Issue 25 - September 2013

Wombat Forestcare Newsletter

Welcome to our spring issue. Two contributors look at the world of lichens.
These complex life forms are not a single organism. They are a symbiosis between different organisms - a fungus and an alga or cyanobacterium. Lichens are not mosses and are classified with fungi. These articles promise to keep your brain active and make your forest walks more interesting.

Planned burns will be evident over the following months as large areas of the Wombat Forest are targeted. We question the wisdom of these burns and consider that many flora, fauna and fungi species are put at risk. Gayle Osborne (editor) & Angela Halpin (design)

Ancient alliances in a modern day Wombat Forest

A review of 'Fungal Biology in the origin and emergence of life' by David Moore[1]

By Alison Pouliot

I've spent the afternoon in the Wombat marvelling at lichens. I've also been pondering their extraordinary habitat choices, often little more than bare rock dashed by an occasional waft of mist. How long have these lichens and their relatives been occupying what we now call the Wombat?

Spinning oneself back through the vast expanse of geological time is a giddying experience. The immediacy of modern communication renders it even more obscure. What organisms existed a thousand years ago, a million years ago, 400 million years ago, where the Wombat is today? There are numerous

A rendition of a painting of *Prototaxites*, by mycologist, Geoffrey Kibby
Image kindly provided by Geoffrey Kibby

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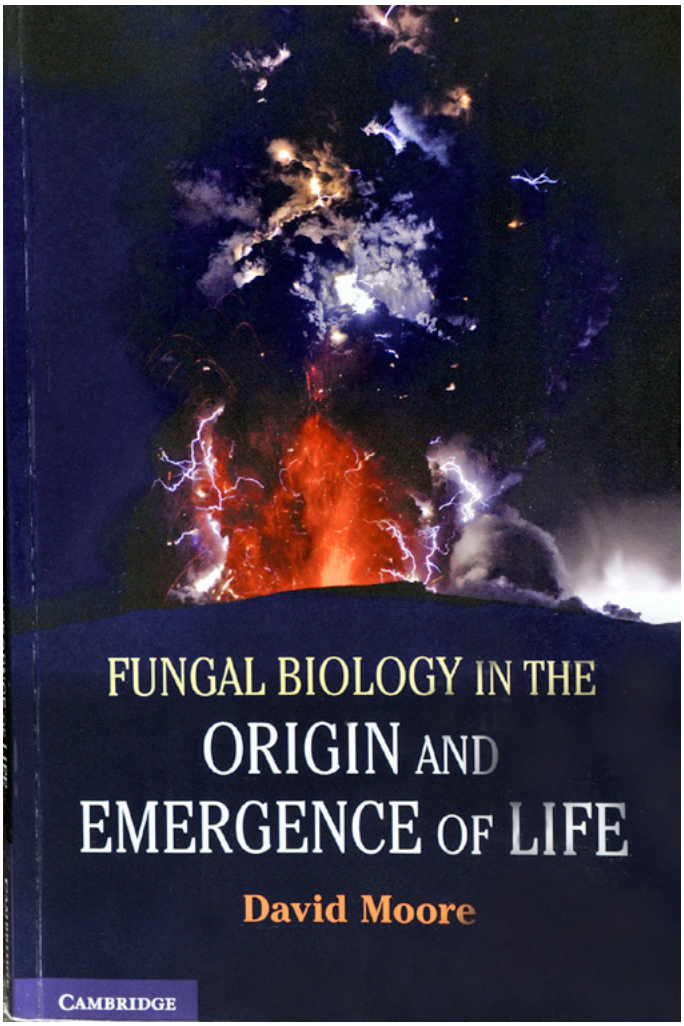
theories and fantasies about how the earth and the Wombat may have looked back then.What were the pioneering invaders? *Prototaxites* perhaps? Towering to nine metres, this enigmatic but now inappropriately named Devonian fossil is thought to have been an early lichen.[2]

Although most accounts of the origin of life pay scant attention to fungi, it is now thought that fungi were among the first organisms to emerge from ancient seas and venture onto terra firma. This is certainly the belief of David Moore in his captivating new book, *Fungal Biology in the origin and emergence of life*. It seems that cooperation was the secret to the successful terrestrial colonisation. Cooperation in its many combinations and permutations has been an extraordinarily effective survival strategy that contributed to the diversity and ubiquity of fungi. It is these mutualistic relationships that are characteristic of ancient fungi, persisting throughout their evolution to the forms that exist today. Lichens represent intimate symbioses between fungi and algae, often in triparite associations with cyanobacteria. As cooperative organisms, lichens take advantage of the photosynthetic ability of algae and the capacity of fungi to secrete enzymes for external digestion. Collectively, these abilities and that of being able to withstand desiccation have enabled lichens to become extremophiles - that is, to tolerate environmental extremes and hence colonise the Wombat's, indeed the planet's, most inhospitable environments throughout the ages.

Moore explores a quintessential question that has intrigued *Homo sapiens* throughout history - where and how did life begin? We're enthralled with ideas of deep time and space and the astonishing creatures that lurk therein. Such curiosity has been an impetus of scientific research and also inspired science fiction. Moore ushers the reader through a four billion year exploration of the various mechanisms through which life may have arisen and progressed on earth. While there is a great swathe of publications on this subject, Moore's unique approach spotlights the central role of the fungal grade of organisation in the evolution of higher organisms. He considers that the inattention to fungi in evolutionary theories reflects a poor appreciation of their significance and function. He asks us to extend our imaginations beyond the animal-centric biases apparent in most investigations of early evolution and give greater consideration to the pivotal role of bacteria and fungi.

Moore reveals an exhilarating world of processes, organisms and alliances - from interstellar space to deep sea hydrothermal vents, from cosmic dusts to primordial slicks to primeval forests, but most significantly, to the dripping rooves of ancient volcanic caves. You'll also get to meet LUCA, the last universal common ancestor. If you're not already sitting down I suggest you find yourself a comfortable chair as I have some rather shocking news to impart. It seems we may well have come from slime. Or more accurately, biofilms. Moore presents compelling arguments about the significance of biofilms as the location where life first began. He challenges us to abandon Darwin's warm little pond and theories about primeval soups and deep sea trenches and contemplate slime.

Moore also discusses the significance to humanity of another ancient group of fungi - the chytrids. Many readers will know about chytrid fungi through the threat some pose to native amphibians. In contrast to the havoc they've wreaked on frog populations,



Fungal Biology in the origin and emergence of life
by David Moore

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chytrid fungi also play a vital role in their interactions with humans via their mutualisms with ruminants. Rumination relies on the presence of chytrid fungi in the guts of ruminants. This relationship between ruminant and chytrid underpins all meat production as well as that of dairy and most fibre production.

A good book can perhaps be judged by the amount of time one spends *not* reading it. Moore's thought-provoking book spent a good deal of time resting in my lap as I traversed mind-bending scales of time and space, contemplating intriguing paradoxes and unorthodox organisms. Although I tripped through some of the biochemistry, Moore's book is rated for readers aged 15+ and considered accessible to non-specialist audiences, so I obviously need to brush up.

Moore's mycological perspective of the emergence of life on earth is enlightening and conclusive. Forty-three years researching and teaching mycology and genetics make him well-qualified to discuss the subject and deserved of his recent retirement although he is still an Honorary Reader at the University of Manchester. His critical analysis and engaging style make this book an absorbing adventure for anyone interested in not just mycology, but also in the larger questions surrounding the origins of life on earth.

While forest activity may be appear to be minimal in the Wombat over winter, the ancient collaborations of lichens - little changed over hundreds of millions of years - continue their work in making the forest a more hospitable place for its great diversity of inhabitants. Grab a warm jacket and a scarf and go for a lovely wander in the Wombat and discover for yourself these captivating organisms. ■

References

1. Moore, David (2013). *Fungal Biology in the origin and emergence of life.* Cambridge University Press, UK. http://www.davidmoore.org.uk

2. *Prototaxites* translates to 'first Taxus' - 'proto' meaning first and 'taxites' originating from *Taxus*, the genus of the Yew, as the fossil was first thought to be that of an early conifer. However, isotope ratio mass spectrometry revealed that *Prototaxites* was in fact not photosynthesising, but consuming and recycling - i.e. it was not a plant, but a fungus.

A couple of lichen websites that may be of interest:
http://www.anbg.gov.au/abrs/lichenlist/introduction.html
http://www.lichenology.org/

Lichens exist in a great diversity of forms and colonise some of the Wombat's less hospitable environments - Photography © Alison Pouliot

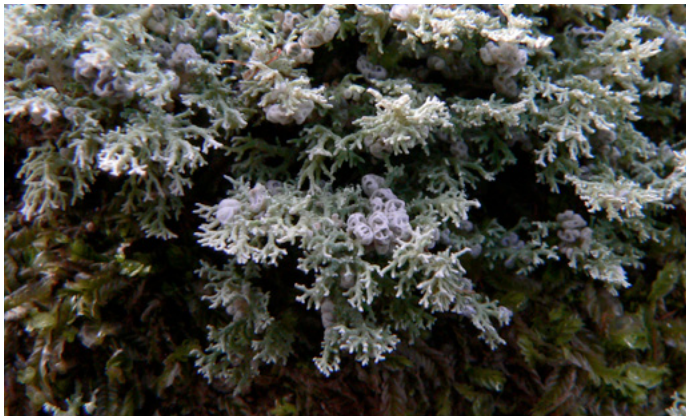
Living on the Edge

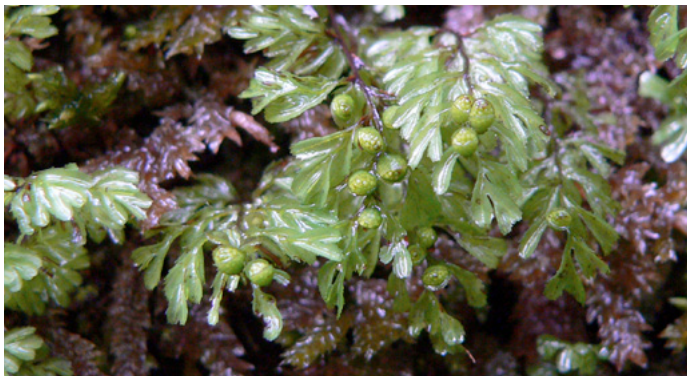
Words and images by John Walter

I grew up on the northern fringe of the Otway Ranges and spent many a Sunday wandering through that district's beautiful fern gullies chasing down waterfalls and the like. The high rainfall (1.5 to 2 metres in some locations) has provided a greater diversity of ferns than we find in the Wombat Forest where our wettest locations have a little over one metre of rainfall. On a short visit to the Otways in April I found a wide range of species including several filmy-ferns and an equally exciting range of rainforest loving lichens. This return visit reminded me of a lichen species I had located in the Wombat Forest in 2012 that is normally associated with wetter forests and rainforest. I began wondering if a wider search of the Wombat Forest site would uncover some interesting ferns as well.

The lichen, *Stereocaulon ramulosum* had previously been collected north east of Blackwood, a few kilometres to the due east of my find; but it is more commonly found to the east of Melbourne, along the New South Wales coast and in Tasmania. It is an unusual species in that the fungus component (Mycobiont) has established an association with two completely different chlorophyll producing species (Photobionts) whereas most lichens are a partnership between a mycobiont and a single photobiont. The main photobiont is a green alga giving the lichen an overall pale bluish-green tint and the secondary partner is a cyanobacteria which is found in special wart-like structures called cephalodia, thus bringing species from three different kingdoms (Fungi, Protista and Eubacteria) together into a single life-form.

In June I searched part of this site near Mt Wilson for ferns and was not disappointed, although I was surprised by the fern species I found. I scrambled down a very steep gully to the creek bank below and found one clump, then another, and then masses of the Common Filmy-fern *Hymenophyllum cupressiforme*. This species is the most drought resistant of the fragile looking filmy-ferns and while it is fairly widespread, it has not been officially collected in the Wombat Forest. The noted botanist Jim Willis did collect it near Creswick and it is also recorded for Mt Macedon. The leafy parts of the fronds on the filmy-ferns are only one cell thick and this allows them to move water and gasses directly into the cells from the atmosphere; similar to the way mosses and liverworts do.





Top – *Stereocaulon ramulosum* sharing an earth bank with mosses. **Inset** – The red brown apothecia produce the fungal spores
Second row – Pale grey cephalodia on *Stereocaulon ramulosum*
Third row – Common Filmy-fern covering a Eucalypt trunk
Bottom row – The sori with their spore containing sporangia are a feature on the filmy fertile fronds

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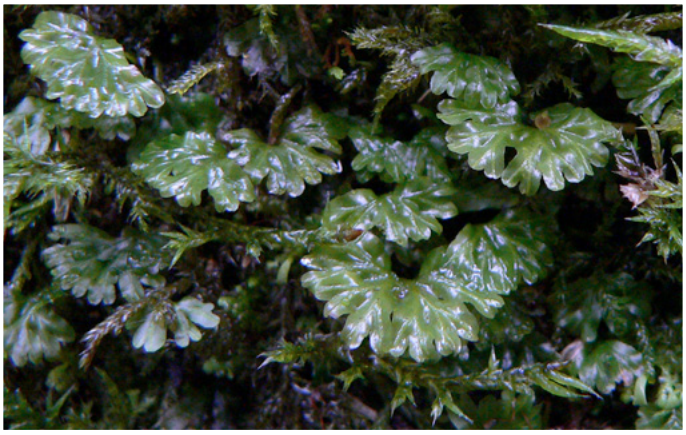
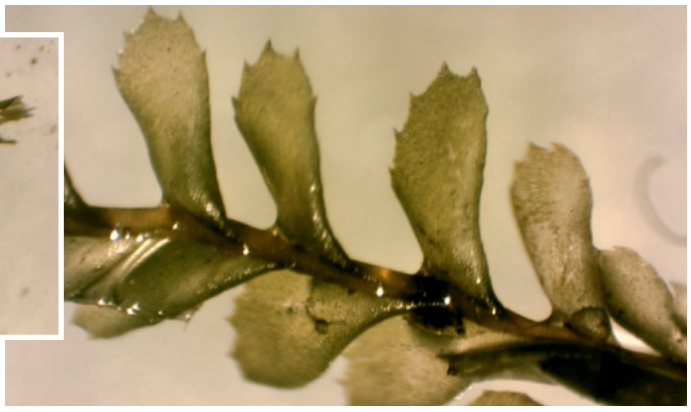
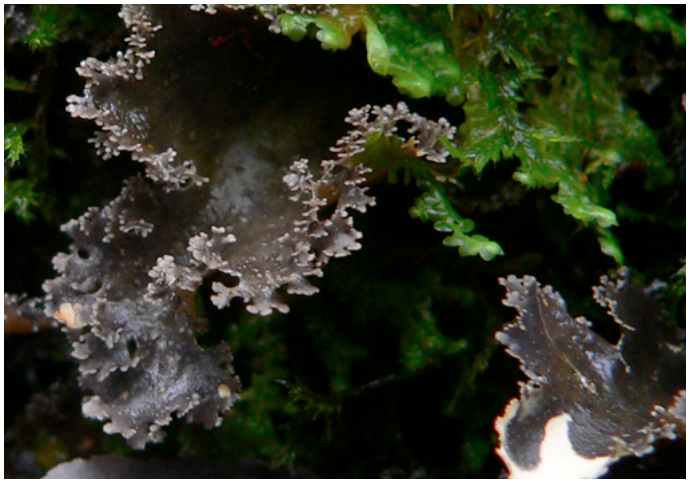
In this type of environment you are never far from a liverwort and growing just a few feet away from the fern was a clump of *Hymenophyton flabellatum*. This liverwort is frequently mistaken for a filmy-fern due to the appearance of the fan-like leaves that are held aloft on short stems. It also has not been collected from the Wombat Forest nor is it listed for Mt Macedon although I did find it there in May this year. It is common in the Otways and eastern Victoria. Its name translates as the "fan shaped membrane plant" while the genus of the filmy fern translates as "membrane leaf". It is not clear to me what the botanist who named the fern thought was cupressiforme or "cypress like".

On a return visit to the site in August I located patches *Plagiochila fasciculata* with rod-like antheridia fanning out from its tips. This is a leafy liverwort and yet another species not listed for the Wombat Forest; the nearest records for it are at Mt Macedon. Each leaf is spiky along its lower margin and tends to fold over on itself giving the plant a distinctive appearance.

Other species growing nearby included a beautiful moss, *Hypnodendron vitiense*, sometimes called the Palm Moss due to its radiating fronds positioned at the top of a long dark stem. Hypnodendron translates as "moss tree". It is reasonably common in the wetter parts of the Wombat Forest, often forming miniature palm forests along sheltered creek banks. Next to that was another lichen species; found at Trentham Falls and Macedon but not common in this area. It has another long name, *Pseudocyphellaria dissimilis* and you can readily see that its photobiont is a cyanobacteria due to the dark grey/blue colour of the upper surface. This species has clusters of small appendages along the edge of most if its lobes called phyllidia. They are one of the many methods of asexual reproduction employed by lichens and readily break off to hopefully grow into fully developed lichens. The big advantage of asexual reproduction for lichens is that the propagules (phyllidia, isidia, and soredia are the best known) contain both the mycobiont and the photobiont. Sexual reproduction however involves only the fungal partner and its germinating spores must locate a suitable photobiont partner if it is to survive.







Top row – The liverwort *Hymenophyton flabellatum*
Second row - *Plagiochila fasciculate* under magnification
Inset – the antheridia
Third row - The Palm Moss from above and – Inset - the shape that gives rise to the name
Bottom row - *Pseudocyphellaria dissimilis* with its shelves of phyllidia

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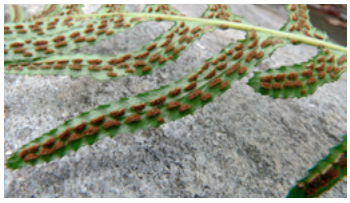
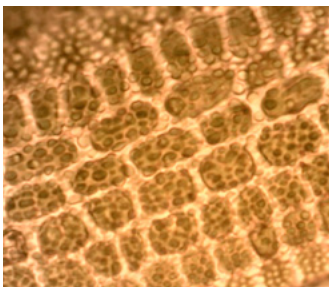
None of the species listed so far are especially rare in Victoria, but with the exception of the Palm Moss, they are very uncommon in the Wombat Forest and appear to be living on the edge of their range at this site. I found a similar example of plants living on the edge further north near my home in Drummond. Their story begins with another fern and ends with three mosses I have not previously found. These plants were living on the edge both figuratively and literally as they were clinging to tiny ledges on a near vertical rock face.

The fern is *Doodia australis*, the Common Rasp-fern and was found in a large hole in a rock face just above the stream level. It appears that the creek would occasionally backwash into the hole after heavy rain and the natural rock overhang reduces opportunity for evaporation thus keeping it moist for extended periods. There was very little light inside the hole but that did not appear to limit the fern and some natural seepage and runoff from the rock face adds to the moisture levels during an otherwise dry summer. The rasp-ferns resemble the water-ferns (Blechnum species) to which they are related, but they have spiky teeth along the margins of the pinnae on each frond. Their fertile fronds also clearly distinguish them as the water-ferns have highly modified fertile fronds with the sori forming a continuous band along each side of the mid vein while in rasp-ferns the sori are smaller and dotted in rows along the underside of the frond's pinnae. This is the only plant I have found anywhere in the district but it was collected by Willis in "rock crevices in the Lerderderg River Gorge" in 1963 and in a similar location by Beauglehole in 1959.

An examination of the smaller ledges and crevices of this four metre high rock wall uncovered a number of mosses that were new to me. The first of these, *Philonotis scabrifolia* was also located by Beauglehole in 1959 on the Lerderderg but there are no other collections for this district. Its distinctive blue colouring and dendroid (tree-like) branching make this a relatively easy species to identify. Its preferred habitat is wet rocks in gorges and by streams which fits with where I found it, but it appears that this rock is the only one wet enough along this particular creek.

Immediately next to it was *Bartramia robusta*, another species ideally suited to the conditions although this species is reasonably easy to find throughout the Wombat Forest. The third species was also very close by and as you would expect it also prefers rocks in moist gorges. It is not especially common but has been collected at





Top row – The rock face – the dark hole in the centre right is home to the fern
Second row – Common Rasp-fern at home
Third row – Common Rasp-fern sori on left and the Hard Water-fern *Blechnum wattsii* on right (still covered by a membrane)
Fouth row – *Philonotis scabrifolia* hugs the rock face, the dendroid habit can be seen on the brown (dead) stems from last year
Bottom row – The flattened spherical capsules of *Bartramia robusta* (left) are characteristic of the genus as are the lumpy cells (right) of *Amphidium tortuosum*

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Bryces Flat and along the Lerderderg River Gorge. It's name is *Amphidium tortuosum* and while the long narrow leaves are very distinctive, making it an easy plant to identify once you know it, its most interesting feature is the numerous bumps (papillae) covering the surface of each cell in the upper leaf. While it may be possible to see the papillae with a good quality hand lens, they are best seen under a microscope.

So what is the future for these edge dwellers? The Mt Wilson site is very steep and access is extremely difficult and this has no doubt deterred visitors and reduced disturbance. While the gorge habitat further north at Drummond is more accessible, few people know it exists also minimising disturbance. I will certainly keep an eye on both sites and will extend my search along both creeks in an effort to identify as much of the specialised flora as possible.

As edge dwellers however, they are very susceptible to any changes in climate or disturbances to the surrounding vegetation that, for example, exposes them to regular day long full sun. The absence of local records for these species does not necessarily indicate they are rare but is rather an indicator of the inadequate level of field work that has been undertaken to date. Our land managers and agencies rely on this field work for information and could easily decide that a particular location has little to offer by way of diversity or only has "poor quality" or "low standard" vegetation because the records do not tell them otherwise. The same land managers may then decide it is OK to burn or OK to mine or OK to widen the road. Mt Wilson has already been identified for a fuel reduction burn in 2015/16, however the available map is so deficient in detail, it is not possible to determine if this particular site will be impacted. When you are already living on the edge, such decisions can be disastrous. ■

Dangerous Burning Ambition

By Gayle Osborne

How can this be happening? Is the Wombat Forest being subject to extensive areas of prescribed burns to make up for targets on public land that cannot be met elsewhere in the state? Why is 10 – 15% of the Wombat to be burnt annually?

The Bushfires Royal Commission Implementation Monitor, Neil Comrie has questioned the effectiveness of these targets saying that, "working towards a pre-determined target may diminish the State's ability to focus on risk reduction in high risk areas."

Large tracts of Victoria's public land are being subject to planned burning without proper monitoring of the effects of these burns on biodiversity, or the effectiveness in relation to public safety.

While these targets are being sought, large areas of public land close to and abutting rural dwellings, frequently infested with inflammable weeds are being ignored. These areas represent a very high danger to life and property but require more effort than large burns away from towns. Targets based on area rather than on protective outcomes are flawed.

It is critically important that in this rush to be seen to be protecting life and property that we do not significantly change the landscape and endanger species and ecosystems.

The argument that fire is natural in our environment does not take into account that we are intervening at such a large scale and with such frequency. Nor does it recognise that many targeted remnants have greater significance as they now represent a much smaller fraction of the landscape. They are the final bastions supporting the preservation of the remaining biodiversity.

Environment, field naturalist and 'friends of' groups throughout the state have been submitting their concerns to the government. Local groups know their area well and are shocked when burns are planned in sites where endangered species are known to exist.

Statewide, large hollow bearing trees are being bulldozed from the sides of roads and burn boundary tracks. This practice seems to have been introduced to protect the burn crew from falling trees. We understand the need to provide a safe working environment for the burn crew, however for many years raking fuel from the base of hollow bearing trees, not igniting the burn at the base of these trees and patrolling with a water tanker has been reasonably effective.

We can only hope that eventually protection of biodiversity will be seen as a priority. ■

Mistletoe *(Loranthaceae)*

by Gayle Osborne

Good or bad? We see large areas of trees heavily infested with mistletoe and worry that it will kill the trees. However, we are generally unaware that this plant is ecologically very important and was recently designated an ecological keystone species.

Mistletoes are only semi-parasitic. The chlorophyll in their leaves means that mostly they can produce their own food. Their leaves are nutrient rich. They need a host to provide water, minerals and support.

At Ballarat University's "Biodiversity across Borders" conference I attended a fascinating lecture by Dr David Watson, ecologist, from Charles Sturt University, whose presentation was titled *"Of mistletoe and mechanisms; a resource bases approach to identify drivers of woodland biodiversity."*

David Watson explained that mistletoe infestations are a symptom, not a cause of a much bigger problem. We have cleared native vegetation and there are now less species such as possums, gliders and koalas as well as some butterfly larvae to keep mistletoe in check.

Mistletoe is both structurally and nutritionally important, providing shade and cover for nesting birds. They often flower in drought and in winter delivering nectar and pollen when other food sources are not available. The flowers are rich in sugar and carbohydrate affording food for very many bird and glider species.

The sticky seed is dispersed by the Mistletoebird *(Dicaeum hirundinaceum),* once eaten it passes quickly through the bird and adheres to a branch. The seed puts out tendrils and excretes enzymes to break through the bark layer.

David Watson is conducting a long-term research project part of which has measured the influence of mistletoe on bird diversity. The project involved removing all mistletoe plants from 17 sites and comparing the bird diversity with untreated sites. After three years, the sites with the mistletoe removed, on average lost "20.9 per cent of their total species richness, 26.5 per cent of woodland-dependent bird species and 34.8 per cent of their woodland-dependent residents."

The really interesting part of this research was the high loss of insect-eating birds and in particular the ground

Drooping Mistletoe *(Amyema pendula)*

foragers, such as robins, from the sites with mistletoe removal. "Mistletoe drops leaves, which are already high in nutrients, without loosing their nutrients, producing high quality litter, which in turn is rich in insects."

This research is focused on resources (e.g. mistletoe) as a way to understand distribution of plants and animals rather than habitat area, location or configuration.

It made me realise that we rarely see mistletoe in the Wombat Forest. The dense regrowth after logging is not ideal, as mistletoe needs sunlight. Mistletoe is also killed by fire and would have been affected by post-logging burns.

Last year I spotted a mistletoe plant on the edge of the Wombat Forest south of Blackwood. It was low on the tree and I was struck by the beauty of the flowers.

David considers that in undisturbed bush. "The more mistletoes present, the greater the resources available for native animals, making the plants an important indicator of the area's health."

Yet again, this raises the issue of prescribed burns. Mistletoe has not been considered as an important component of biodiversity in the Wombat, but this research indicates that we should be seeking the protection of the few examples in our forest. ■

Reference:

Mistletoe as a keystone resource: an experimental test.
David M. Watson and Matthew Herring (Royal Society Publishing)

Targeting the Wombat's Fungi

By Alison Pouliot

The Wombat Forest's fungal species are gradually becoming more familiar through the contribution of fungal records to Fungimap. Founded in 1995, Fungimap is a joint initiative of the Royal Botanic Gardens in Melbourne and the Field Naturalists Club of Victoria. It aims to improve knowledge of the ecology and distribution of Australian fungal species, as well as contribute to fungal conservation.

A major project of Fungimap is a mapping scheme that documents the whereabouts of easily recognisable 'target species'. Although accurate identification of many species relies on microscopic examination, target species have readily distinguishable features that can be seen with the naked eye or the help of a hand lens.

As there are so few mycologists in Australia, the project relies heavily on the volunteer effort of 'citizen scientists'. Several Wombat Forestcare members have been actively involved in this project.

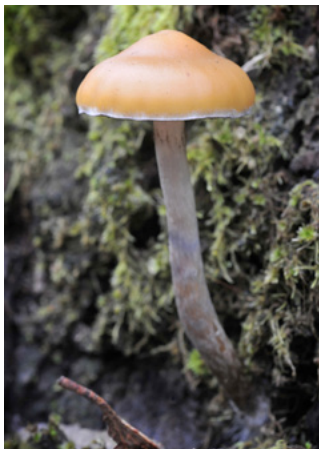
Fungimap has just achieved the amazing milestone of 100,000 records. The target species list is now being expanded and some of the new additions are shown here.

These new target species will be described in the upcoming second edition of the book, Fungi Dowunder. Several Fungimap target species are also included in Fungi of the Wombat Forest and Macedon Ranges guide (available through Wombat Forestcare).

To submit fungus distribution records or find out more about Australian fungi visit www.fungimap.org

As most Australian fungi are still yet to be named or described, you may just be the first to chance upon a new species in the Wombat! ■





Top row left – *Lentinellus tasmanicus*
Top row right – *Lactarius eucalypti*
Second row – *Cortinarius sinapicolor*
Third row left – *Psilocybe subaeruginosa*
Third row centre - *Macrolepiota clelandii*
Third row right - *Mycena cystidosa*
Bottom row left - *Marasmiellus affixus*
Bottom row right - *Hypholoma brunneum*
Photography © Alison Pouliot

The Koala - just hanging on...

Dave Mitchell, landscape ecologist and spatial analyst, from the Australian Koala Foundation spoke at our "You, Me and Biodiversity" June lecture. For over 25 years, this dedicated organisation has studied disease, genetics, habitat use, created the Koala Habitat Atlas (KHA), planning and management plans, landscape ecology and population studies. They also work at community empowerment and lobbying on behalf of koalas.

Dave had a lot of interesting things to say but mostly he is really worried. Thing are looking very bad for koalas.

With GIS mapping, statistical analysis and field data collection skills, Dave has produced a list of trees that constitute koala habitat throughout the koala's entire range. This work shows that in each ecological vegetation class (EVC), koalas need a complex range of tree types to survive. More extreme hot weather and related heat problems also effect koalas. Add this to a poor diet, disease and predation... inevitably extinction follows.

In Southern Queensland where koala habitat is so often used for development, a great deal of effort and money has been spent to help koalas. But their allocated new home will often not have that special mix of trees so essential for their survival. Inevitably the misplaced koalas wander around in search of their required tree types and are attacked by dogs or struck by vehicles.

The tree groups koalas need can now be identified for your area. ■ **https://www.savethekoala.com**

Barking Owl Rescue

This gorgeous young Barking Owl had a close encounter.

As Margaret from Carlsruhe was driving home one evening in a stream of traffic with oncoming cars, she noticed something on the double white lines. As soon as she could safely stop she located the object, took off her cardigan, threw it over the creature and bundled it onto the backseat of her car.

Not even sure at first what she had collected or whether it was injured she was delighted when unperturbed, an owl stared at her with beautiful big eyes. At home, waiting for a wildlife carer, the owl fell asleep in her arms.

Margaret wonders why other people did not stop and hopes the publication of this article will alert people to the possibility of wildlife on roads.

Barking Owls (*Ninox connivens connivens*) are listed as Endangered in Victoria and it is estimated that there may be fewer than 50 pairs in Victoria. They inhabit woodlands and forest edges, preferring the moister riparian and wetland areas. As with many native species they need hollows for breeding.

Thanks to Margaret's quick response we have not decreased the endangered population by one. ■

Wombat Forestcare Membership

Wombat Forestcare Inc. is dedicated to preserving the biodiversity and amenity of the Wombat State Forest by utilising the skills and resources of the community. By becoming a member you will have input into our activities and projects, and give support to caring for our forests.
For memberships and further information contact Gayle Osborne, phone 03 5348 7558 or email info@wombatforestcare.org.au
Membership fees are only $15 single and $20 family. **Visit our website - www.wombatforestcare.org.au**