

// NOISSIM

TO ENHANCE THE MANAGEMENT OF THE BUSHFIRE RISK TO THE COMMUNITY IN AN ECONOMICALLY AND ECOLOGICALLY SUSTAINABLE MANNER.

OBJECTIVES //

TO DEVELOP AN INTERNATIONALLY RENOWNED CENTRE OF EXCELLENCE TO LEAD AND COORDINATE BUSHFIRE RESEARCH IN AUSTRALIA BY:

- Stablishing a sustainable output of university graduates to specifically undertake research into bushfire and hence build the Australasian knowledge base relating to bushfire
- Maintaining the biodiversity of Australasia through improved bushfire management based on knowledge of the impact and positive use of bushfire in relation to sustainable resource management
- Facilitating the transfer of the innovative technology component of outcomes to industry through appropriate commercial arrangements that generate revenue streams to further the pursuit of the objectives

- TO PROVIDE A RESEARCH FRAMEWORK THAT WILL IMPROVE THE EFFECTIVENESS OF BUSHFIRE MANAGEMENT AGENCIES BY:
- Pacilitating Australasian collaboration between end users and researchers to specify outcomes (products and services) that improve community safety and firefighter wellbeing, protect property and reduce risk and cost associated with the sustainable management of bushfire
- > Ensuring the expectations of end users in terms of usefulness and performance of research are fully met to encourage a high level of adoption of future outcomes
- > Ensuring the timely and appropriate delivery of outcomes through continuous end user evaluation

- TO INCREASE THE SELF- SUFFICIENCY OF COMMUNITIES IN MANAGING THE RISKS FROM BUSHFIRES BY:
- Understanding and encouraging appropriate community behaviour toward bushfires
- > Increasing the understanding of the role and importance of volunteerism in relation to the management of Australasian bushfire

TO COMMERCIALISE OR OTHERWISE MAKE AVAILABLE CENTRE INTELLECTUAL PROPERTY IN SUCH A MANNER AS TO ENSURE THAT THE MAXIMUM BENEIT ACCRUES TO AUSTRALIA, INCLUDING AUSTRALIAN INDUSTRY, THE PARTIES, THE AUSTRALIAN ECONOMY GENERALLY, AND

TO PROMOTE THE OBJECTIVES OF THE CRC PROGRAM

PHOTOS COURTESY 0F: NSW fire brigade

NSW fire brigade
CSIRO Forestry and Forest Produ
CSIRO Atmospheric Research

MFB DSE ORFS Timber Promotion Council

Kevin Tolhurst
Brett Hardy, Parks Victori
Alan Wain, BoM
Brad Mahoney, DSE
Simon Milner, DSE

Rachel Dawkins, DSE
Dave Nichols, CFA
Trevor Meers
Cameron Wade RFS
Ian Dicker NSW NPWS
Colin Jolliffe, CFA Victo

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01

XECUTIVE SUMMARY

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY



IN MAC DOUGA

CHAIRMAN'S REPORT

The Bushfire CRC has completed its first year of operation during a period of intense focus on the management of bushfires following the disastrous fires of January 2003, and the major fires of the summer of 2001-2002. This has emphasised the timeliness of the establishment of this new CRC representing the first truly national and comprehensive approach to bushfire research in Australasia

The Bushfire CRC's research program addresses some of the key issues of concern to fire and land management agencies, governments and the community related to improved management of bushfires. These include hazard reduction or prescribed burning, the effectiveness of aerial suppression and ways of making houses less

The make-up of the Centre's research program, and the operating structure that ensures close coordination between the enduser fire and land management agencies and the researchers, mean that the Bushfire CRC is well placed to respond to the research issues that have or will emerge from the various inquiries that were established following the 2003 fires. Because these fires caused so much concern and controversy, responding to all research issues in the shorter timescales now expected will be a major challenge.

A key feature of the CRC's early life has been the strong support of State, Territory and Federal governments. The partners of the CRC include major rural and urban fire authorities, land management agencies, key universities, CSIRO and key Federal bodies such as the Bureau of Meteorology, Emergency Management Australia and the Australian Building Codes Board, as well as our New Zealand fire and forestry research colleagues. The strength of this collaboration will be a major influence on the future success of the Bushfire CRC in Australasia and globally.

research program I am pleased to note the significant achievements in the first year, as described in the CEO's report and in more detail in the chapter on research. Progress has been very good on key research into fire behaviour, weather forecasting, management of fire in the landscape, the impact of fire on biodiversity, how to foster safer communities, and how to improve protection of people and property.

I'm particularly pleased that the CRC is making good progress in the fledgling area of the economics of bushfires. While some data on economic losses from bushfires is available, little work has been done or the economic value of the investment in fire and land management activity. I believe research work in this area could become one the Bushfire CRC's most significant achievements.

While the education program has faced some challenges in securing enough high quality candidates for scholarships, this is clearly an area of high priority in working towards a new generation of researchers across the disciplines needed to address fire research in an integrated way.

t is pleasing that we gained a new partner during the year – the South Australian Department of Heritage and the Environment – and that several others are in the process of or have expressed interest in joining. The level of international interest in the Bushfire CRC is strong – helped by the International Conference on Wildland Fire in Sydney in October 2003, and overseas visits by the CEO and several of our researchers.

The CRC's Board has met monthly and worked very constructively in making the key appointment of the CEO, and setting in place strong governance and strategic planning frameworks. After an extensive search, the Board appointed Kevin O'Loughlin to the position of Chief Executive Officer in September 2003. Mr O'Loughlin has extensive experience as a scientist, and in management and leadership roles in the Commonwealth Bureau of Meteorology and internationally,

including roles as State Regional Director in Victoria and New South Wales, and Deputy Director in the Bureau's national office.

The Board membership changes during the year included the replacement of Kevin O'Loughlin by Dr Ray Canterford, of the Bureau of Meteorology, after Mr O'Loughlin took up the position of CEO, and the replacement of Independent Board member Joanne Bloch, Deputy CEO of the Investment and Financial Services Association, by Anne Gardiner, Company Secretary for the Challenger Group, when Ms Bloch resigned in January 2004 to accompany her family overseas. Details of the current Board membership appear later in the report.

That the Bushfire CRC can show substantial progress on much of its research agenda and is operating smoothly at the completion of its first operational year, reflects great credit on the researchers themselves, and on the management team of the CEO, Centre staff and Program Leaders. I appreciate their efforts very much.

While the Centre's staffing was progressively established during the year, it is important I acknowledge the excellent efforts of people who worked hard to put the original program together and get the CRC established. In particular, I acknowledge Len Foster, CEO of the Australasian Fire Authorities Council (AFAC), whose guidance was invaluable, Geoff Spring of the Victorian Country Fire Authority, who was seconded as project director in the setting up of the CRC, and the End User Leaders, Program Leaders, researchers, AFAC staff and consultants who worked hard on the original proposal.

I also appreciate the personal interest in the CRC taken by the Minister for Science, the Hon. Peter McGauran, who officially launched the CRC at a ceremony in Fitzroy Gardens, Melbourne, on 9 December 2003.

Finally I acknowledge the value of the strong links between the research and user communities in this CRC, epitomised by the colocation of the CRC's office with the office of AFAC. This is not only costeffective, it also helps ensure the CRC's research is carried out in a way that maximises the opportunities to add value to fire and land manager partners.

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lan Mac Dougall Chairman



L-R: SCIENCE MINISTER THE HON. PETER MCGAURAN, KEVIN O'LOUGHLIN, IAN MAC DOUGALL, MARK ADAMS AND KEVIN TOLHURST AT THE LAUNCH O THE BUSHFIRE CRC

EXECUTIVE SUMMARY



VIN O'LOUGHLI

CEO'S REPORT

The Bushfire CRC's first year of operation has featured exciting early progress on its research agenda, a strengthening of the connection between researchers and the fire and emergency services industry, new partner interest and significant interaction internationally.

A major background feature of the report year July 2003 to June 2004 has been the follow-up in several jurisdictions to the disastrous fires that affected Canberra and large parts of Victoria and New South Wales in January 2003. Extraordinary interest in the community and by governments built on pre-existing concerns arising from the extensive fires that affected Sydney and large areas of New South Wales in 2001-02, and continuing major drought conditions over much of eastern Australia. These significantly influenced the work undertaken in 2002 to set up the Bushfire CRC, and the priority given to research on contentious issues such as hazard reduction burning and aerial suppression.

Fire also featured prominently on the international disaster scene when the northern hemisphere summer of 2003 saw extensive fires in locations as varied as Portugal, Spain, France, Greece, California and Canada.

It is significant that the fires in Australia and in the northern hemisphere were quite exceptional in terms of severity, extent and duration. In the context of these major wild fires and the impacts on their communities, the Bushfire CRC's program of multi-disciplinary research is a timely contribution to fire research in Australasia and, potentially, on a wider global scale.

As is detailed in the chapter on research in this report, progress on the Centre's research agenda has been very encouraging. The CRC framework is already showing the benefits of close user-researcher interaction and an integrated, multi-disciplinary approach to the research. A major experimental burn at Tumbarumba, NSW, in February 2004, provided an excellent

example because a number of projects were able to leverage off the main fire behaviour objectives. The experiment could not have been undertaken without extensive cooperation from fire, land management and forestry agencies, and volunteer fire fighters.

The research program's diversity of topics is one of its main strengths. Research areas feature the expected topics of fire behaviour, fire weather, management of fire in the landscape, the impact of fire on biodiversity, and improved fire suppression and protection technology. But equally, the program has a strong focus on important areas of social and economic research related to bushfires. While a major focus is on providing fire and land management agencies with improved knowledge and techniques for managing bushfire risk, the CRC is also engaging with the community and other sectors of industry such as the insurance and building materials sectors. The prescribed, or hazard reduction

burning issue, is a good example of the need for a multi-disciplinary approach, and of the need to engage with the community to achieve greater understanding of a complex topic.

The CRC's research on the current and likely future state of volunteerism is already gaining good feedback from the volunteerbased fire agencies. Research on effective decision-making is another area of psychological research that promises practical results for the operational agencies.

Another major strength of the CRC is the geographic diversity represented by both the partners and the research program.

Research activity ranges from southwest Tasmania to Darwin and from Western Australia to New Zealand. This geographic spread provides an important perspective. The fires in south eastern Australia in recent years have been disastrous, while bushfires in northern and remote areas of

Australia are more often seen as part of the natural cycle, and therefore can be perceived to be "good".

The Western Australian perspective is one of more than 70 years of active management of fire in the landscape, coupled with a commitment to research. It was pleasing to see that the strength of collaboration between the research and user communities in Western Australia saw progress towards the setting up of a "WA node" of the Bushfire CRC. Similarly our most eastern partners in New Zealand provide another perspective on the integration of community protection with that of highly valued commercial forestry assets.

The diversity of topics and geographic spread of both research and user partners have presented particular challenges in communication and coordination.

The CRC held a research workshop back to back with a Stakeholder Council meeting in December 2003, and started a series of smaller program-based workshops, and

State and Territory-based research forums to enable user-researcher interaction on a geographic basis.

The Bushfire CRC's Education Program is making good progress after a slow start affected by delays in formal completion of partner accession to the Commonwealth Agreement, staffing the Education Coordinator's position and attracting enough quality scholarship candidates. The program has accelerated well in the latter part of the financial year and good progress is being made towards the long-term target of an additional 40 higher degree researchers flowing from CRC scholarships. The launch of an innovative education project at the Northern Territory Wildlife Park near Darwin in May 2004 was one of the year's highlights.

The Bushfire CRC is giving attention to links with others working in the fire research field or in related endeavours. We are developing relations with other CRCs that are either working in some area of fire

research, such as the Tropical
Savannas CRC and the Desert
Knowledge CRC, or on related topics
such as the CRC for Spatial
Information. We also aim to provide
a focal point for the exchange of
information among those working
on bushfire research, following the
Minister for Science's decision that
the Bushfire CRC should provide a
vehicle for advice on bushfire
science in lieu of the previously
established Bushfire Research
Advisory Group.

It is pleasing to report that awareness of the Bushfire CRC is already high internationally. The timing of the Third International Wildland Fire Conference in Sydney in October 2003 provided an excellent opportunity for the CRC to make an early impact internationally. This Conference attracted around 1100 delegates from more than 60 countries. The CRC featured with a number of presentations, including an overview of the CRC's plans by Chairman Ian Mac Dougall, several poster contributions, and a launch

by Science Minister, the Hon. Peter McGauran, of a book on experimental fires in the Northern Territory by CSIRO's Dr Alan Andersen and others.

Other international highlights included CRC-sponsored visits for four researchers, and a valuable opportunity I had to attend a review meeting in Spain of a major European Commission-funded fire research project. A conference on the economics of wild fire attended by Professor John Handmer and Beth Proudley of RMIT provided valuable linkages to international research in this fledgling area. It was also pleasing to note that we have attracted several international post- doctoral researchers to work in the CRC.

The public profile of the Bushfire CRC is high. It was reinforced by a well-publicised official launch by the Minister for Science in the Fitzroy Gardens, Melbourne, on 9 December 2003. The launch generated considerable national media coverage.

A major challenge towards the end of the year was that of responding effectively to various inquiries undertaken in 2003. Numerous recommendations from these have direct implications for the Bushfire CRC's work. In particular, the Bushfire CRC has interacted strongly with the Council of Australian Governments (COAG) National Inquiry on Bushfire Mitigation and Management. Effective response to accommodate new work arising from these inquiries, or to accelerate research on existing key issues, will require adjustments to the resource levels and priorities set largely in late 2002. Nevertheless, I feel confident on the basis of progress this year, that the CRC's well-designed program places us well to respond to such new challenges.

Most of the people who have contributed to the successful first year of the Bushfire CRC are mentioned elsewhere in this report, but I would like to mention a few individuals and groups in particular.

In the early months of the CRC's first year prior to my appointment, Geoff Spring and Mavis Reynoldson from the Victorian CFA, consultant James Smith and newly-appointed Business Manager David Peterson did a great job setting up the Centre. They were guided by Australasian Fire Authorities Council (AFAC) CEO Len Foster, who played a central role in the successful bid for the Bushfire CRC and is now a member of the Board. The co-location of the CRC with AFAC is proving to be both efficient in the sharing of resources, and effective in helping to build stronger links between end users and researchers.

The CRC is especially fortunate to have such high quality and experienced Program Leaders for the research programs. They are working very effectively with Research Director Richard Thornton and me, and I believe we have a strong leadership team. I appreciate very much the hard work of all the staff working in the Centre. I also thank the members of the Stakeholder Council and members of the Board and Chairman Ian Mac Dougall, who have provided support and wise counsel to me during the year. I look forward to another exciting year ahead.

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Kevin O'Loughlin

KEVIN O'LOUGHLIN, CEO AND SCIENCE MINISTER THE HON. PETER MCGAURAN AT THE LAUNCH OF THE BUSHFIRE CRC



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INTRODUCTION

The Bushfire CRC operates through an incorporated "not for profit" company, Bushfire CRC Ltd. Participating agencies are members of the company.

Bushfire CRC Ltd was registered in March 2003 and began formal CRC operations in July 2003.

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

The Council meets twice a year to review and receive updates on the progress of research, communication and other activities, and to provide strategic advice to the Governing Board. The Governing Board, has nine members including

two independent members, and meets monthly. The company's constitution allows for participants contributing cash of \$100,000 p.a. or more to be able to vote and nominate members to the Governing Board. Both the Stakeholder Council and the Governing Board have the same independent Chairman, lan Mac Dougall.

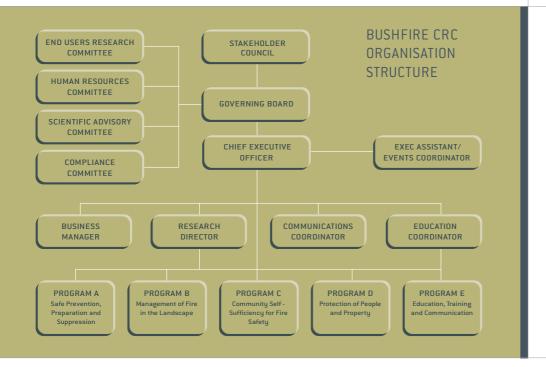
The Governing Board has three committees:

// A Compliance Committee which oversees audit responsibilities, finance and compliance. This Committee has a strong commitment to corporate governance

- // An End Users' Research Committee which ensures that the research conducted meets the strategic aims of the CRC and the needs of the users
- // A Human Resources Committee which manages the complex human resource issues surrounding a CRC.

Another Committee to be established in the second year is an external Scientific Advisory Committee. This Committee will report directly to the Governing Board. It will be a peer review group of two or three people, and will include at least one recognised international expert.

The Scientific Advisory Committee will conduct an annual review to ensure that all aspects of the Bushfire CRC science are of international quality standards.



GARY MORGAN, IAN MAC DOUGALL TIM VERCOE, SOPHIE PANOPOLOUS PHIL KOPERBERG, GARY NAIRN MP, ANNE GARDINER, RICHARD THORNTON, THE HON. KEVIN O'LOUGHLIN, FOSTER, MP, PHIL KOPERBERG, GARY NAIRN MF PETER MCGAURAN, DAVID PETERSON, JOHN GLEDHILL, ROBYN OWENS, STEV

GOVERNING BOARD

GOVERNING BOARD MEMBERS:

lan Mac Dougall

(Independent Chairman)

Anne Gardiner

Company Secretary, Challenger Financial Services Group Limited

Ray Canterford

Assistant Director, Commonwealth Bureau of Meteorology

Len Foster

Chief Executive Officer, Australasian Fire Authorities Council

John Gledhill

Chief Officer, Tasmania Fire Service

Phil Koperberg

Commissioner, NSW Rural Fire Service

Gary Morgan

Chief Fire Officer, Department of Sustainability and Environment, Victoria

Robyn Owens

Dean, Graduate Studies, University of Western Australia

Tim Vercoe

Director Asset Protection Centre, CSIRO - Forestry and Forest Products

GOVERNING BOARD COMMITTEES:

// Compliance Committee:

Anne Gardiner (Independent) Ray Canterford Robyn Owens

// Human Resources Committee:

lan Mac Dougall Len Foster Tim Vercoe Phil Koperberg

// End Users' Research Committee:

Phil Koperberg Gary Morgan John Gledhill Tim Vercoe



STRUCTURE AND MANAGEMENT

PARTNERS

CORE PARTNERS

Australian Building Codes Board

Commonwealth Bureau of Meteorology

Country Fire Authority of Victoria

CSIRO – Divisions of Manufacturing & Infrastructure Technology, Forestry and Forest Products and Sustainable Ecosystems

Emergency Management Australia

Fire and Emergency Services Authority of Western Australia

University of Melbourne, Forest and Ecosystem Science Institute

Melbourne Metropolitan Fire and Emergency Services Board New South Wales Fire Brigades

New South Wales Parks and Wildlife

New South Wales Rural Fire Service

Queensland Fire and Rescue Service

State Forests of New South Wales

Tasmanian Government

University of Western Australia

Department of Sustainability and Environment, Victoria

Department of Conservation and Land Management, Western Australia

ASSOCIATE PARTNERS

ACT Department of Justice and Community Safety

Australian National University

ACT Emergency Services Bureau

James Cook University

La Trobe University

New Zealand Forest Research

RMIT University

South Australian Country Fire Service

South Australian Department of Environment and Heritage

South Australian Metropolitan Fire Service

University of New South Wales

03

FRUCTURE AND MANAG

COMMERCIALISATION, TECHNOLOGY TRANSFER AND UTILISATION

COMMERCIALISATION, TECHNOLOGY TRANSFER AND UTILISATION

The primary goal of the Bushfire CRC is to carry out research that will be utilised by fire and land managers, emergency managers, industry and the broader community. The outcomes of this research will make a difference to those affected by bushfires or responsible for the protection of the nation's assets, private and environmental.

The Bushfire CRC gives high priority to ensuring that the research program is driven by our partners' needs and addresses strategically important issues. Active "user engagement" has been a key component in the successful adoption of research outputs, and integrated into the research program from the very beginning. In this CRC it was the user community which defined the research plans and directions.

The CEOs and chief fire officers of our partner fire and land management agencies are actively involved in the research programs. This high level of engagement ensures the CRC's researchers are well aware of end user priorities, and can access the people responsible for adopting key outputs.

The mission is to improve the management of the risk from bushfires in an economically and environmentally sustainable way. One of our key constituents is the general public, and the CRC's communications and education programs will focus on ensuring effective communication with stakeholders and the community. This may be through our partners, through informing the political debate, through university or school courses, or directly with various communities.

The Bushfire CRC appreciates that it will be judged by the effects its outputs have in making a significant difference to the community. These will be measured by:

// reduced risk of loss to people
 and property

- // increased growth in industries such as sustainable forestry or tourism
- // reduced costs of providing protection and fire fighting, through more effective and efficient policies and practices
- // better management of Australia's environmental assets
- // increased biodiversity, and
- // increased community awareness of and engagement in the issues surrounding fires in Australia.

STRATEGIES

The Bushfire CRC has a number of strategies in place to ensure the outputs of its research go beyond publication in quality scientific journals, and translate to outcomes for its partners and the community.

Strategies include:

1. Effective engagement of senior managers in the End User groups

The CEOs and senior managers of user groups are intimately involved at all levels of the research from serving on the Governing Board through being advisors (User Leaders) to each of the programs, to providing insight on individual projects. The research portfolio and budget is approved by a committee of the Board comprising CEOs and senior managers of the partners.

2. Understanding the adoption path

Each project has identified the path to utilisation as part of its project plan and is required to ensure there is strong engagement at all stages of the research.

3. Embedding end user groups within the research groups

Wherever possible, the CRC encourages end user organisations to be actively involved in the research. A number of the research

projects are actually managed in the user organisations by bringing in the universities and more traditional research providers. This close co-operation has two major advantages:

- // The research progress and directions are closely matched to the needs of, and owned by the end users.
- // Technology transfer is carried through the people in the project. This will enhance prospects of strong retention within the end user organisations, including beyond the life of the CRC.

4. Regular updates and forums to ensure that all parties to the CRC are informed and engaged

The CRC plans a series of State and Territory-based research forums. These will combine with a more general "meet the CRC" session to help engage the broader community. CRC newsletters and update bulletins will help the communication process and strengthen partnerships.

5. Strong educational program

The Bushfire CRC's Education Program is a core element of its strategy for utilisation and technology transfer. One of the major goals of the CRC is to ensure there is a new generation of fire researchers coming through and learning from the senior researchers. The Education Program also focuses on how to communicate research outputs to stakeholders and the community. This will be achieved by working with CRC partner agencies and through specific targeted documents and guides.

6. Targeting information resources

The CRC will investigate the development of targeted information resources utilising university and TAFE courses, school information and public resources. For example, in a project the CRC is running in conjunction with the Territory Wildlife Park in Darwin, a substantial part of the research program is focused on an educational program aimed at the

park's visitors, providing an insight into the factors affecting biodiversity and fire in the Northern Territory. It is hoped that opportunities for similar projects in other states can be explored through CRC.

7. A clearinghouse for bushfire

The Bushfire CRC recognises there are other significant pockets of research into the effects of fire, and will take steps to develop information exchange and collaboration among a larger community of fire researchers whose work may become more visible and relevant because of the work of the Bushfire CRC. It's hoped this will also minimise duplication of research work.

The Bushfire CRC will aim to help in communicating issues affecting bushfire research by developing a role as a clearing house for information and providing a focal point for public dissemination of research outputs and discussion.

This service will be offered to the wider bushfire community with the aim of building a vibrant and world leading bushfire research community in Australia.

COMMERCIALISATION, TECHNOLOGY TRANSFER AND UTILISATION

UTILISATION TABLE

ORGANISATION	REPRESENTED ON BOARD & COMMITTEES	STAKEHOLDER COUNCIL	COLLABORATIVE RESEARCH	INFORMATION/ RESEARCH EXCHANGE	COLLABORATIVE GRANTS
FIRE AGENCIES					
Country Fire Authority, Victoria		•	•	•	
Fire and Emergency Services Authority of Western Australia		•	•	•	
Melbourne Metropolitan Fire and Emergency Services Board		•		•	
New South Wales Rural Fire Service	•	•	•	•	
Queensland Fire and Rescue Service		•	•	•	
Tasmanian Fire Service	•	•		•	
South Australian Country Fire Service		•		•	
NZ Rural Fire Service		•		•	
South Australian Metropolitan Fire Service		•		•	
ACT Emergency Services Bureau		•		•	
Bushfires Council Of NT				•	
LAND MANAGEMENT AGENCIES					
New South Wales National Parks and Wildlife		•	•	•	
State Forests of New South Wales		•	•	•	
Tasmanian State Forests				•	
Victorian Department of Sustainability and Environment	•	•	•	•	
New Zealand Forest Research		•	•	•	
South Australian Department of Environment and Heritage		•		•	
AUSTRALIAN GOVERNMENT AGENCIES				•	
Australian Building Codes Board		•	•	•	
Commonwealth Bureau of Meteorology	•	•	•	•	
Emergency Management Australia		•		•	
CSIRO	•	•	•	•	
OTHERS					
ACT Department of Justice and Community Safety		•			
Territory Wildlife Park NT			•	•	
Australian Institute of Criminology			•	•	
World Wildlife Fund for Nature					•

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ESEARCH ACTIVITIES

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RESEARCH ACTIVITIES

RESEARCH ACTIVITIES















PROGRAM A - SAFE PREVENTION, PREPARATION AND SUPPRESSION

PROGRAM LEADER:
Jim Gould, CSIRO Forestry and
Forest Products

USER LEADER: Phil Koperberg, New South Wales Rural Fire Service This category of research aims to increase understanding of, and the ability to manage bushfires, in order to reduce the risk to firefighters and the community.

Accurate, high-resolution fire weather and fire behaviour predictions are key to taking effective management action before and during fires. There is a need to more accurately describe the fire environment and the level of uncertainty in predictions, so that fire managers can better understand the consequences of their actions, and of their interaction with natural events.

Reliable predictions of different elements of fire behaviour and fire danger are critical in suppression strategies. Diurnal, short-term (up to four day outlooks), seasonal, and long-term predictions of potential fire occurrence and severity are also critical for allocating fire fighting resources, implementing prescribed burning programs and for public warning and fire migration programs.

The duty of care principles constraining bushfire and prescribed fire management across a widening range of social and environmental issues, require that the fire manager uses reliable prediction tools which make the best use of emerging technology. Advances in computing and knowledge-based systems will greatly facilitate the integration of more of the critical variables which determine the development of either wildfire or controlled prescribed bushfire. The challenge will be to determine which are the most relevant factors from all the available sources and then subject these to rigorous field testing.

Program A is divided into five major research themes. Each has a range of research projects, post doctoral research fellows, postgraduate studies, end user collaboration and national and international linkages.

The five themes are:

- // A1. Fire behaviour modelling, with sub-themes:
 - > 1.1 Fire behaviour modelling
 - > 1.2 Bushfire Observer's handbook
 - > 1.3 Fuel classification and availability
- // A2. Fire weather and fire danger
- // A3. Suppression technology
- // A4. Bushfire risk management
- // A5. Computer simulation modelling

Projects aligned with these themes are led by researchers from CSIRO, the Commonwealth Bureau of Meteorology and the Universities of Melbourne, New South Wales, and Western Australia.

Program A has established an End User Advisory Committee to strengthen the important link between researchers and users.





IN TUMBARUMBA FIRE BRI



PROJECT 1.1 > FIRE BEHAVIOUR MODELLING

LEADERS:

Wendy Anderson, Australian Defence Force Academy at UNSW Jim Gould, CSIRO Forestry and Forest Products

The need to improve firefighter and community safety in the management of bushfires has been a growing concern in recent years. This project aims to address this need by providing better knowledge and understanding of the interactions between fire, fuel, weather and topographu.

The project plans to integrate existing and new fire behaviour models into a National Fire Behaviour Prediction System for prediction aspects of bushfire behaviour. Factors include rate of spread, flame height, intensity and spotting for both wildfires and controlled prescribed fires. The research includes experimentation and validation of fire behaviour models, documentation, training and the production and delivery of fire behaviour sustems to end users.

Research work includes field validation of the findings from Project Vesta results to south eastern fuels in Margle State Forest, NSW.

Project Vesta was a comprehensive research project between CSIRO and Department of Conservation and Land Management in Western Australia investigating the behaviour of bushfires in different fuel ages and structures

during burning under dry summer conditions. Experimental burning and the collection of fire behaviour information from major wildfires is a key component of the research. (See website: http://www.ffp.csiro.au/nfm/fbm/vesta)

A highlight of the work this year was a large-scale experimental burn code named "Operation Tumbarumba" conducted in Kosciusko National Park in February 2004. This was the first experimental burn conducted in the life of the Bushfire CRC and was notable because it was linked with a number of other research projects, such as the Fuel Classification and Tanker Systems projects. The experiment involved more than 20 researchers and 60 personnel from NSW Rural Fire Service (staff and volunteer firefighters), Country Fire Authority Victoria (staff and volunteer firefighters), State Forests of New South Wales, New South Wales National Parks and Wildlife Service, Department of Sustainability and Environment Victoria, Department of Conservation and Land Management, Western Australia and New

A postgraduate scholarship at University of Nev South Wales (ADFA) was also established as part of this project to investigate the weather and fuel moisture parameters affecting the behaviour of fires in heathland fuels in the greater Sydney Basin Region.



A FIRE TANKER EQUIPPED WITH PR

PROJECT 1.2 > BUSHFIRE OBSERVER'S HANDBOOK

PROJECT 1.3 > FUEL CLASSIFICATION AND AVAILABILITY

LEADER: Andrew Sullivan, CSIRO Forestry and Forest Products

Observations of bushfire behaviour are extremely subjective at the best of times. The Bushfire CRC enables a unique opportunity to gather information on fire behaviour under many different conditions by many different people and organisations.

This project aims to outline the minimum requirements for designing and executing of an experimental fire. It also aims to describe methods of collecting data on fire behaviour in a consistent manner across the CRC.

The Bushfire Observer's Handbook will provide:

- // definitions of all bushfire behaviour characteristics and methods for estimating or measuring them
- // experimental fire design
 requirements

- // procedures for setting up and conducting an experimental fire, and
- // procedures for measuring environmental conditions.

There is a need for an agreed set of definitions of the characteristics of bushfire behaviour. These include intensity, flame geometry, rate of spread and size. There is also a need for an agreed set of rules for measuring the conditions in which a fire is burning, among them weather, fuel and topography [i.e. slope, aspect]. The Bushfire Observer's Handbook will outline methodologies developed and refined by CSIRO Bushfire Behaviour and Management. It will also include methodologies developed by other groups for specific purposes, and feedback and validation for all methodologies. The project will result in a valuable reference publication for use by all research and field staff during experiments.

LEADERS

Wendy Anderson, Australian Defence Force Academy at UNSW Kevin Tolhurst, University of Melbourne, Forestry and Ecosystems Science Institute

Understanding fuel types is critical for the improved control of bushfires. Initial work for this project focused on revising and improving a fuel classification system developed by David Sandberg and colleagues in the United States. This is a universal classification and hierarchical in structure, with the advantage of providing the necessary parameters for fire behaviour, smoke emission, ecological and other possible models regardless of the amount of detail known about fuels at any particular point in the landscape. This work is being carried out in collaboration with the US Forest Service. Results to date have been to add bark fuels, unshed branches in plantations, and near-surface fuels to the classification.

The classification system was applied to the fuels in the Tumbarumba experiment in February 2004. Systematic classification of fuels across Australia and the development of the classification hierarchy is the next challenge.

The second component of this project relates to fuel consumption. This research aims to be able to predict the extent of fuel consumption under different fire, fuel and weather conditions so that fire behaviour and smoke emission models can be improved. Initial research was undertaken in Tumbarumba in February 2004, when a methodology was developed and initial results obtained. The high level of fuel moisture variability in coarse woody debris in natural forests is a significant problem for fuel consumption modelling. A significant difference in fuel moisture was found between woody material in contact with the ground and material suspended above it, suggesting that the modelling of fuel moisture and availability in natural forests is likely to be more complex than has been indicated by previously published research (predominantly relating to recently logged forest).









PROJECT 2 > FIRE WEATHER - FIRE DANGER



LEADER: Graham Mills, Commonwealth Bureau of Meteorology

Accurate fire weather forecasts can make all the difference to a community or management agency preparing for bushfire. This project's objective is to improve the operational utility of these forecasts and outlooks by providing better knowledge and understanding of wind, temperature and humidity structures and distributions. The goal is that fire forecasts will be improved on very short term, short to medium term and seasonal time-scales. It also aims to facilitate the development of improved forecast products.

The research and development will link with research, communication and education activities of the Bushfire CRC, so that outcomes will include enhanced capability of the community and fire authorities to prepare for adverse fire weather. There are three inter-related components to this project:

A. VERY SHORT RANGE PREDICTION

Fire weather forecasting in support of fire fighting operations needs the accurate prediction of wind changes and wind behaviour. There is a requirement to link the latest numerical weather prediction model guidance to recent observations. This should produce "nowcasts", utilising the strengths of the latest observations and mesoscale numerical forecasts.

B. SHORT-MEDIUM RANGE PREDICITON

The 12-hour to several day forecasts available from the mesoscale, regional scale, and global numerical weather prediction models allow the prediction of regional scale conditions likely to lead to increased fire danger. These would be expected to assist incident controllers in developing more effective strategies to control fires. While wind flow structures are important, humidity forecasts will be a focus of considerable effort. (This aspect is being explored in conjunction with the Bushfire Handbook project).

C. SEASONAL WEATHER

The first step in this project will be to develop a consistent historical dataset of atmospheric humidity and, possibly, wind strength at locations in fire-prevalent areas. This data will be combined with existing high quality historical temperature and rainfall records using a standard fire danger index. The possibility of using the Commonwealth Bureau of Meteorology's seasonal forecast systems to predict seasonal fire danger will be investigated. The historical record of fire danger will also be examined to determine the impact of climate change.

PROJECT 3 > EVALUATION OF SUPPRESSION TECHNIQUES AND GUIDELINES

LEADER: Jim Gould, CSIRO Forestry and Forest Products

This project addresses the need for more insight into suppressing wildfire and how our resources can be best used. Its aim is to develop guidelines for selecting suppression resource strategies (both ground and aerial) based on efficiency, allocation, deployment and real-time use. Considerable attention has been given in recent years to aerial suppression as a result of rising suppression costs, limited budgets and the general interest of the public and media in the use of air tankers.

Fire agencies have highlighted the extensive media coverage and strong community interest in the use of specialised aircraft for fire fighting. This is a dedicated research project investigating all aerial and ground resource techniques, including an updated review of the technologies available and their effectiveness.

Although various approaches could be used to answer the question "How much aerial (retardant drops) and ground suppression is needed to a given fire suppression job?", the preferred alternative is to conduct the study under actual fire operations by quantifying appropriate variables and results. The research aims primarily to:

- // identify the intensity of fire in different fuel types that can be contained by different suppression resources (both aerial and ground)
- // define the rate of line construction of different suppression resources and combination of resources, and
- // define the holding time of suppression lines, especially the holding time of aerial drops (with different suppressants), before the fire burns through



PROJECT 4 > BUSHFIRE RISK MANAGEMENT MODEL

LEADER: Kevin Tolhurst, University of Melbourne, Forestry and Ecosystems Science Institute

There are many facets of risk management in the Bushfire CRC. This project aims to pull together many of these into a single management support system. Two levels of bushfire risk management have been recognised - those associated with strategic planning, and those associated with tactical planning. The project will initially deal with strategic planning issues.

In its initial phase the project aims to describe the fire management business. After considering various options, it was decided to use a structured interview process with experienced, senior fire managers from around Australia. About three managers were interviewed in each state, one representing an

emergency response agency and two representing land managers with fire responsibility (e.g. State Forest and National Parks). Seventeen people were interviewed. The interviews were structured to systematically look at the current status of fire management from each manager's perspective, looking at links between different aspects of bushfire prevention, preparedness, response, recovery and management burning. The results are still being summarised, but it is clear that the management context is important to the nature and strength of the links between various aspects of bushfire management. This fire management business model will form the underlying structure for the risk management model, allowing a better understanding of how changes in one aspect of management can affect other aspects of management.

The second phase will develop a conceptual model to describe the likelihood of a fire with particular characteristics occurring in a particular space and time across the landscape. The essential components of this phase will describe the ignition and spread of fires across the landscape given particular management and weather scenarios. It will identify and characterise specific values, also defining a "fire catchment area". This will mean that it will be possible to calculate the probability of a damaging fire from that catchment. Such probabilities will be affected by different management strategies such as prevention, protection, response, recovery and management burning.



PROJECT 5 > COMPUTER SIMULATION MODELLING

LEADER: George Milne, University of Western Australia

Modelling bushfire spread in a meaningful way improves decision-making when it comes to critical scenarios. This project will develop reliable bushfire spread modelling, simulation and animation technology to underpin and support a wide range of fire management activities, including risk analysis, prescribed burning, wildfire suppression and incident control training.

A computer-based environment will permit rapid and repeatable execution of bushfire simulations under a wide range of conditions, assisting with real-time decisions and "what if" scenarios.

Simulations will be based on the latest understanding of physical

fire behaviour captured within discrete automata-based models. These simulations are key to improving predictions of fire behaviour and the effectiveness of containment strategies. They also increase our understanding of the non-linear scaling found in extreme fire behaviour, as seen in Canberra in January 2003.

The overall outcome will be a computer-based simulation environment for training purposes utilising a high-performance visual display and readily useable interface. This toolset will allow users to understand fire behaviour and how it can be affected by changes to the fire environment and firefighter safety and suppression options. Trainees will experience and explore, in virtual

reality, the effect of different containment strategies via repeated simulation under differing conditions with readily visible consequences. The resulting cause-and-effect relationships will increase understanding of how the positioning of fire-breaks and deployment of fire suppression resources can alter fire spread under various weather, fuel and topographical conditions.

The developed system will present the sequence of conditions and events leading to worst-case scenarios and directly influence safest and best containment strategies.



ORGE MILNE

PROGRAM B - MANAGEMENT OF FIRE IN THE LANDSCAPE

PROGRAM LEADER: Mark Adams, University of Western Australia

USER LEADER: Gary Morgan, Department of Sustainability and Environment, Victoria

Managing fires on the landscape scale is a difficult task in a continen where fire is a central component of both the ecology and the biophysical structure of the environment. This program focuses on the use of prescribed fires to prevent loss of life and property, and to retain key ecological attributes such as biodiversity. Embracing prescribed fire as a central plank in maintaining biodiversity has been one of the major shifts in government policy in recent years and a testament to the work of many scientists over many years. However, the job is not finished and progress in Program B during the first year of the CRC's operation has largely been the continuation of research already underway.

A first example is that, in the past year, several outstanding books on fire have been produced. These include works by Alan Andersen and colleagues, focused on fire in the savannas in northern Australia (CSIRO Sustainable Ecosystems, Darwin), and Geoff Carey and colleagues, focused on forests of the south-east (ANU, UNSW, NPWS-NSW and others). These follow an equally productive period during which at least four other major works on fire were produced by members of Program B, many of which have found their way to the desks of leading fire managers.

The CRC looks forward to further dialogue on how to best integrate the outputs and learning into practice.

Recent launches of books and research projects in Sydney and Darwin have attracted broad media

Another important outcome in this early part of the CRC's life has been the recruitment of key postdoctoral researchers. New young researchers in Program B include Matthias Boer

Roy Witkuhn, Maria Taranto, Karen King and Kate Parr. It is significant that two are international — Matthias from Spain, and Kate from South

Literature reviews will feature highly as outputs for several current research projects. These are eagerly awaited by both the CRC research committee and the stakeholders.

Program B research spans Australia from Darwin to Perth to Adelaide to the entire eastern seaboard. It also spans research across nearly every imaginable type of Australian ecosystem, and includes research conducted within long-term fire regime experiments, as well as that conducted 'opportunistically'. Some of the NSW and WA research aiming to develop landscape-scale use of fire history data in conjunction with biodiversity and other ecological data offers exciting prospects for the CRC's stakeholders. Equally exciting are the prospects of a world-class facility for analysis of bushfire smoke, and the related development of a data-base.





PROJECT 1 > MANAGING FIRES IN
FORESTED LANDSCAPES IN
SOUTH WEST AUSTRALIA

PROJECT 2 > FIRE REGIMES AND SUSTAINABLE LANDSCAPE RISK MANAGEMENT

LEADER: Lachlan McCaw, Department of Conservation and Land Management, WA

This project seeks to improve understanding of the ecological effects of fire on a landscape scale by comparing the flora and fauna in forest areas that have experienced different fire regimes over the past five decades.

Findings will be used to provide fire managers with scientifically based guidelines for the optimum frequency, season, intensity and extent of burning to achieve a range of land management objectives.

The study will utilise fire history records available for forest areas since the early 1950s in the form of maps showing the extent and season of prescribed burning and wildfires. Satellite imagery will also be used to examine spatial patterns of fire intensity, and patchiness within management blocks. A stratification based on landform, vegetation and fire history will be developed for a case study area of up to 50 000 hectares and used to select sampling sites in which flora and fauna attributes will be assessed. Sites will be carefully matched so that valid comparisons can be made to assess the effects of past fire regimes on current ecosystems.

LEADER: Ross Bradstock, National Parks and Wildlife. NSW

The world is changing. Changes to human populations and climate are having a direct impact on fire and its associated risks to people and biodiversity. Fire management is also changing. We are entering an era of risk management that has a deliberate emphasis on the assessment, measurement and mitigation of risks to a wide range of values such as property and ecosystem services, including water, air quality, indigenous values and biodiversity.

How do we assess and quantify these risks? How do we comprehend them at large spatial and temporal scales? How do we compare the impacts of differing management options for decreasing risks? How do we weigh up the trade-offs inherent in managing for multiple objectives and values? Will the same set of management options yield the same results in differing ecosystems? How will climate change affect risk mitigation?

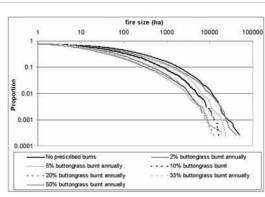
This project seeks to answer these questions through a set of studies focused on four contrasting regions across Australia (the Sydney basin, the ACT, South West Tasmania and Central Australia). A core tool

in this project is the FIRESCAPE landscape/fire regime simulation model. The model is being used to conduct experiments that examine the sensitivity of bushfire risk to different management options (see graph below), and climate change. FIRESCAPE can perform comparisons of options and scenarios at large spatial and temporal scales — for example, less than 1,000,000 hectares and greater than 500 years — scales that are highly relevant to management but beyond the bounds of practical experimentation.

The FIRESCAPE work is part of an international fire modelling program with similar aims in differing continents. This modelling is supported by two major strands of on-ground investigation aimed at measuring the responses of biodiversity to different fire regimes and the sensitivity of fire behaviour to vegetation, fuel moisture, landscape characteristics and fire suppression / prevention activities.

The studies in this project will enhance and validate key functions in FIRESCAPE and allow explicit quantification of risks posed by particular fire regimes.





THE DISTRIBUTION OF SIZES OF SIMULATED FIRES RESULTING FROM LIGHTNING IGNITIONS IN THE WORLD HERITAGE AREA OF SOUTH WEST TASMANIA.

The results show the effect of differing levels of prescribed burning, based on 500-year simulations using the FIRESCAPE model. Fire size directly affects the risk posed to various management objectives such as the protection of alpine and rainforest vegetation.

PROJECT 3 > BEHAVIOUR OF SMOKE PLUMES AND HAZES FROM RURAL OR URBAN FIRES

LEADER: Graham Mills, Commonwealth Bureau of Meteorology

The impact of smoke from prescribed and fuel reduction burns and wildfires on community health and safety is a key concern these days, with growing public interest. The overall objective of this work is to assist in reducing this impact.

In particular, this sub-program will assist prediction of the transport and dispersion of smoke from an urban or rural fire, and predict concentrations of smoke particulates at locations affected bu the smoke plume.

Controlled burns must be planned in a way that minimises the impact of smoke on the community. This project builds on a successful Australasian Fire Authorities Council-funded project that demonstrated via an experimental program how useful forecasts of smoke transport from potential sites of controlled burns can be an aid to planning these burns.

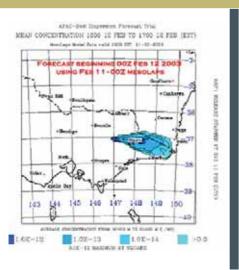
The system uses the Commonwealth Bureau of Meteorology's operational high resolution prediction models to provide forecast wind and temperature fields and the location and strength of the smoke plume.

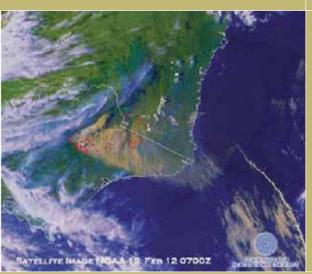
The product is delivered via a registered-user website, and includes the ability for users to interactively specify the ignition sites.

The early part of the project will enhance product delivery to fire and land management agencies, integrate the guidance product with other meteorological information, and deliver products in an agency-compatible form. In the early to middle stages of the project there will be an emphasis on source height specification, together with validation against field observations.

Over the life of the project there will be a move to include the use of more powerful atmospheric chemistry models

Techniques for estimating emissions from a giver source will be developed in several CRC projects and will then be incorporated into such models.





THE LEFT PART OF THE IMAGE SHOWS A HYSPLIT SMOKE DISPERSION FORECAST, WHICH BEGAN AT 1000 EST ON FEB 12 2003, 7 HOURS INTO THE FORECAST AT 1700HRS.

THE RIGHT HAND IMAGE IS AN ENHANCED NOAA-12 AVHRR SATELLITE IMAGE FOR THE SAME TIME, SHOWING THE FIRE



PROJECT 4 > SMOKE COMPOSITION FROM PRESCRIBED AND WILD FIRES AND HEALTH



LEADER: Tina Bell, University of Melbourne, Forest and Ecosystem Science Institute

While regular prescribed fires may be thought to control the severity of wildfires, the impact of the smoke produced on the community may be as great or greater than that produced by occasional wildfires. An issue to be resolved is if the smoke from prescribed fires differs from smoke produced by wildfires.

This project will use new and existing techniques to measure the contribution of prescribed burns and wildfires to particulate matter, classical pollutants (particularly those affecting human health — dioxins, irritants and carcinogens), greenhouse

gases, photochemically active gases and ozonedepleting chemicals in smoke emissions. It will also investigate the impact of smoke on human health by conducting surveys of hospital admissions, patient recovery and community perceptions.

Ecological and environmental considerations will be addressed by asking such questions as:

- // What contribution do prescribed burning and wildfires make to greenhouse gases in the atmosphere?
- // What might be the extent of loss of nutrients through oxidation of carbon, nitrogen and sulphur?

// Is there a 'good' side to smoke for regeneration of vegetation, for example the promotion of germination of seed?

The project will ultimately produce a system for predicting the concentration and composition of smoke from a given vegetation type and condition. This will lead to a reduction in the impact of smoke on community health and safety. It should enable substantial reviews of health and environmental policies, and regulations and legislation relating to smoke production. Prescribed burning strategies and models of bushfire risk management will be improved by incorporating our research findings.

PROJECT 5 > IMPACTS OF FIRE ON ECOLOGICAL PROCESSES AND BIODIVERSITY

PROJECT 6 > PRESCRIBED FIRE AND BIODIVERSITY IN TROPICAL SAVANNAS

LEADER: Alan York, University of Melbourne, Forest and Ecosystem Science Institute

A significant issue for land managers is the implication of hazard reduction burning for Ecologically Sustainable Management.

The ecologically sustainable management of forest ecosystems depends on an understanding of the processes involved in carbon and nutrient cycling. The involvement of organisms in these processes and how they contribute to biodiversity conservation must also be understood.

Forests play an important role in this nutrient recycling, through the accumulation of carbon above and below ground. Low intensity fires are used extensively in managed forests in Australia and there is growing concern that repeated fire may have a negative influence on plant and animal communities.

This project seeks to model nutrient fluxes under different fire regimes, investigating the roles played by mycorrhiza and decomposer fungi and their inter-relationships with plants and invertebrates, and the likely impacts on ecosystem processes and carbon cycling.

The work aims 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.

This knowledge should enable land managers to protect life and property whilst maintaining ecological processes essential to ecosystem health and productivity, and also to improve awareness and understanding of the role of fire in biodiversity management through the integration of research, communication and education.

LEADER: Alan Andersen, CSIRO Sustainable Ecosystems

Southern Australians are often surprised to find that the vast majority of Australian bushfires occur in the tropical north. The Aboriginal tradition of landscape burning continues there, with prescribed fire the key landscape management tool across the vast conservation estates. Half or more of the monsoonal tall grass landscapes of north-western Australia are burnt each year.

The Bushfire CRC has established the 'Burning for Biodiversity' project at the Territory Wildlife Park, near Darwin. This project aims to enhance our knowledge of the effects of different fire regimes on biodiversity and ecological function, improve fire management protocols for biodiversity conservation, and increase public awareness and understanding of the role of fire in northern Australia.

The project is the first of its kind in Australia, and features a new field experiment for fire research, integrated with the delivery of information and learning products for public awareness and education. The field experiment has 18 hectaresized plots, each of which will be subject to one of six fire regimes. A wide range of research activities has been established, covering fuel dynamics and fire behaviour, soil biology and ecological function, grass and tree dynamics, the role of herbivory in vegetation recovery, invertebrate biodiversity, and the population dynamics of small lizards. The first experimental fires were lit in June 2004.



PROJECT 7 > SYNTHESIS AND INTEGRATION

PROJECT 8 > MULTI-SCALE PATTERNS IN ECOLOGICAL PROCESSES AND FIRE REGIME IMPACTS

LEADER: Mark Adams, University of Western Australia

During the year, this project has concentrated on better defining the social, political and economic context for the biophysical science of prescribed burning (or ecological burning). It is apparent to all practitioners of prescribed burning that the science frequently plays a secondary role when decisions are made about the timing, location and scale of such fires. A significant paper on the subject of bushfires and the social, economic and political context was presented to Science Minister Peter McGuaran at a meeting of the Bushfire Research Advisory Group in 2003. This paper will be presented at the Bushfire CRC's conference in Perth in October 2004.

Recent research in the United States has provided a simple economic model that explains much of the social (e.g. bush and fire 'experience') and biophysical (e.g. infrastructure) changes at the urban-rural interface, and is equally applicable in Australia. This model could be populated and parameterised for Australia. Equally, synthesis of the many recent inquiries into the fires of 2003 suggests there is growing unrest in rural areas as a result of the politics of capital cities. That unrest is also likely to manifest as a call for greater recognition of rural experience and less support for policy positions advocated by groups that rural people regard as urban 'greenies'.

LEADER: Pauline Grierson, University of Western Australia

Most studies of impacts of fire or ecological processes have dealt largely with single fire events and have examined fire at localised scales without reference to the variability of fire in the landscape. The lack of an appropriate landscape context for fire management may lead to management decisions that are contrary to the intent of ecologically sustainable fire

Further, the patterning observed after a single fire event is often a consequence of the effects of previous fires, yet the concept of dynamic models that take into account impacts of preceding fires is often missing. Without understanding the consequences of "ecological memory" on local and landscape patterns, it is impossible to predict the likely

effect of future prescribed burning regimes.

"Ecological memory" can be thought of as the correlation of data gathered at successive times. The project will formalise the analysis of fire management impacts in terms of the spatial data and time scales of the management measures, on the one hand, and of the affected landscape patterns on the other hand. The bringing together of process-based data across scales is rare in ecological studies, but of increasing relevance. Linking information to decision-making frameworks is a relatively unique component and key objective of this project.





PROGRAM C - COMMUNITY SELF-SUFFICIENCY FOR FIRE SAFETY

PROGRAM LEADER:

John Handmer, RMIT University

USER LEADER:

John Gledhill, Tasmania Fire Service

The Community Self Sufficiency for Fire Safety program aims to increase community resilience through self-sufficiency in managing bushfire risk. People living and working in bushfire-prone areas bear the fire risk and also, through their lifestyles and locations, help create the risk

Some members of these communities may also create risk by starting fires through carelessness or arson. Through individual and community action people can reduce their own vulnerability, and reduce the probability of fires, and substantially reduce the impact. Communities need support to achieve this, and agencies involve with bushfire risk management need to know how best to provide it. They need to be confident that programs work and that they are

started to address these issues through projects on:

- // understanding communities
- // risk communication
- // negligent and deliberate fire lighting
- // the economics of bushfires, and
- // the "stay-or-go" policy.

A project on the evaluation of community safety policies and programs will also commence in the second year of the CRC. Projects in this program draw primarily on social science and economics.

Each project or project area is working towards two basic aims

- // a state of the art methodology, or guidelines for the specific topic, and
- // the evaluation of selected existing practices through case studies

The projects are closely linked to other CRC activities, in particular parts of Program D on building safety, Program A on aerial fire fighting, and all areas with an interest in bushfire risk modelling. Initial reports and presentations have been produced in the first year and next steps include finalising reports for publication, and commencing primary data collection and analysis, which will involve case studies and collation of disparate datasets.

This work has attracted considerable overseas interest. Collaboration has commenced in the economics area and is also expected soon in the "stay-or-go" project.



PROJECT 1 > UNDERSTANDING COMMUNITIES

PROJECT 2 > EFFECTIVE RISK COMMUNICATION

LEADER: Allison Cottrell, James Cook University

The Understanding Communities project addresses the need for increased community resilience to bushfires. This means building a better understanding of how government policy and public perceptions interact. It also aims to understand how the expectations of service providers, communities and agencies agree and differ.

It will then be possible to develop methods to enhance agreement and resolve differences. Once these are developed they may be evaluated for their effectiveness in meeting the needs of communities and service providers for bushfire mitigation, response and recovery.

It is understandable that previous research on communities and bushfires has tended to focus on a technical response basis, but it is also necessary to develop understanding of community perceptions and attitudes to bushfires. There has been little

in the way of extensive rigorous social research on communities and bushfires, but there is much research from other hazard studies that can be successfully adapted to these communities.

The Bushfire CRC is providing an opportunity to advance research in this area which will make a significant contribution to community well-being and knowledge. Another important task is to document the impact of the COAG bushfire review on fire service provision.

The project is now preparing reports on bushfire hazards for indigenous communities on western Cape York Peninsula, a review of approaches to bushfire hazards by State Government fire services, and a review of existing literature on communities and bushfires.

LEADER: Linda Anderson-Berry, Commonwealth Bureau of Meteorology

A significant proportion of the population in many communities fails to respond appropriately or adequately to fire weather and fire emergency warnings. Most people rely on weather, fire and emergency services to provide the essential information on which they may base the defensive action that will ensure their immediate and longer term safety.

Risk communication is an ongoing difficulty for fire and emergency services. Coroners' reports continue to refer to the need for better, timely warnings and advice on action. The failure of pre-event safety messages, fire warnings, post-event communications and the associated "action" advice results in lower standards of safety and increased property, heritage, environmental and social losses.

The effectiveness of risk communication depends on the appropriateness of communication channels, format and media networks. All stakeholders (weather services, fire and emergency services, community planners and

managers, and the residents of fireprone areas) will benefit from the application of research relating to effective fire risk communication, which is the aim of this project.

The project takes the view that communities need support to achieve effective risk communication networks, by working in partnership with weather, fire and emergency services — and that these services need to know how best to provide that support. The role of media in risk communication is also being investigated, with a literature review now being produced.

Standard qualitative and quantitative social science research techniques being employed include a literature review in academic and industry arenas, surveys of providers of weather information and fire and emergency services, and the community.

Outputs will include a framework and methodology for identifying community information and risk communication needs during bushfire emergency. Documentation and assessment of current practice will also be produced.



COMMUNITY PARTICIPATION IN BUSHFIRE MITIGATION
OUEENSLAND FIRE AND RESCUE SERVICE



NDA ANDERSON-B

PROJECT 3 > NEGLIGENT AND DELIBERATE FIRE LIGHTING



LEADERS:

Derek Jory, ACT Dept. of Justice and Community Safety Toni Makkai, Australian Institute of Criminology

The bushfires that threaten Australian homes and lives on a regular basis originate with a small number of common causes. One is arson, or the deliberate criminal setting of fires. Whether the people starting these fires intend it or not, there is great potential for widespread damage, injury and even death from a deliberately lit bushfire. This potential is increased when fires are started in severe fire weather close to urban developments. This project aims to understand more about arson in Australian bushland environments. Through greater knowledge about who starts these fires, why they do it and what makes them target a particular time or location, improvements can be made in the way investigation and prosecution of offences is undertaken, as well as preventing some of them occurring.

Some of the major outputs expected are:

- // a comprehensive review of the literature on motivation and treatment of arsonists
- // a regularly-updated database of literature relevant to understanding and responding to bushfire arson, and ongoing information on this topic for stakeholders
- // a review of the data available on bushfires across Australia and analysis of the methods of operation of bushfire arsonists
- // examination of the motives and methods of bushfire arsonists through interviews with known offenders
- // reports and guidelines on issues surrounding the investigation and prosecution of bushfire aroon offences

This project is being conducted jointly by the ACT Department of Justice and Community Safety

PROJECT 4 > THE ECONOMICS OF BUSHFIRES

PROJECT 5 > THE STAY-OR-GO POLICY

LEADER: John Handmer, RMIT

Economic input is increasingly seen as an essential part of fire risk management decision-making, from suppression strategies through to land-use planning. Much work on bushfire economics is being done overseas, especially in the US, although much of this work concerns forestry rather than urban interface issues. Considerable loss assessment work has also been done for other hazards like flooding. This project draws on this work where appropriate, and builds collaboration with experienced overseas fire economists.

The project is developing a framework for bushfire loss assessment and the assessment of mitigation options. General frameworks exist, though not

specifically for the urban interface areas. The CRC project expands the scope of what is normally included to ensure that coverage is comprehensive, taking into account the costs of arson, the impact of error and uncertainties, carbon accounting, additional impacts of mega events, volunteers, and intangible losses. In most natural hazards economics research, it is intangible losses that are the stumbling block to establishing a comprehensive loss assessment framework. A method for costing intangibles such as memorabilia, health effects and environmental damage and benefits, needs to be created so an accurate assessment can be made of the economic impacts of fire.

LEADER: John Handmer, RMIT

The position advocated by the Australasian Fire Authorities Council (AFAC), known as the "stay-or-go" policy, is a fundamental component of community bushfire safety. The essence is that people should prepare themselves and their properties and stay and defend when a bushfire is likely, or leave the area well before the fire is likely to arrive.

The aim of this project is to identify impediments to full implementation of the policy, and to suggest improvements. In addition, it examines ways of integrating the policy with other important factors in bushfire risk management. The project has compiled the evidence base for the policy as well as documenting the associated legal situation across Australia.

The legal aspects are complicated because of the number of jurisdictions involved, the range of relevant fire and emergency service legislation, and the recent changes to the law of negligence. The global literature on evacuation has also been reviewed. Overseas material is of limited assistance because the "stay-or-go" policy is not widely used outside Australia, although there is much interest in the approach. Initial reports are being finalised for publication.

The next major step involves case studies of recent fires where there were significant issues surrounding evacuation or staying. The cases are being drawn from Australia and overseas.



PROGRAM D - PROTECTION OF PEOPLE AND PROPERTY

LEADER: Bob Leicester, CSIRO, Manufacturing & Infrastructure Technology

USER LEADER: Neil Bibby, Country Fire Authority, Victoria destruction of property by bushfires in Australia are both major political issues. Community expectations change with time and so does the impact of bushfires. Living in the high risk urban interface is now a much sought after life style for a large proportion of Australians, and the ability of new arrivals to cope with bushfires is often inadequate. In addition, community expectations for the health and safety of firefighters are now higher than they were even a decade ago. Working conditions on the fireground are now expected to be as safe as those in a normal work place.

THE NEED FOR A RISK MODEL

A key focus of this program is developing a risk model for assessin the impact on houses and thence the cost-effectiveness of various recommendations related to safety. The numerous factors that affect safety include climate factors, the terrain and vegetation landscape within a kilometre or so of houses, local urban planning and building

regulation requirements, details of house construction, local fire fighting policies and the preparations and actions of the building occupants themselves. In addition, laboratory studies will be undertaken to develop methods for the design of various building components, such as decking and glazing, to resist attack by bushfires.

FIREFIGHTER HEALTH AND SAFETY

The largest part of this program will target the health and safety of firefighters. Both short-term risks and long-term health hazards will be investigated. Initially the demographics and physiology of Australian firefighters will be obtained. These will be used to map out strategies for work routines, which will then be checked by field measurements under operational conditions. Of particular concern is the health impact of air toxics in the fire-ground, where many potentially hazardous chemicals are detected. Improvements in fire fighting equipment are also being

investigated as part of the safety drive. One such project has assessed the performance of fire fighting trucks that have been modified to provide protection in the event of an accidental burn-over from a moderate forest fire. A project is also underway to assist firefighters in making safe decisions, particularly when subjected to the stress of operational situations

VOLUNTEERISM

The recruitment and retention of volunteer firefighters is seen as a major issue in the protection of people and property. Currently Australia is serviced by about 300,000 highly effective volunteers and their services, which if paid for, would cost several billion dollars each year. The indications are that the size and nature of this volunteer work force will change in the future due to changes in the demographics and culture of those living in rural and peri-urban areas. Accordingly, research is underway to assess the changes and to develop strategies for dealing with them.



PROJECT 1 > BUILDING AND OCCUPANT PROTECTION

LEADER: Justin Leonard, CSIRO, Manufacturing and Infrastructure Technology

This project is pursuing an improved awareness and understanding of the issues surrounding building loss in bushfires, through integrated research, communication and education. As well as reducing the direct loss of buildings in bushfires, the work should also generate an improved lifestyle for people living and working in bushfire-prone areas.

Taking place over seven years, the project will have the following sequential outputs:

- // a risk-based methodology for developing recommendations for town planning, and building standards for building in bushfireprone areas, by collating and drawing on existing data
- // effective timber deck design solutions to minimise ignition by ember. This will be delivered in the form of information packages for community and

- industry, as well as through contributions to scientific publications.
- // a review of previous data and an investigation of current glazing products, resulting in a enhanced understanding of how framing system design and glass product selection mitigates the risk of glazing loss during bushfires. This will be delivered in the form of information packages for community and industry.
- // an understanding of how the use of naturally fire-resistant vegetation can reduce the risk of ignition of structures. This will be delivered in the form of information packages for community, town planners and agencies.
- // an understanding of the most effective methods of using non-combustible solid panel fencing systems in limiting ground fire spread and reducing radiant heat loading

- on buildings. This will be delivered in the form of information packages for community and industry and through contributions to scientific publications.
- // an assessment of the viability of using external water spray systems as a risk-minimisation strategy for buildings. This initiative will also seek to determine the most effective elements of spray system design, and develop a minimum standard of design. It will also seek to promote self-regulation in the spray system installation industry.
- // a study of the factors influencing house-to-house spread of fire during and after the bushfire event. This will be delivered in the form of information packages for community, town planners and agencies.

- // a study of the behaviour of domestic supply gas bottles and town gas supply equipment in bushfires, resulting in the development of effective installation advice for this infrastructure.
- // scientific support for the evolution of the Australian Standard AS3959 as required
- // development of a more
 effective capability for surveys
 of building damage, agency
 and social interaction in future
 fire events, so that data sets
 can be continuously improved
 This initiative will require
 collaboration with established
 agencies and social research
 projects within the CRC





PROJECT 2 > FIREFIGHTER HEALTH AND SAFETY



LEADER: David Nichols, Country Fire Authority, Victoria

Thousands of Australian firefighters battle wildfires on public and private property in rural areas and the wildland urban interface areas each year. Wildfires are inherently unsafe and unhealthy due to the challenge of the work environment that includes heat, smoke, noise, and chemical conditions, as well as physiological and psychological pressures on firefighters. The effects of the wildfire environment on firefighters include stressful conditions in which fatigue and work capacity is affected by work and rest cycles, physical condition and hydration and nutrition.

Firefighter safety is of the highest priority for fire fighting agencies. Firefighter deaths and injuries are a significant cost each uear. The ageing population, demographic variety and physical condition of the Australian volunteer firefighter presents a significant challenge to fire fighting agencies in improving safety conditions on the fire ground

Research targeted at improving the safety of firefighters will provide for the first time a quantified picture of the fireground environment with respect to unhealthy conditions and the effects of wildfire on the firefighter. Firefighter safety and welfare will be studied by measurement of ergonomic, physiological and behavioural factors. The research will determine the effects of fitness, stress, fatigue and crew management on the health, safety and well-being of firefighters working on bushfire suppression. Researchers will identify precisely what factors cause a decline in decision-making

ability – particularly with regard to safety threats – and then devise procedures to minimise this decline.

national strategy for firefighter safety based on measures of firefighter health, safety and well-being related to short and long-term exposure to bushfire, and to the ability to complete assigned tasks. A nationally coordinated strategy for firefighte safety will reduce deaths and injuries, improve fire management agency and firefighter awareness of OHS issues, improve safety training, and increase standardised safety processes and procedures at a the local level



PROJECT 3 > PERSONAL EXPOSURE OF FIREFIGHTERS TO AIR TOXICS AND OHS RISK MANAGEMENT STRATEGIES

LEADER: Steve Brown, CSIRO, Manufacturing and Infrastructure Technology

This project will identify the key air toxic species in bushfire smoke and provide the capability to measure, evaluate and control the exposure of firefighters and rural and semi-rural communities to these toxics.

It will develop and apply capabilities for measuring the personal exposure of bushfire fighters to a wide range of air toxics in different fire scenarios, such that air toxics exposures can be evaluated in the field and controlled where necessary. Health and safety exposure guidelines will be utilized in developing strategies to reduce exposure risks to comply with OHS regulations. There will be a focus on both short-term risks from exposure to air toxics in bushfires and long-term risks from

ongoing exposures to carcinogens and lung irritants.

This project will take place over seven years and aims to produce the following outputs:

- // A review of Australian and international literature to determine the key air toxic species to which bushfire fighters may be exposed. Key fire agencies and researchers in other countries will be contacted for details on related research in progress. These reviews will underpin the determination of key air toxics to which firefighters may be exposed.
- // Measurement of the personal exposure of Australian firefighters to these air toxics will require the selection of commercial air sampling devices or the development of specific devices that the firefighters will wear for

- several hours. These devices will be selected to be robust to endure the harsh field conditions, to be specific to the air contaminants, and to be supported by reliable chemical analyses. Field pre-testing of the devices and methods will then be carried out and a work plan will be developed for field sampling of firefighters.
- // The personal exposure of firefighters will be determined according to their task descriptions (mostly for those close to the fire front) and for a range of fire types. This will be done by intensive field monitoring programs over four fire seasons, with data analysis and interpretation in the off-seasons, and the provision of annual reports of findings. Interaction with other programs that conduct experimental and prescribed fire burns is likely, though access to accidental bushfires is a priority.
- // In year six, all data will be combined to estimate personal exposures and risk potential to firefighters for different tasks and fire types. These assessments (as well as the exposure assessments in years two to five) will be closely linked to assessments of physiological stress and crew management. Similarly, decisions on strategies for risk control (e.g. through personal protection, task assignments) will be linked with CRC research into equipment for reducing fireground risk.
- // In year seven, these strategies will be evaluated for their effectiveness on the fireground, with preparation of a final report that details the air toxics exposures of firefighters, control strategies for managing air toxics exposure risks, and evaluation of compliance with OHS regulations in Australia.



TOXICS MEASURED AT TUMBARUMBA EXPERIMENTAL BURN,

PROJECT 4 > SAFE BEHAVIOUR AND DECISION-MAKING



LEADER: Maru Omodei, La Trobe Universitu

Fire fighting, despite heavy reliance on fire prediction, hazard models, fire control and suppression technologies, is ultimately a human activity. It requires individual firefighters to form risk assessments and initiate courses of action. Firefighter safety, both in bushfire situations and in associated brigade activities, therefore requires that individuals be aware of, and give adequate attention to, the safety implications of any decisions they might implement.

Previous research suggests that human decision-making ability deteriorates in rapidly changing and relatively unpredictable situations such as a bushfire. It is unclear, however, precisely what factors cause such a

decline in decision-making ability, particularly with regard to threats to safety. There is evidence to suggest that such factors range from inherent limitations of cognitive processing abilities through stress and overload, to pervasive effects of an organisation's overall safety climate.

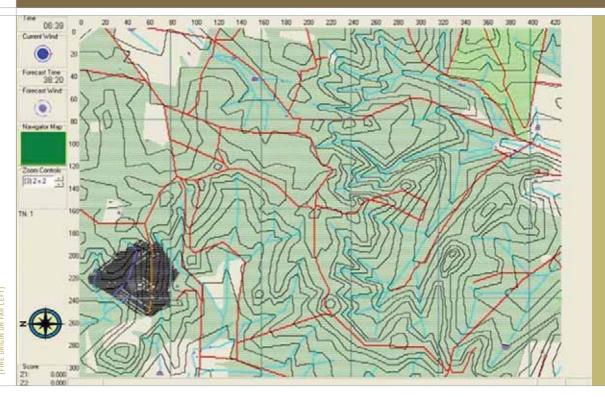
In order to optimise safety-relevant decision-making, it is important therefore that the full range of causes of impaired decision-making is identified and appropriate recommendations and guidelines developed to counter their effects.

Such recommendations and guidelines

comprise not only those pertaining to operational procedures, but also those pertaining to the design of operational decision support tools, and to brigade activities and training situations more generally.

The research activities being undertaken by the La Trobe University team, in collaboration with fire fighting agencies, include:

// conducting interviews with senior officers of fire agencies and firefighter associations to determine perceived research



A COMPUTER SIMULATION OF AN ATTACK PHASE. THIS RECREATES EVENTS LEADING UP THE LINTON FIRES (FIRE ORIGIN ON FAR LEFT)

PROJECT 5 > SAFE COST-EFFECTIVE EQUIPMENT

- // carrying out detailed post-incident debriefings of fire fighting personnel (across all levels of rank)who are involved in incidents which raise safety issues
- // conducting controlled experimentation using computer-generated safety threats (using Networked Fire Chief), and
- // developing and testing methods for presenting fire-related information and for training to reduce safety-compromising behaviour.

LEADER: David Nichols, Country Fire Authority, Victoria

The Australian firefighter constantly works under hazardous conditions with a variety of vehicles and equipment. Little research has been done into the physical hazards and the safety risk to firefighters present in fire fighting vehicles and equipment. Fire fighting agencies have a significant challenge to improve the safety of vehicles and equipment used for fighting wildfire.

Bushfire CRC scientists will identify key issues in equipment and vehicle crew protection needs of Australian fire fighting agencies. Analysis methodologies will be developed to evaluate vehicle and equipment hazards and risks. Laboratory and field trial methods will be developed and implemented to provide users with safety results on identified fire fighting vehicle systems and equipment.

The project will improve the safety and well-being of firefighters by identifying inherent conditions and recommending design enhancements or advancements in fire fighting vehicles and equipment. For the first time, there will be a quantified picture of equipment used on the fireground with respect to the safety of firefighters.

Preliminary work has been completed on fire fighting vehicle engines and fire fighting pump engines as a result of the experimental fires at Tumbarumba, New South Wales. Benefits of the work will include the development of preferred design guidelines for engines to operate safely in the bushfire environment.

Firefighter crew safety will be improved as safer vehicles and equipment are designed and implemented.



TESTS CONDUCTED ON FIRE FIGHTING PUMP ENGINES

PROJECT 6 > VEHICLE CREW PROTECTION SYSTEM FIELD VALIDATION

LEADER: David Nichols, Country Fire Authority, Victoria

Firefighters working from vehicles are exposed to intense radiant heat and flames in wildfire "burnover" situations. Little research has been done into protecting fire fighting tanker crews when vehicles are burnt over by wildfire.

The Country Fire Authority of Victoria (CFA) and New South Wales Rural Fire Service (RFS) commissioned CSIRO to evaluate crew protection systems for fire tankers using a large-scale gas-fires wildfire burnover simulator. As a result of the simulator work, Bushfire CRC scientists have conducted two experimental fires at

Tumbarumba, New South Wales, to validate the crew protection system findings from the wildfire burnover simulator tests. The experimental fires subjected the vehicle crew protection systems to two levels of radiant temperatures and flame duration exposure as the result of controlled wildfire. The tests include measuring the fuel before the fire, measuring conditions within the fuel during the fire, and fitting instruments on the fire trucks to measure radiant heat, temperature, water use by the sprinklers, and toxic gas exposure.

Crew safety can be improved in burnover incidents if crew protection systems are designed to protect against radiant and convective heat and to prevent the entry of flame into crew areas.

Acceptable benchmarks and performance standards for such systems, based on scientific research, will be developed. Rules for the development and implementation of such systems for fire fighting vehicles will be the direct output of the project. The results will provide the scientific principles for the design of safer fire fighting vehicles.



PROJECT 7 > ENHANCING VOLUNTEERISM

LEADERS: Maru Omodei, James McLennan, La Trobe Universitu

Australian rural fire services rely heavily on volunteers. Ensuring adequate crewing levels for the brigades is essential for protecting people, property, and the environment in communities vulnerable to bushfires. There are concerns by many that in the future volunteer numbers may decline in some communities. Potential threats to the number of volunteer firefighters come from several sources.

In some rural communities economic and demographic factors have resulted in declining and ageing populations, and some new housing developments in previously rural areas have low levels of community participation in voluntary activities. Structural changes in the nature of employment, and social and economic pressures on families, may also restrict opportunities for volunteering.

The Bushfire CRC volunteerism project involves carrying out research into factors impacting on the recruitment of future volunteers and the retention of current volunteers. The project aims to provide rural fire services with information to help strategic planning and policy development concerning volunteer numbers, and to suggest new ways of recruiting and supporting volunteer workforces.

The research will involve community surveys, interviews with current volunteers, case studies of best practice brigades, and surveys of employers of volunteers. It will track the experiences of new volunteer recruits as they move through recruitment, induction, training, initial eployments to fires and related emergency incidents.



PROJECT 8 > RESPIRATORY HEALTH OF FIREFIGHTERS

LEADERS: Phil Weinstein, Angus Cook, Phil Thompson, University of Western Australia

Do the smoke masks used by Australian bushfire fighters offer enough protection? Because there is not yet enough evidence to answer this question, this project will investigate the respiratory effects of Australian combustion products as well as the efficacy of the standard issue smoke masks.

The health and safety of firefighters and volunteers has become a key concern in recent years. The effects of vegetation fires in Australian eucalypt and savanna areas may differ from those in deciduous or pine forests overseas. Two types of masks are currently used by Australian firefighters. One mask (P2) is designed to protect from particulates only, and the other (P2+Organic) from particulates and organic volatiles.

This study aims to evaluate the effectiveness of these different masks as compared with using no mask. To do this, a random sample of volunteers will to be selected from the available pool of 900 in the Perth metropolitan area. Those willing will take part in exposure tests carried out in a controlled environment at FESA's Training Centre.

The results of this study will lead directly to the formulation of recommendations on maximising firefighter safety in Western Australian conditions. Also, the technology developed for these tests will be transferable - thus adding to FESA's research capability.



EDUCATION ACTIVITIES

EDUCATION ACTIVITIES

PROGRAM E - EDUCATION ACTIVITIES

LEADER: Mark Adams, University of Western Australia
USER LEADER: Len Foster, Australasian Fire Authorities Council

The Education Program has been moving steadily forward during this first year. Unlike many of the research programs, this program started from a zero base with no students and no projects.

Over the past six months, with the support of Bushfire CRC researchers, the CRC has attracted a good range of students and projects. Because most of these are supported via honours and top-up scholarships, the CRC has good capacity to attract further postgraduate students. This pattern is also indicative of the level of activity prior to the establishment of the Bushfire CRC, and a compliment to the researchers involved.

A scholarships advisory group of Mark Adams (UWA), John Handmer (RMIT), Geoff Cary (ANU), Board members and End User Leaders John Gledhill and Gary Morgan, and Research Director Richard Thornton was formed, to advise the CEO on scholarship proposals. An education reference group was also formed with Mark Adams as chairman to provide overall guidance on the education program.

The CRC now has three honours scholarships, one MSc scholarship and nine PhD scholarships (full, project support and top-up scholarships). These awards cover the range of Bushfire CRC programs and projects.

One of the main aims of the CRC over its seven year life is that between 20 and 40 postgraduate students will gain higher degrees in the field of bushfire research.

With this in mind, the Bushfire CRC will be aiming to find at least another 10 postgraduate students in 2004-05.

The education project described in the following section is an excellent example of an innovative approach that combines research with education in a way that makes the science widely accessible. The Bushfire CRC will be seeking more opportunities of this kind.







PROJECT 1 > BURNING FOR BIODIVERSITY IN NORTHERN AUSTRALIA

LEADER: Alan Andersen, CSIRO, Sustainable Ecosystems

More than 200 people attended the May launch of the Bushfire CRC's fire research and education project at the Territory Wildlife Park, near Darwin. The project involves a team of 27 researchers and educators from CSIRO, the Northern Territory Government and Charles Darwin University. It was launched by NT Chief Minister Clare Martin, and attended by Bushfire CRC CEO Kevin O'Loughlin, Research Director Richard Thornton, and Program Manager Mark Adams. The audience included more than 100 children from the local primary school.

The great majority of Australian bushfires occur in the savanna landscapes of the tropical north, where on average 300,000 square kilometres are burnt each year. Fire intensity in the north is relatively low, and bushfire issues relate primarily to habitat management rather than protection of life and property. In particular, prescribed fire has been adopted as the key landscape management tool across the vast conservation estates of the north, including World Heritage-listed Kakadu National Park. However, the effects of prescribed fire on biodiversity remain poorly understood. Such scientific uncertainty is accompanied by a high degree of public confusion and lack of understanding of the importance of fire in northern Australian landscapes

The Burning for Biodiversity project aims to enhance our knowledge of the effects of different fire regimes on biodiversity and ecological function, improve fire management protocols for biodiversity conservation, and increase public awareness and understanding of the role of fire in northern Australia

The project is the first of its kind in Australia, and features a new field experiment for fire research, integrated with the delivery of information and learning products for public awareness and education. The field experiment has 18 hectare-sized plots, each of which will be subject to one of six fire regimes. The first experimental fires were lit in June 2004

The education component of the project will include a series of public walks through demonstration sites, featuring a range of interpretative displays, where visitors can get hands-on experience of the role of fire in the northern Australian bush. A range of public information products, and training materials for students and fire managers, will also be produced.







SCHOOL CHILDREN AND OTHER TOUR GROUPS WITNESS CONTROLLED EXPERIMENTAL BURNS AT THE TERRITORY WILDLIFE PARK

STUDENT/PROJECT	FUNDING	PROJECT RELATIONSHIP
PhD SCHOLARSHIPS		
Melissa Fixter PhD, UWA	Top-up scholarship: \$7K pa for three years	Respiratory health of bushfire fighters
Christine Kelly Honours, ANU	Honours scholarship: \$5K	Fire regimes and dynamics in in sub alpine forest
Brendan Pippen PhD, UNSW	Full PhD scholarship: \$25K pa for three years	Fire behaviour in heathland vegetation
Alan Rhodes PhD, RMIT	Project support: \$5K pa for three years	"Stay-or-go" policy and community programs
Josh Whittaker PhD, RMIT	Full PhD Scholarship: \$25K pa for three years	Land use planning and bushfire hazard
Philip Zylstra PhD, UNSW	Project support: \$5K pa for three years	Plant species contribution to fire intensity
Luke Balcombe MSc, JCU	MSc support \$25K for two years	Perceptions of bushfire hazards in urban/rural interface
Bevan McBeth PhD, SCU	Top-up scholarship: \$7K pa for three years	Soil, fire and physiological processes in coastal eucalypt forests
Rowan Sadler PhD, UWA	Top-up scholarship: \$7K pa for three years	Long term monitoring and modelling of fire
Madeline Osborn PhD, University of Melb	Project support: \$5K pa for one year	The role of fungi in fire-prone forest communities
Chris Carson PhD, RMIT	Project support: \$5K pa for three years	Bushfire information and warning mechanisms
Pamela Sapurmas Honours LaTrobe	Honours scholarship: \$5K	Firefighter decision-making
Anna Brozovic Honours LaTrobe	Honours scholarship: \$5K	Firefighter decision-making

OLLABORATION
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THE FOUNDATION FOR OUR SUCCESS

Working together, Bushfire CRC researchers and End Users address major, practical problems with a focus on collaborative, usable research.

Our cooperative centre is a joint venture between end user groups (State fire authorities and land management agencies), research providers, and the Federal Government.

Through the Bushfire CRC, many separate groups have become actively involved in much needed fire research with a set of common goals.

It is critical to the success of the CRC that this high level of interaction takes place. Making this happen has already lead to valuable partnerships and notable achievements.

LINKS WITH FIRE AND LAND MANAGEMENT AGENCIES

Having close relationships with Australasia's major fire and land management agencies is one of the Bushfire CRC's major strengths. As well as its links with the individual agencies, the Bushfire CRC works closely with the Australasian Fire Authorities Council (AFAC), the peak body for air and land management agencies in Australia and New Zealand. The co-location of the Bushfire CRC and AFAC offices in East Melbourne greatly facilitates these linkages.

The Bushfire CRC and AFAC CEOs confer frequently, and shared conference facilities make it convenient for participation in each other's meetings. Because of the overlap in membership of the two organisations, close coordination on meeting schedules maximises the opportunities for efficient and effective collaboration. The CRC will hold its major annual research conference in conjunction with the AFAC annual conference in October 2004.

IN THE FIELD

Having structured alliances means bushfire research can be tackled on a number of levels involving the expertise and support of many organisations.

One clear example of such cooperation within the CRC was the experimental burn carried out at Tumbarumba in February 2004. This large-scale event involved a number of research projects.

It was coordinated by researchers from CSIRO's Forestry and Forest Products Division with the help of others such as State Forests of New South Wales, National Parks and Wildlife Service NSW, the Rural Fire Service, the Country Fire Authority, Forest Research New Zealand and the Commonwealth Bureau of Meteorology, as well as university and governmental departments.

Similar experiments are now planned for a number of Australasian locations over coming years.

RESOURCE SHARING

Collaboration between CRC partners has been a key feature in this first year. Leading to new ways of maximising the resources available, this has benefited the CRC in the sourcing of experts, IT support and building communication tools.

OTHER CRCs

There is a growing interaction between the Bushfire CRC and a number of other CRCs including the Tropical Savannas CRC, the CRC for Spatial Information and the Desert Knowledge CRC. This interaction, based on common research interests and the sharing of ideas, will no doubt lead to significant new projects.

INTERNATIONAL

International collaboration is an essential part of the CRC's activities. A number of relationships have already been developed with researchers and fire agencies in Portugal, Spain and China and the United States. In the US the Bushfire CRC collaborates with the US Forest Service on research from Program A (the Fuel Classification project). There is also CRC research taking place in New Zealand investigating fire prediction and behaviour and suppression.

There is considerable interest from overseas in all Programs. Already we are attracting high calibre researchers from overseas with at least four Post-Doctoral fellows being employed from Europe, the US and South Africa, building on Australia's capability.

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MANAGEMENT AND OPERATIONS

MANAGEMENT AND OPERATIONS

CENTRE STAFF

Central management, project coordination, finance administration and promotion activities are carried out by a small team based in Melbourne at the Bushfire CRC office, Level 5, 340 Albert Street.

The CEO, Kevin O'Loughlin, is supported by a Research Director, Richard Thornton, Business Manager, David Peterson, Education Coordinator, Malory Weston*, Communications Coordinator, Derek McCormack and Executive Assistant and Events Coordinator, Kylie Crockett.

*Malory Weston resigned in May 2004 and was replaced by Kellie Watson in June 2004.

The CRC staff work closely with and support the program leaders, project leaders and 170 full and part-time researchers working on the research programs. They also liaise with all stakeholder agencies, support meetings of the stakeholder council, and monthly meetings of the Board.

The Bushfire CRC offices are in newly fitted out premises co-located with the Australasian Fire Authorities Council (AFAC). The Bushfire CRC shares a receptionist with AFAC as well as joint conference and other facilities.



Chief Executive Officer > Appointed Sep 2003



Executive Assistant and Events Coordinator > Appointed Oct 2003



Research Director > Appointed Feb 2004



Business Manager > Appointed May 2003



Mr Derek McCormack Communications Coordinator > Appointed May 2004



Ms Kellie Watson **Education Coordinator** > Appointed June 2004

ED PERSONNEL

SPECIFIED PERSONNEL

SPECIFIED PERSONNEL

Staff whose involvement is essential to the successful operation and running of the CRC are listed below. These staff relate to positions as contained within the Schedules of the Commonwealth Agreement and will be revised in 2004-05 now that the Centre has passed its initial set-up phase.

TITLE AND NAME	ROLE IN CRC	CONTRIBUTING ORGANISATION	ACTUAL TIME ALLOCATION TO CRC (0.0 - 1.0)
Mr Kevin O'Loughlin	CEO	Bushfire CRC Ltd	0.75 (commenced September 2003)
Mr David Peterson	Business Manager	Bushfire CRC Ltd	1.0
Dr Richard Thornton	Research Manager	Bushfire CRC Ltd	0.33 (commenced February 2004)
Mr Derek McCormack	Communications Manager	Bushfire CRC Ltd	0.2 (commenced May 2004)
Mr Jim Gould	Program A Manager	CSIRO	0.65
Prof Mark Adams Mr Gary Morgan	Program B Manager Program B Advisor	Uni of Melbourne (FESI) DSE, Victoria	0.38 0.15
Prof John Handmer Dr Judith Newton	Program C Manager Program C Advisor	RMIT QldF&R	0.7 0.1
Dr Bob Leicester Mr Grant Lupton Mr Ivan Donaldson	Program D Manager Program D Advisor Program D Advisor	Bushfire CRC Ltd SAMFS ACTJCS	0.3 0.1 0.05

UBLICATIONS

A TILITATIONS

PUBLICATIONS

PUBLICATIONS

BOOKS

Cary G, Lindenmayer D, & Dovers S (Eds.): "Australia Burning: Fire Ecology, Policy and Management Issues", 268 pages, CSIRO Publishing

Andersen AN, Cook GD & Williams RJ [Eds] (2003): "Fire in Tropical Savannas: The Kapalga Experiment", Springer-Verlag, New York

BOOK CHAPTERS

Weber R: 'Modelling Heating Effects' submitted in May 2004

JOURNALS

Keane RE, Cary GJ, Davies ID, Flannigan MD, Gardner RH, Lavorel S, Lenihan JM, Li C, and Rupp ST: 'A classification of landscape fire succession models: spatial simulations of fire and vegetation dynamics' *Ecological Modelling*, In Press

Bell T, Tolhurst K, Wouters M: 'Effects of fire retardant on vegetation in eastern Australian heathlands', International Journal of Wildland Fire, In Press

Andersen AN et al: 'Fire frequency and biodiversity conservation in Australian tropical savannas: implications from the Kapalga fire experiment', Austral Ecology (in press)

Keane RE, Cary GJ and Parsons R: 'Using simulation to map fire regimes: an evaluation of approaches, strategies, and limitations', International Journal of Wildland Fire, 12, 309-322

INTERNATIONAL CONFERENCES

Mills GA: 'Mesoscale NWP and extreme fire weather' *3rd International Wildland Fire Conference*, 3-6 October 2003, Sydney.

O'Loughlin KJ: 'Fires and Drought – Meteorologists, Managers, Media and Society', *First World Conference on Broadcast Meteorology*, 3-5 June 2004, Barcelona, Spain.

Wain A and Mills G: 'The AFAC/Commonwealth Bureau of Meteorology Smoke Management Project', 3rd International Wildland Fire Conference, 3-6 October 2003, Sydney

Handmer J & Proudley B: 'The economics of interface wildfires', Proceedings 2nd International Symposium on Wildfire Economics, 19-22 April, Cordoba, Spain

AUSTRALIAN CONFERENCES

Gould J: 'Project Vesta- findings, extension and validation for south eastern Australia eucalypt forest', Bushfire 2004 conference, 25-28 May, Adelaide

Gould J, Plucinski M, McCarthy G: 'Aerial Suppression- need for evaluation' *Bushfire 2004 conference*, 25-28 May, Adelaide

O'Loughlin KJ: 'A New Era in Bushfire Research', *Bushfire 2004* conference, 25-28 May 2004, Adelaide

O'Loughlin KJ: 'Inflaming Passions – New Directions in Bushfire Research', *NSW Conservation* Council Bushfire conference, 24-25 June 2004, Sydney

Leonard RJ, Blanchi R and Bowditch PA: 'Building at the Urban Interface', *Bushfire 2004 conference*, 25-28 May, Adelaide

Blanchi R, Leonard J, Maughan D: 'Towards New Information Tools for Understanding Bushfire Risk at the Urban Interface', *Bushfire 2004 conference*, Adelaide

OTHER

McKaige B and Andersen A: 'Australian first a burning desire in the Territory', *Australian Geographic* [in press]

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PUBLIC RELATIONS
AND COMMUNICATION

PUBLIC RELATIONS AND COMMUNICATION

Recognising that effective communication is critical to successfully engaging end users and the general public, the Bushfire CRC has adopted a structured approach via three major target areas:

- // Internal informing all partners and especially linking researchers and end users
- // External informing other fire researchers, the wider research community, governments, the public and the media
- // Research publications aimed at national and international science and business communities.

The Bushfire CRC is giving high priority to increasing the dialogue among researchers, users and the community. Over its first year of operation the Bushfire CRC has developed multiple channels for interchange between end users. Four research workshops were held, one linked with a Stakeholder Council meeting. A series of roving research forums is planned in States and Territories and in New Zealand in the next financial year to enable wider participation by staff of end user organisations and other interested parties.

Two internal communication tools have been developed:

- // The CEO newsletter, a brief update every two to three weeks providing partners with information on new developments within the Bushfire CRC and its research programs
- // The Bushfire CRC Bulletin, an on-line update every two months that highlights top stories from Bushfire CRC research, news and events.

A more substantial, regular newsletter is planned for general

To further strengthen interaction between the CRC's end user community and researchers, the inaugural Bushfire CRC Annual Conference will be held in conjunction with the 2004 Australasian Fire Authorities Council Conference in Perth in October 2004.

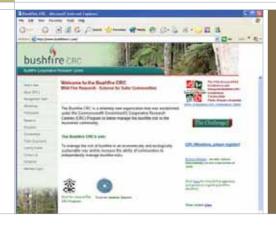
The Bushfire CRC's Website (www.bushfirecrc.com) provides information resources for the public and Bushfire CRC partners.

Available material includes information on Bushfire CRC research projects, personnel and events. Partner agencies can download papers, presentations and reports from research in progress from the members' area of the site.

The Bushfire CRC views its website as potentially a major tool in communicating effectively with its large number of partner organisations, and with the wider community. The site will be developed significantly during

COMMUNICATIONS INITIATIVES 2003-2004

Stakeholder Communications	CEO newsletter in production Contact lists built and stakeholder meetings/minutes formalised Concept of state forums developed Ministerial briefings underway
Researcher Communications	Network established and contact lists built
Online resources	Website launched Research reports and presentations available online in members' area
Publications & corporate identity	Media pack with brochure Poster, stationary, signage and banner
Press/media	Extensive media coverage of Bushfire CRC launch CEO involved in media coverage Media coverage archive created Contact list compiled
Forums and workshops	Research Workshops, December 2003, March 2004 (2) and April 2004 Plans for State and Territory research forums.
Resources	Slide presentation templates prepared Image and graphics library commenced
International	International awareness increased via: // Involvement in 3rd International Wildland Fire Conference, Sydney October 2003 // International missions by four researchers and CEO



: BUSHFIRE CRC'S WEBSI

PUBLIC RELATIONS AND COMMUNICATION

The Bushfire CRC's involvement at the 3rd International Wildland Fire conference in Sydney, 3-6 October 2003 was especially valuable in establishing an international profile for the CRC. The conference was attended by 1,100 delegates from more than 60 countries. The conference also provided a very suitable venue for the launch of the book "Fire in Tropical Savannas: The Kapalga Experiment", in Sydney. Federal Science Minister, the Hon. Peter McGauran, officiated. This book summarises the 10-year research program featuring the landscapescale Kapalga fire experiment in the Northern Territory. Editors include Bushfire CRC researcher Alan Andersen.

Minister McGauran again officiated at the formal launch of the Bushfire CRC on December 9th 2004 in Melbourne's Fitzroy Gardens. The occasion was attended by 150 guests and attracted considerable media attention.

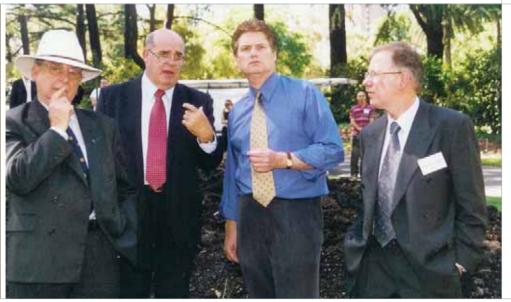
The Bushfire CRC has taken several measures to enhance media relations and to monitor media coverage.

With help from its fire agency partners, the Bushfire CRC has established valuable links with the media most likely to cover bushfire research stories. The CRC has also created two media archives - one which records CRC

press coverage, and the other recording non-CRC news of interest to our members. The maintenance of these archives has been further enhanced through the occasional use of a professional media monitoring service.



BOOK LAUNCH. L-R: ANDREW JOHNSON, KEVIN O'LOUGHLIN, ALAN ANDERSEN, THE HON. PETER MCGAURAN, AND IAN MACDOUGAL.



LR: IAN MCDOUGAL, PHIL KOPERBERG, SCIENCE MINISTE THE HON. PETER MCGAURAN AND KEVIN O'LOUGHLIN AT THE I AINCH OF THE RIISHEIRE FRC

MEDIA COVERAGE HIGHLIGHTS 2003-2004

DATE	MEDIA	COVERAGE	PUBLISHED/ BROADCAST BY	SUBJECT
2004				
01/06/2004	Print	Melbourne	Herald Sun	Bigger than Elvis - Jim Gould comments on Evergreen 747 tanker
15/05/2004	Print	National	Age	Volunteers and fire fighting - interview with Jim McLennan
18/05/2004	Radio	Local	3WM Horsham VIC	New fire research and education facility at the Territory Wildlife Park - Dr Andersen
18/05/2004	Radio	Local	2QN Deniliquin	Territory Wildlife Park
18/05/2004	Radio	Local	2GN Goulburn	Territory Wildlife Park
18/05/2004	Radio	Local	2LF Young	Territory Wildlife Park
18/05/2004	Radio	Local	2NM Musswellbrook	Territory Wildlife Park
18/05/2004	Radio	Local	2RG Griffith	Territory Wildlife Park
18/05/2004	Radio	Local	2VTR Windsor	Territory Wildlife Park
18/05/2004	Radio	Local	2WEB Bourke, 2WG Wagga, 3CS Colac, 3NE North Eastern Victoria, 3SH Swan Hill, 3SR Shepparton, 3WM Horsham, 4BU Bundaberg, 4HI Emerald	Territory Wildlife Park

DATE	MEDIA	COVERAGE	PUBLISHED/ BROADCAST BY	SUBJECT
2004 (continued)				
17/05/2004	Radio	Local	2UE	Territory Wildlife Park
14/05/2004	Radio	National	ABC Darwin News	Territory Wildlife Park
14/05/2004	Radio	Regional	Top FM Darwin, ABC National Regional Radio News, ABC Country Hour	Territory Wildlife Park
14/05/2004	Radio	National	ABC News Radio Rolling News	Territory Wildlife Park
14/05/2004	TV	National	ABC News Darwin	Territory Wildlife Park
14/05/2004	TV	National	Channel 9 Darwin	Territory Wildlife Park
14/05/2004	Online	National	ABC	Territory Wildlife Park
14/05/2004	Online	National	ABC	Territory Wildlife Park
12/05/2004	Radio	National	ABC	CEO media comment in connection with hazard reduction burning program in Victoria.
9/01/2004	Radio	National	ABC's PM Program	Interview with Rod Weber, covering timeliness of funding and establishment of the CRC
10/01/2004	Print	National	The Weekend Australian Magazine	The Burning Issue - What have we learned since Canberra 2003?
1/01/2004	Print	Local	Australian Timberman	Researchers Unite to Fight Bushfires - CSIRO plays major role in national research centre.
17/01/2004	Print	National	The Weekend Australian Magazine	Relevant letters to the Editor (ref: article on 10/1/04)
10/12/2003	On-line	National	The Age	CRC launch.
10/12/2003	Radio	Various Rural	Sky Radio Rural Syndication	Bushfire behaviour, construction in fire-prone areas and arson will be the focus for study at a new bushfire research centre.
10/12/2003	On-line	National	The Age	CRC launch.
10/12/2003	Print	Local	The Canberra Times	Bushfires: Learning from history. Education program designed to cut risk.
10/12/2003	Print	Local	The Australian	Greenhouse effects to 'treble' bushfire menace.
10/12/2003	Print	National	The Australian	Research to reduce the fear of wildfire.

DATE	MEDIA	COVERAGE	PUBLISHED/ BROADCAST BY	SUBJECT
2003				
10/12/2003	Print	National	The Age	Ongoing bushfire battle gets a \$100m boost. CRC launch.
10/12/2003	Print	Melbourne	Herald Sun	Bushfires likely to get worse - Safety fire trucks an early priority.
10/12/2003	Print	National	The Age	CRC launch.
10/12/2003	On-line	National	The Age online	CRC launch.
10/12/2003	On-line	National	The Australian online	Greenhouse effects to 'treble' bushfire menace.
9/12/2003	On-line	National	The Age	CRC launch.
9/12/2003	On-line	National	ABC Online	CRC launch.
9/12/2003	On-line	National	ABC Online	Severe bushfires linked to global warming
9/12/2003	Radio	Melbourne	ЗМР	CRC launch.
9/12/2003	Radio	Melbourne	3AW	CRC launch.
9/12/2003	Radio	Melbourne	Magic 693	CRC launch.
9/12/2003	Radio	Melbourne	ЗАК	CRC launch.
9/12/2003	Radio	Melbourne	3AW	CRC launch.
9/12/2003	Radio	National	ABC - The Bush Telegraph	Brown interviews Matt O'Sullivan, Rural Newsroom. BUSHFIRE CRC.
9/12/2003	Radio	Victoria	ABC	Continuing interview with Kevin O'Loughlin, National Bushfire Cooperative Research Centre.
9/12/2003	Radio	Northern Territory	ABC	Reporter interviews Brent Williams, Bush Fire Council on the "Stay-or-Go" policies of fire fighting.
9/12/2003	Radio	Hobart	HO-FM Radio News	New \$100m bushfire research centre in Melbourne.
9/12/2003	Radio	Sydney	2GB	Morrison interviews Jim Gould about the newly established Bushfire Cooperative Research Centre.

DATE	MEDIA	COVERAGE	PUBLISHED/ BROADCAST BY	SUBJECT
2003 (continued)				
9/12/2003	Radio	Geelong	BAY FM Radio News	A fire tanker protection system designed to save crews in a bushfire will be tested next month.
9/12/2003	Radio	National	ABC Radio National "PM"	CRC launch.
9/12/2003	Television	Alice Springs	Imparja TV State Television News	Experts say the new National Bushfire Research Centre, designed by CSIRO, Met. Bureau and State fire services, will save lives and property.
9/12/2003	Radio	National	ABC National Radio "PM"	CRC launch.
9/12/2003	Television	National	National Ten Network	CRC launch.
9/12/2003	Radio	Brisbane	ABC 612	CRC launch.
9/12/2003	Television	Adelaide	National Nine News	CRC launch.
9/12/2003	On-line	National	Herald Sun online	Climate change to bring more fires.
9/12/2003	On-line	National	The Advertiser	Climate change to bring more fires.
8/12/2003	Television	National	ABC	CRC launch.
8/12/2003	Television	Melbourne	ATV 10	CRC launch.
8/12/2003	Television	National	Channel 9	CRC launch.
8/12/2003	Television	National	Channel 7	CRC launch.

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PERFORMANCE INDICATORS

PERFORMANCE INDICATORS

	PERFORMANCE INDICATORS	PERFORMANCE 03–04
Over its first year, the Bushfire CRC has primarily focused on the set-up of the current research program. The Bushfire CRC's strategic planning processes have also been established for both research and governance activities. The centre's utilisation strategy has developed through its first phase, with further progress to come from the emergence of research outputs. The communications strategy has now been developed for the first year. An infrastructure for effective internal and external communications has also been established. The education and training program has accelerated, with more than 10 scholarships already awarded and a student professional development program now underway.	Goal over life of centre: to enhance the contribution of long-term scientific and technological research and innovation to Australia's sustainable economic and social development. // Develop new technological breakthroughs // Seminars, workshops and public forums // Produce End User focused publications and reports // Demonstrated leading edge research and development // Collaboration with overseas groups // Regular meetings of stakeholders, researchers and technical committee // Regular project reviews held by Project Leaders Goal over life of centre: to enhance the transfer of research outputs into commercial or other outcomes of economic, environmental or social benefit to Australia. // Additional income through contracts and consultancy // Book chapters, two books, 25 refereed journals per annum and 30 refereed conference papers per annum // Exceed budget plan // Greater than 60% of the know-how and research deliverables adopted by End Users // Intellectual Property reviews to be held once a year	Research projects established tackling bushfire issues on a number of levels (refer to research activities) Two State and Territory research forums planned and organised for end users and the public Publications stream begun (refer to publications section) Research workshops held (December 03, March 04 and April 04) International linkages established for collaboration and possible research projects Education Coordinator in place. Education Program developed and links with universities in place A number of CRC books and other publications prepared or in press Strategic planning for utilisation and commercialisation is underway Consultation and collaboration with End User agencies

PERFORMANCE INDICATORS	PERFORMANCE 03–04
Goal over life of centre: to enhance the value to Australia of graduate researchers. // 10 PhDs fully employed by End User groups // At least one student and one post-doctoral fellow per annum on an exchange program // At least 20 fully funded PhD students graduated with further training in research management and all employed within three months of graduation	The Education Program has awarded 10 full and partial research scholarships during the first year The Education Coordinator has introduced induction packages for all new Bushfire CRC students Arrangements have been made with our fire agency partners for fireground training; this will be provided to CRC students and staff
Goal over life of centre: to enhance collaboration among researchers, between researchers and industry or other users, and to improve efficiency in the use of intellectual and other research resources. // 60% of projects to involve End User Participants // Research reviews at least twice a year // At least 50 newsletters to all core and associate participants // User participants to have contributed the equivalent of one person year of "in-kind" from their organisation over the life of the CRC // At least three formal collaborative associations with other CRCs	End User participation is currently at 80% (refer to utilisation section) Quarterly reports and regular Research Leader meetings established in year one Five issues of a CEO newsletter sent to all members Regular briefings to the Australasian Fire Authorities Council (AFAC) A new monthly Bushfire CRC Bulletin internal update designed and prepared for all partners User participants providing "in-kind" contributions as per Commonwealth agreement New linkages with CRCs in progress. These include: // Spatial Data CRC // Desert Knowledge CRC // Tropical Savannas CRC

