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CLIMATE INSTITUTE MEDIA BRIEF

Briefing > BUSHFIRE WEATHER IN SOUTHEAST AUSTRALIA > SEPTEMBER 2007

BUSHFIRE WEATHER IN SOUTHEAST AUSTRALIA

REPORT BY THE BUSHFIRE COOPERATIVE RESEARCH CENTRE, THE BUREAU OF METEOROLOGY AND CSIRO MARINE AND ATMOSPHERIC RESEARCH

The Sydney 'Black Christmas' bushfires in late-2001, the Canberra bushfires in January 2003 and the eastern Victorian fires in early 2003 and 2007 have all raised the profile of bushfires in Australia. In early 2007, The Climate Institute commissioned the Bushfire CRC, the Australian Bureau of Meteorology and CSIRO Marine and Atmospheric Research to undertake the most comprehensive and up-to-date assessment of the impact of climate change on bushfire weather in Australia[1]. This Climate Institute summary provides some of the key results and the Climate Institute's analysis of the implications of the report. More detailed summaries of results for New South Wales/ACT, South Australia, Victoria and Queensland are available separately.

CLIMATE AND FIRE

Climatic and weather conditions have a significant impact on the incidence of bushfire. Dry grass, parched shrubs, dead leaves and twigs are the basic fuel of bushfires. Drought, high temperatures and low humidity dry out timber and grass making it more flammable. High winds supply more oxygen to flames and increase their intensity. Wind also carries burning embers which start new fires – this is called "spotting". Fire ignition by lightning is also a common cause of bushfires, and regrettably, the activity of arsonists is increasing.

FIRE DANGER MEASURES

In the report, fire weather risk is quantified using the Forest Fire Danger Index (FFDI). This index was developed in the late-1960s to help foresters connect the weather to the expected fire behaviour. To quantify "fire weather" temperature, relative humidity and wind speed are combined with an estimate of the so-called 'drought factor' which depends on daily rainfall and the period of time elapsed since the last rain. The Fire Danger Rating, based on the FFDI, is used by fire agencies to help assess the difficulty of controlling a particular fire. The ratings are "low", "moderate", "high", "very high" and "extreme". For example, in "extreme" fire danger conditions the FFDI is greater than 50 and fire suppression is virtually impossible. At the opposite end of the scale, "low" fire danger has an FFDI of 0-5 and fires are easily suppressed.

In their report the Bushfire CRC, the Bureau of Meteorology and CSIRO also examined two additional, unofficial fire danger ratings categories. These are "very extreme" (with FFDI >75) and "catastrophic" (with FFDI >100). A "catastrophic" rating is comparable to the fire weather that accompanied the Canberra fire on 18 January 2003, is currently very rare and not based on many known fire behaviours or intensities.

1 Lucas, Hennessy, Mills, Bathols (2007), Bushfire Weather in Southeast Australia: Recent Trends and Projected Climate Change Impacts, Consultancy Report prepared for The Climate Institute of Australia, Bushfire CRC and Australian Bureau of Meteorology, CSIRO Marine and Atmospheric Research, Melbourne. Available at: http://www.climateinstitute.org.au/

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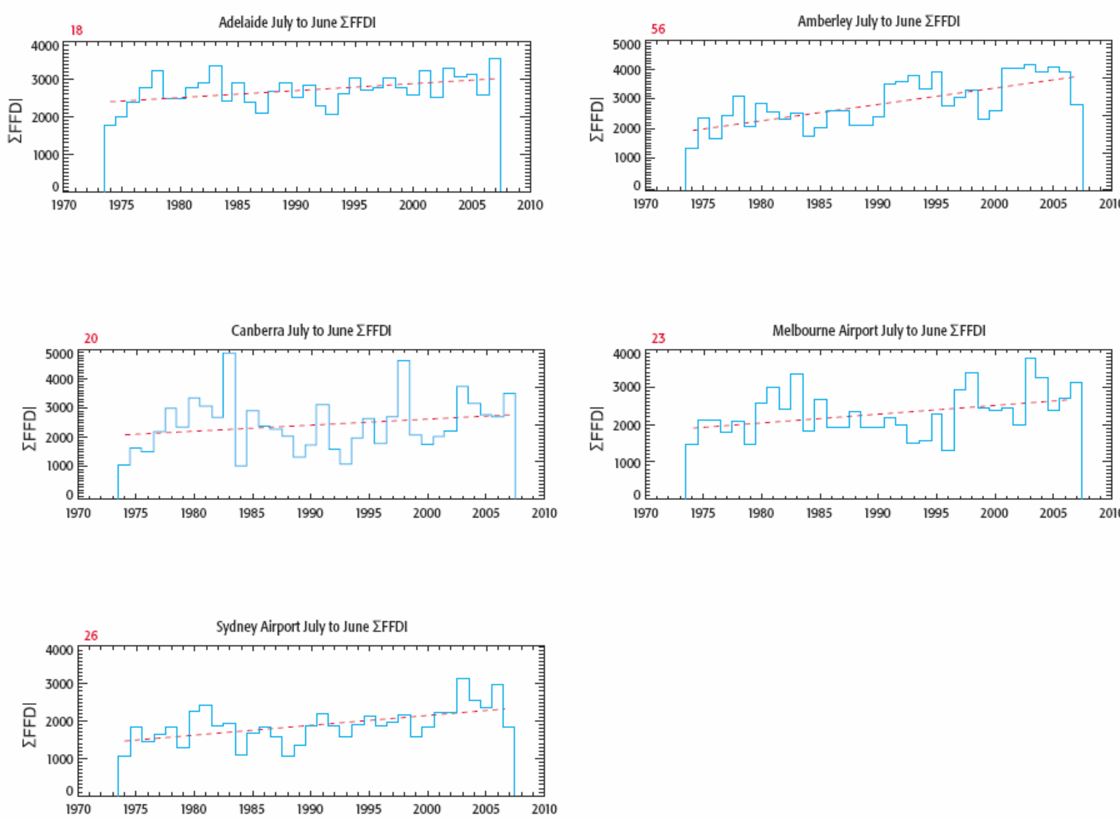
RECENT TRENDS

- There has been a general trend towards more fire weather over the last 30 years. Statistically significant upward trends were identified in South Australia, central NSW, northern Victoria and eastern Queensland (see examples in Figure 1). The majority of the most intense fire weather seasons have occurred since the late 1990s. For example, in Adelaide, the most severe fire weather seasons on record where recorded in 2007, 2001 and 2003.
- Total fire weather (daily FFDI values accumulated from July to June each year) has jumped up significantly since the late 1990s. Increases of 10-40% between 1980-2000 and 2001-2007 are evident at most sites, particularly in central NSW, northern Victoria and Queensland.
- Four of the last five fire seasons have been among the longest on record.
- The strength of the recent jump in fire weather is equal to or exceeds the changes estimated to occur by 2050 in the different climate change projections (see below). For example, the recent increase at Amberley in Queensland is eight times that projected by the most severe warming scenarios by 2020, while in Canberra and Melbourne it has been twice as large.
- The recent observed rise in fire danger may be due to a mix of both natural variability and human-induced climate change. The relative importance of these two factors is not known at this time. Observations from the next few years to decades will allow the determination of the role played by each of these factors.

Figure 1: Total annual fire weather in Adelaide, Amberley (Qld), Canberra, Melbourne (airport), and Sydney (airport). The line of best fit is shown in red. The numerical value of the trend ('points' per year) is given by the red number on the upper left. (Source: Bushfire CRC, BOM, CSIRO)



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CLIMATE CHANGE PROJECTIONS

TOTAL ANNUAL CHANGE IN FIRE WEATHER

Total annual fire weather (daily FFDI values accumulated from July to June each year) is projected to increase from a 1990 base line by 0 to 10% by 2020 and by 0 to 30% by 2050 (Table 1). Smaller increases are associated with lower levels of global warming and more significant increases are associated with greater levels of global warming.

Table 1: Percent changes in annual total fire weather – 2020 and 2050, relative to 1990

2020		2050	
Low global warming (0.4ºC)	High global warming (0.1ºC)	Low global warming (0.7ºC)	High global warming (2.9ºC)
+0-4%	+0-10%	+0-8%	+10-30%

CHANGES IN DAYS WITH VERY HIGH AND EXTREME FIRE WEATHER

Of most concern to fire fighters are days classified as having very high or extreme fire danger. On such days, fires start and spread quickly and are very intense. The extreme fire danger rating indicates that fires become uncontrollable very quickly and are all but impossible to put out until weather conditions change. The number of very high and extreme fire weather days is projected to increase in all scenarios (Table 2). If the rate of global warming is low, the number of extreme days increases 5-25% by 2020 and 10-50% by 2050. If the rate of global warming is high, the number of extreme days rises 15-65% by 2020 and 100-300% (double to quadruple) by 2050.

Table 2: Percent changes in the number of days with very high and extreme fire-weather – 2020 and 2050, relative to 1990

	2020		2050	
	Low global warming (0.4ºC)	High global warming (0.1ºC)	Low global warming (0.7ºC)	High global warming (2.9ºC)
Very high	+2-13%	+10-30%	+5-23%	+20-100%
Extreme	+5-25%	+15-65%	+10-50%	+100-300%

CHANGES IN VERY EXTREME AND CATASTROPHIC FIRE WEATHER

Climate projections indicate very extreme and catastrophic fire danger levels may become much more common. Very extreme days currently tend to occur only once every 2 to 11 years at most sites. By 2020, very extreme days may occur around twice as often. By 2050, high global warming scenarios indicate a four to five-fold increase in frequency of very extreme fire weather across much of southern and eastern Australia.

Less than half of the sites studied have recorded catastrophic fire danger days since 1973. In the high global warming case, by 2020 the number of sites experiencing catastrophic fire weather days nearly doubles. The 2050 high warming scenarios show a substantial increase in frequency, with catastrophic fire weather days occurring across most of south and eastern Australia. For example, Richmond near Sydney does not currently experiences catastrophic fire weather days but with high levels of warming they may occur every 4 years by 2050. Similarly, by 2050, Canberra may experience catastrophic fire weather every 8-17 years.

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IMPLICATIONS - THE CLIMATE INSTITUTE

While the report does not address this, previous assessments indicate an increase in the frequency and intensity of fire weather would:

> increase the risk of injury and death, and subsequent mental depression and post-traumatic stress disorders

> prolong the effective fire season and increase the personal and employer cost for volunteers, and increase the cost of fire fighters, fire management and suppression

> lower the yield and quality of water from fire-affected catchments

> increase damage to property, livestock and crops

> increase the exposure of insurance companies to loss

> alter the distribution and composition of ecosystems

> threaten the security of plantation forests

> narrow periods suitable for controlled burning

> increase emissions of greenhouse gases to the atmosphere as a result of bushfires

The Climate Institute commissioned this report as a resource for ongoing engagement with fire management agencies and to help them plan for the impacts of climate change. Some climate change is now inevitable and this will require adaptation to likely increases in bushfire risk. The Climate Institute does not intend to provide adaptation or management recommendations to agencies and believes this should be nationally coordinated and done in full consultation with relevant stakeholders (e.g. national and state agencies, emergency service volunteers, industry, land managers, local communities and environmental non-government organisations).

However, the projections outlined in the report by the Bushfire CRC, Bureau of Metrology and CSIRO clearly indicate that higher levels of global warming risks an exponential increase in fire weather (Figure 2). Results also indicate that, consistent with separate assessments of recent changes in global temperature and sea level, climate models may be underestimating future climate change impacts on fire weather.

These results indicate that global warming of greater than around 1.5-2°C (above preindustrial levels) may drive spiralling fire danger risk across much of Australia. This implies that greenhouse gas reduction policies that aim to limit global warming to around 2°C can help avoid the worst impacts of fire weather in Australia. This will require global emissions to peak by 2015 and industrialised countries such as Australia will need to reverse rising greenhouse pollution levels within five years.

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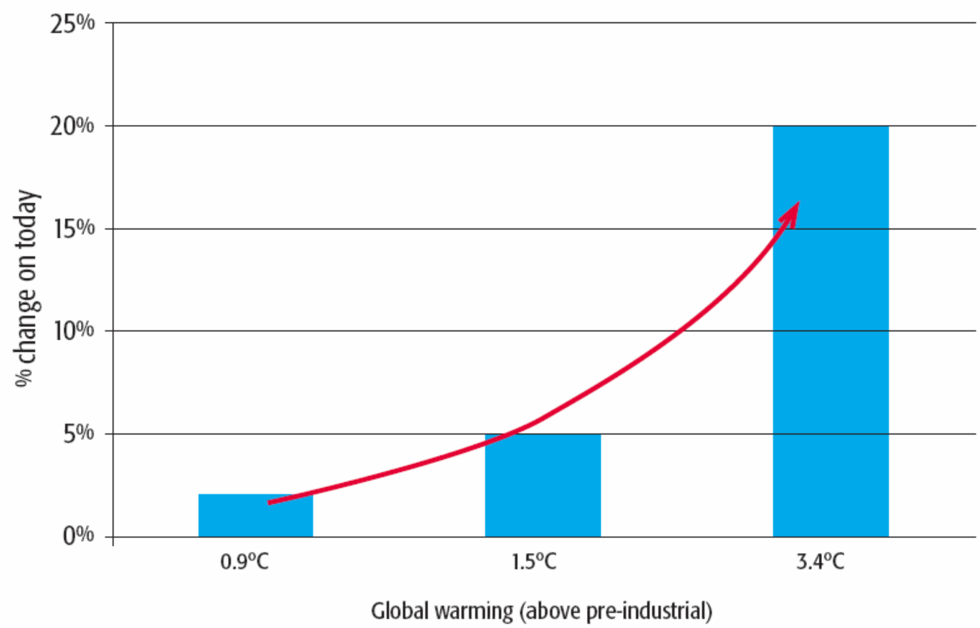
Figure 2: Percent (mid-range) change in total fire risk for given levels of global warming.
Note: Warming levels are 0.5ºC higher than presented in Table 1 as warming from 1750-1990 has been added.



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