

BUSHFIRES IN VICTORIA: INFORMATION FOR TEACHERS



Support material 7

What is a bushfire?

A bushfire is large fire that burns uncontrollably in forests, bushes, grassland and/or shrubs – often having significant effects on people, animals, property and the environment. These types of fires can also be referred to as grassfires or scrubfires.

Bushfires in Victoria

Victoria has a history of some of the most intense and destructive bushfires in the world. Australia's greatest loss of life occurred on 7 February 2009, when in the Black Saturday fires 173 people lost their lives, and 2100 homes were destroyed.

Why is Victoria so prone to bushfires?

Victoria holds an almost unique position in the world when it comes to bushfires. Australia is the second driest continent on earth and has some of the most flammable native plants in the world. Victoria is also subject to variable weather conditions that make fires difficult to predict and control.

Climate

Climatic forces play a major role in influencing bushfire vulnerability. Strong, unpredictable winds have wreaked havoc on bushfire management efforts in the past, and are one of the defining factors in producing and maintaining a severe fire. Winds are particularly significant to the south-east of Australia where strong, hot and dry currents of air are brought in from the centre of Australia due to a high pressure system in the Tasman Sea. (1) According to the Australian Bureau of Meteorology, cold fronts form at the junction of warm and cold air masses. (2) Strong and steady winds tend to shape fires that are long and narrow, but if the passage of wind changes with a cold front, the long side of the fire becomes the fire front. This is what we often refer to as the South West wind change, which is very dangerous for Victoria. Such winds can provide momentum to a fire and bring embers downwards. (2) High winds and cold fronts tend also to produce low humidity conditions which are conducive to bushfire ignition; this is due to the fact that cold air is unable to hold as much moisture as warm air. (3)

Victoria's historically low rainfall levels and prolonged drought help to create perfect conditions for fires to burn, providing dry fuel and low humidity. (4)

Victoria is also renowned for its hot dry summers and dry lightning storms. On Black Saturday the state experienced its hottest ever recorded temperature of 48.8C at Hopetoun, in the state's Northwest. (5) This extreme heat has the obvious effect of drying air and vegetation, but also aids the ignition process – one of the three vital components of a fire.

Plant life

Victoria's native plants include banksia shrubs as well as eucalyptus and acacia trees, which have evolved over thousands of years to adapt to their harsh conditions. They are low in water content, ignite quickly and burn hot and fast. These plants contain very flammable oils and often emit vapour in their close proximity. When hot weather arrives, they become even drier and more combustible. It is not uncommon to see such vegetation burst into flames during bushfires, with fire leaping from tree to tree. (6)

Land management

Over thousands of years Indigenous Australians adapted well to their environment and developed a beneficial relationship with fire. 'Firestick farmers' would initiate controlled burning of the bush to encourage new growth of vegetation and seedling dispersal. The added benefit of this would be the luring of animals to the newly regenerated land – thereby making hunting easier and more efficient. This form of controlled burning removed sticks, leaves, and

other undergrowth as well as excess foliage that would otherwise fuel uncontrollable fires. (7)(8) These firestick farmers have helped make our landscape more fire-adapted in what is a significantly changed environment.

Since the beginning of European settlement in 1788, the landscape of Australia has undergone significant change. The bush was no longer subject to controlled burning. Forests began to build up huge amounts of dead leaves, branches, and undergrowth destined to become fuel for large-scale, intense bushfires. (9)

What causes a bushfire and helps sustain it?

There are three components that coexist to produce fire – without any one of these components combustion cannot be created or maintained. These are:

- **Fuel:** This provides a base source for chemical reactions to occur, which in turn produce fire. Bushfire fuels include wood, bark, leaves, twigs, shrubs, and grass.
- **Oxygen:** Known by its chemical symbol O, fire requires oxygen to survive and will self-perpetuate as long as it is in contact with this and fuel.
- **Heat/ignition:** This occurs when the temperature reaches a level hot enough to initiate combustion. Ignition of bushfires can be natural or man-made and accidental or intentional. This includes lightning strikes, spontaneous combustion, sparks from machinery, lit cigarette butts, power lines, domestic appliance faults, and arson. (10)

Once a small fire has begun there are a number of factors that can turn it into a major bushfire.

High winds

High winds often rapidly fan the flames out to a larger fire. Hot, dry winds can also help maintain the temperature and oxygen levels required for fires to exist, including variable winds (changing speed and direction).

Sudden changes in wind direction and speed have been blamed for the severity of such disasters as Ash Wednesday and Black Saturday, which occurred within wind speeds of 70-120 km/h. (11)

El Niño-Southern Oscillation is a weather phenomenon that occurs on average every five years, causing easterly trade winds to become weaker than usual. The weakening of these winds, which originate from the Pacific Ocean, means that less moisture is carried to Australia (particularly eastern Australia) – which in turn causes the landscape to become drier.

Combustible fuels

This includes dry leaves, twigs and branches, sclerophyllous plants including eucalypts, banksias and acacias.

Relative humidity

Defined as air's capacity to hold water, relative humidity is measured by determining how much moisture is in an amount of air compared to how much the air can actually hold. (12) Humidity of less than 20 per cent can cause potential fuels to dry out – leaving them disposed to ignition. (13)

Topography

The topography of a landscape, its hills, valleys, mountains, rivers and lakes affect the behaviour of a fire. Fire travels fastest up-hill because the flames can reach more unburnt fuel and the heat from the fire preheats the fuel on the slope above the fire. On down-slopes or the lee-side of hills, fire spread can be more unpredictable due to wind turbulence. Gullies, narrow valleys and ridges can change wind speed and direction. Fire behaviour can be more erratic in complex terrain. The aspect of the land (or the particular direction that the land faces) can influence this with the Northern aspect usually being more exposed to dryer and more sunny conditions; where the Southern aspect is usually more shaded and damp in nature. (14)

What effects do bushfires have on people, the land and communities?

People

Bushfires have enormous effects on the people who live within fire-prone regions and a significant number of Australians have died or been seriously injured in these disasters. Approximately 815 people have perished in Australian bushfires over the past 160 years, 173 of whom were killed during Black Saturday. For these figures there are many more who suffer serious injuries.

Animal life

It is not just human life which is affected by fires; great losses of native animals and livestock are also incurred during a bushfire. Over 340,000 sheep and 18,000 cattle perished during the Ash Wednesday fires. (15) It has been estimated that hundreds of thousands, if not millions, of native animals died during Black Saturday. A large number of animals had suffered burns to their limbs from trying to wade through fire and hot embers, and subsequent appeals were set up to support treatment of rescued wildlife. Food drops to fire-affected animals were also provided to try to alleviate starvation caused by the destruction of food-sources and displacement. (16)

Plant life

Bushfires are capable of producing massive environmental damage as well as affecting those who live within these environments. The Black Thursday fires in 1851 are said to have consumed around 5 million hectares of land; the most recent Black Saturday disaster approximately 430,000 hectares. (17) Because most of our vegetation is capable of regenerating after fire damage (albeit sometimes slowly), only a small percentage of flora will experience permanent destruction in a bushfire. Depending on the type of vegetation it could take more than 50 years for established forests to be fully redeveloped and delicate ecosystems to be restored. However it is often the case that many resilient shrubs, trees, and grasslands actually benefit from bushfires. Many of our species actually rely on fire to regenerate, needing the high temperatures from a fire to open seed casings. (18)

Drinking water and soil

Dams, reservoirs and waterways can be affected by bushfires as well. Ash and other burning material from the fires can contaminate these waters and possibly render drinking supplies unusable for months. Post-fire regenerating forests need a lot of water to grow, and this can also affect water storage levels by reducing the amount of water that runs off into the surrounding dams, reservoirs or waterways. This could potentially cause long-term water loss. (19) Of other significant concern is the health of the affected soil which may be covered in ash, have its chemical characteristics altered by the fire's heat, or its capacity to resist erosion tarnished. (20)

Infrastructure and the economy

The loss of property including houses, markets, schools, town centres and medical clinics is very common – all of which have a great effect on the livelihoods of residents. Fully developed rural and urban economies can be destabilised or devastated by fire, evidenced by the \$2.5 billion of property (an apparently conservative figure) lost by towns during Black Saturday. Coinciding with the material damage is the damage caused to the tourism, service and primary industries, including forestry, which plays a significant role in many rural economies. (21)

Communities

Residents who have seen their communities essentially wiped out often take a long time to fully recover, especially in getting back to work, regaining their living standards, and re-establishing day-to-day normality. Many of those affected by bushfires are involved in agriculture, and will require much time to get their businesses back to normal. This includes finding quality livestock to replace that lost and ensuring soil is of sufficient condition to replant seeds. (22)

Climate change

It has been suggested that bushfires also contribute to climate change by releasing millions of tonnes of carbon dioxide into the atmosphere. (23)

Bushfires and our environment

Conversely, there are number of positive effects of bushfires which have been realised for thousands of years. The native vegetation has evolved to cope with stressful events such as fire. This includes eucalyptus trees which being highly flammable often burst into flames at ignition. However, because this combustion is so rapid and transient, little damage is done to the branches and trunks of the trees. Any ailments and excess growth will be removed while fresh leaves and twigs will replace those destroyed in the fire. (24)

There are a significant number of plants that utilise fire for seed dispersal; these are referred to as serotinous. An example of this is the *Banksia serrata*, more commonly known as Saw Banksia or Old Man Banksia. Although this plant is itself killed by fire – the right heat intensity will cause eruption of seed capsules, seed dispersal and germination. (25) Trees such as Mountain Ash can release up to 14 million seeds per hectare, which germinate easier because there is

less litter on the ground. (26) This will not occur, however, if an individual plant is frequently hit by fire, as it can take a number of years for seeds to develop.

Fresh, regenerating vegetation will act as an ample food source for animals. This includes animals such as wallabies, wombats, and kangaroos as well as insects and birds. According to the Department of Environment and Primary Industries (DEPI), possums may feed on new flowers and fruit, however they will only return permanently when hollows or nest sites become available. Owls, magpies and crows are said also to feed on ground-dwellers like native mice and lizards, which are left exposed by the lack of vegetation cover. (27)

What have been some of Australia's worst bushfire disasters?

Australia has experienced some of the most devastating fires in recorded history; fires which have had unprecedented effects on the environment and communities.

- On 6 February 1851, Black Thursday devastated the Dandenongs, found in Victoria, burning about a quarter of Victoria and killing approximately 12 people. Also lost were a million sheep and thousands of cattle. (28)
- The Black Friday fires of 1939 swept through a quarter of Victoria. These fires were said to have been fuelled by a severe drought and a hot, dry summer. Covering 2 million hectares, they burnt over 1000 houses and killed 71 people. (28)
- The 1967 Black Tuesday disaster was the result of 110 separate fires that struck various parts of Tasmania, destroying around 500,000 acres of land and 1400 homes. 62 people perished in these fires. (29)
- The 1983 Ash Wednesday fires, which occurred from February 16-18, were some of the most widespread fires Australia had ever seen. They killed 75 people, spanned two states (South Australia and Victoria) and caused over \$400 million in property damage. (28)
- In January 2003 bushfires affected suburban Canberra. Four people died and over 100 were injured. The fires were made fiercer by strong winds and other extreme weather conditions, and around 500 homes were also destroyed.
- On 7 February 2009, Australia experienced one of the worst natural disasters – Black Saturday. Massive fires swept through Victoria on what is now known as a Code Red fire danger day and 173 people lost their lives. The fires affected almost 430,000 hectares of land and had the effect of wiping out entire towns. A Royal Commission into the disaster has been undertaken and 67 recommendations have been made for avoiding a similar occurrence in the future. (28)

What is being done to help prepare for bushfires?

It's important to remember that fire is a natural part of our environment. Bushfires can't be prevented altogether, but people can try and reduce their damaging effects and be prepared for fires when they occur.

Playing the primary role in helping protect people, animals and property in Victoria is CFA, which coordinates and implements fire prevention and response, and provides community education about fire-related safety issues.

Because bushfires are so difficult to control once they begin, a huge amount of time, money and energy must instead be spent on preparing for them. To do so as effectively as possible requires significant coordination. Authorities have been developed in all Australian states and territories to undertake such coordination, and to provide risk assessment and management, fire response, and community education. In Australia they include the:

- Country Fire Authority (Vic)
- Department of Environment & Primary Industries (Vic)
- Parks Victoria (Vic)
- Metropolitan Fire Brigade (Vic)
- Tasmanian Fire Service
- News South Wales Rural Fire Service
- Fire & Rescue NSW (New South Wales)
- Queensland Fire & Rescue Authority
- Rural Fire Service Queensland
- South Australian Country Fire Service
- South Australia Metropolitan Fire Brigade
- Fire and Emergency Services Authority of Western Australia
- Northern Territory Fire and Rescue Service
- Australian Capital Territory Fire Brigade

These organisations often conduct hazard reduction activities to minimise the danger caused by bushfires. This includes controlled burning (also known as hazard reduction, prescribed burning and planned burning), which involves burning away a bushfire's potential fuel load, including excess leaves, twigs and undergrowth. This is performed by trained firefighters only when the weather conditions are deemed suitable and all possible safety measures can be adhered to. (30) In very large areas, including the Kimberleys in Western Australia, this controlled burning is performed by incendiary devices dropped from aircraft. This is performed under strict guidelines and with an awareness of potential impacts, such as the effects on local residents and the environment.

Controlled burning, however, is not a fool-proof method of fire-hazard reduction and is undertaken in conjunction with other methods such as mechanical clearing. Mechanical clearing involves mowing, bulldozing and slashing away specific vegetation that could act as a bushfire fuel source. Even more specific is hand-clearing or maintaining vegetation, which involves manually removing excess foliage such as leaves, clippings and branches with such tools as rakes and blowers. Those who live in rural areas are encouraged to prepare their homes for the bushfire season by, among other things, hand-clearing fuel from in and around their properties. (31)

A strong component of bushfire preparation and response measures is community awareness. Firefighting authorities conduct education programs in schools and other institutions, and campaign to increase public awareness about bushfire safety. These programs are aimed at providing information on the role of fire authorities in the community as well as teaching fire safety, prevention, preparedness and response. (32)

Coinciding with community awareness and education are important regulations. These regulations are enforced by state governments and local councils in cooperation with the relevant fire authorities. They include restrictions on how people use fire and are subject to weather conditions. For example: in Victoria, during the Fire Danger Period (FDP), anyone seeking to burn off grass and other vegetation will need to obtain a written permit from their local Municipal Fire Prevention Officer or the nearest CFA Regional office, and abide by the conditions stated on that permit. (33) Some municipalities require permits all year round; this is tightly regulated based on land size and location.

Total Fire Bans (TFBs) are imposed in regions of a state declared highly vulnerable to fires and are enforced on a day-by-day basis. These fire bans may affect some or all of a state. For example: in Victoria the regions include Mallee, Wimmera, South West, Northern Country, North Central, Central, North East, West & South Gippsland and East Gippsland districts. Fire management authorities will assess risk factors such as heat, dryness of vegetation and wind speeds, and will determine if a TFB is necessary. What constitutes a TFB varies from state to state, but generally they involve the banning of open flames in the outdoors such as campfires and solid fuel barbecues as well activities like welding and gas-cutting. (33)

How do we respond to bushfires once they begin?

Bushfires are one of the most severe forms of fire in the world. A major bushfire can stretch for kilometres and can be impossible for humans to put out. The focus of fire response is containment and minimising the risk to people, animals and property. This is done using methods such as direct response with firefighters, aerial firebombing, and back-burning.

Firefighters who attend to bushfires are either volunteer or career firefighters. They are required to be ready 24 hours-a-day and are notified by phone or pager. Firefighters play the major role in implementing fire response techniques, and are equipped with lightweight protective clothing, helmets and other safety items. They may also have a backpack spray pump. (34) They use special fire-retardant water and foam to try to contain the fire at its source. This involves directing the retardant at its fuel (for example: shrubs, grassland and leaves on the ground), while trying to enforce an unbreakable perimeter around the fire. (34)

Another effort to combat bushfires is back-burning, which removes as much of this fuel as possible. Back-burning is a type of controlled burn that is performed during emergencies. It helps remove the fuel source for an impending fire, thereby creating containment lines. Other ways of creating containment lines include both bulldozing and manual removal of the fuel source. (34)

Aerial firebombing is also a valuable tool for firefighting, especially when the bushfire is in its early stages. Helicopters such as the Erickson S-64 Air-Crane Helitanker (nicknamed Elvis) are capable of sucking up over 9000 litres of dam water in 45 seconds and can disperse all of this water in one go. (35) This makes it easier for the ground crew to fight the fire. This technique requires careful coordination between ground crew and pilots to ensure nobody on the ground is at danger of being hit by the water, which, in Elvis' case, can weigh over nine tonnes.

Of great importance in responding to bushfires is the activation of a household's Bushfire Survival Plan (BSP). Developing and practising a BSP is the one of the greatest ways for residents to prepare their properties for a bushfire season and to respond to an imminent bushfire. It involves pre-determining what actions a group of people (such as families) will take when a bushfire threatens them and their property. This includes the 'leave early or stay and actively

defend' message promoted by many firefighting and government authorities, which recommends that you leave your property early before a threat is present or, if you choose to stay, you must actively defend your well prepared property – the latter of which must only be done after careful consideration and preparation as the risks are high. It is important to remember that the safest option is to not be in the area of a fire. (36)

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