

# Canopy fire severity

## Using satellites to estimate fire severity across Australia's woody landscapes

The CSIRO has developed a new remotely sensed product that describes the severity of fire impacts on canopy foliage cover. This is calculated using CSIRO's MODIS-based woody foliage cover product<sup>1</sup> and NASA's MODIS Burned Area product<sup>2</sup>. The severity product is a combination of 500 and 250 m imagery, has a 16-day time-step, and starts in 2002. The algorithm identifies the date of a fire and takes the ratio of the woody foliage cover (FC) in the 3 months following the fire to the cover in the 3 months before the fire, and then subtracts this ratio from 1:

$$\text{Canopy fire severity} = 1 - \frac{\text{Post-fire woody FC}}{\text{Pre-fire woody FC}}$$

A canopy fire severity value of 0 indicates that there was no change in the green woody foliage cover caused by the fire. A value of 1 indicates that there was no green foliage observed after the fire (which could be due to green leaves turning brown due to scorching, or because they were combusted). This product does not capture the effects of fire on grasslands, croplands or pastures.

Figure 1 shows effect of a major fire on woody foliage cover in a moist open forest on the NSW south coast. This fire occurred in late 2019 (red vertical line). The average woody (or canopy) foliage cover (FC) for the 3 months before and after the fire are indicated by the black horizontal lines (woody FC of 0.89 and 0.31, respectively). This yields a canopy fire severity of 0.65. Total FC, grass FC, brown cover<sup>3</sup> (that is, cover of twigs and dead leaves) and bare ground<sup>3</sup> fractions are shown for reference.

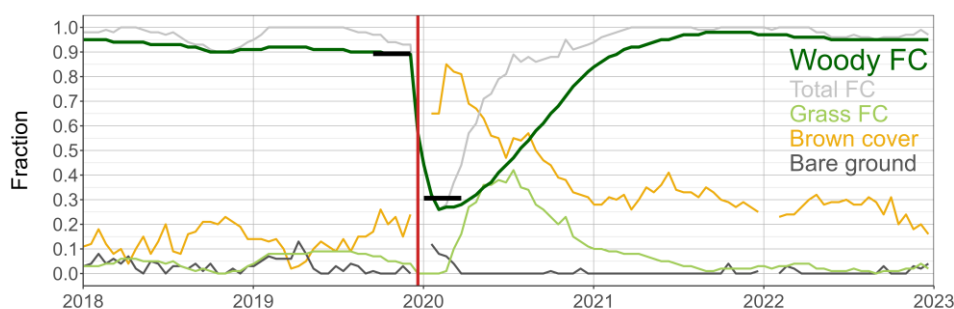


Figure 1. The effect of a major fire on woody foliage cover in a moist open forest, NSW south coast. Foliage cover (FC), brown cover and bare ground are measured as fractions of ground area.

This product has been developed as part of the National Bushfire Intelligence Capability<sup>4</sup>, which seeks to generate nationally consistent fire hazard information, and to make that information easily accessible.

<sup>1</sup> Donohue, R.J., & Renzullo, L.J. (2025). An assessment of the accuracy of satellite-derived woody and grass foliage cover estimates for Australia. *Australian Journal of Botany*, 73. DOI: <https://doi.org/10.1071/BT24060>. Collection 6.1.

<sup>2</sup> Giglio, L., Justice, C., Boschetti, L., & Roy, D. (2021). MODIS/Terra+Aqua Burned Area Monthly L3 Global 500m SIN Grid V061. <https://doi.org/10.5067/MODIS/MCD64A1.061>. Collection 6.1.

<sup>3</sup> Guerschman, J.P., & Hill, M.J. (2018). Calibration and validation of the Australian fractional cover product for MODIS collection 6. *Remote Sensing Letters*, 9, 696-705. DOI: <https://doi.org/10.1080/2150704X.2018.1465611>.

<sup>4</sup> The National Bushfire Intelligence Capability is led by CSIRO and supported by the National Emergency Management Agency. This fire severity work was completed within Stage 2 of this project, which was funded by the Australian Climate Service.

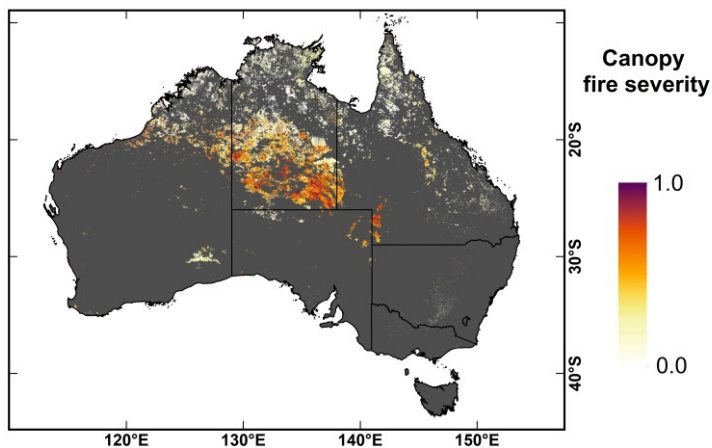


Figure 2. Canopy fire severity at the continental scale for 2011.

Across the arid interior, fires are most prevalent following the build-up of fuels driven by widespread rainfall; such a rainfall event occurred in 2010. Figure 2 shows the maximum severity observed within the 2011 year.

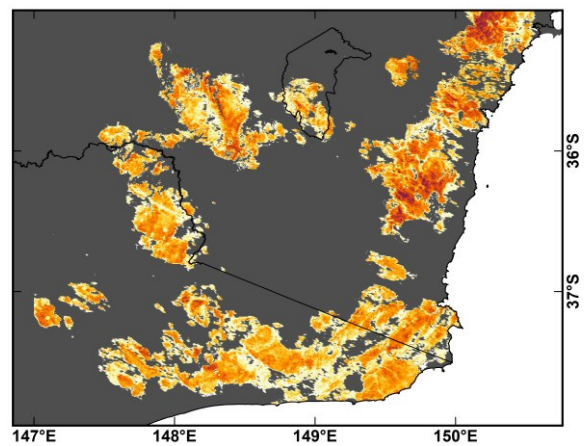


Figure 3. Canopy fire severity of the Black Summer fires (November 2019 to February 2020).

The 2019/2020 Black Summer fires impacted large areas of south-east Australia's forests. Figure 3 shows the impact of these fires, it was generated by compiling canopy fire severity data from November 2019 to February 2020.

As severity is generated every 16-days, the progression of the impact of the Black Summer fires can be tracked at a near-fortnightly time-step (Figure 4) – albeit with a 3-month delay.

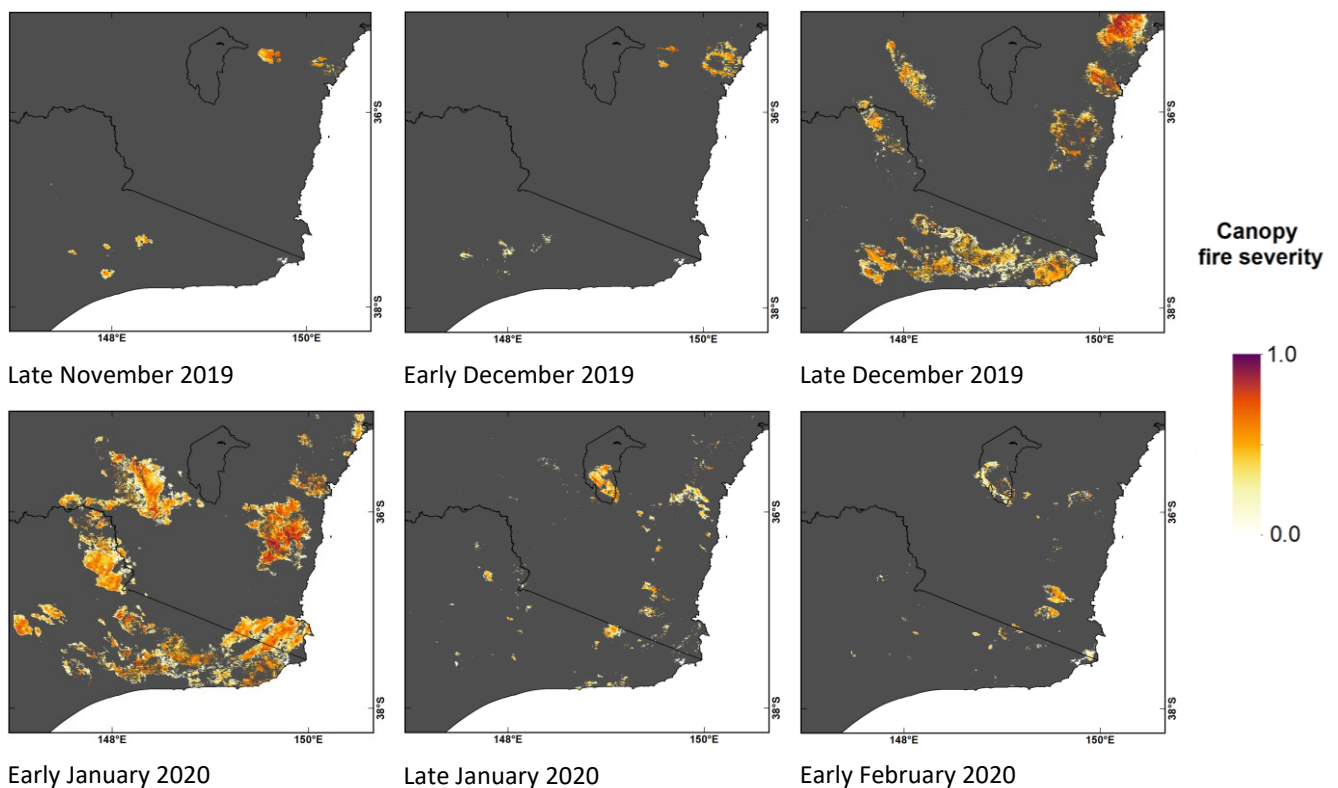


Figure 4. Sixteen-day time-step of the Black Summer fires.

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