bushfire CRC

ANNUAL REPORT
2008-09

CRC AUSTRALIA

Established and supported under the Australian Government's Cooperative Research Centres Program

CORE PARTNERS

CFA

CSIRO

THE UNIVERSITY OF MELBOURNE

QUEENSLAND FIRE AND RESCUE SERVICE

TASMANIA FIRE SERVICE

NSW RURAL FIRE SERVICE

UC UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

FORESTS NSW

Forestry and Municipal Services ACT GOVERNMENT

EMA
Emergency Management Australia

AUSTRALIAN CAPITAL TERRITORY EMERGENCY SERVICES AUTHORITY

NEW SOUTH WALES FIRE BRIGADES

FESA
Fire & Emergency Services Authority of Western Australia

TASMANIA PARKS & WILDLIFE SERVICE

THE UNIVERSITY OF NEW SOUTH WALES

State Government Victoria
Department of Sustainability and Environment

UTAS

Forestry Tasmania
GROWING OUR FUTURE

MFB

NATIONAL RURAL FIRE AUTHORITY

THE UNIVERSITY OF WESTERN AUSTRALIA

Australian Government
Bureau of Meteorology

Department of Environment & Climate Change NSW

Department of Environment and Conservation
Our environment, our future

4 broad research areas **10** members of Governing Board **36** partners across fire and land management agencies and research organisations **44** postgraduate students providing a new generation of researchers **82** research briefs distributed to industry as Fire Notes and Fire Updates **100** booths filled at annual conference trade expo by small and medium enterprises **130** researchers collaborating across Australia and New Zealand **600** residents interviewed on their Black Saturday experiences **685** publications and growing, including reports, presentations, journal articles and posters **1100** participants at the international annual conference **1300** properties examined after Black Saturday **22,000** photographs of Black Saturday documenting fire behaviour and property damage.

bushfire CRC

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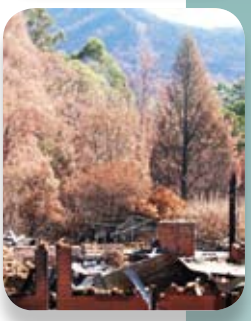


FIRE RESEARCH – 2013 AND BEYOND

The founding aims that secured seven years of funding to the Bushfire CRC in 2003 were shaped by the priorities of the times. This Annual Report on the sixth year of our operations summarises the gains we have made to this day on the original aims embedded in the research program.

Today, in 2009, the priorities have changed in ways unforseen by our industry at the start of this decade. The key drivers of change in our society today are centred on climate and drought, demographic shifts, new demands with workplace health and safety, and emerging technology.

To this mix we can add the multitude of issues arising out of the tragic Black Saturday bushfires in Victoria in February 2009. It is with these new priorities that we look ahead and plan a long term research agenda.

The Bushfire CRC this year received an additional three years funding from the Australian Government; $15 million for research in the period 2010-2013. The Bushfire CRC will use this to conduct research into national issues arising from the current 2009 Victorian Bushfires Royal Commission and to begin research that we have identified as being required to meet the industry's needs by 2020.

Our partners are working closely together to better understand and prioritise the research issues arising from the 2009 Victorian bushfires and to place these in the context of the broader research needs of the industry. The new program will be grouped around the themes of Understanding Risk, Communicating Risk and Managing the Threat.

Further work has begun to obtain funding beyond 2013 for the longer term research projects following the unsuccessful bid in August this year to obtain CRC Program funds for a proposed eight year research program.

Most importantly, work is well underway to build on the success of the Bushfire CRC by seeking to establish an ongoing research institute. This institute will conduct research across a range of fields for the benefit of our broad industry. The institute will work closely with similar bodies internationally and will collaborate with organisations with an association with fire in areas such as building, planning, local government, health, media, risk management, insurance, water and power, and telecommunications.

Our industry has come a long way over the past decade. A broadly-based, nationally coordinated research program with international links is a worthwhile aim. I welcome you to join us as we move forward.

Len Foster AO
Chairman
Bushfire CRC

Our core partners

ACT Emergency Services Agency

ACT Parks, Conservation and Lands

Bureau of Meteorology

Country Fire Authority, Victoria

CSIRO Divisions of Materials Science and Engineering and Sustainable Ecosystems

Department of Environment and Climate Change, New South Wales

Department of Environment and Conservation, Western Australia

Department of Sustainability and Environment, Victoria

Emergency Management Australia

Fire and Emergency Services Authority of Western Australia

Forestry Tasmania

Metropolitan Fire and Emergency Services Board

New South Wales Fire Brigades

New South Wales Forests

New South Wales Rural Fire Service

New Zealand National Rural Fire Authority

Queensland Fire and Rescue Service

Tasmania Fire Service

Tasmania Parks and Wildlife Service

University of Canterbury

University of Melbourne

University of New South Wales

University of Tasmania

University of Western Australia

Our associate partners

Australian National University

Charles Darwin University

Chemistry Centre, Western Australia

Country Fire Service South Australia

Department for Environment and Heritage, South Australia

Department of Justice and Community Safety, ACT

James Cook University

La Trobe University

Metropolitan Fire Service South Australia

RMIT University

SCION

University of Wollongong

Formal collaborations

Memorandums of Understanding:

Association for the Development of the Industrial Aerodynamics

CRC for Spatial Information

CRC for Tropical Savannas Management

National ICT Australia Limited

University of California, Berkeley – College of Natural Resources – Center for Fire Research and Outreach

University of Chile

US Department of Agriculture, Forests Service

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 firefighting, 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 firefighter 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 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, Chile 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 CRC's *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

Left: Public education wall banner based on Bushfire CRC research on vehicle safety, South Australia Country Fire Service.

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.

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 into the taskforce in a very short timescale.

Governance

A Governing Board-initiated 5th 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 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 is 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 postgraduate students provide both formal and less formal assistance to the Commission. The researchers' work has been scrutinised by peers and by the international community and has been held in high regard.

Additional workload

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 successfully 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 led to deliverables being met.
- While the 2009 Victorian Bushfires Royal Commission has been an impediment to delivery of the Bushfire CRC's outputs, our work with the Commission 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 (above right), 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 (right), 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 firefighting 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 2001-02, 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.*

Major developments and initiatives

Fifth year review

The 5th 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.

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 met 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 Stakeholders 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.

Management Staff

Name	Title
Gary Morgan	Chief Executive Officer
Richard Thornton	Deputy Chief Executive Officer, Research Director
Trevor Essex	Business Manager
Jen Lumsden	Education Manager
David Bruce	Communications Manager
Lyndsey Wright	Research Manager
Noreen Krusel	Research Adoption Manager
Valerie Buckle	Executive Assistant
Vaia Delizissis	Event Coordinator
Mike Leonard	Advisor – Strategic Issues

Gary Morgan

Richard Thornton


Len Foster


John Baird


Neil Bibby


Joanne Bloch


Naomi Brown


Ray Canterford


Murray Dudfield


John Gledhill


Alistar Robertson


Ewan Waller

Governing Board Members and Committee Members

Name	Organisation	CRC Position / Role
Len Foster	Bushfire CRC	Independent Chairman Director Audit Compliance Committee HR Committee
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 Meteorology	Director 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


Jim Gould


Rod Keenan


Mark Adams


John Handmer


Bob Leicester


Christine Owen

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.

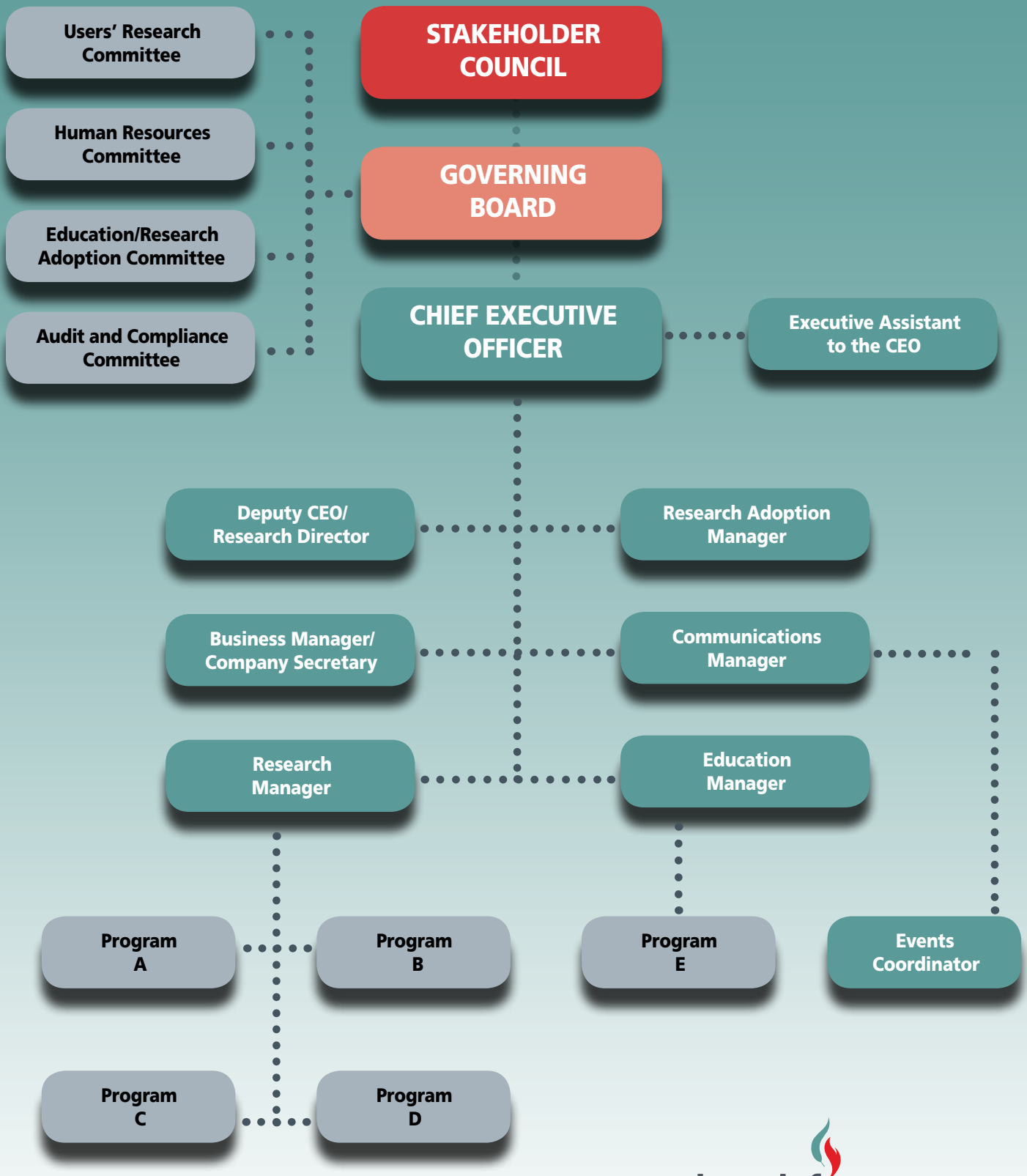
The Stakeholders Council comprises a representative from each of the Bushfire CRC partners. The Council meets twice a year to receive updates on the progress of research, communication and commercialisation activities and to provide strategic advice and direction to the Governing Board. This Council 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 nine skills-based members with the majority being end users. The Board met seven 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 40 on Education and Training and from page 45 on Communications.

Bushfire CRC
Organisation Structure



bushfire CRC

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 5th 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 – *A Field Guide for Burning Under Young Eucalypts* and a *Field Guide for Smoke Exposure Management*. 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 $1.5 million 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 it 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, 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.

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 and Chair of the Editorial Advisory Committee for the *International Journal of Wildland Fire*.
- 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.

HOMES AND THE BUSH

Completed

- Bushfire CRC scientists evaluated house losses after the 2009 Black Saturday fires in Victoria, having done also done so with the Eyre Peninsula fires of 2005 and the Canberra fires of 2003. They looked at why some houses burned and others survived. This has led to better advice on how people can prepare and protect their homes.
- Vehicle burnovers – this study has been adopted by AFAC to refine national guidelines on what to do if caught in a bushfire while driving. This report highlighted the dangers of being caught in a vehicle in a bushfire and outlined the protective actions to take based upon the findings of the tests conducted under simulated bushfire conditions.
- Performance under bushfire conditions – burning tests have been conducted on common types of fencing, water tanks, power poles, windows and decking. This research has helped define what residents need to know when constructing houses in bushfire zones.
- Based on the research on household building materials, advice was provided to Standards Australia and AFAC on Building Standard AS3959.

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 firefighting 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.
- 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.

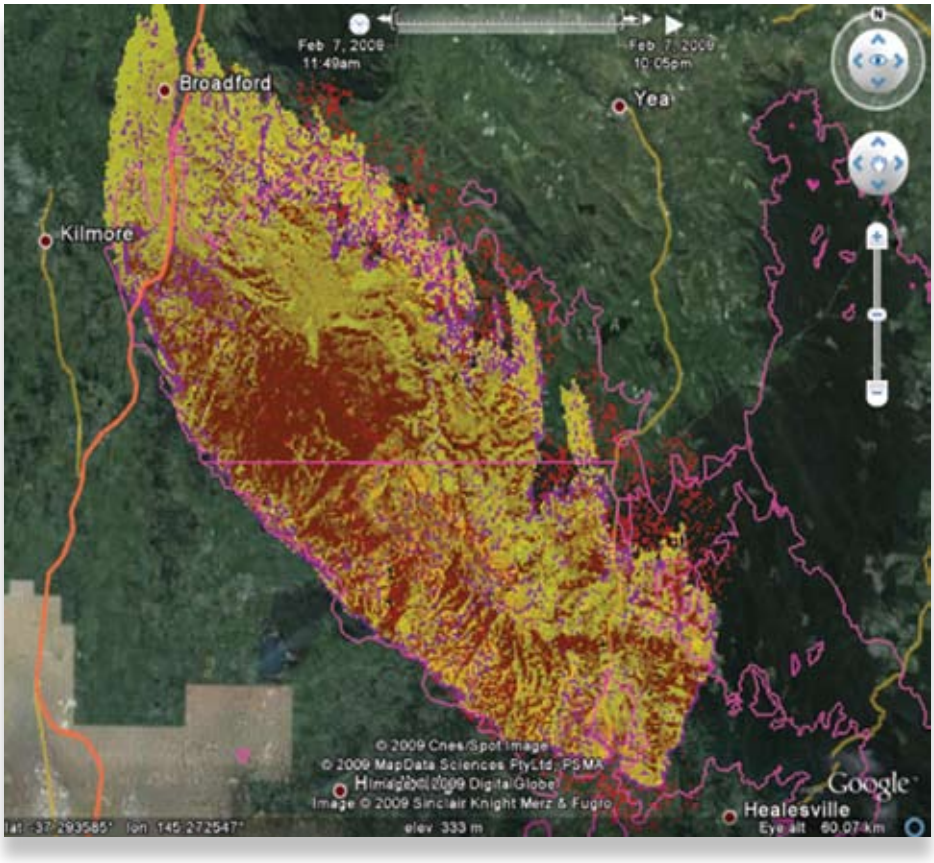
PHOENIX *RapidFire* is being operationally implemented at the Victorian Integrated Emergency Coordination Centre in East Melbourne and will be used on a trial basis during the 2009-10 bushfire season. Specially trained fire behaviour analysts will have access to the program via a web portal – *FireWeb*.

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.
- 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.

AERIAL SUPPRESSION

Completed

- Final report on effectiveness of aerial suppression.
- Final report on cost effectiveness of aerial suppression.
- A guide for the industry – *Assessing Aerial Suppression Drop Effectiveness.*
- A Fire Containment Calculator to assist fire managers with the selection of aircraft in conjunction with other suppression methods.
- An analysis of the operational effectiveness of aerial suppression in the 2007-08 season is in progress, together with the results of aerial suppression tests at experimental burns at Ngarkat Conservation Park, South Australia, in early 2008. These tests compared a range of chemical suppressants (retardant, foam and gel).

These reports help fire agencies determine the most effective combination of suppression resources and the economic efficiency of aerial suppression. They highlight the importance of rapid first attack, the essential combination of ground and aerial resources and the cost disadvantage of large fixed wing air tankers.

FIRE BEHAVIOUR AND FIRE WEATHER

COMPLETED

- An annual, nationally consolidated view on the seasonal fire outlook has been operational for four years. This is coordinated between all states and territories and has provided an essential basis for requests on resource funding for upcoming fire seasons. Fire managers from agencies around Australia have developed maps that indicate the likelihood of bushfires in specific geographic regions, taking into account climate changes, weather forecasts, vegetation growth, rainfall data and local fire management resources.
- A field guide, based on a PhD study, has been produced for plantation managers for conducting prescribed burns around young eucalypt trees.
- Tools for gridded fire weather forecasts are allowing better predictions on fire behaviour.
- Tools to better predict wind changes are helping protect firefighters and the general community.
- A report for the Climate Institute on the impacts of climate change and fire weather for south-east Australia. The report concluded that a hotter world meant longer fire seasons and more intense bushfires.
- A study of "blow-up" conditions has led to new knowledge on the dry slots phenomenon. This knowledge can help fire managers on the fire ground plan for and reduce risk.

Bushfire CRC 2003 - 2009 RESEARCH HIGHLIGHT

- Project Vesta – new fire behaviour and fuel assessment models are now being accepted by fire agencies.
- A report on assessment methods for grassland curing has provided a tool to better predict curing, fire risk, rate of fire spread, and the fire resources required.
- Researchers are currently describing fuel dynamics and fire behaviour from more than 40 experimental burns under very high fire danger weather conditions at Ngarkat Conservation Park, South Australia.

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.
- 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 above, 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 Kerryn 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 journals. Program B researchers have been successful in getting their work published in international journals that range in their scope and impact.

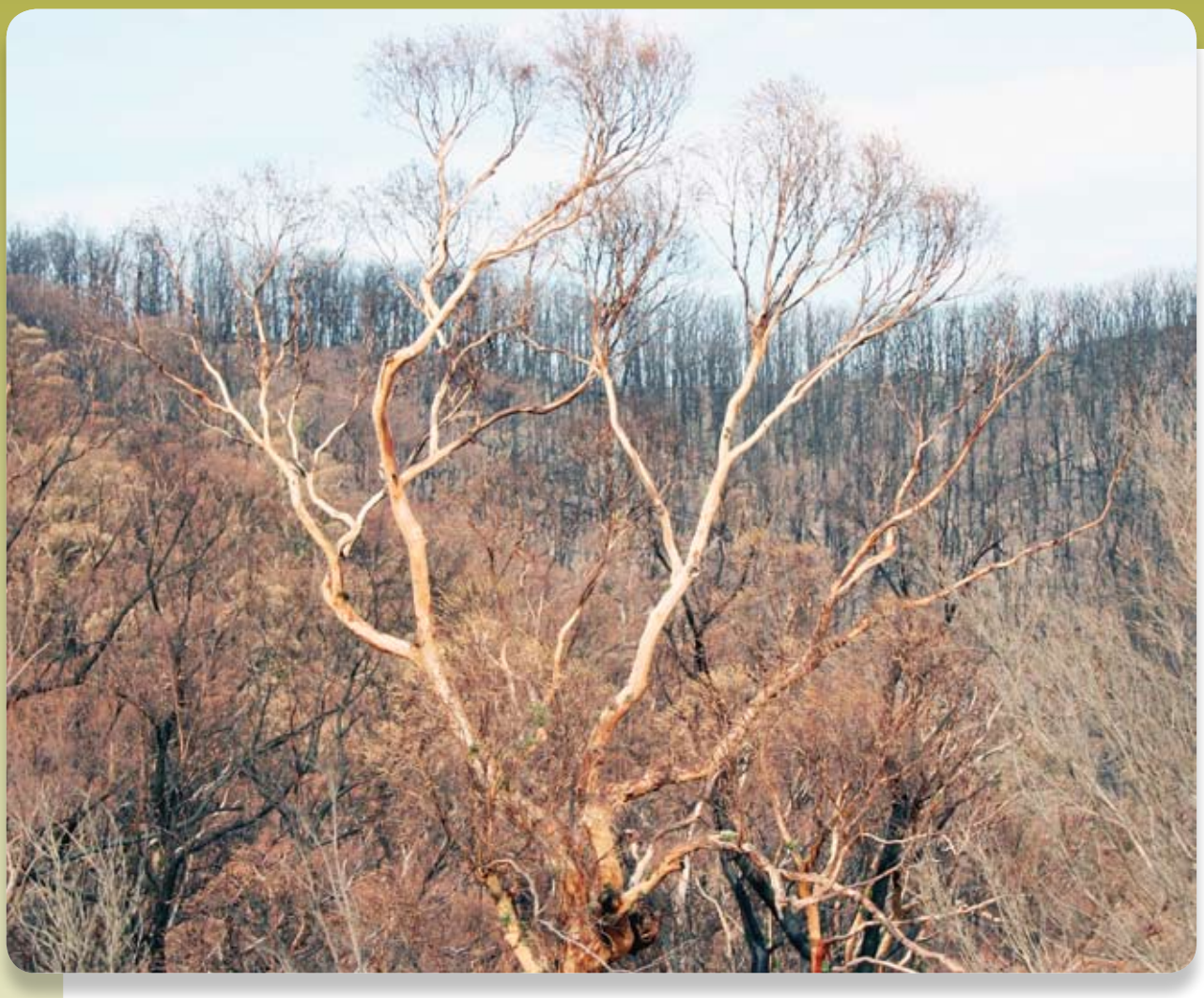
A key part of any assessment of research excellence (for example the *Excellence in Research for Australia* initiative, ERA), rests upon metrics such as citation and journal quality.

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 I*nternational 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.

PRESCRIBED BURNING: FIRE REGIMES AND BIODIVERSITY

Completed

- Changes in climate will almost certainly result in changes in fire frequency and severity, Bushfire CRC research has shown. This finding has many implications for fire and land managers in how the land is managed and how resources are allocated.
- Bushfire CRC research has shown how all fires – prescribed fires and bushfires, from the Top End to alpine country – carry implications for biodiversity. There are significant negative impacts on biodiversity for many ecosystems if fire intervals are less than two to three years. However, fire intervals of five to 10 years have few, if any, discernable negative impacts, provided there is sufficient diversity in fire frequency and intensity.
- Long-term research sites across the high country of Victoria, New South Wales and the ACT have shown the critical impacts of fire on water quality and yield in both the short and long term. Short-term increases in yield are offset by reductions in quality, for example the siltation after fire affects rivers and water storages. Long-term reductions in yield from regenerating forests will pose considerable risks to flows in major rivers and to residential water supplies.
- The same high country research has also shown the critical impacts of fire on both the short and long-term carbon balance of ecosystems. The effect of fires on soil carbon is emerging as one of the great unknowns in the global carbon cycle. This research on soil carbon will provide an essential knowledge base for community, industry and government bodies developing Emissions Trading Schemes.
- Many plants and animals act as 'indicator species' – they can indicate the effects of fires on a wider range of other species and processes. Researchers have looked at a range of soil and litter dwelling invertebrates in areas that differ in vegetation and climate from around Australia to assess the effect of fires on biodiversity.

Ongoing

- *Fighting Fire with Fire* – this soon to be published book discusses the role of fire in Australia's ecosystems, and how to manage fire both for safety and for biodiversity.
- Research is now identifying a number of classes of compounds that are common in smoke from eucalypt fires, which have the potential to be used in predictive smoke models.

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 of 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 La Trobe 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. 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 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 postgraduate 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 Leave 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.

Professor 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	John Beale	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 Leave 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.

THE COMMUNITY

LIVING WITH FIRE

Bushfire CRC 2003 - 2009 RESEARCH HIGHLIGHT

Completed

- A study of 100 years of bushfire deaths in Australia looked at the circumstances of the deaths in order to better target community safety warnings and campaigns.
- A study of the New South Wales Fire Brigades Community Fire Units has provided a basis for all fire management agencies in evaluating and developing programs to organise and resource local communities to supplement the work of professional fire brigades.
- Educating children about bushfire risk – this study has looked at how children understand bushfire.
- *Community Bushfire Safety* – this book is a comprehensive summary of findings from all the community safety projects in the Bushfire CRC, drawing from the social sciences, economics and law. It provides a sound basis for the operational planning of fire agencies and other government and non-government organisations dealing with communities facing the bushfire threat.
- *Communities Living with Hazards* – this book features Bushfire CRC researchers at the Centre for Disaster Studies, James Cook University. It provides new knowledge on how communities understand and respond to the bushfire threat.
- A report on newly arrived Sudanese refugees in Queensland and their understanding of fire hazards assisted the QFRS in dealing with communities from a non-English speaking background.
- A report on bushfires and how they are understood by communities compared the responses of a number of communities across Australia.
- A literature review on bushfire arson showed the current state of knowledge; its links to urban arson, the age and background of arsonists, and the times and places of offences. This review is essential reading for fire agencies and law enforcement authorities attempting to combat arson in bushfire areas.
- Bushfire arson – 53 bulletins have been published to date and are publicly available for discussion and advice. This series is building the knowledge of all aspects of bushfire arson; who lights fires, why they do it, and what the authorities can do about it.
- A review of the legal underpinning of the Prepare, Stay and Defend or Go Early policy analysed the shift in risk and responsibility between the homeowner and the authorities. This legal analysis is an essential complement to the broader research project on this policy and is aimed at managers responsible for implementing this policy into practice.
- A report on the nature and effectives of intervention programs for juvenile arson has been distributed to fire agencies and law enforcement organisations.
- A comprehensive review of trends in deliberately lit vegetation fires across Australia was distributed to AFAC Groups and individual agencies to better understand the nature of bushfire arson.
- A report on better engagement between fire agencies and the media has been used by agencies to better plan their media communications during bushfire incidents.
- What makes communities resilient to bushfires? A study in the high country of Australia documented how people prepare, face and recover from bushfires.
- Bushfire education, awareness and engagement programs: researchers have conducted an evaluation of a range of programs to assess what is the most cost-effective model.

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 firefighters through research into building protection, firefighter 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.
- 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 by mid-2010 are:

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

Firefighter health

In the early stages of this project, it was determined that a more accurate picture of firefighting effort was required before fitness-for-purpose research could be further progressed. To this end 31 Victorian rural firefighters 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 firefighting training centres. Most recently the Victorian Black Saturday fires were used to assess the effect on firefighters arriving for duty in a dehydrated condition.

To better inform procedures to be used in future assessments of the operational fitness of firefighters, 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 firefighters when assigning work tasks. The outcomes of this survey raised considerable

interest among volunteer firefighters 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 of 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 Cowlishaw 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.

SMOKE MANAGEMENT

Completed

- A project looking at firefighter exposure to air toxics has identified and measured the toxicity of bushfire smoke. A handy field guide and a more detailed reference guide have been distributed within the industry.
- The results of these projects are being used by fire managers to regulate firefighter exposure to smoke during both bushfires and prescribed burns. A better understanding of what is in the smoke can lead to better advice to communities in rural and interface areas on how to deal with smoke exposure.
- A report into the effectiveness of several types of smoke masks for fire fighters compared their performance under bushfire conditions. This report was used by the Fire and Emergency Services Authority in Western Australia to endorse the use of a particulate/organic vapour/formaldehyde filter for its career firefighters.
- A literature review has been completed on current smoke sampling and analytical techniques.
- Researchers have compared the impacts of prescribed fire and wildfire, taking in factors such as the contents of the smoke, implications for public health and the impact of releasing greenhouse gases.

FIREFIGHTER HEALTH, SAFETY AND FITNESS

Completed

- Researchers have looked at the human factors that influence decision making on the fireground – such as physical and mental stress, group pressures at crew and management level, and the individuals on thought processes. The project has produced a field guide on how to best conduct interviews after incidents.
- Research has looked at how fire managers and firefighters consider worst case scenarios – how are they best used to improve decision making and, importantly, how they can be included in training programs.
- Fighting fatigue while fighting bushfire – this research has published an overview of factors contributing to firefighter fatigue during bushfire suppression work. It is providing excellent baseline data for agencies to develop fatigue, hydration and fitness guidelines.
- Fighting with fire – this is a report on how bushfire suppression can impact on firefighters' health.
- Research has quantified the work demands of tanker-based fire suppression. This will enable fire managers to better allocate resources for crew management on the fireground
- Researchers are studying how to make interagency Incident Management Teams more effective with information flows. The results are helping IMTs, both in the rural and urban context, better understand how IMT members can work together and how training programs can be structured accordingly.

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 Firefighter health and safety	David Nichols	To improve the safety, health and general well-being of volunteer and career firefighters in their firefighting 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 le arning	Christine Owen	To improve teamwork effectiveness and subsequent organisational and cross-organisational learning.

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 postgraduates and several postgraduate completions.
- Support and assistance to postgraduates 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.
- 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 postgraduate students. As a result it has supported increasing the number of postgraduates entering the industry.

The Bushfire CRC allocated 44 postgraduate 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 postdoctoral researchers are also involved in overseas collaborations.

Involvement of industry in research supervision

All scholarships have been sponsored by an industry agency and postgraduates have regular contact with end users to ensure the research meets targeted industry needs. Each postgraduate has an industry supervisor working in combination with the university supervisor to give an industry-focussed 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 postgraduates. As examples:

- The research of a postgraduate 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.
- •wo 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 the 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 postgraduate student has been interviewed about their research on film. These videos have been uploaded to *YouTube* 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 postgraduate skills include: the Federal Department of Climate Change; 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.
- 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.
- Firefighter 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.
- Firefighter health and safety including safer decision-making.
- 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	Bushfire Incident Response	Adelaide	75, including four Chief Fire Officers	September
Book launch	*Wildfire in the High Country*	Melbourne	65 Launched by Victorian Minister for Emergency Services	October
International Research Seminar	Scott Stephens presented on Fire at Stand and Landscape Scale in California	University of California	55 Coordinated by Bushfire CRC	November
International Research Seminar	Sarah McCaffrey presented on Social science and fuel management, a US perspective	Melbourne	60	March
Workshop	Prepare, Stay and Defend or Leave Early – 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, 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 firefighters.

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, while 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 undergraduate 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.
  - 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.

COMMUNICATIONS STRATEGY

The communications strategy promotes the research and activities of the Bushfire CRC among stakeholders and to the broader community. The strategy complements the communications 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:

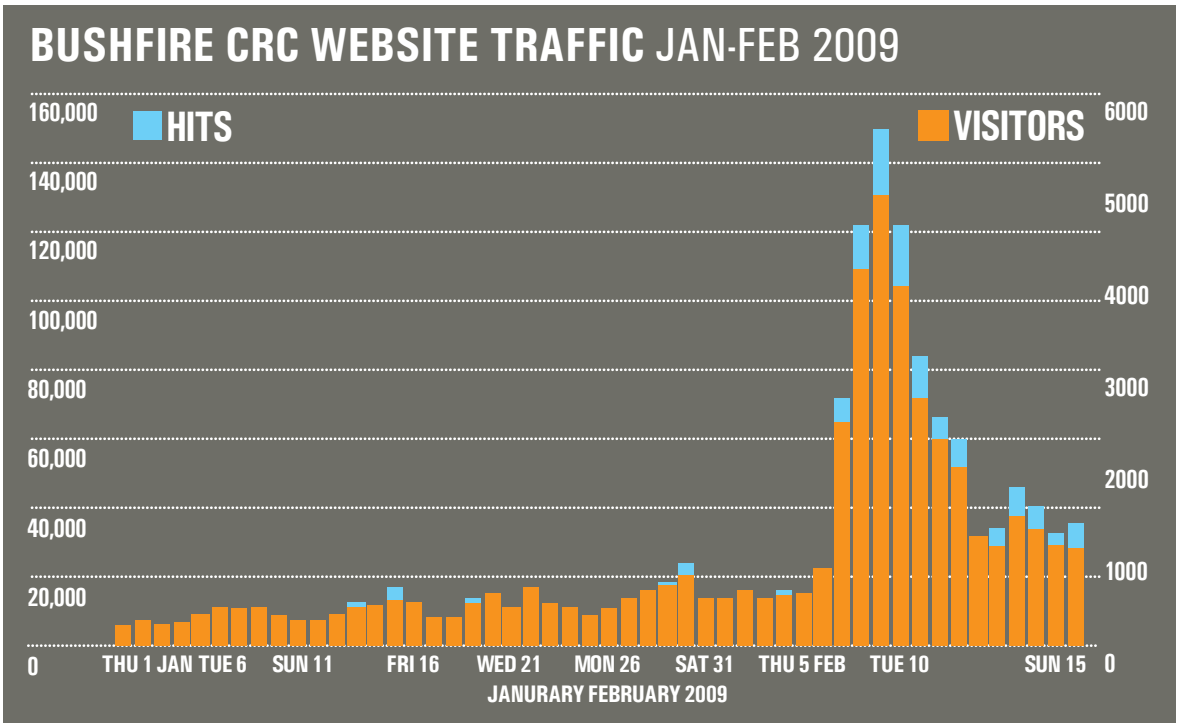
- Online communications.
- Publications.
- Media.
- Events.

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 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
- 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 15th 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 delegates' memory sticks 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 2007-08* – 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) 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 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 (pictured right).

Student skills

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

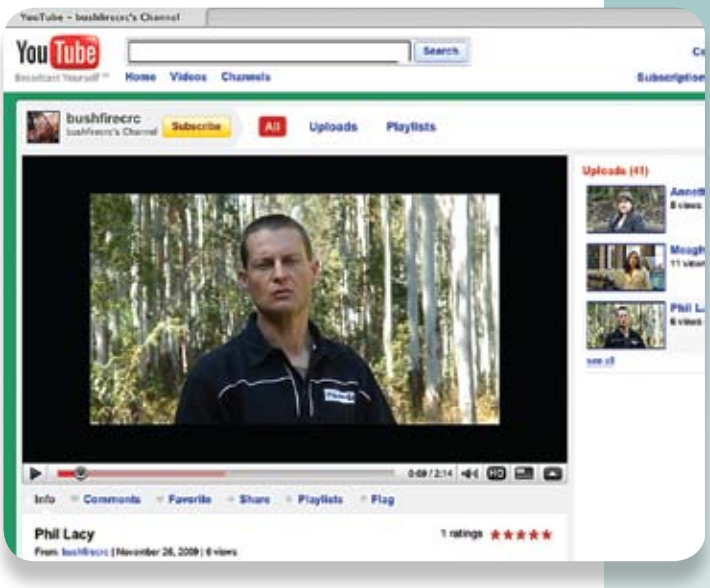
Communications workshop

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 postgraduate 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 46) 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 (top, right) 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 (below, right) 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

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.

VOLUNTEERS

Completed

- A study has looked at the impact of volunteering on the wider family and how this influences recruitment and retention.
- A study of new recruits to the CFA in Victoria identified issues of recruitment and induction after six months in the service, and issues regarding rewards and retention after 12 months. A CFA volunteer recruitment campaign was implemented based upon these findings.
- The QFRS recruitment campaign used Bushfire CRC research to guide its direction and to develop written materials and advertising.
- A study of the impact of mandatory fitness standards on Tasmanian operational volunteer firefighter numbers found more than a third of its members may not meet the fitness standard if it were to be introduced. The report recommended that agencies recruit and retain more younger volunteers, increase the fitness levels of current volunteers, and review the roles and tasks of operational volunteers.
- A study of recognition and awards for volunteer firefighters provided a comparative guide to what is being done across Australia's fire services to recognise volunteers services and, ultimately, to minimise attrition.
- A study of RFS volunteers in NSW uncovered the barriers to volunteering and led to recommendations on making volunteering more attractive and supported.
- Separate surveys of women volunteers (ACT Rural Fire Service and South Australia Country Fire Service) found a range of barriers to female volunteers that agencies could address. Some barriers were external (family and work responsibilities, concern about physical demands), others internal (male-designed protective clothing, lack of female toilets, high storage of heavy equipment, some male colleagues not supportive of female volunteers, others overprotective).
- Employers of volunteers in NSW have been surveyed on the impact to their businesses and on how they can be better educated and supportive of their staff who are volunteers.
- A study is providing information to agencies as they prepare campaigns to recruit and retain volunteers from non-English speaking backgrounds.

APPENDIX A

BUSHFIRE CRC students – employed – June 2009

Name	Project title	Status/due date	Employer
Phil Lacy, PhD	Burning under young eucalypts	submitted	PF Olsen
Madeline Osborn, PhD	The role of fungi in fire prone forest communities	submitted	DAFF - ACT
Francesca Harris-Spence, PhD	Catchment management groups – volunteer community organisations and bushfire management	2009	DAFF - ACT
Alan Rhodes, PhD	Evaluation of the "stay or go" policy and community preparedness	2009	CFA - VIC
Phil Zylstra, PhD	Plant species contributions to fire intensity – towards a total fuels model	2009	NSW NPWS - DECC - Cooma
Rohan Sadler, PhD	Long term monitoring and modelling in quantifying the role of fire in grasslands	submitted	UWA
Brendan Pippen, PhD	Predicting factors affecting fire behaviour in heathland vegetation.	submitted	Dept Climate Change-ACT
Annemarie De Vos, PhD	Health effects of occupational exposure to bushfire smoke in WA	submitted	Asthma CRC-WA
Karyn Bosomworth, PhD	Does current bushfire risk management policy and practice support community and natural resource resilience to climate change?	2010	DSE - VIC
Adam Leavesley, PhD	Impact of fire mosaic on birds in mulga woodlands of central Australia.	submitted	Bushfires NT
Paul Fox Hughes, MA	A meteorological investigation of the "Springtime Bump" in Tasmania.	2009	Bureau of Meteorology, Tasmania
Laura Kelly, MA	Community resilience to and recovery from wildfire in New Zealand	submitted	Working in the UK
Rob De Ligt, Hons	Patterns in the probability of burning with time-since-fire in the Greater Sydney region	submitted	ANU
Josh Whittaker, PhD	Adaptive capacity and social resilience to bushfires in southeast Australia	submitted	RMIT – Centre for Risk and Community Safety
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
Bevan McBeth, PhD	Soil, fire and physiological processes and dieback in coastal eucalypt forests.	2009	Southern Cross University

Name	Project title	Status/due date	Employer
Sonia Whiteley, PhD (unfunded)	Preparing for the worst: measuring the outcomes of community bushfire safety programs	2009	Department of Justice, VIC
Meaghan Jenkins, PhD	Carbon budgets and implications for fuel load and flammability of shrub-dominated ecosystems in the high country	submitted	University of Sydney
Tim Prior, PhD	Community responses to bushfire threat	submitted	UTS - Institute of Sustainable Futures
Jaymie Norris, PhD	Microbial clues for ecological sustainable management of fire prone landscapes.	2009	DSE - VIC
Ken Scott, PhD	Fire & savannah grass ecology	submitted	NT Gov – fire management
Matt Phillips, PhD	Physiological demands of Australian volunteer fire-fighters during bushfire suppression	2009	Dept Defence – ACT
Andrew Edwards, PhD	An alogorithm for mapping burn severity from satellite remote sensing: tropical savannahs, northern Australia.	2009	Bushfires NT
Mae Proudley, MA	Reducing bushfire risk through improved household decision making.	submitted	RMIT
Sean Cowlishaw, PhD	Effects of Fire Service Volunteering on families of volunteers	submitted	University of Hong Kong

BUSHFIRE CRC students – in study – June 2009

Name	Project title	Due date	Supervisor
Annette Salter, PhD	Applications of multi-media education strategies in fire behaviourcomplete 3/20complete 3/2010complete 3/2010	2010	Dr Christine Owen UTAS
Kerryn McTaggart, PhD	The effect of fire on soil microbial populations and their processes in Australian alpine ecosystems.	2009	Dr Tina Bell, University of Melbourne
Lyndsey Vivian, PhD	Determinants of variation in fire response types in the composition of montane plant communities.	2009	Dr Geoff Cary ANU
Bryony Horton, PhD	Fire management and tree decline: mycorrhizal indicators of declining forest health.	2009	Dr Neil Davidson UTAS
Carola Karramotto de Bednarik, PhD	Relative importance of fir regimes, environmental gradients and climate change for rainforest distribution in the Sydney region.	2009	Dr Geoff Cary ANU

Name	Project title	Due date	Supervisor
Alison O'Donnell, PhD	Fire patterns and vegetation structure in semi-arid south-east western Australia	2009	Dr Lachie McCaw, DEC WA Dr Pauline Grierson UWA
Rowena Morris, PhD	The effect of prescribed burning on sediment movement in the Mt Lofty Ranges	2009	Dr Meredith Henderson SA DEH
Anne Miehs, PhD	The role of coarse woody debris in fire-prone forests: Achieving both fire management and conservation objectives.	2009	Dr Alan York University of Melbourne
Briony Towers, PhD	Developmental perspective on bushfire risk communication	2009	Prof Douglas Paton UTAS
Claire Johnston, PhD	Worst Case Scenarios: their role in safe decision making in bushfire fighting.	2009	Dr Mary Omodei, La Trobe University
Dane Hansen, PhD	Characterization of the volatile organic components adsorbed to particulates generated in bushfires	2009	Dr Fabienne Reisen CSIRO
Ian Dwyer, PhD	Communication strategies and collaborative work practices in high-reliability workplaces: A study of coordination centres.	2010	Dr Christine Owen UTAS
Greg Hickey, PhD	Enhancing effective multi agency operations.	2009	Dr Christine Owen UTAS
Julian Black, PhD	Predicting the dynamic spatial pattern of fire front progress and fire destruction in the rural urban interface zone	2009	Dr Raphaele Blanchi, CSIRO
Christine Eriksen, PhD (project support only)	Local environmental knowledge of bushfire management: a case study of new rural landscapes in NSW	2010	Dr Nicholas Gill, UOW
Jennifer Hollis, PhD	Coarse woody fuel availability and consumption in Australian forest fires	2010	Dr Lachie McCaw, DEC
Peter Hayes, PhDPhd	Do teams that have worked together make better teams than ad hoc teams?	2010	Dr Mary Omodei, La Trobe University
Jenni Raines PhD	Fatigue and recovery in rural Australian bushfires	2010	Dr Brad Aisbett, Deakin University
Helen Daily PhD	Development of pasture growth models for grassland fire danger risk assessment	2010	Dr Stuart Anderson, SCION Dr Peter Lane UTAS

APPENDIX B

Financial statements, BUSHFIRE CRC LTD

Statement of financial performance for the year ending 30 June 2009.

Key points:

- Surplus of $553,364 for the year compared to a loss of $1,088,159 in the previous year.
- The balance sheet shows a positive equity position of $85,176 as at June 30 compared to a negative equity of $468,188.
- The Bushfire CRC is in a strong cash position with cash held on deposit at June 30 of $4,406,366.
- In Kind Contributions by the CRC partners for the year totalled $10,450,000 against budget of $8,720,000

INCOME STATEMENT FOR THE YEAR ENDED 30 JUNE 2009

	$	$
	2008-09	**2007-08**
Revenue from ordinary activities	6,430,984	6,225,000
Other income	1,372,936	534,450
	7,803,920	**6,759,450**
Employee benefits expense	(613,428)	(622,926)
Depreciation and amortisation expense	(20,694)	(55,366)
Research program expense	(5,823,635)	(6,506,432)
Rent & outgoings	(127,444)	(124,972)
Meetings & conferences	(226,493)	(208,554)
Other expenses	(438,862)	(329,359)
	(7,250,556)	**(7,847,609)**
Surplus from continuing operations	**553,364**	**(1,088,159)**

BALANCE SHEET AS AT 30 JUNE, 2009

	$	$
CURRENT ASSETS	**2008-09**	**2007-08**
Cash	4,406,366	3,304,084
Trade receivables	1,084,587	158,603
Other	9,158	52,266
TOTAL CURRENT ASSETS	**5,500,111**	**3,514,953**
NON CURRENT ASSETS		
Property, plant & equipment	31,803	67,707
TOTAL ASSETS	**5,531,914**	**3,582,660**
CURRENT LIABILITIES		
Trade and other payables	1,257,629	654,045
Short term borrowings	0	6,688
Provisions	73,662	42,139
Accrued expenses and prepaid income	4,115,447	3,347,976
TOTAL CURRENT LIABILITIES	**5,446,738**	**4,050,848**
TOTAL LIABILITIES	**5,446,738**	**4,050,848**
NET ASSETS	**85,176**	**(468,188)**
EQUITY		
Retained Earnings/(accumulated losses)	85,176	(468,188)
TOTAL EQUITY	**85,176**	**(468,188)**

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

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ACT DEPARTMENT OF JUSTICE & COMMUNITY SAFETY

University of Wollongong

Government of South Australia
Department for Environment and Heritage

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METROPOLITAN FIRE SERVICE S.A.

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