Science for Saving Species

Research findings factsheet Project 3.3.2



Fragmentation of mountain ash and alpine ash forest ecosystems in the Victorian Central Highlands

In brief

Mountain ash and alpine ash forests in the Central Highlands of Victoria provide habitat for a range of threatened and rapidly declining species. The mountain ash forest ecosystem itself has also been assessed as Critically Endangered by the International Union for the Conservation of Nature's (IUCN) Red List of Ecosystems.

Fragmentation and disturbance of habitat is a well-documented threat to forest ecosystems. We quantified the extent of forest disturbance, fragmentation and edge effects resulting from logging and fire in mountain ash and alpine ash forests over the past 20 years (1999–2019).

We found that disturbance and proximity to disturbance increased significantly over the 20-year period and that by 2019, approximately 70% of the mountain ash estate a nd 65% of alpine ash forest estate, was either disturbed or within 200 m of a disturbed area.

Despite large areas of habitat burning during the 2009 and 2019 wildfires, clear-felling has continued since the wildfires. Logging planned under the April 2019 Timber Release Plan will increase the proportion of land that is disturbed or within 200m of a disturbed area to 72% for mountain ash and 70% for alpine ash. While the extent of core areas (i.e. those places >1000 m from a disturbed area) will decrease.

Increasing forest disturbance, fragmentation and edge effects has negative consequences for the remaining ash forest ecosystem and threatened forest-dependent species.





Background

Mountain ash and alpine ash forests in the Central Highlands of Victoria provide habitat for a range of threatened and rapidly declining species, such as the Critically Endangered Leadbeater's possum (*Gymnobelideus leadbeateri*) and the Vulnerable greater glider (*Petauroides volans*).

The mountain ash forest ecosystem itself has also been assessed as Critically Endangered and at risk of collapse by the International Union for the Conservation of Nature's (IUCN) Red List of Ecosystems.

Both mountain and alpine ash forests have experienced extensive wildfire and been subject to intensive and extensive logging for many years by the native forest timber industry. The April 2019 Timber Release Plan (TRP) included plans to further extend the area of forest to be clear-felled over the next five to 10 years. In November 2019 the Victorian Government announced plans to gradually transition away from native forest harvesting and ceasing native forestry by 2030 so areas planned for logging may be revised.

Fragmentation and isolation of habitat is a well-known threat to forest ecosystems and has impacts on key ecosystem processes. It also leads to declines in populations of threatened forest-dependent fauna species by reducing the amount of available habitat, reducing the size of habitat patches, isolating patches, restricting movement, disrupting gene flow, creating more edge environment and increasing disturbance. Disturbance to these forests also has significant impacts on carbon storage and the production of water.

Assessments of spatial cover in forests can reveal not only important information about landscape condition, including an indication of the extent to which forests remain intact or are disturbed, but also the ability of forests to support biota, including threatened species.

Main aims

We aimed to answer the following questions about how the spatial cover of mountain ash and alpine ash ecosystems in the Central Highlands of Victoria have changed over the past 20 years (1999-2019):

- How much of these forests has been disturbed by logging and fire?
- How large are the core areas of these forests (areas >1000 m from a disturbed area)?
- How close are the core areas of forest to each other?
- How have disturbance patterns changed over the last 20 years?
- How will patterns of forest cover change if areas currently proposed for logging are in fact logged?



What we did

In this study, we assessed patterns of landscape cover across the mountain ash (*Eucalyptus regnans*) and alpine ash (*E. delegatensis*) forests (collectively referred to as "ash" forests) in the Central Highlands of Victoria between 1999 and 2019.

Our study area was the ash forests within the Central Highlands Regional Forest Agreement (RFA) area, which is located between 40 and 130 km to the north and east of Melbourne, Victoria. The Central Highlands RFA covers an area of 1.13 million ha, with ash forests encompassing approximately 190,000 ha (17%) of the total RFA area. This includes the largest collective area of mountain ash forest remaining in mainland Australia.

We focused on the extent of forest fragmentation across this region, specifically on changes in the size of core areas of forest, the amount of edge created, and the isolation of patches.

Our disturbance data examined clear-fell logging, forests where high-severity fires occurred, cleared areas designed to act as fire fuel breaks, and main roads.

We considered two classes of "high-severity" fire that often result in tree death in ash forests: crown-consuming fires, where 70–100% of the canopy is burnt and consumed; and crownscorching fires, where 60–100% of eucalypt and non-eucalypt canopies are scorched, but the leaves remain on the branches immediately following the fire. We did not include lower severity fires, as trees can survive them.

We selected a 20-year time period because it allowed for 10 years before and after the February 2009 wildfires that created extensive disturbance in the region. A second reason for choosing a 20-year time period is that regenerating vegetation has enhanced flammability.

We assessed cumulative disturbance, rather than individual or isolated



disturbance events, which can be hidden when shorter periods are considered.

We conducted an analysis of the multiple land tenures of the ash forests, which include protected areas (dedicated reserves) and areas available for resource extraction, such as state forests. Under the Comprehensive, Adequate and Representative (CAR) reserve system established by Australian federal, state and territory governments in the 1990s, there are dedicated reserves, which mostly align with the IUCN definition of protected areas, informal protected areas that are also set aside for conservation purposes in forests that are otherwise production forests, and other areas on public land that are protected by prescriptions for land-use management.

Land Tenure	Mountain Ash	% of subtotal	Alpine Ash	% of subtotal	Total	% of total
Dedicated reserve	37 955	28	15 676	29	5 3631	28
Informal protected area	31 991	23	14 120	26	46 111	24
Other parks	13	0	0	0	13	0
Private land - other	7 024	5	454	1	7 479	4
Logging permitted	60 290	44	24 633	45	84 923	44
Total	137 273	100	54 882	100	192 156	100

Table 1. Land tenure breakdown of mountain ash and alpine ash forests across the Central Highlands Regional Forest Agreement Area.

Key findings

Our analyses show very high levels of disturbance of both mountain ash and alpine ash forests. And that disturbance and proximity to disturbance increased significantly between 1999 and 2019, while core sizes decreased.

In 2019 just over one third of all mountain ash and alpine ash forests was disturbed. 19% of ash forests were disturbed by clear-fell logging, 11% by high intensity fire and 4% by both high intensity fire and clear-fell logging.

The amount of land directly disturbed represents only one part of the impact on forest dependent species as disturbed areas have a negative impact on surrounding land which suffers edge effects. In 2019 around 70% of the mountain ash ecosystem was either disturbed or within 200 m of a disturbed area. The pattern is similar for alpine ash, with 65% of forest either disturbed or within 200 m of a disturbed area. Core areas of mountain ash have become both increasingly fragmented and increasingly isolated as they have decreased in size. At the same time, the distance between disturbed areas has been significantly reduced for both mountain ash and alpine ash forests. We found that the evidence of disturbance across the ash forest was greatest in land tenures where logging is permitted and least within the dedicated reserve system.

Within land tenures where logging is permitted between 1999 and 2019 the amount of land that was disturbed increased from





Measuring a mountain ash. Photo: David Blair

Key findings

20 371 ha (24% of ash forest in this land tenure) to 47,871 ha or 56%.

The area of disturbance across informal protected areas and dedicated reserves also increased between 1999 and 2019. For dedicated reserves, the disturbed area increased from 611 to 10 215 ha between 1999 and 2019 as a result of the 2009 wildfires. For informal protected areas, the area of disturbance increased from 4839 ha in 1999 to 10 216 ha by 2019 due to a combination of the 2009 wildfires and previously logged areas being added to the informal protected area network following detections of Leadbeater's Possum across land tenures previously allocated to logging. By 2019 around 72 361 ha or 85% of ash forests available to logging was either disturbed or within 200 metres of disturbance and the extent of core areas on this tenure decreased to 1529 ha or 2%.







Figure 2. The proportion of ash forest landscape area in different disturbance categories between 1999 and 2019 for three land tenures: formal reserves, informal reserves, and land where logging is permitted. (TRP = identified Timber Release Plan areas)

Credit: Austral Ecology DOI: 10.1111/aec.12863

Implications and recommendations

The extent of disturbance in mountain ash and alpine ash forest has at least three important implications for forest management to preserve forest biodiversity and ecological processes.

First, it is critical to reduce any further disturbance. There is strong evidence to support limiting further logging in forests dominated by mountain ash and alpine ash to prevent additional declines in ecosystem condition and threatened forest-dependent species. This recommendation is also consistent with the IUCN red-listing of the mountain ash ecosystem.

Further disturbance by logging will drive a decline in ecosystem integrity, such as by negatively impacting soil biomes and accelerating the decay and collapse of large old trees. This will, in turn, have negative effects on fauna that depend on these key elements of stand structure. These include threatened species of hollownesting marsupials and birds that are already showing serious population declines.

Clear-fell logging not only directly increases the area of disturbed forest but also increases the

Cited material

Taylor, C. & Lindenmayer, D. 2020. Temporal fragmentation of a Critically Endangered forest ecosystem. *Austral Ecology*. doi:10.1111/aec.12863 likelihood of disturbance by fire – and therefore has a double disturbance effect. Further logging and fire in ash forests would, in combination, increase the landscape-level dominance of young regenerating forest, which is more prone to crown-scorching wildfire. Having more flammable young post-logging regenerating patches in the landscape can lead to a threshold where fragmentation with flammable patches tips the entire landscape into a more flammable state.

Second, there is a need to strengthen protection of the alpine ash ecosystem, which is almost as heavily disturbed as the mountain ash ecosystem. Many areas of alpine ash elsewhere in Victoria have been subject to repeated fires in recent decades and are at risk of collapse as a result of further reburning.

Finally, given the extent of the road network in wood production areas, we recommend that some roads be removed and the forest rehabilitated. The extensive tracks around cut blocks can suppress the growth of regenerating forest after logging operations have been completed. Reducing the extent of the road network will involve analysing trade-offs between disadvantages of reduced access for fighting fires and transporting timber, and benefits of reducing conduits for introduced predators, sources of weeds, and ignition points for arson.



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Further Information



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