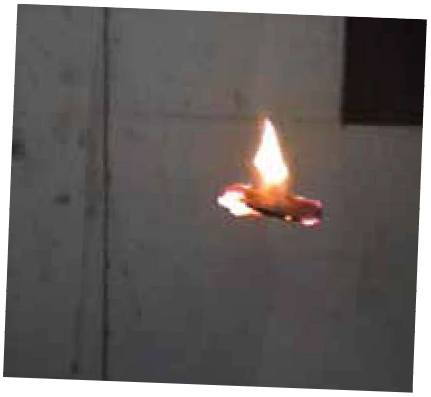
Firebrand research reveals the cause of spotfires

by Andrea Wild



A piece of eucalypt bark flies in the CSIRO wind tunnel.

Australia is a hotspot for spotfires due to the nature of our eucalypt trees which readily release firebrands – burning pieces of material such as bark – during bushfires.

Firebrands and the spotfires they create are the most unpredictable aspect of bushfire behaviour. They can cause uncontrollable bushfires and produce hazardous conditions for firefighters and anyone caught in a bushfire.

Firebrands are also the main cause of house loss at the urban-bush interface. Days of extreme fire weather will be more common in Australia's future climate and understanding how spotfires start, how they behave and their effect on firefighting efforts will increase in importance.

According to bushfire behaviour researcher Dr Peter Ellis of CSIRO multiple spot fires are harder to predict and control than a firefront burning in one location.

"Spotfires can trap firefighters, jump fire breaks and create other spotfires in a chain reaction. Black Saturday was a classic example of firebrands creating multiple spotfires, up to 35 kilometres ahead of the main fire and sometimes causing mass ignition of whole areas."

Wind alone can usually only carry a firebrand about 100 metres. Spotting to greater distances occurs when firebrands are lofted by the convection of a hot bushfire, sometimes thousands of metres high. When the firebrand falls out of the convection column it is transported ahead of the main firefront by the prevailing wind, falling toward the ground at the firebrand's terminal velocity. Whether a firebrand will start a spotfire where it lands depends on many factors, including how long it will burn during flight, its combustion characteristics at its terminal velocity and whether it will be flaming when it lands and therefore able to ignite leaves or grass.

The CSIRO Climate Adaptation Flagship has been using a purpose-built vertical wind tunnel to study the combustion characteristics of different types of eucalypt bark.

"We can't just light a piece of bark on a skewer and see what happens," explains Dr Ellis.

"The wind tunnel experiments simulate the conditions a firebrand will experience during its travel and allow us to study how a firebrand and its aerodynamics change as it burns, and for how long it remains alight under those conditions."

Eucalypts are the most common vegetation type associated with catastrophic bushfires. According to Dr Ellis stringybark trees appear to be the main culprit for concentrated shorter-distance spotting up to around three to four kilometres.

"The bark ignites readily, is easily detached and lofted by a fire and remains flaming at its terminal velocity for a long time. Spotfires that occur at distances of 10, 20 or even 30 kilometres are associated with streamer-like gum-bark eucalypts, such as candlebark. We are yet to figure out how these types of firebrands keep burning for the 10 to 30 minutes needed to travel such long distances."

The research is part of ongoing work looking at firebrand behaviour, how spotfires ignite and what conditions are likely to result in the hazardous situation of mass spotfires.

A bushfire in a eucalypt forest – firebrands are being released which can cause spotfires many kilometres away.