



When and where to burn?

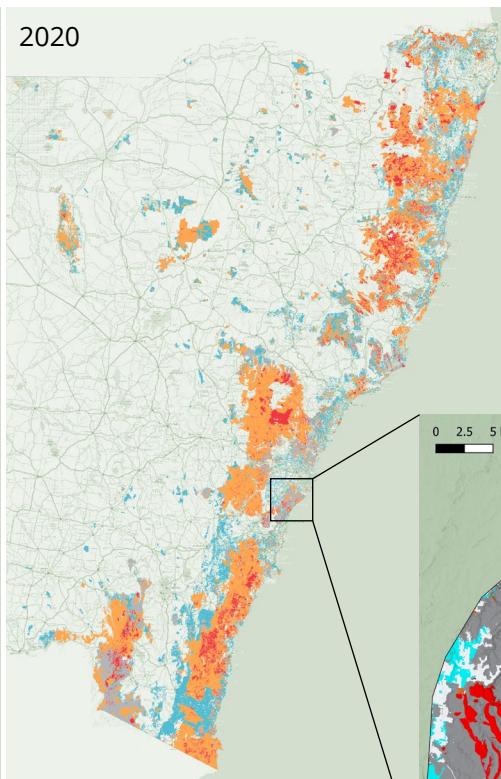
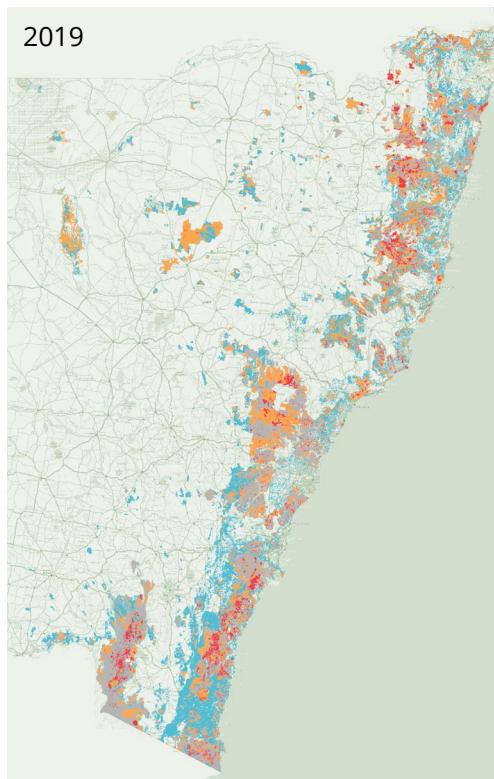
FireTools Cloud - mapping forest biodiversity

FireTools Cloud is an online tool to help managers understand how vulnerable a forest is to fire. Colour-coded maps show when a particular area should, or shouldn't, be burned. If a bushfire is predicted or you are planning a hazard reduction burn (HRB), you can upload data to FireTools and then download information about the area's vegetation. The tool analyses fire history and vegetation data to calculate a **biodiversity threshold status**, based on **ecological fire intervals**.

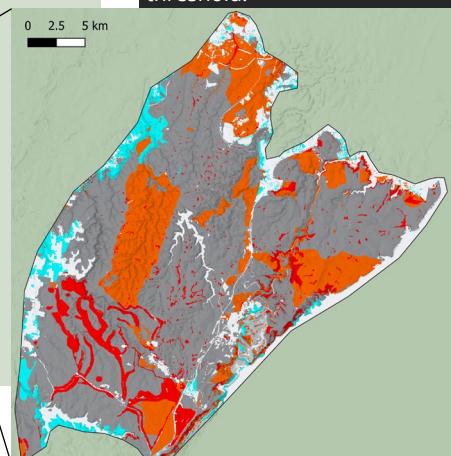
Vegetation may be:

- Long unburnt – vegetation has not been burnt in a long time. This may be good for some fire-sensitive vegetation, but those that require fire may be at risk of ecological state shift.
- Within threshold – likely to tolerate fire now
- Vulnerable – a fire now could push vegetation and associated biodiversity outside the safe threshold
- Too-frequently burnt – vegetation has been burnt too soon and too often and a fire would risk an ecological state shift

FireTools can also calculate the special status of fire management blocks, where fuel reduction is prioritised over ecological thresholds.

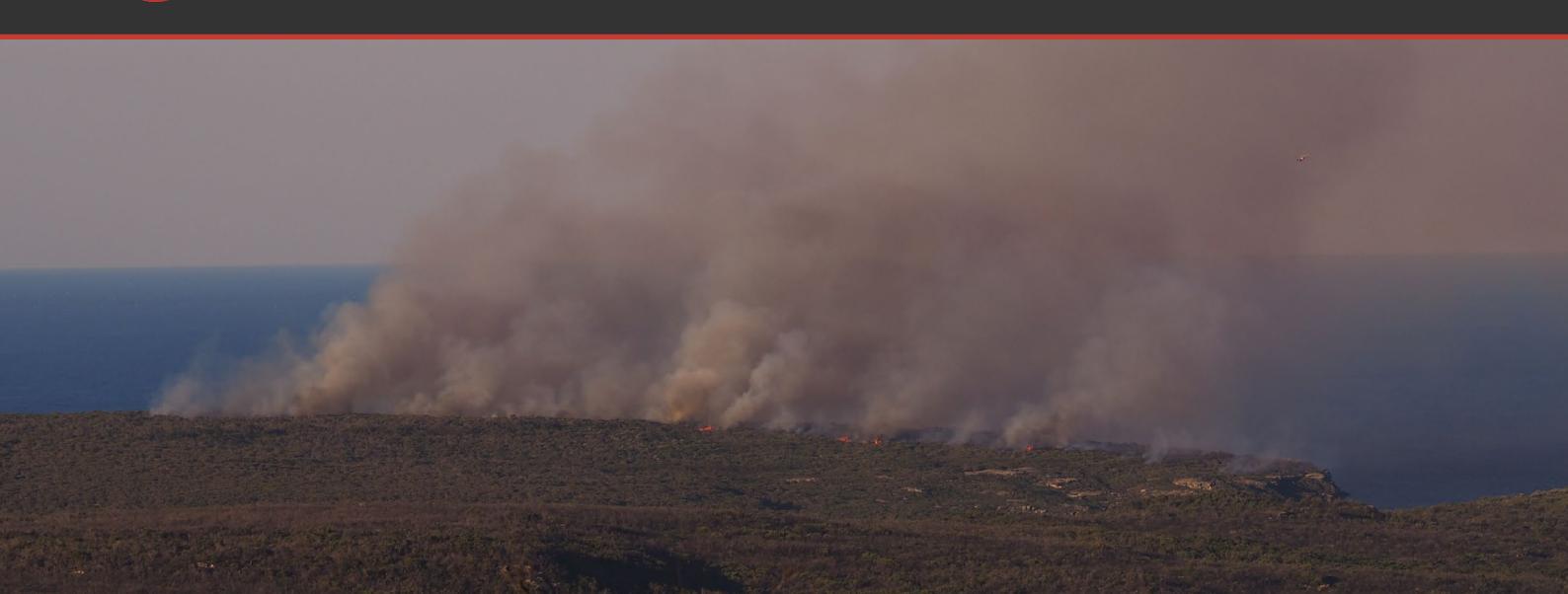


0 2.5 5 km



NSW's Black Summer: FireTools produced before-and-after maps of NSW showing areas of vegetation considered vulnerable to fire (marked in orange). Compared to 2019, the 2020 map shows a large increase in vulnerable areas.

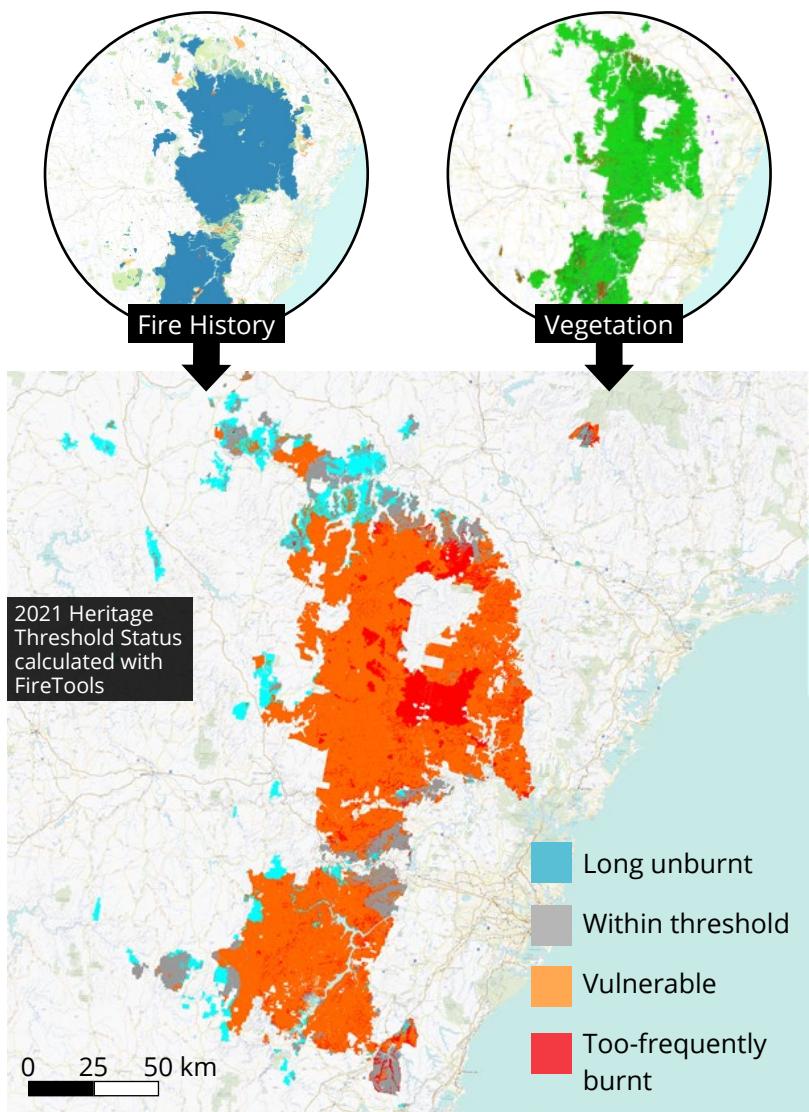
Royal National Park: The FireTools map below shows Sydney's Royal National Park in 2020, with areas too-frequently burnt marked in red and those considered vulnerable marked in orange. Areas in dark grey are within threshold.



How does it work?

- FireTools is a web-based geographic information system. Users upload spatial data files of fire history, vegetation type, ecological fire intervals and fire management blocks. The system returns maps of vegetation status and associated data files, for users to view on their desktops.
- The National Parks and Wildlife Service (NPWS) already uses FireTools to plan HRBs in parks or regions.
- FireTools can process large, high-resolution datasets, processing hundreds of square kilometres at 25-metre cell size, over decades of fire history.

FireTools in action: FireTools uses fire history and vegetation maps to show the status for the Blue Mountains after the 2019–20 fires. Extensive areas are now considered vulnerable to fire (orange) and others are too-frequently burnt (red). The light blue areas in the map below are long unburnt, which may be good for some species, but not others. Grey areas are considered within threshold, meaning a fire now is unlikely to change vegetation status.

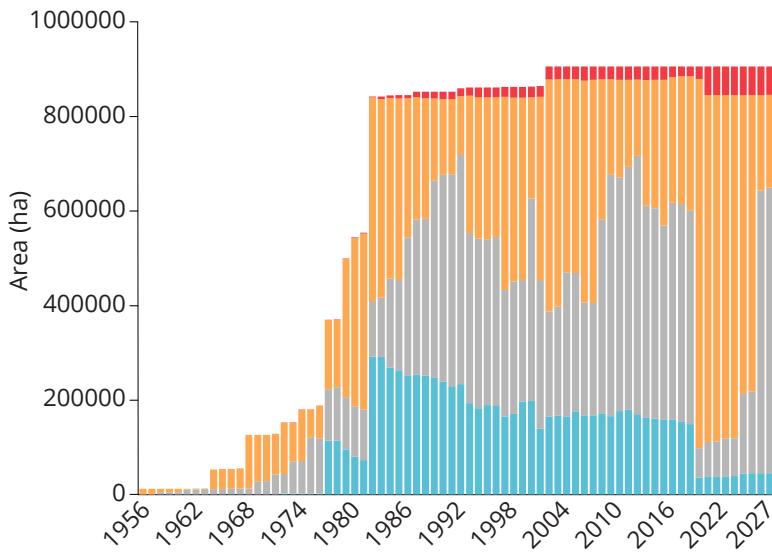




What's next for FireTools?

The NSW Bushfire Risk Management Research Hub is developing versions to:

- run in a high-performance computing environment, producing maps automatically based on the most up-to-date fire and vegetation data
- process multiple years of fire history to understand the context of current vegetation and predict its future state
- summarise statistics for individual vegetation formations and the entire analysis area
- calculate landscape metrics for small, large, clustered and interconnected areas – for example, after the 2019–20 fire season, large, connected areas were in a vulnerable state, while long-unburnt vegetation patches were small and isolated
- integrating data from the satellite Fire Extent and Severity Mapping (FESM) project to interpret a vegetation state based on how severely it was last burnt
- show the fire attributes and tolerances of individual species, as an alternative to the current method based on vegetation types
- agencies around Australia, including in Tasmania and Victoria, have expressed interest in applying FireTools to their ecological assessment and HRB programs
- The tool will become more widely available as automatic processing and data storage improves. FireTools is not yet available to the general public and fire managers must set up an account and undergo training.



Predictions: The graph above shows the status over time of dry sclerophyll forests in NSW's Blue Mountains. FireTools clearly shows the effect of the 2019–20 Black Summer fires, marking a sudden and dramatic increase in vulnerable areas (marked in orange). There is a corresponding loss of within-threshold (grey) and long-unburnt (blue) vegetation. The tool predicts this status is unlikely to change in 2022 and 2023.





"NPWS created FireTools in the early 2000s and continued to develop it. I use it four times a year to help teams plan burns. In 2020 we asked the Hub to enhance and 'future-proof' the tool, so it did not need to be rebuilt each time information systems changed. This is a big step forward."

Brenton Marchant, Manager Operations NPWS



What's next?

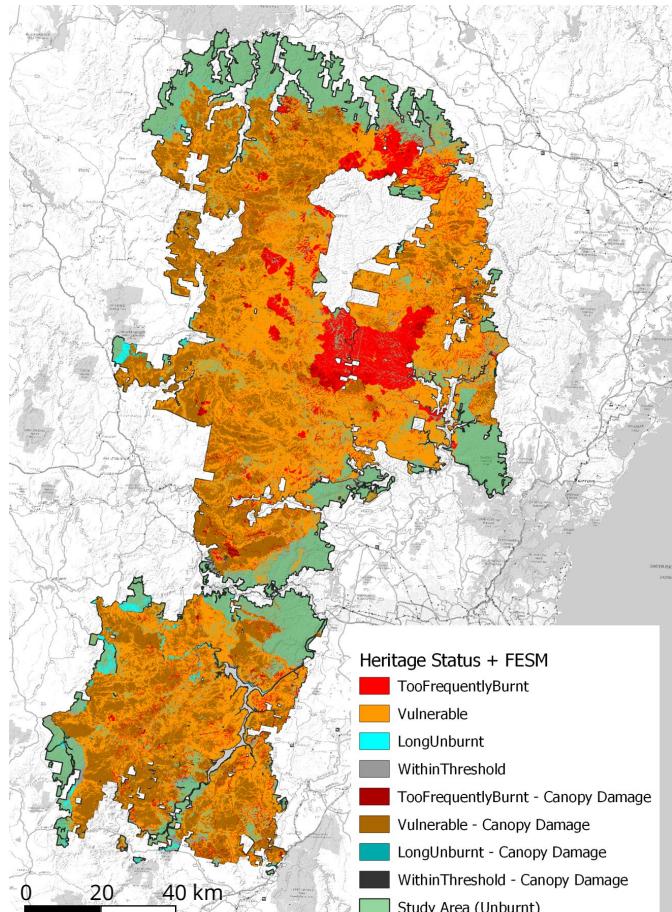
FireTools will automatically overlay threshold status with FESM data, to provide information on past fire severity within each class. The Hub is incorporating data on burn intervals under different severities directly into the threshold calculation algorithm. In the future, multiple minimum fire intervals will be defined for vegetations, at different burn severities, to account for those ecosystems which tolerate low-severity fire at a higher frequency.

Incorporating Statewide Vegetation Type Mapping (SVTM) will increase the accuracy and coverage of vegetation data, allowing easier operation of FireTools outside the NPWS estate.

Researchers

Dr Grant Williamson is a fire ecologist and senior research fellow at the University of Tasmania, and leader of the Hub's work package on dynamic mapping of fire regimes. grant.williamson@utas.edu.au

Dr Rebecca Gibson led development of the FESM severity product incorporated into FireTools, and NPWS officer **Brenton Marchant** and **Professor David Bowman** assisted in FireTools' design and development.



Overlays fire severity: This map of the Blue Mountains shows heritage threshold status from FireTools overlaid with FESM fire severity classes. Within the vulnerable (orange) class, there are areas of low-severity and high-severity fire (canopy damage).

More information

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The **NSW Bushfire Risk Management Research Hub** (www.bushfirehub.org) is a partnership between researchers at the University of Wollongong, Western Sydney University, the University of NSW, the University of Tasmania, supported by the NSW Department of Planning and Environment and the NSW Rural Fire Service.