

Public submission

HARRY LAING

Submission ID: 205183

Organisation: *The Friends of The Mongarlowe River*

Location: *New South Wales*

Supporting materials uploaded: *Attached overleaf*

Submission date: 10/13/2024 9:10:46 PM

Recent Australian wildfires made worse by logging and associated forest management

The recent fires in southern Australia were unprecedented in scale and severity. Much commentary has rightly focused on the role of climate change in exacerbating the risk of fire. Here, we contend that policy makers must recognize that historical and contemporary logging of forests has had profound effects on these fires' severity and frequency.

David B. Lindenmayer, Robert M. Kooyman, Chris Taylor, Michelle Ward and James E. M. Watson

More than 5.8 million hectares of Australia burned between September 2019 and January 2020¹, with several million more hectares burned in subsequent months. Discussions among land managers, politicians, policy makers and scientists have now focused on the origins and behaviour of the wildfires to try to ensure they do not happen again. Not unreasonably, much of this discussion has centred around the role of human-forced climate change², and the associated prolonged drought and extreme weather conditions as major drivers of these recent conflagrations. It is clear that discussions about links between climate change and fire are warranted and should galvanize action to halt climate change³.

However, the contribution of land management, and especially forestry practices, to wildfires has often been neglected in these discussions. This is an oversight given that land management is well within the control of Australians (unlike global action to abate climate change) and that there is an extensive body of science available to decision-makers. Some parts of the forest industry are now calling for increased logging within both the burnt and unburnt forest estates⁴. Here we provide a summary of recent scientific evidence of the impacts of forestry on these fires and discuss strategies to limit future catastrophic conflagrations.

Forest logging and fire

Since European settlement, Australian forests have had a long history of land-use change. While the full extent of forest loss and degradation is unknown, some estimates show that at least 30% of eucalypt open forest and 30% of rainforest have been lost due to logging and agriculture⁵. Most of this loss occurred in the latter half of the nineteenth century. More recently, industry reports show that between 1996 and 2018, 161 million cubic metres of native forest was logged

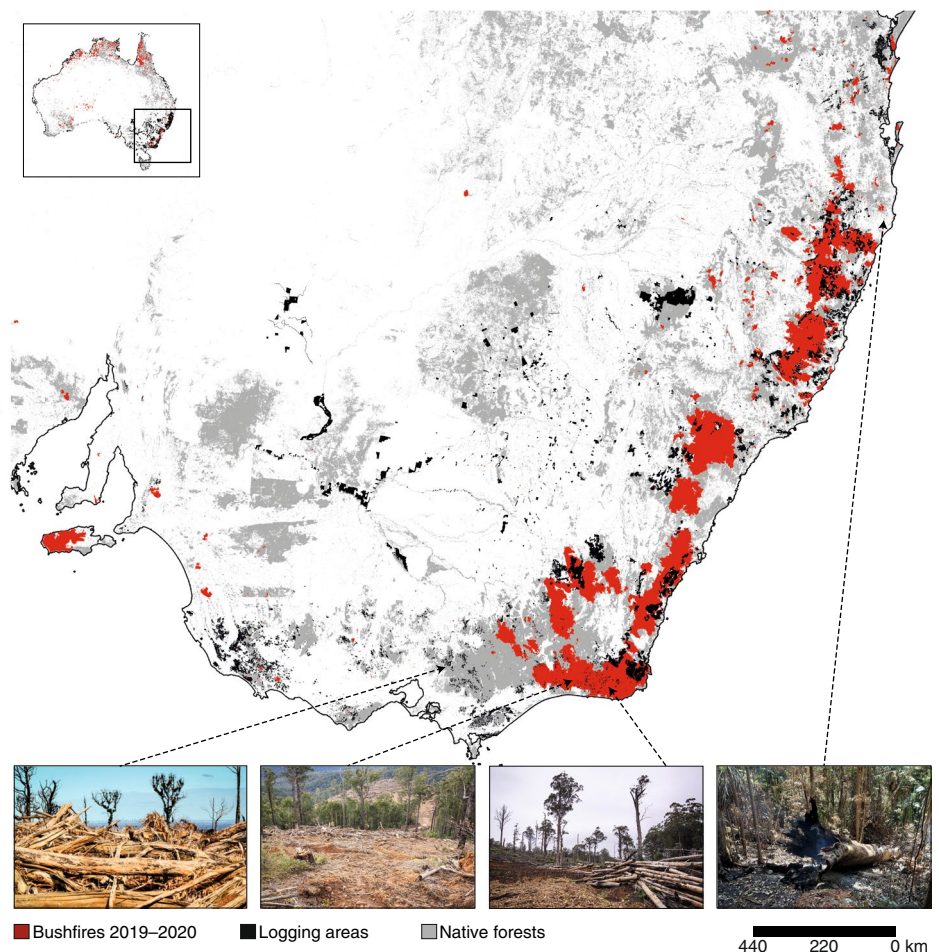


Fig. 1 | Fires within logged areas of native forests. Southeast Australian fires (red) within native forests (grey) and previously logged areas ('logging areas'; black). The first image (left to right) is of the debris remaining after logging in eucalypt forests in central Victoria, the second and third images are of the aftermath of logging in East Gippsland, and the fourth image is of burned Brush Box (*Lophostemon confertus*) within the world heritage Gondwana Rainforest (an ecosystem that has evolved in the complete absence of fire). Logging areas are derived from publicly available data from Forestry Corporation of NSW and VicForests, both of which underestimate the full extent of historic logging. Credit: images 1–3 by C. Taylor; image 4 by R. M. Kooyman

by the forestry industry across Australia⁶. Logging operations have had severe impacts on biodiversity; 181 forest-dependent species

listed as threatened with extinction are directly affected by loss of habitat specifically due to logging⁷. However, this figure is an

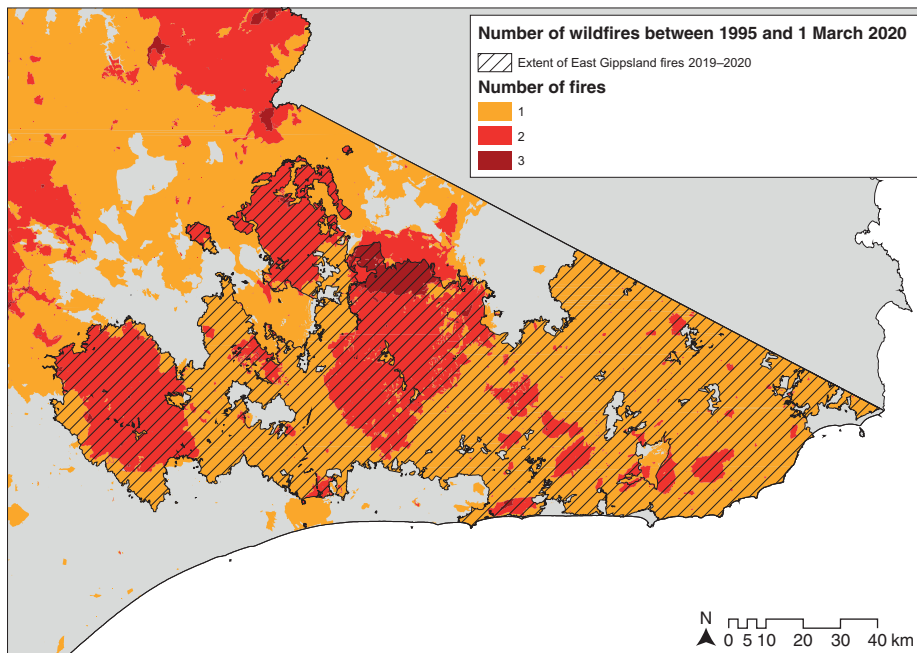


Fig. 2 | Fires within East Gippsland. Analyses of wildfires in East Gippsland, northeastern Victoria between 1995 and 2020 showing that of the ~1 million hectares burnt in the 2019–2020 bushfire season across East Gippsland, ~36% has burnt two or more times since 1995. Credit: map by C. Taylor

underestimate, due to the complexities of listing endangered species in Australia⁸. In addition to the direct impacts of tree felling on species at logging sites, activities associated with production like road construction further fragment already disturbed landscapes — with corresponding negative impacts on biodiversity⁹. For example, in the damp forest ecological vegetation class in the Central Highlands of Victoria, the average distance from logged wood production forests to undisturbed forest is just 71 m relative to 1,700 m in protected areas of the same vegetation type¹⁰. This difference will be further magnified under plans for continued logging over the coming 5–10 years¹⁰.

Beyond the direct and immediate impacts on biodiversity of disturbance and proximity to disturbed forest, there is compelling evidence that Australia's historical and contemporary logging regimes have made many Australian forests more fire prone and contributed to increased fire severity¹¹ and flammability¹². At a site level, logging and other silvicultural treatments leave large amounts of debris (up to 450 tonnes per hectare) (Fig. 1)¹³. This addition of fuel close to ground level increases the severity of subsequent wildfire¹¹. Other major logging-generated changes in forest composition and stand architecture, such as the creation of extensive areas of young even-aged stands characterized by densely stocked trees of short stature and a paucity

of mesic elements such as tree ferns and rainforest life forms, can influence fire dynamics¹¹ and patterns of spatial contagion in wildfires¹⁴. For example, fires spreading from logged areas have burnt into adjacent old growth eucalypts and rainforests dominated by ancient Gondwanan lineages¹⁵. The former have either never burned since establishment or are subject to extremely rare fires (for example, every 300–500 years), and the latter have never burned, with fire only at the rainforest edges at intervals of ~1,000 years¹⁶.

Extensive areas of logged and regenerated forest have burned repeatedly in the past 25 years (Fig. 2). Of the ~1 million hectares burnt in the 2019–2020 bushfire season across East Gippsland (in northeast Victoria), ~36% had burnt previously at least once since 1995. Current understanding of the ecology of forests such as those dominated by the damp ecological vegetation classes suggests they should burn no more than once every 50–150 years¹⁷. Repeated fires in these and other ecosystems can lead to tree species failing to resprout¹⁸, seed production and germination failure, and the death of young trees, triggering potential ecosystem collapse¹⁴.

Appropriate land management response post-fire is now needed

It is important that policy makers acknowledge that climate change affects

fire weather and is making fires worse across Australia³. Policy makers must additionally recognize that land management such as logging operations also has profound effects on fire severity, fire frequency and other key aspects of fire regimes. Efforts to prepare for wildfires therefore require responses not only to climate change but also to historic and current land management.

There are solutions to reduce the risks of further catastrophic fire seasons in the future. First is the removal of logging from areas where it adds considerably to fuel loads and creates forest structures that increase fire severity and risks to human safety. In particular, logging of moist forests must not occur near human settlements. Second, it is essential that landscape-scale impacts of forest fragmentation are reduced; this demands proactive restoration of some previously logged forests to build resilience to future fire events. There is also a need to protect remaining undisturbed or lightly disturbed areas as these are important fire refugia for many species, including arboreal marsupials and birds¹⁹. In the event of wildfires, land managers must avoid practices such as post-fire ('salvage') logging that can impair recovery and make regenerating forests more prone to further fires²⁰. Finally, there is a need to restructure forest industries so that wood production is focused on tree plantations. This is important to maintain employment in the forestry sector and at the same time, limit impacts on the native forest estate, including through a reduction in logging-generated fire proneness in forest ecosystems.

Now is the time for policy makers to recognize and account for the critical values of intact native forests because they are where fire severity is lowest, species persistence during fires is greatest, and rates of recovery after fires are highest²⁰. Forests not degraded by logging, together with the biota they support, are more resilient than degraded forests to pre-fire conditions such as higher temperatures and short-term climatic anomalies (for example, droughts)²¹. Intact forests are critical not just in terms of fire resilience, but also in their role in mitigating climate change, maintaining hydrological cycles and other key ecosystem processes, and providing habitat for a wide range of flora and fauna⁹. Australians must therefore work to de-fragment the forest estate through policies that facilitate the expansion of old growth forest, as these actions can help reduce the patterns of extensive spatial contagion of mega-fires. □

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Published online: 05 May 2020

<https://doi.org/10.1038/s41559-020-1195-5>

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Author contributions

D.B.L., R.M.K., C.T., M.W. and J.E.M.W. contributed equally to the preparation of this paper.

Competing interests

The authors declare no competing interests.

1 Sustainability of current and future forestry operations in NSW

FMR's position is that current forestry operations are not sustainable. Logging, as conducted by ForestryCorp, is damaging our precious native forests beyond repair and driving endangered species such as the koala and Greater Glider towards extinction. Nothing that ForestryCorp says or does gives FMR any confidence this will change. Vital forest habitat is being destroyed and hollow-bearing trees removed. Water catchments are being degraded and native forests made more fire-prone by logging. [Lindenmayer et al. *Recent Australian wildfires made worse by logging and associated forest management*. Nature, Ecology and Evolution, May 2020.] Logging forests releases carbon whereas unlogged forests store it in vast quantities. So far as sustainability goes, it is important to note that the above chiefly applies to native hardwood forests and not ForestryCorp's softwood estate. FMR is supportive of ForestryCorp continuing to manage their softwood estates, so long as there is no clearing of native vegetation for softwood plantations. As for public native forests, logging should cease immediately. Also regarding sustainability, FMR notes that ForestryCorp is making multi-million dollar losses year in year out and that is on top of hefty subsidies from the public purse. Added to which, ForestryCorp is currently having to pay back at least a million and a half dollars in fines for many breaches of logging protocols.

2 Environmental and cultural values of forests, including threatened species and Aboriginal cultural values.

Our forests are vital for preserving biodiversity on so many grounds. Many threatened species rely on native forests. These forests are important for habitat connectivity. There is no way that logging can co-exist with the preservation of maximum biodiversity in our forests. Native forests are critical in the chain of supply of clean high quality water and flow regulation. Our native forests are highly significant for indigenous traditional owners both culturally and spiritually. There are also offer important recreational value for local people and visitors. Environmental and cultural values can in no way be enhanced by destructive logging. The only way the above values can be preserved is by immediate cessation of forestry operations.

3 Demand for timber products, particularly as relates to NSW housing, construction, mining, transport and retail.

It has been the case for years that hardwood from native forests has not been needed for building houses. The need for power poles, floors, furniture and veneers can be met through recycling and native hardwood plantations. The majority of the timber logged in our native forests is turned into pallets and palings, firewood and most shockingly, woodchips. To destroy our native forests for such low grade, low value results makes no sense whatsoever.

4 The future of softwood and hardwood plantations and the continuation of Private Native Forestry is helping meet timber supply needs

Our position in there should be no logging of native forest on public or private land. Hardwood and softwood plantations already provide 91% of Australia's log production. There is a big future for softwood and hardwood plantations so long as they are established on already cleared land. Ending public forest subsidies would boost sustainable timber production (i.e. plantations) on private lands. The slow transition out of logging native forests has been happening for years and should be accelerated immediately.

5 The role of State Forests in maximising the delivery of a range of environmental, economic and social outcomes and options for diverse management, including Aboriginal forest management models

All native forests on public land should be gazetted as National Park, Nature Reserve or Regional Park. FMR sees no future role for ForestryCorp in their management. Protecting and restoring State Forests will generate economic value through increased nature-based tourism, recreation and carbon storage. So far as Indigenous forest management goes, joint management with NPWS would be the preferred model. However the experience of something of a vacuum in Victoria after the demise of VicForests shows that careful transition plans must be drawn up so that all managers have a clear idea of what is expected when logging ceases in native forests. Handing forests over to Indigenous management who then decide to resume logging is not an option for our native forests. Clearing large swathes of forest under the guise of creating fire-breaks as is currently happening under Forest Fire Management Victoria is not an option in NSW.

6 Opportunities to realise carbon and biodiversity benefits and support carbon and biodiversity markets and mitigate and adapt to climate change risks, including the greenhouse gas emission impacts of different uses of forests and assessment of climate change risks to forests.

Logging in native forests increases carbon emissions which exacerbates climate change. Ceasing logging will help forests store more carbon and mitigate climate change. Climate change poses big risks to forests chiefly through fire. The unprecedented fires of 2019/ 20 caused immense destruction in NSW native forests and all logging should have ceased permanently thereafter. As noted previously, logging increases the intensity and destructiveness of fires (see David Lindenmayer's work.) [Lindenmayer et al. *Recent Australian wildfires made worse by logging and associated forest management*. Nature, Ecology and Evolution, May 2020] Preserving our native forests will make an enormous difference to NSW's greenhouse gas inventory on the positive side. But this should not be monetised. It would be quite wrong to allow destructive land management practises to continue by using our native forests as offsets.

About FMR

The Friends of the Mongarlowe River was founded in the early 1980's by Judith Wright, Australia's best known poet and Hugh Tyndale Biscoe, Australia's pre-eminent expert on marsupials. The group has been involved in the preservation of Monga Forest including the transition out of State Forest and into National Park in the early 2000's. FMR continues to be involved in advocating for the correct management of our native forests and for the health of the Mongarlowe River, one of the state's cleanest whose catchment is entirely within Monga National Park.