bushfire&natural HAZARDS CRC

RESEARCH PROJECTS

THE RESEARCH CHALLENGE

In the last decade, we have seen natural disasters cause more damage and destruction across Australasia and our neighbouring region than ever before.

Cyclones, flood, fire, earthquake, tsunami and heatwave cause injury, death and widespread damage. The full impacts of these disasters often remain poorly quantified, but continue to be felt through their long-term consequences for individuals, communities, infrastructure, the landscape, and the economy.

Population growth and changing demographics feature highly among the factors that have increased exposure and vulnerability to natural disasters. A growing, ageing and more multi-cultural population places significant pressure on government policy, particularly around risk communication, land-use planning and infrastructure development.

The policies and settlement patterns of the past are proving inadequate for the challenges of the future and in many instances are intensifying the exposure to risk.

These issues are a challenge for the Bushfire and Natural Hazards CRC.

The new national research capacity is driving our ability to think differently about how to deal with natural disasters into the future.

– Dr Richard Thornton,
Chief Executive Officer,
Bushfire and Natural Hazards CRC

A NEW RESEARCH PROGRAM FOR BUSHFIRE AND NATURAL HAZARDS

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

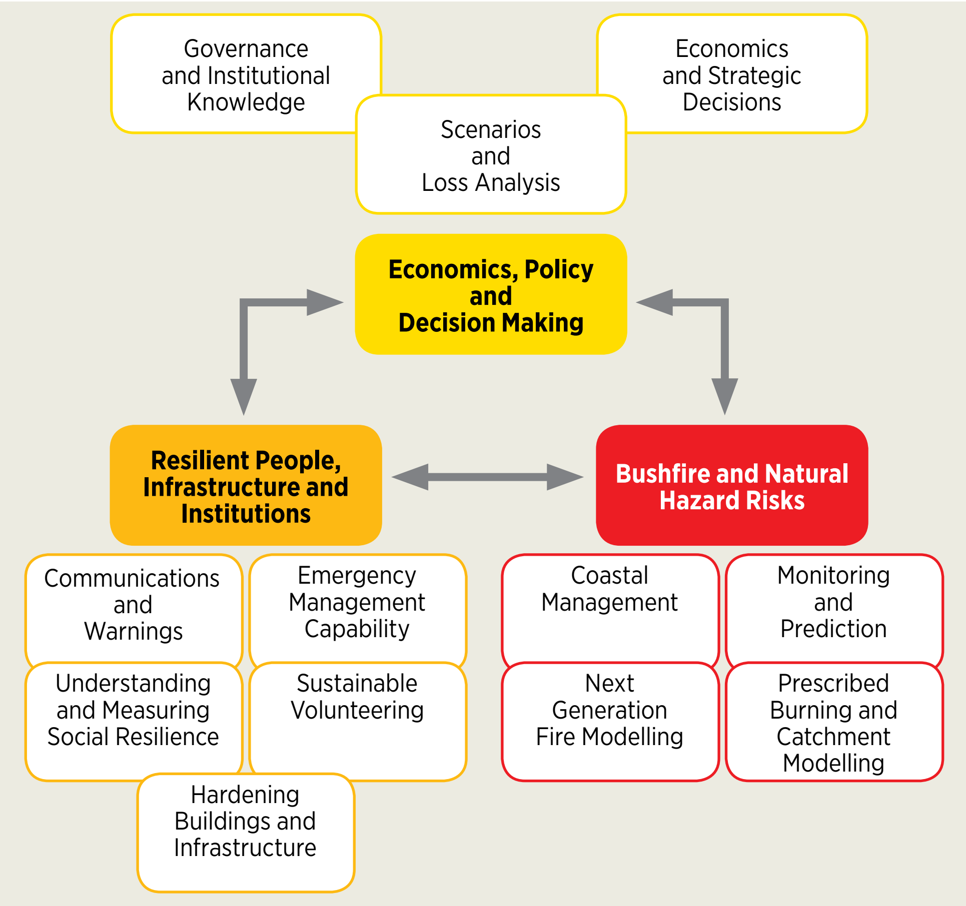
The new CRC expands the national research effort in hazards, including bushfires, flood, storm, earthquake, cyclone and tsunami.

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

INDEX

The research program is taking shape under the direction of researchers and end user agencies.

The research has three major themes covering 12 clusters of projects, most of which span the priorities for those working in a multi-hazard environment.



ECONOMICS, POLICY AND DECISION MAKING

This theme deals with economics and the interface between risk-based priorities and the practice of resource allocation, where greatest tangible benefits can be made.

Governance and institutional knowledge

Lead End User: John Schauble, Fire Services Commissioner Victoria

Policies, institutions and governance of natural hazards

Lead Research Organisation: The Australian National University

Project Leader: Associate Professor Michael Eburn

This research project will shed light on current policy, institutional and governance arrangements with a view to developing new approaches to shared responsibility to increase community resilience to all natural hazards.

The research will build on important issues exposed in recent work in Bushfire CRC and NCCARF projects by the researchers. Across three related topics it will consider issues of policies, institutions and governance across the entire "Prevent, Prepare, Respond and Recover" spectrum.

Topic 1: Mitigating the risk. This topic will identify how current emergency management policies, institutions and governance arrangements help or hinder the ability of communities to play an active role in preparing for and responding to natural hazard events.

Topic 2: Financing recovery and future resilience. The topic will expose the perverse incentives that are hidden in current policies, institutions and governance arrangements, for avoiding steps to reduce exposure to future hazards.

Topic 3: Post event review. Current post-event reviews such as Royal Commissions and coronial inquests and inquiries do not adequately identify and respond to future threats, challenges and vulnerabilities. This topic will look at how best to review the impact of natural hazard events to help communities prepare for the next impact, rather than focus on the last one.

Scientific diversity, scientific uncertainty and risk mitigation policy and planning

Lead Research Organisation: University of Western Sydney

Project Leader: Dr Jessica Weir

A better understanding of the role of science in decision-making will help industry articulate and defend decisions to the community, media, inquiries and elsewhere, and, better frame information and advice on how scientists and professionals communicate.

The project has four components:

1. Exploring how people have different understandings of the science of flood and bushfire risk.
2. A focus on flood and bushfire mitigation activities in urban, peri-urban and rural locales in southeast Australia. This will include sites where flood and fire risk are combined, such as catchment and riparian vegetation management upstream and downstream of large metropolitan water storages.
3. Considering bushfire and flood risk across the spectrum of Prevent, Prepare, Respond and Recover, with an emphasis on mitigation activities.
4. Informing bushfire and flood mitigation practice, policy and planning, and engaging with the experiences of practitioners.

Economics and strategic decisions

Lead End User: Ed Pikusa, SAFECOM

Economics of natural hazards

Lead Research Organisation: University of Western Australia

Project Leader: Professor David Pannell

Decision makers require information about: risks of fire occurrence, risks of fire spread, frequencies of fires of different severities, impacts of weather conditions on these things, losses associated with bushfires of different severities, reductions in those losses under different prescribed burning regimes, and costs of different prescribed burning regimes. This information must be combined in an appropriate way to illuminate the merits of different decision options.

For hazards such as earthquakes, floods, cyclones and tsunamis, similar observations apply. This project aims to fill key knowledge gaps in these areas. It spans issues related to values, risks, and decision making to deliver value for money from public investments in natural hazard management.

The main objectives of this project are to:

1. Estimate in dollar terms the non-financial benefits (particularly the environmental and social benefits) of management and policy for natural hazards.

2. Undertake an integrated economic analysis of management and policy for natural hazards.
3. Conduct risk analysis for different levels of overall budget for natural hazard policy and management, exploring the high variance of budget requirements from year to year.
4. Develop guidelines for the conduct of sound economic analysis of natural hazard policy and management.

Pre-disaster multi-hazard damage and economic loss estimation modelling

Lead Research Organisation: The University of Melbourne

Project Leader: Professor Abbas Rajabifard

The scope of this project is twofold. At the national level it will investigate the economic impact of natural disasters on sectoral growth of the Australian economy. At the state level, it will assess the multi-hazard risks, and estimate the potential damages and economic losses. This will be followed by identifying the optimum economic policy option to recover or minimise such adverse effects. This project will focus on Victoria, with emphasis on three types of natural disasters – bushfires, flood and earthquakes.

The specific sectors for which economic growth impact of natural disasters will be considered include 19 sectors in the National Accounting System of Australia – agriculture, forestry and fishing; mining; manufacturing; food, beverage and tobacco products; electricity, gas, water and waste services; construction; wholesale trade; retail trade; accommodation and food services; transport, postal and warehousing; information media and telecommunications; financial and insurance services; rental, hiring and real estate services; professional, scientific and technical services; administrative and support services; public administration and safety; education and training; health care and social assistance; arts and recreation services; and other services.

Decision support system for assessment of policy and planning investment options for optimal natural hazard mitigation

Lead Research Organisation: The University of Adelaide

Project Leader: Professor Holger Maier

The project will develop decision support tools that enable the impact of different policy and planning options on various economic, environmental and/or social objectives to be assessed. This will enable the best possible disaster mitigation options to be identified, thereby increasing disaster preparedness, as well as reducing disaster impact and the cost of disaster response and rehabilitation.

Mapping and understanding bushfire and natural hazard vulnerability and risks at the institutional scale

Lead Research Organisation: Victoria University

Project leader: Professor Roger Jones

There is a large imbalance nationally between disaster relief and recovery payments on the one hand, and investments in resilience and risk mitigation on the other. At the same time, increasing climate-related hazards and exposure to those hazards will result in greater damage and loss.

Current institutional arrangements would see future insured losses increase, along with uncompensated losses and demands on government compensation. Uncompensated losses have a disproportionate effect on small businesses, communities and the natural environment. Many of these are un-owned risks, and many such risks are systemic, not being well identified at the institutional scale.

Recent events show not only do the immediate and direct economic impacts of bushfires and natural hazards need to be better understood, but also the medium and long term direct and indirect costs to the economy (tangibles) and associated damages to non-monetary values (intangibles).

This project will develop a 'broad brush-stroke' national picture of vulnerability and values at risk to bushfire and natural hazards at the institutional scale. A comprehensive selection of social and economic measures will be combined with hazard data to ascertain hot spots of institutional vulnerability where multiple values are at risk. These measures will then be mapped at the Local Government Area (LGA) scale to communicate current and potential future risks and where key areas of vulnerability lie.

This map will then be used as a basis for developing, in collaboration with key stakeholders, a process-based framework that enables decision makers to work through the task of risk allocation in these areas.

The aim is to build a picture of the factors needed to enable institutional resilience to changing bushfires and natural hazards.

Scenarios and loss analysis

Lead End User: Belinda Davies, NSW State Emergency Service

An analysis of building losses and human fatalities from natural disasters

Lead Research Organisation: Risk Frontiers (Macquarie University)

Project Leaders: Dr Rob van den Honert and Dr Katharine Haynes

This project will analyse building losses and human fatalities from natural disasters in Australia. The detailed examination is a fundamental first step to enabling efficient and strategic risk reduction.

The foundation for this work is the Risk Frontiers data base *PerilAUS.* This is the most authoritative database of Australian natural hazard events that have resulted in either loss of life or damage to property. The database contains historical data dating back to European settlement on the incidence and consequences of such events.

This project will provide an analysis of building damage by hazard and by state and territory due to natural hazards since 1900, and a longitudinal analysis of the social and environmental circumstances in respect to fatalities, injuries and near misses. These trends will be interpreted in the context of emerging issues such as an ageing population, population shifts and climate change, and how these issues might influence vulnerability and exposure trends in the future.

Using realistic disaster scenario analysis to understand natural hazard impacts and emergency management requirements

Lead Research Organisation: Risk Frontiers (Macquarie University)

Project Leader: Dr Matthew Mason (QUT), Dr Felipe Dimer de Oliviera

This project will generate a series of natural disaster scenarios for major cities across Australia to quantify their impacts on society, critical infrastructure, lifelines and buildings, and where possible the natural environment.

This information will allow end-users to understand the implications of these events for their agencies and their industries so they can better prepare for, or mitigate the impacts of events that are beyond their experience.

The hazards to be considered are earthquake, cyclone, flood, tsunami and bushfire.

The project will develop a modelling framework so the impacts of hazard events can be quantified.

Resilient People, Infrastructure and Institutions

This theme aims to improve the conceptualisation of resilience and the factors that both promote and inhibit its development. Improved understanding of these factors is intended to contribute to and optimise the development of a capability to identify vulnerability, manage the risk and enable resilience.

Communications and warnings

Lead End User: Andrew Richards, NSW State Emergency Service

Child-Centred Disaster Risk Reduction

Lead Research Organisation: Central Queensland University

Project Leader: Professor Kevin Ronan

The role of children's disaster education in managing disaster risk has been recognised as a major priority in the National Strategy for Disaster Resilience. Yet, despite a recent surge in child-centred disaster research, the social, psychological, economic and political mechanisms that enable children to both understand and take action to reduce disaster risk remain largely unexplored and the evidence base for best practice remains limited.

A promising approach to supporting children's active engagement in disaster risk reduction is an approach most commonly referred to as Child-Centred Disaster Risk Reduction. Its primary objective is to strengthen children's skills so that they understand the disaster risk in their communities and are able to take a lead role in reducing that risk. While it is becoming increasingly popular among government and non-government agencies and organisations around the world, rigorous empirical research on the efficacy of the approach is scarce.

This project will conduct a nationwide evaluation of programs and strategies based on a Child Centred-Disaster Risk Reduction framework.

Managing animals in disasters: Improving preparedness, response, and resilience through individual and organisational collaboration

Lead Research Organisation: University of Western Sydney

Project Leader: Dr Melanie Taylor

The aim of this project is to identify the best practice approaches to the management of animals in disasters that result in optimal outcomes for public safety, and longer term mental and physical health of emergency services responders, those with animal-related businesses, community members and their communities.

Research in this area is urgently required as there is a paucity of evidence to guide policy development and training needs.

In this project 'animals' include domestic pets, commercial animals, livestock and wildlife. Animal owners may include pet owners, small-scale animal related business owners, livestock producers and those concerned with and interested in wildlife (for example, wildlife carers, rural dwellers). Similarly, responders may be drawn from a broad range of groups, such as emergency services, Local Government, RSPCA officers, Parks and Wildlife rangers, NGOs (Red Cross, Salvation Army), general practitioners, veterinarians and volunteer organisations.

Improving the role of hazard communications in increasing residents' preparedness and response planning

Lead Research Organisation: The University of Melbourne

Project Leader: Associate Professor Jennifer Boldero

The increasing frequency and complexity of natural hazards poses a challenge for community resilience. Communication of risks and warnings plays an essential role in building, maintaining and restoring resilience. Recent natural hazard events demonstrate that current risk and warning communications do not always have the desired effect on community preparedness and planning, response, and recovery.

More specifically, little is known about the extent to which existing hazard communication strategies influence the levels and quality of preparedness and planning for natural hazards, comprehension of the requested actions, and the actual behaviour of individuals (for example, the timing and type of response during hazards) in affected communities during and after hazards.

This project will identify barriers and enablers in residents' decision making, preparing, and planning with regard to natural hazards. It will examine residents' intended use of different types of triggers for action during hazards; for example when to start evacuating and what information source to use. It will investigate why some residents form a better quality household plan with safer intended triggers than other residents. This will provide recommendations for end-users regarding the communication of action triggers to residents during actual hazards. This project will both focus on aspects that will lead to safer responses during disasters, and on aspects that will facilitate recovery post-disaster. The focus will be on recurring hazards such as bushfires, floods, and cyclones and storms.

Connecting communities and resilience: A multi–hazard study of preparedness, response and recovery communications

Lead Research Organisation: Queensland University of Technology

Project Leader: Professor Vivienne Tippett

Risk and warning communication plays an essential role in building, maintaining and restoring resilience in individuals, communities and businesses. Recent natural hazard events demonstrate that current risk and warning communications do not always lead to the desired effect on community response and recovery. This project combines expertise in communication, consumer psychology and marketing, disaster and emergency management and law. The project aims to develop evidence-based strategies that motivate appropriate action and increase informed decision-making during the response and recovery phases of disasters.

The project adopts a multi-hazards approach to examine the effectiveness of response and recovery communication in communities (comprising individuals, groups, and businesses) affected by floods, cyclones, fires and earthquakes. Reflecting the research techniques specific to the disciplines of communication, marketing and law, this project adopts a multi-method research design to:

- Examine the content and delivery strategies of official emergency messages.
- Develop evidence-based advice to guide trigger communications during hazards.
- Analyse the effectiveness and efficiency of official emergency messages in the response and recovery phases.
- Promote both community and end user understanding of the psychological and legal motivators for maximising engagement with emergency instructions.
- Examine opportunities for application of new technology and communication systems (e.g. emerging digital and social media platforms) to maximise the comprehension and compliance of communities at risk.

Community understanding of the tsunami risk and warnings systems in Australian communities

Lead Research Organisation: Massey University

Project Leader: Professor David Johnston

This project aims to better understand the factors that shape community resilience to tsunami in Australia, and effective tsunami warning risk communication.

Public understanding of the limitations of Australia's official tsunami warning systems has been found to be limited in many communities. Reliance on actual and perceived siren systems for public notification during tsunami events has been found to increase the risk to citizens and may increase the risk of fatalities and injuries. Public inability to interpret natural warnings for tsunami, and make decisions about appropriate actions, also places increased responsibility upon Emergency Management practitioners and other hazard education and public safety agencies to educate the public.

This research will evaluate the gaps in public understanding of risk and intended response to official and natural warnings for tsunami and to explore why the push for siren-based systems continues throughout many Australian communities. The outputs of the research will enable us to recommend more effective use of resources and methods to engage with and educate the public about tsunami, natural warnings, and the limitations of technology-based systems such as sirens.

Emergency management capability

Lead End User: Keith Fitzgerald, NSW State Emergency Service

Capability needs for emergency and disaster management organisations

Lead Research Organisation: Queensland University of Technology

Project Leader: Dr Paul Barnes

This study will examine in-depth lessons from historical emergencies and disasters by engaging with state and federal response agencies, as well as those supporting response and recovery, and local government. From this it will examine options for defining agile and sustained skills sets across the full cycle of disaster management.

This study will also enhance planning mechanisms for the delivery of effective disaster response and efficient recovery strategies for future emergencies. The combination of capability gap analysis and scenario-based futures-based thinking will allow the formation of scaled descriptions of capability along a continuum of increasing effectiveness, adaptability and sophistication to contribute to strengthening community resilience.

This knowledge is critical because within the context of modern disaster situations, institutions would be unlikely to face single incidents but rather a series of systemic failures, often appearing concurrently. Emergent complexities in linked systems make crises difficult to anticipate and consequences difficult to plan for. Furthermore, under emergency conditions the pressure on senior decision-makers to ‘make-sense’ of multiple lines of information (for both crisis and consequence modes) is significant.

Practical decision tools for improved decision making in complex time-constrained and multi-team environments

Lead Research Organisation: Central Queensland University

Project Leader: Dr Chris Bearman

This project will develop practical cognitive decision tools and heuristics that can be used in different emergency contexts to enhance strategic level decision making in complex, time-critical, multi-team situations.

This will include constructing straightforward ways for strategic level managers to track the performance of teams they are responsible for to ensure the team is not operating at the edges of safety.

The outcomes of the project are therefore:

- Cognitive decision-making tools: Practical cognitive decision tools that can help people at strategic levels of emergency management to better deal with complex, time-pressured and multi-team situations.
- Monitoring and tracking tools and strategies: Tools to provide a way for strategic level supervisors to monitor the performance of individuals and teams.
- Metrics for evaluation: Process-based performance metrics that allow independent evaluators to assess real-time performance.
- Methods for evaluating existing and newly developed decision heuristics and monitoring tools.

Hardening buildings and infrastructure

Lead End User: Matt Hayne, Geoscience Australia

Cost-Effective mitigation strategy development for flood prone buildings

Lead Research Organisation: Geoscience Australia

Project Leader: Dr Tariq Maqsood

The project will inform decision making on the mitigation of community risk posed by Australian buildings in flood plain environments, either through poor planning, or placed there by design as part of planned developments. It complements parallel CRC projects for earthquake and severe wind.

Floods impact many Australian communities, while some communities are inundated repeatedly due to inappropriate urban development in flood plain areas. This results in significant logistical issues for emergency management, disruption to communities and considerable cost to all levels of government to repair damages and to enable communities to recovery. There is also a need for supporting information on the cost effectiveness of mitigating the risk posed by existing buildings either through retrofit, reconstruction on the site or relocation.

This project is aligned to two other related CRC projects that will collectively address vulnerability and mitigation information requirements associated with the built environment consistently across the hazards of severe wind, earthquake and riverine flooding.

The research in this project will provide the evidence base for decisions concerning the buildings having the greatest vulnerability in Australian communities and contribute the most significant part of severe flood related risk.

Natural hazard exposure information modelling framework

Lead Research Organisation: Geoscience Australia

Project Leader: Dr Krishna Nadimpalli

A nationally consistent exposure information framework for natural hazard risk reduction forms the basis of an essential element for decision making. Decision making at various levels of the disaster governance process is highly complex and depends on multiple attributes, objectives, criteria and functions.

This project will develop a modelling framework based upon a decentralised and open approach to access, merge and transform fundamental data (spatial, attribute and metadata) to create location based exposure information relevant for use at national, state and local government levels. The modelling framework forms the basis of exposure information capabilities describing key characteristics of the population, buildings assets and essential infrastructure exposed to natural hazards and enables vulnerability assessments.

This project will identify the fundamental data requirements and modelling framework to derive exposure information to enable a better understanding of the vulnerability of people, buildings and infrastructure.

The key research outcome of this project will be the development of consistent, standardised exposure information that supports scalability in vulnerability assessments for disaster risk reduction and socio-economic impact analysis to support policy making.

The project provides a framework to assess the reliability of exposure information for both tactical and strategic disaster management from multiple hazards. This will assist government (national, state and local) and industry end users to better understand the reliability of exposure data for decision making.

Once the project is complete, the outputs will be used to improve existing exposure database capabilities at Geoscience Australia (NEXIS), various State Emergency Services and various stages of disaster management and risk assessment models.

Improving the resilience of existing housing to severe wind events

Lead Research Organisation: James Cook University

Project Leader: Associate Professor John Ginger

Typically older Australian houses built prior to the mid-1980s do not offer the same level of performance and protection during windstorms as houses constructed to contemporary building standards. Given that existing houses will represent the bulk of the housing stock for many decades, practical structural upgrading solutions based on the latest research will make a significant improvement to housing performance and to the economic and social wellbeing of the community.

This project will develop the evidence base for risk mitigation by devising simple practical and economic upgrading options for existing houses. The outcomes will promote retrofit investment by home owners and provide a basis for incentives to encourage this action through insurance and government initiatives.

The primary objective of this project is to develop cost-effective strategies for mitigating damage to housing from severe windstorms across Australia. Outputs from this project will target a range of users from policy development through to homeowners and builders on recommended actions to improve resilience of existing housing. The uptake of the research will reduce the cost of natural disasters in Australia.

Enhancing resilience of critical road infrastructure: bridges, culverts and floodways

Lead Research Organisation: RMIT University

Project Leader: Associate Professor Sujeeva Setunge

Road networks and critical road structures such as bridges, culverts and floodways have a vital role before, during and after extreme events to reduce the vulnerability of the community being served.

A major gap in the current research is the lack of assessment techniques and tools to reduce the vulnerability of road structures to enhance both community and structural resilience. This project will develop innovative tools and techniques for implementing strategies to enhance resilience of road infrastructure to multi-hazards of floods, fire and climate change and earthquakes.

The research will commence with close assessment of two case study regions: one in Victoria and one in Queensland. It will then be expanded and validated.

The outcomes of this project will include

1. Quantitative evaluation of vulnerability of road structures under multi hazards of fire, flood, earthquake and climate change; a web based tool for design and maintenance optimisation of bridges, culverts, floodways to flood, bushfire, climate change and earthquake.
2. Quantifying social, environmental and economic consequences of failure; community, emergency services staff and road/local government authorities; community adaptation options to enhance resilience as an alternative to hardening of structures when critical road structures are damaged.
3. Input for decision support at local government and state road authorities; a new design guide for floodways, plus recommended changes to other standards.
4. A generic research methodology that can be applied to other infrastructure, such as transmission towers and water infrastructure.

Cost-effective mitigation strategy development for building related earthquake risk

Lead Research Organisation: The University of Adelaide

Project Leader: Professor Michael Griffith

Earthquake hazard has only been recognised in the design of Australian buildings since 1995. This failure has resulted in the presence of many buildings that represent a high risk to property, life and economic activity. These buildings also contribute to most of the post-disaster emergency management logistics and community recovery needs following major earthquakes. This vulnerability was in evidence in the Newcastle Earthquake of 1989, the Kalgoorlie Earthquake of 2010 and with similar building types in the Christchurch earthquake. With an overall building replacement rate of two percent nationally, the legacy of vulnerable building persists in all cities and predominates in most business districts of lower growth regional centres.

This research project will draw upon and extend existing research and capability within both academia and government to develop information that will inform policy, business and private individuals on their decisions concerning reducing vulnerability. It will also draw upon New Zealand initiatives that make use of local planning as an instrument for effecting mitigation.

The project's scope includes all typical building construction types in Australia as specified in Australian Standard for Earthquake Loading AS 1170.4. It excludes special construction such as power plants, offshore structures, and other industrial/manufacturing structures.

The project will address the need for an evidence base to inform decision making on the mitigation of the risk posed by the most vulnerable Australian buildings subject to earthquakes. While the focus of this project is on buildings, many of the project outputs will also be relevant for other Australian infrastructure such as bridges, roads and ports, while at the same time complementing other CRC project proposals for severe wind and flood.

Understanding and measuring social resilience

Lead End User: Suellen Flint, Department of Fire and Emergency Services, Western Australia

Scoping remote north Australian community resilience and developing governance models through action research

Lead Organisation: Charles Darwin University

Project Leader: Professor Jeremy Russell-Smith

Almost half of the north Australian community are Indigenous and the majority live in remote communities ill-served by existing emergency services.

While these communities have significant

Indigenous and local knowledge allowing them to understand and interact with their traditional estate, poor health, under-investment in infrastructure, restricted communication services and flawed governance models heighten vulnerability to the increasing array of natural hazards across the region.

This project will address the complexities inherent in this problem by identifying and building on the existing knowledge of bushfire and natural hazards. It will develop a fine-grained understanding of how local knowledge and other capacity underpins existing risk management and post-event responses and what changes would be most effective and valued. It will also document how community proposed changes could best be implemented.

A second part of the project aims to critically examine, communicate, and advocate for the contribution that 'new economy' opportunities and associated institutional and policy settings can make towards enhancing community resilience especially in relatively intact north Australian landscapes, and also in adjacent regions.

Northern Australian Bushfire and Natural Hazard Training

Lead Organisation: Charles Darwin University

Project Leaders: Steve Sutton and Jeremy Russell-Smith

The project focusses on the development and implementation of training for the communities and habitats of all the jurisdictions of northern Australia. It will use existing or emerging community organisations as a scaffold for growing leadership and resilience.

There are few examples of advancing capacity in remote north Australia, but two are the indigenous land, fire and sea management rangers and NORFORCE. These two groups identify, encourage and employ talented and motivated community members to achieve specific land management and defence/ intelligence duties. The organisations are also accumulating technical resources that may be adapted to manage natural hazards. These resources, both the human capital and infrastructure provide a foundation to significantly enhance remote community resilience in the face of bushfire and natural hazards.

The Australian Natural Disaster Resilience Index: A system for assessing the resilience of Australian communities to natural hazards

Lead Research Organisation: University of New England

Project Leaders: Dr Phil Morley and Dr Melissa Parsons

The relationship between natural hazards and communities has traditionally been viewed from a vulnerability perspective. Australia's recently adopted National Strategy for Disaster Resilience (NSDR) takes an internationally progressive approach in the application of a disaster resilience paradigm. This strategy gives communities greater options and diversity in managing natural hazards, and places natural hazard preparation, prevention, response and recovery in the context of societies learning from and adapting to change.

The NSDR recognises four characteristics of disaster resilient communities: 1) they function well while under stress 2) they adapt successfully 3) they are self-reliant and 4) they have strong social capacity. Building these characteristics of disaster resilient communities is seen as a shared responsibility among individuals, households, businesses, governments and communities. Yet how could progress towards the development of these characteristics be assessed? Where are the areas of high and low disaster resilience in Australia? How could investments to develop disaster resilience be prioritized, evaluated and reported?

This project will develop an index of the current state of disaster resilience in Australian communities – the Australian Natural Disaster Resilience Index. The index will facilitate assessment, evaluation, reporting and planning for natural hazard resilience under the NSDR. Deliverables will include development of disaster resilience indicators, maps of disaster resilience at multiples scales, a state of disaster resilience report, and examples that use the index in a natural hazard resilience planning context.

Sustainable volunteering

Lead End User: David Rae, NSW State Emergency Service

Out of uniform: building community resilience through non-traditional emergency volunteering

Lead Research Organisation: RMIT University

Project Leader: Professor John Handmer

There is a significant and largely untapped opportunity for state emergency management agencies to contribute to building community resilience to natural hazards by supporting and engaging with non-traditional emergency volunteers – and volunteering organisations – in new ways. The role of volunteers in increasing community resilience to disasters is recognised in both the priority actions of the UN Office of Disaster Risk Reduction's Hyogo Framework for Action and the priority outcomes of the Australian National Strategy for Disaster Resilience.

The traditional model of emergency volunteering employed in Australia and New Zealand is based on formal, accredited volunteers who are affiliated with state emergency management (EM) agencies and are largely involved in response and recovery roles. While this form of volunteering is crucial and has many strengths, it excludes the potentially large number of people who are motivated to volunteer before, during and after emergencies in a less ongoing and formal way.

Given dwindling numbers of traditional volunteers within the EM sector workforce over recent years, it is likely that non-traditional volunteers will provide the bulk of the additional surge capacity needed to deal with the more frequent natural hazard events occurring under climate change. At the same time, there are more and more examples of government and non-government organisations, as well as motivated individuals and groups, finding new ways to harness the capacities of non-traditional emergency volunteers. However, these examples are isolated and have not yet been integrated into new and more inclusive models of volunteering for the EM sector. The development of new, coordinated models is needed to provide a framework for engaging further with this potential additional workforce.

This project has three key objectives:

- To identify how non-traditional emergency volunteering contributes to building community resilience to disasters throughout different phases of emergency management.
- To identify ways the emergency management sector in Australia and New Zealand can promote community resilience through support of non-traditional emergency volunteering.
- To develop and evaluate alternative models for emergency volunteering in Australia and New Zealand that are inclusive of non-traditional volunteering and volunteering organisations.

Improving the retention and engagement of volunteers in Emergency Service agencies

Lead Research Organisation: University of Wollongong

Project Leader: Dr Michael Jones

The NSW SES estimates that the attrition rate of active volunteers is around 20 percent per year. High attrition rates create high operating costs (recruiting, training and equipping volunteers) and reduced organisational effectiveness (a small, overworked core of experienced and trained volunteers). This phenomenon of high turnover in the volunteer sector is not restricted to the SES, it is a common problem in most volunteer organisations.

This research will address an area of organisational strategy that has been largely overlooked in both practice and in research, that is, hosting organisations (e.g. the SES) are not effectively managing endogenous elements of their organisational practice, the impact of this is sub-optimal volunteer retention.

This project will help volunteer-based organisations to better utilise and manage both their resources and their volunteer workforce.

Findings from the project can then be used by comparable organisations across Australia to similarly optimise their workforce and financial strategies and thereby also better serve their communities.

BUSHFIRE AND NATURAL HAZARDS RISKS

This theme seeks better forecasts of likely events and precursor conditions; greater accuracy of forecast tools and more timely forecasts. This leads to increased preparedness for the impacts of natural hazards, improved communications and warnings and enhanced ability to predict and mitigate the risk.

Coastal management

Lead End User: Dr Martine Woolf, Geoscience Australia

Develop better predictions for extreme water levels

Lead Research Organisation: The University of Western Australia

Project Leader: Professor Charitha Pattiaratchi

Potential impacts and hazards of extreme water level events along our coasts are significantly increasing as populations grow and mean sea levels rise. To better prepare, coastal engineers, managers and planners need accurate estimates of average exceedance probabilities for extreme water levels. The occurrence of extreme water levels along low-lying, highly populated or developed coastlines can lead to considerable loss of life and billions of dollars of damage to coastal infrastructure, as the events in New Jersey with Hurricane Sandy recently demonstrated.

It is vitally important that the exceedance probabilities of extreme water levels are accurately evaluated to inform risk-based flood management, engineering and future land-use planning. This ensures the risk of catastrophic structural failures due to under-design or expense due to over-design are minimised.

This project will develop better predictions and forecasts for extreme water levels arising from storm surges, surface waves, continental shelf waves, tsunamis and mean sea level rise.

Resilience to clustered disaster events on the coast – storm surge

Lead Research Organisation: Geoscience Australia

Project Leader: Dr Scott Nichol

Coastal communities in Australia are particularly exposed to clustered disasters, due to the impact of cyclones and tropical storms when there can be coincidence of severe wind damage, storm surge, coastal flooding and shoreline erosion. Because the climatic drivers of cyclones and severe storms are stronger during specific times, these events often repeatedly impact the coast over periods of weeks, months or up to a few years. The consequences of individual events are therefore exacerbated with little or no opportunity for recovery of natural systems or communities.

The processes that drive the coincidence or clustering of natural disasters are reasonably well understood. However there is as yet no clear methodology in use to quantify the elevated risk to communities from clustered or coincident events. Typically, risk assessments are based on individual hazards against a long-term frequency baseline. This is misleading as it underestimates the true impacts of coincident or clustered events on the resources and resilience of communities.

While clustering of events can add significant impact to all natural hazards, coastal communities are particularly sensitive to clustering because of the dynamic nature of the coast. Coastal landforms are not static, and themselves are vulnerable to the impact of the hazards. Coastal landforms provide the physical foundation of coastal communities, as well as potentially forming natural protection to those communities. Inadequate techniques that do not take a holistic approach to the dynamic response of coastal landforms and communities to clustered events can lead to inappropriate decision making or funding allocation.

This study will demonstrate how a methodology developed for storm surge events can be applied to better inform decisions around resource investment in terms of disaster mitigation, planning and response and thereby optimise the resilience of the communities involved.

Geoscience Australia recently developed a national classification of coastal compartments for the entire Australian coast, and this study will build and extend that work to integrate with the risk assessment framework, supporting outcomes with applications at a national, regional and local level.

The aim of this project is to develop a new methodology to quantify the impact and risk of coincident and clustered disasters on the coast, with an initial focus on storm surge, associated erosion and reshaping of the coastline and the resulting inundation and damage to buildings and infrastructure.

Monitoring and predictions

Lead End User: John Bally, Bureau of Meteorology

Mapping bushfire hazard and impacts

Lead Research Organisation: Australian National University

Project Leader: Professor Albert Van Dijk

Government agencies, individuals and businesses need accurate spatial information on fire hazard to prevent, avoid and manage impacts. Bushfire hazard depends not only on weather but also on landscape conditions.

In Australia, fire hazard monitoring involves fire danger indices that consider mainly meteorological conditions, although a simple algorithm is used in the MacArthur Forest Fire Danger Index to calculate the 'Drought Factor Value' from antecedent weather data, intended as a rough estimate of litter moisture content.

To date, there has not been much emphasis on routinely providing and using spatial information on landscape-related hazard factors in determining fire risk. Partly, this is because of a lack of reliable, consistent, accurate and long-term information. This situation is changing, however. Several relevant satellite, airborne and mapping derived products and prediction models are now readily available to estimate important landscape variables that determine fire hazard.

This project will develop methods to produce the spatial information on fire hazard needed by planners, land managers and emergency services. The relevance and added value represented by these new information sources will be compared to the practical feasibility and costs of their use.

Disaster landscape attribution: fire surveillance and hazard mapping, data scaling and validation

Lead Research Organisation: RMIT University

Project Leader: Professor Simon Jones and Dr Karin Reinke

This project will systematically address the provision of rapid, timely and high quality information from multi-scale remote sensing systems. It will develop enhanced metrics on active fire extent, intensity and configuration as well as bushfire landscape attributes.

The project aims to bridge significant information and knowledge gaps that currently prevent optimal use of earth observing technology. These include accuracy and reliability issues in active fire surveillance, quantitative estimates of post-fire severity, a lack of product validation, and out-of-date approaches to collecting information on landscape condition.

The project will lead Australian contributions to GEO / GEOSS / CEOS in this area and integrate and enhance Australian led existing disaster monitoring (e.g. the CSIRO/ GA Sentinel Asia / Sentinel hotspots) and reporting systems with next generation earth observation technology and systems from the DLR and other agencies.

Improved predictions of severe weather to reduce community impact

Lead Research Organisation: Bureau of Meteorology

Project Leader: Dr Jeff Kepert

This project will use high-resolution modelling, together with the full range of meteorological data, to better understand and predict several important meteorological natural hazards, including fire weather, tropical cyclones, severe thunderstorms, and heavy rainfall. The outcomes from the project will contribute to reducing the impact and cost of these hazards on people, infrastructure, the economy and the environment.

Improvements in understanding of the interaction between bushfires and the atmosphere are also necessary. For example, bushfires modify the atmospheric flow nearby, with the changed winds then affecting fire spread and intensity. The development of strong updrafts, leading to ember transport, spot-fire generation and the formation of pyrocumulus clouds likewise involve interaction between the atmosphere and the fire.

This project will to extend our successful high-resolution fire weather modelling work with the Bushfire CRC in the following directions:

1. Extend into additional weather phenomena, particularly tropical cyclones, severe thunderstorms and intense extratropical cyclones.
2. Begin to move from "deterministic" prediction of the most likely outcome, to a pilot demonstration of probabilistic prediction of the range of plausible scenarios, together with the estimation of their relative likelihood.
3. Contribute to the development, and eventual operational implementation, of a run-on-demand severe weather version of the Bureau's ACCESS NWP system.

Improving flood forecast skill using remote sensing data

Lead Research Organisation: Monash University

Project Leader: Dr Valentijn Pauwels

Remote sensing can be a helpful tool for operational water management, and particularly for flood forecasting. In this project, remote sensing data will be used in two ways. First, estimated soil moisture profiles from hydrologic models will be improved through the merging of these model predictions with remotely sensed surface soil moisture values. This is expected to have a beneficial impact on modelled hydrographs.

Second, estimated flood inundations and water levels from hydraulic models will be improved through merging these model results with remotely sensed observations of flood inundations or water levels. This is expected to improve the predictive capability of the hydraulic model. Overall, using remote sensing data in flood forecasting is expected to lead to better early warning systems, management of floods, and post-processing of flood damages.

The objective of the project is to demonstrate the utility of coupled hydrologic/hydraulic model forecasting and data assimilation using remotely sensed data for potential operational use. This is expected to have a strong future beneficial impact on flood management practices in Australia.

Mitigating the effects of severe fires, floods and heatwaves through the improvements of land dryness measures and forecasts

Lead Research Organisation: Bureau of Meteorology

Project Leader: Dr Imtiaz Dharssi

Fire intensity, spread rate and ignition are sensitive to the fuel dryness which is strongly linked to soil moisture content. Estimates and forecasts of fuel and soil moisture are the foundation of the fire danger calculations used to rate and manage wildfires and to warn of developing fire danger. Similarly, estimates and forecasts of soil moisture are essential ingredients to be able to forecast with accuracy river flows on a seasonal scales (one to three months), which is much in demand by water managers and reservoir operators.

Currently landscape dryness is estimated using crude models developed in the 1960s. The most prominent of these used in Australia are the Keetch-Byram Drought Index (KBDI) developed in the US Forest Service, and the related Mount Soil Dryness Index developed by Forestry Tasmania. These simple empirical soil moisture models are designed to be easily hand calculated once per day for a small number of points across the landscape. Flood prediction, runoff potential and water catchment/dam management also are not using the best available technology and use simplified soil moisture accounting systems.

Modern Numerical Weather Prediction (NWP) systems calculate landscape dryness, but with much greater sophistication. They can account for soil characteristics, solar insolation, root depth, vegetation type and biological factors such as stomatal resistance, to better estimate the evaporation and other landscape moisture processes. Satellites can remotely sense soil moisture in the top few centimetres below the surface, with data available from dedicated soil moisture satellites since 2009. Satellite soil moisture data can be used directly, or assimilated by an NWP system to improve consistency with other environmental observations.

The current fire systems only use landscape dryness that uses one layer, soil type and vegetation, at one point in the day. It is imperative to the Australian community that best science and technology that is available to Emergency Management is used effectively and incorporated into warnings systems.

bushfire&natural HAZARDSCRC

Next generation fire modelling

Lead End User: Simon Heemstra, NSW Rural Fire Service, Andrew Stark, ACT Rural Fire Service

Fire spread prediction across fuel types

Lead Research Organisation: Victoria University

Project Leader: Professor Graham Thorpe

It is essential that emergency and disaster management organisations are able to predict the rate of spread and intensity of bushfires. This is achieved by implementing simplified fire propagation models that generate results on time scales that are useful to emergency managers. However, it is essential that these non-physics-based applications tools be refined so that they can predict fire behaviour under a wide range of localised topographic and weather conditions; they also need to be able to account for a range of vegetation types and their moisture status.

To help ensure that non-physics-based application modelling tools are accurate and flexible, the principal objective of this project is to develop an accurate and well-documented computer model that is based on firm physical principles. The model will be used to generate input data for non-physics-based models by simulating a large number of case studies. The new physics-based three-dimensional (3-D) model will form a key component of this project's strategy to develop "next generation" fire modelling capability and capacity.

The underlying physical and chemical mechanisms of fire spread are interdependent and extremely complex, and this renders their modelling intellectually challenging. However, inexorable advances in the physical and computing sciences are transforming the accuracy and detail with which the simulations can be made. The "physics-based model" will include all modes of heat transfer (conduction, convection, radiation) in which both fire-fuel and fire-atmosphere interactions are modelled. The model will account for the transportation of firebrands, pyrolysis (gasification of fuel from the solid state before taking part in combustion), combustion, and soot production submodels.

Bushfires can modify local weather conditions, hence modelling the interaction of fires and the atmosphere is a key component of the project. This requires a deep understanding of the factors that determine air flows and temperature distributions. For example, the height of flames generated by combustion may be tens of metres but it is an inescapable fact that small length scale phenomena on the order of a fraction of a millimetre are important in determining the behaviour of bushfires.

In this project these length scales will be spanned by making use of a computational technique known as large eddy simulation, which accurately resolves phenomena that occur on the length scales of tens of centimetres, and which relies on approximations of the small scale phenomena.

Coupled Fire-Atmosphere Modelling

Lead Research Organisation: Centre for Australian Weather and Climate Research, Bureau of Meteorology

Lead Researcher: Dr Jeffrey Kepert, Mika Peace

Bushfires affect the surrounding atmosphere because of the large amount of heat and moisture that results from the combustion and is deposited in the atmosphere. The atmospheric response to this energy input includes changes to the local winds, modification of the boundary layer, and the development of pyroconvective clouds. These changes can profoundly modify the evolution of the fire. This project will:

- Develop an Australian coupled fire-atmosphere modelling capability based upon the national numerical weather prediction infrastructure.
- •Better understand the contribution of fire-atmosphere interaction and three-dimensional atmospheric structure to fire behaviour, including spread, intensification, and "blow-up" behaviour.
- Better understand the impact of fire on the atmosphere, including fire-generated winds and their damage potential, ember transport and plume development.
- Progress towards an eventual operational capability for coupled fire-atmosphere modelling within Australia.
- Improve operational fire prediction services by efficiently transferring the knowledge gained in this project and others to Bureau of Meteorology fire weather forecasters and to fire agency fire behaviour analysts.
- Explore the development of computationally efficient methods for robustly accounting for fire-atmosphere coupling in fire prediction.

Fire coalescence and mass spot fire dynamics: experimentation, modelling and simulation

Lead Research Organisation: School of Physical, Environmental and Mathematical Sciences, University of New South Wales

Lead Researcher: Associate Professor Jason Sharples

Fire behaviour in dry eucalypt forests in Australia is characterised by the occurrence of spotfires – new fires ignited by the transport of burning debris such as bark ahead of an existing fire. Under most burning conditions, spotfires play little role in the overall propagation of a fire, except where spread is impeded by breaks in fuel or topography. Spotfires allow these impediments to be overcome.

However, under conditions of severe bushfire behaviour spotfire occurrence can be so prevalent that spotting becomes the dominant propagation mechanism and the fire spreads as a cascade of spotfires forming a 'pseudo' front.

It has long been recognised that the presence of multiple individual fires affects the behaviour and spread of all fires present. The converging of separate individual fires into larger fires is called coalescence and can lead to rapid increases in fire intensity and spread rate leading to the phenomenon of a 'fire storm'. This coalescence effect is frequently used in prescribed burning, with multiple point ignitions used to rapidly burn out large areas.

This project will research:

- Fire coalescence to provide better predictions of fire propagation
- The intrinsic dynamics of flame front propagation as a contributor to fire spread across different spatial and temporal scales,
- Within a simulation framework an end-to-end model of the behaviour of mass spotfires, from firebrand/ember launch to fire coalescence.

Extreme and Dynamic Fire Modelling and Fire Danger Rating System

Lead Research Organisation: University of New South Wales

Lead Researcher: Associate Professor Jason Sharples

Most fire behaviour models have been developed based on data and experience relating to fires that can be described as small to moderate in size. At present there are no operational models that adequately deal with extreme and dynamic bushfire behaviour, despite the disproportionate impacts these fires have on the environment and the community.

Current operational fire spread models assume that fires will burn at an approximately constant (quasi-steady) rate of spread under a specific set of environmental conditions. There is increasing evidence, however, that fire propagation can be significantly affected by dynamic feedback processes, which result in the continual development of fire spread rates and severity even when environmental conditions are unchanging (for example, through eruptive fire behaviour, vorticity-driven lateral spread, fire tornadoes, or fire storms). These dynamic feedbacks can arise in a number of different ways including via coupling with the atmosphere, the spotting process and conditional fuel availability.

This project seeks to develop a dynamic bushfire simulator that:

- Scales as a fire develops and decays.
- Captures the impacts of fire-terrain-atmosphere interactions on fire behaviour.
- Characterizes fire and fire-induced winds sufficiently to be able to predict the impact on buildings, structures, soils and plants with 25m spatial resolution.
- Incorporates the impact of fuel modified landscapes and fire suppression activities.
- Can be validated and verified against existing scientific knowledge and real fire events.
- Can support ensemble-based approaches to risk assessment and inform development of a national fire danger rating system that accounts for the dynamic nature of bushfire.

Prescribed burning and catchment management

Lead End User: Naomi Stephens, Office of Environment and Heritage

Savanna fire management

Lead Research Organisation: Charles Darwin University

Project Leader: Professor Andrew Campbell

This project has three major components:

- Savanna burning.
- Management of high biomass weeds.
- Spinifex and mulga landscapes.

Savanna Burning:

The Savanna Burning project builds on the substantial work previously undertaken within the Bushfire CRC's North Australian Fire Mapping project.

The project developed a comprehensive algorithm for mapping fire effects on tropical savanna vegetation. These data and the annual fire history mapping data were then applied in preliminary analyses to assess the risk to biodiversity, greenhouse gas emissions and ecosystem services in general under various climate scenarios.

The Savanna Burning project will build on this work by gathering finer scaled data and undertaking more detailed assessments of these and other criteria in regions defined as being at greatest risk.

The preliminary analyses suggested that the most deleterious effects to ecosystem services occur predominantly on Indigenous owned and/or managed lands. Therefore, the project will involve consultation with lead Indigenous groups such as the North Australia Indigenous Land and Sea Management Alliance and the Land Councils to determine those areas where it would be most feasible to undertake the detailed analyses through the collation of fine scale spatial data leading to research determining community resilience to those risks.

This project will expand upon broad-scale bushfire risk assessments in previously determined high risk regions using higher resolution spatial analyses. Current risk assessments include impacts on greenhouse gas emissions abatement, biosequestration, soil erosion, biodiversity, communities, and enterprises – under different management and climate scenarios.

Managing flammable high biomass grassy weeds:

A range of invasive grasses have spread rapidly in tropical Australia over the past two decades, substantially altering the savanna, riparian and wetland ecosystems.

The ecological, economic and social consequences of these grasses are so significant that many are now declared at the Territory and State level, have been listed as Weeds of National Significance, and listed as a Key Threatening Process under the EPBC Act. The impacts are primarily due to the substantial change in fire regime, with more frequent fires occurring at intensities higher than ever recorded previously in north Australian tropical ecosystems.

In the NT, special fire zones have already been declared based on the increased fuel loads and fire risk resulting from high-biomass grasses. There is a lack of decision support tools or models to effectively inform the longer-term consequences of grass invasion or the optimal decisions regarding the allocation of resources to manage this fire risk. The lack of these tools directly affects determinations about where to invest scarce resources to have the greatest impact on reducing risk and improving community resilience.

This project will assess the likelihood and magnitude of risk of high biomass invasive grasses to fire regimes in the tropical savanna region and provide critical information for Government policy and planning, particularly prioritisation of weed risk for fire-regime changing species, and for fire management planning.

Central Australian spinifex and mulga landscapes:

Substantial R&D has been undertaken over the past 15 years into the development of savanna burning greenhouse gas emissions abatement and sequestration methodologies, and associated project applications.

There may also be considerable potential for the development of complementary methodologies focusing on improved fire management of extensive central Australian mulga- and spinifex-dominated rangelands. Most prospective is a biosequestration methodology focusing both on mulga (*Acacia aneura*) and spinifex (*Triodia spp*). Unlike tussock grasses, Triodia continues to accumulate biomass at decadal scales similar to woody shrubs.

Available national mapping sources indicate that such landscapes cover at least a quarter of the continental landmass. These landscapes are very sparsely settled (mostly by Aboriginal people in small isolated communities), and support no economically significant agricultural or pastoral enterprises.

Despite the extreme aridity (with highly annually variable mean annual rainfall conditions <250 mm/yr) of mulga-spinifex landscapes, very extensive fires occur in the contemporary era particularly after intermittent rainfall events.

These contemporary 'boom and bust' patterns contrast strongly with the well-documented patchwork fire mosaics maintained under Aboriginal fire management until as recently as the late 1950s in some regions.

This project will contribute to the development of an approved Carbon Faring Initiative (or related) biosequestration methodology addressing improved fire management under central Australian conditions.In the longer term, to provide an economic and employment foundation for remote central Australian communities to develop land management enterprises/ undertakings so as to provide a sustainable basis for developing stronger and more resilient communities.

Optimisation of fuel reduction burning regimes for fuel reduction, carbon, water and vegetation outcomes

Lead Research Organisation: University of Sydney

Project Leader: Dr Tina Bell

Application of fuel reduction burning (FRB) to eucalypt forests has been guided for many years by knowledge of the fire-response traits of key species. Managers have been able to prioritise FRB in a spatial context on this basis.

Similarly, landscape features are now moderately well understood in relation to FRB – some landscape positions and aspects are more manageable than others, and, again, managers have been able to prioritise FRB on this basis.

What has been lacking, but which has become increasingly important, is knowledge and projecting capacity of the effects of FRB on fuel loads, broad vegetation types (in biomass terms) and carbon and water potential (e.g. capacity for carbon sequestration, water yield) of the forests at a manageable spatial scale.

This knowledge is required in a format that is readily useable by managers. Most commonly, this lies in the form of predictive models or tools.

This project will move research and management capabilities to its next logical focus – building a predictive model and framework for planning of FRB.

Two underlying issues need immediate attention:

1. Limited knowledge of the water storage capacity and dynamics of soil profiles (e.g. to a depth of at least 1 m) – this hinders both our ability to model water fluxes, especially the yield of water to streams and dams, and our ability to model whole stand and forest water use, before and after fires.
2. Limited knowledge of the effects of differing fire intensities on soil carbon. This requires, *a priori*, development of techniques to reliably and routinely assess the fire-related temperatures within soils at different depths.

These key issues can be tackled within an overall framework of developing models to facilitate optimised FRB regimes. Such spatially explicit models will take into account changes in fuel loads and predict the likely effects of individual fuel reduction fires (FRF) and collectively as FRB regimes on carbon and water potentials and vegetation composition.

From hectares to tailor-made solutions for risk mitigation: systems to deliver effective prescribed burning across Australian ecosystems

Lead Researcher: Professor Ross Bradstock,

Lead Research Organisation: University of Wollongong

Prescribed burning in Australia, currently stands at a cross roads. The 2009 Victorian Bushfires Royal Commission recommended an annual treatment target of 5% of public land in Victoria. Subsequently, concerns have been formally raised (for example in the Bushfires Royal Commission Implementation Monitor 2013 Annual Report) that such an area-based target may not deliver the most effective levels of risk reduction for people and property in Victoria. Concurrently, some other states have adopted such a prescribed burning target, but formal attempts to evaluate its effects on risk to people, property and environmental values across different jurisdictions are lacking. Such extrapolation of the 2009 Royal Commission recommendation pre-supposes that there is a “one-size fits all” solution to the problem. While many agencies are moving toward planning systems supposedly based on risk assessment, knowledge of the best way to use prescribed fire to reduce risk to key values is generally lacking.

The project aims to deliver:

1. A Prescribed Burning Atlas to guide implementation of ‘tailor-made’ prescribed burning strategies to suit the biophysical, climatic and human context of all bioregions across southern Australia. The Atlas will define the quantitative trajectory of risk reduction (including resultant residual risk) for multiple values (such as property, water, carbon, vegetation structure) in response to differing prescribed burning strategies (including spatial configurations and rates of treatment), across different Australian environments based on their unique climatic, biophysical and human characteristics.
2. Continental-scale, biophysically-based models of ignition and fuel accumulation for Australian ecosystems, for use in dynamic risk management planning and operational decision-making about prescribed burning at seasonal and inter-annual time scales, accessible via the Atlas.
3. Detailed scenarios of future change in risk mitigation effectiveness of prescribed burning strategies in response to integrated scenarios of changes to climate, fuel (including elevated CO_2 effects) and ignitions. These will also be accessible through the Atlas.

bushfire&natural
HAZARDS CRC

Level 5, 340 Albert Street
East Melbourne VIC 3002
tel: +61 3 9412 9600
email: office@bnhcrc.com.au

www.bnhcrc.com.au

An Australian Government Initiative

CRC AUSTRALIA

© September 2014