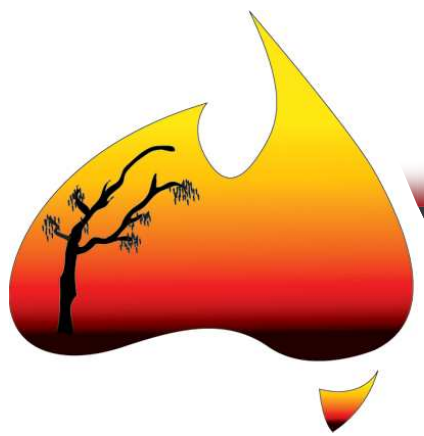


The Nature Conservation Council of NSW  
presents  
Its Sixth Bushfire Management Conference

# BUSHFIRE IN A HEATING WORLD



Centenary Lecture Theatre, Sydney  
31st May—1st June 2007



## DAY ONE: THURSDAY 31ST

8:15 am	Registration
<b>SESSION 1: INCORPORATING CLIMATE CHANGE</b>	
<b>9:00 am</b>	<b>Welcome</b> <i>Adjunct Assoc. Prof. Don White (Chairperson, Nature Conservation Council of NSW)</i>
9:05 am	<b>Welcome to Country</b> <i>Allen Madden (Metropolitan Local Aboriginal Land Council)</i>
9:15 am	<b>Opening Address</b> <i>The Hon. Phil Koperberg MP (Minister for Climate Change, Environment and Water)</i>
9:30 am	<b>Keynote</b> The Impact of Climate Change on the Risk of Forest and Grassland Fires within Australia <i>Prof. Andy Pitman (University of NSW)</i>
10:00 am	Co-operation and Co-ordination: Tackling Climate Change <i>Acting Commissioner Rob Rogers (NSW Rural Fire Service)</i>
10:30 am	<b>MORNING TEA</b>
<b>11:00 am</b>	A Wider View on Local Government <i>Councillor Allan Smith (Local Government &amp; Shires Association of NSW)</i>
11:20 am	A Farmer's Perspective <i>Graham R Brown (NSW Farmers' Association)</i>
11:40 am	Incorporating Climate Change into Bushfire Management in Forestry <i>Trent Penman and Tony Scherl (Forests NSW)</i>
12:00 pm	Speakers' Panel: Questions & Comments from the Floor
12:30 pm	<b>LUNCH</b>
<b>SESSION 2: ECOLOGICAL REALITY: BUSHFIRE IN A HEATING WORLD</b>	
<b><i>Interactions between Climate Change and Bushfire</i></b>	
<b>1:30 pm</b>	<b>Keynote</b> Fire and Climate Change in Australia: is Gondwana a goner? <i>Prof. Ross Bradstock (University of Wollongong)</i>
2:00 pm	Assessing the Impact of Climate Change on Fire Weather <i>Dr. Bertrand Timbal (Bureau of Meteorology)</i>
2:20 pm	Climate Change and Fire Weather Risk in South-Eastern Australia <i>Kevin Hennessy (CSIRO)</i>
2:40 pm	Impacts of Fire on Downstream Water Quality <i>Dr. Scott Wilkinson (CSIRO)</i>
3:00 pm	<b>AFTERNOON TEA</b>
<b><i>Learning from Ecological Evidence</i></b>	
<b>3:30 pm</b>	<b>Keynote</b> Bushfire in a Heating World—Learning from the ecological evidence <i>Dr. Kevin Tolhurst (University of Melbourne)</i>
4:00 pm	The Fire, Human and Climate Nexus in South-Eastern Australia <i>Dr. Scott Mooney (University of NSW)</i>
4:20 pm	<b>Case Study</b> Aboriginal Burning Regimes in South-East NSW <i>Greg Watts (NSW Department of Environment &amp; Climate Change, Parks and Wildlife Division)</i>
4:40 pm	Speakers' Panel: Questions & Comments from the Floor
5:00—6:30 pm	Drinks and poster session at the Vanderfield Building

## DAY TWO: FRIDAY 1ST JUNE

SESSION 3: ECOLOGICAL REALITY: OUTCOMES FOR FLORA AND FAUNA	
	<b>Predicting Ecological Outcomes</b>
9:00 am	<b>Keynote</b> So Little Time? <i>Assoc. Prof. Paul Adam (University of NSW)</i>
9:30 am	Fire, Climate and Vegetation in the Greater Blue Mountains World Heritage Area—Using current patterns to predict future change <i>Dr. Kate Hammill (NSW Department of Environment and Climate Change)</i>
9:50 am	The Prescribed Burning Conundrum—Protecting our neighbours from bushfire <i>and</i> maintaining biodiversity in a time of increasing fire activity due to climate change <i>Pamela O’Neill (NSW Department of Environment and Climate Change, Parks and Wildlife Division)</i>
10:10 am	<b>Case Study</b> Altered Fire Regimes: how resilient are invertebrates to change and what are the implications for biodiversity and the maintenance of ecosystem function? <i>Dr. Alan York (University of Melbourne)</i>
10:30 am	<b>MORNING TEA</b>
	<b>Landscape Burning, Greenhouse Gas Emissions and Adaptive Management</b>
11:00 am	<b>Keynote</b> Developing Emissions Abatement Opportunities from Savanna Burning <i>Dr. Jeremy Russell-Smith (Bushfires NT, Tropical Savannas Management CRC)</i>
11:30 am	<b>Case Study</b> Fire and Climate Change in Woodlands: impacts on grasses and shrubs <i>Dr. Penny Watson (Hotspots Fire Project)</i>
11:50 am	<b>Case Study</b> Bell Miner Associated Dieback: a consequence of a changed ecosystem? <i>Paul Meek (Bell Miner Dieback Working Group)</i>
12:10 pm	Speakers’ Panel: Questions & comments from the floor
12:30 pm	<b>LUNCH</b>
SESSION 4: BUILDING RELATIONSHIPS AND MOVING FORWARD	
1:30 pm	<b>Governance: Decision-making for Change</b> Panel: Responses from NSW RFS, DECC and the Community. <i>Convened by Cate Faehrmann (Executive Director, Nature Conservation Council of NSW)</i>
2:45 pm	<b>AFTERNOON TEA</b>
3:15 pm	<b>Keynote</b> Examples In Successful Community Engagement, Fire Management for Biodiversity <i>Julie Woodroffe (Hotspots Fire Project)</i>
3:45 pm	The Grose Valley Fire Forum—issues and the way forward <i>Dr. Rosalie Chapple (Blue Mountains World Heritage Institute)</i>
4:05 pm	Perspectives on Bushfire Risk Management in NSW <i>Dr. Simon Heemstra (NSW Rural Fire Service)</i>
4:25 pm	<b>Closing Address</b> Economic Benefits of Building Relationships <i>Commissioner Greg Mullins (NSW Fire Brigades)</i>
4:55 pm	<i>Drawing of the lucky door prize</i>
5:00 pm	<b>Conference Close</b>

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## WELCOME

On behalf of the Nature Conservation Council of NSW and more specifically the Bushfire Management Program and its contributors, it is with great pleasure that I invite you to participate in this important conference.

We are proud to be representing a community which values sound science, experience and lifelong learning, and recognise that this community is also looking for leadership. NCC believes that the community is involved in decision-making and the last session of the conference will discuss this further.

I would like to extend my thanks to the conference committee for their time and effort in helping to develop *Bushfire in a Heating World*. I would especially like to thank Dr. Judy Messer for her ongoing dedication and enthusiasm.

We have strived to build a conference that will give the audience the information from which to base any future directions, provide some key examples of how to move forward and broaden discussions to involve decision-makers.

On behalf of everyone involved, I hope that you enjoy this conference and that it provides an opportunity for you to identify, discuss and explore the ecological reality of bushfire in a heating world.

*Pat Westwood*

Coordinator, Bushfire Management Program  
Nature Conservation Council of NSW

## CONFERENCE COMMITTEE

Pat Westwood

Annie Sloggett

Dr. Judy Messer

Prof. Don White

Robert Pallin

Anne Reeves

Cate Faehrmann

Jane Gye

Jim Morrison

Nikki Conroy (Hotspots)

Waminda Parker (Hotspots)

## SESSION 1: INCORPORATING CLIMATE CHANGE

### WELCOME

**ADJUNCT ASSOC. PROF. DON WHITE** Chairperson, Nature Conservation Council of NSW

**Biography:** Don White is the Chairperson of the Nature Conservation Council of NSW. A manager and engineer by training and profession, he is also Adjunct Associate Professor at the Faculty of Engineering, University of Sydney. Don has a longstanding history of community involvement – he is a volunteer firefighter and Publicity Officer for the Rural Fire Service's Laguna Brigade, Co-ordinator of the NCC member group Green Shareholders and an active volunteer bush regenerator and local Resident Group Coordinator.

Don serves on several boards and committees, including the Environmental Trust Waste Committee, Load Based Licensing Technical Review Panel and the Hazardous Chemicals Advisory Committee to the EPA.

### WELCOME TO COUNTRY

**ALLEN MADDEN.** Metropolitan Local Aboriginal Land Council

**Biography:** Allen Madden is a well respected member of the Redfern community and the Educational and Cultural Officer of the Metropolitan Local Aboriginal Land Council. Allen is an Aboriginal Man from Gadigal Land who has resided in the Redfern area of Sydney all his life and is here to welcome you to the land we are meeting on today.

### OPENING ADDRESS

**PHIL KOPERBERG MP. AO, AFSM, BEM.** Minister for Climate Change, Environment and Water

**Biography:** The Hon. Phil Koperberg was appointed Minister for Climate Change Environment and Water in March 2007. He is currently a Member of the Legislative Assembly, Member for Blue Mountains, and Member of the Australian Labor Party. Until receiving this position, he had served as Commissioner for the NSW Rural Fire Service. Minister Koperberg's interest in bushfire management began when he joined his local North Springwood Bushfire Brigade in 1967. He went on to become district manager in 1970. In 1972 he accepted a role as Policy Advisor for Emergency Services. In 1985 he applied for, and was granted, the role of executive officer of the Bushfires Branch of the Office of the Minister for Police and Emergency Services. This branch evolved into the Department of Bushfire Services and then, eventually, in 1997, the NSW Rural Fire Service.

### THE IMPACT OF CLIMATE CHANGE ON THE RISK OF FOREST AND GRASSLAND FIRES WITHIN AUSTRALIA

**PROF. ANDY PITMAN PhD.** Professor and Co-Director of the UNSW Climate Change Research Centre

**Biography:** Andy Pitman holds a chair at UNSW and is the co-director of the new Climate Change Research Centre. He was a lead author on the recent Intergovernmental Panel on Climate Change report, he is on the Prime Minister's Science, Engineering and Innovation Council's task force on regional climate change and adaptation, and he is chair of the World Climate Research Program's committee on terrestrial processes. Andy convenes the ARC Research Network for Earth System Science. He publishes actively in climate science, land cover change, and the impacts of climate change on phenomenon including bush fire risk.

The impact of future climate change on the risk of forest and grassland fires over Australia in January is assessed using a high resolution regional climate model, driven at the boundaries by data from a transitory coupled climate model. Two future emission scenarios (relatively high and relatively low) are used for 2050 and 2100 and four realizations for each time period and each emission scenario are run. Results show a consistent increase in regional-scale fire risk over Australia driven principally by warming and reductions in relative humidity in all simulations, under all emission scenarios and at all time periods. We calculate the probability density function for the fire risk for a single point in New South Wales and show that the probability of extreme fire risk increases by around 25% compared to the present day in 2050 under both relatively low and relatively high emissions, and that this increases by a further 20% under the relatively low emission scenario by 2100. The increase in the probability of extreme fire risk increases dramatically under the high emission scenario by 2100.

Our results are broadly in-line with earlier analyses despite our use of a significantly different methodology, and we therefore conclude that the likelihood of a significant increase in fire risk over Australia resulting from climate change is very high. While there is already substantial investment in fire-related management in Australia, our results indicate that this investment is likely to have to increase to maintain the present fire-related losses in Australia.

## CO-OPERATION AND CO-ORDINATION: TACKLING CLIMATE CHANGE

**ROB ROGERS, AFSM. Acting Commissioner NSW Rural Fire Service**

**Biography:** Rural Fire Service Acting Commissioner Rob Rogers began his career at the age of 15 as a firefighter with Belrose Brigade in northern Sydney. He served with the Belrose Brigade for 16 years, rising to the rank of Captain, during which time he attended a number of major fires in Sydney and surrounding areas including the Blue Mountains, Nowra and Wollongong. In 1995, he was appointed Deputy Fire Control Officer to the Greater Taree District and was later promoted to Fire Control Officer for the Cessnock District.

Bob joined RFS headquarters as Director of Regional Management in 2002, and shortly after became the Executive Director of Community Safety. Some of his achievements include reforming multi-agency risk management plans, implementing necessary hazard reduction on both public and private land and approving development applications in fire prone areas. Bob was also instrumental in the process of integrating community education into all aspects of fire risk mitigation as opposed to it operating as a stand alone programme.

Bob was awarded the Australian Fire Service Medal in 2004.

In January 2007, Acting Commissioner Rogers was appointed to act in the top job after Commissioner Phil Koperberg moved to State politics.

The prospect of climate change brings many challenges to us all and fire services are not immune. Models predicting longer fire seasons and more days of high to extreme fire danger also suggest a narrowing and shift of the prescribed burning period to winter. These two issues combined, will force fire authorities in south-east Australia to rethink much of the underpinning theory and practice of the past. Co-ordination and co-operation are the key drivers that allow for all interested bodies to work together to overcome these challenges. Fortunately, NSW has in place, and has had for many decades, mechanisms that allow this to happen. The Bush Fire Coordinating Committee is the one of principal bodies dealing with the challenges of a changing climate.

## A WIDER VIEW ON LOCAL GOVERNMENT

**COUNCILLOR ALLAN SMITH. Local Government and Shires Association of NSW, Mayor Of Dubbo**

**Biography:** Allan Smith is currently the Mayor of Dubbo, a position he has held for five years. Allan was a firefighter for the NSW Fire Brigade for 18 years. He is currently a member of the NSW Rural Fire Service Advisory Council and the NSW Bushfire Coordinating Committee .

Councillor Smith has been a member of the Local Government Association Executive since December 2000. He is a member of the Zoological Parks Board of NSW, Local Government Association Roads and Transport Committee, RTA Traffic Advisory Council and Deputy Chair of the Orana Regional Development Board.

Local Government continues to have an important community and management role in local fire issues, as well as exercising key roles in many environmental and resource issues across NSW. The Local Government Association of NSW operates many key policy initiatives and plays a strong lobbyist role between the conflicting demands of councils and the government.

## A FARMER'S PERSPECTIVE

**GRAHAM BROWN. NSW Farmers' Association**

**Biography:**

Graham was educated in Sydney in the 1950 and 1960s and received his tertiary training in farm management at Marcus Oldham College, Geelong Victoria. Graham has 40 years' farming experience, managing a wool growing enterprise with cattle and prime lambs. He has a long association with NSW Farmers and its predecessor farming bodies.

Having trained in agricultural farm management in Victoria in the early 1960s and seen first hand the results of farming practices after in some cases six generations of European settlement – Graham was determined to embark on a 'sustainable development' career, his family's farm having already done so for several decades. The main thrust was long-term perennial pastures, to manage drought and to mitigate against fire and provide for family in an economic sense. This was generally achieved until a major bush fire in the mid 1980s and then mining, impacted in the late 1990s. Graham now farms in a sustainable capacity befitting his family's situation.

Graham continues to be active with the NSW Farmers' Association on a wide range of issues.

## INCORPORATING CLIMATE CHANGE INTO BUSHFIRE MANAGEMENT IN FORESTRIES

**TRENT PENMAN AND TONY SCHERL. Forests NSW**

*Abstract Pending*



## SESSION 2: ECOLOGICAL REALITY: BUSHFIRE IN A HEATING WORLD

### FIRE AND CLIMATE CHANGE IN AUSTRALIA: IS GONDWANA A GONER?

**PROF. ROSS BRADSTOCK.** Director, Centre for Environmental Risk Management of Bushfires, University of Wollongong

**Biography:** Professor Ross Bradstock is Director of the new Centre for Environmental Risk Management of Bushfires – a new venture established with assistance from the NSW Department of Environment and Climate Change and the NSW Rural Fire Service. The Centre is devoted to research on the problem of managing bushfire risk and devising optimal solutions for mitigation of risk to diverse landscape values – such as people and property, biodiversity and ecosystem services. He has more than 20 years experience in bushfire research acquired in the public sector. Ross is currently leader of the Bushfire CRC Project B.1.2. ‘Managing Bushfire Risk in Changing World’, involving collaboration with colleagues at ANU, CSIRO and Government agencies in NSW, Tasmania and the Northern Territory. Ross's other research interests include fire ecology, vegetation management, conservation biology, landscape ecology and climate change. He has served on the Editorial Advisory Committees for the Australian Journal of Botany and the International Journal of Wildland Fire. He has recently delivered plenary papers on the consequences of climate change for bushfire risk management at conferences in San Diego, Brisbane and Sydney.

Australia, the progeny of Gondwana, is a continent where fire is a component of both this historical legacy and the current landscape. While a vast area of Australia is either arid or tropical, no part of the continent can be regarded as too wet or dry for fire. The role of fire regimes, climate and vegetation ‘feedback’ in driving vegetation change (past and present) remains controversial. The prospect of a rapidly changing world (climate, CO<sub>2</sub>, invasive species and people) requires a mechanistic understanding of these processes in order to predict consequences. Here global change (GC) prognoses for fire regimes and vegetation response are briefly explored on a biogeographic basis (tropical savannas - TSW, arid zone grass/shrublands - AZHS, warm - WTSFW, and cool temperate - CTSF, sclerophyll vegetation complexes), with the fate of this diverse Gondwanan heritage foremost in question.

Evidence suggests that postulated GC driven shifts in fire regimes in each instance may have most impact on cover and diversity of woody species. For example in TSW, major increases in fire intensity fuelled by Gamba Grass, have resulted in significant tree mortality. By contrast in AZHS a decrease in area burned and fire frequency may ameliorate adverse effects of contemporary fire regimes on populations of obligate seeder shrubs and trees. In WTSFW, where woody plant species diversity (and fire response syndromes) is high, effects may be complex and varied. The uncertainties and complexity of prediction of GC effects are emphasized. Issues requiring resolution include knowledge of effects of elevated CO<sub>2</sub> on fuel mass/structure and dynamics of Australian plant functional types and detailed insights into the probability and intensity of extreme events (drought, wind, high rainfall, etc.) under GC and interactions with invasive species – particularly grasses. Is Gondwana a goner? The jury is out, but significant changes in fire regimes seem most probable in the temperate regions that are bastions of Gondwanan diversity – both among the sclerophyll flora and rainforest relicts. Historically, the former are positively linked with drying and the rise of fire, while for the latter the link is negative. Given the rapidity and totality of GC effects, the legacy of this history as a key to predicting a new future is open to question.

### ASSESSING THE IMPACT OF CLIMATE CHANGE ON FIRE WEATHER

**DR BERTRAND TIMBAL PhD, MBA (Tech).** Senior Research Scientist, Bureau of Meteorology

**Biography:** Bertrand has been in the climate change research area since the early 1990s. He completed his PhD on climate change modelling in 1994, in France and has been located in Australia since 1996. He is currently a Senior Research Scientist within the Climate Forecasting Group in the Bureau of Meteorology Research Centre (BMRC). Bertrand's main interest is to develop techniques (e.g. statistical downscaling models or diagnostic tools) to translate climate change information from climate models to a level usable for applications to understand the impacts of climate changes.

Currently, Bertrand is involved in the South-Eastern Australian Climate Initiative (SEACI) as leader of the research theme on detection and attribution of observed climate change. He is also leading the effort of BMRC to provide downscale climate change projections as part of the Australian Climate Change Science Programme (ACCSP) funded by the Australian Greenhouse Office (AGO). In addition, he is involved in several projects dealing with weather extremes (such as extreme fire danger days).

Fire weather indices have long been developed to help National Meteorological Services advise relevant fire fighting services of the danger of particular meteorological situations for forest fires. Calculating these indices to climate model projections of future climate change is difficult due to the coarse resolution of climate models, and the difficulty that these models have in reproducing the most extreme weather events.

In this presentation, a possible alternative to infer the impact of climate change on fire weather will be outlined. For example, it is possible to use a diagnostic tool derived from Numerical Weather Prediction applications, to identify synoptic systems conducive to high fire danger days. This method has been used to readily identify from broad-scale meteorological fields, those days in which the synoptic conditions are associated with the most destructive and disastrous bushfires experienced in south-east Australia in recent decades. The beauty of this simple method is that it circumvents the need to access a wide range of variables and can be readily applied to climate models.

Also discussed is the possibility of using statistical downscaling techniques to relate large-scale atmospheric fields, skilfully generated by climate models to the local variables needed to calculate reliable complex fire indices such as rainfall, soil moisture, wind-speed and humidity, for which climate models are less skilful due to local heterogeneities.



## CLIMATE CHANGE AND FIRE-WEATHER RISK IN SOUTH-EASTERN AUSTRALIA

KEVIN HENNESSY BSc (Hons), Dip. Science Communications. Principle Research Scientist, CSIRO Marine and Atmospheric Research

Kevin has been employed as a CSIRO scientist since 1987. He has been a member of the Climate Impact Group since its inception in 1989. His expertise lies in analysis of observed climatic trends, analysis of future greenhouse simulations, development of Australian climate change projections, assessment of potential impacts, communication of climate science and responding to 'greenhouse skeptics'. With over 130 publications dealing with climate variability and climate change issues, Kevin's work has been widely disseminated. Much of his time is spent giving presentations and media interviews. He has managed or co-authored a number of consultancy projects for State and Territory departments, the Australian Greenhouse Office and private industry.

Kevin has been a co-ordinator of CSIRO's Climate Impact and Adaptation Working Group since it began in 1999. This Group brings together expertise of about 70 scientists from a range of disciplines across CSIRO to address how climate change may affect Australia and how we might adapt. He represents CSIRO on the Impacts and Adaptation Working Group of the COAG High Level Greenhouse Group, and he is a member of the NSW Greenhouse Advisory Panel reporting to the NSW Premier and the NSW Greenhouse Office.

He has been involved with the Intergovernmental Panel on Climate Change (IPCC) as:

- a contributing author of Chapter 6 "Climate models: projections of future climate" in the 1996 Second Assessment Report on "The Science of Climate Change"
- a contributing author of Chapter 2 "Observed climate variability and change" in the 2001 Third Assessment Report on "The Science of Climate Change",
- a consultant for the Australian government review of the 2001 Third Assessment Report on "Climate change impacts, vulnerability and adaptation"
- a Coordinating Lead Author of Chapter 11 "Australia and New Zealand" in the 2007 Fourth Assessment Report on "Climate change impacts, adaptation and vulnerability".

Fire risk is influenced by a number of factors – including fuels, terrain, land management, suppression and weather. Fire-weather risk relates to how a combination of weather variables influences the risk of a fire starting or its rate of spread, intensity or difficulty of suppression. This study assesses potential changes to fire-weather risk associated with climate change.

Fire danger indices, such as the Forest Fire Danger Index (FFDI) and Grassland Fire Danger Index (GFDI), are used operationally to provide an indication of fire risk based on daily temperature, precipitation, relative humidity and wind-speed. Fire danger indices are calculated for historical weather records from 1974-2003 for sites in New South Wales, the Australian Capital Territory, Victoria and Tasmania. Two climate models are then used to generate climate change scenarios for 2020 and 2050, including changes in average climate and daily weather variability. Fire danger indices are then calculated for 2020 and 2050.

A key finding of this study is that an increase in fire-weather risk is likely at most sites in 2020 and 2050, including the average number of days when the FFDI rating is very high or extreme. The combined frequencies of days with very high and extreme FFDI ratings are likely to increase 4-25% by 2020 and 15-70% by 2050. For example, the FFDI results indicate that Canberra is likely to have an annual average of 25.6-28.6 very high or extreme fire danger days by 2020 and 27.9-38.3 days by 2050, compared to a present average of 23.1 days. The increase in fire-weather risk is generally largest inland. Tasmania is likely to be relatively unaffected.

The study also indicates that the window available for prescribed burning may shift and narrow. It is likely that higher fire-weather risk in spring, summer and autumn will increasingly shift periods suitable for prescribed burning toward winter.

## IMPACTS OF FIRE ON DOWNSTREAM WATER QUALITY

DR SCOTT WILKINSON PhD (Civil Engineering). Research Scientist, CSIRO

**Biography:** The movement of sediment and nutrients through river catchments and their delivery to downstream water bodies affects water quality and also river morphology. Scott is undertaking research into the effects of land management and climate on catchment fluxes of sediments and nutrients. Research techniques include spatial modelling of environmental drivers and sediment fingerprinting. The research aims to provide a technical basis to assist river and catchment management achieve environmental outcomes.

Rainfall during the post-fire recovery of vegetation cover can mobilise large quantities of sediment and nutrients and deliver them to river networks, affecting downstream water quality and river habitat. Following the 2001 fires in the catchment of Sydney's Lake Burragorag water supply reservoir, the quantity and characteristics of sediment moving on hillslopes, through the river network and into the reservoir were studied using sediment tracing techniques. The results presented indicate that annual sediment yields were several times higher than in the absence of fire, and that the sediments were much higher in phosphorus, which is a precursor for algal blooms. These results are consistent with a summary of data from other recent fires and the downstream impacts have affected several urban water supply systems. This presentation describes the physical impacts of fire on sediment and nutrient fluxes and potential implications for future fire management at hillslope and catchment scale. The ecological impact on aquatic ecosystems and downstream water bodies is highlighted as requiring further investigation, particularly given that such ecosystems are often already stressed by prolonged drought and pest species.

## BUSHFIRE IN A HEATING WORLD—LEARNING FROM THE ECOLOGICAL EVIDENCE

DR KEVIN TOLHURST B.For.Sc. (Hons) PhD. Senior Lecturer, Fire Ecology and Management, University of Melbourne

**Biography:** Kevin Tolhurst is Senior Lecturer in Fire Ecology and Management at the School of Forest and Ecosystem Science, University of Melbourne and a member of the Bushfire Cooperative Research Centre. Kevin provides expert advice on fire behaviour and fire suppression strategies at major bushfires and has been an expert witness in several inquiries including: Linton Coronial Inquiry, Canberra Coronial Inquiry, House of Representative 2003 Inquiry, and the 2005 Wangary Coronial Inquiry S.A.

Kevin's current research activities are centred around developing a national bushfire risk management decision support system. This work has been a core activity in the Bushfire Cooperative Research Centre since 2003.

His research and consulting interests include:

- Wildfire behaviour prediction
- Development of prescribed burning techniques and guidelines
- Landscape scale fire ecology management
- Fire risk management
- Ecological impacts of repeated fires

The frequency of high intensity landscape scale fires in south-eastern Australia as we have seen in the last decade, is unprecedented. This shift in fire regime has been brought about by a combination of climate change, human development, landscape fragmentation and fire minimisation in endemic vegetation. Life history attributes of the endemic fauna and flora can be used to guide fire management. By working within the tolerance ranges of all existing species we can maintain our natural ecosystems in a vibrant and responsive state. However, by trying to minimise fires in the landscape, we have inadvertently made these ecosystems more vulnerable to the pressures imposed by climate change. It is possible to reverse this trend, but this will be via a process of maintaining fire in the landscape not limiting it. This should not be seen as licence to incinerate the bush, but requires the skilful and thoughtful management of fire in the landscape. Much can be learnt from our aboriginal history and even some early European graziers, even though it is no longer appropriate to mimic their use of fire. It is not too late to change fire management practices in most places, but it will be if we do not improve fire management soon.

## THE FIRE, HUMAN AND CLIMATE NEXUS IN SOUTH-EASTERN AUSTRALIA

DR SCOTT MOONEY Bsc (Hons), PhD. Senior Lecturer, School of Biological, Earth and Environmental Sciences, UNSW

**Biography:** Scott Mooney is a Senior Lecturer in the School of Biological, Earth and Environmental Sciences at the University of NSW. His research interests include the application of palaeoenvironmental techniques to contemporary environmental issues and natural resource management. The aim of this work is to extend the temporal perspective on these issues. Scott has several publications exploring the long-term history of fire in humid landscapes of eastern Australia and is a Working Group Member of the International Geosphere-Biosphere Program (IGBP) 'Fast-track Initiative' on Fire Regimes: Past, present, future. He also lists climate change and human impact as research foci.

The long history of biotic evolution in the presence of fire means that it is an important component of many Australian ecosystems but in the contemporary environment, fire is also a significant natural hazard. This tension between the maintenance of natural disturbance regimes and risk, coupled with ideas about the role of humans in the past, has resulted in considerable debate about fire and natural resource management. This work seeks to inform this debate through the examination of post-glacial palaeoecological sequences at a number of sites located in eastern Australia. In June, 2004 I presented the preliminary results of work based in the Blue Mountains: since that time a number of other sites have been analysed and this presentation will summarize this work. Together the fire histories of the various sites suggest that fire was a variable feature in the region and through time. Fire activity was higher during the late glacial-Holocene transition but lower in the early to mid-Holocene (*ca.* 9 to 6 ka BP). At most sites there is a change in fire activity from the mid-Holocene (~5.5 ka BP) but this change falls into two categories: the first where fire activity is generally elevated but variable and at a second group of sites charcoal is much lower in the late Holocene. Comparison of the results with palaeoclimatic information and archaeological indices allows a better understanding of driving mechanisms and of the interrelationships between fire, climate and humans. The mid-to-late Holocene changes in fire in eastern Australia apparently relate to climatic variability and altered subsistence and land use strategies, perhaps themselves associated with the new climatic regime, and/or the risks associated with a more fire-prone landscape. The work has several implications for our understanding of human-environment relationships and for the contemporary management of these fire-prone landscapes.

## ABORIGINAL BURNING REGIMES IN SOUTH-EAST NSW

GREG WATTS B.Sc (Forestry), ADEC. Ranger, Deua National Park, NSW National Parks and Wildlife Service

**Biography:** Greg Watts graduated from the Australian National University in 1977 with a degree in Forest Science. He also completed a post graduate diploma in Environmental Management from Mitchell College of Advanced Education in 1986.

After graduating, Greg was employed by State Forests NSW as a Forester, Regional Research Centre Manager and Regional Planning Manager for a total of 13 years in various Districts of NSW. Projects undertaken during this time include Environmental Impact Assessments and Studies, reviews of environmental factors, conservation area management plans, flora and fauna studies, forest resource reports, and forest management and forest research projects.

Greg resigned from State Forests in 1992 and set up business as an Environmental Planning Consultant. He worked with local government as a Strategic Planner for environmental projects, and developed fauna management guidelines for threatened species. He also completed environmental planning projects for a range of State Government, Local Government and private industry clients in north-eastern NSW. Projects undertaken in this period included, threatened species surveys and habitat assessments, project work on Environmental Impact Statements, and fire management planning.

From 1997 to the present, Greg has been employed by the NSW National Parks and Wildlife Service on various assignments including regional fire management planning, regional operations planning, environmental assessment and regulation, National Park management and Aboriginal cultural heritage management. In 2002 he was awarded the NSW Public Service Medal for 30 years of service to bushfire management in NSW. Greg also works part-time for Eurobodalla Landcare as a project officer rehabilitating degraded farmland. He also teaches Environmental Management at NSW TAFE.

Greg lives at Narooma on the NSW South Coast and enjoys surfing and restoring old motorcycles in his spare time.

With global warming South-East NSW is expected to become drier and fire seasons longer with a higher frequency of days of extreme fire danger. 'Mega-fires' covering large areas of forest and pumping large volumes of global-warming carbon dioxide into the atmosphere, are predicted to become more frequent. Use of traditional Aboriginal burning practices presents an opportunity to use environmentally and culturally sustainable fire management in the south-east forests, with opportunities for carbon-credit investment, cultural and financial benefits for traditional owners, and management of the risk of 'mega-fires'. The paper presents an Aboriginal Burning Regime model for the south-east forests and an action plan for implementation.

## SESSION 3: ECOLOGICAL REALITY: OUTCOMES FOR FLORA AND FAUNA

### SO LITTLE TIME?

ASSOC PROF PAUL ADAM MA, PhD. Head of Biological, Earth and Environmental Sciences, UNSW

**Biography:** Paul Adam is a plant ecologist with broad interests in ecology and conservation biology. He has particular interests in a range of coastal vegetation types, including saltmarsh, headlands and heaths and also rainforest. He has served on a number of government committees addressing conservation and land use issues.

The effects of altered fire regimes on flora and fauna will be compounded by the effects of the increasing human population (itself a direct and indirect cause of the altered fire regimes). The effects are widespread, but will be particularly acute in the urban fringe, which often also represents a concentration of high biodiversity. If biodiversity is to be sustained on the urban fringe, with changed climate and fire regimes interacting with fragmentation and other forms of disturbance, then decisions have to be taken now on the design and management of urban bushland.

### FIRE, CLIMATE AND VEGETATION IN THE GREATER BLUE MOUNTAINS WORLD HERITAGE AREA – USING CURRENT PATTERNS TO PREDICT FUTURE CHANGE

DR KATE HAMMILL, Bsc (Hons), PhD. Project Officer, Fire Ecology, Department of Environment & Climate Change

Kate has worked in fire and plant ecology research for 12 years. Her projects have included:

- post-fire regeneration in coastal heath
- restoration of disturbed sites
- floristic surveys in grassy woodlands
- remote sensing of fire severity and intensity, and
- fire-related vegetation surveys in the greater Blue Mountains.

For the last five years she has worked at the Biodiversity Conservation Science Section of the NSW Department of Environment and Conservation. Her current position is funded by an external research grant from the NSW Environmental Trust. Her research focus is on the interacting effects of climate and fire on vegetation in the Greater Blue Mountains World Heritage Area. She is motivated by a deep interest in understanding and conserving our unique and beautiful natural landscapes.

The Greater Blue Mountains World Heritage Area (GBMWA) encompasses ten thousand square kilometres of sandstone plateaux, escarpment and gorge country across seven national parks – Yengo, Wollemi, Gardens of Stone, Blue Mountains, Kanangra-Boyd, Nattai and Thirlmere Lakes. The high conservation significance of this area is due to its great expanse and diversity of species and habitats. A major process in this landscape is fire, with big fire seasons occurring every few years. Climate change is bringing more extreme fire weather, and with it the likelihood of more extensive and intense fires. What might be the impacts of changing fire and climate regimes on vegetation across this landscape? In this paper I will describe one approach of investigating this issue: the concept of plant functional types (e.g. resprouters and seeders). I will present information on existing patterns of plant functional types in relation to current climate and fire regimes. These patterns provide some basis for predicting possible changes to vegetation composition under future climate and fire regimes. The work is based on an analysis of existing vegetation data as well as new data collected from a stratified field survey. Ultimately, the research is intended for use in planning for the conservation of the ecological values of the GBMWA.

### THE PRESCRIBED BURNING CONUNDRUM— PROTECTING OUR NEIGHBOURS FROM BUSHFIRE AND MAINTAINING BIODIVERSITY IN A TIME OF INCREASING FIRE ACTIVITY DUE TO CLIMATE CHANGE

PAMELA O'NEILL, Dip Applied Science (Agriculture). Area Manager Tenterfield, NSW National Parks & Wildlife Service

**Biography:** Pamela has worked for 21 years with the NPWS. Her experience includes:

- fire management experience across a range of landscapes within NSW
- Bushfire response management roles from crew leader to Section 44 Planner, Operations Officer and Incident Controller
- Prescribed burn experience using a number of techniques in the Hunter Valley national parks, including Wollemi and Yengo; and the northern tablelands including Torrington State Conservation Area and Bald Rock National Park.

A case study from Timbarra National Park, northern tablelands region of NSW, of adaptive fire management in practice.

## ALTERED FIRE REGIMES: HOW RESILIENT ARE INVERTEBRATES TO CHANGE AND WHAT ARE THE IMPLICATIONS FOR BIODIVERSITY AND THE MAINTENANCE OF ECOSYSTEM FUNCTION?

DR ALAN YORK, BSc (Hons), PhD Zoology. Senior Research Fellow, University of Melbourne

**Biography:** Program Leader – SFES Bushfire Research and Development Group  
Program Leader – Bushfire CRC Project B3.1 *Effects of fire on ecosystem processes and biodiversity*

Alan is a Senior Research Fellow at the University of Melbourne, leading the Bushfire Research and Development Group within the School of Forest and Ecosystem Science. He coordinates a number of projects under the broad umbrella of Fire Ecology and Management, primarily dealing with the effects of fire on the maintenance of biodiversity and associated ecosystem processes. This research is conducted at a range of scales ranging from small local communities to large landscapes. The aim is to understand the interaction between fire, vegetation, vertebrates, invertebrates and soil organisms in carbon and nutrient cycling, and how this contributes to biodiversity conservation and ecosystem function. This research will elucidate how elements of biodiversity regulate vital ecosystem processes and functions, and how disturbance regimes alter the nature and spatial patterns of ecosystem processes. By understanding these interactions, the Bushfire R&D Group provides assistance to land managers in determining the ecological sustainability of current fire management practices.

Interactions among vegetation, soil flora and litter- and soil-dwelling invertebrates are responsible for regulation of carbon mineralisation and immobilisation in litter and soil, with these organisms also comprising the bulk of our terrestrial biodiversity. Knowledge of soil and litter biota and how these relationships are influenced by fire and fire regimes is critical for good management of forests, particularly when future scenarios predict the likelihood of more frequent and intense fires. Frequent fires in Australian *Eucalyptus* forests have been shown to cause changes in the composition and structure of terrestrial invertebrate communities, with the potential to impact upon rates of litter decomposition and nutrient cycling. This paper outlines recent research that investigates the resilience of invertebrate communities to fire-induced change, and the implications that this might have for both biodiversity conservation and the maintenance of essential ecosystem processes.

## DEVELOPING EMISSIONS ABATEMENT OPPORTUNITIES FROM SAVANNA BURNING

DR JEREMY RUSSELL-SMITH Research Consultant, Bushfires NT, Tropical Savannas Management CRC

**Biography:** Jeremy Russell-Smith works as a consultant ecologist, mostly in northern Australia and neighbouring regions of South-East Asia. He currently leads the fire research programs of the Northern Territory Government's rural fire management agency (Bushfires NT), and the Tropical Savannas Management CRC. With others, he is involved in developing sustainable landscape-scale management solutions for biodiversity and indigenous employment outcomes, particularly through savanna burning greenhouse gas emissions abatement projects.

The vast majority of Australian landscape-scale burning occurs in the tropical savannas, particularly as extensive wildfires in the latter part of the annual dry season. Such burning patterns have major impacts on regional biodiversity, and international implications for climate through emissions of greenhouse gases (GHGs). This presentation describes contemporary national and regional patterning of landscape burning and resultant GHG emissions, and recent development of innovative market-based approaches for addressing regional fire management problems.

## FIRE AND CLIMATE CHANGE IN WOODLANDS: IMPACTS ON GRASSES AND SHRUBS

DR PENNY WATSON B.Sc, M.Env.Management (Hons), PhD. Ecologist, Hotspots Fire Project

**Biography:** Penny is the ecologist for the Nature Conservation Council's Hotspots Fire Project, an educational initiative which aims to help private landholders in NSW to manage fire for biodiversity conservation. She completed a PhD on the effects of fire frequency in Western Sydney's grassy woodlands in 2006, and holds a Masters in Environmental Management from Griffith University. While in Queensland she studied time-since-fire and fire frequency impacts in Girraween National Park in the granite country, and worked as Coordinator for the South-East Queensland Fire and Biodiversity Consortium. Penny's interests include the dynamics of ecosystems across environmental gradients; interactions between plant attributes, vegetation structure and disturbance regimes; translating science into management; and building community capacity to manage for biodiversity outcomes.

This paper draws on research in Western Sydney's grassy woodlands and elsewhere to explore factors affecting the shrub/grass balance. These factors include soil type, grazing and browsing regimes, concentration of CO<sub>2</sub> in the atmosphere, rainfall, temperature and fire frequency. Elements of climate change may affect vegetation structure and composition in different ways, and the sum of these impacts may be different in different vegetation formations and geographic areas. While too frequent fire can cause biodiversity losses and climate change will generally drive us towards more frequent fire—in remnants cut off from fire paths, lack of fire may be a major conservation issue. This may apply particularly to grassy vegetation which is already under threat from fragmentation and the imperatives of production. We need to avoid simplistic, one-size-fits-all responses to the issue of changed fire regimes and climate change.



## BELL MINER ASSOCIATED DIEBACK: A CONSEQUENCE OF A CHANGED ECOSYSTEM?

PAUL MEEK B.App.Sc, M.App.Sc, Grad Dip Assessment & Training. Ecologist, Bell Miner Associated Dieback Working Group

**Biography:** Paul has been the Ecologist for the BMAD Working Group for the last 14 months, a program administered by the NSW Department of Environment and Climate Change. The program aims to mitigate the effects of Eucalypt dieback on forests in NSW and unravel the causative factors leading to this ecological phenomena. Paul has a specific interest in pest animal management and research, having studied the ecology of foxes, free-roaming dogs and cats. For eight years Paul was the northern NSW Ecologist for Forest NSW. He continues two FNSW projects on the ecology of the Hastings River Mouse and the environmental cues for calling in the Sphagnum frog. Paul has an interest in disturbance ecology and the role it has in land management—his interest was triggered while working at Jervis Bay on a Commonwealth bombing range and on Christmas Island where phosphate mining was changing the ecology of the ecosystem. In his current position, he is interested in the effect of a changed landscape on forest health and what active management may be necessary to reverse the effects of dieback.

Eucalypt dieback research and on-ground actions in Australia have largely focused on the effects of *Phytophthora* on Australian forests, however Bell Miner Associated Dieback (BMAD) is also reeking havoc on Eucalypt forests from Victoria, throughout eastern NSW and southern Queensland. Coarse estimates suggest about 2.5 million hectares of Eucalypt forest is at risk of decline due to BMAD. The causes, distribution, severity and implications of canopy loss due to BMAD are still unclear, although the potential effects are considerable. The landscape and ecosystem health due to drought, climate change, land management practices and disturbance has declined and led to poor ecosystem resilience. The impact of further canopy loss and/or fragmentation due to BMAD poses enormous threats to biodiversity and forest dependent production. The BMAD Working Group coordinates and funds research and active adaptive management trials aimed at preventing, controlling and restoring forests effected by BMAD. BMAD is a naturally occurring phenomena that has resulted from a changed ecosystem and has exceeded natural limits. In the absence of active adaptive management and a failure by governments to recognise the contributing role of climate change, drought, increasing temperatures and passive management on the forest, BMAD will continue its, so far un-acknowledged path towards forest destruction. Manipulations of understorey Bell miner habitat using fire, silvicultural practices and herbicide spraying to interrupt BMAD pathology is being investigated as remedial action and will be discussed.

## SESSION 4: BUILDING RELATIONSHIPS AND MOVING FORWARD

### GOVERNANCE: DECISION-MAKING FOR CHANGE

**Panel. Representatives from NSW RFS, DECC and the community will respond to the keynote presentations.**

**Chaired by CATE FAEHRMANN. Executive Director, Nature Conservation Council of NSW**

**Biography:** Cate is Executive Director of the Nature Conservation Council of NSW, the peak environment organisation in NSW, representing 120 member groups across the State.

Cate has previously managed media and election campaigns in NSW, Victoria, South Australia and New Zealand. She has also been a media adviser in State Parliament. Cate is on the Boards of environmental law organisation the Environmental Defender's Office NSW and the on-line campaigning organisation GetUp.

One of Cate's recent initiatives is Walk Against Warming, held across Australia for the last two years, attracting 40,000 people in both Sydney and Melbourne in 2006.

### CASE STUDIES IN SUCCESSFUL COMMUNITY ENGAGEMENT, FIRE MANAGEMENT FOR BIODIVERSITY

**JULIE WOODROFFE BSc (Hons) Ecology. Workshop Facilitator, Hotspots Fire Project**

**Biography:** Julie has many years of on-ground experience across the NSW Northern Rivers region in property management planning and vegetation management. She lives and works on a property at Gleniffer in Bellingen Shire and operates as an independent service provider to landholders and various organisations. She is a Director of the Nature Conservation Trust of NSW, which buys and sells property across NSW for active conservation, and has served on a number of other State and Federal Natural Resource Management (NRM) committees. Julie is currently the NRM representative for the Rural Women's Network of NSW. Julie also brings private sector experience to the Northern Rivers CMA, having worked for many years with large Australian-based corporations both nationally and internationally. Julie is currently working as part of the Hotspots project team on actively assisting landholders around NSW with fire management on their property. She is also taking part in the 2006 Australian Rural Leadership program.

*Abstract pending.*



## THE GROSE VALLEY FIRE FORUM—ISSUES AND THE WAY FORWARD

**Dr Rosalie Chapple, Bsc, PhD.** Research Associate, Blue Mountains World Heritage Institute. Associate Lecturer & Honorary Visiting Fellow, School of History and Philosophy of Science, University of NSW

**Biography:** Rosalie's academic background is in ecology and wildlife management, with current research interests focusing on policy processes for environmental conservation and management of natural resources, in particular policy orientation for resolving complex problems. Rosalie teaches environmental sustainability in various courses at the University of NSW, where she is an Honorary Visiting Fellow in the School of History and Philosophy of Science. In 2004 she co-founded the Blue Mountains World Heritage Institute, a major initiative to further the integration of scientific research with policy and management at a local community level. The Institute is an independent non-profit organisation that supports conservation of the natural and cultural heritage of the Greater Blue Mountains World Heritage Area, through integrative policy-oriented research and community engagement. To ensure effective and on-going engagement of science and communities with policy and management, the Institute works closely with its eight founding partners which comprise government agencies responsible for management of the GBMWH and three universities (NSW Department of Environment and Climate Change (Parks and Wildlife Division), Blue Mountains City Council, Botanic Gardens Trust, Sydney Catchment Authority, Australian Museum and the Universities of NSW, Sydney and Western Sydney).

In response to community concerns about management strategies used for a fire in the Grose Valley in the upper Blue Mountains in November-December 2006, a forum was held in February 2007 with representative community members and fire authorities. The forum was called for by then Minister for the Environment and Local Member for the Blue Mountains, Bob Debus, and organised by the Blue Mountains World Heritage Institute.

A big challenge in bushfire management is how to better integrate valid community interests with those of fire management agencies. Over recent years, the public has come to demand and expect a greater say in decision-making processes that impact upon their local environment. The Grose Valley Fire Forum represented a step forward in this process of better integrating community knowledge and interests into local natural resource management.

In this era of climate change, conflict over fire management can only be expected to increase. It is urgent that we move toward more adaptive forms of governance that can adequately support adaptive management – adaptive governance deals with the institutional and human interactions that inhibit adaptive management. Underlying the Grose Valley forum was the question of adaptive management – it is time to look explicitly at the institutional and human barriers to more adaptive bushfire management. As part of this process, bushfire management needs to better integrate science, policy and decision-making, to manage for change rather than against change.

## PERSPECTIVES ON BUSHFIRE RISK MANAGEMENT IN NSW

**SIMON HEEMSTRA, A/Director, Risk Management Performance, NSW Rural Fire Service**

*Abstract pending.*

## CLOSING ADDRESS

**GREG MULLINS AFSM, Commissioner, NSW Fire Brigades**

**Biography:** Greg Mullins joined the NSW Fire Brigades in 1978, having been a volunteer bush firefighter since 1972. After serving in all ranks, including being the Blue Mountains then Sydney Region Bushfire Hazard Reduction Officer, he was appointed to the rank of Assistant Commissioner in July 1996, and in July 2003 became the first fire officer in the 121 year history of the NSWFB to be appointed as both Chief Fire Officer and CEO. In 2005, Commissioner Mullins was invited to Ireland to address the International Fire Science Conference on bushfires and global warming.

He holds a Masters Degree in Management, is a Fellow of the Institution of Fire Engineers, Australian Institute of Management and a Churchill Fellow. In 2002 he completed the Executive Fire Officer Program at the United States Fire Academy. Commissioner Mullins has been awarded the Australian Fire Service Medal, National Medal and Clasp, Commendation for Courageous Actions, and St Johns Ambulance Emergency Services Award.

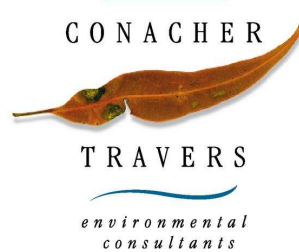
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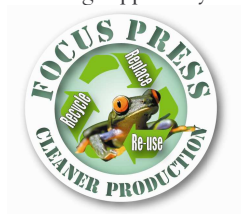


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