Why protect pollinators?

# **Bushfires: can ecosystems recover from such dramatic losses of biodiversity?**

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<https://theconversation.com/bushfires-can-ecosystems-recover-from-such-dramatic-losses-of-biodiversity-129836>

**A fragile system**

The sheer scale and intensity of the Australian bushfire crisis have led to apocalyptic scenes making the front pages of newspapers the world over. An estimated [10 million hectares](https://www.bbc.co.uk/news/world-australia-51008051) (100,000 sq km) of land have burned since 1 July 2019. At least [28 people](https://www.bbc.co.uk/news/world-australia-51008051) have died. And over [a billion](https://sydney.edu.au/news-opinion/news/2020/01/03/a-statement-about-the-480-million-animals-killed-in-nsw-bushfire.html) animals are estimated to have been killed to date. Of course, the actual toll will be much higher if major animal groups, such as insects, are included in these estimates.

The impacts of climate change – in particular, the consequences of the increasing frequency of extreme weather events on all life should be abundantly clear. People finally seem to be taking this seriously, but there is an undercurrent of opinion about the “naturalness” of wildfires. Some are still questioning the [role of climate change](https://www.theguardian.com/australia-news/2020/jan/01/australia-bushfires-defence-forces-sent-to-help-battle-huge-blazes) in driving the Australian bushfires.

It is true that wildfires naturally occur in many parts of the world, and benefit plants and animals in ecosystems that have been uniquely shaped by fire over evolutionary time. And people have been using fire to manage ecosystems for thousands of years. We could learn a thing or two from [Aboriginal people](https://edition.cnn.com/2020/01/12/world/aboriginal-australia-fire-trnd/index.html) and the techniques they have traditionally used to prevent bushfires.

But make no mistake, the [scientific evidence](https://www.pnas.org/content/113/42/11770) shows that human-caused climate change is a key driver of the rapid and unprecedented increases in wildfire activity. What is particularly worrying is the extent to which this is eroding the resilience of ecosystems across wide regions. Yes, it is plausible to expect most plants and animals that have adapted to fire will recover. But the ecological costs of huge, repetitive, high-severity wildfires on ecosystems could be colossal.

And it’s unclear how much the natural world can tolerate such dramatic disturbance. Wildfires are increasing in severity around the world. The Australian bushfires are larger than some of the [deadliest recorded](https://www.telegraph.co.uk/news/2020/01/02/australian-bushfires-numbers-highlight-sheer-scale-unfolding/). Incidences are also increasing in ecosystems where wildfires are uncommon, such as the UK uplands. Not to mention the widespread [deliberate burning](https://www.independent.co.uk/news/world/americas/amazon-fires-brazil-ban-burning-rainforest-climate-change-jair-bolsonaro-a9088396.html) of areas of high conservation value for agriculture, as has been recently reported in large parts of the Brazilian Amazon for beef production and in Indonesia for palm oil.

Unsurprisingly, given the shocking numbers of animals that must have perished as a result of these wildfires, many are questioning whether burned ecosystems can recover from such dramatic losses of biodiversity. In Australia, for example, some estimate that the fires could drive [more than 700](https://theconversation.com/australias-bushfires-could-drive-more-than-700-animal-species-to-extinction-check-the-numbers-for-yourself-129773) insect species to extinction.

The world’s biodiversity is already severely struggling – we are in the midst of what scientists describe as the sixth mass extinction. A [recent report](https://www.bbc.co.uk/news/science-environment-48169783) has highlighted that about a quarter of assessed species are threatened with extinction. Australia already has the highest rate of mammal loss for any region in the world, signalling the fragility of existing ecosystems that might struggle to function in a warming, [fire prone world](https://www.theguardian.com/australia-news/2020/jan/14/australia-bushfires-harbinger-future-scientists).

Fears for familiar and charismatic animals affected by the bushfires, such as koala, have been [expressed by conservationists](https://www.theguardian.com/australia-news/2020/jan/14/a-billion-animals-the-australian-species-most-at-risk-from-the-bushfire-crisis). The outlook for already critically endangered species, such as the regent honeyeater and western ground parrot, meanwhile, is uncertain. But to establish the true ecological costs of wildfires it is important to consider biodiversity in terms of networks, not particular species or numbers of animals.

All species are embedded in complex networks of interactions where they are directly and indirectly dependent on each other. A [food web](https://www.nationalgeographic.org/encyclopedia/food-web/) is a good example of such networks. The simultaneous loss of such large numbers of plants and animals could have cascading impacts on the ways species interact – and hence the ability of ecosystems to bounce back and properly function following high-severity wildfires.

## A fragile system

And so it’s key that we consider biodiversity loss due to wildfires in terms of entire networks of interacting organisms, including humans, rather than simply one or two charismatic animals. I have studied and recently published [research](https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/1365-2435.13388) about the loss of plants and animals due to wildfires in Portugal, using new methods in ecology that can examine the resilience of ecosystems to species extinctions. My team found that networks of interacting plants and animals at burned sites became fragile and more prone to species extinctions.

Our study looked at the impacts of a large wildfire in 2012 on one of the many ecological interactions that keep ecosystems healthy – insect pollination. We examined the responses of moths, which are important but often overlooked [pollinators](https://onlinelibrary.wiley.com/doi/pdf/10.1111/een.12174), to wildfire by comparing those we caught in burned and neighbouring unburned areas.

By collecting, counting and identifying the thousands of pollen grains they were carrying, we were able to decipher the plant-insect network of interacting species. In this way, it was possible to examine not only the responses of the plants and animals to wildfire, but crucially the impacts on pollination processes.

We then used these networks to model the resilience of the ecosystem more generally. We found that burned areas had significantly more abundant flowers (due to a flush of plants whose seeds and roots survived in the soil) but less abundant and species‐rich moths. The total amount of pollen being transported by the moths in burned areas was just 20% of that at unburned areas.

Our analysis revealed important differences in the way these species interacted as a result of the wildfire. Although the study was only a snapshot in time, we were able to show that plant-insect communities at burned sites were less able to resist the effects of any further disturbances without suffering species extinctions.

And so as people start rebuilding their homes, livelihoods and communities in Australia following the devastating bushfires, it is crucial that governments and land managers around the world take sensible decisions that will build resilience into ecosystems. To do this, ecological interaction networks need to be considered, rather than specific species. Cutting-edge [network approaches](https://www.cell.com/trends/ecology-evolution/fulltext/S0169-5347%2818%2930139-3) that examine the complex ways in which entire communities of species interact can and should help with this.

Over 45 years ago, the American evolutionary ecologist and conservationist Dan Janzen wrote: “There is a much more insidious kind of extinction: the extinction of ecological interactions.” We should all be concerned not just about the loss of animals, but about the unravelling of species interactions within ecosystems on which we all depend for our survival.

# **Australian government adviser urges threatened species overhaul after bushfires**

<https://www.theguardian.com/environment/2020/jan/26/australian-government-adviser-urges-threatened-species-overhaul-after-bushfires>

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A senior adviser to the federal government on threatened species has backed calls for the creation of a national scientific monitoring system after the bushfire crisis to help fix Australia’s “very uneven” record in protecting endangered wildlife.

Helene Marsh, chair of the national threatened species scientific committee and an emeritus professor of environmental science at James Cook University, said the scale of the ecological tragedy had made Australians more aware of the risks facing the country’s unique animals and plants and provided an opportunity to improve conservation.

With fires still burning, scientists warn it is too early to have a clear picture of the devastation, but preliminary government data suggests [more than 100 threatened animal and plant species have lost at least half their habitat](https://www.theguardian.com/environment/2020/jan/20/more-than-100-threatened-species-australian-bushfires-towards-extinction) and more than 300 have lost more than 10%. The impact on most species not currently listed as threatened is yet to be assessed.

## More than 100 threatened species hit hard by Australian bushfires, pushing many towards extinction

Birdlife Australia estimates nearly 80 birds have lost at least a third of the area in which they live, and that the superb lyrebird may have [plunged from being a common to a threatened species](https://www.theguardian.com/environment/2020/jan/24/lyrebird-threatened-species-scale-bird-habitat-bushfires-emerges).

Marsh said the threatened species committee planned to review the decision-making process for officially listing species as vulnerable or worse [within the constraints of existing national environment laws](https://www.theguardian.com/environment/2018/jan/30/the-franklin-would-be-dammed-today-australias-shrinking-environmental-protections). She said the protection offered to species after they were listed should also be reconsidered as [the existing model of recovery planning had not worked](https://www.theguardian.com/environment/2018/feb/20/fantasy-documents-recovery-plans-failing-australias-endangered-species). Fewer than 40% of nationally threatened species have recovery plans in place.

She said she was encouraged by the level of goodwill between federal and state governments, scientists and conservationists following the fires, including the response by Sussan Ley, the federal environment minister, who has set up and met with an expert scientific panel to advise on what needed to be done.

The federal government has allocated $50m in wildlife recovery funding, with a promise of more to come, and officials from across fire affected areas are due to meet on Tuesday to continue work on a national response.

Marsh said the creation of a national scientific monitoring facility, [proposed by fire scientists David Bowman and Ross Bradstock](https://theconversation.com/australia-needs-a-national-fire-inquiry-these-are-the-3-key-areas-it-should-deliver-in-130374) to fill critical gaps in bushfire knowledge, made some sense. She said it could include wildlife surveys.

“I’ve been quite concerned about the way we monitor our biodiversity in Australia, it’s a huge job, and I think if we are going to understand the impact of fires that is a very interesting idea that needs consideration,” she said.

Given not everything could be monitored, she said there would need to be clear priorities that would likely be defined by the 12m hectare bushfires. But she said it was important to consider “biodiversity arks”, key areas that had avoided the fires, as well as burned country.

Marsh said it should utilise technology, including remote sensing and drones, as well as on-ground field work by scientists, Indigenous rangers and possibly community groups and citizen scientists. “I do believe that the importance of monitoring the impact of the fires will be a catalyst for doing this work,” she said. “It is very important that it be well designed and scientifically robust.”

## Lyrebird may join threatened species, as scale of bird habitat lost to bushfires emerges

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While she backed the development of a national system, Marsh said monitoring the impact of the fires could not wait for a new system and needed to begin as soon as it was safe.

An analysis by environment groups found the Coalition had cut funding for environmental programs, monitoring and staff [by about 40% since being elected in 2013](https://www.theguardian.com/australia-news/2017/dec/13/environment-funding-slashed-by-third-since-coalition-took-office).

Marsh said changes would be needed to the national environment laws, the [Environment Protection and Biodiversity and Protection Act](https://www.theguardian.com/environment/2018/jan/30/the-franklin-would-be-dammed-today-australias-shrinking-environmental-protections), which is being reviewed by businessman Graeme Samuel.

Asked how successful the laws had been, she said the government’s state of the environment report, which among other things found climate change was [altering the structure and function of Australia’s natural ecosystems](https://www.theguardian.com/environment/2017/mar/07/climate-change-impact-australia-may-be-irreversible-report) and affecting heritage, economic activity and human wellbeing, “spoke for itself”.

Marsh said the review of the laws should consider whether it was appropriate to adopt more advanced criteria used by the International Union for the Conservation of Nature to assess whether an ecological community was threatened.

Government ministers including Ley last year stressed the review would focus on [cutting “green tape”](https://www.theguardian.com/environment/2019/oct/29/review-of-federal-environment-laws-will-cut-green-tape-and-speed-up-approvals). Scientists have expressed hope it may now address the impact of the fires and what was needed to avoiding an extinction crisis [that scientists said was worsening before the devastating fire season](https://www.theguardian.com/environment/2019/oct/28/toughen-environmental-laws-to-stem-extinction-crisis-scientists-tell-morrison).

Scientists last year said three native Australian species [had become extinct](https://conbio.onlinelibrary.wiley.com/doi/abs/10.1111/cobi.12852) in the past decade and [another 17 could follow](https://www.publish.csiro.au/PC/PC18006) in the next 20 years. More than 1,800 Australian plants and animals [are listed as threatened with extinction](http://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl#birds_critically_endangered). Scientists warned in a letter to the government before the fires that this was likely to be [an underestimate.](https://www.aph.gov.au/DocumentStore.ashx?id=0e3fd676-fd7b-4a07-bd5c-c110f426c2a6&subId=659993)

# **We need to talk about the impact the bushfires are having on insects**

<https://www.australiangeographic.com.au/topics/wildlife/2020/01/we-need-to-talk-about-the-impact-the-bushfires-are-having-on-insects/>

[David Yeates](https://people.csiro.au/y/d/david-yeates), the Director of the Australian National Insect Collection, is used to insects getting the short-end of the stick. “Insects are small, whereas koalas are cute and everyone loves things that look cute,” he says.

Indeed, stories of the impact the recent bushfires have had on Australian wildlife have centred around the adorable marsupials. Images of burnt paws and singed fur are, naturally, both heartbreaking and evocative.

But according to David, we should be more concerned about what impacts the unprecedented fires are having on Australia’s insect populations – a group of animals that could make or break the Australian environment.

It’s estimated that over one billion animals have been killed or injured during the bushfires, including [at least 20 threatened species that are now closer than ever to extinction](https://www.australiangeographic.com.au/news/2020/01/a-season-in-hell-bushfires-push-at-least-20-threatened-species-closer-to-extinction/). But entomologists such as David will struggle to fully estimate the impact of the fires on insects.

Concerns about an ‘insectageddon’ have featured in headlines over the past year – most stories concerning insect populations of the Northern Hemisphere, rather than Australian populations. “We don’t have the data for insect declines in Australia,” says David. “Scientists in the Northern Hemisphere have done more surveys over several decades.”

[Following a symposium in Brisbane late last year](https://theconversation.com/scientists-fear-insect-populations-are-shrinking-here-are-six-ways-to-help-128213), a large gathering of entomologist, including David, found they only had conclusive data for declines in three Australian species – the bogong moth, Key’s matchstick grasshopper and green carpenter bee. There’s undoubtedly more, but a lack of funding and long-term data means definitive conclusions are hard to delineate.

David’s thorough knowledge of Australian insects gathered over the past 30 years, however, leads him to believe that the recent bushfires may have caused irreversible damage to Australia’s insect populations, due to the intensity and extensiveness of the fires, which he says will make recovery difficult.

“Typically, when a fire goes through a patch of bushland it’ll burn some areas quite heavily but will leave other areas mostly untouched,” David says. “Insect populations survive by having a few insects populate those untouched areas, but there won’t be many of those untouched pockets.”

Out of the 250,000 known insect species that exist in Australia, David says many are unnamed and have narrow distributions. “Of some species, we may only collect them twice in our whole lifetime,” he says. “We’re now worried that some of those uncommon, narrowly distributed little beetles and other insects may have gone extinct through these fires. They just couldn’t escape.”

David’s second-biggest concern is the damage the bushfires have wreaked on Australia’s UNESCO World heritage-listed Gondwana rainforests and its ancient insect inhabitants. [Analysis by *The Guardian*](https://www.theguardian.com/environment/2020/jan/17/its-heart-wrenching-80-of-blue-mountains-and-50-of-gondwana-rainforests-burn-in-bushfires) has reported that 80 per cent of the Blue Mountains and 50 per cent of Gondwana rainforests have burned.

“The rainforests have old, evolutionary roots from the mesozoic era, when the dinosaurs were around,” David says. “Australia was a much wetter and cooler place, and our rainforests are not adapted to fire at all. They can’t regenerate after being burnt.

“There are a lot of mesozoic insects that live in those rainforests that are evolutionarily fascinating and are our amazing biological legacy.

“Think strange primitive moths and sucking bugs, unusual beetles and strange flies that only live in those rainforest environments. These ancient species have given rise to the animal lineages that are common in our more open forests. They are the remnants of ancient life.

“Their habitat has disappeared.”

Australia’s insect populations are under pressure. But, we can all make a difference.⠀
⠀
Here are six steps you can take to address insect decline in your area:⠀
- Entice insects to your garden⠀
- Put the fly spray away⠀
- Turn off the lights⠀
- Build them a home⠀
- Resist the urge to clean up⠀
- Track insects on your phone⠀