

# Study sheds light on bushfires' microclimate impact

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A study examining the urban microclimatic impact of the 2019-20 Australian bushfires has uncovered how they affect local meteorological and air quality.

Its findings could help understand the potential consequences of an increased rate and extension of bushfires, and especially regarding improving risk preparedness and coping strategies.

The research was carried out by scientists from The University of Sydney and the University of New South Wales, Sydney. They monitored [air temperature](#), relative humidity, barometric pressure, precipitation, wind (speed and direction), [solar radiation](#), UV radiation, UV index, and a range of particulate matter pollution (PM1, PM2.5 and PM10) at a site in Sydney from 20th of December 2019 to 13th of January 2020, when hundreds of bushfires were ravaging the bordering areas.

The study is published today in the IOP Publishing journal *Environmental Research Communications*. Senior co-author Professor Gianluca Ranzi, from The University of Sydney, said: "Many studies have investigated and confirmed the health implications of bushfires, as biomass burning is a major source of ambient particulate matter (PM). But underexplored is the impact on local urban microclimates, concerning not just temperature, but factors including solar and UV radiation, relative humidity, wind patterns and gusts, and urban heat island intensity.

"Our study aims to unveil the connection between weather anomalies and livability of urban areas, by using multi-parameter measurements and a multifocal approach."

During the team's monitoring period, extreme pollution, heat wave and drought were recorded simultaneously. The PM10 content reached a maximum of 160  $\mu\text{g}/\text{m}^3$ , the temperature peaked at 46.2°C, while the accumulated rain was 13.6 mm.

Lead author Dr. Giulia Ulpiani, from The University of Sydney, said:

"We found that specific combinations of air temperature and [relative humidity](#) were conducive to higher/lower levels of pollutant accumulation, reflecting findings from previous studies. In general, higher PM concentration was recorded for night-time and early morning, especially after daytime overheating events (with temperatures above 35°C). We also found that long-transport mechanisms and complex interactions between prevailing and local winds could have played a major role, making it difficult to establish definite correlations between PMs and single environmental parameters.

"Intense rain splashing was also associated with the most intense concentration of dust. Our data confirm that, despite their acknowledged air-cleansing properties, heavy raindrops also trigger a mechanism that produces solid particles from soil, which can substantially raise local pollution levels."

The study also established a link between ultraviolet index (UVI) and PM concentration. It identified several PM thresholds above which UV radiation was strongly blocked, and below which the UVI was likely to surpass moderate levels. Using evolutionary algorithms, the relationship was further demonstrated, and supports previous scientific evidence of the attenuating effects of smoke aerosols on UV irradiance.

Senior co-author Professor Mat Santamouris, from the University of New South Wales, said: "We also compared the urban heat island intensity during the bushfire event to that recorded during the same period over the previous 20 years. Data from several Bureau of Meteorology stations indicated an additional effect of the microclimatic perturbation caused by the bushfires: the disappearance of cool island events and the exacerbation of UHI events over the median."

Dr. Ulpiani added: "While quantitative evaluations should be interpreted with caution, our study offers a new holistic approach to environmental

monitoring. The associations we discovered would be extremely valuable in building up a cohesive national health protection strategy, and encouraging better responsiveness from governments and city planners. We will continue this work, to hopefully identify general laws and climate dependencies."

**More information:** Giulia Ulpiani et al, Experimental evidence of the multiple microclimatic impacts of bushfires in affected urban areas: the case of Sydney during the 2019/2020 Australian season, *Environmental Research Communications* (2020). [DOI: 10.1088/2515-7620/ab9e1a](https://doi.org/10.1088/2515-7620/ab9e1a)

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