

EarthSong

ECOLOGY, SPIRITUALITY AND EDUCATION

VOLUME 3 ISSUE 1, SPRING 2015



Stardust

Down to Earth: the answer lies in the soil

Soils of the Liverpool Plains



Soils Alive!

UNEARTHING

A FORAY INTO FUNGAL UNDERWORLDS

Alison Pouliot

FEATURE

One of the wonders of a walk in the bush, or even at times in suburbia, is the vast array of fungi in such a variety of shapes and colours. These often small beings work away at their tasks on fallen logs, between rocks, up tree trunks and any corner where there is some moisture and a host to participate in Earth's continuous recycling processes. The article engages us in a journey of wonder into their world.

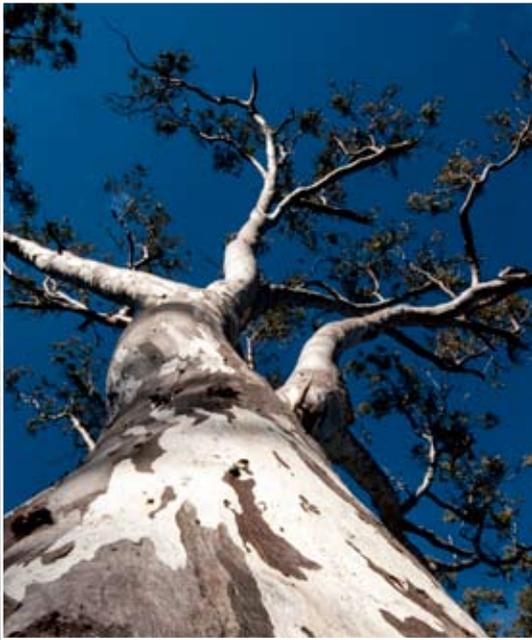
PLUNGE MY HAND into the hollow interior of a rotting log. Centipedes scuttle out tailed by a scrambling procession of spineless inhabitants. I'm witnessing something that should make the hearts of every farmer and gardener sing – the creation of soil. Pedogenesis. Soil evolution.

An alliance of industrious and mostly unseen organisms – bacteria, invertebrates and fungi – all toil away to deconstruct their woody dwelling. On this old and eroded continent, blown clean of most of its topsoil, witnessing soil in the making inspires new ways of imagining and conceiving the preciousness of this resource. As the foundation of life, soil embodies the dynamic nourishing and flourishing of the teeming unseen, in which life also ends. It is the most biologically diverse and intensely productive part of almost every terrestrial ecosystem, the 'interface between geology and biology, the bridge between the dead world of rock and the bustling realm of life'.¹ Soil shelters the intimate interconnectivities of these organisms whose actions support the biosphere. Soil maintains hydrological cycles, sequesters carbon and stabilises

climate. It filters, absorbs, buffers and stores, making life possible on earth. Its inhabitants add to the organic layer, catalyse chemical reactions, recycle nutrients, structure soil, fix atmospheric nitrogen, regulate water, suppress disease and collectively underpin the overall health, fertility and productivity of the soil. In this article I delve into the soil-making processes of a seldom considered group of organisms – the Kingdom Fungi.

Fungi enter the consciousness of those attuned to their existence mostly via the sexual expressions of their being. Fungal fruitbodies manifest in the familiar forms of mushrooms, but also in curious configurations shaped like brains, antlers, corals, phalluses and goblets. The imperative to reproduce through the production and dispersal of spores compels the evolution of these diverse morphological forms,

Every eucalypt relies on subterranean relationship with fungi to maintain its vigour and vitality.



Fungi underpin soils enabling forests to flourish.

Fungal mycelium creeps through the litter, secreting enzymes that break it down.



underpinning the success of fungi as some of the oldest (500+mya) and most ubiquitous organisms on earth. Fungal fruitbodies have also alerted us to the otherwise largely inconspicuous existence of underground mycelia. As one ascends from their often-flamboyant sexual expression into the subterrain, fungi become even more astonishingly arcane. Mycelia in all their vast literal and metaphorical manifestations arguably eclipse their albeit remarkable reproductive structures. Mycelia provide a tapestry of interconnectivity between soils, organisms, kingdoms and systems across scales of time and space. It is also mycelia that perpetuate our own evolution and existence as a nexus of connectivity, communication, life and death.

Fungi occupy this transitional continuum between life and death, as architects of both, constantly transforming and configuring their environments. That we commonly treat soils like dirt implies a gross misunderstanding of the role of fungi in terrestrial ecosystems. Fungi maintain soils by providing soil architecture through expansive scaffolds of mycelia. These mycelial

scaffolds bind soils and aerate them by creating spaces between soil particles, allowing the slow and gentle percolation of water. The significance of fungi in soils becomes even more apparent when one examines their 'modes of existence'. Fungi have evolved essentially two trophic modes or ways of nourishing themselves – they either rot stuff or muster the help of others. The lichens epitomise the latter, but other fungi also engage various symbiotic strategies. Along with bacteria and invertebrates, fungi are major decomposers or recyclers of organic matter. They are known as saprobes. Most fungi are saprobes and have been deconstructing the planet for a good half billion years.² Through the external digestion of primeval landscapes fungi provided the first soils for colonisation by other organisms. While fungi can degrade pretty much any organic material containing carbon, among the two most significant are cellulose and lignin. Together they form the major structural and strengthening components of wood. Bacteria and invertebrates also contribute to decomposition processes, but only fungi can

deconstruct lignin. As wood is the most widespread substrate on the planet, it is fortuitous that organisms are available to degrade it, release locked up energy and perpetuate cycles of life.³ Every leaf and branch that falls to the forest floor is likely to be colonised by saprobic fungi that secrete enzymes to convert larger molecules into smaller ones, recycling minerals and nutrients for other forest inhabitants. Different saprobes degrade different compounds. Some are generalists deconstructing a variety of compounds while others are specialists. White-rot fungi metabolise lignin, brown-rot fungi break down cellulose and hemicellulose, while soft-rot fungi have a shot at rotting them all. Consequently fungi cycle and govern nutrient and energy flows through ecosystems, regulating resources for both subterranean and above-ground life.

The complexity of the activities in this thin lamina of life exist in constant flux 'in cycles that have no beginning and no end.'⁴ Rachel Carson was one of the few writers within the early environmental movement who recognised the importance of fungi in soils, noting

***Mycena austrororida* sports a lichen skirt of *Pseudocyphellaria crocata*.**



This tiny *Mycena* and its lichen friend are just two among dozens of fungi working away to deconstruct a log.



'we know too little of the threads that bind the soil organisms to each other and the world'. She recognised the soil community as an inseparable web of interwoven lives, with soil only being viable so long as its inhabitants flourished. Carson published her pertinent message more than half a century ago, yet fungi still slip through the cracks of Australian biodiversity conservation, education and our concepts of what constitutes life. The ways in which we perceive and conceive soil, as Carson showed, affect how we regard it. For example, thinking of soil as a 'surface' can reduce it to a place which is simply 'occupied' or on which things are done. Alternatively, thinking of soil as depths of interactive complexity expands perceptions of its dynamism and necessity. Fungi do much more in than on soil in contributing to the functioning of ecosystems. Anthropologist Tim Ingold describes organisms as inhabiting the world and in doing so contributing to its 'ever-evolving weave' noting that the 'inhabited world, as such, has no surface'.⁵ Inhabiting rather than occupying implies active involvement. Recognising the fungal habitat of soil

as active, alive and having agency acknowledges fungi as essential inhabitants.

Along with the challenge of conceptualising the material nature of soil and dirt, they are also richly symbolic, associated with the undesirable, unclean, infertile and uncontrollable. Author Raymond Briggs allied fungi and dirt with the filthy, grotesque and subversive in his character Fungus the Bogeyman. In her influential book *Purity and Danger*, anthropologist Mary Douglas explores the symbolic systems (values) of societal understandings of purity and dirt, famously defining dirt as 'matter out of place' that 'offends against order'⁶. Dirt as impurity disrupts symbolic order. Such impurities are anomalies that defy boundaries within classificatory social and conceptual systems that strive for order. Symbolic of impurity, darkness and inertia, dirt is undesirable as are its inhabitants. Geomorphologist David Montgomery also describes the topsoil that gets blown or dislocated from agricultural landscapes as soil out of place, as dirt. Dirt is displaced, anonymous and devoid of history. It is the mud on the carpet and the

dirt that becomes airborne behind the tractor. Dirt is the stuff that exists in places we'd rather it weren't. The very act of displacement is why soils are so often regarded as dirt, as inert, rather than as vibrant living systems.

The vitality of matter, of soil, needs our concern, because, says political theorist Jane Bennett 'the image of dead or thoroughly instrumentalized matter feeds human hubris and our earth-destroying fantasies of conquest and consumption'.⁷ This way of thinking hinders our detecting, our sensing and engaging with the very environments in which fungi exist, those that they create and sustain. Bennett asks us to advocate an aesthetic-affective openness to material vitality, to recognise the energetic vitality of dirt. She considers that the 'figure of an intrinsically inanimate matter' stifles the emergence of a more ecological thinking that is not based on considering matter as a resource or commodity.⁸ Physical detachment from soil has helped us regard it as dirt. Perhaps only when soil is not regarded as an inert substratum, devoid of life, will fungi also be regarded as something worthy of our consideration. On

Evidence of fungal decay in action.



Parmelia lichen dismantles an old fence post.



your next forest wander, reach into a rotting log for a handful of freshly minted soil. Breathe in its vitality. Feel its vibrancy. And just for a moment, ponder the hidden endless toiling of its fungal creators ■

Endnotes

Montgomery, David *Dirt – The Erosion of Civilisations* (California; University of California Press, 2007),

Taylor, Thomas, Klavins, Sharon, Krings, Michael, Taylor, Edith, Kerp, Hans, and Hass, Hagen "Fungi from the Rhynie Chert: A View from the Dark side," *Transactions of the Royal Society of Edinburgh: Earth Sciences*, 94 (4) (2003): 457-473.

Moore, David, Robson, Geoffrey and Trinci, Anthony, *Twentieth Century Guidebook to Fungi* (Cambridge University Press: Cambridge 2011).

Carson, Rachel, *Silent Spring* (London: Penguin Books, 1962).

Ingold, Tim, *Being Alive – Essays on Movement, Knowledge and Description* (New York: Routledge, 2011).

Douglas, Mary, *Purity and Danger – An Analysis of the Concepts of Pollution and Taboo* (London: Routledge, 1966).

Alison Pouliot is an ecologist and environmental photographer and spends much of her life crawling around forests hanging out with fungi. She is fascinated with the design, diversity and connectedness of living things. A background in research ecology has given her an ideal framework to understand the subjects of her photography. With her camera she has travelled to many remote and unique environs both within Australia and overseas. Her writing and images are her attempt to reflect and share her wonderment with the diversity of nature. See more of her work at <http://alisonpouliot.com/>

Cortinarius persplendidus emerges from the leaf litter.



Miniscule Marasmius fruitbodies.



The burnt orange caps of the saprobic fungus, *Hypholoma australe*.



The beefsteak fungus, *Fistulina hepatica*.



A trio of *Cortinarius austrovenetus*.

