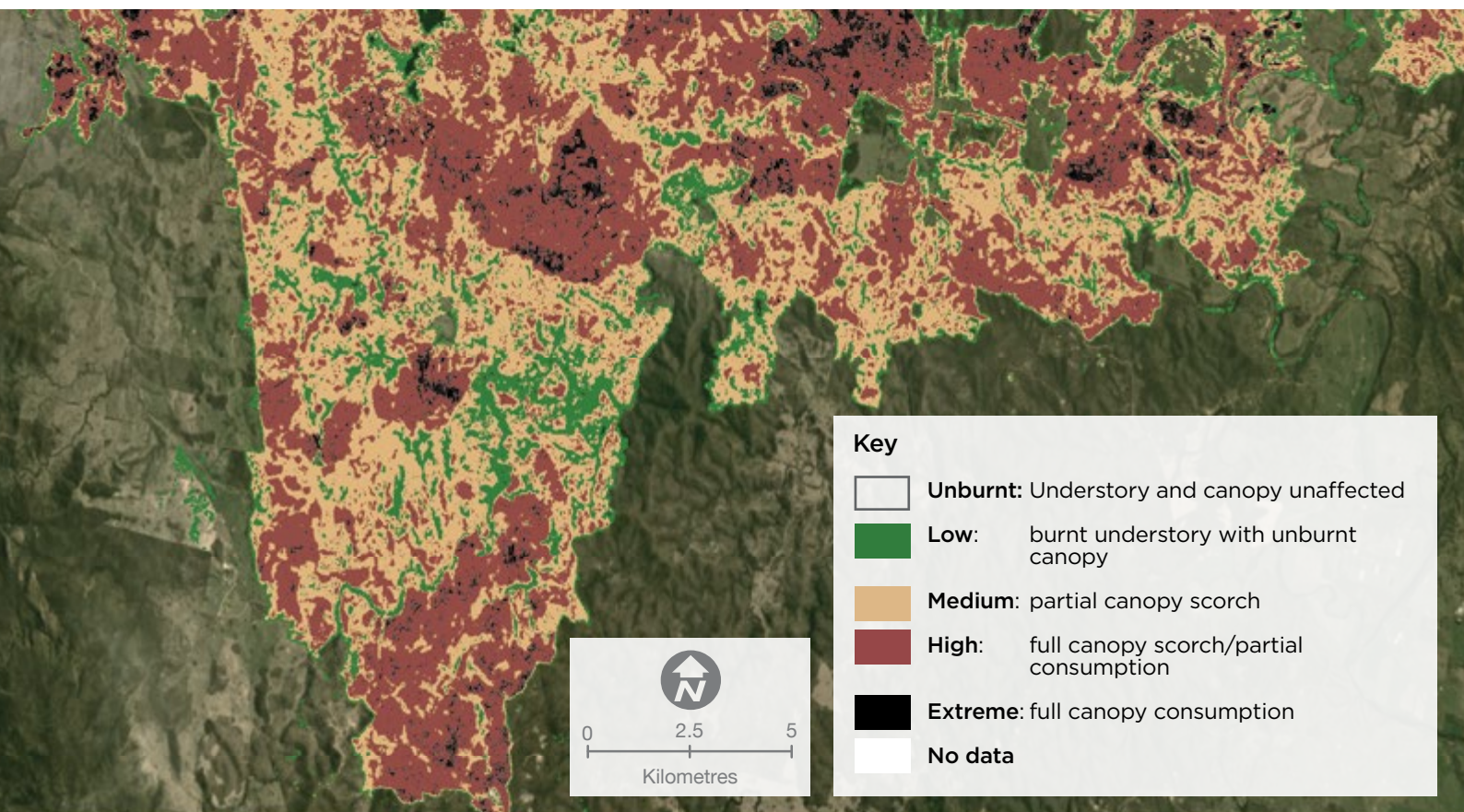


Supporting fire management with fire extent and severity maps

Fire mapping by machine learning



Information about the severity of a fire on a landscape is critical to understanding the relationship between fuels, fire behaviour and landscapes.

The Department of Planning, Industry and Environment's Science, Economics and Insights Division has been working with the NSW Rural Fire Service since 2018 to develop Fire Extent and Severity Mapping (FESM). The operational system for FESM went live in July 2020.

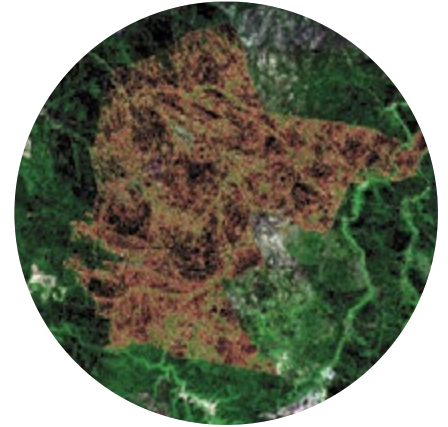
Fire extent and severity mapping

Our scientists have been looking at vegetation changes due to fire, working with the Rural Fire Service and other organisations in the NSW Bushfire Risk Management Research Hub.

FESM is a mapping system that uses satellite imagery and machine learning to deliver near real-time maps of fire severity. Maps are produced of NSW fires as each fire event stabilises.

The maps produced through FESM provide an understanding of how a fire has changed the landscape at a detailed level. It is a standardised, automated remote-sensing approach that supports fire management planning, fire management and research, conservation and landscape ecology.

Maps are produced year on year and enable us to understand vegetation changes as a result of fire events, as well as vegetation trends that impact fire behaviour over time.



How fire extent and severity mapping works

FESM uses machine learning to classify and model fires. Machine learning uses algorithms and statistical models to understand patterns in data.

A 'random forest' algorithm was trained on fire season case studies from 2017–18, 2018–19 and 2019–20. The algorithm learns from each case study and the corrections made by scientists, which helps us classify and model new fires.

FESM has a standardised classification system of fire severity and can predict and compare the severity of fires across different landscapes.

The algorithm has been trained to better understand the impact of fires, so we can provide information about the impact on species and habitats.

How data is reported

In addition to event-based spatial data which are shared with agencies as fire events stabilise, annual summary reports covering each fire year are issued in May each year. The first FESM annual report, released in 2021, covers three fire years: 2017–18, 2018–19 and 2019–20.

The summary report data provides statistics of the area (hectares) and proportion (%) of fire severity classes, as well as fire extent represented by various regional boundaries such as local government areas, and ecological units such as vegetation formations, soil types and bioregions.

The reporting framework will support comparisons of fire effects between regions within a fire year, as well as change over time. The FESM spatial data products are available on the Sharing and Enabling Environmental Data (SEED) portal by searching 'FESM'.

Benefits of mapping fire extent and severity

A semi-automated system like FESM that can rapidly model information helps us process large volumes of data quickly and improves our ability to develop a robust, statewide FESM archive.

In some cases, interim FESM products are produced before the fire is out and smoke or cloud has cleared from the imagery. This supports rapid-response decisions and prioritisation. These interim FESM products will be finalised when the fire is out and suitable imagery is available.

We are consolidating the maps being produced through this project into the NSW Fire History Database, which is maintained by NSW Rural Fire Service. This database is used in fire management planning, providing analysis of fire behaviour and fuel assessment. Fire severity maps also have the potential to support research into fire emissions, the health impacts of smoke and carbon dynamics.

Cover photo: Fire Extent and Severity Maps, R Gibson/DPIE.
Above left to right: Remote sensing scientist out in the field verifying FESM data with a NPWS field officer, Shannon Greenfields/DPIE; Fire flames woodland from Brindabella I Dicke/DPIE; Fire Extent and Severity Map, R Gibson/DPIE.

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