delivering a dataset of coupled fire-atmosphere simulations of fundamental burning scenarios for comparison with experimental data.

Christopher is now a researcher at the University of New South Wales' Climate Change Research Centre.

CHATHURA WICKRAMASINGHE
RMIT UNIVERSITY

Multi resolution, high temporal fire monitoring and intensity mapping using Himawari-8 Advanced Himawari Imager data

PHD ASSOCIATE STUDENT
COMMENCED MAY 2015, COMPLETED DECEMBER 2018

Current role: GIS Coordinator at HVP Plantations and Remote Sensing Analyst at CO2 Australia.
Supervisors: Prof Simon Jones, Dr Karin Reinke and Dr Luke Wallace

Dr Chathura Wickramasinghe's study focused on utilising the multi-resolution and high frequency data from the Advanced Himawari Imager to develop new algorithms for fire line mapping and fire intensity calculation. Chathura's research proposed two algorithms for fire line mapping and fire radiant energy: calculations are improved by using accurate fire area calculation and correcting for radiant heat from smouldering areas.

Chathura is now GIS Coordinator at HVP Plantations and works as a remote sensing analyst at CO_2 Australia.

RAHUL WADHWANI

VICTORIA UNIVERSITY

Refinement and validation of the pyrolysis and firebrand transport sub-models for a physics-based bushfire prediction model

PHD SCHOLARSHIP STUDENT
COMMENCED JANUARY 2015, COMPLETED NOVEMBER 2019

Current role: Sub-group Leader at the International Association for Fire Safety Science, India
Supervisors: Dr Khalid Moinuddin and Dr Duncan Sutherland

Using a firebrand modelling dragon system, Dr Rahul Wadhwani's PhD refined two sub models in the Wildland-Urban Interface Fire Dynamics Simulator: pyrolysis and firebrand transport. His research is benefiting fire model developers and improving numerical modelling of short-range embers.

"These embers travel in front of a fire front and can start new fires, which can trap firefighters or destroy houses," Rahul said. "I'm hopeful that my results could help enable better predictions for fire behaviour in vegetation where a lot of embers are generated."

In 2017, Rahul spent five months at the Department of Mechanical Engineering at the Imperial College London as a visiting PhD student, working as part of a team reviewing fire behaviour on significant fires internationally: 2016's Fort McMurray (Canada) fire, the 2016 Haifa (Israel) fire, the 2014 Västmanland (Sweden) fire and 2009's Black Saturday in Australia.

Rahul has presented his research findings at a conference in Sweden and took part in the Three Minute Thesis at the Research Advisory Forum in 2018. He now leads the Large Outdoor Fires and the Built Environment subgroup, established by the International Association for Fire Safety Science.

SERGIO ZARATE
UNIVERSITY OF QUEENSLAND

Physical and fire behaviour characterisation of bushland fuels

PHD ASSOCIATE STUDENT
COMMENCED FEBRUARY 2018

Supervisors: Juan Hidalgo

Sergio Zarate's research aims to provide insight into the fundamental process of fire growth of bushland fine-sized fuels, focusing on how the ignition and subsequent fire spread of fuel particles are affected when different convective and radiative conditions are applied.

The results of this research will show how significant the convective heat exchange is for fine-sized particles, and if the effect of convection needs to be included in both empirical and physical models intended for predicting rate of fire spread in vegetation with similar size characteristics.

YANG ZHANG
UNIVERSITY OF NEW SOUTH WALES

Understanding spatial patterns of wildfire occurrence in south eastern Australia

PHD ASSOCIATE STUDENT
COMMENCED SEPTEMBER 2014, COMPLETED APRIL 2018

Supervisors: A/Prof Samsung Lim

The limitation of resources and the requirements for quick responses demand prediction of locations where fires will occur. Employing fire records within empirical models is essential to quantify the characteristics of fire occurrence to support planning and decision-making. Dr Yang Zhang's study incorporated geospatial information in exploring how top-down and bottom-up drivers regulate fire occurrence and how the relationships between them vary spatially in south eastern Australia, with the aim of providing practical guidance for fire management.

LI ZHAO
AUSTRALIAN NATIONAL UNIVERSITY

Spatially forecasting coupled litter and root moisture dynamics for bushfire management

PHD SCHOLARSHIP STUDENT
COMMENCED JUNE 2016

Current role: Research Assistant at the Australian National University
Supervisors: Dr Marta Yebra, Prof Albert van Dijk and A/Prof Geoff Cary

Soil moisture has been shown to affect fuel moisture content but the role of soil moisture in determining fuel moisture content is uncertain. Li Zhao's research aims to forecast fuel moisture content by coupling fuel moisture content and water cycle models. By applying the model at a large scale for operational use, Li's research will provide land managers with better tools to predict fuel moisture content, leading to more reliable and accurate outcomes in bushfire management. The fuel moisture content model is a physical process-based model and the water cycle model is the Australian Water Resources Assessment system landscape model.

At the time of print, Li expected to submit her PhD in late 2021. She is currently working at the Fenner School of Environment and Society at the Australian National University as a research assistant to Dr Marta Yebra.

Future Workforce

HEATHER BANCROFT
UNIVERSITY OF MELBOURNE

Wellbeing of firefighters: the impact of individual factors, potentially traumatic event exposure, and operational and organisational factors on mental health outcomes

PHD SCHOLARSHIP STUDENT
COMMENCED JUNE 2014, COMPLETED OCTOBER 2019

Current role: Psychologist and Principal at Bancroft Psychological Consulting and Resource Development Officer at the Australian Psychological Society
Supervisors: A/Prof Andrea Phelps and Prof Meaghan O'Donnell

Dr Heather Bancroft's study has improved the knowledge of the prevalence of mental health disorders amongst Australian volunteer and career firefighters, as well as the understanding of the range of factors contributing to better and worse mental health outcomes.

Four organisations participated in her research: SA Country Fire Service, ACT Fire and Rescue; ACT Rural Fire Service and the NT Fire and Rescue Service. Heather conducted 300 clinical interviews with career and volunteer firefighters to assess their mental health. She then collected additional information through two identical online surveys that were completed by 817 participants in round one and 335 in round two.

Depression and alcohol dependence (both 5.5 per cent) were identified as the two most prevalent rates of mental health disorders experienced in career firefighters during the interviews, while anxiety (4.9 per cent) and depression (4.4 per cent) were the most common disorders found in volunteer firefighters. These results were compared to the Australian National Survey of Mental Health and Wellbeing from 2007, which found that, compared to the general population, volunteer firefighters had a lower rate of post-traumatic stress disorder (PTSD) but higher rates of anxiety, while both career and volunteer firefighters had a higher rate of alcohol dependence. Heather discovered that career firefighters who had high job satisfaction because of aspects like shift work, physical fitness requirements and the responsibility of the job, had fewer symptoms of PTSD and depression.

Heather says that the research is showing that a supportive and open culture within the fire services will help to reduce the stigma associated with having a mental health problem.

Heather presented her research findings at the CRC's Research Forum in 2018 and has had extensive experience working in the sector as a clinical psychologist with Ambulance Victoria, where she was Clinical Director of the Victorian Ambulance Counselling Unit. Heather runs her own business, Bancroft Psychological Consulting, as well as working as the Resource Development Officer at the Australian Psychological Society.

STEVEN CURNIN
UNIVERSITY OF TASMANIA

Spanning boundaries to support effective multi-agency coordination in emergency management

PHD ASSOCIATE STUDENT
COMMENCED JANUARY 2012, COMPLETED FEBRUARY 2015

Current role: Director, Disaster Resilience Research Group at the University of Tasmania
Supervisors: A/Prof Christine Owen and Prof Douglas Paton

Dr Steven Curnin's project began with the Bushfire CRC and investigated multi-agency emergency management coordination to develop a conceptual framework that identified the core requirements of liaison officers working at state level control centres. Findings from his research were encompassed into operational doctrine for liaison officers in several state level control centres.

After completing his PhD, Steve worked as an emergency management advisor in the critical infrastructure sector. He is now a Research Fellow at the University of Tasmania and was a researcher on the CRC project, *Improving decision making in complex multi-team environments.* Through this project, Steve and his colleague A/Prof Ben Brooks developed two cognitive decision tools and training aides to enhance the decision-making capability of practitioners in emergency management. Both tools – the *Psychological Safety Checklist* and the *Cognitive Bias Aide Memoire* – were featured in *Hazard Note 73* and are being used by emergency managers and local councils. They are available on the CRC website.

As a member of the Resilience Expert Advisory Group for Critical Infrastructure Resilience, Steve has extended CRC research to develop a publication released by the Commonwealth Department of Home Affairs in 2018. The publication offers six characteristics of the strategic decision-making process to assist stakeholders within the business community to better understand and apply the principles of decision making during a crisis. In addition, Steve conducts regular masterclasses for the critical infrastructure sector on decision making.

As Director of the Disaster Resilience Research Group at the University of Tasmania, Steve conducts regular masterclasses, drawing on his CRC research, for the critical infrastructure sector, emergency managers and local councils on how to optimise decision making. Steve is now also the course coordinator of the Graduate Certificate in Organisational Resilience and lectures in emergency management. He was awarded a prestigious research grant under the Discovery Early Career Research Award for 2021, which will allow him to continue his longstanding history of effective collaboration with emergency management agencies.

BILL CALCUTT
UNIVERSITY OF WOLLONGONG

Valuing volunteers: better understanding the primary motives for volunteering in Australian emergency services

MASTERS SCHOLARSHIP STUDENT
COMMENCED FEBRUARY 2014, COMPLETED JULY 2019

Current role: Private consultant
Supervisors: A/Prof Michael Jones and Dr Matthew Todres

Utilising the NSW State Emergency Service in a multi-site case study, Bill Calcutt's Masters research has provided a better understanding of the primary motives for formal volunteering in Australian emergency services. His research applied the Schwartz Theory of Basic Human Values and associated Portrait Values Questionnaire survey to determine the shared and contrasting values of a large state-wide emergency service volunteer workforce.

Values are powerful motivators, with shared values reinforcing volunteer commitment and retention, and conflicting values contributing to volunteer turnover. Bill's findings show statistically significant variations in values preferences within the existing emergency service volunteer workforce by gender and generation, with females expressing a stronger preference for altruistic (other-oriented) values, and males and younger volunteers expressing a stronger preference for egoistic (self-oriented) values. This affirms the crucial role of values as primary motives for emergency service volunteering, and the values differences revealed by Bill's research have important implications for how the divergent values needs of distinct sections of the volunteer workforce can be acknowledged and accommodated.

Bill presented his research as a Three Minute Thesis at the CRC's Research Advisory Forum's in 2017 and 2019. He now works as a private consultant.

RUSSELL DIPPY
CHARLES STURT UNIVERSITY

What human capacity demands should inform the development and appointment of an emergency manager?

PHD ASSOCIATE STUDENT
COMMENCED JANUARY 2018

Current role: Emergency Management Coordinator at South Australia Police
Supervisors: A/Prof Valerie Ingham

Russell Dippy's research is analysing 20 years of Australian judicial and semi-judicial reports to discover the role of human capacity in emergency management. The research will contribute to and advance elements of human capacity in Australian emergency managers to reduce the effects of emergencies upon the community.

Russell is currently the Emergency Management Coordinator at South Australia Police and is responsible for the coordination of all organisational emergency management planning and policy. He is also the treasurer at the International Association of Emergency Managers.

JOEL DUNSTAN
UNIVERSITY OF SOUTH AUSTRALIA

Development of an occupational fitness evaluation – the identification and quantification of criterion tasks performed by South Australian professional urban firefighters

MASTERS SCHOLARSHIP STUDENT
COMMENCED APRIL 2019

Current role: Fitness Coordinator at the South Australian Metropolitan Fire Service
Supervisors: Prof Roger Eston and Prof Kevin Norton

Joel Dunstan's project involves an injury analysis to identify a need for an occupational fitness evaluation process. To reduce injury and illness in firefighters, AFAC provided health and fitness recommendations for its associated fire service organisations in 2002. The recommendations offer a framework with which fire and emergency service organisations can monitor and assess the health and physical fitness of career and volunteer firefighters and include regular Physical Performance Assessments.

Consistent with these recommendations, the South Australian Metropolitan Fire Service (SAMFS) is committed to creating an evidence-based in-service fitness evaluation for use by its employees. Joel's research aims to develop the fitness evaluation. This will involve numerous steps, including a retrospective cohort study of injury reports recorded by the SAMFS from 2011 to 2018, determination of critical tasks specific to SAMFS firefighters, the creation of a preliminary fitness evaluation, and establishing the physical and physiological demands associated with the fitness evaluation battery.

Joel is currently a Fitness Coordinator and postgraduate researcher at the SAMFS.

VIVIEN FORNER
UNIVERSITY OF WOLLONGONG

Leading with Self-Determination Theory

PHD ASSOCIATE STUDENT
COMMENCED SEPTEMBER 2012, COMPLETED DECEMBER 2019

Current role: Director of Research at the Institute of Management Psychology and Research Associate at the University of Wollongong
Supervisors: Prof Nina Reynolds and A/Prof Michael Jones

Vivien Forner's PhD has improved the leadership capabilities of those who manage and supervise volunteers. Using the Self-Determination Theory,

she tested the impact of a leadership development program that teaches leaders evidence-based approaches for supporting their volunteers and building a positive work climate within the brigade or unit.

Vivien is currently the Director of Research at the Institute of Management Psychology and a visiting research associate with the University of Wollongong.

GEMMA GRAY
UNIVERSITY OF MELBOURNE

Spontaneous volunteers in the emergency management sector

MASTERS ASSOCIATE STUDENT
COMMENCED JULY 2015, COMPLETED JULY 2016

Current role: Project Manager at Emergency Management Victoria
Supervisors: Prof Alan March, Prof John Handmer and Angela Sutherland

Gemma Gray's Masters research looked at the long-term viability of emergency services in Australia, given the increasing frequency and severity of disasters, and at examples of spontaneous volunteers arising to support their community in times of need. Her thesis addressed the paradox of people's willingness to help and provide support during disaster event versus the capacity of emergency services to effectively utilise offer of assistance. Gemma's research also explored the concept of shared reasonability to address future risks and reliance on emergency services and government through recent case studies of high-profile examples of spontaneous volunteering including the 2010–2011 Queensland floods and Christchurch earthquakes, identifying what impeded and what facilitated collaboration for more resilient communities during these disasters.

Gemma is now a project manager in the Executive Office of the Emergency Management Commissioner at Emergency Management Victoria.

SARAH HALL
DEAKIN UNIVERSITY

Sleep and stress in on-call fire and emergency service workers

PHD SCHOLARSHIP STUDENT
COMMENCED MAY 2015, COMPLETED SEPTEMBER 2018

Current role: Associate Lecturer at Deakin University
Supervisors: A/Prof Brad Aisbett, Prof Sally Ferguson, Dr Anne Turner and A/Prof Sam Robertson

Dr Sarah Hall's PhD investigated the effect of working on-call on the sleep and physiological stress of fire and emergency service workers. Participants in this study wore an activity monitor on their wrist for two weeks and completed a daily sleep and work diary, they also collected saliva samples for the first week of the study.

Sarah used this data to examine how subjective and objective sleep is affected when working on-call from home and to quantify the effect of working on-call from home on the activity of the two main stress systems. Sarah found that some aspects of sleep and physiological stress are affected by this form of work scheduling.

Sarah was a regular presenter to the AFAC Work Health and Safety Technical Group and is currently working at Deakin University teaching physiology and continuing her research involving the physiological stress systems.

BRUCE HANKINSON
QUEENSLAND UNIVERSITY OF TECHNOLOGY

Network enabled agility: a model for filling the strategic void in interoperability thinking

PHD ASSOCIATE STUDENT
COMMENCED JULY 2016

Current role: Managing Director at Raft Risk Solutions
Supervisors: Prof Melissa Haswell

With an extensive background in the Navy and Queensland state government, Bruce Hankinson's study is using network enabled agility to develop an innovative, future-proof model for communities to not only adapt, but also to thrive, in uncertainty. Network enabled agility increases the capability of geographically dispersed emergency networks to collaborate peer-to-peer through a high level of shared awareness.

This multidisciplinary research will test the applicability of the model on real life situations using case studies. Bruce's research will assess individual and shared awareness, quality of decisions, quality of information and levels of enterprise synchronisation of complex emergency management operations, providing an evidence-based value chain that can guide strategy and capability development now and in the future.

FIONA JENNINGS
RMIT UNIVERSITY

Navigating uncertainty: a qualitative study of resident involvement in the 2013 Forcett Tasmania bushfire disaster

PHD SCHOLARSHIP STUDENT
COMMENCED AUGUST 2014, COMPLETED JANUARY 2019

Current role: Wellbeing Support Officer at Bushfire Recovery Victoria
Supervisors: Prof John Handmer and Dr Josh Whittaker

Dr Fiona Jennings' PhD explored the impact of the 2013 Forcett bushfires in Tasmania on local residents.

As a former resident of Dunalley herself, which was severely impacted by the fire, Fiona's PhD offers an understanding of how people directly affected respond in a bushfire disaster. Fiona's findings illustrated a pragmatic view of community resilience, volunteering, and disaster recovery, and offers new ways the emergency management sector can support and engage with community volunteers and volunteering organisations.

Fiona presented her research findings at the CRC's Research Forum in 2017 and hosted a webinar in 2020 that explores how community members approached the Forcett bushfire event and why. Fiona has worked as a Bushfire Recovery Mental Health Clinician for the Royal Flying Doctor Service of Australia and now works as a Wellbeing Support Officer for Bushfire Recovery Victoria.

BRIANNA LARSEN

DEAKIN UNIVERSITY

Simulated self-paced wildfire suppression work in different thermal conditions

PHD SCHOLARSHIP STUDENT
COMMENCED JANUARY 2012, COMPLETED OCTOBER 2015

Current role: Postdoctoral Research Fellow at Griffith University and Research Consultant at Human Performance Science
Supervisors: A/Prof Brad Aisbett, Prof Rod Snow and Dr Amelia Carr

Dr Brianna Larsen's PhD began at the Bushfire CRC and evaluated the effect of different ambient temperatures on firefighters' work performance and physiology. Brianna completed her PhD in 2015 at the Bushfire and Natural Hazards CRC by evaluating firefighters performing simulated work tasks in various ambient conditions. She found that firefighters safely performed the same amount of work during both hot (33°C) and temperate (18°C) conditions, likely due to the intermittent nature of the work, frequent task rotation and increased fluid consumption in hot conditions. However, firefighters were unable to maintain their work output in very hot conditions (45°C) and displayed significantly elevated heart rates and core body temperatures, despite doubling their fluid consumption.

Brianna is now a postdoctoral research fellow at Griffith University and research consultant at Human Performance Science.

JOHN MASON

MONASH UNIVERSITY

Giving voice to our givers: a phenomenological study addressing the perceptions of Rural Fire Service volunteers in Queensland

PHD ASSOCIATE STUDENT
COMMENCED MARCH 2018

Current role: Government Engagement Coordinator at the Department of the Prime Minister and Cabinet
Supervisors: A/Prof Jane Southcott

John Mason's project addresses the serious social issues entwined with declining emergency services volunteering rates during times of community need. Generation of data useful in developing strategies to attract, recruit, enlist maintain and develop Rural Fire Service volunteers in Queensland is the main objective of John's research.

John is currently Government Engagement Coordinator at the Department of the Prime Minister and Cabinet.

PETER MIDDLETON

CHARLES STURT UNIVERSITY

Enhancing public information practice in Tasmania's emergency services

MASTERS ASSOCIATE STUDENT
COMMENCED FEBRUARY 2018, COMPLETED OCTOBER 2018

Current role: Manager Public Information and Warnings, Tasmania Fire Service and Tasmania SES
Supervisors: Sandra Barber

Peter Middleton completed his Masters research in 2018, investigating the provision of public information in Tasmania's emergency services. He conducted a literature review and baseline survey on the state of Tasmania's emergency services and examined the communication flow of public information in these agencies.

After coordinating community development at the Tasmania Fire Service for many years, Peter is now the manager of public information and warnings for both TFS and the Tasmania SES.

NICHOLAI POPOV

UNIVERSITY OF WOLLONGONG

The impact of leadership development on organisational citizenship behaviour and social capital: an intervention using Self-Determination Theory

PHD ASSOCIATE STUDENT
COMMENCED FEBRUARY 2013

Supervisors: A/Prof Michael Jones and Prof Dominique Parrish

Nicholai Popov's research is utilising leadership development to promote organisational citizenship behaviour and cultivate social capital, which have been associated with reductions in intentions to quit and improved engagement among organisational members. By using a training intervention that applies Self-Determination Theory, leaders can be trained in how to satisfy the three basic psychological needs among their direct reports. At the time of print, Nicholai expected to submit his PhD in late 2021.

BILLY HAWORTH

UNIVERSITY OF SYDNEY

Assessing the potential, application, and implications of volunteered geographic information in disaster risk reduction

PHD SCHOLARSHIP STUDENT
COMMENCED JULY 2013, COMPLETED FEBRUARY 2017

Current role: Lecturer at the University of Manchester, United Kingdom
Supervisors: A/Prof Eleanor Bruce, Dr Josh Whittaker, A/Prof Kurt Iveson and Prof Matt Duckham

The recipient of the CRC's Special Recognition Award in 2016, Dr Billy Haworth was a fantastic ambassador for the CRC. He was one of the first CRC students to complete his PhD in 2017. Billy's PhD research was widely recognised, and he was awarded with the International Association of Wildland Fire PhD scholarship in 2015, the 2015 Esri Australia Young Scholar award, the University of Sydney Faculty of Science Postgraduate Research Prize in 2015 and a University of Sydney special recognition award in 2016.

Billy's research looked at volunteered geographic information (VGI), community engagement and bushfire preparation. VGI refers to the widespread engagement of citizens in the creation of geographic information, often through social media, smartphones and online mapping tools. It represents a shift in the ways information is created, shared, used and experienced, and has important implications for disaster management.

Billy's PhD research examined the role of VGI in fostering community engagement in bushfire preparation in Tasmania, where VGI has potential to aid in building risk awareness, community connectedness and increased disaster resilience. His findings show that VGI is more than just technology – it is about people sharing their knowledge and mapping collaboratively as a social practice. It presents opportunities for citizen empowerment in line with shared responsibility, but also challenges with power moving away from the traditional command and control of emergency services.

Billy's research provides a clearer path for emergency service agencies to best-utilise these technologies for and with communities, helping to increase volunteering sustainability, community engagement and disaster resilience.

Billy undertook a work placement with the Tasmania Fire Service in 2016 and presented his research findings at the CRC's Research Forum, as well as the largest academic geography conference globally, the Association of American Geographers annual meeting in 2015.

He is now a lecturer in disaster management and Director of Postgraduate Teaching at the University of Manchester's Humanitarian and Conflict Response Institute.

ALEX REDSHAW
UNIVERSITY OF SOUTH AUSTRALIA

Defining and assessing movement capacities associated with modern Australian urban firefighting

MASTERS SCHOLARSHIP STUDENT
COMMENCED APRIL 2019

Current role: Fitness Coordinator at the South Australian Metropolitan Fire Service
Supervisors: Prof Roger Eston and Prof Kevin Norton

Alex Redshaw's study will provide a sound understanding of the movement capacity requirements of modern South Australian Metropolitan Fire Service (SAMFS) firefighters. The findings will identify the physical demands of critical occupational tasks, aiding the teaching and programming of future training activities. This study will also assess the movement capacities of full-time firefighters. The establishment of a contemporary 'normative' database of movement capacities in the SAMFS will be the first of its kind and will aid the development of future injury prevention initiatives.

Alex is currently a Fitness Coordinator at the SAMFS.

WAVNE RIKKERS
UNIVERSITY OF WESTERN AUSTRALIA

Fighting the fires within: breaking down the barriers to mental help-seeking amongst first responders with Post-Traumatic Stress Disorder and high psychological distress

PHD SCHOLARSHIP STUDENT
COMMENCED MARCH 2019

Current role: Senior Research Officer at the University of Western Australia
Supervisors: Dr David Lawrence and Prof Stephen Houghton

Wavne Rikkers' research aims to identify the strategies and recommendations that emergency services agencies could adopt to improve the mental health and wellbeing of their workforce. The focus of this research is on barriers to help-seeking by workers who have developed, or are at risk of developing, serious mental health conditions such as post-traumatic stress disorder, because of their work experiences. Results to date indicate that emergency service agencies may need to address issues such as stigma or mental health literacy. The former would require a significant shift in culture and attitudes and the latter requires an easier fix that uses training programs aimed at increasing mental health literacy and improving the understanding of how early intervention and support can ameliorate development or worsening of mental health conditions/symptoms.

Wavne is currently a Senior Research Officer in the Graduate School of Education at the University of Western Australia. She is also Co-Chief Investigator of After the Fires, the national survey of the wellbeing and resilience of Australia's emergency services following the 2019-20 bushfire season.

GRACE VINCENT
DEAKIN UNIVERSITY

Fighting fires and fatigue

PHD ASSOCIATE STUDENT
COMMENCED FEBRUARY 2012, COMPLETED MAY 2015

Current role: Postdoctoral Research Fellow at CQUniversity
Supervisors: Dr Brad Aisbett, Dr Nicola Ridgers and Prof Sally Ferguson

Dr Grace Vincent's PhD began at the Bushfire CRC and was completed in May 2015. Over 50 firefighters were recruited from across Australia to help gather important data on sleep behaviour during multi-day deployments. The results from Grace's PhD have assisted in managing firefighter health and safety, with her research contributing some of the first data about the sleep quantity and quality that firefighters obtain during multi-day deployments.

Grace is now a senior postdoctoral research fellow at CQUniversity.

KAITLYN WATSON
QUEENSLAND UNIVERSITY OF TECHNOLOGY

The roles of pharmacists in disaster health management in natural and anthropogenic disasters

PHD ASSOCIATE STUDENT
COMMENCED FEBRUARY 2016, COMPLETED JULY 2019

Current role: Founder and CEO of Disaster Pharmacy Solutions, and Postdoctoral Researcher, University of Alberta, Canada
Supervisors: Prof Lisa Nissen, Prof Vivienne Tippett and Dr Judith Singleton

A registered pharmacist, Dr Kaitlyn Watson's PhD investigated pharmacists' roles in disasters, and identified the acceptance and expectations of pharmacists throughout the different stages of a disaster. Taking an all-hazard and inclusive approach, this research included key stakeholders from international disaster and emergency management organisations as well as pharmacy organisations. Pharmacists' skills and knowledge are typically underutilised in disasters and it was identified that their abilities extend beyond the traditional role of logistics and supply management. There are multiple practice areas in a disaster in which a pharmacist's expertise could be valuable in-patient care, logistics, governance and public health.

Kaitlyn's research featured in *Hazard Note 78* and she wrote for *Fire Australia*. She presented her findings at the Australia and New Zealand Disaster and Emergency Management conference in 2019.

Currently living in Canada, Kaitlyn is the founder and CEO of Disaster Pharmacy Solutions and a postdoctoral researcher at the University of Alberta. She is a Fellow at the Higher Education Academy, Co-chair of the Primary Care Special Interest Group at the World Association for Disaster and Emergency Medicine and a local advisor for the Commonwealth Pharmacists Association.

ALEX WOLKOW
DEAKIN UNIVERSITY

Sleep restriction across a simulated firefighting deployment: the impact on acute stress responses

PHD ASSOCIATE STUDENT
COMMENCED JANUARY 2012, COMPLETED DECEMBER 2015

Current role: Postdoctoral Research Fellow at Monash University
Supervisors: Dr Brad Aisbett and Prof Sally Ferguson

Dr Alex Wolkow's PhD began at the Bushfire CRC and was completed in 2015. Alex investigated the effects of sleep restriction and stress responses on firefighters to better understand whether working in emergency response could have a negative impact on health and whether a physiological stress response is affected by a lack of sleep for firefighters.

Alex is currently a Postdoctoral Research Fellow at Monash University.

Alex Wolkow (right) conducting a test with a Country Fire Service volunteer firefighter.

Indigenous Initiatives

SARAH DICKSON-HOYLE
UNIVERSITY OF BRITISH COLUMBIA

Restor(y)ing fire-adapted landscapes: landscape change, Indigenous co-management and restoration in Secwepemcúl'ecw

PHD ASSOCIATE STUDENT
COMMENCED SEPTEMBER 2018

Current role: Research Assistant at the University of British Columbia, Canada
Supervisors: Prof Lori Daniels and A/Prof Shannon Marie Hagerman

Sarah Dickson-Hoyle's research sits at the nexus of community-based bushfire management, ecological restoration and Indigenous knowledge and governance.

Working collaboratively with the Secwépemcul'ecw Restoration and Stewardship Society in Canada – founded by eight Secwépemc First Nation communities directly impacted by the 2017 Elephant Hill bushfire in British Columbia – her research is employing a combination of ethno-ecological and qualitative social science methodologies to monitor post-fire recovery of culturally important plants and other eco-cultural values; document local social-ecological knowledge and memories of landscape change; and support the development of co-management initiatives that seek to support First Nations in (re)asserting traditional stewardship practices, knowledge and connection to land and place in fire-adapted and fire-affected landscapes.

Sarah completed her Master of Forest Ecosystem Science as an associate student with the Bushfire CRC. She is currently a research and teaching assistant in the Faculty of Forestry at the University of British Columbia while she completes her PhD as a Future Forests Fellowship recipient.

DANIEL MAY
AUSTRALIAN NATIONAL UNIVERSITY

Taking fire: the historical and contemporary politics of Indigenous burning in Australia and the western United States

PHD ASSOCIATE STUDENT
COMMENCED APRIL 2016, COMPLETED AUGUST 2020

Current role: Research Associate at the Parliamentary Library
Supervisors: Prof Tom Griffiths, A/Prof Geoff Cary and Prof Nicholas Brown

Dr Daniel May's project investigated the political and cultural influence of the understanding of Indigenous fire in settler societies, with a particular focus on 20th and 21st century Australia and the United States. Daniel investigated how non-Indigenous understandings of Indigenous fire have not been confined to the academy as anthropological curiosities, but have historically been political incendiaries that competing interest groups have attempted to draw upon, appropriate or deny.

Photo: Don Hankins

In 2018, Daniel was awarded the Endeavour Research Fellowship through the Australian National University and visited the United States to work alongside leading geographer and expert on Native American and Aboriginal Australian fire management practices, Professor Don Hankins at California State University. As part of the trip, Daniel took part in prescribed burns, researched historical fire management, and gathering information on how the cultural burning movement in the US compares to Australia.

> "I think there's similarities in how non-Indigenous people in both countries have come to understand Indigenous burning," Daniel says. "General community awareness in some populated states is growing massively in Australia."

Daniel has authored the chapter 'Shallow fire literacy hinders robust fire policy: Black Saturday and prescribed burning debates' in the book *Disasters in Australia and New Zealand: Historical Approaches to Understanding Catastrophe* (Palgrave Macmillan, 2020). The chapter draws on his PhD research and discusses the relationship between policy, writing and prescribed burning. Daniel has also written a feature article for *Inside Story* and *Fire Australia.*

Daniel is currently employed as a research associate at the Parliamentary Library in the Science, Technology, Environment and Resources section.

JANE URQUHART
LA TROBE UNIVERSITY

Locating gendered knowledge and practices in Aboriginal fire ecology

PHD ASSOCIATE STUDENT
COMMENCED FEBRUARY 2018

Supervisors: Dr Nicholas Smith

Jane Urquhart's PhD topic is Aboriginal fire ecology and its interconnection to the outcomes of native title as lands are restored to Indigenous ownership and burning country is incorporated with environmental work. Her research is conducted in collaboration with the Nyangumarta Warrarn Aboriginal Corporation in the Pilbara in Western Australia, and is investigating if Nyangumarta people's cultural knowledge and practices of burning country is gendered.

Ethnographic research will identify Nyangumarta women's interests in burning country. This research will be carried out in collaboration with Nyangumarta people's aim to re-implement a cultural fire strategy, in conjunction with environmental imperatives to protect and conserve biodiversity in the Nyangumarta Warrarn Protected Area. The findings of this research have the potential to identify and analyse the dynamics of change and transformation occurring in power and knowledge in Nyangumarta society, with respect to contemporary gender relations and current conservation initiatives that provide a post-native title livelihood opportunity.

KATE VAN WEZEL
CHARLES DARWIN UNIVERSITY

Women caring for Waanyi and Garawa country

PHD SCHOLARSHIP STUDENT
COMMENCED MARCH 2015

Current role: Women and Youth Coordinator at the Northern Land Council
Supervisors: Adj/Prof Jeremy Russell-Smith and Dr Sean Kerins

The inclusion of women in fire management across remote Indigenous communities in northern Australia is the focus of Kate van Wezel's PhD.

Kate's work follows women in the Waanyi and Garawa country in the remote south west Gulf of Carpentaria in the Northern Territory, analysing their subordination in fire management practices. Working with these women in their communities, Kate has helped to design the Waanyi-Garawa woman ranger program and helped the rangers to produce a booklet documenting the process. The program allows women to build new skills and confidence through their ranger work and allows them to be able to participate fully in managing their Indigenous Protected Areas.

Her research is providing a case study of successful collaborative land management in remote Indigenous Australia, and a gendered analysis of the caring for country movement as a strategy towards community resilience.

Kate is currently Women and Youth Coordinator for the Northern Land Council's Caring for Country branch.

Infrastructure and Impact

ANITA AMIRSARDARI

UNIVERSITY OF MELBOURNE

Assessing the seismic performance of reinforced concrete gravity moment resisting frames in Australia

PHD ASSOCIATE STUDENT
COMMENCED JANUARY 2014, COMPLETED AUGUST 2018

Current role: Research Fellow at Swinburne University of Technology
Supervisors: A/Prof Helen Goldsworthy and Dr Elisa Lumantarna

Dr Anita Amirsardari's PhD assessed the seismic performance of reinforced concrete gravity moment resisting frames in buildings that have shear walls or cores as the primary lateral load-resisting system. Her project involved an investigation to obtain the history of the design of reinforced concrete buildings in Australia to provide an understanding of the existing building stock, including typical building configurations and design detailing. This was achieved by speaking to and corresponding with experienced practicing structural engineers and from reviewing older editions of the Australian concrete structures and loading standards. Based on the findings, six archetypal buildings were designed. These findings show whether retrofitting existing buildings is necessary, as well as highlighting potential improvements to the current design philosophy incorporated in the Australian standards and codes.

Anita is currently a Research Fellow at the Swinburne University of Technology.

DOUGLAS BROWN

UNIVERSITY OF SYDNEY

Domestic architecture and the perception of risk in bushfire-prone areas

PHD ASSOCIATE STUDENT
COMMENCED MARCH 2010, COMPLETED FEBRUARY 2018

Current role: Principal at Bushfire Architecture: Research and Consulting
Supervisors: Dr Glen Hill

Dr Douglas Brown's PhD commenced with the Bushfire CRC and was completed in 2018, exploring householders' perceptions of bushfire risk, and whether perceptions change when different building materials or design and architectural features are applied. His research investigated if these factors increase or decrease risk perception, or whether other factors, such as proximity to bushland, change the perception of fire risk. Douglas examined which parts of their house residents might consider safer and most vulnerable during a bushfire and why. To investigate how particular aspects of the construction of a house influences residents' expectation of its performance during a bushfire, residents were asked which architecture/construction/design attributes they might expect to improve the performance of a house during a bushfire.

Douglas gave two presentations on bushfire bunker design consideration and incorporating landscape design to improve bushfire performance in 2020 at the Australian Bushfire Building Conference in the Blue Mountains. He also presented at a seminar held by the Australian Institute of Architects in Sydney in February 2021 on what bushfires mean for buildings in terms of embers, radiant heat, flame contact and erratic winds. Douglas is a regular contributor to *The Conversation* and runs his own consulting architecture firm, Bushfire Architecture: Research and Consulting.

AMILA DISSANAYAKE

RMIT UNIVERSITY

Fire resilience of existing composite steel plate girder bridges

PHD SCHOLARSHIP STUDENT
COMMENCED FEBRUARY 2015

Current role: Project Engineer and Manager at Civlec Construction
Supervisors: Dr Hessam Mohseni and Prof Sujeeva Setunge

Amila Dissanayake's PhD is identifying the vulnerability index for a structural form of a steel bridge that has been exposed to bushfire. He is investigating ways to enhance the fire resilience of bridges and the effect of fire on bridge retrofitting works. Findings will help to develop time-temperature curve for bushfires and will broaden the knowledge on the use of structural retrofitting works on the disaster mitigation process.

Amila is currently a Project Engineer and Manager at Civlec Construction.

DARRYL DIXON

CHARLES STURT UNIVERSITY

The exposure of emergency service personnel to asbestos

MASTERS ASSOCIATE STUDENT
COMMENCED JULY 2012

Supervisors: Ian Manock and A/Prof Valerie Ingham

Darryl Dixon's Masters research is comparing current Australian emergency services training, policies and procedures when the likelihood of exposure to asbestos is suspected or confirmed. Darryl has seen asbestos in many emergency situations as a former member of the NSW Police Force and as a current volunteer for NSW Rural Fire Service. His research is ensuring that these policies and procedures comply with Australian Standards and best practice policies. His findings will support the recommendations of the Asbestos Management Review, including an asbestos awareness workshop that can be used by any emergency service or organisation to provide an induction on how to work with asbestos in the workplace or at incident scenes. Darryl presented his research at the CRC's Research Advisory Forum in 2018.

Photo: University of Wollongong

ALAN GREEN
UNIVERSITY OF WOLLONGONG

Sprinkler systems for the protection of buildings from wildfire

PHD ASSOCIATE STUDENT
COMMENCED FEBRUARY 2014, COMPLETED JULY 2019

Current role: Research Fellow at the University of Wollongong
Supervisors: Prof Paul Cooper, Prof Ross Bradstock and A/Prof Trent Penman

Dr Alan Green's study focused on the analysis of external water spray systems that are designed to protect buildings from bushfires. He undertook experiments to better understand the detailed behaviour of water sprays and the effects of wind on system performance and used computational fluid dynamics simulations to build on the experiments, improving our understanding of how well these spray systems perform. Alan presented his findings at the 2018 CRC Research Forum.

Alan is now a Research Fellow at the University of Wollongong's Sustainable Buildings Research Centre. He is working to publish his PhD findings in academic journals and assemble a new research project on bushfire sprinkler systems. Such systems could save homes and lives from bushfires, but more scientific investigation is required.

SONAM DORJI
QUEENSLAND UNIVERSITY OF TECHNOLOGY

Effects of masonry in flat-slab structures

PHD ASSOCIATE STUDENT
COMMENCED NOVEMBER 2019

Supervisors: Dr Hossein Derakhshan

Sonam Dorji's PhD project conducts extensive experimental and finite element modelling of masonry infilled frames for structural engineers to rely on, focusing largely on typical Australian building construction systems.

This research investigates the behaviour of masonry infilled frames subjected to lateral loads. In most earthquakes, masonry has been blamed for the collapse of the buildings and understanding the exact interaction of the masonry and the frame members has become important. Initial research shows that researchers are far from being able to comprehensively predict the response of masonry infilled frames when subjected to lateral loads.

Prior to undertaking his PhD, Sonam was a civil and structural engineer in Bhutan.

AKVAN GAJANAYAKE
RMIT UNIVERSITY

Measuring social, environmental and economic consequences of road structure failure due to natural hazards

PHD ASSOCIATE STUDENT
COMMENCED AUGUST 2016, COMPLETED JUNE 2020

Current role: Project Officer at the City of Port Phillip, Research Fellow at RMIT University and sessional lecturer at Monash College
Supervisors: Prof Kevin Zhang

Akvan Gajanayake's research assessed the wider impacts of road damage during natural hazards. Through stakeholder engagement with communities affected by natural hazards, Akvan developed a framework to measure the impact of road networks, which is providing valuable data to decision makers, as well as other researchers. To Akvan's knowledge, this is the first research that measured the impact of road failure during natural hazards, and as such it will have practical and policy implications in recovery post hazard.

Akvan is a Waste Futures Project Officer at the City of Port Phillip, Research Fellow with RMIT University and sessional lecturer at Monash College.

MITCHELL HUMPHREYS
JAMES COOK UNIVERSITY

Wind induced internal pressures in industrial buildings

PHD SCHOLARSHIP STUDENT
COMMENCED FEBRUARY 2016, COMPLETED FEBRUARY 2020

Current role: Structural Engineer at GHD
Supervisors: A/Prof John Ginger and Dr David Henderson

Dr Mitchell Humphreys' PhD improved the resilience and survivability of buildings to high winds, especially from cyclones and storms. He conducted controlled full-scale tests as benchmarks for future detailed tests with pressure loading actuators in a simulated environment, and model-scale buildings in a wind tunnel. Additionally, Mitchell gathered data from real world examples part of a research team that deploys mobile weather stations in Queensland in the event of a landfalling cyclone.

By calculating the internal pressures for industrial buildings, Mitchell's research provides an accurate overall net wind load for a wide range of scenarios, enabling a consistent, optimal design for buildings, with the potential to lead to improvements to wind loading codes and standards in cyclonic and non-cyclonic regions around Australia. Mitchell's study can improve how buildings are designed for such scenarios, increasing the resilience and survivability of buildings to high winds.

He presented his research findings as a Three Minute Thesis at the CRC Research Advisory Forum in 2018 and has had his research published in the *Journal of Wind Engineering and Industrial Aerodynamics*. Since completing his PhD, Mitchell has been working as a structural engineer at GHD.

FAROOK KALENDHER
RMIT UNIVERSITY

Synthetic damage curves for concrete girder bridges under flood hazard

PHD ASSOCIATE STUDENT
COMMENCED JULY 2015, COMPLETED OCTOBER 2017

Current role: Research Fellow at RMIT University and Research Agent at VicRoads
Supervisors: Prof Sujeeva Setunge, A/Prof Kevin Zhang and Dr Hessam Mohseni

Dr Farook Kalendher's research investigated the resilience of bridges during natural hazards, particularly during floods. He identified that bridges have a major impact on resilience of road infrastructure and damage to bridges can increase the vulnerability of communities that heavily rely on road infrastructure.

To address this issue, Farook developed a methodology to derive structural vulnerability models for bridge structures and determine vulnerable structures in road networks.

Farook is currently a Research Fellow at RMIT University and a Research Agent at VicRoads.

RYAN HOULT
UNIVERSITY OF MELBOURNE

Seismic assessment of reinforced concrete walls in Australia

PHD SCHOLARSHIP STUDENT
COMMENCED OCTOBER 2014, COMPLETED SEPTEMBER 2017

Current role: Lecturer at the University of Melbourne
Supervisors: A/Prof Helen Goldsworthy and Dr Elisa Lumantarna

Dr Ryan Hoult's PhD assessed the performance of reinforced concrete walls in response to rare and very rare earthquakes. Ryan's research analysed both rectangular and C-shaped concrete walls to develop a Secondary Cracking Model to predict the potential of cracks forming in these types of walls. Ryan found that the direction of loading and the mode of bending were particularly important for the seismic performance of these sorts of walls.

Post PhD, Ryan moved to Switzerland to take up a Research Fellow position at Ecole Polytechnique Federale de Lausanne University, leading a project with South American researchers on mitigating earthquake risk, and has noted that South America and Australia have similar issues about a lack of testing on structures to assess their risk.

> "Their buildings codes are actually lacking over there (South America) quite surprisingly, considering they get a lot of earthquakes," Ryan said. "The Australian concrete structures code [AS 3600] has allowed designers to detail reinforced concrete walls with a relatively low amount of reinforcement. This is designed for a relatively low earthquake return period, which has resulted in the reinforced concrete buildings of Australia to be vulnerable to a rare earthquake event."

Ryan now lectures at the University of Melbourne for a range of structural engineering subjects.

NOUMAN KHATTAK
QUEENSLAND UNIVERSITY OF TECHNOLOGY

Seismic retrofit of unreinforced masonry building facades with fibre reinforced polymer composites

PHD ASSOCIATE STUDENT
COMMENCED AUGUST 2019

Supervisors: Dr Hossein Derakhshan

Nouman Khattak's research focuses on the seismic retrofit of unreinforced masonry building facades using fibre reinforced polymer composites. Research outcomes will provide experimental and numerical evidence on the seismic performance of masonry facades (parapet and gable walls) with and without retrofit. Test results and numerical studies outcomes are anticipated to assist structural engineers and design practitioners in better understanding the response of unreinforced masonry facades with different types of fibre reinforced polymer retrofitting. This research will give confidence to practicing engineers to apply a retrofit technique to protect buildings against future earthquakes. General conclusions of the work will include recommendations for application of the developed guidelines and for future studies.

Nouman is a highly motivated structural engineer with more than 10 years' experience in industry, academia and research. He has been involved in designing a wide range of buildings, dams and infrastructure projects from feasibility and concept through to final detailed design and construction.

MARYAM NASIM
RMIT UNIVERSITY

Investigation into the behaviour of a U-slab bridge due to flood

PHD SCHOLARSHIP STUDENT
COMMENCED JULY 2015, COMPLETED NOVEMBER 2019

Current role: Structural Bridge Engineer at the Department of Transport Victoria
Supervisors: Prof Sujeeva Setunge and Dr Hessam Mohseni

With the U-slab bridge a bridge type widely used in Australia, it is vulnerable to damage during floods. Dr Maryam Nasim's PhD provided vulnerability models for road authorities to use in developing strategies to strengthen these bridges, helping both emergency services and communities during a flood, as well as afterwards. Maryam was awarded the prestigious Austroads Young Engineer Best Paper Award at the Austroads Bridge Conference in 2017.

Maryam is now a Structural Bridge Engineer at the Victorian Department of Transport.

KORAH PARACKAL
JAMES COOK UNIVERSITY

The structural response and progressive failure of batten to rafter connections under wind loads

PHD SCHOLARSHIP STUDENT
COMMENCED MARCH 2015, COMPLETED DECEMBER 2018

Current role: Research Fellow at James Cook University
Supervisors: Dr David Henderson and A/Prof John Ginger

Dr Korah Parackal is at the forefront of analysing and assessing the ways in which cyclones and other strong wind loads impact housing.

Korah's PhD examined the dangers of losing fasteners on the roof of a home during a cyclone by using a wind tunnel to test the connections and surveying past cyclone damage to finally create a model that demonstrates progressive and cascading failures within a simulation.

"My PhD research studied the way roofing connections of houses fail in a progressive or cascading manner during severe winds," Korah explained. "It was able to determine what parts of the roof are most vulnerable and how damage spreads."

The outcomes of his PhD have allowed for the design and construction of more resilient structural systems and techniques for retrofitting existing structures.

In 2018, Korah was a finalist at the Early Career Researcher competition conducted by the CRC Association, and his research was also voted as the crowd favourite at the 13th America's Conference on Wind Engineering in 2017. He presented at the CRC's Research Forum in 2015 and gave a Three Minute Thesis at Research Driving Change – Showcase 2017.

Post-PhD, Korah was a researcher on the CRC project *Improving the resilience of existing housing to severe wind events*. Through this project, he has led the development of a new website called *Weather the Storm* to inform buildings and homeowners about how to improve an existing home's key structural connections against extreme wind. The website is packed with helpful information about how to improve the strength and safety of a house, guiding users through three levels of protection: general maintenance, window and door protection, and roof tie-down retrofitting (offering the most protection).

ISMAIL QESHTA

RMIT UNIVERSITY

Fragility and resilience of bridge structures subjected to extreme wave-induced loads

PHD ASSOCIATE STUDENT
COMMENCED SEPTEMBER 2016, COMPLETED AUGUST 2019

Current role: Graduate Structural Engineer at Sterling Infrastructure
Supervisors: Prof Sujeeva Setunge, Dr Javad Hashemi and A/Prof Rebecca Gravina

Bridges are susceptible to severe damage due to wave-induced forces during extreme events, such as coastal flooding, cyclones, storm surges and tsunamis. Dr Ismail Qeshta's study investigated the fragility and resilience of bridges subjected to extreme wave hazards.

Ismail has had his research published in *Engineering Structures* and has presented his research at the 2018 International Conference on Bridge Maintenance, Safety and Management in Melbourne.

After working as a Structural Engineer at RMIT University, Ismail is now a Graduate Structural Engineer at Sterling Infrastructure.

TIMOTHY RAMM

UNIVERSITY OF TASMANIA

Improving adaption planning for future sea level rise and coastal flooding

PHD SCHOLARSHIP STUDENT
COMMENCED FEBRUARY 2015, COMPLETED AUGUST 2018

Current role: Aviation Technical Lead at the Australian Antarctic Division
Supervisors: Dr Christopher White, Dr Christopher Watson and Prof Andrew Chan

Preparing communities for sea level rise and increased coastal flooding is a difficult task. Dr Timothy Ramm's PhD research has helped advance the development and analysis of improved long-term coastal adaption strategies under the conditions of uncertainty. Billions of dollars of infrastructure in Australia could be threatened by rising sea levels by the end of the century. Although such timeframes appear distant, planning and development decisions made today will help to mitigate these future threats. Coastal infrastructure, such as roads, utilities, rail, residential and commercial buildings, often last between 20-100 years. Timothy's research developed an interdisciplinary approach to advance the planning of long-term adaptation pathways in the context of coastal flood risk management.

Utilising three case studies in south east Australia, the study combines the strengths of robust decision making and dynamic adaptive policy pathways – both prominent tools to support decision making under

Korah Parackal (right) explains what can be done to strengthen a roof at a community day in Townsville.

Photo: Cyclone Testing Station

conditions of uncertainty – together with solicited values-based information to make three novel advances towards flexible adaptation pathways planning. The findings can support local government in planning sustainable strategies to manage long-term flood impacts. This has global applications for coastal flood risk management that will become increasingly important throughout the coming century.

Timothy's research is featured in *Hazard Note 67 – Adaption pathways to manage increasing coastal flood risk*, which shows that adaption pathways can support coastal managers to plan alternative actions by mapping out flexible plans and monitoring early warning indicators, allowing changing risks to be anticipated and action to be taken before impacts become unacceptable. Timothy currently works at the Australian Antarctic Division.

MITCHELL SCOVELL
JAMES COOK UNIVERSITY

An investigation of the psychosocial factors that influence cyclone mitigation behaviour in homeowners

PHD ASSOCIATE STUDENT
COMMENCED AUGUST 2016, COMPLETED APRIL 2021

Current role: Postdoctoral Fellow at CSIRO
Supervisors: Dr Connar McShane, Dr Anne Swinbourne and Dr Daniel Smith

Cyclones can cause significant damage to housing in high-risk areas and, due to a changing climate and increasing coastal population, the number of individuals vulnerable to property damage is likely to increase. Installing structural upgrades (e.g., cyclone shutters) can reduce this damage but the uptake of these upgrades in cyclone-prone regions has been relatively low. Mitchell Scovell's project investigated the psychological factors that influence cyclone mitigation behaviour. His research focused on understanding the ways in which people perceive long-term cyclone risk and how people make decisions around installing structural upgrades. The findings can be used to inform risk communication messaging to promote mitigation behaviour in cyclone-prone regions.

Mitchell was an active communicator about his research throughout his PhD, winning the James Cook University Three Minute Thesis competition in 2018, and making the final of the Asia-Pacific competition. He also submitted a video for the Cooperative Research Centre Association's Early Career Researcher communication competition in 2019. Mitchell is now a Postdoctoral Fellow at CSIRO.

EMMA SINGH
MACQUARIE UNIVERSITY

Modelling the impact of lifeline infrastructure failure during natural hazard events

PHD SCHOLARSHIP STUDENT
COMMENCED JANUARY 2014, COMPLETED JANUARY 2019

Current role: Catastrophe and Climate Risk Consultant at Willis Towers Watson, United Kingdom
Supervisors: Dr Christina Magill and Prof John McAneney

Through her PhD study, Dr Emma Singh combined natural hazard modelling and geographic information system (GIS) analysis with graph theory tools to provide a better understanding of the impacts of lifeline failure during natural hazard events and assess the usefulness of graph theory techniques in aiding disaster mitigation, emergency response and community recovery. Focusing on the exposure of road networks to volcanic ash from a future eruption at Mount Fuji in Japan, Emma worked with local governments in Japan to understand better how ash-induced road closures can impact evacuation plans and community recovery post-eruption. The methods that Emma developed can be applied to any natural hazard or lifeline network to identify at-risk critical infrastructure and determining the potential disruption caused by service failure.

Governments, emergency management agencies and communities can all benefit from Emma's findings.

Emma was an active communicator about her research findings during her PhD. She presented her research findings at the CRC's Research Forum in 2014 and 2015, as well as at international volcanology conferences in the United States and Italy, and blogged about her research trips to New Zealand, Japan, Mount St Helens and Yellowstone National Park in the United States, and Mount Vesuvius in Italy. Her research findings feature in *Hazard Note 66 – Can graph theory help prepare for lifeline failure during a disaster?*, which shows how graph theory techniques can be applied to aide disaster mitigation, emergency response and community recovery.

Emma also made it to the Macquarie University Three Minutes Thesis finals in 2015 and was voted People's Choice winner. Emma credited her CRC speaker training with helping her communicate her research.

"I don't think I would have had the confidence to do the Macquarie University 3MT competition if I had not presented in a similar format at the CRC and AFAC conference – the training from the CRC really helped me create a good three minute script," Emma said.

Emma also credits her ties with the CRC for her ability to translate academic learning into usable outputs for end-users and her passion for interagency collaboration.

Emma currently lives in London and is a Senior Associate Catastrophe and Climate Risk Consultant at Willis Towers Watson.

SAIM RAZA
SWINBURNE UNIVERSITY OF TECHNOLOGY

Collapse behaviour of limited ductile high-strength reinforced concrete columns under simulated earthquake loading

PHD ASSOCIATE STUDENT
COMMENCED AUGUST 2016, COMPLETED JULY 2020

Current role: Postdoctoral Researcher at Empa, Switzerland
Supervisors: A/Prof Hing-Ho Tsang and Prof John Wilson

Dr Saim Raza employed experimental, numerical and empirical methods to evaluate the seismic resilience of high-strength reinforced concrete columns constructed in high-rise buildings in Australia. This project investigated collapse performance of limited ductile high-strength reinforced concrete columns through experimental testing under uniaxial, biaxial and triaxial seismic loading. The research outcomes are expected to have important implications for the earthquake safety of building stocks in Australia and globally.

Saim currently works as a postdoctoral researcher at the Swiss Federal Laboratories for Materials Science and Technology, Empa.

BAMBANG SETIAWAN
UNIVERSITY OF ADELAIDE

Quantifying the seismic and site amplification characteristics of Adelaide's regolith

PHD ASSOCIATE STUDENT
COMMENCED JULY 2013, COMPLETED DECEMBER 2018

Current role: Lecturer at the University of Syiah Kuala, Indonesia
Supervisors: Prof Mark Jaksa, Prof Michael Griffith and David Love

Dr Bambang Setiawan's PhD research quantified the site amplification characteristics of Adelaide's regolith with respect to earthquake loading. These characteristics will enable engineers to more accurately to predict the behaviour of a range of structures subjected to earthquake loads of varying magnitude. This was important because fault lines within 100 kilometres of Adelaide present the greatest threat of an earthquake magnitude of magnitude 7+, with the Para Fault presenting the highest threat. Quantifying the soil response due to seismic ground motion and its relationship to structural behaviour is paramount in for robust and effective design of infrastructure.

Bambang is now a lecturer at the University of Syiah Kuala in Indonesia.

SONJA MAREE VAN NIEUWENHOVEN
UNIVERSITY OF MELBOURNE

Planning for bushfires on the rural-urban interface: an analysis of the correlations between house setbacks and house loss as evidence of house-to-house fire spread in the 2009 Victorian bushfires

MASTERS ASSOCIATE STUDENT
COMMENCED MARCH 2015, COMPLETED JULY 2017

Current role: Senior Strategic Planner at the City of Casey and Sessional Tutor at the University of Melbourne
Supervisors: Prof Alan March and Dr Maria Kornakova

Sonja Maree van Nieuwenhoven's research determined that there is a correlation between house setbacks and house-to-house fire spread as a causation of house loss in the 2009 Victorian bushfires. These correlations determined if house setbacks are a contributing factor to house-to-house fire spread or not by establishing associations between the house setbacks and house loss in the 2009 Victoria bushfires.

Sonja currently works as a senior strategic planner at the City of Casey and is a sessional tutor at the University of Melbourne.

ALIREZA ZABIHI
SWINBURNE UNIVERSITY OF TECHNOLOGY

Seismic retrofitting of RC beam-column joints using diagonal haunch

PHD ASSOCIATE STUDENT
COMMENCED SEPTEMBER 2015, COMPLETED NOVEMBER 2019

Current role: Structural Test Engineer and Sessional Teacher at the Swinburne University of Technology
Supervisors: A/Prof Hing Ho Tsang, Dr Jessey Lee, Prof John Wilson and Prof Emad Gad

Dr Alireza Zabihi's PhD researched recent earthquakes worldwide and the poor performance of limited-ductile reinforced concrete frame buildings during these earthquakes. Alireza investigated the feasibility of using the single diagonal haunch with post-installed anchors for improving the seismic performance of vulnerable beam-column joints, and found that this less-invasive and more architecturally favourable solution can result in reducing the effect of seismic actions on buildings and consequently diminishing casualties.

Alireza was the recipient of Gold and Silver Medals from MIE2013 and MRC-IIE2014 for the innovation of Rubber Wall Damper and MR Damper, respectively. He is currently a Structural Test Engineer and Sessional Teacher at the Swinburne University of Technology. In 2019, he was awarded the Sessional Teaching Excellence Award for his work in providing teaching and learning support to students.

Managing the Landscape

JOJI ABRAHAM
FEDERATION UNIVERSITY

Fire and heavy metals: when wild and controlled fires transform un-rehabilitated mining waste

PHD ASSOCIATE STUDENT
COMMENCED JANUARY 2015, COMPLETED JULY 2018

Supervisors: A/Prof Kim Dowling

Dr Joji Abraham's PhD analysed fire and heavy metals, specifically dealing with how wild and controlled fires transform un-rehabilitated mining waste. Joji identified the importance of soil and water characterisation in association with both prescribed and bushfires in terms of arsenic and other heavy metals and consider the associated risks in terms of ecotoxicological effects, both locally and downstream.

NICOLAS BORCHERS ARRIAGADA
UNIVERSITY OF TASMANIA

Assessment framework for the evaluation of wildfire risk reduction strategies

PHD ASSOCIATE STUDENT
COMMENCED JUNE 2018

Current role: Environmental and Energy Consultant at Superintendencia del Medio Ambiente, Chile
Supervisors: A/Prof Fay Johnston and Prof David Bowman

Nicolas Borchers Arriagada's study combines research and practice from diverse areas with the purpose of developing an integrated assessment framework that will allow fire practitioners to objectively evaluate the impacts that bushfire risk reduction strategies impose on society and the environment. Of interest to Nicolas' research are the correct identification, quantification and evaluation of health impacts produced by fine particulate matter emissions from fire smoke.

While undertaking his PhD, Nicolas undertakes remote consulting in environmental issues, business intelligence and data analysis for the Superintendencia del Medio Ambiente in Chile.

VERONICA BERJON
UNIVERSITY OF SYDNEY

Dynamics of litterfall and fine fuels after fire in sclerophyll forests and woodlands

PHD ASSOCIATE STUDENT
COMMENCED JULY 2017

Current role: Ranger and CRAFT Firefighter Field Officer at NSW National Parks and Wildlife Service
Supervisors: A/Prof Tina Bell

A former firefighter in Spain, Veronica Berjon's research is using empirical, ground-based research to investigate the effects of local topography on accession rates and fine fuel dynamics in sclerophyll eucalypt forests of south eastern Australia. Several sites within sclerophyll forested areas will be measured across NSW, Victoria and ACT for a range of vegetation and topographic variables to examine the differences in accumulation patterns across the landscape, with findings to inform fire management planning in similarly forested areas across eastern Australia.

Veronica is a ranger and CRAFT Firefighter Field Officer with the NSW Office of Environment and Heritage – National Parks and Wildlife Service.

AMANDA CHONG
UNIVERSITY OF MELBOURNE

Accurate location of buildings and its importance in bushfire damage assessment

MASTERS ASSOCIATE STUDENT
COMMENCED MARCH 2015, COMPLETED DECEMBER 2016

Current role: Spatial Analyst at Arup
Supervisors: Dr Mohsen Kalantari and A/Prof Trent Penman

Dr Amanda Chong's research centred around voluntary geographic information (VGI) which is a computationally easy and inexpensive alternative approach to acquire geographic data and enables contributors to provide invaluable local knowledge of a given area to those who need it. Considering the lack of current authoritative data nationwide, crowdsourced VGI is a new and unique approach to gathering effective and valuable information for research and analysis. Amanda's Masters research crowd-sourced building locations for use in risk assessments into software such as PHOENIX RapidFire and compared the differences between the current method and the crowd-sourced building footprint centroids in residual risk calculations.

Amanda is now a Spatial Analyst with Arup's Economics, Planning and Design team.

DARIO RODRIGUEZ CUBILLO
UNIVERSITY OF TASMANIA

Landscape ecology of fire: lessons from the Tasmanian wilderness

PHD SCHOLARSHIP STUDENT
COMMENCED DECEMBER 2016, SUBMITTED APRIL 2021 AND AWAITING CONFIRMATION

Supervisors: Dr Grant Williamson and Prof Greg Jordan

Dr Dario Rodriguez Cubillo's project investigated the 2016 central Tasmanian bushfires that destroyed significant natural and cultural assets within the Tasmanian Wilderness World Heritage Area. His

research is structured in three spatio-temporal scales: 1) the biological impacts of the fires in one endemic subspecies of Eucalyptus, 2) landscape ecology of the fires in one area severely affected area and 3) climate and hydrological contextualisation of the preceding conditions to the 2015/2016 fire season in Tasmania. This research is providing land managers with new ecological findings in plant recovery after fire and better uses of river data in fire management.

Dario submitted his PhD in April 2021 and at the time of print was waiting on confirmation.

ANTARA DASGUPTA

MONASH UNIVERSITY

Towards a comprehensive data assimilation framework for operational hydrodynamic flood forecasting

PHD ASSOCIATE STUDENT
COMMENCED JULY 2015, COMPLETED JANUARY 2020

Current role: Postdoctoral Research Associate at the University of Osnabrück, Germany
Supervisors: Prof Jeffrey Walker

With the growing volume of hydrological data available through satellite remote sensing and crowd-sourcing to improve flood forecasting skill, more advanced techniques are needed. Dr Antara Dasgupta's research integrated remote sensing derived water levels with a 2D hydrodynamic model using data assimilation for flooding in both Australia and India. The water levels were calculated by combining flood maps derived from optical and synthetic-aperture radar imagery with topography, and additionally from crowd sourced images. The effect of the inclusion of crowd-sourced information on the modelling was also be evaluated.

Antara is currently a postdoctoral research associate at the University of Osnabrück in Germany.

HANNAH ETCHELLS

UNIVERSITY OF WESTERN AUSTRALIA

The impacts of catastrophic wildfire on ecological interactions among regenerated vegetation, fungi and small foraging marsupials

PHD ASSOCIATE STUDENT
COMMENCED MARCH 2017, COMPLETED JANUARY 2021

Supervisors: Dr Pauline Grierson, Dr Alison O'Donnell and Dr Lachlan McCaw

Dr Hannah Etchell's PhD research investigated the ecological impacts of catastrophic bushfire. The forested regions of Australia and North America have both witnessed unprecedented large-scale bushfire over the last decade, and bushfire in both regions is projected increase in frequency and severity over the next century.

Hannah's research promoted the sharing of knowledge between Australia and the United States, forging research ties and developing collaborative projects to understand catastrophic bushfire events in a global context.

Hannah's PhD was supported by the School of Biological Sciences at the University of Western Australia, the Department of Biodiversity, Conservation and Attractions (WA), the Holsworth Wildlife Research Endowment, the World Wildlife Fund and the Fulbright Program.

SAADMANN EUSUF

UNIVERSITY OF NEW SOUTH WALES

Voxel-based approach to estimate the volume of fuel load from point cloud data for hazard reduction burning

MASTERS ASSOCIATE STUDENT
COMMENCED FEBRUARY 2019

Current role: Tutor at James Ann Coaching College
Supervisors: Prof Sisi Zlatanova and Dr Jack Barton

Saadmann Eusuf's study focuses on the reduction of the severity of bushfires by exploring the method of hazard reduction burning. The research takes a voxel-based approach to estimate the volume of fuel loads, under tree canopy from LiDAR point cloud data, to be able to precisely estimate the volume of fuel loads in a bushfire prone area, which could assist in the planning of the next hazard reduction burn.

Saadmann currently tutors at James Ann Coaching College.

JAY EVANS

CHARLES DARWIN UNIVERSITY

Savanna fire management, resources, methods and effectiveness

PHD ASSOCIATE STUDENT
COMMENCED JULY 2017

Current role: Bushfire Research Officer at Charles Darwin University
Supervisors: Adj/Prof Jeremy Russell-Smith

Jay Evans' project is exploring the requirements for effective and appropriate fire management in north Australian savannas. Jay is using case study examples to describe various resource levels and methods and assess effectiveness in sustainably meeting specified ecological targets. He is also looking at what the specific characteristics of a fire regime are that would best deliver biodiversity conservation outcomes, and what practices, tools and resources might be required for sustainable and efficient implementation and monitoring of such a fire regime.

Jay works as a Bushfire Research Officer at Charles Darwin University's Darwin Centre for Bushfire Research.

Grigoris Goldbergs (right) conducting field research post fire in the Northern Territory with PhD supervisor Dr Andrew Edwards.

GRIGORIJS GOLDBERGS
CHARLES DARWIN UNIVERSITY

Remote sensing of tree structure and biomass in north Australian mesic savanna

PHD SCHOLARSHIP STUDENT
COMMENCED DECEMBER 2014, COMPLETED MAY 2019

Current role: Lecturer at Latvia University of Life Sciences and Technologies and Remote Sensing Data Engineer at the Institute of Electronics and Computer Science, Latvia
Supervisors: Prof Lindsay Hutley, Dr Andrew Edwards and Adj/Prof Jeremy Russell-Smith

Dr Grigorijs Goldbergs' project developed a new approach for measuring biomass/carbon stocks in savanna vegetation, offering insight into the factors causing the poor dense image matching by high-resolution stereo satellites. Utilising a two-phase Light Detection and Ranging (LiDAR) analysis procedure integrating both individual tree detection and area-based approaches, Grigorijs has been able to better understand how the uncertainty of biomass estimation varies with scale.

Although airborne LiDAR provided higher tree detection rates and accurate estimates of tree above ground biomass, Grigorijs found that a 3D point cloud obtained from light weight optical unmanned aerial systems imagery is an adequate low-cost alternative for the detection of dominant and co-dominant tree stands, at least at a local scale in Australian tropical savanna. The methodologies developed can be applied to large areas of savanna country across northern Australia.

Grigorijs is now a lecturer at Latvia University of Life Sciences and Technologies and a Remote Sensing Data Engineer at the Institute of Electronics and Computer Science in Latvia.

ANGELA GORMLEY
UNIVERSITY OF SYDNEY

Effects of surface litter by forest classification on fuels and fire behaviour in Hornsby Shire

MASTERS ASSOCIATE STUDENT
COMMENCED JANUARY 2016, COMPLETED OCTOBER 2018

Supervisors: A/Prof Tina Bell and Dr Malcolm Possell

Angela Gormley's study characterised changes in fuel loads from prescribed burning in a heavily populated area of the Sydney Basin to aid local land managers in assessing the reduction in bushfire risk using planned fire. She aimed to answer questions about whether prescribed burning alters all the components of the fuel load in typical vegetation types in the Sydney Basin, and whether plants that are characteristic of different vegetation types in the Sydney Basin differ in their leaf morphology and flammability traits. Angela also explored whether information about fuel loads and flammability can be used to guide land managers in mitigation of risk from bushfires.

DIANA KUCHINKE
FEDERATION UNIVERSITY

The influence of time since fire, fire frequency and prescribed burn severity on woodland birds

PHD ASSOCIATE STUDENT
COMMENCED DECEMBER 2010, COMPLETED FEBRUARY 2019

Current role: Director of Kuchinke Management Group and Lecturer at Federation University
Supervisors: Prof Peter Gell and Dr Grant Palmer

Dr Diana Kuchinke's PhD monitored birds on 84 sites across western Victorian woodlands and determined the common species driving assemblage patterns on sites of differing fire ages and fire histories. Her research investigated predictions of fire impact and severity on birds using generalised linear mixed models based on a before-after-control-impact design.

Diana developed an effective tool in adaptive management to predict the trends of common forest birds, as surrogates for entire bird communities, not just for fire responses, but for a broader reflection on the health of the landscape. Key findings centre around the Laughing Kookaburra, which is in decline along Australia's east coast. Diana found that kookaburras prefer unburnt vegetation and how their numbers drop in abundance quite markedly in landscapes that have dense post-fire regrowth vegetation. This has major implications when bushfires and prescribed burns across the Australian landscape are increasing in frequency, severity and extent.

Diana runs her own business, Kuchinke Management Group, and lectures at Federation University.

SEAN MORLING
RMIT UNIVERSITY

Developing a spatial approach to model sediment transfer in catchments affected by bushfire

PHD ASSOCIATE STUDENT
COMMENCED JULY 2014

Supervisors: Dr Colin Arrowsmith

Sean Morling's PhD is studying erosion and sediment transfer for post-fire monitoring to integrate the variables of an erosion model into spatial layers using GIS. Map algebra will be utilised to quantify sediment transfer in catchments affected by fire, which will enable the determination of regional post-fire erosion hazards and target locations for appropriate initiation of mitigation and conservation measures.

GABRIELA RADUCAN
RMIT UNIVERSITY

Impact of bushfire on water quality

PHD ASSOCIATE STUDENT
COMMENCED MARCH 2014, COMPLETED JANUARY 2018

Current role: Founder and Director of Tech4Future, Senior Research Fellow at La Trobe Innovation and Entrepreneurship Foundry and Lecturer at RMIT University
Supervisors: Dr Colin Arrowsmith

Dr Gabriela Raducan's study investigated the impacts of land use types on river water quality during base-flow and storm-flow conditions for areas subjected to bushfires in Victoria. She considered the analysis of the cumulative impacts of land use influence on the chemical, physical and biological properties of water and how these are affected by bushfire. Her research also evaluated how the use of refined digital elevation models (based on LiDAR) affects water quality modelling and how land managers can model both point source and diffuse inputs using GIS.

Gabriela founded and directs Tech4Future, is a Senior Research Fellow at La Trobe Innovation and Entrepreneurship Foundry, and is a lecturer and demonstrator at RMIT University.

KATE SIMMONDS
UNIVERSITY OF MELBOURNE

Impact of fires on temperate rainforests in northern New South Wales

PHD SCHOLARSHIP STUDENT
COMMENCED APRIL 2021

Current role: Analyst at Investor Group on Climate Change
Supervisors: Prof Patrick Baker and Dr Ross Peacock

Kate Simmond's project is examining the consequences of recent unprecedented landscape scale bushfires in northern NSW on a world heritage listed ecosystem renowned for its diversity of ancient plant lineages that exhibit few obvious adaptations to increasing fire activity.

The existing knowledge base for planning post-fire recovery in fire-sensitive rainforest communities in eastern Australia is almost absent. The value of the existing long-term monitoring network to inform the update of northern NSW reserve fire management strategies is immense. Findings from this research will be presented to NSW National Parks and Wildlife Service, the Australian World Heritage Advisory Council and the scientific community and will inform future management of rainforests across Werrikimbe and Willi Willi National Parks, and more broadly across temperature rainforests in Australia.

Kate is a Climate Action 100+ Analyst at the Investor Group on Climate Change.

HEATHER SIMPSON
UNIVERSITY OF WOLLONGONG

Productivity and effectiveness of suppression resources and tactics on large fires

PHD SCHOLARSHIP STUDENT
COMMENCED JULY 2015

Supervisors: Prof Ross Bradstock and Dr Owen Price

Heather Simpson's PhD is providing empirical measures and modelling of resources that are used for suppression of campaign fires. Her research is examining historical data by evaluating recent campaign fires in Australia. She is then using operational data to generate models of current suppression resourcing and tactics. These models will be used to evaluate various resource scenarios in simulation studies.

One of Heather's key findings to date relates to suppression firing, or backburning - a practice used for bushfire control. She examined the prevalence and practice of suppression firing in Victoria to investigate its impact on fire containment and the fire environment.

RENE VAN DER SANT
UNIVERSITY OF MELBOURNE

Aridity index as a predictor of the hydrogeomorphic response of burnt landscapes

PHD ASSOCIATE STUDENT
COMMENCED JUNE 2011, COMPLETED MAY 2016

Current role: Land Asset Practitioner at Melbourne Water
Supervisors: Prof Patrick Lane and A/Prof Gary Sheridan

Dr Rene Van der Sant's PhD research began with the Bushfire CRC and was completed in 2016. Rene tested the hypothesis that landscape aridity could be used as a predictor of post-fire erosion and runoff response. Her findings showed that increased aridity affected long and short-term soil properties, which reduced infiltration capacity and increased runoff production. Higher aridity areas generated more surface runoff and recovered more slowly, increasing the likelihood of high magnitude debris flows during rainfall after a fire. These findings from her research are essential for understanding the hydrogeomorphic implications and management applications of aridity in a burnt landscape.

Rene is now working at Melbourne Water as a Land Asset Practitioner.

SEAN WALSH
UNIVERSITY OF MELBOURNE

Improving decision support tools for conservation of fire-adapted ecosystems in southern Australia, through integrated simulation of reproductive ecology and landscape dynamics

PHD ASSOCIATE STUDENT
COMMENCED JUNE 2016

Supervisors: Dr Craig Nitschke

Having worked in the private sector, state government and in academia, Sean Walsh is a passionate environmental scientist specialising in large and complex simulation systems. Sean's PhD is using conceptual and mathematical models to examine the response of fire-adapted ecosystems to increased pressure from altered fire regimes and climate, with particular attention to the role of seed ecology. Temporal, spatial and floristic dynamics will be examined through systematic development of tractable models, sensitivity analysis and comparison with available observations. The separate and combined effects of management intervention and climate change will be assessed using plausible future scenarios. A key theme in Sean's study is to investigate factors which limit the ability of canopy and soil seed banks to buffer populations against changes in composition.

HOUZHI WANG
UNIVERSITY OF ADELAIDE

Initiation of biomass smoldering combustion in bushfires

PHD SCHOLARSHIP STUDENT
COMMENCED JANUARY 2015, COMPLETED DECEMBER 2017

Current role: Researcher at the University of Adelaide
Supervisors: Dr Malcolm Possell

Dr Houzhi Wang's research developed a greater understanding of the initiation of smoldering combustion under different conditions. With little currently known about how smoldering contributes to fire development and ignitions, Houzhi looked at the effects of oxygen concentration and heat transfer on the initiation of smoldering, and how it impacts different vegetation types.

Houzhi was awarded the best paper prize after presenting his research at the Australian Combustion Symposium in Melbourne in 2015. He is now undertaking postdoctoral research at the School of Mechanical Engineering at the University of Adelaide.

JANE WILLIAMSON
AUSTRALIAN CATHOLIC UNIVERSITY

Are prescribed fire intervals maintaining fauna habitat?

PHD ASSOCIATE STUDENT
COMMENCED MARCH 2017

Current role: Ecologist at GIS Environmental Consultants and Lecturer at the Australian Catholic University
Supervisors: Dr Jennifer Taylor and Murray Ellis

Jane Williamson's PhD project is determining ecologically sustainable fire interval guidelines that conserve both flora and fauna diversity. Prescribed burning is a commonly used tool, designed to reduce fuel loads and limit the extent and intensity of bushfires. In NSW, ecologically sustainable fire interval guidelines are based on how different plant species respond to fire, and are derived to enhance and maintain biodiversity. However, there is only limited understanding of whether these fire interval guidelines are adequate for maintaining native animal species diversity. Jane's study aims to increase understanding of the associations between faunal habitat selection and habitat attributes within the recommended fire interval guidelines used to promote plant species diversity.

Jane currently lectures in environmental legislation and planning at the Australian Catholic University. She is also an ecologist at GIS Environmental Consultants.

MENGRAN YU
UNIVERSITY OF SYDNEY

Approaches for investigating fire impacts on catchment hydrology

PHD ASSOCIATE STUDENT
COMMENCED MARCH 2015, COMPLETED OCTOBER 2018

Current role: Spatial Analyst at Macquarie University
Supervisors: A/Prof Tina Bell

Dr Mengran Yu's PhD analysed the relationships between bushfires, prescribed fires, soil carbon, forested catchments and water quality. Mengran looked at how fires of different intensities affect the quality of soil carbon in forests, how changes in soil carbon affect water quality from forested catchments, and whether certain areas or characteristics of catchments affect water quality after bushfires. Her work also investigated how the effects of low and high intensity fire on water quality can be predicted.

Mengran is now working as a Spatial Analyst at Macquarie University.

Policy, Political Engagement and Influence

GEORGE CARAYANNOPOULOS
UNIVERSITY OF SYDNEY

Whole of government and crisis management: understanding coordination in a time of crisis

PHD ASSOCIATE STUDENT
COMMENCED JULY 2011, COMPLETED FEBRUARY 2017

Current role: Head of Research and Development at the University of Sydney
Supervisors: Prof Allan McConnell

Dr George Carayannopoulos completed his PhD in 2017 on crisis coordination, exploring the response to both the 2009 Black Saturday bushfires and the 2011 Queensland floods. As large-scale events, they epitomise the challenges of crisis management in Australia, with George's research examining how each state confronted the disasters from political and operational perspectives. His PhD specifically framed the understanding of these events through a model that emphasised seven important factors. Foremost among them was a whole of government response, which involves public service agencies working across portfolio boundaries to achieve shared goals. The other key mediators were crisis management, leadership, coordination, organisational culture, social capital and institutions. The individual and combined impacts of these mediators defined the outcomes of these crisis events.

George is now the head of Research and Development in the Faculty of Medicine and Health at the University of Sydney. He has written a book titled *Disaster Management in Australia: Government Coordination in a Time of Crisis* that examines government coordination when faced with large scale crises, as well as regularly featuring as a media commentator for SBS and the BBC. His PhD research was featured in *Hazard Note 44 – Rhetoric or reality: crisis coordination.*

GRAHAM DWYER

UNIVERSITY OF MELBOURNE

We have not lived long enough: sensemaking and learning from bushfire in Australia

PHD SCHOLARSHIP STUDENT
COMMENCED MARCH 2015, COMPLETED JUNE 2017

Current role: Course Director, Discipline Leader and Lecturer at Swinburne University of Technology
Supervisors: Prof Cynthia Hardy, A/Prof Susan Ainsworth and Prof Graham Sewell

Dr Graham Dwyer completed his PhD in 2017, examining how organisations understand and learn from bushfires and how emergency management organisations implement recommendations emanating from public inquiries, as well as the role that sensemaking plays in this. Through this research, Graham highlighted the role of both positive and negative emotions and how they influence the sensemaking process associated with implementing recommendations. A key finding from his thesis showed that we now know enough about bushfire behaviour and how our community and emergency services react, that the money, time, energy and political attention devoted to royal commissions would be better spent planning for the future.

Graham is now lecturing at Swinburne University of Technology's Centre for Social Impact and is Course Director and Discipline Leader of the Master of Social Impact. He has been published in *The Conversation* and speaks to the media about learning from disasters.

Graham is currently working on an ARC Discovery Grant project tackling the challenges that coordinated collective action faces in situations of complex crisis.

SUSAN HUNT

AUSTRALIAN NATIONAL UNIVERSITY

Implementing policy to enable disaster resilience in the Australian Federation

PHD SCHOLARSHIP STUDENT
COMMENCED FEBRUARY 2014, COMPLETED DECEMBER 2020

Current role: Research consultant
Supervisors: A/Prof Michael Eburn, Prof Stephen Dovers and A/Prof Karen Hussey

Dr Susan Hunt's research investigated good practice for disaster resilience policy implementation. She proposed a good practice framework with four broad policy domains and policy objectives that could be used to achieve successful implementation. The framework is based on a model of dynamic and networked adaptive capacities: social capital, community competence, economic development, and information and communication. The provisional framework was applied to five disaster resilience case studies: one at each level of government, one in the business sector and one in a not-for-profit organisation.

This provided information about the extent that implementation of the five activities was being informed by disaster resilience policy objectives. It was found that the principal of subsidiarity, which is closely aligned with federalism, can account for the relative success of some implementation practices as well as explain how others could be improved. The application of subsidiarity as the guiding principle of governance in the Australian disaster management system would ensure power is shared effectively by regarding the need for capacity building, negotiated roles and responsibilities, unrestricted access to information, and effective coordination across the system. So, subsidiarity was incorporated as the 5th policy domain of the Disaster Resilience Policy Implementation Framework, providing a useful resource for disaster resilience policy practitioners.

After completing her PhD, Susan has been working as a private research consultant. She has led research for the CRC, commissioned by the Yarra Ranges, Maroondah City and Knox City Councils to evaluate how Maroondah and Knox City Councils' policies align with resilience. Sue has assessed the councils' resilience indicators for emergencies to identify gaps and opportunities for council policies to better support community resilience. Susan presented her PhD research at the CRC's Research Forum in 2015, 2017 and 2018.

SIMONE RUANE

CURTIN UNIVERSITY

Planning for bushfire risk at the urban bushland interface: a local adaptive governance approach

PHD ASSOCIATE STUDENT
COMMENCED MARCH 2016

Supervisors: A/Prof Laura Stocker

Simone Ruane's project will contribute to the field of bushfire management and governance in local government areas by examining the connections and contentions that exists between urban planning, bushfire management and urban bushland conservation. Over the past two decades, southern Australia has experienced a pronounced increase in destructive bushfires. Simone's study is focused within south west Western Australia, which is a bushfire prone region and a global biodiversity hotspot. Based on climate change projections, the frequency and intensity of bushfires in the region is expected to rise.

Simone's research has been featured in the *International Journal of Justice and Sustainability*, examining how bushfire management measures can be adapted to minimise the interrelated social, environmental and economic impacts of fire in the landscape.

GRAEME RIDDELL
UNIVERSITY OF ADELAIDE

Foresight for risk – using scenarios for strategic risk assessment and management of emergent disaster risk

PHD SCHOLARSHIP STUDENT
COMMENCED FEBRUARY 2014, COMPLETED APRIL 2019

Current role: Research Manager at Marsh McLennan, Singapore
Supervisors: Dr Aaron Zecchin, A/Prof Hedwig van Delden and Prof Holger Maier

Dr Graeme Riddell's PhD focused on incorporating uncertainty and complexity into disaster risk management and assessment. This is achieved by integrating foresight principles into disaster risk management to explore emergent risks. The research has produced specific approaches of how this can be achieved and describes and demonstrates this across case-study applications throughout Australia. There are also particular examples of how scenarios and scenario planning can be used for risk assessment and management and how they should be designed and modelled for greatest impact.

Alongside his PhD study, Graeme was involved with multiple CRC projects, conducting research as part of the *Improved decision support for natural hazards risk reduction* and *Urban planning for natural hazard mitigation* projects. Graeme was also one of the developers of the Unified Natural Hazard Risk Mitigation Exploratory Decision support system (UNHaRMED). The UNHaRMED scenario risk modelling tool helps government, planning authorities and emergency service agencies think through the costs and consequences of various options on preparing for major disasters on their urban infrastructure and natural environments. Importantly, it also allows future changes to be considered, giving a complete picture on the impact of certain polices and land use management decisions. This work is informing decision making in South Australia, Victoria, Tasmania and Western Australia, and has been highlighted by the Investor Group on Climate Change as a key tool to help navigate future climate risk. Graeme was also part of the research team that received the CRC's 2017 Outstanding Achievement in Research award.

Graeme has been a regular speaker at conferences, including the CRC's Research Forum and AFAC conferences in 2017, 2018 and 2019, as well as Adaptation Futures, European Geophysical Union, International Wildland Fire and Fuels Conference, and the International Disaster and Risk Conference. Graeme is now the Research Manager in Emerging Risks at Marsh McLennan, based in Singapore.

CATHERINE RYLAND
UNIVERSITY OF WOLLONGONG

Planning for bushfire protection: maintenance of bushfire protection measures

PHD SCHOLARSHIP STUDENT
COMMENCED FEBRUARY 2021

Current role: Director at CR Bushfire
Supervisors: Prof Ross Bradstock and Dr Josh Whittaker

Catherine Ryland's research will determine which different options exist for providing a compliance/enforcement program to address this significant gap in bushfire protection. Importantly, the research will uncover whether there are certain ways to design developments and bushfire protection measures that advantageously play to the strengths of human behaviour. Thus, bushfire protection becomes a day-to-day habit, rather than a significant exercise. In doing this, her study will determine whether design can top regulation in the long-term maintenance of bushfire protection measures.

Catherine is an urban planner and bushfire resilience expert with almost 20 years of diversified industry experience in the UK and Australia. She currently runs her own business, CR Bushfire, and previously worked at the NSW Rural Fire Service.

CAROLINE WENGER
AUSTRALIAN NATIONAL UNIVERSITY

Flood management in a changing climate: integrating effective approaches

PHD SCHOLARSHIP STUDENT
COMMENCED OCTOBER 2013, COMPLETED MAY 2017

Current role: Teacher at the Australian National University
Supervisors: A/Prof James Pittock, A/Prof Michael Eburn and Dr Katherine Daniell

Dr Caroline Wenger was one of the first CRC students to complete her PhD, graduating in May 2017. Focusing on flood management, Caroline investigated flood mitigation strategies used overseas to see which strategies could be best adapted in Australia. Her research identified institutional barriers and investigated whether disaster resilience policies lead to adaptive outcomes and used four international case studies of flood-prone countries: Australia, the USA, the Netherlands and China. Interviews were then held with Australian flood experts and case studies were verified by international experts to analyse the results.

Her research found that the adaptive management options used overseas, such as flood compatible development planning, relocation and floodplain restoration, face significant barriers in Australia. The results suggest that resilience policies need to be more discriminatory so they can more clearly support activities likely to be adaptive over the longer term.

By identifying institutional barriers and investigating whether disaster resilience policies lead to adaptive outcomes, Caroline's research has the potential to be used by development planners and flood managers to aid selection of adaptive flood management options and could also be used to inform policy at different government levels.

Caroline now teaches casually at the Australian National University. Caroline's PhD research was featured in *Hazard Note 47 – Flood management in a changing climate.*

BELINDA YOUNG
UNIVERSITY OF MELBOURNE

The viability of shared responsibility in relation to wildfire prevention in Victoria and California

PHD ASSOCIATE STUDENT
COMMENCED DECEMBER 2017

Current role: Communications Director at The Philanthropic Collective
Supervisors: A/Prof Janet Stanley and Prof Alan March

As climate change is predicted to increase the intensity and frequency of bushfires, preventing the 80–95 per cent of bushfires caused by humans is paramount. In California and Victoria, bushfire management strategies have involved varying degrees of collaborative input from local peri-urban communities to address the bushfire risks. However, community and agency collaboration has mostly focused on preparedness and response activities with limited attention given to the prevention of the ignition itself. By comparing bushfire prevention approaches in Californian and Victorian and involving agencies, real and virtual world communities, Belinda's research is examining whether a shared sense of responsibility between stakeholders can be fostered in online communities to prevent human caused bushfires.

Belinda is currently Communications Director at The Philanthropic Collective.

Bushfire and Natural Hazards CRC

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