

# Research Programs: An Overview

The Bushfire CRC is a major initiative of the fire and land management agencies in Australia and New Zealand, and national research partners. Since 2003 all jurisdictions have had a co-ordinated approach to fire research.

The Bushfire CRC is a collective move towards the achievement of a better understanding of the complex social, economic and environmental aspects of bushfires. This, in turn, has led to a greater national focus on the development of strategies, policies and procedures and growing inter-agency agreement on the need for an on-going research investment into the sector. The combination of partner resources and the Australian Government's CRC program grant provides for a substantial investment in this research.

Industry focussed research and collaboration, together with strong education and knowledge transfer programs is delivering practical benefits to the fire and land management industry and to the wider community.



## Our Mission

*The Bushfire CRC's mission is to enhance the management of the bushfire risk to the community in an economically and ecologically sustainable manner.*

*It includes the following objectives:*

- *To develop an internationally renowned centre of excellence to lead bushfire research in Australia*
- *To provide a research framework that will improve the effectiveness of bushfire management agencies*
- *To increase the self-sufficiency of communities in managing the risks from bushfires.*

## Program A: Safe Prevention, Preparation and Suppression

**End User Leader:** Steve Rothwell, Queensland Fire and Rescue Service

**Alternate:** Bob Conroy, NSW Parks and Wildlife Services

**Program Leader:** Rod Keenan, University of Melbourne

Fire managers need reliable tools that make the best use of emerging technologies to support their decisions in how best to manage the landscape, before, during and after a bushfire. This program is providing a better understanding of key issues such as fire behaviour, fire weather, bushfire danger rating, and strategies for aerial and ground suppression.

### A1.1 Fire Behaviour Modelling

**Project leader:** Miguel Cruz, CSIRO Sustainable Ecosystems

Providing better knowledge and understanding of the interactions between fire, fuel, weather and topography; integrating existing and new fire behaviour models into a *National Fire Behaviour Prediction System*. The work includes field validation of the findings from the earlier Western Australian based *Project Vesta* and experimental fires in

South Australia and New Zealand.

Developing a universal classification of forest and heathland fuel types; systematically classifying fuel types across Australia; and predicting the extent of fuel consumption under a range of bushfire behaviours. This will be directly applicable to the major fuel types across Australia.

### A1.4 Grassland Curing

**Project Leader:** Stuart Anderson, SCION

Providing improved methods for the prediction of grassland curing for better inputs into fire danger rating systems and fire behaviour models. Direct measurements from Western Australia, Queensland, ACT, New South Wales and New Zealand are being fed into the development of curing models.

### A2.1 Fire Weather – Fire Danger

**Project Leader:** Graham Mills, Bureau of Meteorology

Improving the operational utility of fire weather forecasts and outlooks, by offering enhanced knowledge, and understanding of wind, temperature and humidity structures and distributions, on the very short term (1-12 hours), short to medium term, and seasonal time scales. Annual seasonal bushfire weather outlooks are conducted across both northern and southern Australia.

### A3.1 Evaluation of Aerial Suppression Techniques and Guidelines

**Project Leader:** Matt Plucinski, CSIRO Sustainable Ecosystems

Investigating the effectiveness of aerial fire fighting for suppressing bushfires by helping fire and land management agencies optimise the effectiveness and efficiency of aircraft use in fire fighting operations. Data has been obtained from both real bushfire fighting operations and from experimental fires. This project

has delivered a final report on the effectiveness and efficiency of aircraft and on the cost-effectiveness of using aircraft.

#### A4.1 Fire Management Business Model

**Project Leader:** Kevin Tolhurst, University of Melbourne

Developing, at both the strategic and operational levels, a risk management decision support system for fire and land management agencies, communities living in the rural/urban interface, town planners, power supply companies and firefighters. The model is now being used to assist bushfire fighting management in several state operations.

#### A5.1 Computer simulation modelling

**Project Leader:** George Milne, University of Western Australia

Developing reliable bushfire



spread simulation and animation technology to support a wide range of fire management activities including risk analysis, prescribed burning, wildfire suppression and incident control training.

This modelling is being directly led by FESA as the lead end-user and has been extensively used by FESA for discussions on the importance of fuel reduction burning in the Perth region.

## Program B: Fire in the Landscape

**End User Leader:** Liam Fogarty, Victorian Department of Sustainability and Environment

**Alternate:** Tony Blanks, Forestry Tasmania

**Program Leader:** Mark Adams, University of Sydney

This program is helping firefighters, land managers and the broader community learn to manage fire and understand its importance as a land management tool. It is gaining a better understanding of the role of fire in Australian ecosystems.

#### B1.1 Managing Forest Fires in South Western Australia

**Project Leader:** Lachlan McCaw, Department of Environment and Conservation, WA.

Improving the understanding of the ecological effects of fire at a landscape scale by analysing the impact of varying fire regimes over the past 50 years; and thereby improving the capacity to use modelling to predict the sensitivity of bushfire risk to various management strategies and climate change. Looking at bushfire history in semi arid southern Western Australia.

#### B1.2 Fire Regimes and Sustainable Landscape Risk Management

**Project Leader:** Ross Bradstock, University of Wollongong

Studying four contrasting regions across Australia (the Sydney Basin, ACT, south-west Tasmania, Central Australia) to enhance and validate key functions in the landscape/fire regime simulation model, FIRESCAPE. By measuring the responses of biodiversity to different fire regimes and the sensitivity of fire behaviour to vegetation, fuel moisture, landscape characteristics and fire suppression/prevention activities the outcomes will quantify the risks posed by particular fire regimes.

#### B2.1 Behaviour of Smoke Plumes and Hazes from Rural or Urban Fires

**Project Leader:** Graham Mills, Bureau of Meteorology

Delivering improved prediction products for agencies. The smoke plume



prediction/management model and training module is now operational in agencies for bushfires, prescribed burns, and smoke from urban and industrial fires.

#### B2.2 Smoke Composition from Prescribed and Wildfires and Health

**Project Leader:** Tina Bell, University of Melbourne

Applying new and existing techniques to measure the contribution of prescribed burns and wildfires to particulate matter, classical pollutants, dioxins, irritants and carcinogens, greenhouse gases, photochemically active gases and ozone-depleting chemicals in smoke emissions. Also investigating the impact of smoke on human health through surveys of hospital admissions, patient recovery and community perceptions.

#### B3.1 Impacts of Fire on Ecological Processes and Biodiversity

**Project Leader:** Alan York, University of Melbourne

Focusing, under different fire regimes, on nutrient fluxes; and on the roles played by mycorrhiza and decomposer fungi,

their inter-relationships with plants and invertebrates, and on the likely impacts of the reactions on ecosystem processes and carbon cycling.

#### B3.2 Tropical Ecosystems

**Project Leader:** Alan Anderson, CSIRO Sustainable Ecosystems

Investigating fire regimes in the Tropical Savannas of northern Australia with experimental fires that cover fuel dynamics, fire behaviour, soil biology and ecological function, grass and tree dynamics, the role of herbivory in vegetation recovery and invertebrate biodiversity. The Burning for Biodiversity project is aiming to improve the understanding of effects of fire on biodiversity and to increase public awareness and education of fire in northern Australia. The work has direct application to the fire management issues Western Australia and Queensland as well as the Northern Territory.

#### B4.1 Synthesis and Integration

**Project Leader:** Mark Adams, University of Sydney

Production of a book that establishes the social, political and economic context relevant to the biophysical sciences involved in the use of prescribed fire; synthesizing and interpreting existing data and knowledge with the purpose of positively influencing relevant land management and fire policy.

#### B4.2 Multi-scale patterns in Ecological Processes and Fire Regime Impacts

**Project Leader:** Pauline Grierson, University of Western Australia

Integrating ecological information derived at smaller scales with larger scale management perspectives. The outcomes will determine appropriate scale for decisions aimed at ecologically sustainable fire regimes.

**B5.1 HighFire – Ecosystem Processes****B5.2 HighFire – Living with Fire****B5.3 HighFire – Risk Management**

**Project Leader:** Mark Adams, University of Sydney

Established long-term research sites in the high country of New South Wales, the ACT and Victoria to examine the impacts of climate change on fuel accumulation rates, flammability, fire severity, and the

trade-off between fire regimes and water yield. Researchers are also providing empirical data on how communities learn to live with fire; an understanding of community values and expectations for fire management of high country areas; establishing effective engagement with and among land managers; and examining a range of socio-legal governmental, economic, and regulatory and policy issues currently influencing bushfire management in the high country.

**B6 Tree Decline in the Absence of Fire**

**Project Leader:** Neil Davidson, University of Tasmania

Examining nationally the hypothesis that tree decline is caused by reduced frequency or absence of fire. Study sites are in New South Wales, West Australia and Tasmania where the same forest type occurs as long unburnt stands adjacent to sites where there are good records of frequent burning.

**Program C: Community Self-Sufficiency for Fire Safety**

**End User Leader:** Damien Killalea, Tasmania Fire Service

**Alternate:** Lyndsey Wright, Metropolitan Fire and Emergency Services Board

**Program Leader:** John Handmer, RMIT University

This program is helping communities become more resilient in the face of the threat from bushfires. It is seeking to understand what communities need to manage the risk, which varies greatly from one community to another across Australia and New Zealand. Central to this program is better understanding what drives human behaviour before, during and after a bushfire.

**C1 Understanding Communities**

**Project Leader:** Alison Cottrell, James Cook University

Developing improved understandings of community perceptions and attitudes to bushfire and incorporating research from other hazard studies in ways that can be successfully adapted by bushfire prone communities. The project is comparing community responses in Queensland and Victoria and other areas. This project has delivered reports and regular bulletins on surveys of community perceptions.

**C3 Bushfire Arson**

**Project Leader:** John Beale, Australian Institute of Criminology

Reviewing current arson prevention practices; defining the framework for best practice arson prevention models; developing a better understanding of arson in Australian bushland environments; and reducing deliberate, negligent bush fire-lighting. This project has delivered reports on the effectiveness of current prevention programs, a comprehensive review of national trends



in deliberately lit vegetation fires and regular bulletins on issues.

**C4 Effective Risk Communication**

**Project Leader:** Doug Paton, University of Tasmania

Defining the framework and surveying different communities on their information needs before, during and after a bushfire emergency. Collecting and analysing examples of current practices. Developing best practices model and plans for its implementation and evaluation with test communities.

**C5 Bushfire Economic Costs**

**Project Leader:** John Handmer, RMIT University

A comprehensive economic analysis of bushfire loss, taking into account the costs of arson, the impact of error and uncertainties, carbon accounting, intangible losses and the additional impacts of *mega-fires* events and on volunteers. Report delivered on the cost effectiveness of aerial fire fighting.

**C6 Evaluation of 'Stay or Go' Policy**

**Project Leader:** John Handmer, RMIT University

Collating and analysing current practices in the context of their legal, organisational, emergency planning and other issues across Australia using recent fires as case studies. Published reports on findings and recommendations. Developing plans for definition and implementation of preferred approach for people and property protection.

**C7 Evaluation of Community Safety Programs**

**Project Leader:** Gerald Elsworth, RMIT University

Developing a comprehensive analysis of Community Education programs regarding bushfires. The effectiveness of these programs is being assessed using a number of tools. The project team assisted with the Eyre Peninsula coronial investigation and has been directly involved with programs in Western Australia, Victoria, South Australia and New South Wales.

**Program D: Protection of People and Property**

**End User Leader:** Karen Roberts, Fire and Emergency Services Authority, Western Australia

**Alternate:** Tim Anderson, NSW Rural Fire Service

**Program Leader:** Bob Leicester, CSIRO

This program is examining methods to increase the safety at the interface between people, property and the natural bushland environment. It is focussed on the health and wellbeing of the community and firefighters through research into building protection, and firefighter health and safety. It is also studying the drivers of demographic and attitudinal changes affecting the retention and recruitment of volunteers.

**D1 Building and Occupant Protection**

**Project Leader:** Justin Leonard, CSIRO

Improving the awareness and understanding of issues surrounding building loss in bushfires in order to reduce the direct loss, particularly in urban-rural interface areas. Results of the research have fed into building codes and practices and includes research on infrastructure such as decking, windows

frames and water tanks as well as civilian vehicles.

**D2.1 Fire Fighter Health and Safety**

**Project Leader:** David Nichols, Country Fire Authority of Victoria

Developing a quantified picture of the total fire ground environment through the measurement of ergonomic, physiological and behavioural factors; determining the effects of fitness, stress, and fatigue and

crew management on the health, safety and wellbeing of firefighters working on bushfire suppression at bushfire events and at experimental fires in Victoria, South Australia, Western Australia, New South Wales and Tasmania.

### D2.2 Air Toxics Exposure and Management

**Project Leader:** Mick Meyer, CSIRO

Identifying key toxic pollutants in bushfire smoke; evaluating their concentration; and providing the tools and techniques to measure, evaluate and control the exposure of fire-fighters (and to some extent communities) to these substances. Tests carried out at bushfires, prescribed burns and at experimental fires across Australia.

### D2.3 Safe Behaviour and Decision Making

**Project Leader:** Mary Omodei, La Trobe University

Increasing the understanding of the human factors (including the effects of physical and mental stress, group pressures at crew and agency level, and the firefighters' own thought processes) affecting decision making that could compromise safety on the fire ground.

### D2.4 Safe, Cost Effective Equipment

**Project Leader:** David Nichols, Country Fire Authority of Victoria

Reviewing and surveying fire services to define perceived fire fighter equipment needs. Developing a methodology to assess hazards and to evaluate risk



controls. Reviewing the current range of passive protection measures used for vehicle crew protection.

### D3 Enhancing Volunteerism

**Project Leader:** Adrian Birch, La Trobe University

Analysing the factors impacting on the recruitment of future volunteers and the retention of current volunteers. This project is tracking the experiences of new volunteer recruits as they move through recruitment, induction, training, and initial deployments to incidents. It is analysing why people do or do not volunteer. Outcomes have assisted fire agencies across Australia in strategic planning and policy development.

### D4 Respiratory Health of Firefighters

**Project Leader:** Phil Weinstein, University of Western Australia

This project has investigated the efficacy of the standard issue smoke masks

in conjunction with FESA, as part of a postgraduate thesis.

### D5 Enhancing Emergency Incident Management Team Effectiveness and Organisational Learning

**Project Leader:** Christine Owen, University of Tasmania

Improving teamwork and effectiveness, at both the Incident Management Team and organisational (and cross-organisational) levels. The project includes looking at information flow and the role of multi-agency approaches. States involved in the data collection on this project to date include Victoria, Tasmania, New South Wales, and Western Australia.

### D6 Domestic Smoke Alarms

Determined the efficacy of the current AFAC position through a review of the academic and trade literature on domestic smoke alarms, both in Australia and overseas.

## Program E: Education and Research Adoption

The Bushfire CRC's education program addresses the chronic shortage of bushfire research skills in Australia. The program now supports more than 40 postgraduate students in topics spread across the Bushfire CRC's four program areas.

Through the development of education and training, technology transfer, the Knowledge Web and other knowledge networking programs the Bushfire CRC is working with industry partners to better manage bushfire risk through transforming research outputs into outcomes for the agencies and the community.

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For further information on the Bushfire CRC's research programs and activities go to:  
[www.bushfirecrc.com](http://www.bushfirecrc.com)



## bushfire CRC Partnerships

### Core partners

- ACT Emergency Services Agency
- ACT Parks, Conservation and Lands
- Bureau of Meteorology
- Country Fire Authority of Victoria
- CSIRO - Divisions of Manufacturing & Infrastructure Technology, Forest Biosciences, and Sustainable Ecosystems
- Emergency Management Australia
- Fire and Emergency Services Authority of Western Australia
- Melbourne Metropolitan Fire and Emergency Services Board
- New South Wales Fire Brigades
- National Parks and Wildlife Service of New South Wales
- New South Wales Rural Fire Service
- Queensland Fire and Rescue Service
- State Forests of New South Wales
- Tasmanian Government – Tasmania Fire Service, Parks Tasmania, Forestry Tasmania
- University of Melbourne, School of Forestry and Ecosystem Science
- University of Tasmania

- University of Western Australia
- University of New South Wales
- Department of Sustainability and Environment, Victoria
- Department of Environment and Conservation, Western Australia
- New Zealand Rural Fire Service and University of Canterbury

### Associate Partners

- ACT Department of Justice and Community Safety
- Australian National University
- James Cook University
- La Trobe University
- New Zealand Forest Research
- RMIT University
- South Australian Country Fire Service
- South Australian Department for Environment and Heritage
- South Australian Metropolitan Fire Service
- Charles Darwin University
- WA Department of Industry and Resources, Chemistry Centre
- University of Wollongong