MDPI

Perspective

Catastrophic Bushfires, Indigenous Fire Knowledge and Reframing Science in Southeast Australia

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Abstract: The catastrophic 2019/2020 Black Summer bushfires were the worst fire season in the recorded history of Southeast Australia. These bushfires were one of several recent global conflagrations across landscapes that are homelands of Indigenous peoples, homelands that were invaded and colonised by European nations over recent centuries. The subsequent suppression and cessation of Indigenous landscape management has had profound social and environmental impacts. The Black Summer bushfires have brought Indigenous cultural burning practices to the forefront as a potential management tool for mitigating climate-driven catastrophic bushfires in Australia. Here, we highlight new research that clearly demonstrates that Indigenous fire management in Southeast Australia produced radically different landscapes and fire regimes than what is presently considered "natural". We highlight some barriers to the return of Indigenous fire management to Southeast Australian landscapes. We argue that to adequately address the potential for Indigenous fire management to inform policy and practice in managing Southeast Australian forest landscapes, scientific approaches must be decolonized and shift from post-hoc engagement with Indigenous people and perspectives to one of collaboration between Indigenous communities and scientists.

Keywords: Southeast Australia; fire; Indigenous fire management; climate; fuel; cultural burning; British invasion

1. Introduction

In the austral summer of 2019/2020, the southeast of Australia was subject to the worst fire season in the recorded history (dubbed the Black Summer bushfires), with unprecedented areas of forest burnt (ca. 18 million hectares; Figure 1a), significant immediate and ongoing financial costs and a yet untold environmental impact that included the death of an estimated 1 billion mammals [1,2]. The Southeast Australian Black Summer bushfires are one of several recent global conflagrations, following the 2017 British Columbia wildfires (ca. 1.2 million hectares), the 2018 Californian wildfires (ca. 0.8 million hectares), the 2019 Amazon wildfires (ca. 1 million hectares) and the 2020 Californian wildfires (ca. 1.8 million hectares) [3–7]. Collectively, these fires resulted in more than 600 deaths and the destruction of more than 50,000 buildings and had a total economic cost of more than US$1 trillion [7–9]. These events are continuing today, with the current (2021) North American wildfires (>0.4 million hectares) and another emerging wildfire crisis in the Amazon. One unifying feature of these landscapes is that they are all places invaded and colonised by

Europeans that were managed by Indigenous peoples with fire for millennia [10–12]. These European invasions have occurred over the last few centuries and led to the suppression and cessation of Indigenous land management practices in many places [10,13–16].
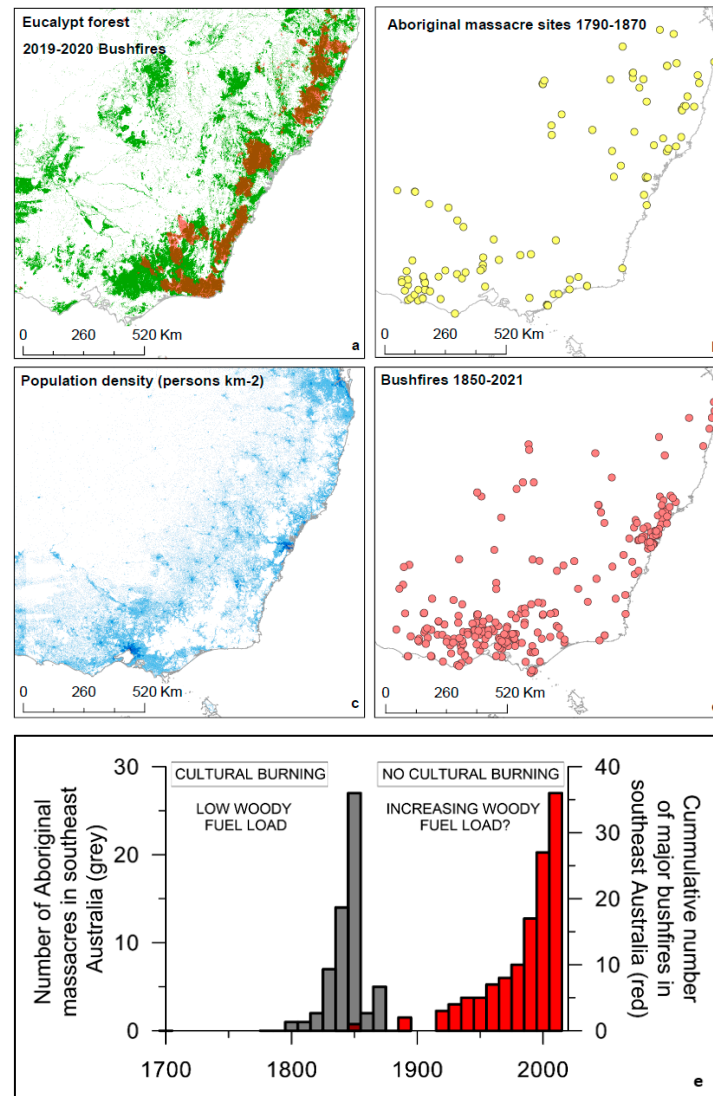
Figure 1. (**a**) Distribution of temperate eucalypt forests (green) and the 2019/2020 bushfire burn area (red) [17]; (**b**) Aboriginal massacre sites between 1780 and 1870 [18]; (**c**) population density [19]; (**d**) the location of all recorded bushfires in Southeast Australia (1850–2021) [20]; and (**e**) a time-series plot of massacres (grey) and a cumulative plot of recorded catastrophic bushfires in Southeast Australia (red).

In the wake of the Black Summer bushfires, the return and expansion of existing Indigenous cultural burning practices to landscapes have been raised as a potential management tool for mitigating against climate-driven catastrophic bushfires in Australia [21]. Here, we highlight new research that clearly demonstrates that Indigenous fire management produced a radically different landscape and fire regime than what is considered "natural" today, with an increase in woody fuels and fire following the British invasion in areas which were not cleared for agriculture and livestock. Additionally, we discuss some barriers to the return of Indigenous fire management to Southeast Australian landscapes. We argue that to adequately address the potential for Indigenous fire management to inform the policy and practice of managing Southeast Australian forest landscapes, we must: (1) shift scientific approaches from one characterised by post-hoc engagement

with Indigenous people and perspectives to one in which the framing of questions, the employment of methodologies, and the interpretation of data are performed collaboratively between Indigenous communities and scientists; and (2) focus on data gaps that emerge from this reframing.

2. Southeast Australian Forests and Fire

Perhaps more than anywhere else in Australia, the impacts of invasion and colonisation on Southeast Australian Indigenous societies were profound (as reflected in the number of massacres committed on Aboriginal people by invaders and colonists; Figure 1b,e). Today, Southeast Australia is host to more than two-thirds of the country's population and the largest expanse of temperate *Eucalyptus*-dominant forest in Australia (Figure 1a,c). Catastrophic bushfires have been recurrent events in this region since the 1850s (Figure 1d). The juxtaposition of a dense population and one of the most flammable biomes on Earth [22] exacerbates the potential impact of catastrophic bushfires on modern Australian society, driving significant investment in efforts to suppress and mitigate fire in this region.

The Southeast Australian forest system has a high biomass (fuel load) that is dominated by arguably the most flammable and most iconic fire-loving (pyrophilic) tree on Earth—*Eucalyptus*, which is a tree that is so flammable and capable of changing fire regimes [10,23]. Some countries have banned its planting in an attempt to mitigate wildfire risk [24]. Despite most *Eucalyptus* depending on fire for their reproduction in various ways [25–28], these *Eucalyptus*-dominated forests across Southeast Australia have not experienced such intense and widespread fires as the Black Summer bushfires through the historic period [25,29]. Presently, these forests often have a dense understorey of flammable woody shrubs that provide fuel for fire and which communicate fire rapidly from the ground to the canopy (Figure 2a) [30]. Canopy or crown-fires are usually hot, fast moving and capable of sending embers great distances from ignition areas [31]. In the heavily populated southeast of Australia, these characteristics mean that catastrophic bushfires present an ongoing threat to life, property and biota [31].

Many settlers consider that catastrophic bushfire is, and has always been, an integral part of the Southeast Australian landscape [32]. Indeed, this narrative has pervaded post-catastrophic wildfire responses throughout the recent history and has emerged as a counternarrative to the role of climate change in our current bushfire crisis [32].
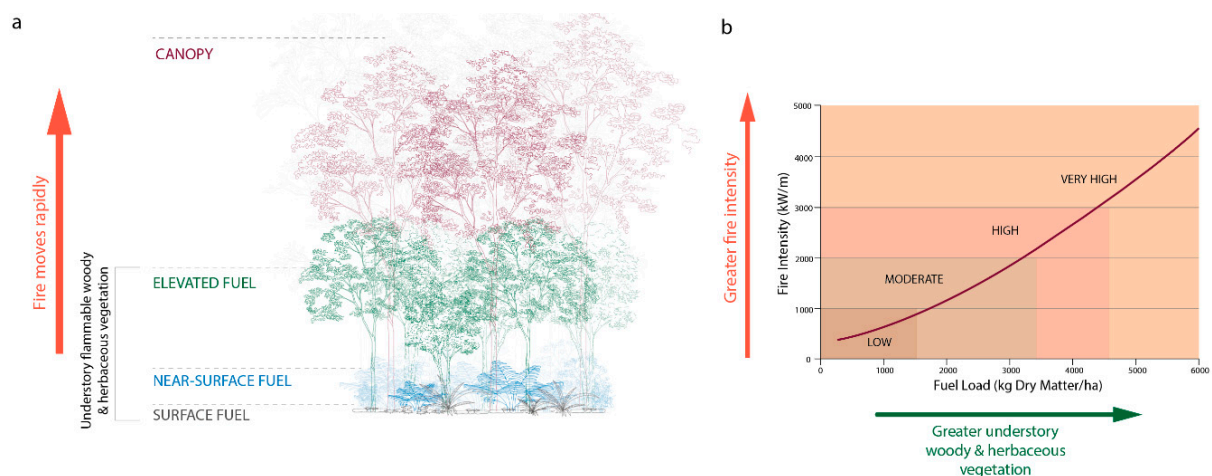
Figure 2. (**a**) Fuel layers that comprise the overall fuel load in Southeast Australian forests [33]: canopy (burgundy), elevated fuel (green), near-surface fuel (blue) and surface fuel (grey) each based on its position in the vegetation profile; (**b**) the relationship between fuel load and fire intensity in Eucalypt-dominant forest in Northern Australia [34]: fires at the landscape scale are modulated by: (1) the type and spatial array of fuels (i.e., vegetation); (2) climate via its influence over fuel condition (wet or dry); and (3) ignitions (humans and lightning). Fuel load (i.e., flammable vegetation) and moisture content tend to determine vegetation community flammability—the denser the fuel load (the *x* axis), the greater the fire intensity (the *y* axis).

3. More Than a Climate Problem

The dominant framing of factors responsible for the unprecedented Black Summer Bushfire season includes four themes: 1. climate change; 2. ignitions; 3. fuels; and 4. risk-adverse policy frameworks [1,29,35]. There is now both scientific and broad political consensus that recent climate change has and will continue to increase the incidence of extreme fire weather in Australia. Indigenous communities in colonised regions did not cause climate change but are burdened with its impacts [36,37]. More frequent occurrences of catastrophic fire weather and prolonged shifts in temperature and moisture threaten both the ecological and cultural integrity of Indigenous lands. Such consequences of climate change disproportionately impact Indigenous people, their livelihoods and their obligations to country [31,38–41]. Moreover, climate change is a problem that is exacerbated by the purposeful inaction from settler governments [42,43] that has severe ramifications over the ways in which Indigenous people can and do use fire.

As a result of climate change, dry-lightning strikes are an increasing ignition source [44–46]. Compounding this is the ever-increasing human population of Australia, which has and will always carry with it the risk of accidental and deliberately lit fires on extreme fire weather days [47,48]. The role of fuel in the recent fire crisis has been fiercely debated; however, the focus is principally on the efficacy and successful execution of hazard reduction burning [25]. Hazard reduction burning places primacy on managing areas near infrastructure, assets and population centres and is less concerned with fuel management across the whole Southeast Australian forest estate [49]. Despite the recognition that fuel management and ignitions are important factors for catastrophic bushfire, most of the scientific effort is concerned with the role that climate change plays and will continue to play in the bushfire crisis [39,44,50,51].

This disproportionate focus on climate is built on the base assumption that the "natural" vegetation state across Southeast Australia is one of densely stocked and highly flammable trees and shrubs. In such a high biomass landscape of contiguous fuel connectivity, the moisture of fuel as determined by climate and the influence of climate over extreme weather events emerges as the most important factor in determining whether fires will turn catastrophic. It is then easy to see why there is such a heavy focus on climate and climate change. This assumption is so deeply rooted that it is rarely overtly stated, let alone challenged. It forms the base assumption of almost all ecological and environmental research, policy and practice concerned with what is now the Southeast Australian forest estate. However, is this a valid assumption? Have these forests always been so dense and contiguous? Conversely, have they always been forests? More than just academic, these questions have serious implications for how we manage the Australian landscape in the face of climate change.

4. Indigenous Fire Management

Unlike prescribed burning for hazard reduction, Indigenous fire management is part of a range of cultural practices that are not simply designed around asset protection. Indigenous fire management protects sites and clears access through land ('Country' for Aboriginal Australians) for cultural uses—hunting, access to fish traps, ceremony, Country keeping, and many other purposes [52–55]. Collectively, this is referred to as cultural burning. Cultural burning is conducted by Indigenous fire practitioners, who use traditional knowledge to assess the right time of the year and the right conditions for burning, operating under strict cultural protocols [55]. Put simply, cultural burning is a holistic approach at landscape management that is based on an intimate understanding of places and is reflexive to local environmental conditions and cues. It is a method of landscape management that has many purposes, only one of which is hazard reduction [55]. More than simply land management, the reciprocity between Australian Indigenous people and the world around them underscores a markedly different relationship between people and landscapes from the European-style management paradigm that prevails in Australia today [56]. This Indigenous relationship is one in which the health of people is linked to

the health of the world around them (Country), an epistemology that obliges people to "care for Country". This reciprocity is fundamental to the health, lives and livelihoods of Indigenous Australians, and reconnecting people to places through the lens of natural resource management has had significant and widespread social and cultural benefits [57] and significant environmental benefits [9,21,58,59]. With respect to fire, this philosophical underpinning is markedly different to the ethos of prescribed burning, which is narrowly focused around assets (such as property and population centres) and which still carries many of the ideas that underpin the outdated fire-suppression framework, as reflected in the paramilitary approach to fire "fighting" and fire use that has the central aim of reducing fire [60–62].

## 5. Bushfires in Southeast Australia

Australia's first major bushfire was recorded in Southeast Australia (including Tasmania) almost a century prior to the impacts of anthropogenic climate change in the austral summer of 1850–1851 [63,64], and catastrophic bushfires have punctuated the British occupation of this region since then (Figure 1d). The rapid and sustained increase in the frequency of major bushfires in Southeast Australia follows the brutal and effective decimation of Aboriginal communities and cultural practices following the British Invasion and subsequent colonisation (Figure 1b) [65]. While records of bushfire occurrence on mainland Australia are possibly biased by low settler populations and poor recordings of bushfires prior to 1851, the first catastrophic bushfires reported in the north of the island of Tasmania in 1850–1851 occurred more than 50 years after the establishment of permanent settlements in the region, suggesting a shift in the fire dynamic in this landscape at this time. The 1850–1851 Tasmanian catastrophic bushfires follow an empirically documented explosion in tree recruitment in response to the removal of Indigenous fire management in the north of Tasmania in the early 1800s [23]. While the data reported from Tasmania are located within rainforest vegetation, which negates fire in that high-rainfall zone, they demonstrate a shift to more wooded landscapes following the removal of Indigenous fire management. In the more flammable *Eucalyptus*-dominant forests that occupy the majority of Tasmania, the increase in woody fuels significantly increased forest fuel loads, preconditioning the landscape for large catastrophic bushfires.

6. Reimagining the Landscape

In contrast to the densely stocked forests that we are accustomed to today, early written depictions of the Australian landscapes are full of superlatives, with an overwhelming depiction of open bountiful landscapes reminiscent of England and well suited to the purposes of the new British colony [66]. It was a landscape characterised by treeless or thinly wooded grassy plains and deep rich soils [63,65,66]. Such depictions reinforce the notion of substantial change in the Australian landscape following the British Invasion and provide a powerful narrative to support calls for the return of Indigenous fire management as a potential strategy not only for maintaining low landscape-scale fuel loads in Southeast Australian forest systems, but also for providing an avenue to commence healing the people who created, managed and lived in the landscapes of Southeast Australia for many thousands of generations.

Reinforcing these colonial descriptions, a recent synthesis of subfossil pollen and charcoal records from across Southeast Australia demonstrates a bifurcation in the vegetation following the British Invasion (Figure 3a) [13]. Subfossil pollen and charcoal data are the only empirical ecological data capable of demonstrating past changes in the structure and composition of vegetation, along with changes in fire, in response to the British Invasion. This synthesis applies cutting-edge pollen modelling techniques to over 50 records of vegetation change across Southeast Australia [13]. The findings demonstrate that in areas which were not actively maintained as open agricultural or pastoral land, wooded landscapes generally became woodier and fires shifted from low-variability herbaceous fires to high-variability woody fires (Figure 3a). This study demonstrates empirically that Indigenous

people actively managed and maintained open landscapes across Southeast Australia using low-intensity fires that principally consumed herbaceous and fine fuels [67–70]. Further, it clearly demonstrates that areas which were not converted to agriculture and pasture became woodier and that this increase in fuel loads has driven a shift across the landscape from frequent low-intensity grass and herb fires to less frequent and hotter forest fires (Figure 3b).
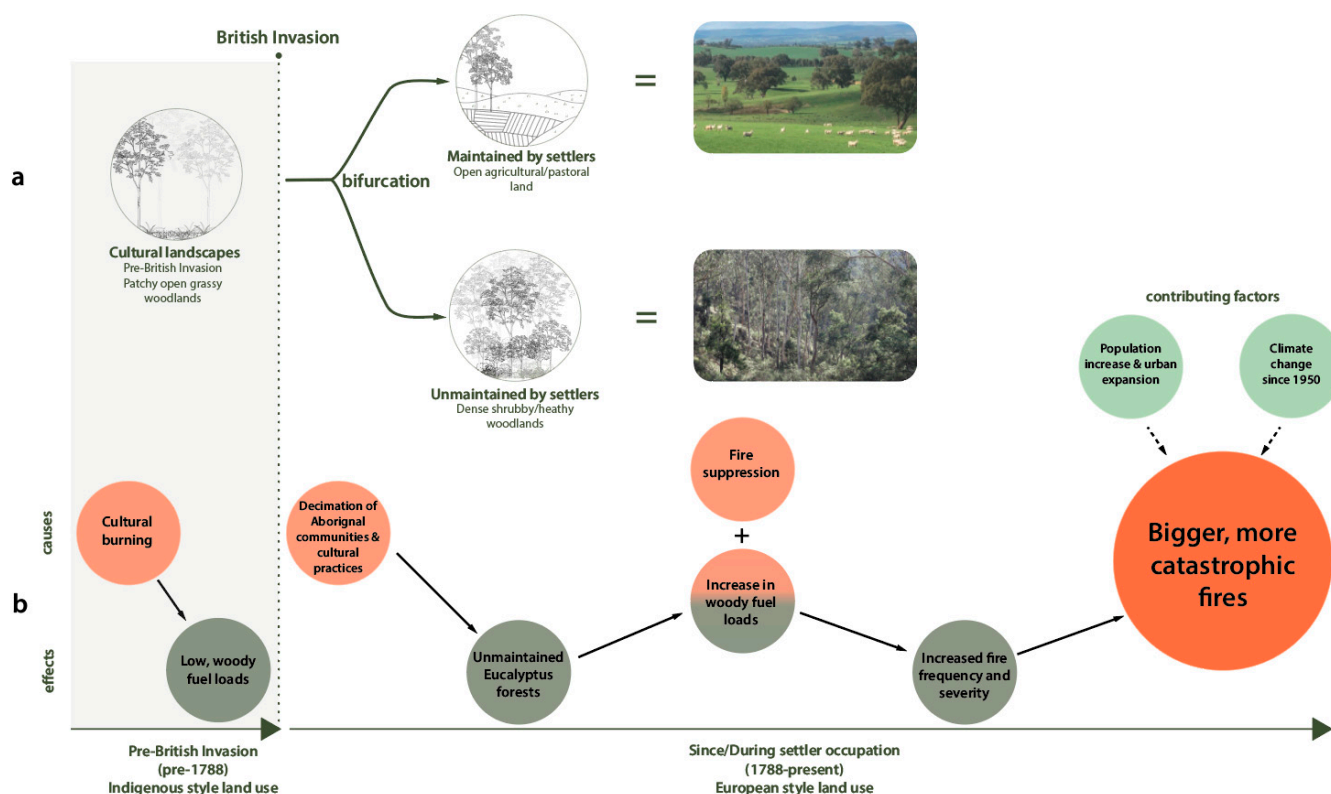
Figure 3. (**a**) Diagram of the bifurcation of the Southeast Australian vegetation landscape following the British Invasion where landscapes have divided into: (1) areas maintained by settlers as open pastoral or agricultural land and; (2) areas unmaintained by settlers becoming shrub-rich, dense woodlands [13]; (**b**) simplified process diagram demonstrating the pre-British Invasion, when under Indigenous land management current open landscapes (i.e., agricultural/pastoral land) were already dominated by grassy/herbaceous vegetation, and since the British Invasion, areas outside European-style land use (e.g., unmanaged *Eucalyptus* forests) have become shrub-dense, which in turn, has directly fueled an increase in the frequency and intensity of fires with other contributing factors (e.g., climate change and population/urban growth).

7. Future Scientific Effort

The assertion of Indigenous fire management as a landscape management practice that can mitigate catastrophic bushfire in Southeast Australia is based on the enormous reservoirs of traditional fire knowledge in Indigenous communities [21,70], abundant ethnohistorical information depicting radically different landscapes under Indigenous management [23,66,69] and sound, albeit scant, empirical data that demonstrate how Indigenous fire management both mitigates large climate-driven bushfires and increases ecosystem health [58–61,71–73]. Despite the abundance of Indigenous voices advocating for the return of Indigenous fire management to both heal Country and heal its people [74–77], there are many barriers to the effective return of Indigenous fire management in Southeast Australian forests [78]; among these are the following: (1) the power of the nature–culture binary in mainstream society that sees the perpetuation of the myth of "wilderness" and its influence over public perceptions, land management decisions and confirmation bias in science [79]; (2) uncertainty about the degree to which Indigenous people actually managed these high biomass and extremely flammable forests prior to the British Invasion; (3) heavy

reliance that non-Indigenous land managers place on empirical data derived from scientific observation and experimentation for decision-making; and (4) policy and legal barriers that prevent Indigenous people from managing landscapes according to their customary laws. These examples are interconnected, creating strong biases against the potential for Indigenous knowledge and practice to contribute to, guide and lead management strategies into the future.

Notwithstanding the need for a radical shift in the way we perceive, research, govern and manage Australian landscapes toward one that engages with, elevates and prioritises Indigenous knowledge and practice, there is an urgent need for rethinking the way we frame, conduct and interpret science [78–80]. The scientific method, rather than representing a beacon of "objectivity" in pursuit of "universalities", is an inherently subjective pursuit rooted firmly in cultural bias. The cultural bias that informs science often produces confirmation bias whereby the framing and context of research questions dictates both the methodologies employed and the interpretation of data. Humans are not good at generating examples to disconfirm their own theories [81], and confirmation bias often results in the perpetuation of inaccurate paradigms, such as "wilderness" occupying Indigenous cultural landscapes. In extreme examples, this confirmation bias places the burden of proof on "proving" unequivocally that Indigenous homelands are the product of Indigenous agency, rather than proving that they are not, i.e., the colonial framing of science in these cases assumes no human agency and, by extension, an absence of humanity in Indigenous people (i.e., the legal myth of *Terra Nullius*) [78]. Valuing and facilitating the ability of diverse epistemologies to interact enables more productive conceptual advances [82]. Indigenous people must be engaged in all phases of research if science is to contribute to the development of policies and practices that will bolster ecosystem resilience, and mitigate catastrophic bushfires in Southeast Australian forests.

Rather than the dualistic framing of contemporary Southeast Australian forests as high-value biodiversity regions that must be "locked up" for conservation or resources to be "opened up" for logging, we need to frame these landscapes as the neglected homelands of Indigenous Australians if we are to arrest the wave of extinctions that are stripping Australia of its unique biodiversity. We need to see biodiversity loss not as emblematic of the destructive agency of humans, but rather as the result of the poor landscape management of a particular set of human practices. As for the collective failure to care for Country, we need not lay the blame for catastrophic bushfires squarely at the feet of climate change, but to own the neglectful approaches to forest management that have led to the overabundance of highly flammable fuels. We need to give back Aboriginal people their humanity and agency. We need to view the landscape that was initially invaded and colonised by the British as a constructed one, in which deliberate and intelligent Aboriginal management produced the very biodiversity we are now losing. Science has a critical role to play in this, by producing the data that speak to power. Science needs to take seriously the task with which it has been charged and challenge existing paradigms by seeking out alternate viewpoints and understandings, not simply seek to confirm its own biases. It is time for us all to do better and create a better future for all.

Conflicts of Interest: The authors declare no conflict of interest.

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