



Chapter 1
An introduction to entangled worlds

Low mists span the hills of Victoria's Great Dividing Range. The crops are now harvested and surpluses pickled and bottled. A handful of remaining wildflowers flash their last blooms of colour. Slipping through the slanting light of the Wombat Forest, our senses awaken to the change of seasons. Autumn. All is subtly muted, softened. Dampness subdues the usual crack of sticks and leaf litter underfoot. Birdcall and the buzz of insects diminish with the cooling air. And it smells different. Distinctively different. At first it seems the forest is winding down for the winter. However, something stirs beneath the leaf litter, beneath the soil. With extraordinary reproductive zeal, fungi reveal their whereabouts as their sporebodies push through the forest floor. We have come to meet with mushrooms.¹

'Look!' exclaims Angelica, my five-year-old companion. We squat down beside a *Russula*. Vermillion red, its cap maps tiny peregrinations – slid, rasped and bitten through by unknown wayfarers. Each trail traces a tiny journey in search of shelter or food. Angelica flips onto her stomach and peers under its cap. 'Look!' she exclaims again, pinching off a slug with her fingers, its stalked eyes rapidly contracting. I open my field guide. There are at least a dozen reddish russulas. Angelica examines the images, sliding a slug-slimed finger across each. 'Nup, it's none of 'em', she asserts dismissively and continues prodding the slug. I ask her how she can be so sure. She shoots me a pitying look then explains how none has a slug or the same pattern of holes. She is right. The field guide meticulously illustrates idealised specimens, depicting morphological features for identification. But each is also an isolated entity, concealing larger stories of interactions with unseen creatures, of connecting ecosystems, underpinning the forest's existence, our existence, life.



This is an inquiry into fungi. Into people. Fungi and people. Kingdoms, ecosystems, landscapes, underworlds. It focuses less on individual species and more on relationships. Between fungi and fungi. Fungi and plants. Fungi and animals including *Homo sapiens*. Fungi and soil. Fungi and life. Complex entanglements, interrelations, circulations. In particular, I explore the histories that shape the ways fungi are understood and valued. Over the years, I have interacted with people who interact with fungi, including mycologists (those who study the science of fungi) and mycophagists (those who eat fungi), farmers and field naturalists, aesthetes and artists, conservationists and rangers, and those who seek fungi for reasons beyond food or science. Through their impressions of the natural and cultural histories of fungi, I have sought to understand why these organisms are regarded so differently from other forms of life. My hope is to provide a stimulus for the more appropriate inclusion of fungi within the bigger picture of nature, biodiversity and conservation. A more fungal way of thinking might even awaken a new ecological consciousness to enrich the ways we interact with the natural world.

The extraordinary lives of fungi are explored through a collection of voices in anecdotes, histories and science gleaned across the world and across societies. Their accounts come alive through direct engagement with fungi in their habitats – forests, woodlands, grasslands, deserts, backyards and unexpected places. I have tried to reflect fungi in their various guises,

not just to classify them, but also to convey their lyrical essence. In doing so I hope to inform and inspire care, so that to exclude fungi from concepts of nature or conservation might seem as perverse to the reader as it did to me, motivating me to write this account.

Beyond mushrooms to mycelium

Without fungi, life is radically diminished. Fungi regulate the biosphere and support Earth's ecological functioning. Yet the exceptionally few mushrooms with the capacity to dismantle human livers or kidneys are the ones deemed worthy of attention by a spectacle-obsessed press. This is most apparent in the English-speaking world. Shark attacks sell newspapers splendidly, but once the swimming season ends, any notion of gently easing into autumn is quickly expunged by lethal fungal substitutes: 'Killer mushrooms invade picnic spots'; 'Potential killers stalk Victoria's fields'; 'Wild fungi death trap'; 'Beware the killer mushrooms', warn the Australian newspapers. Forget sharks and brace yourself for survival on this threateningly fungal continent. Fungi are seldom considered newsworthy within spheres of human concern except, it seems, when intentionally stalking their human victims.

English language speakers' common aversion to fungi has long been recognised. Negative portrayals of fungi arise not only through public ignorance and misunderstanding, but also through the scientific focus on their destructive ability. This is unsurprising given the potential of fungi to wreak havoc on crops and bodies, albeit usually in direct response to poor human management. Such ways of thinking about fungi overshadow their many values and human dependence on their existence. In 1957, the controversial ethnomycologist (a person who studies the human use of fungi) Robert Wasson popularised the terms 'mycophilia' and 'mycophobia', referring to the love and fear of fungi. Although Australia's sparse mycological history and negative press portrayals of fungi are typical of English-speaking nations, attitudes to fungi today might not be as polarised as Wasson supposed. As interest grows in both fungal ecology and foraging for edible mushrooms, Australia is shifting from a traditionally mycophobic position towards a greater spectrum of attitudes. It is an exciting transitional time, although there is still a good way to go until fungi are appreciated as a vital part of life. But just for a moment, imagine how things could have been different for fungi, as well as for *Homo sapiens*.

Had biology taken another route to understanding nature – a route that valued interactions as much as individual identities – the living world might have been perceived in an entirely other way. Darwin's oft-quoted description of foliage on his 'tangled bank' in the concluding paragraph of *On the Origin of Species* (1859) acknowledged the inherent interdependency of species. Whether metaphorical or real, his tangled bank could be considered as an early precursor to the concept of 'ecosystems' coined by British botanist Arthur Roy Clapham in the early 1930s. The idea of interdependencies between organisms is not new, and less formulated concepts go back more than two millennia to Theophrastus. However, the human need to define boundaries is the premise of hierarchical taxonomic schemes of classification and is fundamental to the way many people think. Consequently, the autonomy of species had more sway than ideas about interactions and set the foundations for the path of biology. However, imagine opening a biology textbook, or say a gardening

book, and there on the first page loomed an enticing illustration of a mycelium as the archetype of the living organism. If fungi were considered as representational of biology, current concepts of nature might be very different. Such an approach begins with recognising nature as systems of relations, rather than being premised on separation and cataloguing. It acknowledges the fluid nature of life processes. Thinking of mycelia as the biological prototype advances the idea of Natural Selection underpinned by competition, to one that includes cooperation and complementation as ways of understanding interactions. This way of thinking helps shift limited conceptions of fungi as isolated sporebodies or species, to the sophisticated and cooperative biological collective of mycelia. Consider the organisational and communication networks of human societies that course beneath the soil – the fibre optics of the Internet, electrical cables, sewerage systems, train networks and tunnel roads. It becomes startlingly obvious how they mirror mycelia. As human threats push species to extinction, the need to better understand relationships and processes might override Linnaean routines for naming.

Although many scientists advocate the significance of symbioses, the biological autonomy of species still governs much scientific thinking, research funding and conservation. To define something *only* by its identity risks underestimating its interrelations. As long as we reduce organisms to ‘objects’ or ‘bounded entities’ we are prone to thinking about them as ‘things’ rather than in the context of their processes. Mycology (the scientific study of fungi) has revealed the staggering diversity and complexities of fungi, but less attention has been given to mycelial fungi as living systems. This is not an attack on mycology and its revelations, but a call towards the depth and mystery of the fungal kingdom. Returning to the forest floor, I am not suggesting we throw away our field guides. Recognising something as different and being able to name it imbues it with meaning and significance. It is not possible to refer to what a fungus *is* without identifying it and categorising it in some way, to differentiate it from another fungus, or a numbat. I simply ask why identity has historically overshadowed relationships and processes and show how it perpetuates limited ideas about nature. Rethinking fungi involves a switch from regarding a sporebody as a thing, subject to naming, plucking or representation, to acknowledging interactive processes. Ideas about the fluidity of nature abound in the thinking of many indigenous cultures including those of Aboriginal Australians. The concept of ‘Country’, for example, recognises this continuity. Country is multidimensional, representing more than species, land or water. It has future and past, exists in and through time. It is life. Country is an all-embracing notion of belonging, being owned by place and connection. Aboriginal ideas of animals as part of kin, rather than as taxonomic species, upend European approaches to biodiversity conservation that rely on defining individual species.

Mushrooms provide an obvious tangible link to humanity. However, the bigger fungal picture unfolds in the dynamism of their mycelia. Mycelia are characteristically connective, versatile, complex, heterogeneous, changeable and resilient. Mycelia, rather than just sporebodies, offer a compelling framework to contemplate the full potential of fungi. Most plants rely on mutually beneficial symbioses with fungi for their survival. This tangle of relationships is central to life and evolution, not an alternative or secondary strategy.

Although symbioses were long considered an anomaly, they are now regarded as foundational and a general mechanism of evolutionary innovation. Or perhaps think of it this way – what organism do you know of that lives in isolation from others? Despite our need to separate and categorise, organisms are not autonomous. Life is symbiotic.

Thinking, *un*-thinking, *re*-thinking fungi

I do not recall eating mushrooms in my Australian childhood. I am not sure why they never appeared on my dinner plate, but suspect they were too ‘foreign’ or ‘undefinable’ for my mother to contemplate buying. They were not meat, and they were not quite vegetable and she was certainly not about to go digging for them in the dirt. The fact is, it had never actually occurred to me to eat them. I had seen the benign and insipid mushrooms (*Agaricus bisporus*) in the supermarket but somehow never linked them with the incredible representations of fungal life in the bush. I knew neither was animal or vegetable, but the similarity between the supermarket mushrooms and those in the bush ended there. Those in the wild were life forms of sheer beauty and bizarreness. Their aesthetics intensified my curiosity. I wanted to know why they looked like they did and what they were doing.

My most immediate concern was that I had no idea how to walk in the bush. I was terrified of treading on things. Every footstep crushed stuff; tiny lichens and mushrooms, mosses and sundews, spiders sleeping inside curled leaves. There was no space to tread. How heavy did I need to be before the fungal webs of mycelia beneath the leaf litter would be destroyed? What was blatantly obvious even to a child’s mind – or perhaps because I had a child’s mind – was that everything in the bush was connected. Connectivities were more obvious than the distinctiveness of things. Clambering about in the bush triggered a lifelong urge to document these unseen microcosms in the hope they might not get trodden on and their connections severed. In this book I aim to present a more inclusive concept of fungi by proposing a shift in thinking – from thinking of sporebodies as discrete entities, to considering fungi as sophisticated entangled systems. I also propose a challenge for their inclusion within what is valued. I see it as a transition from thinking about fungi (inserting them in human consciousness) to *un*-thinking fungi (in the limited ways they have been perceived historically) to *re*-thinking fungi (within broader contexts and dimensions).

The fungal folk (as I am calling the people who have special relations with fungi) I have met offer insights from diverse cultural backgrounds to consider fungi in different ways. While more people care about fungi in Australia today than historically, fungi remain largely absent from an ecological awareness that includes other life forms. Conservation in Australia has mostly attempted to manage nature through a command-and-control approach, rather than acknowledging and protecting its inherent connectedness. A growing environmental awareness and concern in the 1970s saw the rise of an ecological consciousness along with the establishment of more national parks. It was during this time that fungi also penetrated the remote edges of public awareness. Given the ubiquity and ecological significance of fungi, almost all environmental issues involve them. Declining air, water and soil quality, species extinction, catastrophic fire and the overarching issue of climate change all affect fungi, but the effects are seldom noticed or documented. As fungi operate on slow timescales

in invisible realms, they are especially prone to changes and impacts that slip below the radar, unnoticed and unmonitored. If a fungus species or a thousand fungus species succumb to extinction in the subterrains of the soil, would anybody notice? I suspect only a few, and only then if the fungi were known in the first place.

The lack of acknowledgement of fungi in Australian environmental management and biodiversity conservation is my starting point. To be endowed with chlorophyll or a backbone is to be deemed charismatic. Such organisms have historically been the focus of conservation. In recent decades conservation shifted from species to ecosystem and landscape scales that integrate functions, processes and interactions. However, the ambiguity of concepts such as ‘biodiversity’ mean that all groups of organisms require representative flagships and dedicated advocates. Red Lists (inventories of the conservation status of species) have helped prioritise conservation efforts. The Red-listing of fungi has been crucial to their inclusion in European conservation. The near absence of fungi on Australian Red List equivalents partly explains their exclusion from Australian biodiversity conservation. However, the conservation dimension of this book is not a plea to squeeze another group onto lists of species to conserve. It is not a manual on how to save the fungus kingdom. There are no dot-point lists of recommendations or policy guidelines. First we need to ask what saving fungi means, as well as the implications of not saving them. It begins with examining human–fungus relationships. This means understanding their history of exclusion from what is valued and questioning the frames of reference that shape how we think about the natural world. It means considering fungi in larger contexts as the connective tissue of terrestrial life. It means re-envisaging the hierarchical and polarising histories that have led to the radically degraded environment in which we now find ourselves. My approach is simply a return to the dirt, to the senses and to fungus–human interactions, as a way to confront these challenges in the hope we might remember that we are part of the one ecology.

‘Can I eat it?’ ask foragers with predictable regularity. ‘What do fungi do for the community?’ asked a sceptical Canberra politician, as if admonishing them for their absence from the community sausage sizzle. ‘How can fungi increase my crop yields?’ asked a Queensland farmer. Exploring the tensions in considering how people use fungi, while not reducing them only to their usefulness to humans, fosters more imaginative ways of regarding them. ‘Mushrooms there are, such as the *clathrus cancellatus* [sic], so strange of line and hue that he who for the first time sees them is struck incredulous: can such things really be?’ asked Gordon Wasson and his wife Valentina in 1957.² Can such things really be? Can we not just let them be and value them for just *being*? Might we just for a moment contemplate the possibility of being ‘struck incredulous’, to rediscover a sense of wonder in the extraordinariness of fungal lives?

Fungal places – from Down Under to the Swiss Alps

Australia is a fungal utopia. Tens of millions of years of isolation from other landmasses has fashioned a distinctive mycota (fungi of a particular location). The size of the continent along with its variable climate, countless fungal habitats and partners all contribute to its megadiversity. Fungal mycelia pervade soils. Fungus spores are omnipresent in air, water and

human bodies, shaping environments as much as environments shape fungi. The fungi and fungal folk I have encountered emanate from a great diversity of habitats, mostly from the bush, the outback and the ‘end of the world’. The bush and the outback are in Australia. While neither appears on maps, the outback usually lies beyond the bush, both being comparatively remote from urban areas. However, rich and extensive cultural histories of fungi from elsewhere provided me with new insights for thinking about Australian fungi in other ways. So off I went to the ‘end of the world’, which is in the middle of Europe, although I imagine there are other ends elsewhere. It is only about 25 minutes away according to the yellow sign on the track marked End der Welt in the Swiss Jura mountain range. However, in reality, getting to the end of the world always takes much longer. The 25-minute timing is determined with Swiss temporal precision, based on a formula of walking at exactly 4 km per hour and calibrated accordingly for gradient changes. This timing, of course, predicts the prompt arrival at the destination End der Welt. It is not about pausing to marvel at the expanding ring of giant cloud funnels (*Clitocybe nebularis*) or be amused by the gang of grey shags (*Coprinus cinereus*) rolling up their inky caps and exposing their spore-laden lamellae to the world. It does not allow for an idle conversation with foragers scouting in the undergrowth for golden chanterelles (*Cantharellus cibarius*) or penny buns (*Boletus edulis*), let alone to build a fire and sample the bounty. In the fast-forward fury of modern times, serendipitous encounters while slowly ambling to the end of the world allowed time for illuminating interactions. Beyond the end of the world, I sought fungi and fungal folk across the Swiss Alps, dropping down into the northern Italian larch and chestnut forests; across to ancient oaks in the French Jura; along the Turkish Turquoise Coast, over to England’s Yorkshire Moors and Scotland’s windswept Hebridean islands; and among the lichen-speckled boulders of the Swedish High Coast.

Mycogeography – the study of the distribution of fungi – lags behind the biogeographic study of many other groups of organisms. Fungi comprise part of the very fabric of the Earth, including its watery and gaseous components, and their distribution is determined by myriad environmental and climatic influences. Australia is yet to be comprehensively surveyed for fungi, with fungus distribution maps still reflecting surveyor distributions as much as those of fungi, although this is changing as maps get dottier with recent finds. Geographical concepts usually refer to the surfaces of places and most Australian fungus surveys are based on the surface distributions of fungus sporebodies. Survey techniques are changing as molecular analyses of mycelia become more accessible and affordable. However, such maps currently represent distribution of fungus sporebodies, not fungi, as the true geography of fungi exists below the soil surface. In occupying an underground geography, fungi therefore inhabit even less known and less mapped geographies than many other organisms. This is further exaggerated in a country shaped by age and isolation, nutrient-poor soils, drought and fire, where, in response to such extremes, many fungi have adopted an ingenious fruiting response – their truffle-like sporebodies remain underground, in the safe comfort of the soil, away from desiccating winds and climatic extremes. When not just their mycelia, but also their sporebodies are hidden underground, the potential vastness of this kingdom becomes acutely apparent, along with the challenges of mapping the margins.

Underground truffle-like fungi evolved in many different evolutionary lineages and are considered to be among the most advanced fungi, activating a whole other timescale from an evolutionary perspective. Australia is, in fact, thought to be the evolutionary centre of the world for truffle-like fungi, although trying to convince the French of this is probably futile.

Choosing the scale at which to study organisms is a trade-off between detail and context. While this book spans geological and human timescales, it focuses on comparatively recent history, particularly the last few decades during which fungi have slowly infiltrated public awareness in Australia. It also crosses various spatial scales from the intimate to the infinite, but operates mostly over areas that I can traverse in a day, stopping, of course, to meet fungi and fungal folk along the way. Fungal biological processes operate at multiple scales. Comprehending geological scales of fungal origins (possibly 500 million years ago) is giddy. Even contemplating individual fungi whose lifetimes might be 20 or 30 times longer than ours requires a decent dose of imagination. Fungal timescales are imprecise, but fungi sit even less comfortably in concepts of spatial scale. For example, an unearthed plant clearly reveals its entirety: its leaves, flowers, stem and roots. Likewise, animals are spatially bounded. However, such physical boundaries are less apparent with fungi. Moreover, unlike many plants and animals, they are not neatly contained by defined home ranges or territories or other discernable confines. This scalar ambiguity of fungi complicates choices of scale with which to understand them. We can hold sporebodies in our hands, but mycelium is almost always unseen without magnification. Humans interact with fungi at different scales. The intricacies of taxonomy require mycologists to work at the microscopic, often single-cell scale, some zooming in more closely to the genetic scale of molecular sequences. Foragers in Australia roam at a pine plantation-sized scale. Fungus conservationists operate on various habitat scales. Those working with global fungus Red Lists assess species extinction risk at an international scale. The opportunity to switch between scales offers a great sweep of insights and perspectives. On a practical level, size is a convenient way to differentiate fungi. Macrofungi are those that produce sporebodies visible to the human eye. Microfungi are microscopic. While the destructive capacity of microfungi such as smuts and rusts has been a focus of mycological research, I concentrate on those fungi that might be perceived through a range of senses on a forest stroll, unencumbered by a microscope.

Seeking fungi

People seek fungi for various reasons. There are those who forage (seek edible fungi) and those who foray (seek fungi of scientific interest). Mycologists study the ecological and evolutionary significance of fungi to situate them within larger schemes of life. Naturalists make lists of species to understand fungal ecology and geography, or to test identification skills. Farmers tend to care less about names or lists and want to know what fungi do in soils. For fungal aesthetes, form and colour are the focus. A growing band of foragers seeks edible species. Then there are those who target fungi for extermination, should they have the gall to spring forth on their neatly manicured lawns or putting greens.

Particular fungi have repeatedly captured public attention in Australia. Species such as the anemone stinkhorn (*Aseroë rubra*), ghost fungus (*Omphalotus nidiformis*), death cap (*Amanita phalloides*), saffron milk cap (*Lactarius deliciosus*), salmon gum mushroom (*Phlebopus*

marginatus) and the dark vegetable caterpillar (*Cordyceps gunnii*) recur in written records throughout history because of their conspicuous characteristics or cultural resonances. Each possesses particular qualities such as toxicity, luminosity, palatability, strange habits, or other physiological or morphological peculiarities that separate them from the fungal crowd. Although they are often unnamed in historic accounts, given the rarity of traits such as luminosity, much can be surmised about a species' identity. While scientific literature provides most information on the mycology of fungi, newspapers give an historical impression of which fungi were present in public consciousness. Over time, previously unmentioned species gradually began to appear in the newspaper press. These 'new' species might indicate the arrival of exotic species in Australia such as the death cap, or newfound cultural significances such as the edibility of the saffron milk cap, or increased awareness of fungal diversity in the noticing of less conspicuous species. Rather than condense all the known information about these fungus species in one place as one would find in a typical field guide, fragments of information about particular species are successively revealed so as to situate them within different frameworks of significance as they arise within a particular theme. In doing so, I hope these fungal characters move beyond being merely 'taxonomic specimens'.

In speaking of Australians' relationship with the landscape in 1961, Australian poet and environmentalist Judith Wright commented:

Australia is still, for us, not a country but a state of mind. We do not speak from within, but from outside. From a state of mind that describes rather than expresses its surroundings or from a state of mind that imposes itself upon rather than lives through landscape and event.³

Understanding fungi involves getting into the dirt, 'living through' rather than 'imposing upon' the landscape, going into it deeply, tuning into its subtleties and nuances, participating directly. In my experience, the most illuminating interactions with fungal folk always occur in the field. The field is where conversations are most animated and perceptive. People express their attitudes to fungi in diverse ways. Some are demonstrative and some are secretive. Some become childlike in expressing the discovery of a newfound passion. Others enjoy the power of holding fungal knowledge. There are those who are simply glad to meet someone interested in their obscure corner of mycological research. Perceptions of fungi are often relatively benign, with fungi regarded as largely irrelevant to people's lives. Others display obvious repulsion, relaying powerful images of disgust. Many struggle to find any context for fungi beyond food or disease. The very occasional, usually European, person expresses what could only be described as a visceral bond with fungi. Understanding fungi means being able to talk about them and some people never stop! Foraging stories are often held as dear as the forage itself. As with fishing stories, it is in the telling that fungi take on another level of significance and meaning. In a data-choked world, stories are what people remember. Fungi make good stories because of their bizarreness, elusiveness and the plots humans embed in their being. Fungi thrive on storytelling and people inhabit those stories.

However, the most telling information about people's attitudes to fungi is unspoken. It is in the physical gestures and facial expressions, pauses and hesitations, the way someone moves through the forest, whether they handle fungi, and if so whether with care, caution or

disdain. So much is apparent in the expressions on faces when viewing a fungus up close through a hand lens and then what they do with the fungus once examined; in how fastidiously they wash their hands afterwards, or if they just nonchalantly wipe them on their jeans. The ways in which scientific collectors wield specimens also speak volumes about how fungi and the forest are regarded. Such details about people's fungal interactions are often written out of scientific accounts committed to objectivity.

What's inside?

Having introduced fungi, fungal folk and the purpose and path of this book, the second chapter delves deeper into the extraordinary manifestations of fungus sporebodies. It begins in Southern Tasmania in 1792 with French naturalist Jacques Labillardière, who made the first scientific description of an Australian fungus species, the striking anemone stinkhorn. This perplexing fungus provides a rich starting point to unravel the great array of perceptions and attitudes that fungi evoke. From here, we dart among the multitude of fungus forms, exploring their complexities and curiosities. The ingenuity of the 'biological umbrella' that characterises the mushroom form is introduced through the iconic fly agaric (*Amanita muscaria*), the world's most depicted and mythologised species. Other less familiar fungus forms, from goblets to lattice balls, are examined through the inventiveness of their spore-dispersal mechanisms. Such forms broaden popular conceptions of what constitutes a fungus sporebody. What exactly are fungi doing there on and under the forest floor? In providing clues to the secrets of their success, we trawl back through geological time to contemplate the ancient symbioses that are lichens. However, the idea of organisms in mutual existence did not sit well within nineteenth century scientific circles and the proponents of symbioses fought embittered battles to advance a theory that contradicted Linnaean biological autonomy.

Chapter 3 explores some of the places where fungi grow, beginning in the blistering sands of the Australian desert. It focuses particularly on the subterranean and hidden nature of fungi and how this confounds ideas about fungal habitats and human notions of 'place'. Displaced fungi and dichotomies of 'native and exotic' species translate differently across cultures and we explore this through various translocated species. Organisms that occupy the margins of the subterranean, taxonomic categories and human awareness can perhaps be better understood in context of their processes, rather than being reduced to static 'things'. We then venture into more objectionable fungal places – dirt, litter and dung – as literal and allegorical barriers to connecting with fungi. Diving deep into the faecal depths of a solitary cow pat high in the Swiss Alps, the volatile politics of coprophilous (dung-loving) cohabitation, cooperation and competition are shaken and stirred.

Every discipline has its own specialist lexicon as well as its jargon. Mycology has escaped neither. I have tried, wherever possible, to avoid mycological terminology while being careful to maintain scientific resolution and meaning. Where necessary for clarity, specialist terms and concepts are introduced in the context of the themes in which they arise, rather than confronting the reader with a barrage of contextless terms from the start. Chapter 4 examines the development of language around fungi and how it profoundly affects the ways in which they are perceived. From Linnaeus' dismissal of fungi as thievish and voracious beggars to the

use of ‘mushrooming’ as a verb of condescension, we explore how the degradation of mushrooms by derogatory monikers contributes to their disregard. In the battle to find words to describe sensory perceptions of fungi, metaphors and similes offer fascinating insights into cultural differences and similarities that help us to understand them.

Chapter 5 finds us at the kitchen table of potato farmer, Dorothy Hunter, in the Victorian Central Highlands, where saffron milk caps threaten to discolour the laminex. Dorothy has spent more time digging in the dirt than most and has very particular thoughts about which mushrooms are worthy of consideration and which find themselves kicked across the paddock at the end of her ancient gumboot. What are the origins of fungal ambivalence and fear? Clues are revealed in the foreignness, obscurity and ephemerality of fungi, in their toxicity and other associations embedded in the myths and witchcraft that taint their reputation. As with other organisms cast to the bottom of the hierarchy and inferiorised as ‘other’, we examine ways of thinking that have marginalised fungi and entrenched their invisibility.

Mycology in Australia is inherently taxonomic. Without the taxonomic revelations of the last 150 years, science would be largely ignorant of the fungal riches of the Australian continent. Part of knowing is the act of naming. Scientists could not communicate ideas without the universal currency of Linnaean binomial nomenclature that theoretically transcends language and culture. Chapter 6 revolves around the question of how best to order life. It investigates the nomenclature and measures used by mycologists and other scientists to identify and categorise organisms. DNA sequencing has revolutionised taxonomic mycology and accelerated access to a previously only imaginable wealth of fungal life. The zeal to classify has driven mycology, but how is this need for names and order apprehended by those beyond the scientific community? How are the ways that fungi are perceived via the senses affected by their representation by numbers and sequences? This leads us to an exploration of the many ways of ‘knowing’ fungi.

Returning to the dirt, Chapter 7 asks what it means to ‘know nature’, to ‘know fungi’. It expands on traditional orthodoxies in the ways knowledge is produced and asks whether fungal knowledge could be enriched through greater focus on relationships and processes. I examine other fungal knowledge-making processes that could allow for a more accessible and inclusive understanding of fungi and fungus–human relationships. We take a trip to the dusty plains of northern Victoria and meet with Judy Crocker, Howard Hepburn and a bunch of flannelette-shirted farmers to get their take on fungi. We also fossick among the scant ethnomycological records in Australia to discover what is known about Aboriginal understanding of fungi. This takes us to the Mandurama scrub of New South Wales with Wiradjuri custodians to search further for Aboriginal traces of knowledge about fungi.

Extending ideas about fungal knowledge from the previous chapter, the eighth chapter is firmly in the field with foragers and forayers. It investigates the various motivations that lead some people to forage and others to foray and asks whether they regard fungi differently. While forayers and foragers occupy separate camps in Australia today, this was not always the case. In some European countries such as Sweden, forager-forayers wander through the forest with a specimen collection box under one arm and a basket brimming with tasty

chanterelles under the other. Among the moss and mushrooms we delve into the cultural divides and ideologies, the different reasons for collecting fungi and how relationships with fungi develop in different places over time. From the Kooyoorra State Park in northern Victoria to the Italian Piedmont, the ways in which foragers negotiate their contested terrains is told directly through their many varied voices.

The final chapter asks about the ways in which fungi are valued and why it might be worth conserving them. It begins with examining current approaches to fungal conservation in a rapidly changing world, questioning whether existing paradigms such as biodiversity and Red Lists are the only possibility for the kingdom that is neither plant nor animal. This means asking how old questions might be newly inflected to bring together knowledge and ethics. Drawing on progressive conservation initiatives in Australia and Scandinavian countries, I ask how we could progress beyond strategies and management plans to more active conservation. How might we rediscover an ‘attentiveness to things’ (like fungal ‘things’) that Henry David Thoreau but also more recently Australian writers like Judith Wright, Val Plumwood and David Malouf urge us to rekindle? In a time of rapid environmental change, we might want to reconsider how nature is evaluated, to move beyond the economic sense of a price placed on nature in service of a profit imperative. This means examining whether ethical solutions to environmental issues can be included within concepts such as biodiversity, and exploring paradigms that could enrich our thinking about life with fungi.



I pen these words in the sunny garden of a friend’s house in Vesancy, France. Formerly a chateau, it was reputedly frequented by Antoine de Saint-Exupéry, author of *The Little Prince*, whose open-minded inquisitiveness resonates with ways to contemplate fungi. Before retiring to the attic the previous evening, we feasted on a grand selection of Camembert, Gruyère and Roquefort cheeses accompanied by crusty baguettes and local wine from dusty bottles. This immensely pleasurable experience would not have been possible without the work of fungi whose actions contributed to our feast and spared me the *escargot*. Fungi can also spoil the fun and flair of the feast along with the forgotten food in the fridge. The nectarines that had rolled to the back corner sprouted whiskers. Had we been here a few centuries earlier, the effects of ergot contamination of our baguettes might have had us convulsing uncontrollably in psychosis. Fortunately, we survived these fungal perils to sing the praises of their more agreeable actions and to embrace another day foraging for fungi in the forests.