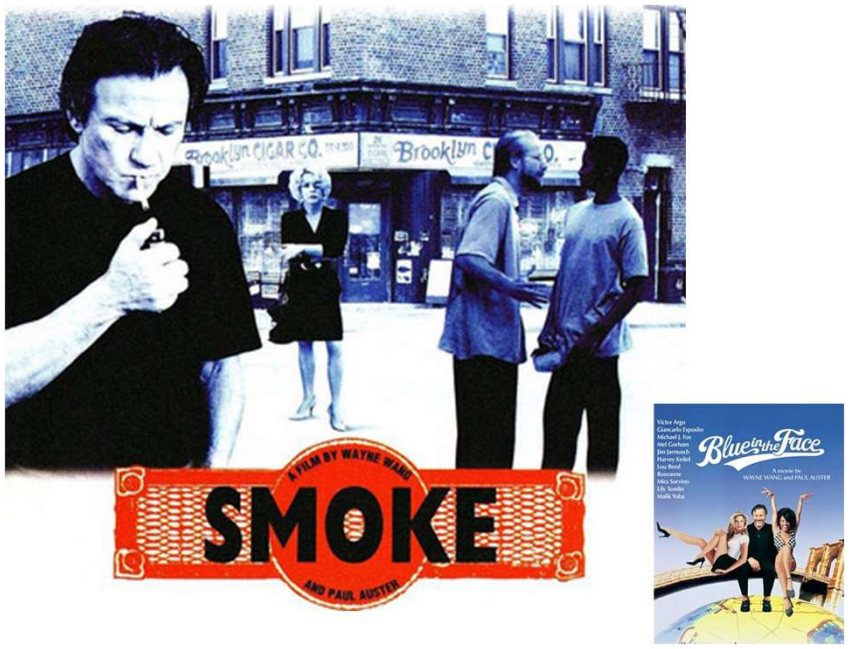
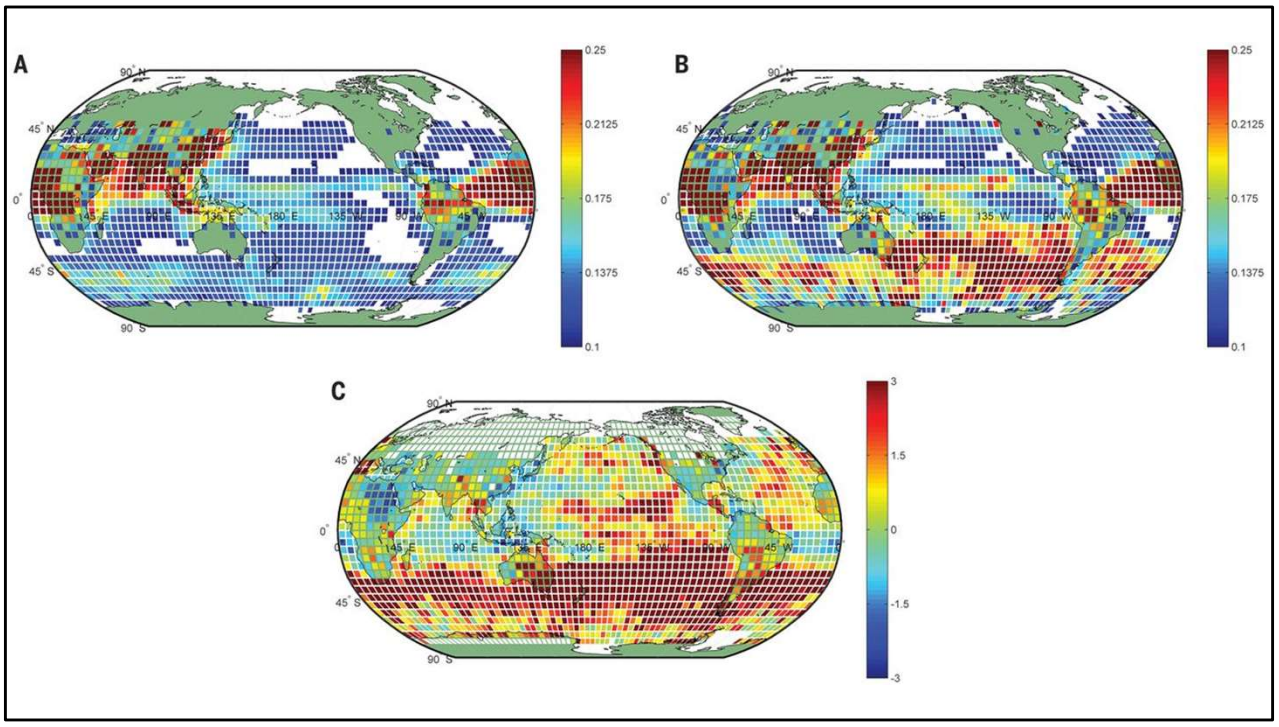
When asked by one of our hosts, Dr Martek, if I would consider presenting at this webinar I suggested a title – Smoke -, that was it, just Smoke. Oddly, Dr Martek seemed to consider this a somewhat less informative than what he was seeking.



I told him that it was a great film starring Harvey Kartel, and that it, and the follow up comedy entitled Blue in the Face had distinct correlations to the topic. He was still somewhat unconvinced - 'Something a little more 'academic', more descriptive of the research, might be better' was his response. Now that we are here, lets discuss 'smoke' anyway…

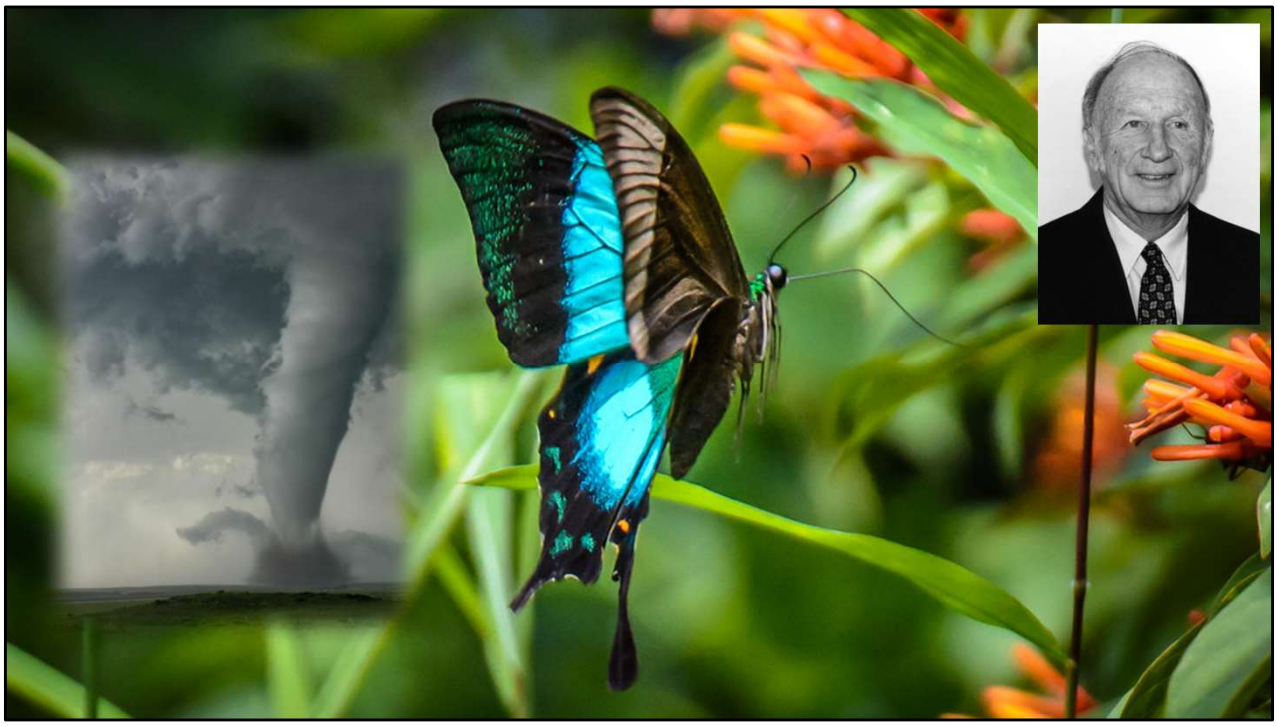
This sort of smoke…, bush or wildfire smoke. In so doing, I'll take you on a brief excursion, and perhaps Dr Marteck will be forgiving



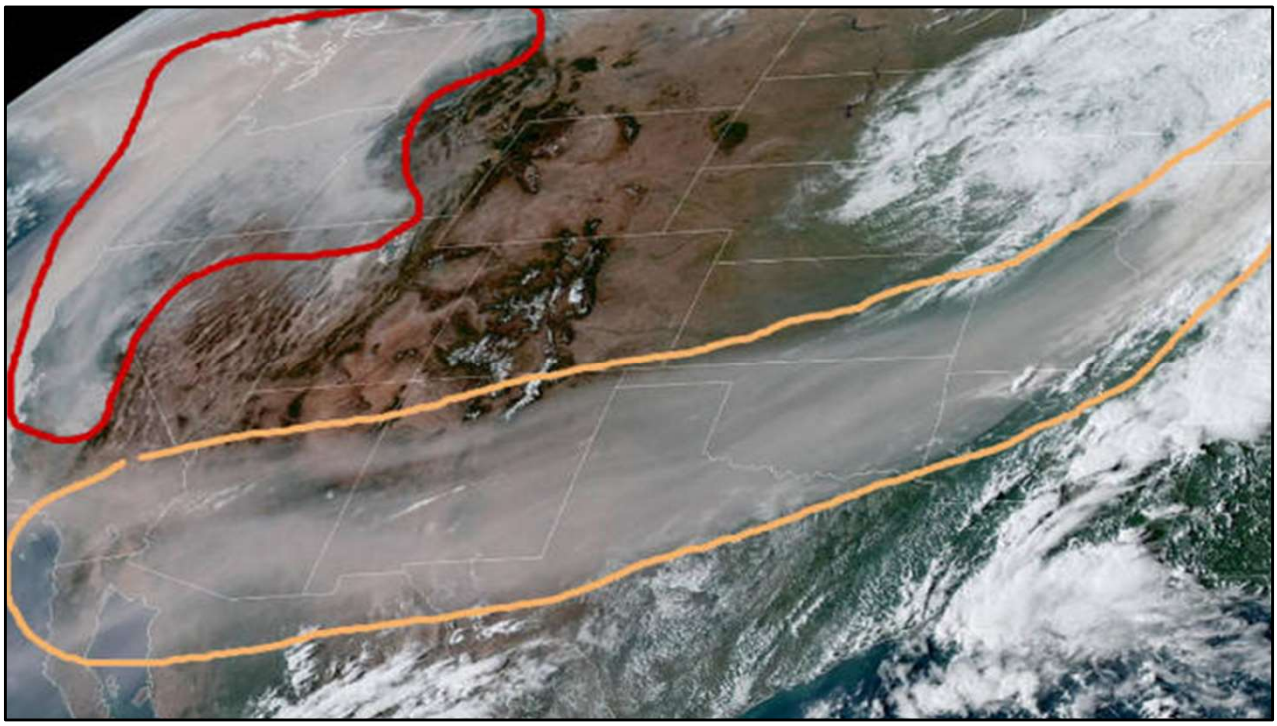
The smoke from Australian bushfires in 2019/2020 was so intense that it quickly circled the planet. Meaning people in Western Australia, dealing with their own fires, also had to deal smoke for the Eastern Australian coastal fires coming at them from the west, across the Indian Ocean a week later. South America and South Africa all had to deal with this blanket, affecting health, crops and wildlife. such events are no longer atypical, but are becoming the norm, and in places other than Australia. We are also just beginning to understand the knock on effects of such events, and from our actions in defence of such

effects.

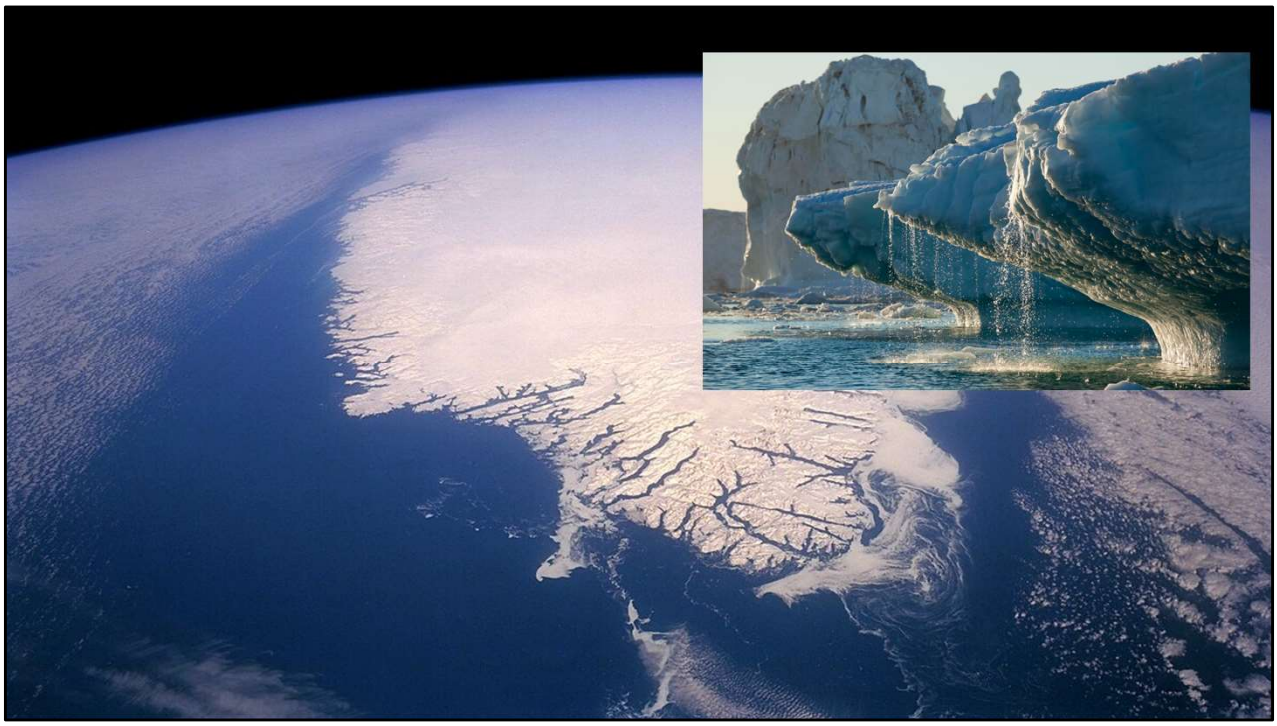
Allow me to run a human tragi-comedy past by way of explanation.



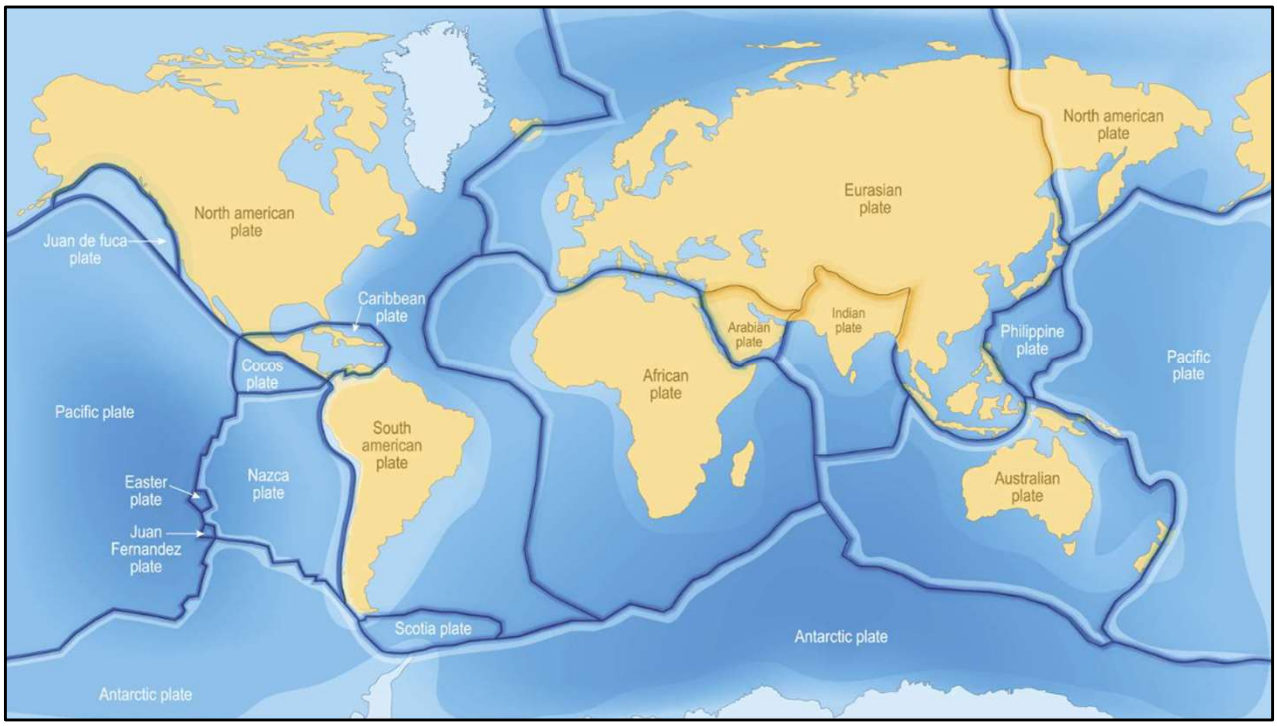
Some of you may be familiar with Edward Lorenz's 'butterfly effect'. The concept, frequently misused, is that a small influence in a distant location – symbolically the beat of a butterfly's wings in the amazon – could cause significant changes in the weather in another part of the world – typically taken as a hurricane in the US. Lorenz wasn't really being that direct, but rather, he was telling us that our scientific weather modelling was flawed, less accurate than what we believed it to be, or ever could be.



I raise this because there is an unfortunate similarity between Lorenz's butterfly in the Amazon, and a spark or dropped match, in California. Wildfires line that US state, generate smoke that travels right across that nation, before cooling and falling upon Greenland's glaciers.



Darkening them and causing them to melt more quickly. As they melt, Greenland gets lighter…



...allowing the tectonic plate to rise, which in turn, allows the southern parts of the North American plate to sink, which effectively raises the sea level in that area.

So we build seawalls, out of concrete, using Portland cement, a product that produces around 7-8 % of human derived atmospheric carbon. Which increases climate change. Which increase extreme wildfire potential, which generates more smoke, which aids in the depletion of Greenland's glaciers, which raises the effective sea level in Florida and the cycle continues.

The effect of bushfire or wildfire smoke is thus only just being fully understood. That, if you like, is big picture stuff, lets look a little closer to home.

Smoke is insidious. It gets into buildings, particularly the average Australian rural home, with unfortunate ease. And whilst newer homes on the urban fringe tend to be sealed more effectively if new, the older stock are seldom much better than their rural cousins. And once the smoke is inside, it takes some time before its heavy particles drift to the floor, filter into curtain, walls, furniture or the like. So we breath it in.

Now a bit of wood smoke can't hurt us much, surely. Most of you attending today will have sat at a campfire more than once, have stood before open fires, or otherwise enjoyed the pleasantries of a bit of wood smoke scented air. We, I at least, tend to enjoy it – its even homely, full of pleasant (though when camping, occasionally somewhat damp) memories.

Speaking of memories, let me talk to you of a particular memory that is the hub of this talk, that about which this presentation is framed.

I was sitting with my doctor in her Albury clinic a few months after the smoke of Australia's 2019-2020 bushfires had cleared and discussing the potential air quality in the region when proposed clearing burns went ahead.

This led to a seemingly divergent comment from her. She declared that the placentas of babies born following the 2020 fires were grey, and the babies themselves underweight. Listening to her speak, it was clearly an issue that had disturbed her for some time. And so she went further "Placentas should be pink" she said, "What I'm seeing is what I'd expect from a mother who smoked several packets of cigarettes a week".

At this point I should tell you up front that my doctor, Dr Rebecca McGowan, is no ordinary GP. Dr McGowan, now retired, was then the most esteemed GP in the region, and also the region's forensic specialist, aiding various agencies as required. As a farmer in the Indigo valley of Victoria's north east, she is also very well appraised of bushfire and its threats.

In preparation for a short paper on retrofitting for bushfire, and for this session today, I contacted Dr McGowan and found that, though retired, she had developed a website through which many key issues were being promoted and research accumulated. I also learned that hers was not the only voice calling for deeper research into the influence of bush or wildfire smoke upon the human body, but she is one of the few who had a clear insight into its effect upon our unborn children.

One of the first papers to make this connection was published in 2013 by O'Donnell & Behie. These authors noted the effects of the 2009 Black Saturday fires in Victoria, though never pointing specifically to bushfire smoke, they identified significantly reduced birth-weights (a 150 percent increase in underweight babies) and increased pre-term births (a 50 percent increase in those born between 20 and 27 weeks in the three months immediately following the fires). Both these studies concluded that, while there was a definitive correlation, the mechanism or cause was not understood.

An extensive 2019 North American study by Abdo et al. went further, showing a distinct correlation between wildfire smoke and adverse pregnancy outcomes. But again, the mechanism remained elusive. In 2022, Simmons et.al went deeper, producing a significant study on the toxicology of bushfire smoke and its constituent parts.

Last year, 2023, Marlier et al. noted rises in child and adult respiratory triggered hospital admissions and deaths during, and after, bushfire events – suggesting staggering global death figures in the '…hundreds of thousands…' annually. Such estimates were back by some significant research across multiple countries, including Australia.

The main suspect in all of this, and other background research, is particulate matter less than 2.5 Microns.

Beyond AS 3959 and the identified BAL

energies MDPI

Article

Bushfire: Retrofitting Rural and Urban Fringe Structures—Implications of Current Engineering Data

Glenn P. Costin Published: 14 June 2021

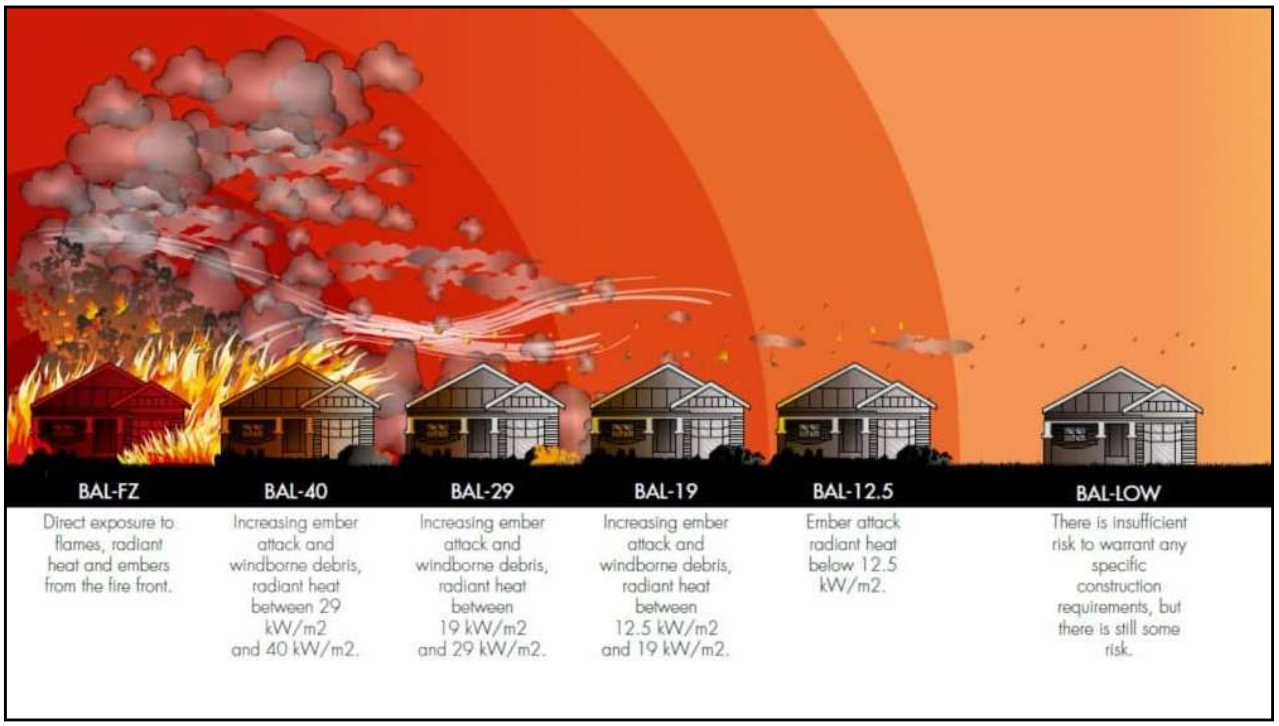
Key points:

- Design for extreme 'dynamic' wind uplift – upgrade cladding fixings (wall and roof) [3. pp. 3-8]
- Improve glazing (min 5 mm toughened)
- Identify and eliminate all gaps to structure greater than 2 mm (ember ingress)
- Identify and eliminate all gaps to habitable internal space (smoke ingress)
- Identify zones of potential ember deposition and replace flammable materials
- Potentially seek means for pressure equalisation [5. p.12]
- Sprinkler systems design to ensure wall surface contact [6. pp. 12-14]
- Landscaping to reduce flammable materials and addition embers [7. p. 14]
- Design for smoke filtering and inhibiting

} [4. pp. 8-12]

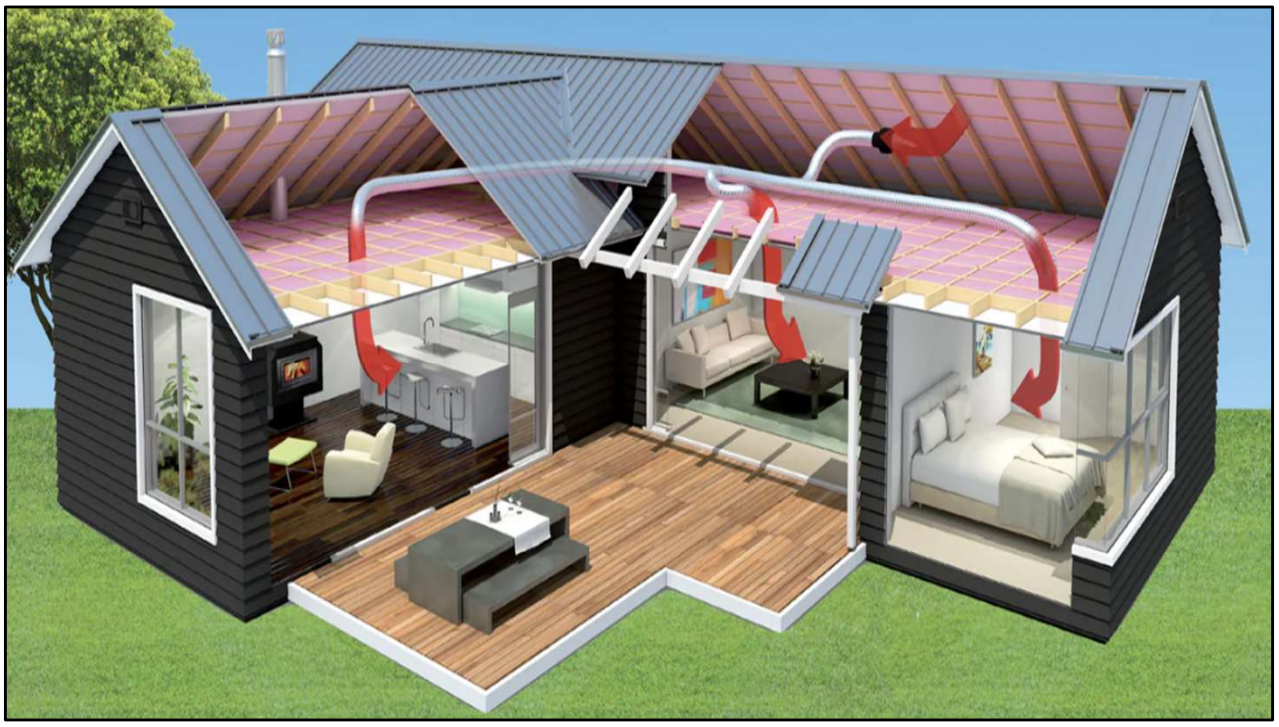
So why am I telling you all this? Today we are speaking about retrofitting existing building stock, advancing sustainability, community resilience and circular economics. All in the face of climate change. Retrofitting a building against bushfire attack, even just ember attack, is a complex and detailed matter as I laid out in a paper published in 2022.

Despite this, it is achievable. And, within reason, we can retrofit a home effectively against the bushfire front.

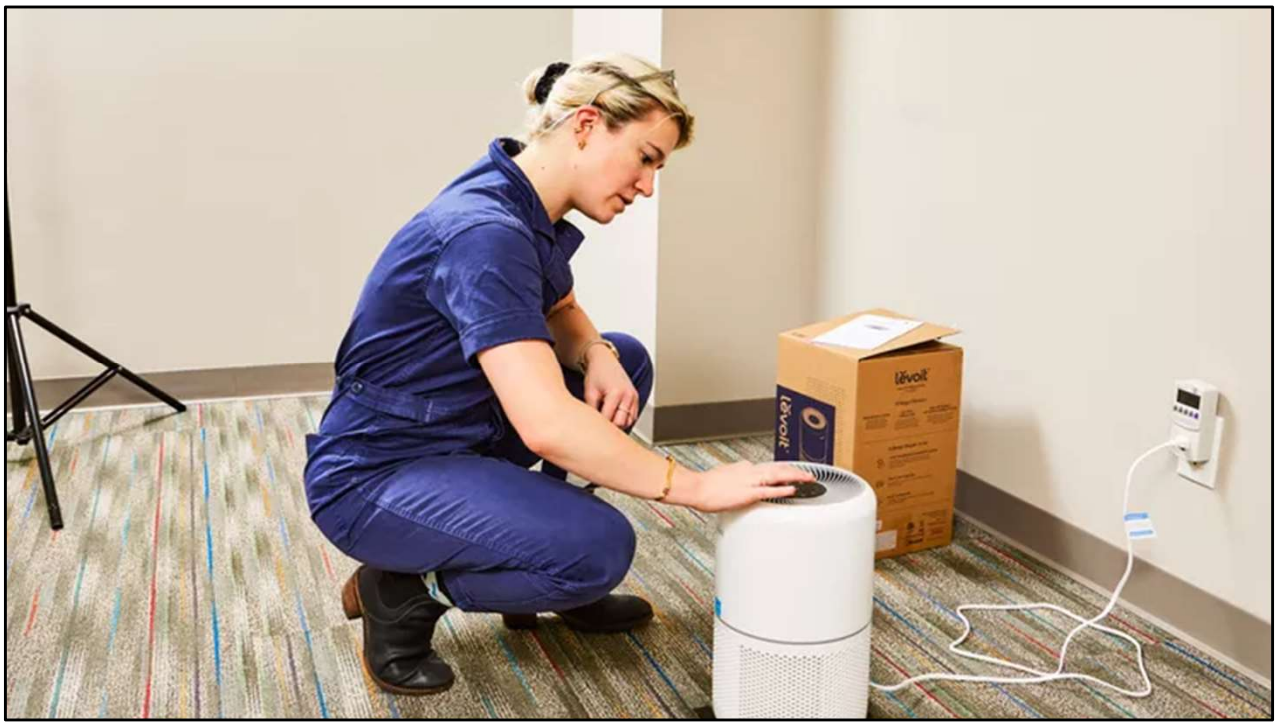


However, whilst protecting the structure is necessary to protecting the occupants, this may not be enough. It needs to be remembered that for most regions, the fire front, even the embers, never get to the property at all.

But the smoke does. In our worst bushfire events, enormous tracts of Australia are heavily affected. Thus, a large proportion of the Australian population is, effectively, sheltering in smoke, living in smoke. Further, large communities can find themselves swathed in smoke from increasingly necessary preventative fuel reduction burning, not bushfires at all.

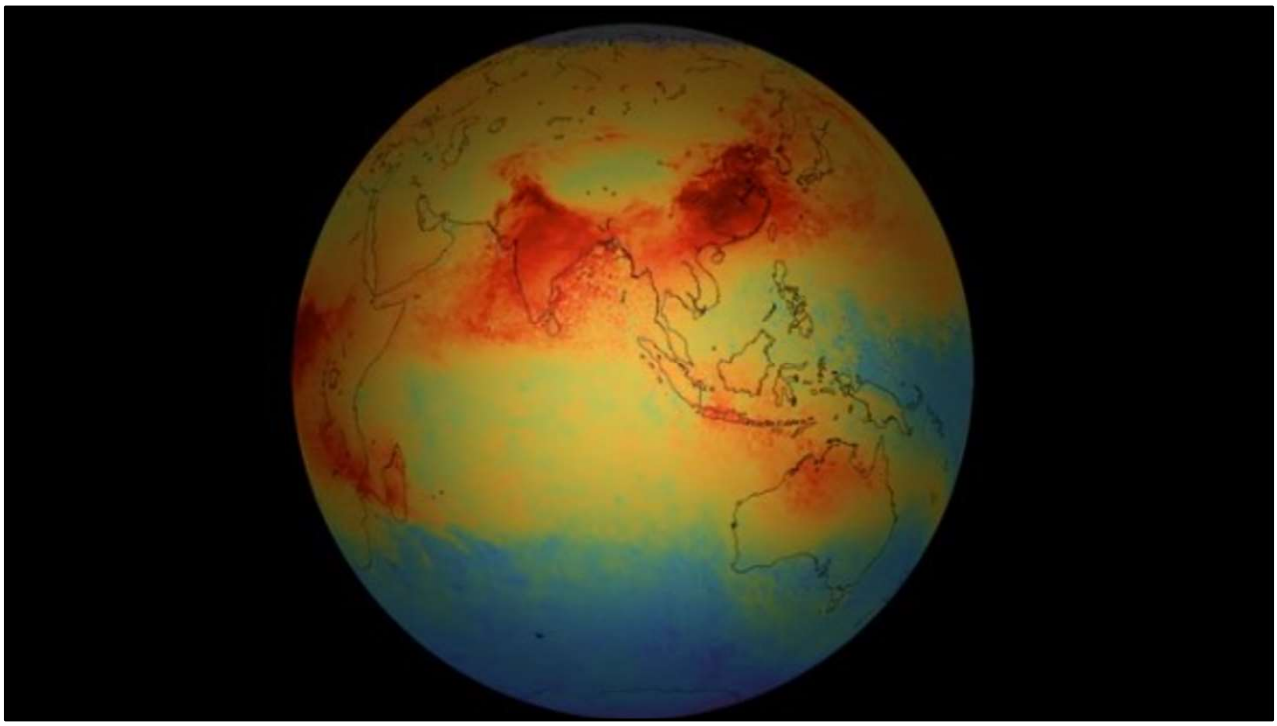


So we need to rethink a little. We need to expand our concerns beyond the fire itself, expand our understands of the effects of bushfires beyond the immediate threat to structure and be more alert to the smoke, as we have become more alert to the embers.



We need to design in, or retrofit in, smoke filtration systems.

We need to alter our forestry practices, listening more to indigenous knowledge and their perspectives on bush resilience and regenerative approaches to fire and country.



Failing to do so could mean we rob our unborn of the chance to enter this world healthy and resilient. A resilience they will need given we are failing miserably in providing them with a world that is healthy and resilient in its own stead.