

sigma *extra*

Australia: extreme temperatures and bushfire risk

The 2019/2020 bushfire season in Australia has been the most extreme on sigma and national records. It ran from September 2019 to February 2020, the longest ever, burning more land and houses than in any previous season.¹ Widespread and heavy smoke created hazardous air quality conditions, in some locations lasting for weeks.² Loss of life was significantly lower than for other wildfires, testament to the efforts of the firefighters. Even so, if the experience is a taster of things to come, more effective policies on how to live sustainably in increasingly fire-prone landscapes are needed.

Burning: a new norm?

The 2019/2020 bushfires further confirm the growing contribution of secondary perils (fire, due to extreme temperatures and dryness) to natural catastrophe losses (economic and insured). The impact to the local economy is still to be fully assessed, but will likely be significant due to 1) loss of tourism revenue (many of the impacted coastal regions rely heavily on seasonal tourism); and 2) the impact on forestry, agriculture and viticulture.

Is the season representative of a new norm? Last year was Australia's warmest (national mean temperature 1.52°C above average) and driest (rainfall 40% below average) on record.³ December was the hottest month on record, both in terms of national mean and mean maximum temperature.⁴ The national annual accumulated Forest Fire Danger Index was the highest since records began in 1950.⁵

Table 1

Wildfires in Australia, with insured losses (USD million in 2019 prices), hectares and houses burnt

Event	Insured losses	Burnt area (mn ha)	Total Buildings	Homes
1983 Ash Wednesday	750	0.3	3703	2003
2003 Canberra	366	0.2	800	488
2009 Black Saturday	1146	0.4	3500	2029
2019/20 season	1546	16	>5900	>3000

Source: Australian Institute for Disaster Resilience, National Museum Australia, University of Melbourne, Swiss Re Institute

¹ CAT195 Australian Bushfire Season, Insurance Council of Australia, 8 November 2019.

² Annual climate statement, Bureau of Meteorology, 2019.

³ Ibid.

⁴ "Attribution of the Australian bushfire risk to anthropogenic climate change", worldweatherattribution.org, March 2020.

⁵ Ibid.

Longer-term climate change-effects with respect to extreme temperatures are having a significant impact on bushfire risk in Australia. There has been an observed increase in extreme temperatures and drying conditions since the 1970s,⁶ in part attributable to anthropogenic climate change.⁷ The trends are particularly pronounced in the southeast,⁸ and are also evident in actual fire occurrence, with an increasing occurrence of major bushfire events over the past century.⁹

Within those trends, there has also been substantial inter-annual variability. This has been driven by several modes of climate variability, including the El Niño Southern Oscillation (ENSO), Indian Ocean Dipole (IOD) and Southern Annular Mode (SAM).¹⁰ Fire seasons are typically more severe during El Niño conditions. The 2019/2020 fires, however, occurred in a neutral phase of ENSO, due to hot and dry conditions. These conditions are attributable to a strong and long-lived positive IOD, and negative phase of the SAM.

The frequency of occurrence of severe fire weather conditions in southern and eastern Australia is likely to increase in future climate scenarios, due to projected warming and drying.¹¹ The risk of wildfires with extreme pyroconvection¹² (eg, the 2003 Canberra fires,¹³ and 2009 Black Saturday fires¹⁴ and also some of the 2019 bushfires) will likely also increase.¹⁵

⁶ Ibid.

⁷ A. J. Dowdy, "Climatological variability of fire weather in Australia", *Journal of applied meteorology and climatology*, vol 57, 2018,.

⁸ *State of the Climate 2016*, CSIRO and Bureau of Meteorology, 2016.

⁹ J. J. Sharples et al., "Natural hazards in Australia: extreme bushfire", *Climatic Change*, vol 139, no 1, 2016.

¹⁰ S. Harris, C. Lucas, Understanding the variability of Australian fire weather between 1973 and 2017, *PLoS one*, vol 14, 2019.

¹¹ *CSIRO and Bureau of Meteorology*, Climate Change in Australia Information for Australia's Natural Resource Management Regions: Technical Report, CSIRO and Bureau of Meteorology, Australia, 2015.

¹² Wildfires with strong convective processes (similar to thunderstorms) in their smoke plumes, which can create clouds. The feedback between the atmosphere and fire causes unpredictable changes in fire behaviour, making the fire more difficult and hazardous to fight.

¹³ M Fromm et al. "Violent pyro convective storm devastates Australia's capital and pollutes the stratosphere", *Geophysical Research Letters*, vol 33, 2006.

¹⁴ A. J. Dowdy, M. D. Fromm and N. McCarthy, "Pyrocumulonimbus lightning and fire ignition on Black Saturday in southeast Australia", *Journal of Geophysical Research: Atmospheres*, vol 122, no 14, 2017

¹⁵ A.J. Dowdy et al., "Future changes in extreme weather and pyroconvection risk factors for Australian wildfires", *Scientific Reports*, vol 9, no 1, 2019.