

Recurring fires are threatening the iconic snow gum

September 4 2017, by Tom Fairman, Lauren Bennett And Dr Craig Nitschke



Snow gums at Lake Mountain, burned - but recovering - after the Black Saturday bushfires of 2009. Credit: University of Melbourne

In the 11 years between 2003 and 2014, the same amount of forest was burned in Victorian bushfires as in the previous 50 years – around four million hectares.

Our recent study found these higher incidences of bushfires, which are likely due to climate change, are devastating for the usually [fire](#)-tolerant snow gums of southern Australia.

Over 90 per cent of the Victorian distribution of snow gums has been burned at least once since 2003. What is of greater concern though, is that each of the large fires of the last 15 years has overlapped to some extent, leaving thousands of hectares of snow gums burned by wildfire twice, and sometimes three times.

The snow gum is an iconic tree species in Australia – not only is it strongly associated with the high country, it has also been voted Australia's second favourite eucalypt. It is also a particularly resilient tree species, growing as it does in the challenging environment of the high country where ice, storms and freezing temperatures are fairly common.

It's not all about the coldness though, as the tree also has a close relationship with fire. This is a necessity given that the mountainous regions of Australia are subject to periodic bushfires. While the bark on the stems of snow gums is particularly thin, meaning their trunks and branches are frequently killed outright by fire, snow gums have a built-in insurance mechanism that ensures persistence – a large swelling at their base, known as a 'lignotuber'.



The perils of leaving your field trips a little too late in the season. Credit: University of Melbourne

Partially buried, the lignotuber is where reserves of energy are stored, as well as protected buds that lie dormant until the tree's canopy is lost. This feature allows it to vigorously re-sprout after fire, rapidly producing new leaves.

While snow gums are resilient to one fire, we wanted to know how well their lignotuber can handle two fires in quick succession – or even three fires? And what are the impacts of such frequent fires on the broader sub-alpine snow gum ecosystem?

Climate change means more frequent and severe bushfires are anticipated for many forests in south-eastern Australia, so working out the impacts now may provide us with important insights into how our forests will look and function in the future.

With these questions in mind, we did what all forest ecologists love to do – we went out bush, set up some plots, and looked to the [trees](#).



Tale of two forests: snow gums that escaped fire (left), and snow gums that burned three times in ten years. Credit: University of Melbourne

WHAT WE FOUND

Our findings have been recently published – and the outlook isn't great for snow gum forests.

We found that the lignotuber continued to re-sprout very well after one fire, but after two and three fires, the number of new sprouts significantly declined. The level of whole-tree death (that is, the stems

and lignotuber dying) was fairly low following one and even two, fires; however, after three successive fires, on average half of all trees in our plots were dead. In some plots, this figure was as high as 80 per cent of all trees.

However, the death of established trees is not too much of a problem if there are a lot of new seedlings, as these will one day replace the dead trees. After one fire, we found there was a 'pulse' of snow gum seed regeneration – but unfortunately, after two and three fires, these seedlings were killed and significantly reduced in abundance. This means for double and triple burned forests, the next generation of trees to replace the older cohort has been eliminated.



Triple burned forest on Dargo Road in the Victorian Alps. Credit: University of Melbourne

We also looked beyond the snow gums to see if there were any changes in the shrubs and grasses. Typically after one fire in a snow gum forest, the shrub layer increases as the shrub 'seed bank' in the soil germinates, and competition is decreased. Our results were consistent with this pattern, but we also found that the shrub layer was significantly reduced after two and three fires, while the proportion of grasses significantly increased.

The combination of these factors – higher tree death, fewer seedlings, and more grasses – means that the post-fire dynamics of the snow gum system has changed from one that is dominated by trees, and periodic fluxes of seedlings and shrubs, to one that has fewer trees, a more open canopy, and an under-storey dominated by grasses. For people who like trees and plants, this is a concern.

But the changes in the snow gum [forest](#) could have broader implications. There are fauna that don't just like snow gum forests, but depend on it for their survival. The critically endangered Mountain Pygmy Possum relies on structurally complex shrubs in alpine areas for habitat. Similarly, while not in our study area, there are restricted populations of the (also) critically endangered Leadbeaters Possum that rely on snow gum forests for hollows.

Increased tree mortality and decreased tree regeneration may also have implications for the ability of these forests to store carbon into the future.



Impacts across boundaries: the changes in the snow gum forests (foreground) and the alpine ash forests (background). Pre-2003, these mountains would have been clothed in dense forest canopy – now a mixture of dead stems, living stems, grass and shrubs. Credit: University of Melbourne

It's highly likely that the impacts of changing fire regimes won't be restricted to [snow](#) gum forests. Just down the hill from our sites, alpine ash forests have been affected by equally frequent fires, and research has shown that 97 per cent of seedling regeneration in these forests was killed by the same recurrent fires.

We can no longer think of changed fire regimes as a hypothetical scenario, but one that is already happening. Outstanding questions remain about how we manage these changes to the landscapes.

Do we attempt to restore these forests through large-scale reforestation projects? Do we accept the changes as unavoidable consequences of [climate change](#), and adjust our expectations of how they will look and function in the future? Or do we, as some scientists suggest, examine reforestation of these regions with eucalypts that may be more resilient to recurrent fires?

These are ultimately tough ethical, philosophical and political questions with no easy answers, but ones that we will need to face - possibly sooner than expected.

More information: Thomas A. Fairman et al. Frequent wildfires erode tree persistence and alter stand structure and initial composition of a fire-tolerant sub-alpine forest, *Journal of Vegetation Science* (2017). [DOI: 10.1111/jvs.12575](https://doi.org/10.1111/jvs.12575)

Provided by University of Melbourne

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