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Attributing Blame in the Black Saturday Wildfires: February 7, 2009

This Issue

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Even as fire services still struggle to contain Victorian fires, the blame game has begun. With about 200 deaths and 1800 homes destroyed, someone has to be responsible.

The experts have all the answers: global climate change; arsonists; lack of clarity of the warnings; the controversial 'prepare, stay and defend or go early' policy; inter-state bickering by politicians; greenies, who, by opposing prescribed burning, have encouraged fuel loads to get to dangerous levels; inflated house prices; lax land planning regulations, and the latest, the dastardly Australian Building Code, which, captured by sinister commercial interests, would mandate lower building standards in fire prone areas. No doubt even more culprits will be uncovered before another Royal Commission can soberly review all of the evidence and pronounce judgment.

The media have proclaimed this natural disaster the worst of its kind in Australia's history. Regardless of how 'history' is qualified – peacetime or the period since European colonisation – it is not so: in 1974, Cyclone Tracy demolished about 3,700 dwellings in Darwin and damaged another 3,300; in 1889, Cyclone Mahina, a Category 5 cyclone, claimed about 410 lives, and the heatwave that preceded the 1939 Black Friday bushfires in Victoria is accredited with 438 excess deaths. Still, with the ratio of deaths to property damage in the Black Saturday fires running at two to three times that of any other extreme bushfires in the last century (Table 1), questions need to be asked.

Table 1: Historical fires losses with greater than 500 homes destroyed. Some of the early data are necessarily approximate and the Black Saturday figures are still provisional.

Date	States	Homes Destroyed	Deaths
February 14, 1926	Victoria	550	60
January 8-13, 1939	Victoria and NSW	650	71
Various fires over 1943-44 summer	Victoria	885	46
January 7, 1967	Tasmania	1,557	62
February 16, 1983	Victoria and South Australia	2,253	83
February 18, 2003	ACT	530	4
February 7, 2009	Victoria	1,800	200

Some allegations can be easily put to rest. To say that climate change caused these fires is untenable. Despite the obvious influence that climate change may have on some of the environmental pre-conditions for bushfire, our analyses show little change in the probability of property destruction by bushfire over the last century (Table 2). That being the case, it is hard to believe that climate change will do what all of the other significant sociological and technological changes and improvements in fire behaviour that have occurred since the early 1900s have so far collectively failed to do, that is, to materially change these loss statistics. The fact is that Australia has a bushfire problem now. Forget 2050 and beyond, we must tackle the immediate problem.

Table 2: National bushfire building loss probabilities calculated between the start year and 2003. The first row gives the frequency of any (non-zero) building loss, while the second considers only those events that have resulted in more than 100 homes destroyed within a single week. (Source: PerilAUS, Risk Frontiers.)

Start Year	1900	1926	1937	1967	1983	1990
Annual probability of a loss	56%	53%	48%	57%	57%	57%
Annual probability losing > 100 homes in 1 week	18%	19%	22%	19%	19%	21%

While the 'prepare, stay and defend or go early' policy seems supported by evidence from previous fires, its effective implementation is difficult and needs to be questioned. The policy is aimed at avoiding last minute evacuations, situations in which many lives have been lost in the past. It is already clear that on Black Saturday many died in vehicles.

But on Black Saturday, these were not average conditions according to the Bureau of Meteorology, whose forecasts this time proved unfailingly accurate. Record high temperatures (46.4 C measured in Melbourne), low humidity and very high winds produced a MacArthur Forest Fire Danger Index right off the scale. This index is an empirical metric that purports to measure the ease of fire suppression.

Is MacArthur's scale meaningful under the conditions we saw on Black Saturday? And if it is, how many homes are really defendable under such circumstances? Do we need a category scale for bushfires like tropical cyclones? And if mass evacuation is not a realistic option, then should people be allowed to live so close to the bush, or if they do, have they any right to expect fire fighters to risk their lives to help? There are more questions than answers.

On seven occasions since 1926, Australians have seen more than 500 homes destroyed by bushfire (Table 1). These losses all occurred in extreme fires which, as we saw only too clearly on Black Saturday, can overwhelm even the most professional of fire services, irrespective of resources. In these situations, man is not in control. Rather nature is out of control. And the best the fire services can do is pray that the weather will change for the better.

Staying in a home, however, is not a risk free solution. It demands significant preparation and a determined commitment to actively defend the dwelling. A few plastic buckets will not do the trick. And courage: how many of us truly have what it takes to look death firmly in the face and fight? Some do: one of my colleagues interviewed a seventy-five year old man living in a home that was threatened by a turbulent fire front burning tall trees only about 15 meters from the dwelling. Every time conditions get bad, he prepares. Seriously prepares. And this time it paid off.

But for many others, preparing for something that might never happen is well down the priority list. Life just gets in the way. We have estimated the average annual chance of a random home being destroyed by a bushfire on the urban-bushland interface (100 m from large areas of bushlands) to be of the order of 1 in 6,500, a factor 6.5 times lower than the probability of an ordinary house fire and half as likely as the owner dying in a road accident. Thus on average the incentive for individual homeowners to mitigate and reduce the bushfire danger even further is low.

More severe bushfire scenarios are possible. Particularly worrying is Melbourne's extended tree laden urban-bushland interface. Risk Frontiers databases also show that some 110,000 Victorian addresses lie within 200 m of large areas of bushlands. The comparable figure for New South Wales is three times greater! Distance to bushlands is not the only factor influencing bushfire risk, but it is demonstrably one of the more important. In my view, without strong political leadership and regulatory pressure limiting such development or at least stipulating certain safety measures like minimum distances to trees, there is the potential for even worse bushfire outcomes than we saw on Black Saturday.

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Energy Conservation and Thermal Comfort

by Richard de Dear

Commercial buildings are large consumers of energy - in the USA they account for about 11% of the total energy use. In Australia, the equivalent figure is about 6% with heating, cooling and ventilation accounting for over 60% of greenhouse emissions from the commercial building sector. It comes as no surprise then that energy consumption patterns within the built environment will be central to achieving conservation measures. My work identifies building occupants as the key to reducing greenhouse emissions from buildings.

More efficient heating and cooling equipment, more intelligent building envelopes and more effective insulation will take many decades to be rolled out across our entire building stock. But we can instantly reduce the carbon dioxide emissions from existing building by adapting their occupants to indoor climates that are more closely aligned to outdoor conditions. The figure below demonstrates the concept. Virtually zero investment is required; yet up to 7% of total building energy can be conserved simply by shifting air conditioning set-point temperatures only 1 C closer to the outdoor temperature (or 20% for a 3 C shift).

A challenge for reducing greenhouse gas emissions is to find ways of making energy savings in buildings without sacrificing occupant comfort. One of the most promising issues pertaining to building energy efficiency relates to air conditioning set-points i.e. the indoor temperature that heating and air conditioning systems are designed to maintain. In this country the typical practice is 23 C, with perhaps 1 to 1.5 C of latitude either side. Researchers from CSIRO's Energy Technology branch were able to demonstrate a 14% saving in a Melbourne office's air conditioning system energy consumption by simply lifting the indoor design temperature from 22 C to 23 C.

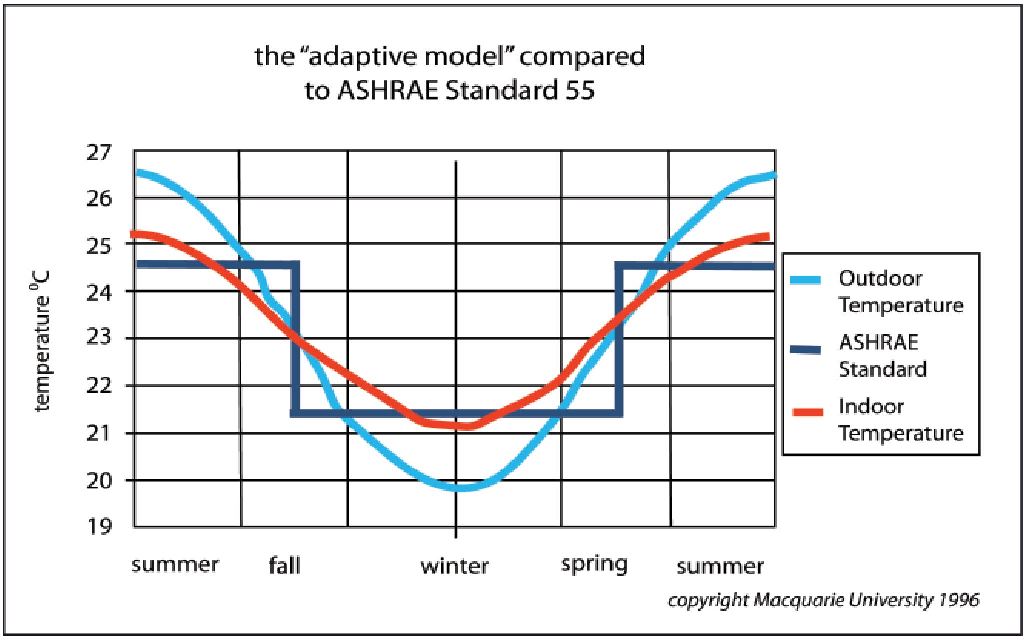

Figure 1: The adaptive model compared to the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) Standard 55.

People adapt to their environment through a set of complex and interconnected physiological, behavioural and psychological mechanisms. Behavioural adaptation includes actions such as putting on a jumper, opening a window or adjusting the climate controls. Physiological adaptation comes down to genetic adaptation and acclimatisation - sweating and shivering are two automatic responses of the human body to uncomfortable thermal regimes. Psychological adaptation depends on their expectations of the environment.

These adaptations, when acknowledged and understood by designers and engineers, can bring about major energy savings in buildings. My work with Professor Brager at University of California, Berkley is now internationally recognised as the adaptive model of thermal comfort and has been distilled into an algorithm. This formula, based on statistics describing the outdoor climate to which building occupants have become adapted, predicts the range of temperatures that occupants will find acceptable.

After half a decade of debate and public review, the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) has recently published a fundamental revision to its influential comfort standard – ANSI/ASHRAE Standard 55: Indoor Environmental Conditions for Human Occupancy. This new standard includes an entire section on the implementation of the adaptive comfort model in naturally ventilated buildings.

The impacts on office workers of an indoor temperature increase are the subject of much discussion, but there is a broad consensus that productivity would be relatively unaffected. If productivity is not a barrier to lifting air conditioning set-points, then the only real resistance is fear of an occupant backlash when indoor climates fail to meet their comfort expectations. These concerns were tackled head-on by the Japanese Ministry of Environment a few years ago when it launched a campaign to lift summer-time air conditioning set-points to 28 C. A national advertising campaign featuring the then Prime Minister announced a new line of relaxed and comfortable office clothing under the slogan of CoolBiz. Dressing the CoolBiz way precludes the traditional business suit, tie and jacket; this more relaxed office dress-code has become a very popular and acceptable trade-off in exchange for elevated office temperatures.

In response to the Kyoto Protocol, in 2003 the European Parliament and Council passed a European Directive for Energy Performance of Buildings. The European Standards Organisation has since drafted several new standards to help member countries implement the directive. One standard, Criteria for the Indoor Environment, includes a section on buildings without mechanical cooling, but with high degrees of occupant control (e.g. operable windows and relaxed dress codes). The thermal comfort criteria detailed in this standard are explicitly based on de Dear and Bragers' adaptive comfort model.

The best measure of all for gauging the impact of the adaptive thermal comfort model is to look for actual buildings where the model has been explicitly acknowledged in the design and engineering of the building. The following selection, while not exhaustive, provides some indication:

- San Francisco Federal Building
- Evergreen Valley College
- Northern Arizona University
- Kirsch Environmental Science Building
- Stanford Science & Engineering Building
- University of California San Diego Office Building
- Rand Corporation Headquarters
- San Francisco Pier 1 Embarcadero

Figure 2: The recently completed San Francisco Federal Building.

The San Francisco Federal Building is probably the first major office building to rely purely on natural ventilation since the advent of air-conditioning in the early 20th century. It was commissioned under the auspices of the Design Excellence Program of the General Services Administration and houses five USA Federal Government agencies. The design documentation explicitly refers to the adaptive thermal comfort model. The building incorporates many innovative technologies including an integrated window wall that maintains internal comfort conditions through natural ventilation, thermal mass storage and passive and active sunshading. The adaptive model of thermal comfort is having an impact on how buildings are designed and constructed.

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In memory of Laraine Hunter

Laraine Hunter passed away on February 11, fifteen months after she was diagnosed with Motor Neurone Disease.

After an early career as a nurse, in the banking industry, and as a mum, Laraine did Bachelors and Masters degrees in Mathematics and Climatology at Macquarie University. She worked in statisics at Sydney University for a bit and then joined a fledgling research group at Macquarie in the early 1990s, a group that became the Natural Hazards Research Centre and then Risk Frontiers. By 2004 Laraine had become the longest serving staff member at Risk Frontiers.

Laraine's early work was on an earthquake loss model built in a series of spreadsheets, refining it and then coding the model in Fortran. That we were proud of that model, the first home-grown earthquake loss model in Australia, owed much to Laraine's skills, dedication, and sense of order – she could always find the electronic files we had misplaced and make them run again years later, even after we had changed software three times. Laraine also played a central role in the development of PerilAUS, HailAUS and, more especially, FloodAUS where her GIS work was at the very core of its success. Laraine played a valued role in almost every successful project that Risk Frontiers has been involved in since the early 90s.

Just as importantly, Laraine was also the social glue in the first decade of the research centre, until Carol Robertson (Laraine's sister) joined Risk Frontiers and the pair of them charted a course of memorable morning teas, lunches and Christmas parties that were always fun, a couple of steps ahead of the competition, and an important part of the things that makes Risk Frontiers a great place to work.

No matter how busy Laraine was on her own work projects – and she was *always* busy, because she was so good at what she did – she always had time to help out her less tech-savvy colleagues with their problems, no matter how big or small. Her good-humoured, endless patience and her friendship were as wonderful and as valued as her expert advice. She really was part of the fabric of Risk Frontiers, inextricably linked to its proper functioning in every way. Laraine, we miss you.