

Bushfire Weather

Australia has a history of severe bushfires. Such tragedies as the Ash Wednesday fires of February 1983 (71 deaths in Victoria and South Australia), the Tasmanian fires of February 1967 (62 lives, more than 1400 houses and buildings lost) and the New South Wales bushfires of 1994, place bushfires high on the list of Australia's natural disasters.

The bushfire threat

Fires, of both natural and human origin, have shaped Australia's environment. Fire, which is essential for the regeneration of many fire-adapted plant species, was the most powerful land-use management tool of the Aborigines.

Large areas of Australia suffer from the threat of bushfires. The Australian climate is generally hot, dry and prone to drought. In the southeast, occasional strong winds with summertime cold fronts can lead to extreme fire danger.

Many of Australia's native plants burn easily. The eucalypts' high oil content makes them particularly fire prone. The vast areas of dry grass common in mid-to-late summer also burn readily.

Most loss of life and property damage occurs around the fringes of the cities where homes are sometimes surrounded by flammable vegetation.

Varied fire seasons reflect different weather patterns. For most of southern

Australia, the danger period is summer and autumn. For New South Wales and southern Queensland, the peak risk usually occurs in spring and early summer. Northern Australia experiences most of its fires in winter and spring.

Weather and fire

Low relative humidity, high winds and lack of rain all contribute to increased fire danger. Sunshine and high temperatures rapidly dry timber and grass (fuel) which burn very quickly. Hot air can lower the moisture content of forests and grasslands to around 5 per cent and in extreme cases to 2–3 per cent, greatly increasing the speed of the fire.

Humidity Relative humidity is the most commonly used measure of atmospheric moisture and is defined as the ratio of the amount of water vapour actually measured to that which air could hold at saturation. Very low relative humidity of, say, less than 20 per cent, causes fuels to dry out and become more flammable.

Wind Air movement provides the oxygen the fire needs to keep burning. Higher winds mean more oxygen and more intense flames. Doubling the wind speed will quadruple the rate of spread of the fire. Winds also carry burning embers downwind, which can start new fires. This is known as spotting.

Rainfall Dry grass, parched native shrubs and dead leaves and twigs are fire's basic fuel. During droughts and in very hot, windy weather, even heavy fuels like large logs and the green leaves and smaller branches of large trees can become dry and flammable.

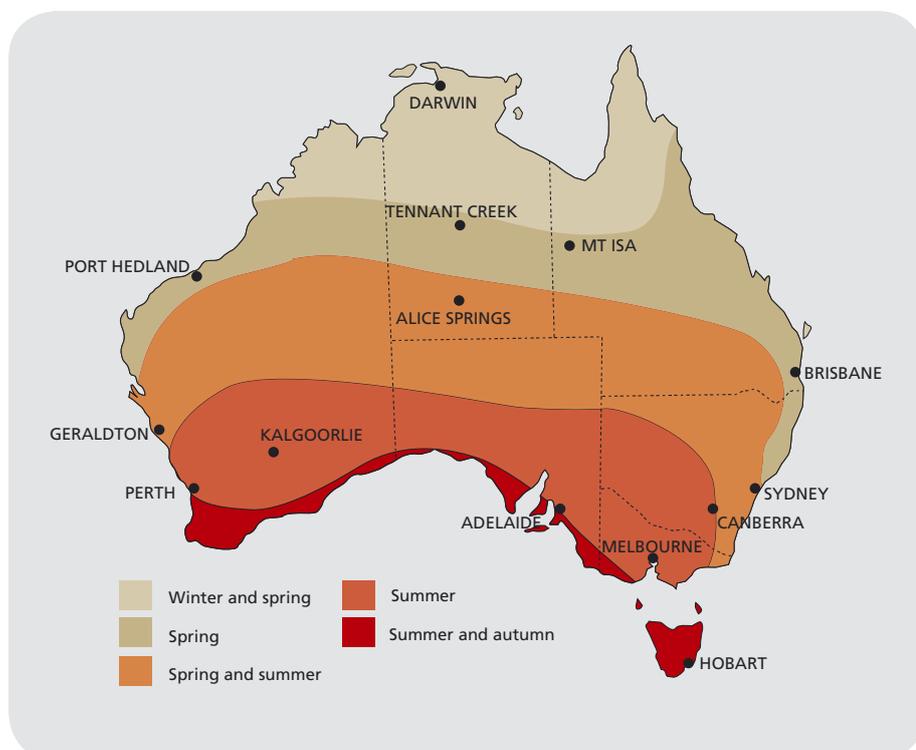


Figure 1 Fire seasons



Bushfires in Australia spread as a thin front of flame, with flames usually about as thick as they are high. Forest fires normally travel at one to three km/h, have flames 10–20 metres high and thick, and will pass a spot in 30–60 seconds. Severe forest fires travel at up to 12 km/h, with flames 100–150 metres high and thick. Grass fires generally travel about three to ten km/h, but speeds of around 25 km/h have been recorded.

Anatomy of a fire danger day

By world standards, Australia has a fairly low and very unreliable rainfall, and droughts are a significant feature of the Australian climate. Dry spells create a high fire risk, particularly if the dry spell follows a period of good rain that has encouraged lush growth.

Temperature, relative humidity, wind speed, drought and the amount of fuel can be combined into a fire danger index.

Weather systems like the highs, lows and cold fronts that appear on weather maps control the temperature, humidity and wind. Because Australia spans a large range of latitude, from tropics to temperate, these weather systems work differently in different regions of the country. Each part of Australia has its own special combination of weather systems that produces severe bushfire conditions, but in all cases these conditions result from hot, dry winds blowing from Australia's central arid region.

In southern Australia, cold fronts are probably the most powerful influence on our fire weather. Cold fronts occur at the junction of warm and cold air masses where the strong temperature contrast provides the energy source that generates the frequently associated strong winds.

As a cold front passes, the wind direction will often swing about 90 degrees. Usually, the winds ahead of a cold front are hot northwesterlies, while cooler southwesterlies follow the front, with significant effects on the behaviour and structure of existing fires.

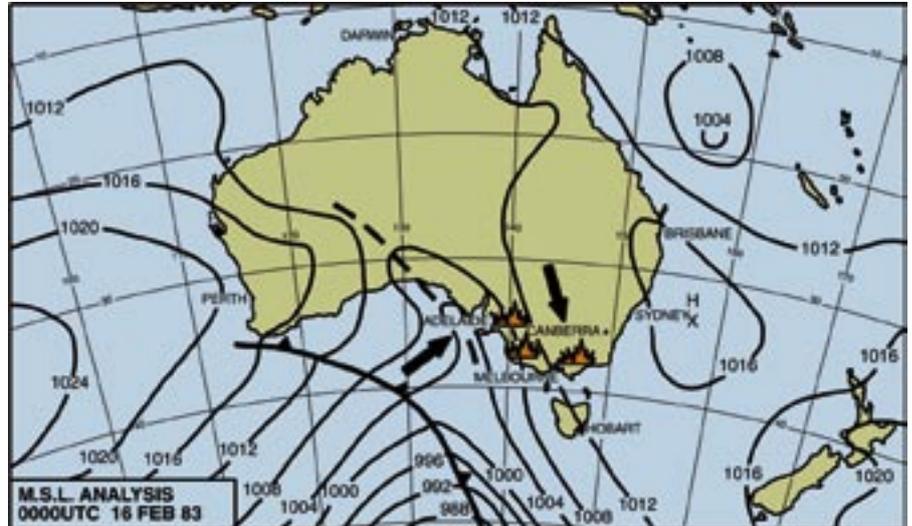


Figure 2

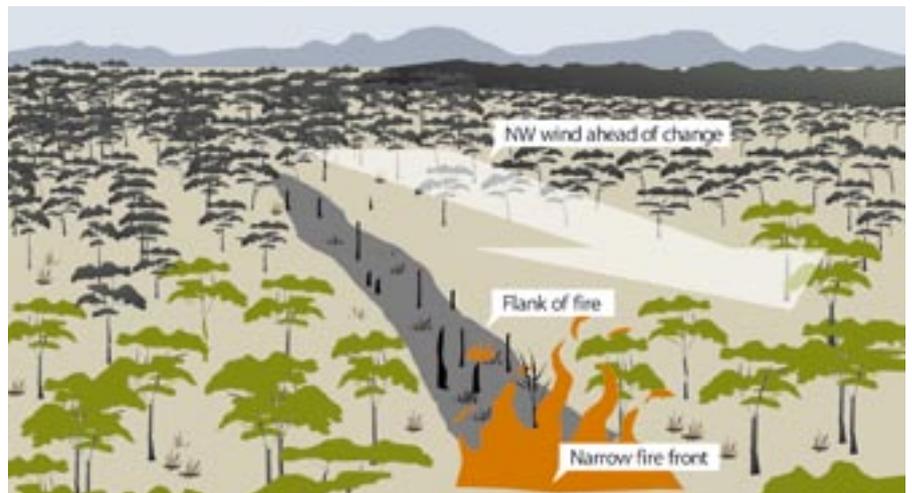


Figure 3

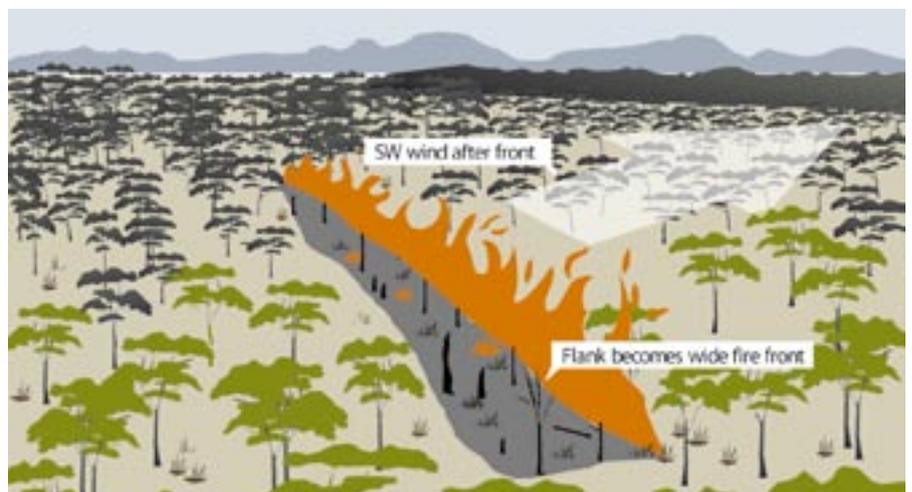


Figure 4

High risk weather patterns

Southeast Australia

Summer and autumn are the most dangerous times of year in southeast Australia. The highest temperatures occur during these seasons and in most years the grass and forests have dried out by mid-summer.

A typical dangerous fire situation occurs in southeastern Australia when a vigorous cold front approaches a slow-moving high in the Tasman Sea, causing very hot, dry, northwesterly winds. Figure 2 shows the situation associated with the Victorian Ash Wednesday fires of 16 February 1983. The passage of the cold front can cause the winds to suddenly change direction, shifting fire direction abruptly (Figure 3).

Fires driven by a strong, steady wind are usually long and narrow. When the wind changes with the passage of a cold front, the long side of the fire can suddenly become the fire front (Figure 4).

New South Wales and southern Queensland

The fire season for most of Australia's east coast extends from spring to mid-summer. The greatest danger occurs after the dry winter/spring period, before the onset of the rainy weather common in summer. The worst conditions occur when deep low-pressure systems near Tasmania bring strong, dry, westerly winds to the coast, as occurred in the major New South Wales fires in January 1994 (Figure 5).

Western Australia and the Northern Territory

The northern Australian fire season occurs during the warm, dry and sunny winter and spring, when the grasses are dead and the fuels have dried. In summer, a strong high pressure system over South Australia can bring strong southeast to northeast winds that increase the fire danger in the southern parts of western Australia (Figure 6).

The third dimension—the vertical profile of a severe fire day

A layer of warm air sitting over a layer of cold air is called a temperature inversion. Inversions are common during the night and early morning when cool night air collects close to the ground (Figure 7(a)).

This arrangement of air is stable because cold air near the ground is heavy and tends to stay near the ground. The warm air above the inversion is lighter and tends to stay above the inversion.

There are often strong winds in the warm air above inversions, but while

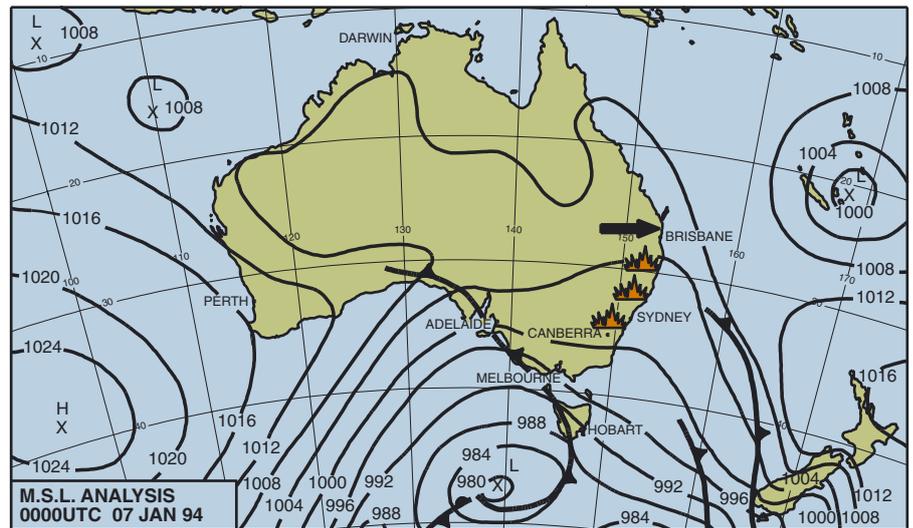


Figure 5

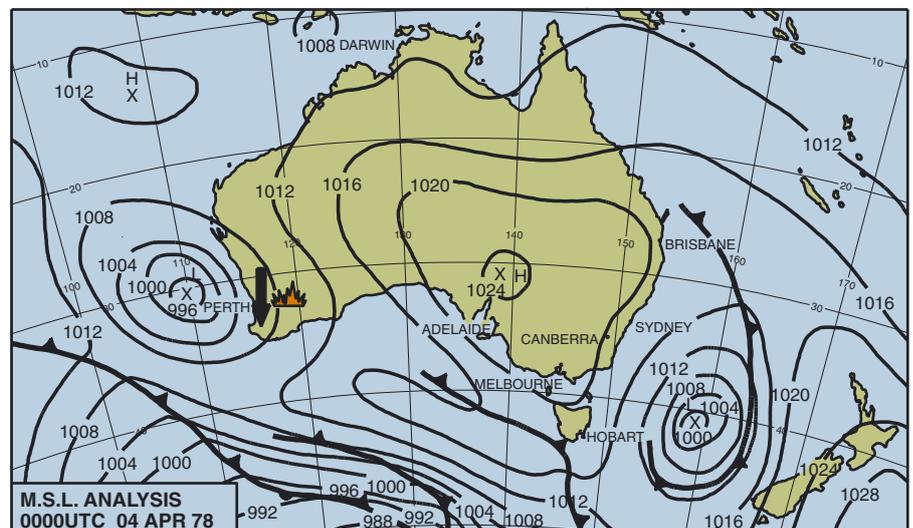


Figure 6

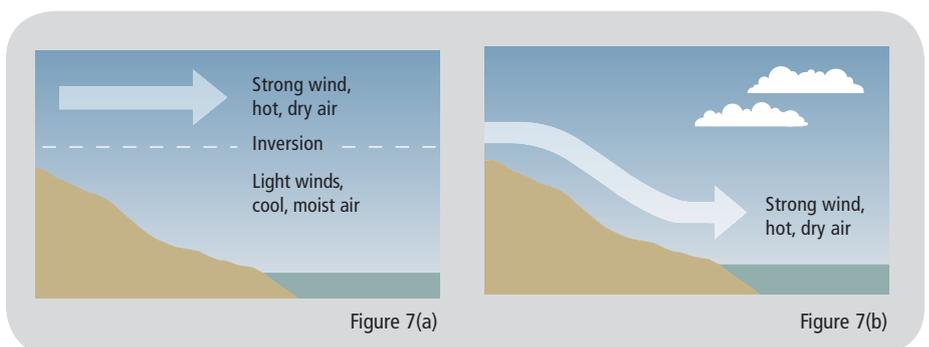


Figure 7(a)

Figure 7(b)

the inversion lasts these winds cannot come down to ground level.

As the sun heats the ground during the day, the inversion weakens and strong winds may begin to blow near the ground. This is one reason why many bushfires burn more fiercely in the afternoon, as happened with the fires in Hobart in 1967 (Figure 7(b)).

Fire weather warnings

When fire danger conditions become extreme, the Bureau of Meteorology issues Fire Weather Warnings. Warnings are broadcast on radio and television. In most States and Territories, fire authorities will declare a Total Fire Ban when they receive a Fire Weather Warning from the Bureau.

Protecting yourself and your home

The big killer in a bushfire is heat radiating from a fire onto bare skin. You need to cover all bare skin with long-sleeved shirts, long trousers, jeans or overalls, sturdy shoes and wool or cotton socks. Don't forget to wear a wide-brimmed or hard hat, goggles, or glasses and gloves if you are outside.

Other causes of death are inhalation of super-hot air and flames, dehydration in the hot, dry conditions and being hit by falling trees and branches.

Although radiant heat is fierce, it is easily blocked by a solid barrier such as building walls. If you are caught in a bushfire, the safest place is inside a building away from the radiant heat, hot air and flames.

Radiant heat from even the worst bushfire rarely lasts more than ten minutes. If you can shelter for this time you have a good chance of survival.



Enhanced satellite image showing smoke from the New South Wales bushfires of January 2003.

Houses have never been known to burn down in the first ten minutes when the fire front is moving past. They are usually ignited by blowing embers, radiant heat and the burning of adjacent structures like wood heaps, trellises and timber decking, and they can take hours to burn down. If you shelter inside while the fire front goes past and then put out the small spot fires inside and around the outside of your house there is an excellent chance that you and your home will survive.

The dry and hot air around bushfires can cause dehydration. Remember to have a drink of water as often as you can, preferably every ten minutes. Do not drink alcohol – it will dehydrate you even more.

On fire danger days, use the radio to keep up with the latest information on the weather and fire situation. If you plan to stay in your house make sure you are well

prepared. If you plan to leave, then leave early. Getting trapped by a fire when you are out in the open is very dangerous. Keep a woollen blanket in the car and get under it if you are trapped in a fire. Remember that car petrol tanks don't usually explode in a bushfire. You are much safer in your car than out in the open and you are much safer in a building than in a car.

Further Information

- Your local fire authority has an excellent range of pamphlets on fire safety.
- Up-to-date weather information is available on radio and from Bureau of Meteorology offices.
- Visit the Bureau of Meteorology web site at

www.bom.gov.au

