



# Heating up: bushfires and climate change

December 2006

Christian Downie<sup>1</sup>

---

## 1. Introduction

Each December, as Australians begin their summer holidays, their television screens invariably begin to show pictures of bushfires threatening lives and property. In January and February, it is not uncommon to hear reports of fire fighters attempting to control many fires as resources criss-cross the country to assist those most in need.

The most recent and devastating of these episodes was the 2002-03 fire season. Over three million hectares of bushland and vegetation were destroyed across the country. In Canberra, the worst affected city, four people died, 501 houses were lost and over 160,000 hectares were burnt.<sup>2</sup>

The devastation caused by the 2002-03 fire season precipitated state and federal inquiries. While each inquiry assessed bushfire mitigation strategies, the impacts on the environment and the resources available to fire services, for the first time all the inquiries raised concern about the impact climate change could have on fire risk in Australia. This paper considers the impact climate change could have on fire risk in Australia.

## 2. Climate change in Australia

The Australian climate is changing. The year 2005 was the hottest on record in Australia with the average daily temperature 1.21 degrees Celsius above average. In fact, all but four years since 1979 have been warmer than average.<sup>3</sup> At the same time rainfall patterns in Australia are changing. Since 2002, Australia has experienced a particularly dry period largely due to the El Nino effect (see below).<sup>4</sup> Moreover, climate change projections estimate that New South Wales and Victoria are likely to

---

<sup>1</sup> The author is grateful to Professor Mark Adams for his comments on this paper. Any remaining errors, however, are the sole responsibility of the author.

<sup>2</sup> Allen Consulting Group, *Climate change risk and vulnerability: promoting an efficient adaptation response in Australia*, report the Commonwealth Department of Environment and Heritage, Commonwealth of Australia, Canberra, 2005.

<sup>3</sup> W. Steffen, *Stronger evidence but new challenges: climate change science 2001-2005*, Australian Greenhouse Office, Commonwealth of Australia, Canberra, 2006.

<sup>4</sup> W. Steffen, *Stronger evidence but new challenges: climate change science 2001-2005*, Australian Greenhouse Office, Commonwealth of Australia, Canberra, 2006.

become significantly drier in the future.<sup>5</sup> In short, there is now evidence which indicates that Australia's climate is becoming hotter and drier.

Moreover, since the United Nations Intergovernmental Panel on Climate Change Third Assessment Report<sup>6</sup> was released in 2001 showing the world is warming, more evidence has emerged to indicate that Australia along with the rest of the world is experiencing climate change. The evidence confirms that the surface of the earth is warming, that this warming is beyond what can be expected from natural variability and that human-induced greenhouse gas emissions are the major cause of these changes.<sup>7</sup>

### **3. Could climate change increase the risk of fire?**

The danger of fire, or the fire risk, refers to the risk of a fire starting, its rate of spread, intensity and the difficulty of successfully extinguishing the blaze. In short, the fire risk is the fire frequency and intensity.<sup>8</sup>

Aside from arson, the risk of fire is influenced by a range of factors, including fuels, terrain, land management, suppression (i.e. resources for extinguishing the fire) and weather. Unsurprisingly, given most fires occur during summer, weather conditions are a critical determinant of the fire risk. For example, high temperatures, low precipitation or, worse still, prolonged drought, can dry out timber, grass and leaves increasing the risk of a fire starting. With compliant weather conditions fire intensity is likely to be greater and suppression more difficult.

Consequently, understanding what determines weather conditions and changes in the climate is crucial to assessing fire risk. For many years the principal variable in the weather mix has been the 'El Nino' effect. El Nino, and its opposite La Nina, describe extreme phases of the naturally occurring climate cycle. In Australia the El Nino effect, which is twice as frequent as the La Nina effect, produces drier and hotter conditions and many of Australia's droughts are believed to be caused by El Nino conditions. According to the Commonwealth Scientific and Industrial Research Organisation (CSIRO), many of Australia's fire seasons have occurred during droughts associated with El Nino events.<sup>9</sup>

The other variable for understanding fire-weather risk is climate change. Although in the short-term the El Nino effect is likely to have a greater impact on the risk of fire,

---

<sup>5</sup> K. Hennessy, C. Lucas, N. Nicholls, J. Bathols, R. Suppiah and J. Ricketts, *Climate change impacts on fire-weather in south-east Australia*, CSIRO, Commonwealth of Australia, Canberra, 2005.

Department of Environment and Heritage, *Australia state of the environment 2006*, Commonwealth of Australia, Canberra, 2006.

<sup>6</sup> Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2001: The Scientific Basis of Climate Change*, Summary for policymakers, Third Assessment Report of the Intergovernmental Panel on Climate Change, 2001.

<sup>7</sup> W. Steffen, *Stronger evidence but new challenges: climate change science 2001-2005*, Australian Greenhouse Office, Commonwealth of Australia, Canberra, 2006.

<sup>8</sup> Bushfire Cooperative Research Centre, 'Fire note', issue 4, September 2006.

<sup>9</sup> K. Hennessy, C. Lucas, N. Nicholls, J. Bathols, R. Suppiah and J. Ricketts, *Climate change impacts on fire-weather in south-east Australia*, CSIRO, Commonwealth of Australia, Canberra, 2005.

there is concern that over the long-term human-induced climate change could significantly raise the fire danger in Australia.

Since the 2002-03 fire season a series of reports and inquiries have investigated the impact of climate change on the risk of fire. In 2004, the National Inquiry on Bushfire Mitigation and Management's report to the Council of Australian Governments concluded that climate change would increase the risk of fire in Australia.

Fires' frequency, intensity and size are expected to increase under climate change as temperatures rise, rainfall variability increases, droughts become more severe and ecosystem dynamics alter, resulting in changed biomass fuel loads and types. The projected hotter, drier, windier conditions associated with climate change caused by greenhouse warming would extend the period of fuel drying and increase rates of fire spread.<sup>10</sup>

Moreover, the inquiry found that climate change could hamper mitigation measures because 'there could be a reduction in the number of periods for planned fire' and worryingly, 'more intense fires could make suppression more difficult'.<sup>11</sup>

Similarly, a report to the Commonwealth Department of the Environment and Heritage by the Allen Consulting Group in 2005 warned that the 'incidence of bushfire is likely to be impacted by the temperature, humidity and precipitation changes brought about by climate change'. It also argued that the frequency and intensity of fires will be affected by changes in climate conditions.<sup>12</sup>

In 2003, the Report of the Inquiry into the 2002-2003 Victorian Bushfires recommended that potential climate change impacts be incorporated into future planning against bushfires. The report's findings were based on a double concern about changes in weather conditions from El Niño and from climate change. The report stated that:

[d]uring periods of drought, such as those associated with El Niño events, evidence indicates there is an increased risk of large fires. Additionally, climate change throughout the present century is predicted to lead to increased temperatures and, with them, a heightened risk of unplanned fire.<sup>13</sup>

Pre-existing concerns about the El Niño effect could therefore be exacerbated by the potential impacts of climate change. In fact, the CSIRO projects that global warming will likely enhance the drying associated with El Niño events.<sup>14</sup>

---

<sup>10</sup> Council of Australian Governments (COAG), *Report of the national inquiry on bushfire mitigation and management*, Commonwealth of Australia, Canberra, 2004, p. 119.

<sup>11</sup> Council of Australian Governments (COAG), *Report of the national inquiry on bushfire mitigation and management*, Commonwealth of Australia, Canberra, 2004, p. 119.

<sup>12</sup> Allen Consulting Group, *Climate change risk and vulnerability: promoting an efficient adaptation response in Australia*, report to the Commonwealth Department of Environment and Heritage, Commonwealth of Australia, Canberra, 2005, p. 73.

<sup>13</sup> B. Esplin, A. Gill and N. Enright, *Report of the inquiry into the 2002-2003 Victorian bushfires*, State Government of Victoria, Melbourne, 2003, p. 19.

<sup>14</sup> CSIRO, *Climate Change Projections for Australia*, Commonwealth of Australia, Melbourne, 2001.

The findings of these inquiries were confirmed in a 2005 report by the CSIRO, which specifically assessed the climate change impacts on fire-weather in south-east Australia. Drawing on complex global climate models, scientists at the CSIRO made some important findings. They found that climate change is likely to increase the risk of fire in most locations in south-east Australia. In particular, they found that the frequency of very high and extreme fire danger days is likely to increase by 4-25 per cent by 2020 and 15-70 per cent by 2050 across south-east Australia. The report points out that these findings are supported by previous assessments which indicate that global warming will increase fire frequency and severity.<sup>15</sup>

In November 2006, research by Professor Andy Pitman and his colleagues at Macquarie University reinforced the report by the CSIRO linking climate change to the risk of fire. They found that in 2050 and 2100, under both low and high greenhouse gas emission scenarios, the risk of fire would increase. Pitman argues that the risk of fire will increase by an estimated 25 per cent in 2050 regardless of measures taken now to reduce greenhouse gas emissions. However, by 2100 they found that under the low emission scenario the fire risk would increase by 25 per cent but under high emissions scenarios they could increase by between 50 and 100 per cent.<sup>16</sup>

#### **4. Implications**

There is now a considerable body of evidence which indicates that changes to weather conditions in Australia caused by climate change will increase the frequency and intensity of bushfires in Australia. The most recent and comprehensive research predicts that climate change will increase the frequency of very high and extreme fire danger days by 4-25 per cent by 2020 and 15-70 per cent by 2050 across south-east Australia.

The enhanced fire risk caused by climate change could also exacerbate climate change itself. This could happen in two ways. First, bushfires could act as a contributor to climate change through the emission of gases to the atmosphere thereby worsening global warming. Second, because Australian forests act as carbon sinks soaking up carbon that would otherwise be released into the atmosphere, as bushfires become more frequent and more intense they will reduce the size of the sink and thus increase global warming.<sup>17</sup>

In all, the evidence reinforces the need to address climate change to reduce the risk of fire in Australia. It also highlights the need for more effort to be put into other areas, particularly fuel management as the fire danger increases. Nevertheless, without urgent action to reduce greenhouse gas emissions Australian summers are likely to experience more frequent and more intense bushfires. As this happens, the devastation caused by the 2002-03 bushfires could become the norm rather than the exception.

---

<sup>15</sup> K. Hennessy, C. Lucas, N. Nicholls, J. Bathols, R. Suppiah and J. Ricketts, *Climate change impacts on fire-weather in south-east Australia*, CSIRO, Commonwealth of Australia, Canberra, 2005.

<sup>16</sup> The findings are forthcoming in the journal *Climatic Change*. See also: W. Frew, ‘Bushfire risk will double if emissions continue to rise’, the *Sydney Morning Herald*, 7 November 2006 and G. Welsh, ‘More bushfires – another likely product of climate change’, *Macquarie University News*, November/December 2006.

<sup>17</sup> W. Steffen, *Stronger evidence but new challenges: climate change science 2001-2005*, Australian Greenhouse Office, Commonwealth of Australia, Canberra, 2006.

**For more information:**

[http://www.bushfirecrc.com/publications/downloads/Firenote\\_climate190906.pdf](http://www.bushfirecrc.com/publications/downloads/Firenote_climate190906.pdf)

[http://www.cmar.csiro.au/e-print/open/hennessykj\\_2005b.pdf](http://www.cmar.csiro.au/e-print/open/hennessykj_2005b.pdf)

<http://www.coagbushfireenquiry.gov.au/findings.htm>

<http://www.dar.csiro.au/impacts/future.html>

<http://www.deh.gov.au/soe/2006/index.html>

<http://www.dpc.vic.gov.au>

<http://www.greenhouse.gov.au/impacts/publications/risk-vulnerability.html>

<http://www.greenhouse.gov.au/science/publications/science2001-05.html>

<http://www.ipcc.ch/>