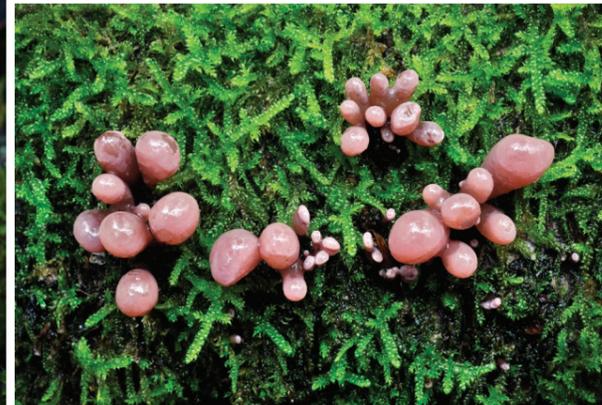


Rethinking the fungal dimension of biodiversity



Left: *Russula persanguinea* grows in eucalypt forests and woodlands. **Top right:** The mushroom is the reproductive structure of the fungal mycelium which is seen here as a matrix of interconnected hyphae that is decomposing this log. **Bottom right:** *Ascocoryne sarcoides* decompose a log.

EXPLORING THE NATURAL ENVIRONMENT IS ECOLOGIST AND PHOTOGRAPHER ALISON POULIOT'S FOREMOST PASSION. SHE ALSO HAS A DEEP CONCERN FOR THE RAPIDLY CHANGING STATE OF OUR NATURAL ENVIRONMENTS. YOU CAN SEE MORE OF HER PHOTOGRAPHS AT WWW.ALISONPOULIOT.COM

Victoria's national parks are tremendous refuges for Victoria's biodiversity, including *Homo sapiens*.

But what actually is biodiversity?

Generally speaking, biodiversity (biological diversity) describes the variety of life on earth. More specifically, this may refer to variation within genes, species or ecosystems.

Biodiversity is more than an ecological concept. It's also an important political tool of global environmental conservation.

Although the term *biodiversity* was intended to include all life forms, it is often used to refer only to flora and fauna.

An entire kingdom – the fungi, which are not plants – is often overlooked.

Current approaches to Australian biodiversity management focus predominantly on plants and vertebrates – that is, they address less than 10% of Australia's total megadiversity.

State legislation overlooks fungi

Our state protective legislation, the Flora and Fauna Guarantee Act 1988, is one such example that largely excludes fungi.

The summarised purpose of the Act is to 'to enable and promote the conservation of Victoria's native flora and fauna and ... the management of potentially threatening processes'.

But what about fungi?

Dozens of mammals – such as bettongs, potoroos and wallabies – and numerous other animals rely on fungi as food, and the great majority of plants can't take up nutrients and water effectively without the help of their fungal partners.

Arguably, every species of animal and plant relies either directly or indirectly on fungi. Fungi therefore need explicit recognition in biodiversity legislation to enable not just their own conservation, but that of all biodiversity.

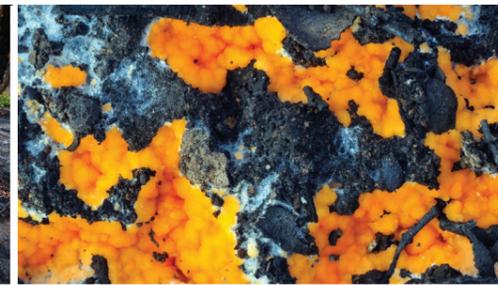
The importance of fungi as vital organisms underpinning terrestrial ecosystems and contributing to their resilience and persistence is well documented. Hence, it is time to recognise the need for their inclusion in definitions and representations of biodiversity, legislation, education and conservation.

Secret relationships

So what are all those fungi doing exactly, and why are they so important?

Many of the functions that they perform are not always readily apparent. Firstly, most of the action happens underground.

We're usually only aware of fungi when we see their reproductive structures – mushrooms and other forms of fruiting bodies such as puffballs, brackets, cups



Far left: Every eucalypt in Victoria's forests has mycorrhizal fungal partners.

Above: Fungi such as *Pyronema omphalodes* are among the first colonisers of burnt soil.

Left: These tiny *Marasmius alveolaris* play an important role decomposing leaf litter.

PHOTOS: ALISON POULIOT

and discs – push through the soil or appear on trees or other substrates.

However, most of the work is performed by the fungal 'body', a matrix of interconnected filamentous hyphae collectively known as *mycelia*. This part of the fungus forms an underground framework, stabilising soils, improving water retention, cycling nutrients, and connecting organisms and systems.

Many fungi form mutually beneficial relationships, known as *mycorrhizal associations*, with plants. By forming a sheath around the tiny rootlets of plants, or directly penetrating them, the fungus effectively extends the plant's root system, increasing the plant's capacity to access greater volumes of soil in search of water and nutrients. The fungus also protects the plant from soil pathogens.

In return, the plant provides the fungus with carbohydrates produced through photosynthesis.

The majority of fungi play another vital role in colonising and decomposing organic matter such as fallen trees and leaf litter. These fungi secrete enzymes that break down compounds, including cellulose and lignin, into simpler compounds, thereby making nutrients available for other organisms.

Other fungi are parasitic. While for some people the word *parasite* conjures less pleasant associations, indigenous pathogenic fungi are an essential part of functional ecosystems.

Making a difference for fungi

We can begin by simply recognising that fungi are a vital part of biodiversity.

We need to do this both at society and government levels.

Our current national biodiversity strategy – a requirement of being a signatory of the Convention on Biological Diversity – does not include fungi. It's perplexing that we've managed to overlook an entire kingdom of organisms, but there is fortunately an opportunity to rally for change.

Australia's Biodiversity Strategy 2010-2030 is to be reviewed in 2015, and this is an opportunity to push for public contribution to the review process.

Most national park management plans also exclude fungi, or only recognise them as agents of destruction. Although the enormous destructive potential of fungi needs to be acknowledged, to recognise only this role is to overlook their many vital beneficial functions. Such a limited perspective on fungi potentially influences public perception of their significance.

However, this is also something we can change, as well as lobbying for the inclusion of fungi in the biomonitoring of Victoria's national parks. This in turn may help to get fungi included in state and national biodiversity conservation legislation.

Calls to conserve fungi are not just about efforts to preserve a favourite kingdom of organisms. They're about conserving *all* biodiversity, and about understanding the inherent interdependencies, interconnectivities and functions of ecosystems.

Conserving fungi first requires knowledge of their diversity and distribution. Volunteers like field naturalists and other fungal enthusiasts collect most of the distribution data on Australian fungi. These data are managed by the national non-profit citizen-science organisation Fungimap, which is dedicated to advancing fungal knowledge of and conserving fungi.

This resource then feeds into further research, conservation and policy development and the Atlas of Living Australia.

Approximately 15,000 fungal species have been described in Australia, but the actual number in existence could be ten times that or more.

Where are they? Victoria's national parks are undoubtedly repositories of undiscovered fungi, and Fungimap is keen to know what's out there! Next time you spot one of the Fungimap target species in a national park or elsewhere, tell Fungimap about it and contribute to Australia's knowledge of fungi. Information about how to submit records can be found on the Fungimap website www.fungimap.org.au.

Responses to environmental issues such as loss of biodiversity require a combination of scientific, societal and political perspectives. Scientific understanding of biodiversity is a predecessor to practical social and political action.

It would be unthinkable to lose our wonderful fungal species before they've even been named, or their stories told. • PW

Thanks to Tom May for his assistance with this article.