Science for Saving Species

Research findings factsheet

Project 3.3.4

Threatened Species Recovery Hub

National Environmental Science Programme

The conservation of greater glider populations in the Victorian Central Highlands

In brief

Quantifying the long-term population trajectory of species and the factors affecting these trends is a fundamental part of animal conservation. We undertook a long-term investigation into the occurrence of the threatened arboreal marsupial, the greater glider (*Petauroides volans*) in the wet eucalypt forests of the Central Highlands of Victoria.

Using data gathered between 1997 and 2018, we quantified relationships between greater glider presence and landscape-level variables, including the number of hollow-bearing trees at a site, and changes in the extent of fire and logging in the surrounding landscape over time.

The presence of greater gliders at a site depended on the number of large old hollow-bearing trees at the site. Hollow-bearing trees are critical den sites for arboreal marsupials; however, we found that the number of hollow-bearing trees has declined substantially in the past two decades.

Overall, numbers of greater gliders declined over time, with numbers at sites declining with increasing amounts of fire in the landscape. Negative fire effects are a concern, as montane ash forests are becoming increasingly susceptible to high-severity wildfires. Stronger efforts are needed to reduce the extent and frequency of logging and fire disturbance in mountain ash forests to protect the greater glider.

Background

The long-term conservation of the greater glider, which is Australia's largest gliding mammal, is a matter of significant concern. This leaf-eating herbivore depends on older hollow-bearing trees for shelter and nesting, and is currently under assessment for uplisting from Vulnerable to Endangered. Greater gliders occur in forests along the east coast of mainland Australia, from northern Queensland to central Victoria. Within Victoria, greater gliders are distributed throughout forested eastern parts of the state, including the moist mountain ash forests of central Victoria. The mountain ash forests support several species of arboreal marsupials of conservation concern, but the Mountain Ash ecosystem is now heavily disturbed and it has classified as a Critically Endangered ecosystem.

The primary form of natural disturbance in mountain ash forests is wildfire. In the past century, fires have occurred frequently, and there have been five major and at least four smaller wildfires in the region – when the interval between major wildfires should be more than 75–150 years. If fire is too frequent or burns young stands, regeneration can be compromised, and mountain ash forest will be replaced by *Acacia* woodland.

Widespread clear-cut timber harvesting commenced in the mid-1970s and is the primary form of human disturbance in these forests. Logging debris is typically left on the forest floor for 1–2 years before being burned in high-intensity regeneration fire. The nominal rotation time between harvesting at a site is only 80 years.

A third kind of disturbance in mountain ash forests is salvage logging. Fire-damaged stands are harvested to recover some of the economic value of the wood.

Australian National University

Background (continued)

Salvage-logged stands are often burned a second time before being artificially reseeded to promote regeneration of new stands of trees.

There is an urgent need to understand the long-term impacts of these various forms of disturbance on arboreal marsupials, including the greater glider. This understanding is needed to inform management strategies for montane ash forests to ensure they will support the survival and recovery of the threatened entities that occupy them.

Main aims of the research

We aimed to quantify the patterns of change in how many greater gliders we have documented at Victorian Central Highlands sites over time and to determine the key factors influencing these trends. The specific questions we asked were:

1. Is the occurrence of the greater glider changing with time?
2. Are the number of dens (tree hollows) for greater gliders changing with time?
3. Is the number of hollow-bearing trees related to land tenure and landscape levels of wildfire and logging?
4. Is greater glider occurrence related to the number of hollow-bearing trees, land tenure, and landscape levels of wildfire and logging?

What we did

This study took place in the mountain ash (*Eucalyptus regnans*), alpine ash (*E. delegatensis*) and shining gum (*E. nitens*) forest ecosystems in the Central Highlands of Victoria, south-eastern Australia. Forests dominated by these three tree species are collectively termed montane ash forest. We have established 164 long-term monitoring sites, each measuring 1ha in the Central Highlands region. These sites have been surveyed on a repeated basis for arboreal marsupials and vegetation characteristics since 1997.

Our long-term field sites encompass a wide range of environmental conditions, including the age of stands, slope, aspect, and whether a site was burned in the 2009 Black Saturday fires. The survey sites spanned two key forms of land tenure in approximately equal proportion. The array of sites included areas broadly designated for pulpwood and timber production, which we collectively called wood production forests; and reserves and closed water catchments where logging is excluded, which we called protected forests.

We conducted repeated field surveys at our long-term sites between 1997 and 2018. The surveys were co-ordinated by The Australian National University and involved field-based volunteers assisting in night-time arboreal marsupial observations. The field surveys documented the presence and abundance of greater gliders emerging from large old hollow-bearing trees. We reported on the site occupancy of the greater gliders, which is the probability of finding the gliders at a site. In addition, we documented characteristics of the structure of the field sites as well as the condition of the forest surrounding each site. We conducted extensive statistical analyses of our datasets to relate the occurrence of the greater glider to the abundance of hollow-bearing trees, the extent of fire and logging in the surrounding landscape and other variables such as land tenure.

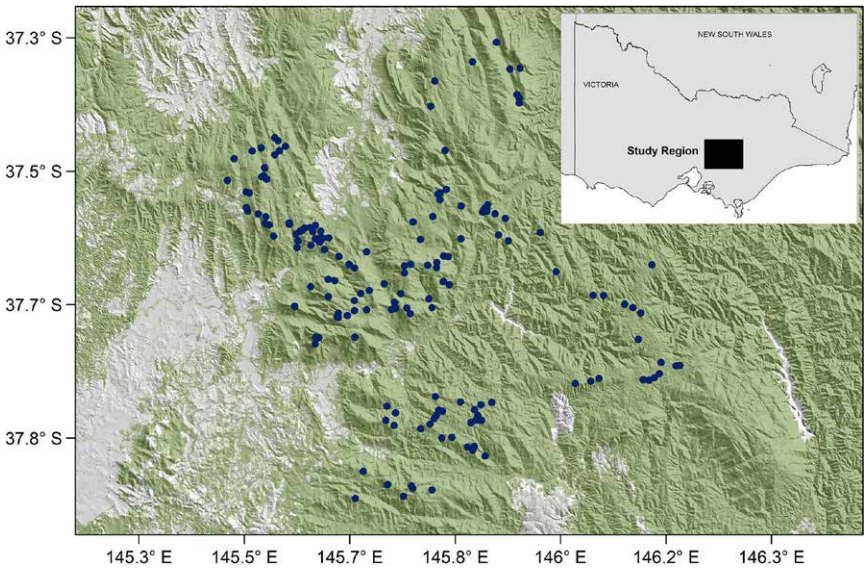


Figure: Location of the study sites (blue dots) in the Central Highlands of Victoria, south-eastern Australia.

RIGHT: Greater glider.
Image: David Cook, CC BY-NC 2.0, Flickr

Key findings

The greater glider was once the most commonly detected arboreal marsupial species in the montane ash forests, but this is no longer the case. Our analyses revealed a significant decline in greater glider site occupancy over the past two decades. Site occupancy declined almost 80%, from approximately 60% in 1997 to less than 15% in 2018. We found that the loss of hollow-bearing trees, fire and logging are all drivers of decline for this species.

The probability of greater glider occurrence declined with increasing amounts of fire in the surrounding landscape, with marked declines coinciding with the 2009 Black Saturday wildfire. These declines may be directly related to the animals being killed on-site by the high-intensity fires, or indirectly through the loss of feeding resources when tree canopies are burnt. In addition, hollow-bearing trees collapse at a higher rate in burnt forests, and this may deplete nesting and den sites for these and other cavity-dependent animals after a fire. The amount of logging in the surrounding landscape also had a negative effect on site occupancy by the greater glider.

We found a strong positive relationship between the greater glider and the number of hollow-bearing trees at a site, with gliders more likely to be recorded in sites with a large number of hollow-bearing trees. This result was expected, as arboreal marsupials need nesting and denning sites to survive.

The number of hollow-bearing trees per site declined between 1997 and 2018. Statistical models revealed that fewer hollow-bearing trees were found on sites where high proportions of the surrounding landscape had been burned, and on sites located in timber production forest. Fires that consume large amounts of forest can lead to altered microclimatic conditions, such as elevated wind speeds, which can increase the loss of large old trees. Timber harvesting in forests can also lead to landscape-level changes in wind speeds.

An increase in trees being uprooted by wind is likely to be a key reason for the reduced numbers of large trees in production areas. Since the 2009 wildfire, the number of sites with at least one hollow-bearing tree has also decreased.

We recorded only very limited recruitment of hollow-bearing trees over the 20+ years of repeated surveys at our long-term sites. This was expected, as the forest at most sites is dominated by trees 80 years of age or younger. It will be at least another 40 years before we would expect these trees to develop cavities.

The effect of time was retained in our best-fitting statistical model even after other explanatory variables were added. This suggests that factors that were not modelled are contributing to the ongoing decline of the greater glider. For example, the greater glider is known to be heat-sensitive and elevated temperatures in the study region in recent decades may also be contributing to declines.

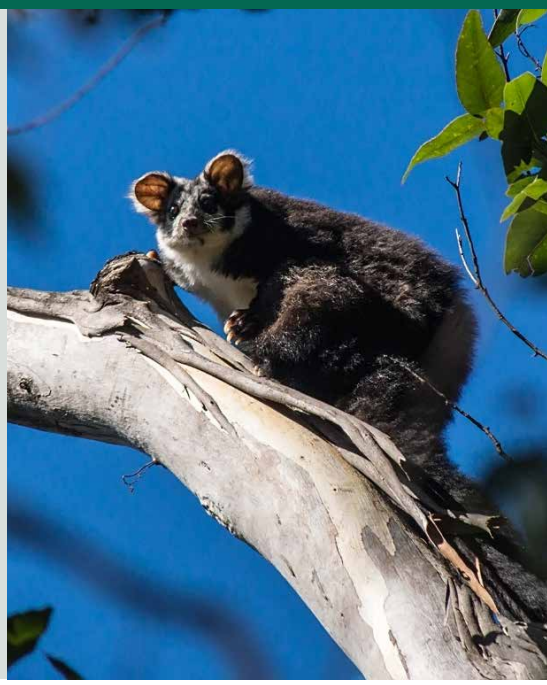
Implications and recommendations

The consistent and large declines in the greater glider population in Central Victoria indicate that effective conservation action is needed immediately to save this species from local extinction. The extent of decline is so significant that the species may be a candidate for uplisting from threatened to endangered in Victoria.

Our analyses of the viability of the greater glider population indicate that the existing reserve system is insufficient to ensure their persistence in the medium to long term. Therefore, protection of substantial additional areas of mountain ash forest is required to adequately protect populations of the greater glider. The sensitivity of this species to disturbance has highlighted the importance of limiting disturbances to both the forest cover and forest structure. All existing living and dead hollow-bearing trees need to be protected by buffers of unlogged forest within wood production forests. This would increase their standing life and provide essential habitat for cavity-dependent fauna.

Greater efforts are also needed to reduce the occurrence of wildfire in montane ash forests. This could involve reducing the amount of area logged, as logging creates large areas of flammable young forest that can lead to regenerating stands being more prone to crown-scorching fires. The protection of existing advanced regrowth forest would allow it to mature through to old growth, with empirical studies showing that old growth forests burn at a lower severity than young regrowth forests.

BELOW: Greater glider.
Image: David Cook, CC BY-NC 2.0, Flickr



Implications and recommendations (continued)

The greater glider was once commonly detected in field surveys of wet forest in eastern Australia. Its decline appears to be an example of a formerly common – but specialist species – rapidly becoming rare. The loss of this specialist leaf-eating species would mean that a key role in the ecosystem would no longer be being performed. Such loss of the greater glider could have flow-on effects to other species, such as large forest owls, for which arboreal marsupials are an important prey item.

These findings have major implications for the Government of Victoria, who are responsible for managing this species in central Victoria. Indeed, the Government of Victoria has now embarked on a major targeted conservation program for the greater glider and implemented a set of protection areas in an attempt to better secure remaining populations of this species. The Government of Victoria also has committed to exiting native forest logging by 2030 with a major reduction in logging by 2024.

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Further Information

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