Brown Hill Community FireAware Network
Finlay and Bradbury St Cluster
First Information Session held 24 September 2016

This session provided overall details of the risk of a fire impacting on the community of Brown Hill and in particular the Neighbourhood Cluster of Finlay St Sth and Bradbury St.

Presenters were

- Dr Kevin Tolhurst (Assoc. Professor in Fire Ecology and Management) presented on fire behaviour and cluster risk assessment
- Mark Cartledge (City of Ballarat, Municipal Fire Prevention Officer) presented on the role of the City of Ballarat and emergency services in the event of a bushfire impacting on Ballarat suburbs

Notes taken on fire behaviour and cluster risk assessment

When looking at assessing risk there are two levels to consider:

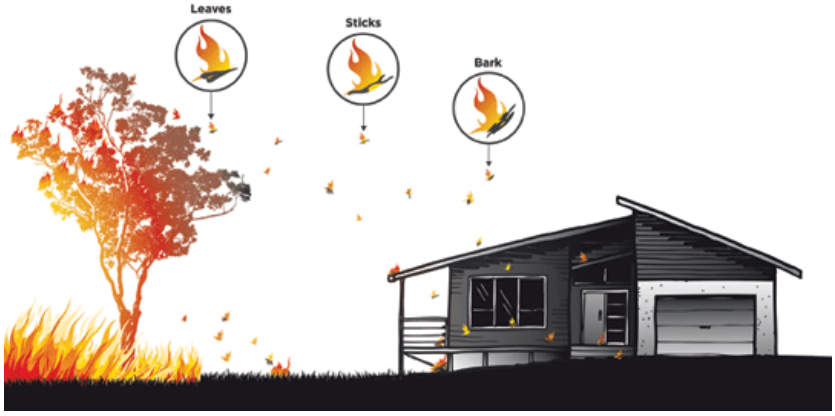
- A high fire danger local event
- A catastrophic big event

Bushfire hazards:

Ember attack

- can happen before, during and many hours after a fire front has passed
- 80% to 90% of houses lost are due to ember attack

What is an ember attack?



Embers are burning twigs, leaves and pieces of debris
Ember attack occurs when twigs and leaves are carried by the wind and land on or around houses
Ember attack is the most common way houses catch fire during bushfires
Embers can land on top of debris in your gutters and set fire to your house
Ember attack can happen before, during and after the bushfire.
Source: http://www.cfa.vic.gov.au/plan-prepare/how-fire-behaves/

Smoke

- making it difficult to see and breath

Whilst a visible haze will indicate the presence of bushfire smoke, the concentration of hazardous particles and gases will be dependent on a number of factors including: the size of the bushfire and the amount of smoke produced; the distance the smoke has travelled from the source of the bushfire; and the prevailing weather conditions.
Source: http://health.act.gov.au/sites/default/files/Fact%20sheets/Bushfire%20Smoke%20-%20Information%20Sheet%20(December%202014).pdf

Radiant heat

- is measured in kW/m^2 – over 2 kW/m^2 are lethal to a human body; at this rate bare skin will undergo a 2nd degree burn in about 40 seconds houses have greater capacity to withstand radiant heat;
- Radiant heat travels in straight lines;

The figures prescribed for building construction in a Bushfire Management Overlay(BMO) area and the Bushfire Attack Level (BAL), relate to the amount of radiant heat a building may be exposed to with the particular construction details for each BAL intended to reduce the risk of ignition while the fire front passes. For example, a building exposed to between 19 and 29 kW/m² of radiant heat is built to BAL-29 to reduce the chance of ignition.

The effects of radiant heat

Radiant heat flux kW/m²	Observed effect
1	Maximum for indefinite skin exposure
3	Hazardous conditions, firefighters expected to operate for a short period (10 minutes)
4.7	Extreme conditions, firefighters in protective clothing will feel pain after 60 seconds of exposure
6.4	Pain after 8 seconds of skin exposure
7	Likely to be fatal to unprotected person after exposure for several minutes
10	Critical conditions, firefighters not expected to operate in these conditions although they may be encountered. Considered to be life threatening in less than 60 seconds in protective equipment. Fabrics inside a building could ignite spontaneously with long exposure.
12.5 (BAL 12.5)	Volatiles from wood may be ignited by pilot flame/spark after prolonged exposure. Standard float glass could fail during the passage of a bushfire.
16	Blistering of skin after 5 seconds
19 (BAL 19)	Screened float glass could fail during the passage of a bushfire
29(BAL 29)	Ignition of most timbers without piloted ignition (3 minutes of exposure) during the passage of a bushfire. Toughened glass could fail.
40+	Flame zone – exposure to direct flame contact from fire front.

Source: http://www.cfa.vic.gov.au/fm_files/attachments/plan_and_prepare/planning-for-bushfire-web.pdf

Convective heat

- Formed by heated air and concentrated gases and usually travels upward;
- Gases in bushfire smoke may include carbon monoxide, carbon dioxide, nitrogen oxides and volatile organic compounds;
- Steepness of terrain can affect its significance;
- Can be difficult to breath; death can occur due to lung searing and asphyxiation;

Convection is the transfer of heat through the movement of heated air or fluids. Combustion in a fire heats the air, causing it to rise because it is hotter than the surrounding air. As the hot air mixes with the cooler surrounding air it gradually loses this heat. As a fire gains intensity, the air above it is heated to an even greater temperature, so the air rises faster.

Cooler air must move in towards the fire at the ground level to replace this heated air. This air is known as indraught wind. Most of the heat transferred from a bushfire is from convection currents of hot air. This process forms a convection column of rising hot air and a smoke plume above the fire.

The convection column can carry ash, embers and pieces of burning fuel, as well as preheating the vegetation above the fire (higher shrub layers and tree canopies). Large convection columns can produce severe weather events including cyclonic wind and lightning. As convective heat generally travels upwards, its effect on a building is usually negligible when compared to radiant heat. However, for a building located on a steep slope, the impact of convective heat may be significant, lifting tiles or roofing iron, breaking windows or breaking branches off overhanging trees, making this an extremely dangerous location to develop.
Source:
http://www.cfa.vic.gov.au/fm_files/attachments/plan_and_prepare/planning-for-bushfire-web.pdf

How best to protect yourself:

- Wear protective clothing

What to wear
During a bushfire, it can be very hot and there may be sparks or embers flying around. For this reason, it is important to wear personal protective clothing. Loose fitting clothing made from natural fibres such as pure wool, heavy cotton drill or denim is important to protect you from injury. Synthetic fabrics can melt or burn.
Recommended personal protective clothing includes:

A wide brimmed hat or hard hat; A hat can stop embers from dropping onto your head or down the back of your shirt.

Glasses or goggles: Eye coverings can protect your eyes against any smoke, embers and debris that may be in the air.

Gloves: Gloves can protect your hands from radiant heat, embers and debris that may be in the air or on anything you pick up around your yard when protecting your property.

A mask(Use a mask rated P2. or cloth (non-synthetic)
Covering your nose and mouth, may protect you from inhaling smoke, ash and embers.

A long-sleeved shirt made from thick cotton or wool is ideal (e.g. cotton drill work shirt)
A shirt can stop embers from burning your skin and help protect you from radiant heat and debris.

A pair of heavy cotton pants, such as denim jeans, oil free drill pants or cotton overalls
Long pants can stop embers from burning your skin and help protect you from radiant heat and debris.

Sturdy leather work boots or shoes along with a pair of woollen or cotton socks
Sturdy leather footwear can stop embers from burning your skin, help protect you from radiant heat and debris.

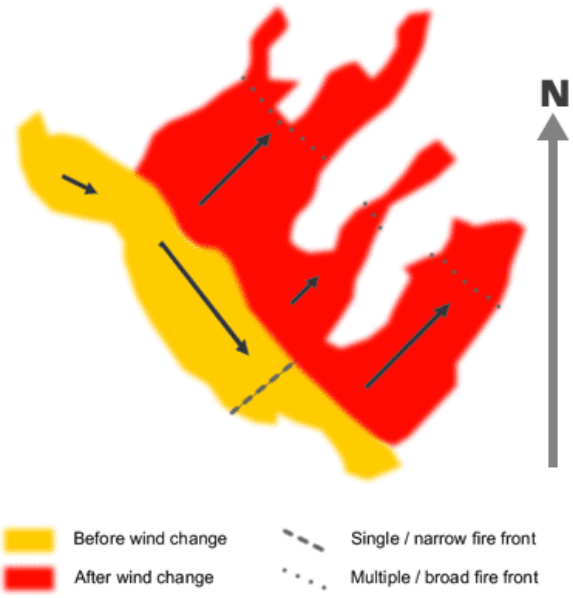
- Keep hydrated by drinking water

Dehydration occurs when the body loses more fluid than it gains. Dehydration is dangerous because it creates a build up of salts and minerals in the body tissues which put strain on the kidneys. When the kidneys fail, death can quickly follow.

The high air temperature during a bushfire and the added stress of wearing extra clothing to shield against radiant heat will make you sweat heavily. People involved in active bushfire defence may lose up to two litres of fluid per hour.
Some simple ways to avoid dehydration are:
✓Keep COOL by splashing your face with cool water
✓Drink cool WATER often – even if you don't feel thirsty
✓AVOID alcohol and fizzy drinks as they increase dehydration
Source: http://www.latrobe.edu.au/education/downloads/bushfire_safety.pdf

Brown Hill Risk Level

- The highest risk areas of Ballarat to a fire threat are Nerrina, Invermay and Brown Hill;
- The direction of the threat coming from the forested areas north-west of the city – Creswick and Clunes – depending on ignition point a fairly large fire could develop;
- Intensity of any fire depends on the fire rating and weather conditions at the time of ignition;
- wind direction on high fire danger days usually comes from the north west – this could change dramatically if a south westerly wind change comes through – which causes significant changes to the configuration of the fire front



Wind

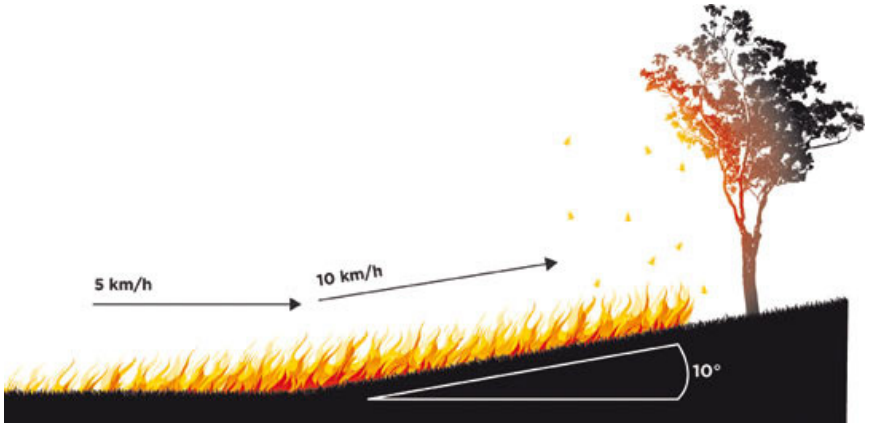
Wind is a major controlling factor that determines rate and direction of spread, and shape of fire. The diagram illustrates the fire that can result from a change in wind direction.

Notice that a change in wind direction from the NW to SW has caused the flank fire to become the new fire front — much larger and potentially more difficult to control than the original narrow front.

*Source:*http://learnline.cdu.edu.au/units/env207/fundamentals/weather.html

- However the terrain is not significantly steep as the more mountainous areas of eastern Victoria.

Terrain (topography)
A fire will burn faster uphill. This is because the flames can easily reach more unburnt fuel in front of the fire. Hot gases and radiant heat pre-heats the fuel in front of the fire, making the fuel burn more rapidly.



For every 10˚ slope, the fire will double its speed. For example, if a fire is travelling at 5 km per hour along flat ground and it hits a 10˚ slope it will double in speed to 10 km per hour up the hill.
By increasing in speed the fire also increases in intensity, becoming even hotter and throws more embers forward.

The opposite applies to a fire travelling downhill. The flames reach less fuel, and less radiant heat pre-heats the fuel in front of the fire. ** Fires tend to move more slowly as the slope decreases.
Source: http://www.cfa.vic.gov.au/plan-prepare/how-fire-behaves/

*** Fires do not slow at the same rate as they increase with slope. There is strong experimental and field evidence that fires in forest do not reduce in downhill speed much more than 50% even for very steep slopes.*

- Relative narrow range of vegetation and therefore fuel load; a fire travelling at about 10 km/h on flat ground would have a flame depth of about 110 m in forest and 14 m in grassland.
- If the width of the vegetation (fuel) is less than these dimensions, such as alongside a road or creek or narrow windbreak, then the heat from the fire will be less than if it was coming from a deep area of fuel such as a forested area.
- Due to the lower fuel load and relatively smaller forested area, than other forested areas of Victoria, it is less likely that a fire would have the ability to develop into a catastrophic event. This however, does not mean that a fire hasn't the potential to infiltrate the urban fringe of the city

Main risk for Brown Hill Clusters south of the freeway (Finlay & Russell Sq)

- Houses adjacent to the Yarrowee River and nature reserve are at a higher risk of direct fire contact;
- The greatest threat to the majority of the suburb is from ember attack; to defend against an ember attack can take hours of vigilance both outside and inside a house;
- Houses can burn down hours after a fire has past due to a slow build up of embers;
- Investigation into the Canberra fires in 2003 and the Wye River fires in 2015 revealed that the majority of houses lost were from ember attack and not the direct fire front;
- Spot fires can start in multiple backyards as embers can travel long distances before a fire arrives, during and long after the initial threat has past;
- If embers have time to build up and are not extinguished quickly they can enter unsealed areas/weak points and ignite houses;
- Once houses have ignited, house to house fires then become a high risk;
- If high winds are created by the fire they have the potential to lift tiles, even momentarily, which allow entry of embers in roofing area;

- Having metal fencing, protecting windows with metal (aluminium flywire) screens and ember proofing a house can assist to lower the risk of ignition;

Research into the impacts of bushfires in Australia indicates that approximately 85% of house loss occurs within 100 metres of bushland.

Established 'urban' areas that contain or are within close proximity to significant areas of high fuel loads: The buildings will be exposed to radiant heat and localised flame contact from individual elements burning in the landscape rather than a definable fire front. These include elements such as neighbouring buildings, clumps of vegetation and sheds. Numerous spot fires are likely.

Ember attack is the most common way that houses catch fire during a bushfire. Research conducted after major fires, indicates that up to 80% of house losses are due to ember attack. Ember attack occurs when small burning twigs, leaves and bark are carried by the wind, landing in and around a building. Embers can enter gaps as small as 1.8 millimetres, igniting timber and other materials in a building. They can also ignite flammable materials in the garden, such as leaf litter, dead plants, outdoor furniture, fencing and sheds. Ember attack can happen before, during and after a bushfire and is often characterised by the slow onset of a house burning before becoming fully engulfed in fire.
Source: http://www.cfa.vic.gov.au/fm_files/attachments/plan_and_prepare/planning-for-bushfire-web.pdf

- As environmental moisture is also key to the intensity of a fire it is easier for a fire to take hold when moisture content is low e.g. during drought conditions. This also applies to houses as they also dry out.
- Due to the high moisture content build up during our wet winter it could lessen the intensity of this coming fire season but fine fuels such as undergrowth and grasses can dry out quickly with a run of hot days

When bushfire fuel contains more than 30% moisture by weight it is impossible to ignite; when it is less than 20%, it can be readily ignited; when it is less than 10%, combustion is rapid and fires can spread easily; and when it is less than 5%, fire behaviour is highly erratic and fire spread is rapid. In Victoria on Black Saturday, 7 February 2009, the entire landscape for much of the afternoon had a moisture content of less than 5%. Under these conditions the slightest spark can ignite the fuel and fires will spread very rapidly.
*Source:*https://blogs.csiro.au/ecos/bushfire-in-australia-understanding-hell-on-earth/

Three stages of a fire
During a fire, people and properties are at risk from several things, depending on the stage of the fire. The ways of mitigating the threats posed at each stage are detailed in fact sheets on Preparing your Property, Physical and Emotional Preparation and On the Day of a Bushfire, but the main principles are listed below. It is vitally important to plan well before the fire arrives as to what action you will take and whether you will leave early. Preparing a Bushfire Survival Plan will assist with this decision making and understanding when and which plan to enact. Never wait until the bushfire arrives before preparing both your property and yourself.

Stage one – before the fire arrives
The lead time is highly variable, but a general guide is up to 30 minutes.
In the time leading up to the arrival of the fire front, the main threats are ember attack, thick smoke, increasing fire noise and increasing darkness. It will also be hot and frightening. Deal with these threats by:
→ember proofing your home
→preparing a defendable space around your home
→patrolling inside and outside the house, extinguishing any spot fires
→dressing in protective clothing and wearing a protective mask
→preparing yourself psychologically for the ordeal
→sheltering in the house if conditions become too bad.

Stage two – during the fire
This is a relatively short period, but that does not make it less horrific. It will last from 5 to 20 minutes, depending on *conditions (KT: unless you are in rugged mountain terrain such as in the Eastern Highlands when you may be exposed to fire fronts for 2 to 3 hours).* Although the exposure is normally brief, this is the most dangerous stage and people should seek shelter inside. As the fire front passes, properties will be subject to radiant heat, flame contact, ember attack, smoke, loud noise, darkness, and power failure.

Radiant heat
Radiant heat is the greatest threat to people and can kill well before the fire front arrives.
You *must* seek shelter from it. Radiant heat is many times hotter than the air temperature. The front of a moving fire radiates up to six times more heat than its back. Radiant heat only radiates *in straight lines* and will *not penetrate solid objects*. Although it may not set a building on fire, it can crack and break windows, allowing embers to enter your home. ** Bushfires in forests radiate a more significant amount of heat than bushfires in grassland.

Stage three – after the fire front has passed
Many hours, sometimes days, after the fire front has passed, properties continue to be at risk from ember attack and smouldering fuel. You should extinguish small fires and check roof spaces and other likely places for embers.
Source: http://www.cfs.sa.gov.au/site/prepare_for_bushfire/know_your_risk/bushfire_behaviour.jsp

***Definition of "bushfire": being any open-air vegetation fire whether it is in grassland, shrubland, woodland or forest*

Final note: Often people who have experienced a fire at close quarters express how loud the fire was. What causes this noise?
The noise of an approaching fire, generated by the rapid cellular decomposition of vegetative matter and shockwaves associated with the gas phase combustion of the released volatiles, can be most frightening, particularly when the fire itself cannot be seen due to smoke and topography. It is often compared to the sound of a steam train at full tilt or the roar of a jet engine.
*Source:*https://blogs.csiro.au/ecos/bushfire-in-australia-understanding-hell-on-earth/