

## The forensic fireman

Published in The Weekend Australian Magazine March 22-23 2003 Phil Cheney has spent his working life analysing bushfires. Despite the lessons of history, he says Australians still don't understand the nature of fire.

Story: Åsa Wahlquist

Fire man Phil Cheney scoops up a shovelfull of glowing coals from a burning stump, places them on the recently burnt ground, and sits his prized annular billy over the top of them.

Beside him lies the smouldering trunk of a tree that fell not half an hour earlier. Around him the ground, a mass of black tufts, with lines of white ash, smokes with a spookily blue light. An old hollow tree is starting to choof smoke.

In front of him is a gully just consumed by fire. Above him, thick smoke obscures the sky. At his back is a light breeze. From not too far away come terrible sounds, the sharp rending and splitting, the thundering crashes of old trees brought to their end by fire.

Cheney surveys the scene, sits down and takes his time feeding the tiny fire. Waiting is important in the life of a fire man.

Perhaps he is cataloguing this fire - fire front, wind speed, humidity, temperature, time, vegetation type, terrain - filing it alongside the many thousands he has seen. Or perhaps this laconic bushman is composing a couple of lines of poetry, romantic poetry so he says, about people and place. His face won't give you the answer, and he is not the type of man you ask that question of, outright.

His prized billy, the inside hollowed for fire, the water jacket on the outside efficiently capturing the fire's heat, steams. "Here we go," he says, "we have boiled already. How about that." The mystery of fire has never ceased to hold and amaze Phil Cheney, throughout his forty year career.

Cheney, as senior principal research scientist with the CSIRO is arguably the nation's top bushfire scientist. He is an outspoken advocate of prescription or hazard reduction burning. He despairs at the sight of men in thongs and T-shirts hosing fires, and thinks Australians these days simply do not understand fire. "You can see examples of astounding stupidity as far as bushfire is concerned," he says.

His life's work has been to scientifically analyse fires: to prove some intuitions right, and some fundamental assumptions wrong. His identification of the Dead Man Zone will secure his place in Australian bushfire history.

In the middle of a long conversation about the science of fires, Cheney suddenly quotes French psychoanalyst Gaston Bachelard, from his book, *Psychoanalysis of Fire*. "It had a beautiful quote in the foreword. He said: 'we are about to study something that nobody has managed to study objectively before, because the charm of the initial object is so strong it will warp the mind of the clearest thinker.'

"Lovely quote", Cheney sighs, "and that's happened".

Cheney's story actually began with water. He grew up in a fishing village, Newhaven, on Victoria's Phillip Island, living the sort of childhood that no longer exists. "We used to spend a lot of time wandering through the swamps and looking for birds nests, catching snakes and building huts, building canoes."

By senior high school, the boy from the fishing village who knew so little about the outside world he had not even heard of the career of engineer, decided on forestry "because fishing was too much like hard work. I thought it was something that was out of doors, the prerequisites were subjects that I liked doing."

He began his career looking at forest hydrology, or water use, but soon attracted the attention of Alan McArthur, Australia's first full-time bushfire scientist, a bold and forthright figure who argued persuasively, and successfully, for scientific prescription or fuel-reduction burning.

"The fuel on the ground is the only thing you can manage," Cheney says. "If you want to reduce the intensity of the fire, you have to reduce the amount of fuel that is there producing the heat."

McArthur, in his tables that were widely used for decades, argued that fire spread "is directly related to the amount of fuel. He had absolutely no scientific evidence for that. We all believed it," Cheney said.

But it was Cheney, who speaks about his mentor with frank admiration, who proved McArthur wrong.

Fire, says Cheney, is, in chemical terms, a chaotic reaction. "Molecules are torn apart and reformed and torn apart again with the end products, after going through all sorts of steps, ending up as mostly carbon dioxide and water (as steam). Then you place that burning over a variable terrain, with a fuel that varies spatially, and blown by a force that varies both

in time and space."

One of the key changes, between the sixties when McArthur worked, and the nineties when Cheney mounted Project Vesta (after the Roman Goddess of the hearth) was the advent of computers. "To an analysis you do in 15 or 20 seconds now would take you hours as you cranked through all the procedures, so McArthur said 'don't worry about statistics you will never be able to prove statistically any of this work'."

But now they can, and Cheney has. "My contribution to science over 40 years has been to show that the width of the fire influences its rate of spread, along with the wind speed and moisture content."

Cheney's first paper with this finding, in 1990, was instantly rejected by one referee, "who said quite simply 'this cannot be right because if it is, it invalidates the last 30 years of our research'." While the theory lags, Cheney's findings are indisputably correct.

Scientists used to believe that fire went through a period of acceleration. But Cheney had experimental results that did not fit that picture, fires that suddenly and mysteriously increased in speed.

The answer was quite simple.

Fires basically burn in an elliptical shape, the long axis in the same direction as the wind, the head fire, at one narrow end. But a sudden wind swing of 90 degrees can turn the whole long flank into a new, wide head fire. Contrary to accepted wisdom, the new head fire did not start slowly and then build up in speed, but, being wider, actually burnt at an even faster pace.

To linger where it had been thought to be safe, too close to the flank of the fire, was Cheney proved, to risk incineration. He named the area the dead man zone. It was a critical finding, destined to save countless fire fighter lives.

Fires had been thought to go through a build up phase, to accelerate. But fires have no mass. "If it has no mass, what is to stop it spreading at what ever rate the wind determines?" Cheney asks. "And that is basically what happens."

Fire width, he showed, was critical: wider fires burn faster, dangerously faster.

Here was the explanation for some fire disasters - Wingello, Linton - that Cheney had been asked to give expert advice on. "We looked at these fire disasters. What happened, why did people get caught? And the common denominator was they were suddenly faced with a wide section of fire, a flank that changed. There had been a change of wind direction.

"The other thing was the time that elapsed between them taking evasive action was extremely short, so it appeared as though the fire had not gone through a build-up phase."

He went back to his years of experimental data. "We found that the fires travelled the first 25 metres as fast as they travelled the last 25, after they had travelled 200 metres. At 25 metres the flames were still building up and burning in the litter and maybe the low shrubs. In the last 25 metres the flames were coming out the tops of the trees, but it was going the same speed."

The finding staggered the researchers. "It looked so different. Then it dawned on us, part of the problem is people don't perceive they are in danger until it is too late."

Fire does not just charm, as Bachelard asserts, it tricks and mesmerises, beguiles and terrifies. It can fool even the most experienced scientists and observers.

There is another huge problem. Australians, says Cheney, do not understand fire.

Stephen Pyne is a US professor of environmental history, and author of the seminal text, *Burning Bush, A Fire History of Australia*.

He outlines the evolution of the fire-loving Australian bush, writing: "fire seized the core....diverting the whole biota into new evolutionary pathways, from which recovery might be impossible. Fire integrated the elements of the bush. Above all, fire bonded the bush to humans. The bush could not be understood without its distinctive, singular fires."

Cheney points out charcoal lies alongside eucalypts in the fossil record. They have been closely associated with fire ever since. Eucalypts drop a huge quantity of leaf litter. Some, like the stringy-barks have long tongues of bark that carry fire to the leaves with their high level of volatile compounds. Ignited bark can fly ahead, creating spot fires.

After fire, eucalypts shoot profusely from buds that have been protected by the thick bark. Heat prompts the release of seeds that germinate in the new ash bed.

"Those conditions that made fire so universally powerful, also placed it beyond total human control," Pyne writes. "Bushfires could burn independently of any human will or act. If fire was a universal solvent, bushfire was also a brooding, ineffable, sometimes fatal presence that from time to time could burst forth with terrifying effect, a psychological as much as a physical presence, a nightmare out of a Gondwana Dreamtime."

Cheney, whom Pyne describes as "an exceptional fire scientist", says "the concept that fire is a threatening process in Sydney's vegetation is absolute nonsense. There are communities of plants and animals that thrive best on a certain fire regime. Maybe it is our European heritage, but the general population does not see fire as a natural ecological process, and it is. You can't replace it with anything else."

Pyne, in *Vestal Fire*, argues the story of European civilisation is the story of controlling fire: "Traditional societies needed free-burning fire; modernising ones sublimated those flames into machines." European settlers brought with them to these shores the 'civilised' horror of the untamed blaze.

How fire is used depends on how we want our land. This is the key to the conflicts about prescription or hazard reduction, the deliberately lit, low intensity winter fire designed to reduce the fuel load.

Once the control of most of the national estate was held by forestry, who also held, according to Cheney, "the core of fire control knowledge". Foresters knew what they were managing for. "They had a clear charter to produce timber so when they burnt, the aim was to protect the generation of trees they wanted to carry through, and protect the forest," Cheney says. "But it is not so straightforward to National Parks people."

Cheney dismisses the National Park unwillingness to burn on the grounds it is influencing nature. "Anything you do to stop fires is influencing nature. They have just as much influence by keeping fire out, as burning it deliberately."

Cheney argues National Parks have not been adequately financed to manage fire, instead relying more and more on volunteers. "So the volunteer, who originally joined to protect their own land and their own community, is now being asked to fight fires in national parks and state forests. They are shifting these people interstate, to do a job that I believe is the responsibility of the land management agency."

But the debate about fire is difficult to hold when most Australians not only do not understand the role of fire in our ecology, but have little experience of fire itself.

"My view is fire as a phenomenon is being removed from people, being removed totally," Cheney says. "It affects how people think about fires, and it colours their response, how they personally respond to fires, what they can do, whether they are prepared to look after themselves if they are in a fire environment."

Cheney says his philosophy is "if we understand fire behaviour then we are in a better position to tell people how to control fires. I have focussed most of career in trying to understand fire. It's been a slow hard grind."

Cheney says fires can really only be controlled at the bottom three per cent of their intensity, measured in kilowatts per metre at the fire edge. "For practical purposes you can say the scale is 100,000 units long. We can control fires by hand tools at about 1,000 kW/m, and using the biggest air tankers and bulldozers, at about 3,000 kW/m. There is such a huge range of fire intensity beyond what you can't do anything with, it just boggles the imagination."

Speaking the day after the firestorm hit Canberra on January 19, Cheney readily admits he was surprised at the extent of the damage. "I knew there would be damage, but I didn't anticipate the scale." The intensity of that fire, he says, "was somewhere near the top end of the range."

"I was down at the head of the fire, on the Monaro Highway, and conditions were pitch black but dead calm, there was no wind at all. And yet at the Canberra end there were winds of over 100 km/hour. There was certainly interaction with the atmosphere during these fires that we don't understand."

He argues fires are ultimately predictable, but we are long way from that point.

Supercomputers will be used to analyse fire, mimicking on a small scale their use in climate forecasting. They will be particularly useful in analysing the sort of interaction of the fire with the atmosphere that occurred in the Canberra blaze.

Three days before the Canberra fires, Cheney studies a fire in the Brindabellas, a burn-out to counter wildfire caused by lightning strikes.

He stands on burnt out ground, safe above a bush track, studying a fire burning up the gully. The fire rushes forward, the flames suddenly leaping to the height of the trees. The air is orange, asphyxiating, a sudden violent turbulence of scorching heat, thick smoke and ash. Cheney stands resolute, briefly silhouetted by flames. Then we turn, stumbling up

the hill, choking, our eyes streaming. It was just, he announces calmly once the billy is on, a low intensity fire.

Later this year, or perhaps next, Cheney, the fire man will retire, at least on paper. His retirement has been delayed. Among other post-Canberra fire tasks, Cheney will assist the ACT Coronial Inquiry, advising on fire behaviour and fire management. And he is reworking the prediction models in light of the information collected about the Canberra firestorm: "It is so important. Rather than let it drift into folklore, we have to try and put as much data together as possible."

His hope is that the Canberra fire will stimulate research and funding, "so we can do better next time, 25 years or so down the track". There are still promises to honour, a re-write of Harry Luke and Alan McArthur's classic Bushfire in Australia. He wants to learn paragliding so he can study the naturally sculpted terrain of Cape Howe on NSW's south coast.

"I might be fishing and studying the fire in the campfire with the annular billy," he muses. "Not ocean fishing, I had that beaten out of me, inland fishing on a lake." A lake presumably surrounded by forest, so he can enjoy the enduring themes of his life: water, forest and fire. Perhaps he might even write a poem, or two, about them.

Copyright News Limited. Not to be reproduced or transmitted in any way without permission from [newstext@newsLtd.com.au](mailto:newstext@newsLtd.com.au)