



# BUSHFIRE CRC ANNUAL REPORT 2008 -09



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October 2009

## CEO'S CERTIFICATION

CEO's certification must state that:

*I hereby certify that the information provided to the Department of Innovation, Industry, Science and Research by the Bushfire CRC in:*

- *the CD section of the CRC's 2008-09 Annual Report;*
- *the CRC's online milestone tables for the 2008-09 financial year\**
- *the CRC's online financial tables for the 2008-09 financial year;*
- *the CRC's online 2008-09 Management Data Questionnaire; and*
- *the four Quarterly Reports provided online for the 2008-09 financial year*

*provides a true and fair view of the matters reported on therein.*

*I certify that the Commonwealth funding and Researcher/Participant Contributions were applied for the Activities of the CRC as specified in Schedule 1 of the Commonwealth Agreement.*

*I certify that the CRC has met its obligations in relation to the treatment of Intellectual Property.*

*I certify that the Chairman of the Board meets the requirements of independence set out in the Commonwealth Agreement and that the majority of Board members are not Research Providers.*

*I am aware that giving false or misleading information is a serious offence.*



Signature:

Name: Gary Morgan

Position: CEO, BushfireCRC

Date: 28 October 2009

### CEO's Checklist (Answer each statement with a ✓/Y (Yes) or N (No))

The CEO's checklist does not have to be provided with the Annual Report certification, it is provided to assist a CRC to ensure it has completed all reporting requirements under the Commonwealth Agreement.

Has the CD of the written Annual Report been mailed to the Department?	Y
Have the Milestone tables been submitted through CRC Online? <a href="https://www.crc.gov.au">https://www.crc.gov.au</a> . (Not applicable to 2000 round CRCs)	Y
Have the Financial Tables been submitted through CRC Online? <a href="https://www.crc.gov.au">https://www.crc.gov.au</a>	Y
Has the Management Data Questionnaire (MDQ) been submitted through CRC Online? <a href="https://www.crc.gov.au">https://www.crc.gov.au</a>	Y
Have the Audited Financial Statements on the Account and CRC Company (2004 and 2006 Round CRCs only) been forwarded with or included in the written Annual Report?	Y
Has the original of the Qualified Accountant's Certification and Checklist on the CRC Online financial tables been mailed to the Department?	Y





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## EXECUTIVE SUMMARY

### ACHIEVEMENTS AND ACTIVITIES FOR THE REPORTING PERIOD

High level achievements for 2008-2009 include:

#### Research

The outputs from the Bushfire CRC were independently assessed as being of high quality overall, and of international benchmark standard in the social sciences.

- 43 research reports and journal articles published (a further 21 accepted for publication) into the major areas of the bushfire research program including the cost effectiveness of aerial fire fighting, bushfire fatality trends, community safety, fuel mosaics and prescribed burning, wind and fire spread, fire danger climatology, fire management in eucalypt forests, enhancing volunteerism and fire fighter fitness.
- 14 refereed international conference papers published, a book (*The Handbook of Disaster and Emergency Policies and Institutions*) and eight book chapters. These informative articles cover the breadth of physical and social sciences of fire research.
- The outputs of two research projects were delivered to industry in the form of easy to digest decision support tools - *A Field Guide for Burning Under Young Eucalypts* and a *Field Guide for Smoke Exposure Management*. To make these guides readily accessible to operational personnel in the industry these are available for order on the Bushfire CRC website and through the online Shop of the Australasian Fire and Emergency Service Authorities. Interest from the industry has been excellent with 20,000 orders received for the smoke management guide within the first month of release.
- Research output after six years now totals more than 685 publications. All these publications - reports, journal articles, presentations, posters - are online at [www.bushfirecrc.com](http://www.bushfirecrc.com) and also appear on the AFAC Knowledge Web, a product of the Bushfire CRC now managed by the industry.
- The Bushfire CRC has strong international associations in particular in the United States, Canada and southern Europe, which will continue to provide research opportunities for collaboration and for benchmarking the quality of the research program.

#### Research Adoption

The Research Adoption process ensures that the research knowledge is transferred into industry to make the industry and the community safer. An independent analysis of the program praised the Bushfire CRC's high level of research utilisation within the industry. Highlights this year include:

- The Bushfire CRC held an international conference in Adelaide in September. The conference was seen as a major international event attracting more than 1100 delegates, including many international speakers and delegates, and 100 trade exhibitors from the broader industry. The three day conference heard from more than 90 international and Australian speakers from research organisations and from the fire and related industries. In addition, a hands-on workshop was provided to assist in the transition of research into agencies responsible for community safety. Many CEOs attended, highlighting the high value the research has to the industry.
- The Bushfire CRC is turning scientific reports into easy to read publications for the industry and communities. This included 19 *Fire Note* and *Fire Update* briefing papers distributed to the industry on subjects including climate change and fire management, retaining a volunteer workforce, burning in eucalypt plantations, fire in alpine Australia, smoke toxics, remote sensing, evaluation of community safety programs, burning in Kakadu, and community preparedness. In



addition, four editions of the Bushfire CRCs *Fire Australia* journal were produced and sent to 6000 research and industry readers to widen the reach of research outputs from the Bushfire CRC.

## Education

Bushfire CRC research outputs are being integrated into structured courses, seminars and workshops by agencies, AFAC Groups and research organisations. One example is the extensive use of Program B research and researchers in the Australian National University “Fire in the Environment” course.

Of the 44 postgraduate students, 15 have successfully completed their study - pleasingly all are now placed in industry employment or in research, indicating the positive benefit the Bushfire CRC is having in building capacity within the industry

Fire agencies have adopted much of the research for community education campaigns in areas including house protection, volunteer recruitment and safety in cars during a bushfire (right, Public education wall banner based on Bushfire CRC research on vehicle safety, South Australia Country Fire Service,).



## Victorian bushfires response

The Bushfire CRC provided major and on-going assistance to Victorian emergency service and land management authorities and to the 2009 Victorian Bushfires Royal Commission in the wake of the February ‘Black Saturday’ fires.

The Bushfire CRC deployed its Research Taskforce onto the fireground during the week immediately following Black Saturday. Teams of up to 50 researchers and agency staff drawn from around Australia gathered data on human behaviour, property loss, and fire behaviour.

This demonstrates the success in capacity building and the ability of the Bushfire CRC to coordinate and manage a large research response at short notice. Through the capacity built in the Bushfire CRC, researchers from across Australia, New Zealand and the US were brought in the taskforce in a very short timescale.

## Governance

A Governing Board initiated 5<sup>th</sup> Year Independent Review in late 2008 concluded, among things, that:

*The CRC has played a leading role in initiating or further developing a culture of ‘improvement by research’ evident in all the agency representatives interviewed.*

And that:

*“The Panel has been greatly impressed by the quality of science and by the rate of adoption of research results evident in the Bushfire CRC.”*

This is a major achievement in such a short period of time and highlights the strong gains made in the utilisation of Bushfire CRC research.

These significant achievements have been brought about through continual contact with Stakeholders ensuring close alignment of Bushfire CRC research with the industry’s requirements. Formal governance was provided through:



- Two Stakeholder Council meetings of stakeholders, each meeting comprising more than 60 participants, drawn from each Australian jurisdiction and New Zealand.
- Seven Governing Board meetings.

## Communications

The Bushfire CRC has had a high media profile throughout the year across all levels - locally, nationally and internationally. While this was spread over the year, the Bushfire CRC was in particularly high demand during fire events in North America and southern Europe, and over the extreme fire season across southern Australia, both before, during and after the Black Saturday fires then subsequently the 2009 Victorian Bushfires Royal Commission.

The *Los Angeles Times* series *Big Burn* in August (a subsequent Pulitzer Prize winner) featured much content supplied by the Bushfire CRC with our researchers quoted across several articles.

The international Bushfire CRC research conference in Adelaide attracted considerable media coverage, including (pictured, right) national media based at the conference for the duration of the event.



The Bushfire CRC website received a steady increase in hits over the year with demand particularly strong around major bushfire events, in particular around the February 2009 Victorian bushfires, and with the launch of new research. The website drew many enquiries from the interested general community in fire zones around Australia as well as industry and academic enquiries, including school and tertiary students.

Publications on the research that are written and designed specifically for the industry for improved fire management and community safety are online and in printed format. The Bushfire CRC website and the Knowledge Web now include all publications, reports, conference papers and posters of the Bushfire CRC. The bulk of uploading of this content was completed this year and new material now being uploaded as it is produced.

## Planning for the future

The bushfire-related research needs of the industry in both Australia and New Zealand were defined to the year 2020 and beyond in a series of workshops and high level meetings over the year. The Bushfire CRC was heavily involved with an AFAC led consortium that secured ongoing support for research from the broader industry and from research organisations.

The agreed research program focussed on risk management, carbon, water, biodiversity, local government, policy and practice, community resilience, economic impact assessment, residential fires, incident management, and the use of technology.

The outcome of this process was a nationally agreed list of research priorities that has provided a long-term research focus for the industry. As a result, Australia and New Zealand will have, on conclusion of this research, knowledge to address the anticipated 2020 scenario for our communities.

## RISKS, OPPORTUNITIES AND RESPONSES

### Research into Industry

Now in the sixth of its seven year life and with most of the key research outputs and activities achieved or close to being finalised, the Bushfire CRC spent the year focussed on its *Research Adoption Strategy* and completing the scientific requirements through the submission of journal articles and other academic outputs. This strategy will ensure that research outputs are founded in rigorous scientific publications and are properly managed through to industry adoption.

The legislative responsibility for life and property rests with the state and Territory fire and land management agencies, all of which have community engagement programs. In order to bring about changes to new research knowledge in the most efficient and effective manner the Bushfire CRC must have strong relationships with industry stakeholders. Hence, all projects have both a nominated industry and research leader to ensure that the development of each project has been a collaborative effort of researchers and end-users. This presents the Bushfire CRC with the opportunity to ensure that these outputs are properly transferred into useful outcomes for industry and the community. Conversely, this also presents a risk in that if this process of research transfer is not successful the overall benefit of the Bushfire CRC will not meet its full potential. However, to date the process has worked well in bringing the latest knowledge to communities and agencies.

### Scrutiny of Research

More immediately, and as a consequence of the deliberations of the Victorian Bushfires Royal Commission, the work of the Bushfire CRC is receiving significant additional ‘third party’ exposure and scrutiny as leading researchers and post-graduate students provide both formal and less formal assistance to the Commission. The researcher’s work has been scrutinised by peers and by the international community and has been held in high regard.

**Impediments to achievement of the CRC’s objectives experienced during the year and strategies adopted to address these.**

The Bushfire CRC has met its Commonwealth and end-user requirements and has exceeded these in some cases.

Impediments during the year and actions to address these include:

- The February Victorian Black Saturday fires put a considerable strain on the limited resources (human and financial) of the Bushfire CRC. Given their expertise, key Bushfire CRC researchers and post-graduate students were in high demand by the industry and by investigative bodies immediately following the disaster. Some have chosen to move to full time specialist positions on projects others were chased for positions with agency partners to build their internal capacity. Despite these pressures disrupting some research projects, readjustment of resources lead to deliverables being met.
- Whilst the 2009 Victorian Bushfires Royal Commission has been an impediment to delivery of the Bushfire CRC’s outputs it is clearly



consistent with the broader intent of building the capacity within industry and of being a national centre of bushfire knowledge. Prior to the Bushfire CRC, such a strong and coordinated scientific involvement to assist a bushfire Royal Commission would not have been possible.

## AWARDS, SPECIAL COMMENDATIONS, CRC HIGHLIGHTS

### Special service - emergency research

In the wake of the tragic bushfire-related events in Victoria in February, the Bushfire CRC, with the agreement of relevant Victorian authorities and the State Coroner, moved quickly to assemble and deploy specialist research teams to the affected areas.

The specialists, pictured below on the first day of the Taskforce field collection on 12 February 2009, were sourced primarily from non-Victorian member agencies and research organisations of the CRC.



This research effort initially focused on the collection of data across the areas of Fire Behaviour, Human Behaviour and Community Safety, along with building and land-use planning issues. The project surveyed more than 1300 properties, collected more than 22,000 photographic images and interviewed more than 600 affected residents.

Prior to the advent of the Bushfire CRC (in 2003) it would not have been possible to assemble, rapidly deploy and manage such a large scale specialist resource as that fielded in Victoria recently.

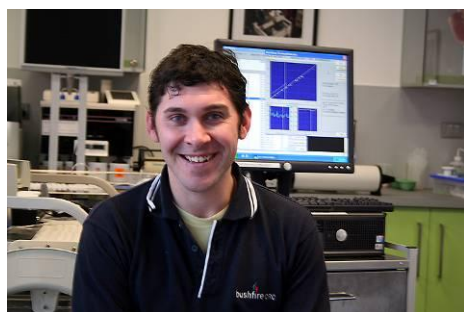
While the originating circumstances are tragic, out of this recent national tragedy Australia would now seem well placed to be able bring the results of soon to be completed valuable scientific and social research to the future planning for and management of landscape fire and its associated risk, both here and internationally.



## Awards



- Dr Tina Bell, a Project Leader and senior research fellow at the University of Melbourne gained a scholarship with the prestigious Fulbright Program in early 2009. Tina has since travelled to the Centre for Fire Research and Outreach at the University of California, Berkeley to study the effect of fuel reduction fires on grapevines.



- PhD student Matt Phillips from Deakin University was shortlisted out of 35 applicants (in the top 4) for the CRC Association Early Career Scientist Award at the CRCA Conference. He presented on his research into the fitness of tanker based fire fighting crews. Matt was also one of two students invited to present to a CRC Chairman's breakfast at Parliament House.

## CONTEXT AND MAJOR DEVELOPMENTS DURING THE YEAR

### A changed industry context - climate

The Bushfire CRC operates primarily within the fire and land management industry and secondly within the broader emergency services sector;

Climate change projections show that most of Australia, but in particular the southern parts of the continent, are moving towards a hotter and drier climate. Australia can expect more extreme fire days across a more fire prone landscape;

Some 12 months ago the industry reached agreement that the current practices of fire management and protection are not sustainable under these emerging conditions. The industry is now looking to the Bushfire CRC, and to fire researchers more generally, to provide a research direction to tackle these challenges.

This is having a significant impact on the objectives of the Bushfire CRC. Its research program was established in 2001/2, when climate change was not the main driver of change in this industry, or indeed any other industries. Much of this year was devoted to redefining the national research agenda for bushfires around new drivers of change - climate and drought, demographic movements, workplace health and safety, and changing technology. This was done as a combined effort to secure ongoing funding as the Bushfire CRC came to an end of its seven year life.

## Unprecedented external scrutiny

Another significant change in the industry context has been the unprecedented rise in the level of scrutiny of the management of bushfires in Australia, most recently by the 2009 Victorian Bushfires Royal Commission and the announcement of inquiry into bushfires by the Australian Senate. The need for the industry to actively participate in these Inquiries places considerable demands on researchers and CRC staff.

Conversely, these Inquiries provide considerable opportunities to broaden research/industry interactions and to provide high quality scientific knowledge to assist high level inquiries make strategic recommendations to improve community safety.

## Senate support

The Australian Senate voted to include a \$15m grant to the Bushfire CRC as part of the Economic Stimulus Package that was developed by the Australian Government in early 2009. This funding was for an extension to the current Bushfire CRC research program from 2010 to 2013. With the Bushfire CRC initially set to finish in mid-2010, this extension funding has presented the opportunity to renew the research program with an invigorated and contemporary agenda to 2013.

The Australian Senate passed a resolution on 11 February 2009 that highly supported the work of the Bushfire CRC. The resolution of the Senate:

*(a) Notes the extensive and internationally-recognised work of the Bushfire CRC; and*

*(b) Recommends the Government assess the value of upgrading the Centre to be a global wildfire research facility.*

## THE VALUE OF OUTCOMES

### The expected monetary and non-monetary outcomes of the CRC

Under CRC Objective 2.1 Benefit to Australia, the actual and future benefits were predicted to be more than three times the Commonwealth Grant through a cost-benefit analysis.

### Does the value of outcomes match the expectations?

An economic study compiled for the Fifth Year Independent Review showed that the likely economic NPV return from the Bushfire CRC is in the range of \$66m-\$450m. As the Commonwealth contribution to the Bushfire CRC is in the order of \$26m, this represents a factor of between 2.5 to 17 times the Commonwealth Grant depending upon the discount factors and assumptions used. This work has been reviewed by Prof David Pannel of University of Western Australia and has been submitted to the *Australasian Journal of Environmental Management*.

### How does the CRC intend to address any issues and maximise the value of outcomes over the remaining life of the CRC?

The Bushfire CRC has established a formal process with its industry, through AFAC, to ensure that the research is developed in cooperation between researchers and industry. This process ensures that the final outputs are transferred as widely as possible into industry in a manner allowing for rapid assimilation and ease of delivery by the agencies to the communities for which they are responsible.

## MAJOR DEVELOPMENTS AND INITIATIVES

### Fifth Year Review

The 5<sup>th</sup> Year Independent Panel Review concluded its work in November 2008 with a positive assessment of the Bushfire CRC's research quality, performance against agreed milestones and research adoption.

The Review was chaired by Dr Steve Morton, Group Executive, Manufacturing, Materials and Minerals, CSIRO. He was assisted by panel members Bob Mitchell, an independent consultant and a former CEO of the Fire and Emergency Services Authority (WA), and Dr Tim Vercoe, a forestry consultant and a former Director, Asset Protection, at CSIRO Forest Biosciences, General Manager with ENSIS, and an original member of the Bushfire CRC Board.

Utilising their knowledge and experience they provided incisive comments and recommendations to assist the Bushfire CRC.

The executive summary of the report concluded:

*"The Panel has been greatly impressed by the quality of science and by the rate of adoption of research results evident in the Bushfire CRC."*

The Panel expressed an extremely positive view of the Bushfire CRC. In particular, the panel noted:

- the achievements of the Bushfire CRC to date, especially in comparison with other CRCs at this stage of their life
- the rate of adoption across the industry
- the close association between AFAC and the Bushfire CRC.

### CRC funding bid



Over the last year the Bushfire CRC has been heavily involved with the members of an AFAC led consortium that has been meeting to identify bushfire-related research needs to 2020 and beyond.

Several industry-led workshops developed a nationally-focussed research proposal to address the broad areas of risk management, carbon, water, biodiversity, local government, policy and practice, community resilience, economic impact assessment, residential fires, incident management, and the use of technology. In addition to all current end-users

committing to this ongoing research program, several new end-user organisations joined the bid process.

Although the bid was ultimately rejected by the CRC Program, the process of galvanising and focussing the industry on long term research goals was an extremely beneficial one. Such long term focus on research was unprecedented in the industry and the Bushfire CRC considers it a major achievement to foster this new culture of research.

The bid also included Local Government. For the first time, all three levels of governments would have combined on bushfire research to make Australian communities safer.

Looking ahead, the Bushfire CRC is working with AFAC and the broader fire industry and research organisations to develop a sustainable and ongoing research program.



## Staff Appointments and Movements

Program Leader Jim Gould ((Program A: Safe Prevention, Preparation and Suppression) accepted an offer of an opportunity to work in Canada as part of an exchange agreement between CSIRO and the Canadian Forest Service. He was replaced with Professor Rod Keenan, Head of Department of Forest and Ecosystem Science for the University of Melbourne.

As the CRC moved into transferring research into industry, Dr Noreen Krusel, from the Country Fire Authority, was seconded to the position of Research Adoption Manager.

Lyndsey Wright, Manager, Planning and Research at the Metropolitan Fire Brigade, was seconded as Acting Research Director of the Bushfire CRC.

# NATIONAL RESEARCH PRIORITIES

## NATIONAL RESEARCH PRIORITY GOAL HIGHLIGHTS

### An Environmentally Sustainable Australia

*Transforming the way we utilise our land, water, mineral and energy resources through a better understanding of human and environmental systems and the use of new technologies.*

The Bushfire CRC's research is examining how land can be managed through the use of fire to ensure a reduction in risk to the community.

The focus is on:

- Maintaining and enhancing the quality and quantity of water.
- Maintaining the health of soils ecosystems
- Maintaining and enhancing the biodiversity
- Examining how climate change will impact on fire regimes, and ecological systems

### Promoting and maintaining good health

*Promoting good health and preventing disease, particularly among young and older Australians.*

The Bushfire CRC research program includes assessing the impact of fires on the health and safety of communities and fire fighters. It is examining the impact of bushfire smoke on communities and determining ways to better predict where smoke will travel. This is helping to reduce the incidence of conditions such as asthma. This year a Field Guide to Smoke Exposure Management was produced for the fire managers by researchers.

The Bushfire CRC is also undertaking research into the impact of smoke related problems specifically in fire fighters to ensure better health, particularly among the aging volunteer workforce. In addition, the Bushfire CRC is conducting research into how fire agencies can provide more productive roles for aging volunteers.

### Safeguarding Australia

*Safeguarding Australia from terrorism, crime, invasive diseases and pests, strengthening our understanding of Australia's place in the region and the world, and securing our infrastructure, particularly with respect to our digital systems.*

Core to the mission of the Bushfire CRC is reducing the bushfire risk to the community, critical infrastructure, industry and ecosystems. This includes research into effectiveness of incident management systems and the effectiveness of techniques and technologies utilised by the fire and emergency service agencies.

## National Research Priorities and CRC Research

NATIONAL RESEARCH PRIORITIES	CRC RESEARCH (%)
<b>AN ENVIRONMENTALLY SUSTAINABLE AUSTRALIA</b> - <i>Transforming the way we use our land, water, mineral and energy resources through a better understanding of environmental systems and using new technologies</i>	
Water - a critical resource	5
Transforming existing industries	15
Sustainable use of Australia's biodiversity	10
Responding to climate change and variability	5
<b>PROMOTING AND MAINTAINING GOOD HEALTH</b> - <i>Promoting good health and preventing disease, particularly among young and older Australians</i>	
Ageing well, ageing productively	10
Strengthening Australia's social and economic fabric	10
<b>FRONTIER TECHNOLOGIES FOR BUILDING AND TRANSFORMING AUSTRALIAN INDUSTRIES</b> - <i>Stimulating the growth of world-class Australian industries using innovative technologies developed from cutting-edge research</i>	
Breakthrough science	10
Promoting an innovation culture and economy	10

<b>SAFEGUARDING AUSTRALIA</b> - Safeguarding Australia from terrorism, crime, invasive diseases and pests, and securing our infrastructure, particularly with respect to our digital systems	
Critical Infrastructure	15
Protecting Australia from invasive diseases and pests	5
Protecting Australia from terrorism and crime	5





## GOVERNANCE AND MANAGEMENT

The Bushfire CRC operates through an incorporated not for profit company, Bushfire CRC Ltd.

The Company, Bushfire CRC Ltd was registered in March 2003 and began formal CRC operations in July 2003. Participating parties are members of the company, which is limited by guarantee.

The Bushfire CRC's Stakeholders Council consists of representatives of each of the participating agencies.

The Stakeholders Council meets twice a year to review and receive updates on the progress of research, education, communication and other activities, and to provide strategic advice to the Governing Board. The Governing Board, has 10 members including two independent members, and seven times throughout the year. The company's constitution allows for participants who contribute cash of \$100,000 or more per year to vote and nominate members to the Governing Board. Both the Stakeholder Council and the Governing Board have the same independent Chairman.

The Governing Board has four committees:

- An **Audit and Compliance Committee** that oversees corporate governance, audit responsibilities, finance and compliance.
- A **Users Research Committee** that ensures the research conducted meets the strategic aims of the Bushfire CRC and the needs of the users.
- A **Human Resources Committee** to advise on and oversee the Bushfire CRC's personnel matters including selection, remuneration and performance management.
- An **Education and Research Adoption Committee** that is responsible for providing strategic advice on the overall development of the Bushfire CRC's postgraduate program, new educational initiatives, and on the strategy for research adoption.

### CEO, Governing Board Members and Committee Members

Name	Organisation	CRC Position / Role
Len Foster	Bushfire CRC	Independent Chairman Director Audit Compliance Committee HR Committee
Gary Morgan	Bushfire CRC	CEO
John Baird	Rector, Australian Defence Force Academy	Director Education/Research Adoption (Chair)
Neil Bibby	Chief Executive Officer, Country Fire Authority	Director Audit Compliance Committee
Joanne Bloch	Independent	Director Audit Compliance Committee (Chair)
Naomi Brown	Chief Executive Officer, Australasian Fire and Emergency Service Authorities Council	Director HR Committee (Chair)
Ray Canterford	Assistant Director, Bureau of	Director

	Meteorology	Users Research Committee
Murray Dudfield	National Rural Fire Officer, New Zealand Fire Authority	Director Users Research Committee Education/Research Adoption
John Gledhill	CEO/Chief Officer, Tasmania Fire Service	Director HR Committee Education/Research Adoption
Alistar Robertson	Dean, Faculty of Natural and Agricultural Resources	Director Users Research Committee
Ewan Waller	Chief Fire Officer, Department of Sustainability and Environment	Director Users Research Committee (Chair)

#### Program Leaders

Name	Organisation	CRC Position / Role
Jim Gould	CSIRO Forest Biosciences	Program A (to 12 September)
Rod Keenan	University of Melbourne	Program A (from 13 September)
Mark Adams	University of New South Wales/University of Sydney	Program B
John Handmer	RMIT University	Program C
Bob Leicester	CSIRO Manufacturing and Infrastructure Technologies	Program D
Christine Owen	University of Tasmania	Program E

#### Governing Board and Executive Staff 2008



## RESEARCH PROGRAMS

### KEY RESEARCH ACHIEVEMENTS

#### International bushfire research conference

This year the Bushfire CRC held a major International Bushfire Research conference in Adelaide that attracted more than 1100 delegates including many international speakers and delegates. The industry participated in three days of discussion on research and innovation plus a pre-conference specialist workshop. In addition, 60 Bushfire CRC research posters were displayed and more than 100 expo sites were filled by small to medium sized enterprises displaying the latest in technology for bushfires.

#### Research goals - a 2020 agenda

The bushfire-related research needs of the industry were defined to 2020 and beyond in a series of workshops and high level meetings over the year. The Bushfire CRC was heavily involved with an Australasian Fire and Emergency Service Authorities Council (AFAC) led consortium that aimed to secure ongoing support for research from the broader industry and from research organisations, supplemented by funding from the CRC Program.

The agreed nationally-focussed research program aimed to address the broad fire related-areas of risk management, carbon, water, biodiversity, local government, policy and practice, community resilience, economic impact assessment, residential fires, incident management, and the use of technology.

#### Five years of research achievement

The 5<sup>th</sup> Year Independent Panel Review concluded with a positive assessment of the Bushfire CRC's research quality, performance against agreed milestones and research adoption. The review that concluded, among things, that:

*The CRC has played a leading role in initiating or further developing a culture of 'improvement by research' evident in all the agency representatives interviewed.*

And that:

*"The Panel has been greatly impressed by the quality of science and by the rate of adoption of research results evident in the Bushfire CRC."*

#### Black Saturday response

In the immediate aftermath of the fires, the Bushfire CRC assembled a Taskforce of researchers and agency staff from across Australia to gather data on fire behaviour, property loss and community behaviour from the fire affected areas. An interim report was prepared for the Victorian fire and land management agencies and the 2009 Victorian Bushfires Royal Commission. This large quantum of data is a unique resource available for all Australian and international agencies and research organisations for many years to come.

Seasonal Bushfire Outlook 2008-2009	This is a national initiative through which fire service agencies have been provided with significant information on weather and fire danger outlooks for the period as compiled by Bushfire CRC researchers. For the third year, this information continues to have a major influence informing pre-season preparations in all states and territories. Researchers and fire service agencies delivered an Outlook for both northern and southern Australia.
Developing an ongoing capability in bushfire research	One of the key reasons for establishing the Bushfire CRC was the national shortage of bushfire researchers. The Bushfire CRC now has more than 80 post-doctoral fellows and PhD students working in the area, many with international recognition. This will provide a lasting research capability for the industry.
Field guides for industry	The outputs of two research projects were delivered to industry in the form of easy to digest guides - <i>A Field Guide for Burning Under Young Eucalypts</i> and a <i>Field Guide for Smoke Exposure Management</i> . Both these guides are available for order on the Bushfire CRC website and through the AFAC Shop.
The cost effectiveness of aerial fire fighting	This report followed on from the earlier related report on “The effectiveness and efficiency of aerial fire fighting” of 2007. This new report combined the expertise of social science researchers with suppression experts within two Program areas to produce an economic analysis of aerial fire fighting, the first such report for Australia, despite the widespread use of aerial suppression over many decades.
Bushfire fatality trends	This report “100 years of Australian civilian bushfire fatalities: exploring the trends in relation to the ‘stay or go’ policy” was an in-depth analysis of the nature of all bushfire deaths in Australia. Drawing on a database of deaths from natural hazards, and supplemented with coronial and media reports, this research reinforced the basic tenets of bushfire safety and education programs. Lead researcher Dr Katharine Haynes was called to give evidence in the first week of sitting for the 2009 Victorian Bushfires Royal Commission.
Community self-sufficiency	A report on the NSW Fire Brigades approach to community safety through its Community Fire Units has provided a basis for all fire management agencies in evaluating and developing programs to empower local residents to help protect themselves and their properties in a bushfire.



## CONSULTANCIES

### Nature of major consultancies and their contribution to the CRC

The Bushfire CRC has continued to undertake consultancies for the individual fire service agencies and the Victorian Bushfires Royal Commission during this financial year. These have all enabled the Bushfire CRC to undertake a broader scope of work than would have been otherwise possible.

Work with individual fire service agencies (in particular Department of Sustainability and Environment, Victoria,) has enabled an extension of existing Bushfire CRC projects into guidelines and other products that are more accessible to the industry.

Of particular note is a substantial consultancy project undertaken on behalf of the Victorian agencies of the Country Fire Authority, Department of Sustainability and Environment and the Office of the Emergency Service Commissioner, the \$1.5M cash consultancy was to undertake a substantial data collection project following the Victorian fires on 7 February. This cash contribution has been matched by a similar in-kind contribution from many agencies and companies from around the country and the globe. The interim report was delivered to the agencies in June and tabled in the Royal Commission, shortly after. In the Royal Commission's interim report the information in this interim report is extensively cited in its findings. The executive summary can be found at:

<http://www.bushfirecrc.com/publications/downloads/Victorian-2009-Bushfire-Research-Response-Interim-Report--Overview-15-6-09-RC-Tabled.pdf>

Similarly the Bushfire CRC has entered into an MOU with the 2009 Victorian Bushfire Royal Commission and has undertaken confidential research on its behalf.

### Nature of any grants and how they contribute to the CRC

The Bushfire CRC has not applied for nor received any grants during this period.

### Any changes proposed to future research directions

The Bushfire CRC, during the development of its plans for refunding in Round 11 of the CRC Program, has worked closely with its partners, to develop a new research agenda that will help to establish the policies and practices required for the Emergency Services to meet the challenges presented by climate; demographic; technology and workplace changes in the next decade.

Following the awarding of an extension of the Bushfire CRC by the Australian Government in early 2009, the Bushfire CRC and the industry are now planning the work program for the next three years, based upon the unsuccessful bid research agenda and the outcomes from the 2009 Victorian fires and subsequent Royal Commission.

## ASSESSMENT OF SCIENTIFIC QUALITY

The Fifth Year Independent Review Panel utilised an assessment framework developed by CSIRO (See table in Appendix), in a modified form, for gauging the impact of both science and adoption. Within this framework, it focussed its assessment on the five CRC Programs. As a major input, the Panel analysed reviews of scientific papers emanating from the Bushfire CRC that had been conducted by external experts prior to the review.

## 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

**Bushfire management has four related goals – to prevent an uncontrolled bushfire occurring, to prepare in case it does, to suppress it if it arrives, and to enable rapid recovery after the event.**

**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.**

### Overview

Program A fire behaviour researchers were active in the aftermath of the 7 February fires in Victoria; rapidly mobilising to gather vital information on fire behaviour for further analysis.

These included fire behaviour specialists from several partner Bushfire CRC research organisations working closely with colleagues in fire agencies, working to determine the origins, path, intensity and impact of the major fires of that day. This data was then provided to investigation and industry organisations and the 2009 Victorian Bushfires Royal Commission and is now ready to be shared with the international research community.

In the last year Program A researchers have continued to evaluate and refine tools developed in previous years of the CRC and to translate these into fire management action. These include:

- The Phoenix fire behaviour model has been at the forefront of analysis efforts following Victoria's February 2009 fires. The *RapidFire* version model is now being implemented operationally at the Victorian Integrated Emergency Coordination Centre and will be used on a trial basis during the 2009/10 fire season.
- At the University of Western Australia, research produced modeling software to implement a proof-of-concept Simulation System for fire spread simulation, which is being embedded in the WA Landgate products for use during fire events.
- A computer based fire containment calculator and an associated written guide are further research outputs that can predict the probability of bushfire containment success with and without aerial suppression. This calculator was designed for use by dispatchers of fire fighting resources to inform aircraft deployment decisions.
- Fire weather - seasonal forecast. For the third year researchers in this project facilitated the preparation of *Seasonal Bushfire Assessments* for both northern and southern Australia. This process has become a key input into the strategic decision making processes used by all agencies in Australia in their preparations for resource planning for their bushfire seasons and prescribed burning programs.
- Grassland curing - considerable progress was made with this project this year. Regional or grassland-specific algorithms were developed initially for northern Australia with a broader roll-out of the final product scheduled for 2010. The systems being developed use remote sensing

from satellites (grasslands cover nearly 75 percent of Australia, including grasslands mixed with woodlands and scrublands). The predictive capability being developed is using physiological-based models.

## Highlights

### Aerial Suppression Industry Forum

In May an aerial suppression industry forum was held in Melbourne. At this workshop the results of the Bushfire CRC project were presented and a range of tools and guidelines suitable for use by bushfire suppression agencies were unveiled.

The workshop audience included the Board members and the General Manager of the *National Aerial Firefighting Centre* and the members of the *Australasian Fire and Emergency Service Authorities Council's* Wildfire Aviation Technical Group.

The tools and guidelines developed for this workshop included:

- A computer based fire containment calculator derived from models predicting the probability of bushfire containment success with and without aerial suppression. This calculator was designed to be used by dispatchers of fire fighting resources to help them in the decision of whether aircraft should be deployed to a fire or not.
- A fire containment guide - a print version of the fire containment calculator, with explanatory notes.
- A drop assessment guide - a short informative note designed to help general firefighters assess the effectiveness of aerial suppression drops.

Draft versions of the fire containment guide and fire containment calculator were sent for evaluation by agency operational staff.



### Bushfire Risk Management Model

The bushfire spread simulation model *PHOENIX RapidFire* has been developed to evaluate multiple fire management options under a range of weather and fire suppression scenarios. This work built on the earlier bushfire characterisation simulation, *PHOENIX*.

In the wake of the tragic Victorian *Black Saturday* bushfires there has been considerably heightened interest in this work, both nationally and internationally, and the principal researcher (Dr Kevin Tolhurst) has, in the wake of the fires, given several days of evidence to the 2009 Victorian Bushfires Royal Commission.

Trials of PHOENIX *RapidFire* were this year undertaken in two sample areas in Victoria - the Otway Ranges and the Central Goldfields District. Following these trials presentations of the results were made to various audiences including:

- NSW Nature Conservation Council conference;
- Wannon Water Authority / Parks Victoria / DSE Victoria;
- ANZIIF Reinsurance Industry Conference, NSW;
- Chief Scientist of Australia, Dr Penny Sackett;
- Department of Sustainability and Environment / Department of Forest and Ecosystem Science public seminar series, Melbourne;
- Bushfire CRC Communications and Media Workshop, Melbourne; and
- The Australian and New Zealand Institute of Insurance and Finance Conference, Queensland.

PHOENIX *RapidFire* has been developed to run on a computer cluster, using gridded weather forecasts produced by the Bureau of Meteorology for Victoria. This facility is now enabling large numbers of fire simulations to be done in a short period of time.

PHOENIX *RapidFire* is being operationally implemented at the *Victorian Integrated Emergency Coordination Centre* in East Melbourne and will be used on a trial basis during the 2009 / 2010 bushfire season. Specially trained Fire Behaviour Analysts will have access to the program from via a web portal - *FireWeb*.

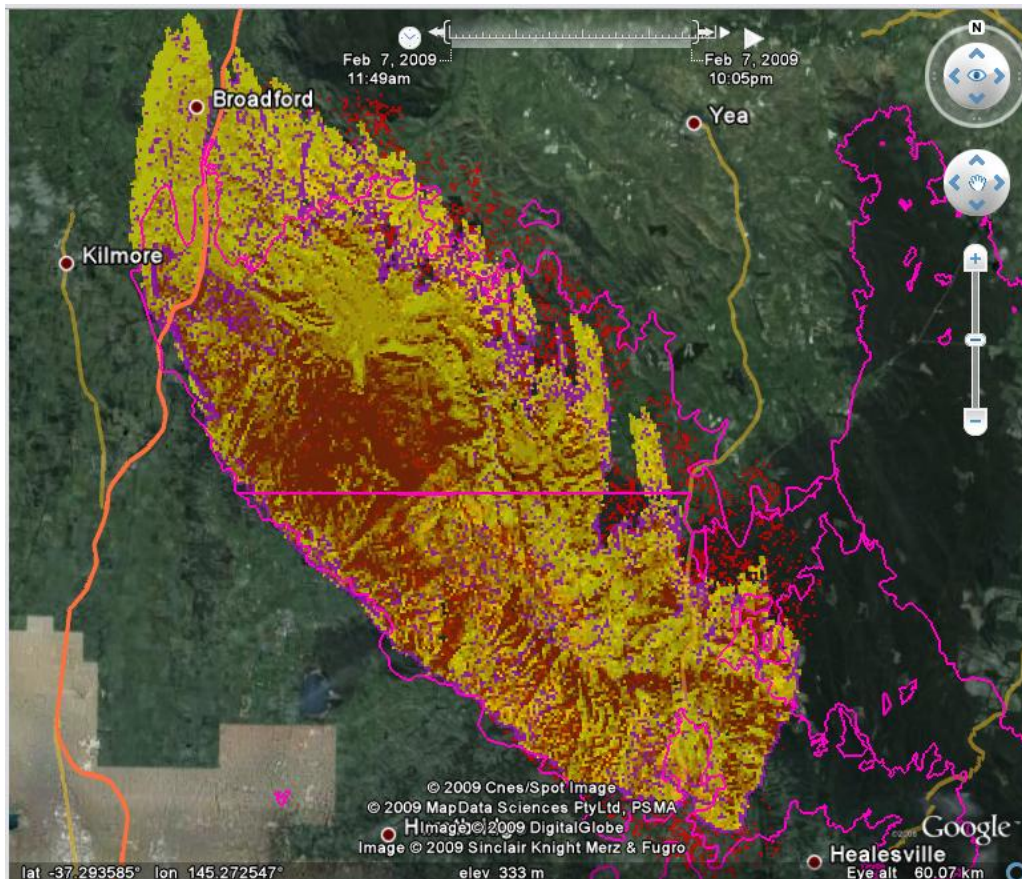
PHOENIX *RapidFire* has been linked to hourly gridded weather forecasts (also developed partly by the Bushfire CRC) for a seven day period using a three kilometre resolution. Topography, fuel, fire history, roads, streams and firebreak data layers can be updated daily as needed and directly accessed when the simulations are run. Progress made in this reporting year has ensured that PHOENIX *RapidFire* will be used during the 2009/10 fire season on a daily basis to identify areas in Victoria most at risk. In addition, all reported wildfires will be automatically set to run in the simulator for six simulated hours after ignition, to help identify fires with the greatest impact potential. This will help ensure that fire fighting resources and community warnings can be optimised.

Researchers were invited (and sponsored) to present the underlying details of the spotfire component of PHOENIX to an international spot fire modelling conference in Toronto, Canada, in April. Researcher Derek Chong presented the spotting model used in PHOENIX to this workshop. The spotfire modelling in PHOENIX proved to be more advanced than models used elsewhere in the world.

PHOENIX *RapidFire* was under trial during the Black Saturday bushfires in February in Victoria. It was being used by Dr Kevin Tolhurst on an operational basis and proved its worth in terms of its speed of execution. Post-fire analysis of the Black Saturday bushfires was undertaken using observed weather data and showed how well the model worked even under these exceptional conditions.

PHOENIX *RapidFire* simulations were subsequently used on several occasions as part of evidence given to the 2009 Victorian Bushfires Royal Commission. (An example of the simulated fire extent and the final fire extent is shown below.)





*Brown and yellow area shows the extent and relative intensity of the fire as modelled by Phoenix RapidFire, starting near Kilmore East. The pink lines show the mapped edge of the actual fire and the burnt area by 12 February, although most of the fire extent occurred on 7 February. The pink lines to the right show the extent of the Murrindindi fire.*

### Computer Simulation Modelling

This project has been focussed on developing an improved computer-based simulation environment for training purposes, utilising a high-performance visual display and useable interface that will enhance the effectiveness of fire agency training.

This year, with collaborators from the Western Australian land administration authority (Landgate), researchers have implemented a proof-of-concept Simulation System within ArcGIS using University of Western Australia developed fire spread simulation software.

The data sets required for fire spread simulation are prepared and maintained prior to operation. These include:

- topographic maps;
- vegetation maps;
- fuel load maps; and
- A rate-of-spread calculation model for each vegetation type.

As the output fire spread map is generated within a GIS, it can be manually reviewed and it could, potentially be automatically passed on to the alert component of an Early Warning System.

Project title	Project Leaders	Objective
A1.1 Fire behaviour modelling	Jim Gould, Wendy Anderson	To improve firefighter and community safety in the management of bushfires, by providing better knowledge and understanding of the interaction of fire, fuel, weather and topography across Australia.
A1.3 Fuel classification and availability	Peter Ellis	To develop a single fuel classification system in Australia to be used in smoke emission models, fire behaviour predictions and habitat modelling.  To develop a model of fuel availability based on fuel, weather and fire behaviour characteristics.
A1.4 Improved methods for the assessment and prediction of grassland curing	Stuart Anderson	To develop improved methods for the assessment and prediction of grassland curing as an input into fire danger rating systems and fire behaviour models.
A2.1 Fire weather and fire danger	Graham Mills	To improve the operational utility of fire weather forecasts and outlooks by providing a better 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.
A3.1 Evaluation of suppression techniques and guidelines (aerial and ground)	Jim Gould	To optimise the effectiveness and efficiency of aircraft use during firefighting operations.
A4.1 Bushfire risk management	Kevin Tolhurst	To develop a risk management decision support system for communities living in the rural/urban interface, town planners, power companies, firefighters and land managers.
A5.1 Fire spread simulation	George Milne	To develop a physically accurate modelling, simulation and animation toolset that will permit rapid execution of a model of a specific bushfire situation to permit the prediction of fire development and the effect of containment strategies.

## 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 New South Wales (now 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.

### Overview

Geographically, the work of Program B is spread across the continent with outputs relevant to a broad range of bio-systems. The Program B researchers also have strong international partnerships, particularly with the United States.

In the west, the teams at the Department of Environment and Conservation (McCaw and Wittkuhn) and University of Western Australia (Grierson and Boer) have continued to analyse fire regimes and fire-return intervals (including through the use of prescribed fire) and their effects on key features including:

- Fuel loads;
- Plant population demography;
- Biodiversity; and
- Productivity.

One example of this knowledge being used is by the Department of Environment and Conservation in its fire management of the heavily forested areas of south-west Western Australia.

*Researcher Lachie McCaw, at left below, conducts a workshop on fuel and fire behaviour in Tasmania in October. This was one of 13 such workshops held around Australia with around 500 participants.*



University of Western Australia students Rohan Sadler, Jaymie Norris and Alison O'Donnell have completed their studies and are working on further theses and papers.

In Tasmania, at the University of Tasmania, Neil Davidson and Dougald Close have completed a 'first-cut' analysis of the ecological effects of a lack of fire across a wide range of sites in western and eastern Australia, and Bryony Horton is well advanced in her detailed work on the effects of fires on soil biota, which is gaining international recognition.

Dr Tina Bell, a Project Leader and senior research fellow at Melbourne University gained a scholarship with the prestigious Fulbright Program. Tina has since travelled to the Centre for Fire Research and Outreach at the University of California, Berkeley, to study the effect of fuel reduction fires on grapevines.

The smoke effects team (Bell, Maleknia and Adams) continue to develop and apply new methods to the analysis of eucalypt fuels. This project has acquired a world-leading smoke analysis facility that will underpin future research at the University of Sydney.

In the ACT and NSW, the Australian National University-based group (Cary, Bradstock and King) has continued with modelling studies, and are now moving to cross-comparisons of models in an effort to refine the ability to predict the outcomes of fire regimes. Parks NSW is a leading end-user in implementing aspects of this research in its fire regime planning.

Based in the Snowy Mountains region of New South Wales, Phil Zylstra is examining the flammability of plants, with his PhD close to completion.

The University of Melbourne based biodiversity team of Alan York and Tina Bell continued to progress their studies of decomposer organisms. This work includes the PhD studies of Madeline Osborn examining the role of fungi in fire prone eucalypt forests, and Anne Miehs, who is developing our knowledge of the ecological importance of coarse-woody debris in the forests of western Victoria.

The *HighFire* project (with research sites spread over the Australian Alps), with its multiple elements, concluded its three years of funding in July 2008. A number of students benefitted from *HighFire* support including Meaghan Jenkins, Ian McHugh and Kerry McTaggart and work on their theses has continued.

Several other students, including Robert Simpson and Edith Huber, had parts of their studies on the effects of the 2003 bushfires supported by the *HighFire* project. The long-term study sites established by the team are now producing internationally significant research outputs, beginning with a clear understanding of the effects of bushfires and prescribed fires on water and carbon fluxes.

Successfully concluded projects in operational use this year include:

- Smoke plume modelling, based in the Bureau of Meteorology, now in use by fire agencies to forecast smoke plume movement for both planned burns and wildfires.
- The ecological impacts of savannah and wetland burning in the Northern Territory by CSIRO, now in use by northern Australia fire managers to enhance biodiversity with traditional fire management techniques.

## Publications

At this stage of the Bushfire CRC there is now a major focus on publications in journal articles. Program B researchers have been successful in getting their work published in international journals that range in their scope and impact.



A key part of any assessment of research excellence (for example the *Excellence in Research for Australia initiative*, ERA), rests upon metrics such as citation and journal quality.

As might be expected, many of the Program B outputs have appeared in the *International Journal of Wildland Fire*. While this journal has a modest impact factor of 1.4 (2008), it is perhaps the most widely read of all 'fire in the landscape' journals and has an 'A' ranking in the draft ERA.

Recent outputs in the *International Journal of Wildland Fire* include modelling contributions from the Bradstock/Cary/King team on fuel mosaics in south-west Tasmania and on the relative contributions of different influences to the area burned. Jason Sharples has had published his work on wind-slope corrections for rates of fire spread.

A recent Bushfire CRC paper in the new journal *Environmental Research Letters*, by Stephens *et al.*, is in the top 10 percent of articles for the number of downloads across all journals produced by the publisher IOP (>50 journals).

Publications in the major forest science journal *Forest Ecology and Management* (IF=2.1, an 'A\*' journal) include those by Penman *et al.*, Attiwill and Adams, and Boer *et al.* These papers emphasise the central importance of fire to management of eucalypt forests in Australia.

Moving further up in the rankings, there have been CRC contributions to less obvious but internationally significant journals such as *Landscape Ecology* (a 'B' journal, IF 2.5) by Boer *et al.*, and in the *International Journal of Mass Spectrometry* (an 'A' journal, IF=2.5) by Maleknia *et al.*.

Finally, there are a number of contributions accepted or in press, including work in the A\* journal *Global Change Biology* (IF=5.9) by Jenkins *et al.*

## Conferences

Program B played a significant role in the Bushfire CRC International Bushfire Research Conference in Adelaide in September with 11 researchers delivering presentations, including four students.

A number also attended international gatherings. Presentations at these forums were followed by further engagement with Stakeholders with requests for involvement in community forums, training sessions, and university teaching.

## Education

On-going teaching programs established in earlier years of the Bushfire CRC at ANU, UWA and the University of Melbourne continued and were enhanced by the contribution of ongoing research.

Similarly, the development of strong relationships between CRC researchers and rural communities in eastern Victoria and southern NSW continued, particularly in relation to the *HighFire* Project with widespread benefits for researchers in the field.

The 2009 Victorian Bushfires and the subsequent Royal Commission have created considerable public interest in land management issues. A number of researchers have spent considerable time responding to media requests for comment and/or interviews.

Project title	Project Leader	Objective
B1.1 Managing fires in forested landscapes in south-western Australia	Lachlan McCaw	To identify patterns of change in the abundance and richness of biota as a result of different fire regimes in forested landscapes in south Western Australia.
B1.2 Managing bushfire risk in a changing world	Ross Bradstock	To provide optimal solutions for sustainable bushfire risk management, in differing ecosystem, management and global/climate change contexts.
B2.1 Behaviour of smoke plumes and hazes	Graham Mills	To assist in the reduction of impact of smoke from an urban or rural fire on community health and safety by predicting the transport, dispersion and concentrations of smoke particulates.
B2.2 Smoke composition and impact on health and ecosystems	Tina Bell	To identify and quantify the chemicals in smoke produced from biomass burning.
B3.1 Effect of fire on ecosystem processes and biodiversity	Alan York	To understand the interaction between fire, vegetation, invertebrates and soil organisms in carbon and nutrient cycling, and how this contributes to biodiversity conservation and ecosystem function.
B3.2 Prescribed fire and biodiversity in northern Australia	Alan Andersen	To enhance the effectiveness of fire management for biodiversity conservation in northern Australia.
B4.1 Synthesis and integration	Mark Adams	To synthesise existing data and integrate with world literature and produce plain language text on prescribed burning.
B4.2 Multi-scale analysis of patterns in ecological processes in relation to fire regimes	Pauline Grierson	To integrate ecological information derived at smaller scales with larger scale management perspectives.
B6 HighFire: underpinning evidence-based policy for fire regimes and their management in the high country	Maria Taranto, Mark Adams, John Handmer, Rick McRae, Rod Weber.	To contribute to the current evidence-base for fuels management, understanding and improving human resilience and managing bushfire risk in high country landscapes.
B7 Eucalypt decline in the absence of fire.	Neil Davidson	To study tree decline caused by reduced frequency or absence of fire.

## 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. Research projects seek to understand what communities need to do to manage risk, which varies greatly from one community to another across Australia and New Zealand. Central to this program is the development of a better understanding what drives human behaviour before, during and after a bushfire.

### Overview



As this was to be the final year of full funding for Program C, all projects were tasked to complete their final outputs. Delays however have been experienced in a few project areas as a consequence of some researchers having a significant involvement in assisting the Royal Commission and with the Bushfire CRC Research Taskforce - both of which were established in the wake of the Victorian Black Saturday fires in February 2009.

Final outputs consist of reports, bulletins, papers, presentations and book chapters that are in a form accessible to Bushfire CRC end-users, and publications that give scientific legitimacy to our research and confidence to those who draw on our results.

All projects continue to be involved with research adoption activities. Again however, some delays have been experienced as many of our resources were dedicated to post-fire research after Black Saturday.

The Program's Research and End-User leaders led the development and implementation of the post-Black Saturday human response research. PhD student Joshua Whittaker was a fieldwork leader. Jim McLennan led LaTrobe University's active involvement in the data collection and initial analysis. This work will continue until at least the end of 2009.

Direct contributions to the Royal Commission process continue as do inputs into the Australasian Fire and Emergency Service Authorities Council (AFAC) national review of community safety and public warnings.

The Program C (with contributions from Program D) book launched in April 2008 *Community Bushfire Safety* has been a fundamental information source for the 2009 Victorian Bushfires Royal Commission and fire agencies around the country that have initiated their own post-Black Saturday reviews.

A follow-up volume, also to be published by CSIRO Publishing, is now scheduled for completion in early 2010. Unlike The first volume is a collection of results from across the Programs, while the new volume will integrate the work and present a strong case for a community safety-based approach to bushfire risk management.

A new book was published and launched to the broader emergency services industry: *The Handbook of Disaster and Emergency Policies and Institutions*, by John Handmer and Stephen Dovers, was based on much Program C research.

Joshua Whittaker and Mae Proudley finished their post-graduate programs. The remaining two Program-based PhD students are on track to finalise their studies by the end of 2009.

## Research Adoption

In addition to a range of research publications written for end-users, the Program assisted with research adoption through many workshops and presentations. The Program held a Users Workshop at the annual Bushfire CRC International Bushfire Research Conference in Adelaide that attracted high level 75 participants, and assisted with major AFAC Workshops on community safety in late 2008 and the first half of 2009 - all of which were well attended by many CEOs and Chief Fire Officers in end-user agencies.

## Strategic matters

The Program has also supported the strategic development of Australian fire-related research. It played a key role in the development of the economic case underpinning the bid for a new CRC. The Program Leader is also Convenor of the Climate Change Adaptation Research Network for Emergency Management across Australia. This leadership role resulted from a competitive process that saw considerable support being provided by the Bushfire CRC, AFAC, and other fire agencies and universities from across Australia. This national research network is one of eight to promote adaptation research in the sector.

## Other Project Highlights

### The National Prepare to Stay and Defend Your Property or Go Early Policy

In this area, members of Programs C and D have made major and collaborative contributions to the Bushfire CRC Research Taskforce response to the Victorian bushfires, specifically in the area of human response to the fire. More than 600 residents from the fire areas were surveyed face-to-face in the immediate aftermath of the fires. A mail-out survey is being prepared to gather data from a greater number of people in the communities that were impacted.

Prof John Handmer and Dr Katherine Haynes were retained as expert witnesses by the Royal Commission and gave evidence based on their Bushfire CRC and related research.

### Arson

In March, the Federal Attorney-General, Robert McClelland, convened a National Forum on the Reduction of Deliberate Bushfires in Australia. Bushfire CRC researchers and staff were heavily involved in the forum and in the process that committed to develop a National Action Plan on arson.



Five *Bushfire Arson Bulletins* were published during the year on the following topics:

- Climate change and fire danger;
- Australian juvenile arson intervention programs;
- Using crime prevention to reduce deliberate bushfires in Australia;
- Weekly patterns in bushfire ignitions; and
- Law enforcement levels and bushfire arson rates.

### Bushfire Economics

Although the original Economics Project has been completed, related work continued throughout the year with a sub-project developing a standard approach to loss assessment.

Project title	Project Leader	Objective
C1 Understanding communities	Alison Cottrell and Judy Newton	To contribute to the understanding of community needs, expectations, behaviours and attitudes to bushfire risk, response and recovery.
C.3 Bushfire arson	Matthew Willis, Toni Makkai and Derek Jory.	To reduce the impact of deliberate and negligent fire lighting in Australian bushland environments.
C4 Effective risk communication	Douglas Paton, Peter White and Peter Hughes	To investigate the factors in a risk communication program to promote readiness for bushfires and to respond effectively on receiving warnings.
C5 Bushfire economic costs	John Handmer	To coordinate research in Australia to increase the self-sufficiency of communities in managing the risk from bushfires.
C6 Prepare to Stay and Defend or Go Early	John Handmer	To identify impediments to the full implementation of the “Prepare, Stay and Defend or leave early” policy.
C7 Development of an evaluation framework for community safety policy and programs for bushfire	Gerald Elsworth	To develop an evaluation framework and associated methodology for the community safety approach to bushfire risk.

## PROGRAM D: PROTECTION OF PEOPLE AND PROPERTY

End User Leader: Karen Roberts, FESA (WA)  
Alternate: Tim Anderson, NSW Rural Fire Service  
Program Leader: Bob Leicester, CSIRO

This program is examining methods to increase safety at the rural-urban interface between people, property and the natural bushland environment.

It focuses on the health and wellbeing of the community and of fire-fighters through research into building protection, fire-fighter health and safety, safe behaviour and decision-making and the trends and motivations in volunteerism.

### Overview

All Program D projects are well progressed with their agreed final deliverables, with the exception of one project (volunteerism), which has extenuating circumstances (see below). These deliverables are typically in the form of brief operational guides, reference documents that describe the research findings on which the advice in the guides are based, and workshops and seminars that embed the guides into the fire and land management agencies' operating procedures.

During the latter part of the year four of the Program's Project Leaders, along with several key researchers and students from across the Program, were heavily involved in providing assistance to the 2009 Victorian Bushfires Royal Commission, in the wake of February's tragic Black Saturday bushfires. Most of this was done through involvement with the data collection for the Bushfire CRC Research Taskforce. Notwithstanding this commitment all Projects will still be able to deliver on their promised Bushfire CRC milestones. All doctoral students are on target to complete their research, with one already completed.

### Safer Buildings

Tasks related to the Black Saturday fires include two major projects:

- a report on relevant building regulations for 2009 Victorian Bushfires Royal Commission; and
- The undertaking of a field survey of houses impacted on by the Black Saturday bushfires as part of the Bushfire CRC Research Taskforce.

Both reports relate to Bushfire CRC research milestones. Despite this necessary and important diversion, all previously agreed project work will be completed.

The two major products that will be delivered as part of this project prior to the conclusion of the current Bushfire CRC in mid-2010 are:

- a risk model for house survival; and
- an information package outlining the effectiveness against bushfire attack of a variety of building components, such as decking and glazing.



## Fire-fighter Health

In the early stages of this project it was determined that a more accurate picture of fire-fighting effort was required before fitness-for-purpose research could be further progressed. To this end 31 Victorian rural fire-fighters were invited by the researchers to take part in an assessment of the relative, perceived physiological effort expended on various tanker-based firefighting tasks.

Some 55 typical fire-fighting tasks were discussed and ranked - of these, using 38mm hoses on the fire ground topped the list in terms of perceived effort required.

During the course of this project considerable data has been collected at prescribed burns and at formal fire-fighting training centres. Most recently the Victorian Black Saturday fires were used to assess the effect on fire-fighters arriving for duty in a dehydrated condition.

To better inform procedures to be used in future assessments of the operational fitness of fire-fighters, cardiovascular health screening was undertaken on approximately 1000 volunteers in Victoria. The results of this survey mirrored that of the general Australia population - a potential issue for managers of volunteer fire-fighters when assigning work tasks. The outcomes of this survey raised considerable interest among volunteer fire-fighters and personnel of other emergency services from across Australia with the related website receiving up to 800 hits a day.

## Smoke Toxics

This project is essentially complete; the remaining tasks involving the field trialling of an operational guide and the preparation the associated reference documentation. The guide provides operational procedures to assist fire and land management agencies to manage smoke exposure by agency personnel during bushfires and prescribed burning operations. This guide was delivered to member agencies at the April 2009 Stakeholder Council meeting.

A related research paper, based on environmental field data, is close to finalisation. The paper will summarise data relating to exposure to smoke particles, ozone and BTEX (volatile organic compounds - benzene, toluene, ethylbenzene and xylene) over a period of about a year.



## Safe Decisions

The field research component for this project has been completed with the focus now largely on the adoption of the research by industry.

To this end an initial seminar was conducted with representatives from three states, the RFS (NSW), CFA (Vic) and CFS (SA), to seek advice on the development of appropriate methodologies. Subsequently, a larger Impact Assessment workshop on the research output was conducted that included representatives from all states and territories.

It was agreed that a subtle and multilayered approach would be needed to effectively embed a safe decision-making culture within the fire and land management agencies and that research adoption should be built around the themes of national leadership, communication, training and operations.

## Enhancing Volunteerism

While the research components of the milestones for this project have been met, there have been difficulties associated with the fact that a number of partner fire agencies have delayed their response to earlier project reports. This is due in part to the sensitivities associated with some issues covered by this project.

The final outcome will be an over-arching report that will include a summary of all the research topics covered within this project over the past six years.

The PhD thesis of Sean Cowlshaw on the “Effects of Fire Service Volunteering on the Families of Volunteers” was completed.

## Incident Management

The primary activity during the past year has been a national survey on the efficacy of the Australasian Inter-service Incident Management System (AIIMS) that was adopted by the Australasian Fire and Emergency Service Authorities Council in 2004.

The survey was related to specific incidents and included extensive analysis of the relevant interactions. The survey was distributed widely and generated responses from 579 personnel from 25 Australian and New Zealand based agencies. More than half the incidents selected involved more than 100 persons.

Other achievements over the past year have included:

- Collaboration - the analysis of incident management related voice data by Dr Fang Chen of NICTA (an Australian Information and Communications Technology Centre of Excellence)
- International Links - a study of ergonomic matters in Incident Control Centres conducted by Visiting Fellow Dr Pascal Beguin, Director of Research at the French National Institute for Agricultural Research.
- Field Operations - recording observational data during a multi-agency incident management exercise in Queanbeyan in October 2008.

Project title	Project leader	Objective
D1.1 Building and occupant protection	Justin Leonard	To improve awareness and understanding of the issues surrounding building loss in bushfires, through research, communication and education.
D 2.1 Fire fighter health and safety	David Nichols	To improve the safety, health and general well-being of volunteer and career fire fighters in their fire fighting duties.
D 2.2 Personal exposure of firefighters to air toxics and OHS risk management strategies	Steve Brown (until December 2005), Donavan Marney (from January 2006)	To develop and apply capabilities for measuring the personal exposures of bushfire fighters to a wide range of air toxics in different fire scenarios.
D2.3 Safety in decision-making and behaviour	Mary Omodei	To identify the human factors that lead bushfire fighters to make decisions that place themselves or others at risk.
D2.4 Safe, cost-effective equipment for reduced firefighting risks to firefighters	David Nichols	To increase the safety of firefighters through improvements in equipment, vehicles and processes.
D3 Enhancing volunteer recruitment and retention	Mary Omodei (Manager: Jim McLennan)	To carry out joint research with fire agencies that will assist them to maintain sufficient numbers of volunteers and brigades to meet community needs.
D4 Respiratory health of firefighters	Phil Weinstein, Angus Cook, Phil Thompson, Brian Devine	To investigate the respiratory health effects of occupational exposure to combustion products from bushfires as well as the efficacy of the protective filters on firefighters' masks.
D 5 Optimising information flow through collaborative work performance: Enhancing emergency incident management team effectiveness and organisational learning	Christine Owen	To improve teamwork effectiveness and subsequent organisational and cross-organisational learning.



## RESEARCH COLLABORATIONS

During the year the Bushfire CRC continued to build on formal and informal research collaborations both nationally and internationally.

The Bushfire CRC has built upon established links with other CRCs including its Memorandum of Understanding with Spatial Information CRC, which was signed in 2005 and Tropical Savannas CRC signed in 2009.

During the reporting period a number of collaborations were undertaken.

- The Bushfire CRC has entered into a number of consultancies during the year mainly with its existing end-user partners. The primary aim of these is to help to customise and build upon the core research of the Bushfire CRC.
- The Bushfire CRC is currently in discussion in formally joining with the Tropical Savannas CRC in producing a linked project as part of the two rebid proposals of each CRC. This has been critical to ensure that there is no duplication of research effort in the two CRCs and that the benefits to communities are maximised.
- The Bushfire CRC is in discussions with the US Department of Interior regarding an MOU covering exchange of research.
- The Bushfire CRC has been an integral part of the development of the Voluntary Guidelines for Fire Management through participating in drafting the Guidelines and becoming a founding member of the United Nations Fire Management Action Alliance supporting the Guidelines within the United Nations Food and Agriculture Organisations.
- The Bushfire CRC has acted as secretariat for the development of a national policy on fire management in forests and rangelands overseen by the Forest Fire Management Group and the Natural Resource Management Ministerial Council.
- The CEO and Research Director of the Bushfire CRC are Board members on the International Association of Wildland Fire. The CEO is also a member of the international liaison committee for the International Wildland Fire Conference.
- The Bushfire CRC has developed close links with the European Fire Paradox Project currently being undertaken by the European Union with researchers Jim Gould and Justin Leonard participating in the Steering Committee and Technical advisory committees respectively.

## COMMERCIALISATION AND UTILISATION STRATEGIES AND ACTIVITIES

The detail of the commercialisation and utilisation strategies can be found in the Commercialisation and Utilisation Strategy reviewed in October 2008.

A copy of this can be found at <http://www.bushfirecrc.com/members/downloads/Bushfire-CRC-Commercialisation-and-Utilisation-plan-amended-april-2007.pdf>

## INTELLECTUAL PROPERTY MANAGEMENT

Refer to the detailed Bushfire CRC Commercialisation and Utilisation Plan. (See link above)

## COMMUNICATIONS STRATEGY

The communications strategy promotes the research and activities of the Bushfire CRC amongst stakeholders and to the broader community. The strategy complements the communication's objectives of all the stakeholder fire and land management agencies and research organisations. One of the main priorities is to maintain a close working relationship at appropriate levels within these organisations to transition new research knowledge into agencies and subsequently the communities for which they are responsible.

Progress continues on a range of communications activities that are aligned to the strategic direction of the Bushfire CRC to enable the CRC to better communicate with its target audiences:

- Bushfire CRC partners
- The fire industry (SMEs and large enterprises)
- The research community
- The general public

Activities are focussed on priority areas including:

- online communications
- publications
- media
- events

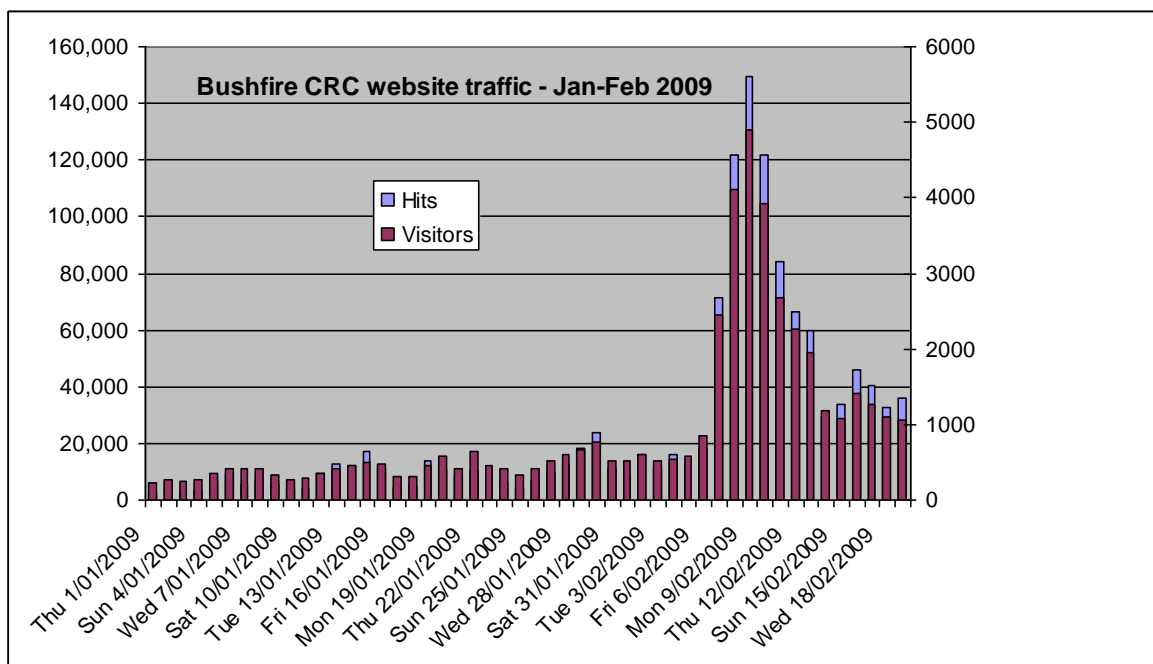
The Bushfire CRC maintained a high profile in the media throughout the year.

### Victorian Fires

The tragic fires of February 2009 in Victoria dominated much of the work effort of the Bushfire CRC centre in the second half of the reporting period. The broader effort of the Bushfire CRC is documented elsewhere in this Annual Report but the major communications activities between Bushfire CRC staff, researchers, agency partners, governments at all levels and the public included:

- The Bushfire CRC was called upon to provide comment and opinion from news media around Australia and internationally. In doing this the Bushfire CRC provided much needed support for our partner agencies handling media demands. Internationally, interviews were conducted with media from countries including China, Japan, Ireland, United States, United Kingdom and New Zealand.
- Most of the queries were on complex issues where the media were looking for a more in-depth discussion than could be provided by the agencies. Issues included climate change, fire weather, the "Prepare to Stay and Defend or Leave Early" position, house protection, bunkers, community education and warnings, arson, and an historical perspective of where these fires sat with Australia's history of bushfire.
- The *Herald Sun* commissioned an Opinion article by CEO Gary Morgan, "We Still Need to Know More", 10 February. Researchers featured in ABC TV special bushfire programs including *The New Inventors* and *4 Corners*. More details at [www.bushfirecrc.com/news/fires09.html](http://www.bushfirecrc.com/news/fires09.html)
- In the days immediately after 7 February, the Bushfire CRC responded to 147 contacts from the media.

- Information on the Bushfire CRC Research Task Force was provided online and in a regular newsletter e-mailed to all Bushfire CRC and Taskforce partners.
- Extensive video and still footage was taken of the Bushfire CRC Research Taskforce at work in the field in the aftermath of Black Saturday. This has been used to demonstrate the work of the Taskforce to a wide audience.
- The Bushfire CRC distributed to our partners a *Fire Update* (Issue 31) with a summary on the roles and powers of a Royal Commission.
- The Bushfire CRC website attracted considerable traffic and maintained strong visitation over the duration of the fire event. The following graph shows the web traffic immediately before and after the fires:



## Communicating with our industry and researchers

### Annual Conference

Our biggest event of the year, the International Bushfire Research Conference, incorporating the 15<sup>th</sup> Annual AFAC Conference, attracted almost 1100 delegates to Adelaide in September.

For five days, the fire research community and the broader fire industry (including SMEs and large industry organisations) discussed, debated and shared knowledge. There was also a large Trade Expo with almost 100 booths booked, mostly by SMEs.

The pre-conference workshop - *Bushfire Incident Response* - attracted 75 senior personnel with a working interest in managing all the complexities of a bushfire incident. This included five CEO/Chief Officer level participants. In addition, there were 60 research posters from across the Research Program on display, added to the delegate's memory stick and uploaded to the Bushfire CRC website.

Importantly, the conference, the workshop and the posters are prime vehicles for the research of the Bushfire CRC to be transferred into our agency partners. The presence of so many people from across the industry - from the many CEOs to those in day-to-day operations - is an acknowledgement that the industry is seizing the opportunity to be informed of the latest developments in its field.

This was a prime event for researchers. All Bushfire CRC postgraduate students are invited to attend each annual conference - many get the opportunity to present their work on the conference or workshop program, and all get to present their work on a poster.

Few other CRCs attract as many participants to their annual conference. The industry clearly sees the value in gathering to participate in the research process.



### Fire Australia

The *Fire Australia* journal continues to provide a vehicle for the promotion of Bushfire CRC research and activities to the broader fire industry. The journal is a joint publication of the Bushfire CRC, Australasian Fire and Emergency Service Authorities Council, Fire Protection Association Australia and the Institution of Fire Engineers Australia.

*Fire Australia* is published four times a year with a distribution list of 6000 that includes all Bushfire CRC researchers and end-users, AFAC members, the fire protection industry, academic libraries, and selected local, state and federal members of parliament. The publication was significantly redesigned this year with new sections added and the quality of content and graphics improved.

### Research Briefs

One-page Bushfire CRC *Fire Updates* and four-page *Fire Notes* on research projects were emailed to end-users and researchers on a regular basis throughout the year. *Fire Updates* serve as a brief summary of the project designed to keep all Bushfire CRC members abreast of current developments. *Fire Notes* are more in-depth summaries of issues important to the industry. These publications are also available online for general access. There were 11 *Fire Notes* and 7 *Fire Updates* published this year.

### Newsletter

The CEO distributed eight newsletters to Bushfire CRC end-users, researchers, and students, in addition to full reports on Bushfire CRC activities to Board and Stakeholder Council members.

A new publication *KWnews* began in December 2008. This monthly online and email newsletter is a product of our Fire Knowledge Network and is published jointly by the Bushfire CRC and the Australasian Fire and Emergency Service Authorities Council with news from both organisations. It is distributed to industry and research members of the Knowledge Web.



## Corporate publications

Bushfire CRC corporate publications include:

- *Annual Report 2007-8* - this was submitted to the Department of Innovation Industry, Science and Research in October. A printed copy, with more detail on progress since 2003, was provided to all Stakeholder partners shortly after.
- *High Impact Research Outcomes* - this publication provided a summary of eight key outcomes of the Bushfire CRC. A copy was emailed to all partners.
- *Research Adoption Plan* - this publication detailed the roll-out of research adoption activities and events. A copy was emailed to all Stakeholder partners and is also available online.

These publications are available in hard copy for partners and can also be found on the Bushfire CRC website.

## Knowledge Web

The AFAC Knowledge Web ([www.afac-kw.com](http://www.afac-kw.com)) has expanded the concept of the Bushfire CRC Fire Knowledge Network to draw in the operational knowledge of fire, land management and emergency service organisations in Australia and New Zealand, creating an online source of knowledge and sharing for the industry.

As a product of the Bushfire CRC and a prominent example of knowledge transfer, it is fitting that the Knowledge Web now includes all outputs (more than 600 publications, reports, conference papers and posters) of the Bushfire CRC. The bulk of uploading of this content was completed this year and new material now being uploaded as it is produced.

## Stakeholder Meetings

Two Stakeholder Meetings were held at the Bushfire CRC- in October 2008 (below, left) and April 2009. The second meeting included the launch of two fire manager field guides that are a product of two research projects plus a half-day field trip to fire affected communities in Marysville, Kinglake and Strathewen.



## Student skills

Communication/media skills training courses were conducted in Melbourne and Adelaide (above, right) by an external trainer. The postgraduate students gave very positive feedback on this training to improve their skills.

## Communications workshop

In December, the Bushfire CRC hosted a workshop on media issues for Communications Managers from agency partners. The workshop heard from key researchers and began to develop a series of media statements. These draft statements and the support networks developed at the workshop were welcomed by the member agencies during the long bushfire season and its aftermath.

## Students online

The project to film all post graduate students continues. An interim compilation DVD of the interviews completed so far was showcased at the Adelaide conference. The footage is also able to be viewed on the individual student web pages and on the Bushfire CRC *You Tube* channel. *Fire Australia* has carried a four-page feature on the project, which further exposes the students and their work to industry.

## Communicating with the public

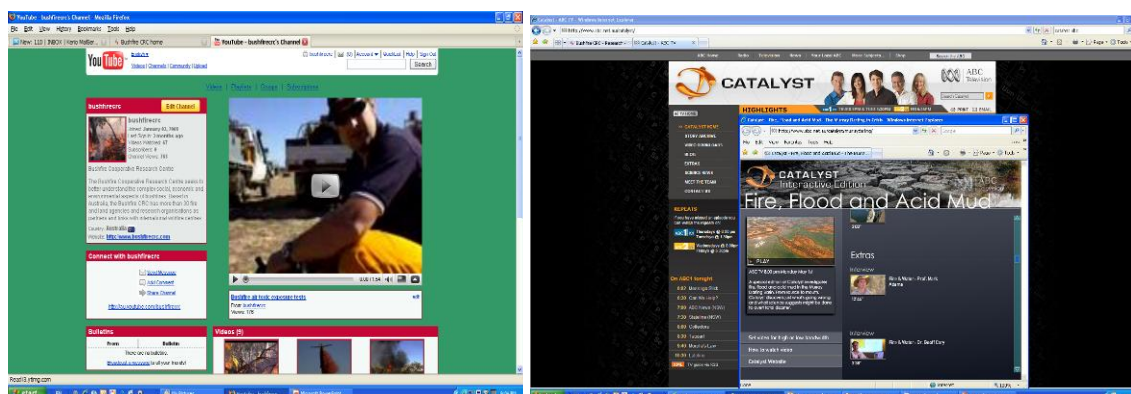
### Online Communications

The Bushfire CRC website is a prime communications tool for both internal and external audiences. It received a steady increase in hits over the year with demand particularly strong around major bushfire events, in particular around the February 2009 Victorian bushfires, and with the launch of new research. The website draws many enquiries from the interested general community in fire zones around Australia as well as industry and academic enquiries, including school and tertiary students.

### Bushfire CRC online

Visitation to the site was particularly high after the 7 February bushfires in Victoria (see graph page 35) and continued at abnormally high levels for several weeks. Papers from the Adelaide annual conference continue to be popular along with major research reports, briefing papers and news reports.

The Bushfire CRC *You Tube* site features videos of Bushfire CRC research in action. You Tube provides a simple mechanism of promoting Bushfire CRC work to Australian and international audiences with short (less than two minutes) videos. Importantly, these videos are linked to the main Bushfire CRC website. New content is being progressively uploaded as it becomes available. See <http://www.youtube.com/bushfirecrc>

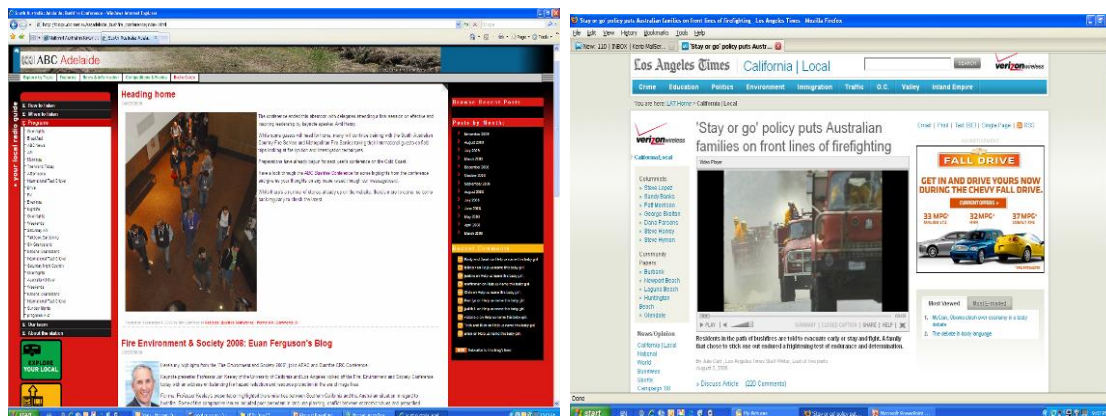


## Online national media briefing

In January, two weeks before the tragic bushfires in Victoria, the Bushfire CRC and the Australian Science Media Centre held an online national media briefing on bushfire research. Speaking for the Bushfire CRC were CEO Gary Morgan and Program Leaders Professor Mark Adams and Professor John Handmer. This was a simple but innovative way of presenting an update on ongoing Bushfire CRC research. The briefing attracted representatives from 26 media organisations from around Australia and internationally online.

## Conference Media

The ABC dedicated a website (below, left) to our conference and commissioned three journalists to cover the three days of presentations. In addition the Country Hour broadcast live from the Adelaide venue and the national rural reporter filed reports for ABC Current Affairs. This was the first time the ABC has dedicated such a large amount of resources to support a research conference anywhere in Australia. In its role as the emergency services broadcaster, our conference was an ideal opportunity for the ABC to enhance its reputation in the area. Go to [www.abc.net.au/bushfireconference](http://www.abc.net.au/bushfireconference)



## Media coverage

The extensive coverage of Bushfire CRC activities and views after the Black Saturday bushfires, as outlined above, and the coverage of our International Bushfire Research Conference that included print, online, radio and television media, has dominated the media activity during the year. In addition, the Bushfire CRC featured in other media including two notable instances:

- The *Los Angeles Times* series *Big Burn* in August (a subsequent Pulitzer Prize winner) featured much content supplied by the Bushfire CRC with our researchers quoted in several articles (above, right). See: <http://www.latimes.com/news/local/la-me-fire-index,0,4857752.htmlstory>
- The Bushfire CRC Seasonal Bushfire Outlook for southern Australia was released in October in a nationally coordinated process with the Bureau of Meteorology and other Bushfire CRC partners. Coverage was achieved in TV, radio, print and online across all states of Australia. As an example, see the coverage in *The Age* :

<http://news.theage.com.au/national/bad-bushfire-season-looming-say-experts-20081006-4upk.html>

### Bushfire Research Fund

The Fund was established in 2008 when the Bushfire CRC was placed on the Australian Government's Register of Environmental Organisations. The Fund was established to provide a mechanism for small organisations and the general public to donate to environmental bushfire projects. With the Black Saturday fires producing an enormous amount of goodwill for donations to the recovery of those caught up in tragic circumstances, the decision was made by the Bushfire CRC to not actively promote this Fund during this time so as to avoid any potential for confusion.

### Science on show

The Bushfire CRC participated in the Australian Science Festival alongside the annual CRC Innovations Conference at the National Convention Centre in Canberra in late May. These two events under the one roof were an excellent opportunity to showcase Bushfire CRC research to a wide scientific, political and general audience. The Bushfire CRC used this to promote bushfire science to schools (more than 10,000 children were bused in over the week), the general public, and to invited parliamentarians, and department and embassy staff. Our booth was ranked eighth best out of the 37 exhibitors by the school children - an excellent outcome considering the big names in public science communication that were present.



## END-USER INVOLVEMENT AND CRC IMPACT ON END-USERS

The Bushfire CRC end-users are involved in a wide range of activities at both the formal and informal level.

The Stakeholder Council comprises a representative from each of the Bushfire CRC partners. The Council meets twice a year to receive updates on the progress of research, communication and commercialisation activities and to provide strategic advice and direction to the Governing Board. This Council provides advice at an executive level on the needs of stakeholders and appropriate stakeholder membership of the Governing Board.

The Governing Board governs the Bushfire CRC. This Board consists of the independent chairman and eight skills-based members with the majority being end users. The Board met six times this financial year.

All research programs and individual research projects have an end-user leader, along with a research leader.

For more details on the involvement and impact of end-user activities see from page 34 on Communications and from page 42 on Education and Training.

Also see Table in Appendix - *End-user involvement in CRC Activities*.





## PROGRAM E: EDUCATION AND TRAINING

End User Leader: Ken Thompson NSW Fire Brigades

Program Leader: Christine Owen - University of Tasmania

### Overview

The year has seen a major shift from research to its adoption and the education and training program has played a vital role in achieving successful research adoption outcomes.

Highlights over the past year have included:

- Continued support of post graduates and several post-graduate completions;
- Support and assistance to post graduates to locate full-time employment in the industry;
- Recognition and formalisation of connections between the peak industry body AFAC and Bushfire CRC research projects on an integrated outcome basis to drive research adoption;
- Consultation on the best pathways to support industry skill development and the incorporation of education and training initiatives into the research adoption portfolio that support that focus;
- The programming of national events (seminars, forums, workshops and conference) to support research adoption; and
- Initiatives to embed Bushfire CRC research outcomes into formal education and training pathways.

### Highlights

#### Scholarship Program

The Bushfire CRC has exceeded its target in terms of recruiting and supervising post graduate students. As a result it has supported increasing the number of post graduates entering the industry.

The Bushfire CRC allocated 44 post graduate scholarships; 15 have completed as of June 2009. (See full list of students in Appendix.)

Graduate students continue to participate in knowledge building in the industry, particularly through their involvement in annual industry conferences. A number of post doctoral researchers are also involved in overseas collaborations.

#### Involvement of industry in research supervision

All scholarships have been sponsored by an industry agency and post graduates have regular contact with end-users to ensure the research meets targeted industry needs. Each post graduate has an industry supervisor working in combination with the university supervisor to give an industry strong scholarship experience.



*Bushfire CRC students 2008*

#### Graduate Contribution to skill development in the industry

The Education Program continues to contribute significantly to the overall development of skills in the industry. For some projects the skill developed has specifically come from post graduates. As examples:

- The research of a post graduate scholar (Project: Effective Risk Communication) has informed the development by industry of community education programs targeting bushfire preparedness for children.
- The Grassland Curing project has a scholar as a member of the advisory group at the pilot stage of a new national system to predict curing.
- Two PhD scholars are working with advisory groups to produce industry adoption products - the *Human Factors Interview Protocol* and a *Fire Intensity Guide for Northern Australia*.

The research undertaken by scholarship holders continues to achieve recognition for its high quality. Again as examples, two PhD scholars submitted applications to *Early Career Scientist Award* sponsored by the CRC Association with one being short listed to present his research at the Association's annual conference in Canberra in May.

To support links between students and the industry, each post graduate student has been interviewed about their research on film. These videos have been uploaded to the You Tube and the Bushfire CRC website, have been shown at conferences and other events, and have been distributed to Stakeholder agencies as a DVD. The broader fire industry has read the interviews in the Bushfire CRC magazine *Fire Australia*.

#### Graduate destinations

Of the students who have graduated, almost 100 percent have gained employment within three months of project completion. Of the total number of scholarship holders, almost half have gained employment within the industry, including some of those yet to submit.

Employers who are benefiting from the post-graduate skills include: the Federal Department of Climate Change; the RMIT University, Victoria; the Institute of Sustainable Futures, NSW; PF Olsen Plantation Management; the University of Hong Kong; the University of Sydney; the Department of Defence; and the Department of Sustainability and Environment, Victoria.

### Industry Skill Development

In addition to skill development based on graduate contributions, the education and training program has been more broadly involved in industry skill development. The process of moving research into adoption has included initiatives such as:

- working with the relevant AFAC Specialist Groups;
- facilitating industry impact assessment processes to drive research adoption;
- product development: and
- embedding research outcomes into education and training.

### Working with AFAC Groups

The Bushfire CRC has played a key role in facilitating agency leadership to drive the research output to industry adoption. As examples, the following research projects have been most active this year in engaging with AFAC Specialist Groups:

- Tree decline in the absence of fire;
- High Fire project;
- Community Safety and Engagement (several project grouped together);
- Safe Behaviour and Decision Making;
- Air Toxics Exposure and Management;
- Prediction and Assessment of Grassland Curing;
- Fire Behaviour Monitoring;
- Enhancing Volunteerism; and
- Fire-fighter Health and Safety.

### Industry impact assessment

The year has seen the accomplishment of a range of industry impact assessments in key areas. Industry impact assessments have been conducted by end-users reviewing research outcomes to endorse appropriate research adoption pathways in the following areas:

- Aerial Suppression;
- Bushfire Arson;
- Community Safety;
- Grassland curing;
- Fire-fighter health and safety including safer decision-making; and
- Enhancing volunteerism

## Embedding research outcomes into education and training

An ongoing national program of seminars, forums and workshops has been conducted to facilitate skill development. These events have been crafted to encourage the thinking and interaction of participants and have been identified by the fire and emergency service sector as ‘key enablers’ to knowledge creation. Highlights of the program include:

Event	Title	Location	Participants	Date
Workshop	Southern Seasonal Bushfire Assessment	Melbourne	30 agency members from southern states	August
Annual Conference workshop	<i>Bushfire Incident Response</i>	Adelaide	75 including four Chief Fire Officers	September
Book launch	<i>Wildfire in the High Country</i>	Melbourne	65 Launched by Victorian Minister for Emergency Services	October
International Research seminar	Scott Stephens presented on <i>Fire at Stand and Landscape Scale in California</i>	University of California	55 Coordinated by Bushfire CRC	November
International Research Seminar	Sarah McCaffrey presented on <i>Social science and fuel management a US perspective</i>	Melbourne	60	March
Workshop	<i>Prepare, Stay and Defend or Leave Early</i> - research to inform national industry position and agency policy	Melbourne	40	April
Workshop	Safer Decision Making - industry assessment	Melbourne	40	May
Seminar	Enhancing Information Flow and Incident Management Team Effectiveness’		35 AFAC Group member	May
Workshop	Northern Seasonal Bushfire Assessment	Cairns	23 agency members from northern states	May
Festival Expo stand	Australian Science Festival	Canberra	10,000+ General public and CRCA Conference participants	May
Workshop	Enhancing Volunteerism Industry Impact Assessment	Melbourne	26	May
Workshop	Aerial Suppression Industry Impact Assessment	Melbourne	With National Aerial Firefighting Council	May

## Product Development

There is a growing industry demand for product development in the wake of Bushfire CRC research outcomes. Over the reporting year 11 new *Fire Notes* have been produced with a further 11 distributed by submission of this report. At this point in time, 23 others are in various stages of production for with new issues being commissioned regularly.

The development of guides has also been particularly popular in the industry (examples include a *Smoke Management Field Guide* and a *Burning under Young Eucalypts Field Guide*). As an example of endorsement of these guides a NSW fire agency ordered 20,000 copies of the *Smoke Management Field Guide* for the training of its fire fighters.

## Higher Education and Vocational training

### Mapping the research and education landscape

Mapping of the linkages between the educational landscape and the research programs and projects was completed this year. This mapping has identified that the fire and emergency service sector has a highly developed vocational training culture whilst land management agencies are more reliant on graduate recruitment and in house development of fire specific expertise and knowledge. The agencies operating at jurisdictional level are best positioned to have capacity and existing community credibility to conduct community education. The 2009-2010 emphasis will be on embedding research into vocational training and higher education. For example, a website will be launched in 2009-2010 providing learning resources for educators.

### Agency involvement in developing undergraduate courses

The Bushfire CRC has also supported a range of initiatives to ensure that Higher Education member institutions are able to maximise the value out of their involvement with the CRC. These strategies have resulted in a tailored approach to ensuring appropriate research transfer into teaching is occurring at all relevant levels of education. The following examples of collaborative involvement illustrate the ways in which there is Bushfire CRC and end-user involvement in under-graduate course developments:

- RMIT University has developed a short course and a longer advanced course on *Evaluation of Bushfire Community Education*, with strong agency input and successful completion of a pilot - the materials are soon to be released;
- The Australian National University is combining researchers (including post-graduates) across disciplines to teach in its *Fire in the Landscape* course;
- The collaborative National Forestry Masters, jointly provided by the University of Melbourne, the University of Tasmania and the Australian National University, continues to renew its coursework using Bushfire CRC expertise;
- The University of Western Australia actively incorporates research into undergraduate programs in consultation with key end-users;
- A *Fire Behaviour Analyst* course is now being delivered nationally in partnership between Department of Sustainability and Environment - Victoria, the Bushfire CRC and the University of Melbourne.



## Plans for 2009-2010

The education and training program to support adoption for 2009-2010 has been endorsed by the industry and is mapped out in the Bushfire CRC Governing Board endorsed Research Adoption Plan 2009-2010.

The emphasis of the graduate program will remain on facilitating completion of research degrees and the placement, where appropriate, of graduates into industry.

There will be a continuation and extension of the seminar/forum and workshop program and an increasing emphasis on the absorption of the research into education and training. This will be done through:

- Continuing to work with AFAC to better understand industry workforce needs;
- Marketing of bushfire-related research to education providers. Actions here will include:
  - The launch of a new bushfire education web site
  - Engagement of universities in further research-teaching nexus collaborations.
- Embedding bushfire-related research into vocational training, including:
  - The inclusion into national industry reviews and production of learning materials; and
  - The development of short courses and trainer professional development.
- Working with professional associations (specifically from the planning and building sector) to raise awareness of the importance of bushfire-related research outcomes among their constituencies.



# APPENDICES

## GLOSSARY OF TERMS

ADFA	Australian Defence Force Academy
AFAC	Australasian Fire and Emergency Service Authorities Council
AIC	Australian Institute of Criminology
AIIMS	Australasian Inter-Service Incident Management System
ANU	Australian National University
BOM	Bureau of Meteorology
CFA	Country Fire Authority Victoria
CFS	Country Fire Service South Australia
CSIRO	Commonwealth Scientific Industrial Research Organisation
DEC	Department of Environment and Conservation WA
DSE	Department of Sustainability and Environment Victoria
EMA	Emergency Management Australia
ESA	ACT Emergency Services Agency
FESA	Fire and Emergency Services Authority WA
IMT	Incident Management Team
JCU	James Cook University
MFB	Metropolitan Fire Brigades
NPWS	National Parks and Wildlife Service NSW
RFS	Rural Fire Service NSW
RMIT	RMIT University
SCU	Southern Cross University
TFS	Tasmania Fire Service
USDA-FS	US Department of Agriculture - Forest Service
UWA	University of Western Australia

## Scientific Quality Rating

<b>PROGRAM A</b> <b>SAFE PREVENTION, PREPARATION AND SUPPRESSION</b>	<b>STRONG</b> Able to set and sustain new scientific direction	Research in fuel dynamics, fire behaviour, fire weather and aerial suppression is setting new science directions both internationally and nationally. Project Vesta represents a major breakthrough in the description and understanding of forest fire behaviour. Other parts of the Program, such as PHOENIX, are less well developed but highly promising. Wider publication in international literature is needed to boost this rating.
<b>PROGRAM B</b> <b>FIRE IN THE LANDSCAPE</b>	<b>STRONG</b> Able to set and sustain new scientific direction	Rated as 'Strong' because it is leading the directions of research effort in Australia. The contributors are publishing excellent work in highly regarded international journals, some of it of agenda-setting quality. Hence, the Program borders on "Benchmark", but requires greater coherence if it is to achieve that ranking.
<b>PROGRAM C</b> <b>COMMUNITY SELF-SUFFICIENCY FOR FIRE SAFETY</b>	<b>BENCHMARK</b> Sustained scientific leadership - well recognised internationally	This Program is rated as "Benchmark" because it has created international and national leadership and agenda-setting with its research.
<b>PROGRAM D</b> <b>PROTECTION OF PEOPLE AND PROPERTY</b>	<b>FAVOURABLE</b> Able to maintain a good position internationally	The Program is applying scientific methodologies in some vital applied areas; it could benefit from a more strategic approach to science and from more peer-reviewed publications in order to lift international input and exposure.
<b>PROGRAM E</b> <b>EDUCATION AND RESEARCH ADOPTION</b>	<b>STRONG</b> Able to set and sustain new scientific direction	The Program is delivering huge benefit by creating a cadre of new researchers (both postdoctoral fellows and postgraduate students) for Australian fire sciences. If these new scientists could gain an even more integrated view of inter-connections across the CRC's research the rating would be 'Benchmark'.

## BUSHFIRE CRC students – employed – June 2009

	Name	Project title	Status/due date	Employer
1	Phil Lacy, PhD	Burning under young eucalypts	submitted	PF Olsen
2	Madeline Osborn, PhD	The role of fungi in fire prone forest communities	submitted	DAFF- ACT
3	Francesca Harris-Spence, PhD	Catchment management groups - volunteer community organisations and bushfire management	2009	DAFF- ACT
4	Alan Rhodes, PhD	Evaluation of the “stay or go” policy and community preparedness	2009	CFA -VIC
5	Phil Zylstra, PhD	Plant species contributions to fire intensity – towards a total fuels model	2009	NSW NPWS -DECC- Cooma
6	Rohan Sadler, PhD	Long term monitoring and modelling in quantifying the role of fire in grasslands	submitted	UWA
7	Brendan Phippen, PhD	Predicting factors affecting fire behaviour in heathland vegetation.	submitted	Dept Climate Change-ACT
8	Annemarie De Vos, PhD	Health effects of occupational exposure to bushfire smoke in WA	submitted	Asthma CRC-WA
9	Karyn Bosomworth, PhD	Does current bushfire risk management policy and practice support community and natural resource resilience to climate change?	2010	DSE - VIC
10	Adam Leavesley, PhD	Impact of fire mosaic on birds in mulga woodlands of central Australia.	submitted	Bushfires NT
11	Paul Fox Hughes, Ma	A meteorological investigation of the “Springtime Bump” in Tasmania.	2009	Bureau of Meteorology, Tasmania
12	Laura Kelly, Ma	Community resilience to and recovery from wildfire in New Zealand	submitted	Working in the UK
13	Rob De Ligt, Hons	Patterns in the probability of burning with time-since-fire in the Greater Sydney region	submitted	ANU
14	Josh Whittaker, PhD	Adaptive capacity and social resilience to bushfires in southeast Australia	submitted	RMIT – Centre for Risk and Community Safety
15	Luke Balcombe, Ma	The perceptions of bushfire hazard in urban fringe areas of tropical Australia.	submitted	Environmental scientist in private firm - undertaking a PhD, Griffith University
16	Bevan McBeth, PhD	Soil, fire and physiological processes and dieback in coastal eucalypt forests.	2009	Southern Cross University
17	Sonia Whiteley, PhD (unfunded)	Preparing for the worst: measuring the outcomes of community bushfire safety programs	2009	Department of Justice, VIC
18	Meaghan Jenkins, PhD	Carbon budgets and implications for fuel load and flammability of shrub-dominated ecosystems in the high country	submitted	University of Sydney
19	Tim Prior, PhD	Community responses to bushfire threat	submitted	UTS - Institute of Sustainable Futures
20	Jaymie Norris, PhD	Microbial clues for ecological sustainable management of fire prone landscapes.	2009	DSE - VIC

21	<b>Ken Scott, PhD</b>	Fire & savannah grass ecology	submitted	NT Gov - fire management
22	<b>Matt Phillips, PhD</b>	Physiological demands of Australian volunteer fire-fighters during bushfire suppression	2009	Dept Defence - ACT
23	<b>Andrew Edwards, PhD</b>	An algorithm for mapping burn severity from satellite remote sensing: tropical savannahs, northern Australia.	2009	Bushfires NT
24	<b>Mae Proudley, Ma</b>	Reducing bushfire risk through improved household decision making.	submitted	RMIT
25	<b>Sean Cowlshaw, PhD</b>	Effects of Fire Service Volunteering on families of volunteers	submitted	University of Hong Kong

### BUSHFIRE CRC students - in study – June 2009

	<b>Name</b>	<b>Project title</b>	<b>due date</b>	<b>Supervisor</b>
26	<b>Annette Salter, PhD</b>	Applications of multi-media education strategies in fire behaviour	2010	Dr Christine Owen UTAS
27	<b>Kerryn McTaggart, PhD</b>	The effect of fire on soil microbial populations and their processes in Australian alpine ecosystems.	2009	Dr Tina Bell, University of Melbourne
28	<b>Lyndsey Vivian, PhD</b>	Determinants of variation in fire response types in the composition of montane plant communities.	2009	Dr Geoff Cary ANU
29	<b>Bryony Horton, PhD</b>	Fire management and tree decline: mycorrhizal indicators of declining forest health.	2009	Dr Neil Davidson UTAS
30	<b>Carola Karamotto de Bednarik, PhD</b>	Relative importance of fire regimes, environmental gradients and climate change for rainforest distribution in the Sydney region.	2009	Dr Geoff Cary ANU
31	<b>Alison O'Donnell, PhD</b>	Fire patterns and vegetation structure in semi-arid south-east western Australia	2009	Dr Lachie McCaw, DEC WA Dr Pauline Grierson UWA
32	<b>Rowena Morris, PhD</b>	The effect of prescribed burning on sediment movement in the Mt Lofty Ranges	2009	Dr Meredith Henderson SA DEH
33	<b>Anne Miehs, PhD</b>	The role of coarse woody debris in fire-prone forests: Achieving both fire management and conservation objectives.	2009	Dr Alan York University of Melbourne
34	<b>Briony Towers, PhD</b>	Developmental perspective on bushfire risk communication	2009	Prof Douglas Paton UTAS
35	<b>Claire Johnston, PhD</b>	Worst Case Scenarios: their role in safe decision making in bushfire fighting.	2009	Dr Mary Omodei, La Trobe University
36	<b>Dane Hansen, PhD</b>	Characterization of the volatile organic components adsorbed to particulates generated in bushfires	2009	Dr Fabienne Reisen CSIRO
37	<b>Ian Dwyer, PhD</b>	Communication strategies and collaborative work practices in high-reliability workplaces: A study of coordination centres.	2010	Dr Christine Owen UTAS
38	<b>Greg Hickey, PhD</b>	Enhancing effective multi agency operations.	2009	Dr Christine Owen UTAS
39	<b>Julian Black, PhD</b>	Predicting the dynamic spatial pattern of fire front progress and fire destruction in the rural urban interface zone	2009	Dr Raphaele Bianchi, CSIRO
40	<b>Christine Eriksen, PhD</b> (project support only)	Local environmental knowledge of bushfire management: a case study of new rural landscapes in NSW	2010	Dr Nicholas Gill, UOW
41	<b>Jennifer Hollis, PhD</b>	Coarse woody fuel availability and consumption in Australian forest fires	2010	Dr Lachie McCaw, DEC
42	<b>Peter Hayes, PhD</b>	Do teams that have worked together make better teams than ad hoc teams?	2010	Dr Mary Omodei, La Trobe University
43	<b>Jenni Raines PhD</b>	Fatigue and recovery in rural Australian bushfires	2010	Dr Brad Aisbett, Deakin University
44	<b>Helen Daily PhD</b>	Development of pasture growth models for grassland fire danger risk assessment	2010	Dr Stuart Anderson, SCION Dr Peter Lane UTAS



## End-user Involvement in CRC activities

End user	Relationship with CRC (e.g. <i>Industry, Participant, International</i> )	Type of activity and end user location	Nature / scale of benefits to end user (e.g. <i>exports increase, productivity, employment</i> )	Actual or expected benefit to end user (\$ terms)
<b>ACT Emergency Services Authority</b>	Industry Participant	Research Utilisation (ACT)	Research outputs expected to be used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community	Significant but not able to be assessed at this level.
<b>Country Fire Authority of Victoria</b>	Industry Participant	Research Utilisation (Victoria)	Research outputs expected to be used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community.	Significant but not able to be assessed at this level
<b>Fire and Emergency Services Authority of Western Australia</b>	Industry Participant	Research Utilisation (Western Australia)	Research outputs expected to be used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community.	Significant but not able to be assessed at this level
<b>Metropolitan Fire and Emergency Services Board (Melbourne)</b>	Industry Participant	Research Utilisation (Victoria)	Research outputs expected to be extrapolated to an urban environment and used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community.	Significant but not able to be assessed at this level

<b>New South Wales Fire Brigades</b>	Industry Participant	Research Utilisation (New South Wales)	Research outputs expected to be used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community.	Significant but not able to be assessed at this level
<b>New South Wales National Parks and Wildlife</b>	Industry Participant	Research Utilisation (New South Wales)	Research outputs expected to be used in improving effectiveness and efficiency of programs in maintaining and supporting organisational objective and particularly in the interaction between fire and the environment.	Significant but not able to be assessed at this level
<b>New South Wales Rural Fire Service</b>	Industry Participant	Research Utilisation (New South Wales)	Research outputs expected to be used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community.	Significant but not able to be assessed at this level
<b>Queensland Fire and Rescue Service</b>	Industry Participant	Research Utilisation (Queensland)	Research outputs expected to be used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community.	Significant but not able to be assessed at this level
<b>South Australian Country Fire Service</b>	Industry Participant	Research Utilisation (South Australia))	Research outputs expected to be used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community.	Significant but not able to be assessed at this level
<b>South Australian Department of Environment and Heritage</b>	Industry Participant	Research Utilisation (South Australia))	Research outputs expected to be used in understanding the interaction between fire and the environment	Significant but not able to be assessed at this level
<b>State Forests NSW</b>	Industry Participant	Research Utilisation	Research outputs expected to	Significant but not able to be

<b>Tasmanian Fire Service</b>	Industry Participant	(New South Wales)  Research Utilisation (Tasmania)	be used in improving management of fire in the forest environment  Research outputs expected to be used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community	assessed at this level  Significant but not able to be assessed at this level
<b>Forestry Tasmania</b>	Industry Participant	Research Utilisation (Tasmania)	Research outputs expected to be used in improving management of fire in the forest environment	Significant but not able to be assessed at this level

<b>Tasmania Parks and Wildlife Service</b>	Industry Participant	Research Utilisation (Tasmania)	Research outputs expected to be used in improving effectiveness and efficiency of programs in maintaining and supporting organisational objectives and particularly in the interaction of fire and the environment	Significant but not able to be assessed at this level
<b>Department of Sustainability and Environment Victoria</b>	Industry Participant	Research Utilisation (Victoria)	Research outputs expected to be used in improving effectiveness and efficiency of programs in maintaining and supporting organisational objectives, particularly in the interaction of fire and the environment	Significant but not able to be assessed at this level
<b>Department of Conservation and Land Management, Western Australia</b>	Industry Participant	Research Utilisation (Western Australia)	Research outputs expected to be used in improving effectiveness and efficiency of programs in maintaining and supporting organisational objective and particularly in the interaction between fire and the environment	Significant but not able to be assessed at this level

## PERFORMANCE MEASURES

### Progress on Performance Measures

PERFORMANCE MEASURE	2007-08 PROGRESS / ACHIEVEMENT	2008-09 PROGRESS / ACHIEVEMENT
<b>CRC Programme Objective 1:</b> <i>To enhance the contribution of long-term scientific and technological research and innovation to Australia's sustainable economic and social development</i>		
<b>Centre Objective 1.1:</b> Achievement of and delivery of research outcomes		
Develop at least four new technological breakthroughs	Programs are being developed and rolled out in cooperation with industry partners.	Programs are being developed and rolled out in cooperation with industry partners.
<b>Centre Objective 1.2:</b> Seminars, workshops and presentations		
More than five seminars, workshops and public forums each year	<p>Annual conference in partnership with Australasian Fire and Emergency Service Authorities Council attracted 900 participants from across the fire industry. September, Hobart.</p> <p>Three pre-conference workshops.</p> <p>Numerous program and project based workshops.</p> <p>A range of community forums with venues in towns including Perth, Melbourne, Bendigo, Stawell and Lakes Entrance.</p>	<p>Bushfire CRC International Research Conference and Annual conference in partnership with Australasian Fire and Emergency Service Authorities Council attracted 1100 participants from across the fire and emergency industry. September, Adelaide.</p> <p>One cross-program pre-conference workshop.</p> <p>Numerous program and project based workshops.</p> <p>Australian Science Festival Expo participant.</p>
<b>Centre Objective 1.3:</b> Centre publications transferring R&D outcomes and technology to end users and the public		

PERFORMANCE MEASURE	2007-08 PROGRESS / ACHIEVEMENT	2008-09 PROGRESS / ACHIEVEMENT
At least 50 end user focused publications and reports	Completed A wide range of end user publications and reports have been completed for each program. Most publications are on the Bushfire CRC website and are being progressively loaded on to the AFAC Knowledge Web.	Completed A wide range of end user publications and reports have been completed for each program. All publications or links are on the Bushfire CRC website the AFAC Knowledge Web.
<b>Centre Objective 1.4:</b> Scientific status and end user satisfaction		
Demonstrated leading edge research and development quality through peer review processes	Independent quality review underway. Establishment of Scientific Advisory Panel.	Fifth year review confirmed the quality of science and the rate of research adoption plus the development of a culture of research within the industry. International collaborations confirm the high standing of research activities.
<b>Centre Objective 1.5:</b> International interest in research		
Collaboration with at least four overseas groups	Completed.	Completed.
<b>Centre Objective 1.6:</b> Scientific Status		
Rated world class in its activities by an independent international review board	Third Year Review completed.	Independent Fifth Year Review and international collaborations confirm the high standing of research activities.
<b>Centre Objective 1.7:</b> Project Reviews		



PERFORMANCE MEASURE	2007-08 PROGRESS / ACHIEVEMENT	2008-09 PROGRESS / ACHIEVEMENT
Regular meetings of a Users, Researchers and Technical committee  Regular project reviews held by Project Leaders	Periodic and ongoing project reviews have been undertaken through regular meetings between researchers and end users.  Major review completed during budget cycle that began December 2007.	Periodic and ongoing project reviews have been undertaken through regular meetings between researchers and end users.  Annual conference in Adelaide in September with 100 researchers and 1100 industry participants.  Formal review of all project deliverables as part of the budget process.

#### **CRC Programme Objective 2:**

**To enhance the transfer of research outputs into commercial or other outcomes of economic, environmental or social benefit to Australia**

#### **Centre Objective 2.1: Economic Benefit to Australia**

Actual and future benefits > 3 times the Commonwealth Grant through cost benefit analysis.	On track.	Demonstrated through economic analysis of research impacts.
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#### **Centre Objective 2.2: Economic benefit to Centre**

Economic benefit to Centre. Additional income through contracts and consultancy: \$2M	Whilst not the primary focus of the centre, contact research and consultancy work continue – additional income of \$300,000 this year.	Whilst not the primary focus of the centre, contact research and consultancy work was significant this year, particularly following the February bushfires in Victoria – additional income of \$1.5m this year from Victorian agencies for the 2009 Victorian Bushfires Royal Commission.
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#### **Centre Objective 2.3: Research Publications**

10 Book chapters	Book chapters – completed.	Book chapters – completed.
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2 Books 25 refereed Journals per annum 30 refereed conference papers per annum	Books – completed. Journals – on track. Conference papers – on track.	Books – completed. Journals – on track. Conference papers – on track.
<b>Centre Objective 2.4: Patents</b>		
5 Patents	None planned at this stage	Not anticipated this CRC will deliver any patents.
<b>Centre Objective 2.5: Achievement of and delivery of research outcomes</b>		
Develop at least four new technological breakthroughs	In progress.	See 1.1.
<b>Centre Objective 2.6: Financial return to the Centre</b>		
Exceed budget plan	On target	On target
<b>Centre Objective 2.7: Adoption of the research outputs by End Users</b>		
Greater than 60 percent of the know-how and research deliverables adopted by end users	Implementation of the research adoption programs are continuing with a range of initiatives linking researchers and end users across all programs. Target utilisation is on track.	Significant research adoption activities in place across all programs.
<b>Centre Objective 2.8: IP Review Intellectual Property</b>		
Intellectual Property Reviews to be held once a year	Completed	Completed

**CRC Programme Objective 3:  
To enhance the value to Australia of graduate researchers**

**Centre Objective 3.1: Placement of Centre trained students and researchers into industry**

10 PhD's fully employed by User Groups	On track	Completed
<b>Centre Objective 3.2: Staff/Student exchange</b>		
At least one student and one postdoctoral fellow per annum on an exchange program	Do not have formal exchange programs as this impacts on the delivery of research and on PhD completion. However, all researchers and students have numerous opportunities to interact and work with end-users.	Do not have formal exchange programs as this impacts on the delivery of research and on PhD completion. However, all researchers and students have numerous opportunities to interact and work with end-users. Many were seconded to the Bushfire CRC Research Taskforce following the Victorian bushfires in February.
<b>Centre Objective 3.3: Postgraduate students trained to become the future leaders in Australia in the design, research and management of bushfire management</b>		
At least 20 fully funded PhD students graduated with further training in research management and all employed within three months of graduation	On track	On track
<b>Centre Objective 3.4: Industry training</b>		
All students to undergo an industry/end user induction	Completed.	Completed.
<b>Centre Objective 3.5: PhD Degrees Awarded</b>		
Greater than 90% of students completing postgraduate studies	Recent deferment of students is placing this at risk. Bushfire CRC is investigating reasons.	Review identified no systemic problems or issues particular to the Bushfire CRC. On track to have close to 90% completion.
<b>Centre Objective 3.6: Health and Safety</b>		
Zero lost time injuries	Zero	Zero

<b>CRC Programme Objective 4:</b> <b>To enhance collaboration among researchers, between researchers and industry or other users, and to improve efficiency in the use of intellectual and other research resources</b>		
<b>Centre Objective 4.1</b> Frequency of interchange of personnel between participating organisations between participating organisations		
At least one student and one postdoctoral fellow per annum on an exchange program.	Under review	See 3.2
<b>Centre Objective 4.2:</b> Projects involving end user participants		
60 percent of projects to involve end user participants	All projects have active involvement of end-users. All projects are linked to an end user “sponsor” or steering group.	Completed.
<b>Centre Objective 4.3:</b> Extent of participation by each participant in research and support programs		
Participants involved in research and support programs	All Bushfire CRC participants are actively involved in the activities of the Bushfire CRC.	Completed.
<b>Centre Objective 4.4</b> Time commitment of researchers		
Less than 10% with 20% of time or less	Identified as an issue during Third Year Review process – strategies being developed to address	Review has indicated those with less than 20% of time commitment to the CRC are in oversight roles. Less than 10% of researchers have less than 20% time commitment to the Bushfire CRC.
<b>Centre Objective 4.5</b> Degree of consultation between research providers and end users		
Research reviews at least twice a year between research providers and end users	On track. Stakeholder meetings held twice a year. Board Research Committee meets twice a year.	On track. Stakeholder meetings held twice a year. Board Research Committee meets twice a year.
<b>Centre Objective 4.6</b> The extent of participation by each participant in research and support programs		
All participants to be involved in active and	All Bushfire CRC participants are actively	Completed

proposed research projects	involved in the activities of the Bushfire CRC.	
<b>Centre Objective 4.7</b> Communication to Users		
At least 50 newsletters to all Core and Associate Participants .	Regular Bushfire CRC newsletters from CEO. <i>Circulation of Fire Notes, Fire Updates and Fire Australia</i> throughout the Bushfire CRC and AFAC, and to the broader fire industry. Regular meetings with end user agency representatives at all levels	Completed.
<b>Centre Objective 4.8</b> Evidence of collaboration between participants		
Active integration with more than 90% of Bushfire CRC projects to involve more than two participants	Completed.	Completed.
User participants to have contributed the equivalent of one person year of in-kind from their organisation over the life of the Bushfire CRC	Completed.	Completed.
<b>Centre Objective 4.9</b> Collaboration with other research groups within Australia		
At least three formal collaborative associations with other CRCs	Formal relationship with the Spatial CRC Tropical Savannas and Desert Knowledge CRC plus informal contacts with the Sustainable Forestry CRC.	Completed.