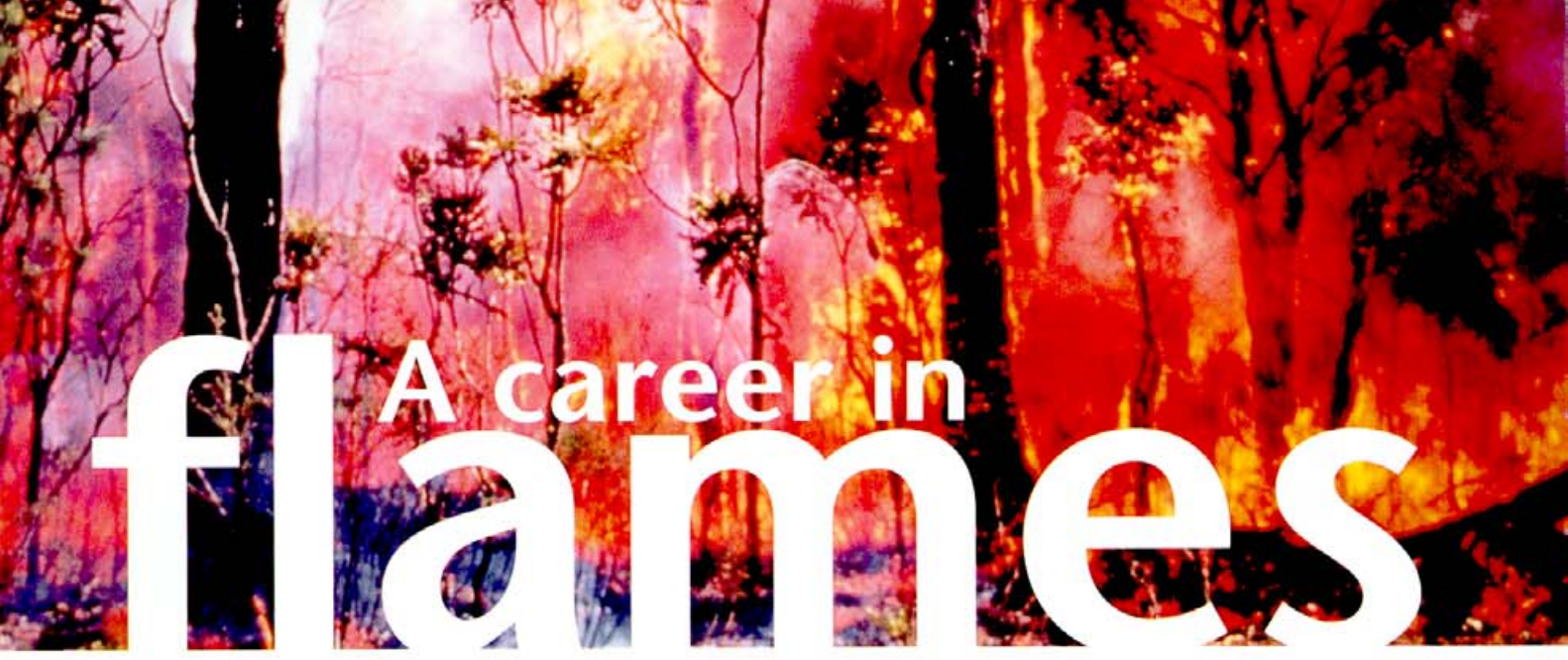


A career in flames

Phil Cheney's career in bushfire research has nearly gone up in flames on more than one occasion. Such as in 1965, when he and a colleague were monitoring a wildfire near Tantangara dam in the Snowy Mountains.

'We were trying to cross the head of the fire, which was a foolhardy thing to do under extreme fire conditions,' he says. 'When we saw we were about to be trapped, I backed the car up about 50 metres to a wet soak we had just passed. We got out of the car and into our little fire shelters – this was in the days when there was a belief that cars weren't safe in bushfires – and watched as the fire swept over.'

Cheney says that the heart of a bushfire is not a particularly pleasant place to be.

Phil Cheney: 'Australians have become dangerously unfamiliar with bushfire'.

'You can't see anything, for a start,' he says. 'The smoke becomes very dense, usually before the fire arrives. It goes very dark and then the whole atmosphere around you turns red as the flames get close. All the light from the flames is reflected back down off the smoke in the air so you're in this swirling red environment.

'The noise level can be exceedingly high, with deafening explosions happening all around as the fire passes over you. Apart from the heat you've just got a continuing mass of flames and burning embers for perhaps five minutes, and then it gradually gets better. It clears away and you're still there.'

If you're lucky.

Cheney was born into a fishing family on Phillip Island in Victoria. While it may not have been a life-changing experience, he did have an early brush with fire.

'I scared the pants off myself as a very little kid when I was trying to smoke some bees out of their hive,' he says. 'I set a huge banksia alight down in a local swamp. It was impossible to put out with little buckets of swamp water, and I went home very nervous about the swamp burning down. I later found out as I learned a bit about fire behaviour that it was a pretty safe spot to light a fire. It wasn't going anywhere.'

After working as a fisherman for a time, Cheney decided there must be an easier way to earn a living. He did a forestry degree in the early 1960s and took a position with the Forestry Research Institute (later to form part of the CSIRO Division of Forestry). He found himself under the supervision of Alan McArthur, Australia's pre-eminent bushfire scientist at the time.

'The key issue with McArthur's work was to demonstrate that of the factors determining fire behaviour, the only one you could manipulate was the amount of fuel on the ground, and the only economic way to do that was to burn it,' Cheney says.

This was the beginning of forestry's main approach to fire management: prescribed burning; fighting fire with fire.

'In those days there was a fair bit of antagonism towards prescribed burning in the forestry profession,' he says. 'Many foresters were raised with the attitude that fire was the enemy of the forest.'

Slowly – usually after a major fire – the forestry services were convinced of the need for prescribed burning. Cheney spent his early research years providing the knowledge of fire behaviour that would enable the practice to be employed with a reasonable degree of control.

For most Australians, bushfires are the recurring nightmare of the Australian landscape. We fear them, rightly, as killers. But for Cheney, fire and the Australian landscape were made for each other.

'One way or another, fire has been around in the continent for as long as the geological record can be tracked back,' he says. 'The eucalypts came in probably about 50 million years ago, and as soon as they appeared, charcoal appeared in the sedimentary record.'

Even prescribed burning may not be all that new.

'I think the evidence is pretty clear that the Aboriginal inhabitants burnt the country extensively and frequently,' he says. 'The density of many dry forests is probably much greater today than they were when Cook first landed. There are some brilliant passages in his journal where he describes the vegetation around Sydney as like a painted garden. There were widely spaced trees like a parkland, and moorlands which were no more than

Fire myths, facts and fallacies

IN THE final chapter of their book *Grassfires: fuel, weather and behaviour*, CSIRO's Phil Cheney and Andrew Sullivan address some common myths and fallacies surrounding fire behaviour. Three are summarised under the headings below.

Exploding petrol tanks

In reality, petrol tanks don't explode. What happens when they are subjected to strong heat is that the petrol vaporises and expels all the air in the top of the tank, making the mixture too rich for an explosion to occur. The vapour may be blown out of the filler cap or vent, and burn strongly when it contacts the air.

In most situations, a normally maintained car will provide good protection from a grassfire – even if it subsequently catches alight and burns out. The time taken for a car to burn out is quite long. Fire usually progresses from the tyres through to the engine bay, into the oils and greases around the engine, into the linings of the car, and last, but not least, to the petrol tank.

The heat of the burning car will melt or burn some part of the fuel line, draining the petrol underneath the car. This will indeed burn quite violently. But this all takes time. In a grassfire, the grass around the car will burn out in less than a minute, and even if the car does catch alight it will still be possible to get out onto the burnt-out ground. To increase your chances of coming through safely:

- Park on bare ground or where there is the least fuel around the vehicle.
- Park the car into the wind so that if the fuel tank catches alight the flames will be blown away from the cabin.
- Turn on the headlights, particularly if you are parked on a road, and wind the windows up tightly.
- As the flames arrive, get down beneath window level to protect yourself from radiant heat.
- If possible, cover your nose and mouth with a wet cloth because some gases from the burning paint or the door seals could enter the car shortly after the flames hit.

After the flames pass there will be a minute or so when blown ash and debris just behind the flame front will obscure your vision outside. Be confident the air will rapidly clear and you can step out of the car onto burnt ground.

The shelter provided by a car does not always guarantee survival. If exposed for a long period to heat from a forest fire, or even from fuel accumulated beneath trees lining a narrow road, the door seals and interior lining may catch alight, filling the car with poisonous gases. It is essential that either the refuge area is large enough to ensure the thermal heat pulse is tolerable, or the fuel burns out before conditions inside the car force you to leave.

Faster than a speeding bullet

After every wildfire there are reports of fires spreading at phenomenal rates. People describe having driven at 80 or 90 km/h and not keeping pace with the fire. On later analysis, the pattern of fire spread often reveals a rate of 16-20 km/h for the maximum fire speed.

Fires burn in direct lines determined by wind direction, but a person following a fire is likely to turn toward and away from the fire front, often negotiating bends and obstacles. High speed is needed to catch up with the head.

Another feature of fire behaviour that can give the illusion of high rates of spread is waves of flames in the flank fires. As the wind oscillates, its change in direction progressively picks up the flames on the flank, giving the appearance of a wave of flame actively travelling down the edge of the fire. This wave will appear to travel at the speed of the gust, perhaps as fast as 80 km/h.

It can't happen here

Severe grassfires can occur anywhere in the agricultural belts of southern Australia. All that is required is a good season with abundant grassy fuel that cures after a brief summer drought, a day of extreme fire danger with strong hot dry winds and an ignition source.

Better awareness, more stringent regulation and more efficient suppression have dramatically reduced the number of fires burning in the countryside on days of less than extreme fire danger. But the number of ignitions that occur on the extreme days does not appear to have decreased. Individuals throughout rural Australia should take basic sensible precautions to protect their homestead and stock from wildfire.

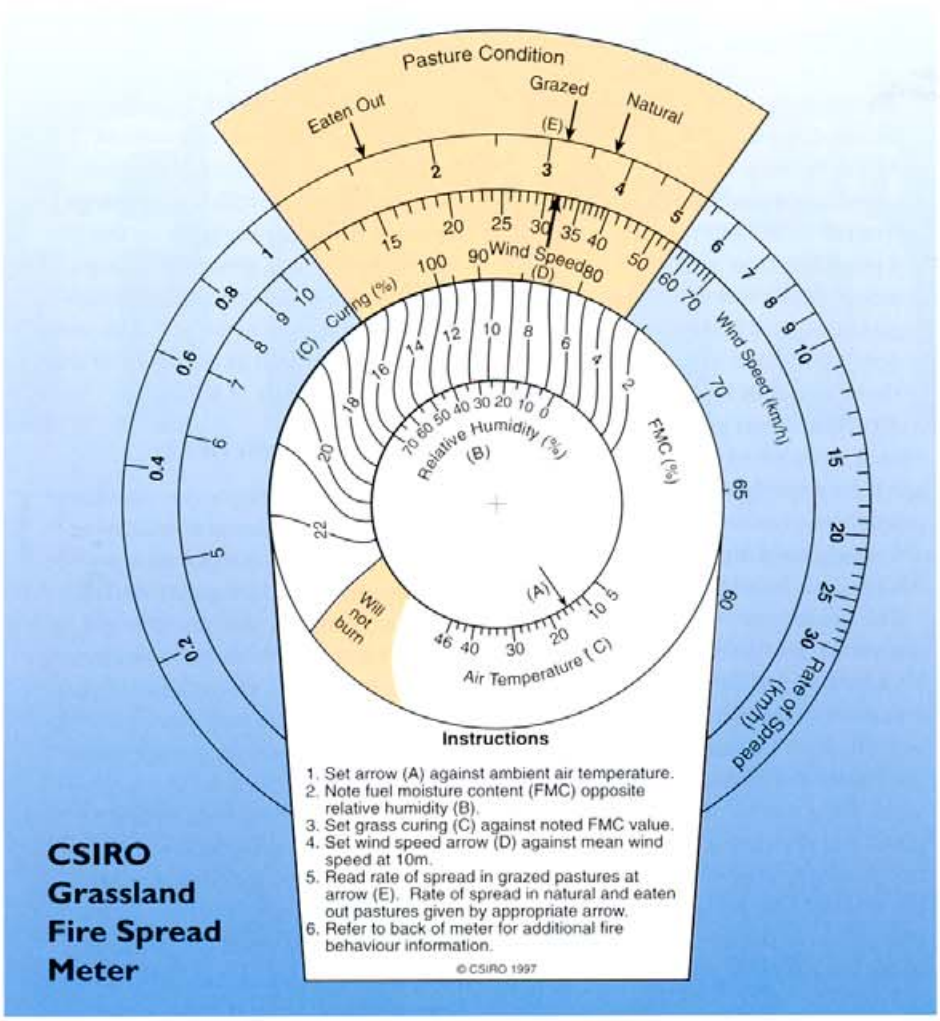
Whatever the cause of a fire, its intensity is determined by the amount of fuel retained on the property. The landholder effectively owns the fuel and so determines whether the fire can spread and how intense it will be. In other words, the landholder owns the fire. Homesteads can be protected by ensuring that home paddocks are eaten out and by keeping the surroundings of the house clean, with minimum accumulations of flammable material nearby.

knee high. He's talking about Sydney sandstone vegetation; today you could only get that physical response from the vegetation if it was burnt every two to three years.'

One gets the impression that Cheney is obsessed with fire, which perhaps explains why he's devoted his entire working life to it, often at considerable risk. But one can also sense the frustration he feels at the general ignorance of the Australian public about fire – both its ecological role and its immense destructive power. He believes Australians have become dangerously unfamiliar with bushfire, as fire-protection strategies have become more effective.

Urban-based people are moving back into the rural setting, often with large gardens of native plant species which are virtually indistinguishable from the surrounding bush. They may fail to appreciate the capacity of the bush to burn at high intensity.

'The size of the blocks are often more than residents can manage in terms of fire protection,' Cheney says. 'On top of that, they expect someone else to come and protect them. That puts more pressure on our volunteer bushfire brigades, but in severe fire weather there's little the brigades can do about protecting these people's homes.'



Research by CSIRO's Bushfire Behaviour and Management group has led to an upgraded system for predicting fire danger and the rate of spread of grassland fires. The system uses two circular slide rules or 'meters': the Grassland Fire Spread Meter and the Grassland Fire Danger Meter.

Cheney is now a senior principal research scientist at CSIRO Forestry and Forest Products, and head of research into bushfire behaviour and management. In recent years he has realised that while current fire behaviour models are reasonably accurate for low-intensity fires, they often fail to predict the behaviour of major conflagrations. This is partly because wildfires are so difficult to study.

'Observations on wildfire are extremely difficult,' he says. 'It is a chaotic situation over which you have no control.'

An improved understanding of how high-intensity fires behave will flow from a series of field experiments soon to be conducted by Cheney and a team of scientists from CSIRO and CALM. 'To really study high-intensity fires you have to light them under hot summer weather in a way that lets them achieve, say, 90% of their full potential, but where there's no chance of them escaping,' he says.

Not easy work, but important: even with all the power of modern technology, there is little that any fire-fighting system can do in the face of a major fire. It is therefore essential to determine the point at which suppression efforts only put the lives of fire fighters at risk.

'If you have good forecasting tools and if you understand fire behaviour, you can be bold in saying, "we cannot suppress the fire beyond this point, so we shouldn't try",' Cheney says. Rather, we should develop strategies to reduce the intensity of the fires and to focus our suppression efforts at a time and place where these efforts will be effective.

Firefighting manual

To help raise fire awareness in Australia, particularly among rural landholders and bushfire brigades, Cheney and his colleague Andrew Sullivan have written *Grassfires: fuel, weather and fire behaviour*. The book presents information gathered during 15 years of research by the Bushfire Behaviour and Management Group of CSIRO Forestry and Forest Products, and recent work by other CSIRO divisions and the Western Australian Department of Conservation and Land Management.

Much of the research was conducted during large-scale fire experiments in the Northern Territory which found that fire speed is influenced not only by weather and fuel variables, but also by the size and shape of the fire itself.

This issue had been largely ignored by fire scientists worldwide and now explains many of the difficulties that arose from using the results of various small-scale experiments to predict the behaviour of wildfires.

The research has also enabled development of a system for predicting fire danger and the rate of spread of grassland fire. The system uses two circular slide rules or 'meters': the Grassland Fire Spread Meter, and the Grassland Fire Danger Meter.

For the past 30 years, rural fire authorities have used a combined fire danger and rate of spread prediction system developed by Alan McArthur. The new system separates these predictions because it is now known that conditions affecting fire danger do not affect fire spread in the same way.

Fire danger and difficulty of suppression are related exponentially to wind speed; as wind speed increases, the difficulty of putting out a fire rises at an ever increasing rate. The rate of forward spread, on the other hand, has a near-linear relation to wind speed. So while wind speed is important to predicting fire spread and fire danger, fire spread cannot be directly linked to a fire danger index.

Alastair Sarre

***Grassfires: fuel, weather and fire behaviour* costs $24.95. It is available from CSIRO Publishing, free call 1800 626 420, email: sales.publish.csiro.au, fax (03) 9662 7555.**