**Submission No 228**

# INQUIRY INTO LONG TERM SUSTAINABILITY AND FUTURE OF THE TIMBER AND FOREST PRODUCTS INDUSTRY

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# NSW LEGISLATIVE COUNCIL INQUIRY INTO THE LONG TERM SUSTAINABILITY AND FUTURE OF THE TIMBER AND FOREST PRODUCTS INDUSTRY

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## Background

I am a Professor of Ecology at the Fenner School of Environment and Society at The Australian National University. I have worked in forests and on responses to wildfires since 1983. I am one of the most highly cited ecologists globally and in the top 50 of Australia's scientists across all disciplines. My submission is based on detailed, empirically-based scientific studies on forests and wildfire in south-eastern Australia. In the past 12 months, I have been involved in a major collaborative study on wildfires with researchers from Griffith University in Queensland. That work has entailed completion of several meta-review studies of bushfire science from Australia (e.g. Lindenmayer et al. 2021a, Lindenmayer et al. 2021b, Mackey et al. 2021a, Mackey et al. 2021b). My submission is informed, in part, by those meta-reviews.

## Climate change and bushfire fire

The 2019-2020 Black Summer wildfires were unprecedented in terms of their spatial extent, the extent of high-severity wildfire (Collins et al. 2021), and impacts on biodiversity (Ward 2020). The prolonged drought, and extreme weather conditions contributed significantly to the extent, severity and impact of the wildfires (van Oldenborgh et al. 2021). Moreover, there has been an increase in fire frequency, including the frequency of mega-fires (conflagrations that exceed 1 million ha) (Lindenmayer and Taylor 2020).

**Climate change is contributing to the frequency and severity of dangerous wildfire conditions in Australia, especially in the south-eastern part of the continent** (Mackey et al. 2021a). There has been a major increase in the number of days of extreme Forest Fire Danger Index days as well as a lengthening of fire seasons. Ongoing climate change with further increase these dangerous conditions and further lengthen fire seasons (Mackey et al. 2021a).

**Forest management and the flammability of vegetation**

A series of studies, both in Australia and overseas (reviewed by Lindenmayer et al. 2021a), contain **compelling evidence that young, regenerating forests recovering after logging are at increased risk of elevated fire severity** (Attiwill et al. 2014, Bradstock and Price 2014, Taylor et al. 2014, Jenkins et al. 2016, Zald and Dunn 2017, Tiribelli et al. 2018, Lindenmayer et al. 2020, Lindenmayer et al. 2021c). **The increased probability of high severity fire is particularly pronounced for crown burns – the most severe kind of wildfire (Taylor et al. 2014, Lindenmayer et al. 2021d)**. Therefore, whilst climate and extreme fire weather are key drivers of fire ignition, behaviour and frequency (Jones et al. 2020), forest attributes like stand age and forest composition also affect fire severity (Zylstra et al. 2016, Zald and Dunn 2017, Tiribelli et al. 2018). Elevated stand-age flammability relationships may be explained by several inter-related mechanisms, such as crown-density, plant architecture and specific plant-traits within species or groups of species (Zylstra et al. 2016, Pausas et al. 2017). For instance, some plant life-forms that occur at high densities in young montane-ash forests (Bowd et al. 2021) have been associated with an increase in flammability.

A recent major study of stand-age fire severity relationships following the 2019-2020 fires in north-eastern Victoria showed a strong negative polynomial relationship between stand age and fire severity (Lindenmayer et al. 2021c). Hence, as in work completed after the 2009 fire (Taylor et al. 2014), young forest exhibited higher levels of flammability relative to older stands (Lindenmayer et al. 2021c).

Whilst the evidence that young forests are susceptible to high severity wildfire is compelling (Lindenmayer et al. 1999, Taylor et al. 2014, Taylor et al. 2020, Lindenmayer et al. 2021c), other kinds of evidence like the structure of old growth stands indicate that older forests are more likely to experience lower severity fire (Lindenmayer et al. 1999).

**Thinning and fire severity**

Thinning is one form of logging that has been claimed to reduce fire severity (Volkova et al. 2017). There is some evidence that thinning has some effectiveness in a North America and particularly when it is accompanied by prescribed burning (Kalies and Yocom Kent 2016). However, **in an Australian context, empirical analyses indicate that thinning often makes limited difference to fire severity and in some cases it can even elevate fire severity** (LasSala 2001, Taylor et al. 2020, Taylor et al. 2021). In Australia, thinning and prescribed burning are often not inter-linked because of the damage done by the later to sawlog value (Taylor et al. 2021).

**Post-fire (salvage) logging**

Post-fire logging has occurred following 2019-2020 in south-eastern New South Wales and north-eastern Victoria. There is compelling evidence of the highly detrimental effects of post-fire logging that comes from a raft of detailed studies gathered from around the world in the past 20 years (e.g. Thorn et al. 2018, Thorn et al. 2020). These include studies in Australia (e.g. Lindenmayer et al. 2018). **Indeed, the body of research shows that post-fire logging it is <u>the</u> most damaging form of logging**. For example, the increased loss of large old trees in post-fire logged forests means that such areas remain unsuitable habitat for many wildlife species for up to 200 years (Lindenmayer and Ough 2006). Hollow-dependent mammals like the vulnerable Greater Glider cannot survive in areas that have been burned and then logged. Salvage logged forests have the lowest bird biodiversity relative to other forests, including those that have been burned at high severity (but which remain unlogged) (Lindenmayer et al. 2018). Critical plants such as tree ferns are all but eradicated from forests that have been burned and then logged (Blair et al. 2016, Bowd et al. 2018). Soils remain extensively altered for many decades after post-fire logging (Bowd et al. 2019) and mass wasting of soils (reviewed by Lindenmayer et al. 2008) is a major concern because of fouling of rivers and streams and subsequent negative impacts on aquatic organisms like fish. Young forests produced by post-fire logging generate significant lower yields of water for human consumption (Taylor et al. 2019).

One of the key reasons why the impacts of post-fire logging are so substantial is that it is a double disturbance (Lindenmayer et al. 2017). That is, forest ecosystems are disturbed by fire, after which they begin the processes of recovery. However, the majority of plants and animals in burned forests are simply not adapted to deal with a second intense disturbance so soon after a first one. For example, young germinating plants are highly vulnerable to being driven over and destroyed by heavy logging machinery (Lindenmayer and Ough 2006). Moreover, in an Australian context, post-fire logging makes no sense in the majority of eucalypt-dominated ecosystems. This is because many tree species naturally resprout – and this is an essential part of forest recovery (Photo 1).

In summary, post-fire (salvage) logging has a wide range of highly detrimental impacts on the recovery of, and biodiversity in, forest ecosystems, including those in Australian ecosystems (reviewed by Lindenmayer et al. 2021b).

<u>**Photo 1. Post-fire resprouting in dry, mixed species forest burnt in the 2009 wildfires in Victoria. (Photo by David Blair).**</u>

**Timber availability and recurrent wildfires**

Some of the issues around inter-relationships between fire and logging have major consequences for the sustainability of the timber industry *per se*. The frequency of high severity fire in several parts of the State mean that there is high probability (~ 80%) that some forest types like those dominated by ash-type eucalypts (such as Alpine Ash) will be burnt before the trees reach an age where they are suitable for sawlog production (Cary et al. 2021). This has economic and ecological ramifications as it indicates there is both declining certainty in future sawlog supply and potential increasing pressure to log remaining unburnt forest (which often has high conservation value for threatened forest-dependent species (Taylor and Lindenmayer 2019)) – thereby adding to the overall extent of disturbed forest in the landscape. Indeed, recent analyses (Mackey et al., 2021) that unburnt refugia within the footprint of the 2019-2020 were both rare and typically small (1-3 ha in size). Further disturbance of these areas, such as through logging operations, may well further exacerbate the problems for species persistence created by the widespread, high-severity wildfires will characterized the Black Summer fire season.

**Concluding comments and recommendations**

The increasing frequency, severity and extent in southern Australia demands a rethink in the way Australia deals with wildfires in the future. There is a critical need to reduce the flammability of some forest ecosystems – for example by not logging areas close to human settlements (Lindenmayer et al. 2020, Lindenmayer et al. 2021c). In addition, there is a critical need to grow more forest through to an old growth stage – where fire severity tends to be lowest (Taylor et al. 2014, Zylstra et al. 2016, Lindenmayer et al. 2021c). Conventional strategies for reducing fuels like prescribed fire and mechanical thinning will have limited effect (Taylor et al. 2020, Mackey et al. 2021b) – particularly under extreme weather conditions (when the majority of house loss occurs) (Gibbons et al. 2012).

Given the extent of flammability, limited effects of strategies like prescribed burning, **there is an urgent need for the integration of new technologies such as drones and rapid suppression methods to help more quickly detect and then extinguish fires** (e.g. Roldán-Gómez et al. 2021). The Australian National University is currently developing new approaches to improve rapid responses to wildfires.

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