

As we head toward summer, researchers suggest a rethink of Australia's bushfire risk

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Winter is the off-season when it comes to bushfires in southern Australia. But people could be forgiven for feeling anxious ahead of the Australian summer, with the Northern Hemisphere experiencing

scorching heat waves, tourists fleeing fires in Greece and Hawaii, megafires raging in Canada, and smoke blanketing the eastern United States. All of this with a likely El Niño event just around the corner.

Fire managers have a tough job and the [impact of climate change](#) on [fire regimes](#) is making that job even harder.

The aim of our team's work in the [FLARE Wildfire Research](#) group is to support fire managers with three big and complicated questions:

1. How do bushfires affect all the different things we care about? Not just people and properties but plants, animals, water quality, the economy and much, much more.
2. How can fire management—including prescribed fire—reduce these risks?
3. What does [climate change](#) mean for those first two questions?

Ultimately, these questions boil down to one of risk. How do we identify areas of the landscape at greatest risk and how effective are tools like prescribed burning for reducing risk?

How do we weigh up the costs of prescribed fire, in terms of cost, impacts on fire-sensitive vegetation, native wildlife and human health from smoke, with its [potential benefits](#) of reduced bushfire impacts?

The trade-offs of fire management

To address these questions we set out a framework to systematically explore risk mitigation strategies in the Australian state of New South Wales—a state where some 7% (or 5.5 million hectares) of land was burnt during the 2019–20 Black Summer fire season.

Frameworks like ours provide a forum for exploring links between fire

behavior, fire impacts and fire management scenarios. We use simulations to perform experiments that wouldn't be possible in the field: hundreds of thousands of combinations of weather, ignition location and management intervention.

Insights from our modeling help set the direction of bushfire risk management in south-eastern Australia, illuminating the trade-offs, [cost effectiveness](#) and mitigation from interventions like prescribed burning, fire suppression and fuel breaks.

Our research found that optimal strategies are elusive—what works well in one region may not work in another and what reduces risk to one asset may increase it for another.

These trade-offs are intrinsic to fire management.

We also found that the picture changes as we bring in more values like the influence of fire seasonality on plant responses to fire or the impacts of bushfire smoke on human health (more on that later).

And when you add [climate](#) change to the equation, we can expect widespread decreases in the effectiveness of prescribed burning and a corresponding increase in the costs of fire.

So what does all of this mean for the way we manage fire now?

The 'era of global boiling'

First of all, there has to be a stocktake of current practices to understand what will and won't be viable in a warming world.

If we continue with a "business as usual" approach, we will increasingly struggle to meet the challenges of fire in what the UN Chief Antonio

Guterres has called the "era of global boiling."

Secondly, our study highlights the need for flexibility in the development and implementation of fire management strategies—this is something that risk-based approaches can provide.

Put simply, we need to be agile—to integrate new understandings and perspectives into our practices to ensure we're delivering the best outcomes possible for people and the environment.

A good example is research showing that when a plant burns can be just as important as whether it burns. Incorporating fire seasonality into our modeling will mean better outcomes for fire-sensitive vegetation.

Our framework also looks at the compatibility of risk-based approaches with Indigenous cultural burning. We found that cultural land management has many benefits and values, but the paradigm of risk may not be the best way to look at them.

Instead, we believe productive engagement will require greater understanding and recognition of Indigenous cultural burning in its own terms, rather than as simply another value to be incorporated into frameworks like ours.

Increasing danger of wildfire smoke

Our latest research, published in the *Nature* journal *npj Climate and Atmospheric Science*, takes our framework and zeroes in on the health costs of bushfire smoke in a changing climate.

What do we mean by health costs? These are economic assessments of the cost of things like premature deaths, hospital admissions and emergency department presentations as a result of smoke inhalation.

Our approach uses a collection of climate models specifically designed to explore both wetter and drier futures—it's worth noting that in all of the scenarios our planet is hotter.

As our climate warms, and if it dries, we can expect to see bigger and more intense bushfires, leading to more and more health impacts from smoke. The [fine particles](#) from wildfire smoke have been linked to increased deaths from cardiovascular and respiratory causes—both locally and globally.

We found changes were proportional to current levels of risk, which means we're likely to see the worst impact in areas like the Blue Mountains, west of Sydney, with large settlements close to fire-prone forests.

And the economic knock-on effects will be costly.

Under the worst-case scenarios, the total health costs from bushfire smoke could increase by almost 40%.

If we look at best-case climate scenarios—by which we mean a hotter but wetter future—smoke health costs are likely to remain stable or decrease slightly.

Significantly, the cost increases driven by climate change often outweigh abatements from fuel treatment. In other words, what we gain from prescribed burning, we lose from global warming.

An urgent reminder

Our analysis concluded that there is just no feasible treatment option that's likely to reduce overall health impacts and costs if humankind reaches the upper end of climate change projections. It means

unmitigated climate change will increase the health burden of bushfire smoke and undermine the effectiveness of prescribed burning.

In fact, our results may even underestimate the true health costs of increased bushfire smoke. But as science comes up with better models of the links between [fire](#), smoke, [human health](#) and our economy—we can use our flexible modeling framework to update these risk assessments.

All of this tells us that alternate risk mitigation strategies must be considered. We need to look at all the areas that are affected by the brutal reality of our changing climate through actions like planning, education, fuel breaks and suppression.

Ultimately, the threat of another catastrophic bushfire season in Australia is another urgent reminder of the need to cut our emissions deeply and quickly.

More information: Hamish Clarke et al, A flexible framework for cost-effective fire management, *Global Environmental Change* (2023). [DOI: 10.1016/j.gloenvcha.2023.102722](https://doi.org/10.1016/j.gloenvcha.2023.102722)

Hamish Clarke et al, Health costs of wildfire smoke to rise under climate change, *npj Climate and Atmospheric Science* (2023). [DOI: 10.1038/s41612-023-00432-0](https://doi.org/10.1038/s41612-023-00432-0)

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