



# On the map: Our most flammable barks

In a first for the state, researcher Kate Fuller is helping fire managers know where the trees with the most flammable barks occur, across NSW. Eucalypts help make south-east Australian forests some of Earth's most flammable ecosystems. Bark traits can contribute significantly to forest flammability. Some bark types generate copious fuel and spread embers. Their texture and quantity can alter fire behaviour, exacerbating hazards to fire managers and increasing risks to life and property. Now they are on the map.

Fire managers need to know where the most (or least) flammable bark types are likely to occur. This work builds on a report by Horsey and Watson (2012), which predicted the likely abundance of eucalypt bark types for each vegetation type in NSW and predicted hazard by assigning bark fuels by vegetation type. In her study for the NSW Bushfire Risk Management Research Hub, Kate has examined bark-type distributions at finer scales, applying models to predict bark types based on species observations and allowing for within-vegetation-type variation. Kate classified NSW eucalypts into 11 major bark-type categories. In an exhaustive exercise, she used existing species distribution and environmental data to model distributions across the state. Kate added new species to the classification system laid down by Horsey and Watson, incorporating additional literature sources and updated information. She examined bark types as potential indicators of ecological strategies, in addition to sources of fuel. She found:

- bark types can be predicted at high levels of accuracy using environmental variables (up to 88% accuracy)
- patterns of bark-type distributions differed, indicating ecological differences between these groups, and supporting the idea that bark type is an indicative ecological trait in eucalypts
- variables related to water stress, such as aridity, were important predictors in all bark-type models
- other important predictors were rainfall seasonality; soil texture and fertility; and temperature at the driest time of year.

## Shedding bark

All smooth-barked eucalypts shed their outer layer of bark to expose the smooth layer beneath. Bark accumulates in piles at the base of the trunk, increasing ground fuel loads. Some species shed bark from the whole stem, others retain bark just at the base of the trunk, and still others retain bark halfway up the trunk. These bark types are respectively known as **smooth**, **smooth with stocking**, and **halfbarks**.

## Balancing act

Species with thicker bark have greater protection against heat and fire. Trees with smooth bark shed the outer layer of their bark, which may reduce their degree of protection. However this strategy allows more light to reach the trunk and likely increases bark photosynthesis, converting sunlight for growth. **Smooth**, **smooth with stocking** and **halfbark** eucalypts theoretically strike a balance between the need for protection from fire and the benefits of bark photosynthesis. This study is the first to look at how bark traits might influence tree distributions in NSW, as a result of this trade-off.

## Associated articles

Fuller, Kathryn (2022): Eucalypt bark type distributions across New South Wales. figshare. Collection. [bit.ly/BarkFuller](https://bit.ly/BarkFuller)

This research builds on previous work by Horsey, B. and Watson, P., 2012. Bark fuel in New South Wales forests and grassy woodlands. Centre for Environmental Risk Management of Bushfire. (Wollongong, NSW).



## Smooth barks

Trees which shed bark from their whole trunks can accumulate copious bark fuel at the base of their trunks.

Maps produced in this study show smooth-barked eucalypts are highly likely to occur in the eastern portion of the state, with lots of local variability, but not at all in the western portions of the state.

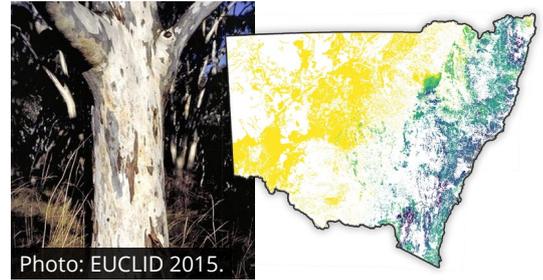


Photo: EUCLID 2015.

## Smooth with stocking

Trees which shed bark from the upper portion of their trunk but retain a short stocking (less than four metres high) can accumulate large piles of debris at their base.

Maps produced in this study show discontinuous distributions of these trees, with some locations of high likelihood in the inner west and some further east.

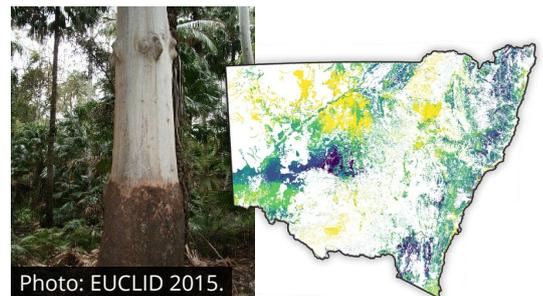


Photo: EUCLID 2015.

## Halfbark

Trees with smooth upper bark and a tall stocking (greater than four metres high) are known as halfbarks. They also shed bark, contributing to surface fuel loads.

Maps produced in this study show halfbark species are very likely to be concentrated in the central west of NSW. They are also likely to occur in the south-west and to a lesser degree on the coastal strip.

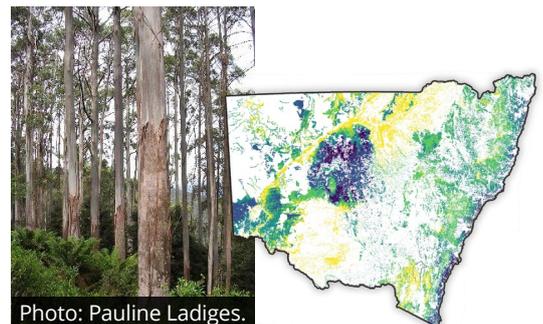


Photo: Pauline Ladiges.

## Ribbon barks

Some eucalypts shed bark in particularly hazardous long, aerodynamic ribbons, a form of bark fuel unique to eucalypts. As in other shedding species, this creates piles of debris around their trunks but, when ignited, ribbon bark can carry embers up to 30km, starting spot fires. Any tree which sheds its bark, including rough-barked species which shed bark from their branches, can produce long ribbons and fit into the ribboning category. In her analysis, Kate classified eucalypts from all bark categories by their likelihood of forming aerodynamic ribbons.

Maps produced in this study show those areas in the state where ribbonbarks are more likely to be concentrated.

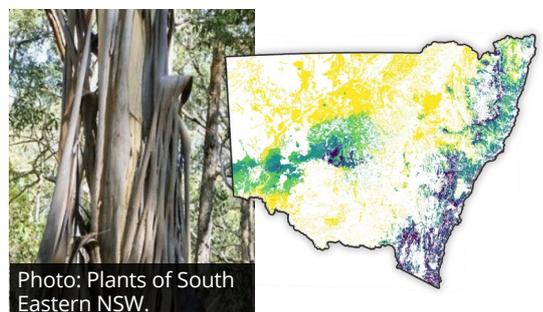


Photo: Plants of South Eastern NSW.

### Probability of occurrence

0.8 to 1.0 0.6 to 0.8 0.4 to 0.6 0.2 to 0.4 0.0 to 0.2



## Stringybarks

The bark of stringybark eucalypts is highly flammable. Fire can wick up their trunks into the forest canopy and burning fragments easily become airborne. These airborne fragments generate huge showers of embers, endangering personnel on the ground and causing short-distance spot fires.

In her Hub-supported PhD research, Kate shows flammable stringybarks are most likely to occur on the NSW east coast and ranges, but are increasingly rare in the western part of the state. There is also fine-scale variation in occurrence. These maps can help fire managers identify specific locations with hazardous bark fuels.

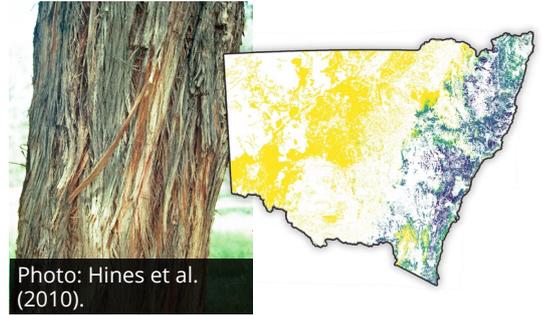


Photo: Hines et al. (2010).

## All the rest

The remainder of the bark type categories pose less of a threat in terms of producing bark fuels. However, the difference in protection their bark provides requires more study. Kate mapped each of their distributions to look at what fire regimes dominated. This opens new opportunities to investigate how bark types are related to differing ecological strategies and potential differences in fire tolerance.

“Bark hazard research by Horsey and Watson (2012) is currently used in NSW to produce maps of spotting hazard and range. This new project has the capacity to build on that foundational work and improve existing information that underpins fire behaviour predictions.”

Dr Meaghan Jenkins, Supervisor Bush Fire Analysis, NSW Rural Fire Service

## Box

The bark of these species is described as rough, fibrous and flaky.

Species with box-type barks are the most wide-spread of any examined in this study. They are also the only species which occur throughout the western portion of the state.

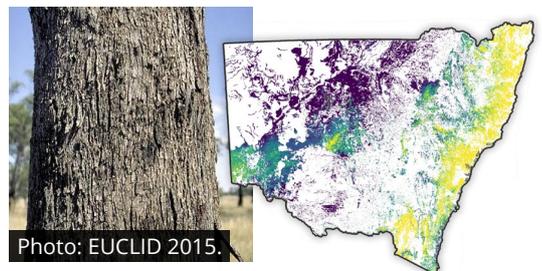


Photo: EUCLID 2015.

## Subfibrous rough bark

The bark of these species is described as rough and shortly fibrous, sometimes fissured.

Species with subfibrous, rough bark are more likely to occur on the Northern ranges and North coast, extending south to a lesser degree, but are absent in the subalpine regions.

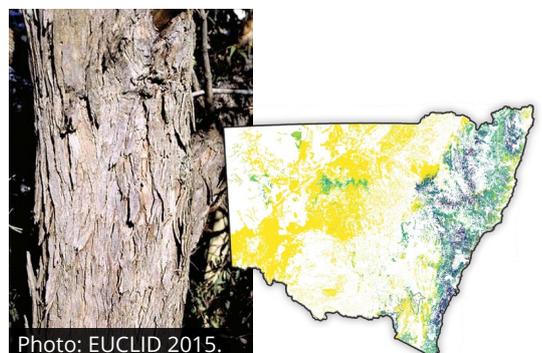


Photo: EUCLID 2015.

### Probability of occurrence

0.8 to 1.0 0.6 to 0.8 0.4 to 0.6 0.2 to 0.4 0.0 to 0.2



### Ironbark

Ironbarks are described as having rough, hard bark, which often forms ridges and deep furrows.

Ironbarks are most likely to occur in the northern half of the state, especially in and just south of the Pilliga, with other high probability locations scattered east and west of the Great Dividing Range.

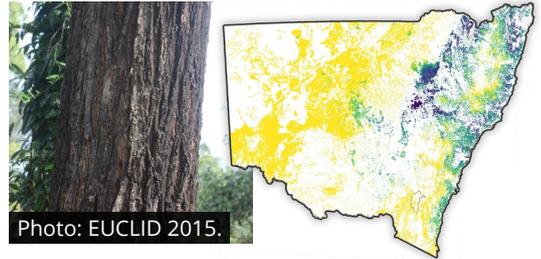


Photo: EUCLID 2015.

### Subfibrous stringy

The bark of species with subfibrous stringy bark is described as fibrous and short-fibred. While the name is similar to stringybark, they have not been described as being particularly flammable or as causing spot fires.

Trees with this bark type are concentrated in a strip from the Queensland border extending about halfway down the east coast of NSW.

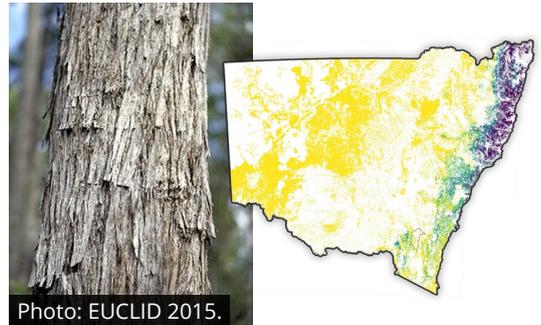


Photo: EUCLID 2015.

### Peppermint

Species with peppermint bark are described as rough, finely fibrous and with longitudinal fissures.

The peppermint barks are concentrated in the south-east of the state, with isolated patches of high probability in the Great Dividing Range to the north.

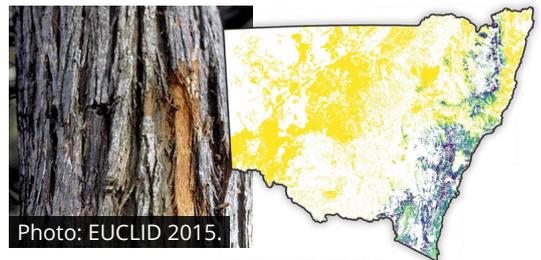


Photo: EUCLID 2015.

### Tessellated

Tessellated bark appears similar to tile mosaics, with a flaky, fibrous surface texture.

Trees with tessellated bark are very likely to occur on the North Coast, but are also highly likely to occur in the Pilliga region, with a distribution most similar to that of the ironbarks.

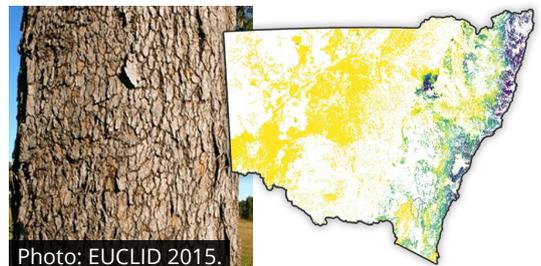


Photo: EUCLID 2015.

#### Probability of occurrence

0.8 to 1.0 0.6 to 0.8 0.4 to 0.6 0.2 to 0.4 0.0 to 0.2

#### More information

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### Researchers

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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 and the University of Tasmania, supported by the NSW Department of Planning and Environment and the NSW Rural Fire Service.

