

Research Article

Todd LeVasseur*

The Soil is Alive: Cultivating Human Presence Towards the Ground Below Our Feet

<https://doi.org/10.1515/culture-2024-0010>

received March 19, 2024; accepted May 21, 2024

Abstract: This article invites readers to rethink the presence and role of soil by creating a *soliumpoietics*, without which terrestrial plant life itself struggles to occur. It utilizes both materialism/material agency and hyperobject lenses to analyze soil. In so doing it argues that these lenses may provide a more holistic understanding to better theorize soil as an agential and interobjective other, without which civilization would most likely rapidly collapse. It undertakes this exploration within the context of rapid climate change and global heating, which threatens the survival of many soils (and thus plants), too. These alarming scenarios have severe implications for the academy, broadly, which the article argues scholars must attend to within their teaching and researching, including new research regimes on plant-based caloric lifeways, especially where such lifeways are regenerative to soil, plants, and thus, the human.

Keywords: new materialisms, hyperobject/s, *soliumpoietics*, soil, agriculture, cultivation, academy

1 Introduction

I appreciate the breadth of vision for this special issue's call for articles as an opportunity to rethink, refeel, and reimagine plants: how they are studied, why they need to be theorized and thus, theorized differently, and the implications this has for teaching and research. I add my voice to this special issue on the vegetal turn of critical plant studies by bringing our scholarly and human–animal gazes, both, to the substrate within which terrestrial plants receive nourishment and grow: to the soil. This focus is required for without soil there would exist minimal types of plants on earth without the soil within which they grow: soil is a necessary condition for almost all terrestrial plant life.¹ As such I bring the attention of the reader in the pages that follow to two theoretical ways we can possibly think differently about soil, with direct implications on how we also think about plants. I explore these ways through a series of stories, for just as soil has layers, so too does this article.

The topsoil story of the article is a story that there is something called “academic work,” performed by academics, in “the academy” (as if that is a monolithic thing), where part of performing this story is that academics produce peer-reviewed work. This academic labor, therefore, leads to a second story about the cultivation of the soil, and attention to soil, where such cultivation of the soil is a necessary condition for cultivating non-hydroponically grown domesticated plants, and where soil itself is necessary for the growth of almost all terrestrial plants. This second story, as will be traced throughout the article, is specifically a story about how without soil, there are not many possibilities for humans to tell other kinds of stories, whether

¹ Here, I note hydroponics are used to grow plants without soil but such forms of plant cultivation are not considered in this article. Soil is also not required for the growth of epiphytes (especially *Tillandsia*) that also fall outside the purview of this article.

* **Corresponding author: Todd LeVasseur**, Environmental Studies, Yale National University Singapore College, Singapore, Republic of Singapore, e-mail: ToddL@yale-nus.sg.edu

academic or non-academic. In the case of this special issue, these are academic stories about plants and plant worlds offered via various academic lenses (refer to story one, and the call for articles for this special issue). Running through this topsoil story, though, is a third story, about rapid climate destabilization, and how a rapidly changing climate threatens both stories one (LeVasseur, 2021a) and two. As will be explored in this third story of anthropogenic climate destabilization, such destabilization potentially threatens the story of soil; or more specifically, the biomaterial reality of soil, and thus, the biomaterial reality of many plants, both aquatic² and terrestrial. Story three points towards a fourth and then a fifth story, which when put into dialogue brings me back to story one – these fourth and fifth stories form the hard pan bedrock upon which the topsoil resides. These are two analytical stories respectively of and about both new materialisms and object-oriented ontologies (OOO), and specifically within OOO, hyperobjects (Morton, 2013), and how these two analytical approaches may assist scholars in various domains in rethinking soil and thus plant life. The fruits of this labor is a larger overall story about the need to cultivate awareness of the centrality of soil and to cultivate academic awareness of cultures of soil where holistic, place-based understandings (or lack of understandings) of soil are central to potentially resilient (or unsustainable) biocultural lifeways.

Overall, this submission to the special issue functions, then, similarly to the “phytopoetics” of Ryan (2023). However, instead of a focus upon “a vegetally attentive ecopoetics [that focuses] on the botanical world, vegetal lives, human-flora relations, and threats to plant vitality [where] phytopoetics also signifies a social, cultural, psychological, or metaphysical praxis – an enactment, embodiment, or realization – that incorporates specifically vegetal modes of being-in-the-world” (Ryan, 2023, p. 118), I focus on a poesis of soil. This poesis of soil is what I call a *soliumpoietics*. I derive this term from the Vulgar Latin *solium*, a Middle-English turn of the Anglo-French use of *solium* that means soil and piece of land, itself a change of the Latin *solea*, or sole or sandal.³ In my usage, a *soliumpoietics* recognizes the becoming of and emergence of soil as a living emergent entity, an agential force, and an embodied collection of organisms upon which most of terrestrial life is dependent for survival. A *soliumpoietics* celebrates soil as the soul of society (McIntosh, 2001), and as the “sole” of material culture, including plant-based material cultures. Just as we walk on soil in our terrestrial biocultural worldings and environings (Berghthaller et al., 2014), we also get our calories by consuming plants, fungi, and/or animals⁴ grounded in soil – therefore, this biomaterial sole of soil is also the geo-poetic soul of a land-based society.

In cultivating these stories of a soil-bound and soil-focused *poiesis* (a drawing forth, an active becoming, a praxis-oriented ontology of creative world-making [LeVasseur, 2012]), I continue by providing a context for understanding this soulful (Penniman, 2018) and sole-ful ground below our feet. This context comes from the ecological agrarian essayist, poet, and regenerative organic farmer from Kentucky (USA), Wendell Berry, who writes from his Christian (and quasi-pantheist) perspective that:

What I have been trying to do [in the essay from which this passage derives] is to define a pattern of disintegration that is at once cultural and agricultural. I have been groping for connections—that I think are indissoluble, though obscured by modern ambitions—between the spirit of the body, the body and other bodies, the body and the earth. If these connections do necessarily exist, as I believe they do, then it is impossible for material order to exist side by side with spiritual disorder, or vice versa, and impossible for one to thrive long at the expense of the other; it is impossible, ultimately, to preserve ourselves apart from our willingness to preserve other creatures, or to respect and care for ourselves except as we respect and care for other creatures; and... it is impossible to care for each other more or differently than we care for the earth (Berry, 2019, p. 357).

Here, I want to extend Berry’s insights, and say that we will not preserve and thrive for long if we do not also care for the soil, and if we do not cultivate our connections to the soil. In other words, Berry is explaining that our “modern ambitions” of industrial agriculture, of chemically laden commodity-based grocery store

² Aquatic plants are also outside of the purview of this article.

³ On this etymology, refer to <https://www.merriam-webster.com/dictionary/soil> accessed 1 February 2024.

⁴ Where animals largely get their calories from plants: herbivores, obviously, but even omnivores and carnivores are eating plants that have been metabolized in the form of other animal flesh/bodies.

shopping and international shipping of food stuffs, all of which depend upon earth-destroying fossil fuels, have hidden the necessary connections human animals bio-ecologically have with the varied soils of the earth.

Such occlusion of soil, and the absence of our connections to soil, is also in part a result of certain aspects of the academy and the academy's situatedness within modernity. This is seen for example where outside of soil and plant sciences (including genetics), often located in biology and chemistry departments, and geology and sustainable agriculture programs, there is often minimal sustained discussion about soil. This largely holds whether that discussion is political, cultural, artistic, religious, philosophical, legal, educational, and/or economic. Broadly speaking, soil in the academy is reduced to the natural sciences and is largely absent from most humanities, social science, legal, arts-based, and education-based disciplines.

On one level, such structural academic approaches to soil are not surprising given “the European Enlightenment's predatory hubris in relation to the earth and its resources” (Ghosh, 2016, p. 75) and how gendered and racialized domination of the earth is scaffolded into modern science and education, both (Merchant, 1980; Yusuff, 2018). A similar predatory hubris is also present at times in the modern academy, where intertwined factors such as myopic research, grant funding, disciplinary silos, and administrative inertia structurally contribute to unsustainable earthen and biogeochemical trajectories (Afzaal, 2023; Kinol et al., 2023). These trajectories, according to Amitav Ghosh, are further consolidated in part by the onset of modernity and its “regime of thought and practice” (Ghosh, 2016, p.23) that has crystallized into “the deification of the human” in modernity and via globalization (Ghosh, 2016, p. 44) and that is too often present in the academy (Cajete, 2016). Ghosh continues, adding that such thought justifies earthen destruction and violent enclosures (Ghosh, 2021), and for the stories being told in this article, thus the destruction of soil and soil fertility (Burger et al., 2023; Gantzer et al., 1991; Kimbrell, 2002; LeVasseur, 2015b). This destruction has been and continues to be driven by colonial trajectories that now extend into the manipulation of the genomes of species of flora that are monetized as proprietary property to make profits for agribusiness-based transnational corporations (Shiva, 2016). These factors combine to contribute, then, to Berry's concern about cultural and agricultural disintegration; to what can be seen as a cultural, ontological, mechanical, and technological disconnection between the human body and the animate earth (Harding, 2006).

This uncoupling, seen in scientific and technocratic treatment of plants, ecosystems, and soils and especially where this treatment is in service of commercial profits/proprietary research (Shiva, 2016), is in part based upon either forgetting or denying that, per interspecies posthumanist insights (Tsing, 2012), “there is no difference between the without and the within” (Ghosh, 2016, p. 6). One of the interactions where the without and the within intermingles is biogeochemically how human survival is largely dependent, at least until the invention of hydroponics, on soil. This is because the products of plants that are grown in soil and that humans consume (even if humans are consuming animal others who had eaten the original products of the soil) nurture, nourish, and heal human bodies without and within: we imbibe nutrients that enable our bodies to exist, where these nutrients originate within the living matrix of soil. Furthermore, these nutrients also feed the intestinal flora and bacteria that literally keep us alive. The overall story of this article further explores why this lack of connection and appreciation is important to scholars thinking differently about plant life. It also advocates for scholars to hopefully work on cultivating ways to make the academy more relevant to a climate-changed planet (Mayes & Holdsworth, 2022) by foregrounding a *soliumpoietics* in teaching, theorizing, and research.

2 What is Soil

We reside and dwell (Ingold, 2022) as evolved social primates on a mineral-based orb that circles a constantly exploding thermonuclear ball of hydrogen. The elements that populate and constitute lifeforms, as well as the varied abiotic aspects of earth, and the earth itself, all derive from ancient stars that have exploded throughout the billions of years of the universe's (multiverses?) history. Random interactions at chemical, and then via evolution, at organismic levels have led to an earth conducive to life: life where almost all organic bodies run (i.e. get the chemical nutrients and energy they need to survive) on sunlight via the trophic pyramids (aquatic and terrestrial), from microscopic to macroscopic body sizes. Such bodies live nested within larger ecosystems,

where the diversity of species present co-create the various ecosystem types that help constitute the earth. These types are also impacted by, and contribute to, global biogeochemical cycles related to water (hydrological cycles), air (think here of air currents and jet streams), oxygen, tectonic shifts, subsidence, nitrogen cycles, methane circulation, carbon sequestration, and a variety of other earthen biogeochemical cycles.

Another cycle, built upon hundreds of millions of years of evolution, nutrient cycling, global weather patterns (think especially here of glaciation that crushed rocks into minerals that help to form soils and that are utilized by plants), and the decomposition and sugar-releasing work of billions of microbes, is the soil cycle. Soil is a key carbon sink for the earth and is classified into a variety of types. Depending on the mineral content and size of various minerals that are present, soil can be sand, clay, peat, loam, chalk or silt, or a mixture of these. These types often correlate to various geographic areas related to latitude, longitude, rock substructure, and other climatic variations, including the type of plant coverage the soil hosts. Soil health and fertility are directly related to the type of life that grows on and in soil and are also directly related to larger atmospheric cycles, including those related to greenhouse gasses.⁵ Soil is also impacted by and responds to the availability of water, fire regimes, and temperature gradients, amongst other influences.

As a whole, “[s]oil forms a thin mantle over the Earth’s surface and acts as the interface between the atmosphere and lithosphere...It is a multiphase system, consisting of mineral material, plant roots, water and gases [sic], and organic matter at various stages of decay. The soil also provides a medium in which an astounding variety of organisms live” (Bardgett, 2005, Chapters 1, 2). Therefore, the soil is a comprehensive ecosystem as a whole, functioning as a superorganism: plant roots sift through the soil, creating passages for water and pockets of air, whilst interacting with beneficial microbes (Wong & Plett, 2019) and various types of earthworms and nematodes. These microbial communities recycle, filter, and feed on nutrients, thus helping to metabolize various nutrients as chemical compounds throughout the entire soil community, making these nutrients accessible to plants via symbiotic partnering with mycorrhizae and root hairs (Bhattacharjee et al., 2020). As these mycorrhizae and root hairs grow, then die and decompose, further habitat is created for other microbes, thus creating an ever more fecund soil food web and community in a positive feedback loop. Soil also weathers rocks into further soil particulates through chemical processes of hydrolysis, carbonation, hydration, dissolution, and/or oxidation and reduction (Ashman & Puri, 2002). And key for this special issue, soil anchors plants and provides the medium through which terrestrial plants feed. Then, as plants die, they lose their leaves, fallen stalks, branches, and also fruits and seeds, which will decompose via the interaction of heat, water, fungi and various nematodes, worms, and microbes, further adding more nutrients, texture, and volume to the matrix of soil.⁶

However, and while recognizing that long-term impacts of CO₂ increase on soil food web dynamics are currently understudied, early data nonetheless suggest that soil-based nitrogen and carbon availability will be impacted in ways that in the short term benefit microbial and plant growth, but that in the long term will impede such nutrient distribution and uptake. This suggests that as CO₂ continues to build up in the atmosphere, this will result in less healthy plants and impoverished soil food webs (Meier et al., 2015). Models also predict that over time many soil types/ecosystems will lose fertility in climate warmed drought conditions. This is key, for to understand soil, is to understand it as a symbiotic community of life that is recycling nutrients and that is resilient to a point, but that without enough water, or carbon, or too much heat, or too much water, can lead to the die off of the community that maintains its structure. In fact, according to the University of Ohio Extension service, “There are more microbes in a teaspoon of soil than there are people on the earth. Soils contain about 8–15 tons of bacteria, fungi, protozoa, nematodes, earthworms, and arthropods.”⁷ All of this life in the soil helps to break down and recycle minerals such that their collective functioning (including the decomposition of these organisms as they die) makes the rich, loamy dirt brown soil that is so often associated

⁵ For a sobering discovery that shocked the scientific community, given this event was not predicted to occur for decades to centuries to come based on best modeling practices, in 2019, it was discovered that trees have migrated into and taken root within Arctic tundra soils in response to rapid global heating. Online: <https://www.theguardian.com/environment/2022/aug/10/forests-changes-global-heating-arctic-amazon-studies>.

⁶ This is of course why adding compost is so central to the practice of regenerative/organic farming.

⁷ Online: <https://ohioline.osu.edu/factsheet/SAG-16>.

with fertile agriculture. Climate change, therefore, also threatens this bacterial community that resides within and helps to constitute soil.

With this very basic overview of soil⁸ and its physical and biogeochemical structure now layered into the story of this article, I turn to story three mentioned earlier. This is the first of the two analytical stories used in this article to help think differently about the superorganism of soil and is a story based on new materialist/materialisms insights.

3 Vibrant Soil

There has been a gathering move in the arts and humanities over the last 15 years to better recognize, respond to, and thus theorize the agential autonomy of the non-human. One of the key theoretical approaches to recognizing the agency of the non-human, in both biotic and abiotic formations and symbioses, is “new materialism.”⁹ Taken as a collective whole, this “turn to the material works to address what was absent, attenuated, or untheorizable during the ascendancy of the linguistic and cultural turns. Thus categories like nature, the biological, the infrastructural, the animal, aspects of the material body, and the ontological self, which were seen as entirely constructed or were ignored altogether during the linguistic turn, can now be posited and theorized in all of their material force, resistance, and agency” (Breu, 2019, p. 297). Given this special issue, we can also add to this list more granular new materialist categories of plants/fauna, the vegetal, and the soil.

Within new materialisms, broadly speaking, scholars are moving beyond the inherited Cartesian dualisms of Enlightenment modernity that assumed a fixed, unique essence found only in humans, which in part justified the exploitation of that labeled “material” (see above section with Ghosh), as well as moving beyond and correcting the postmodern and poststructuralist “language games” of the latter 1900s and early 2000s. A key goal of new materialist theorizing is to better understand how ecological meshworks interact and inter-become in ways that co-create a materially active, agential world of living ecologies of places and the beings, and material forces within those places. Given the diversity of scholars working with new materialist lenses there is not a monolithic new materialist approach.¹⁰ Moreso many of the sub-categories within new materialist thinking are even at times at odds with and/or may be critical of one another. Rather, given such diversity, new materialism is better seen as “a label associated with ontological and epistemological *interventions*...New materialism therefore is not only a rejection of the distinction between ‘matter’ and ‘the social,’ but [is] also a critique of the separation of the natural sciences and social sciences” (Kissman & van Loon, 2019, pp. 4, 14, italics in original).

Soils are therefore worthy of being analyzed and theorized via new materialist insights, not only for their agential creative power and their centrality as a key medium upon and through which other material bodies derive sustenance and live but also because soil is a product of dead material bodies. Here, soil transforms materially dead matter of once living material organisms and powers into a living matrix, therefore creating a sort of queered nondual and interpenetrated continuity with the past, marking another hallmark of new

⁸ For a richly evocative overview of soil and its constitutive parts, see also Chapter 1, “What Lies Beneath,” from Monbiot’s *Regenesi* (2022).

⁹ Which is not to be confused with a Marxist materialist and dialectical view, although according to Breu (2019) the latter provides some antecedents to new materialisms. On connections of new materialisms with Marx, see also Sasaki (2021).

¹⁰ The sociologists Kissman and van Loon write, “Those associated with [new materialism] have almost without exception deployed different terms to describe their own position: Agential realism (Barad); schizoanalysis (Deleuze and Guattari); cyborg feminism (Haraway); posthuman feminism (Braidotti); speculative realism (Harman); actor-network-theory (Latour, Callon, Law, Mol); speculative constructivism (Stengers); monadology (Tarde); process-theology (Whitehead). They are a loose gathering because they derive from divergent, sometimes even completely oppositional, ontological and epistemological considerations, analytical methods, and even disciplines. They have been gathered by a process of ascription, usually by those who disagree with the challenges these interventions have offered” (2019, 4).

materialist thinking (Sellberg, 2021). Soil is also a “vibrant matter” (Bennett, 2010), where soil health is directly implicated in the stability of civilizations (agricultural collapse, often tethered to overexploitation of soil, is one of the key drivers of civilizational collapse) and also with the ability of human communities to sustain themselves at a caloric level.

Soil, too, is an agential matter that precisely collapses the false modern boundaries between social, humanistic, and scientific, and also between human and nature: soil microbes end up in human intestinal flora; there is no land-based society without soil; and the trading of goods grown in soil has thoroughly shaped human dwelling habits, politics, economies, and political ecologies for at least 10,000 years, and in some places, for 40,000 (Pascoe, 2014). By extension, the soil is thus literally the ground upon which civilizations that have religion have also developed.

Soil also collapses boundaries between plant, mineral, fungal, biological, geological, and even the categories of living and dead. Soil is vibrantly alive, and is one of the key loci of matter that matters to the ability of other material agents and conglomerations to form, interact, and further shape co-symbiotic inter-becomings that help to define life on earth. These inter-becomings also impact the carbon cycle, the hydrological cycle, and concentrations of atmospheric gasses – all processes that new materialists may engage with in their theorizing beyond the isolated-human-as-only-actor on the planet. Soil is also a key carbon sink, where its material becoming assists the larger material body of the planet, and thus all the other material bodies on the earth, by materially locking up carbon dioxide. Lastly, and that will be further explored later in this article and that was mentioned briefly above, without healthy soil, there are constraints on the abilities of humans to have healthy land-based bio-cultures grounded sustainably in materially active and materially alive more-than-human places. Having cultivated soil into a new materialist container, I now turn to story five mentioned in the beginning; this is another story about soil, with this story approached from OOO.

4 Soil as Hyperobject

While some (footnote 12, for example) include OOO and new materialism in the larger category of materialisms, these are actually oft competing efforts to explain, describe, and make sense of visible reality and the forces, powers, agents, and objects that constitute it. The agential becomings of new materialist insights I describe in the prior section in large part see visible and experiential reality as being made and co-created by materially present and active forces, agential beings and/or powers, and vibrant co-becomings and assemblages. Many new materialists take such sympoietic braidings and creations and dissolutions (Haraway, 2016), all that are located beyond the human, and “bring[them to] the fore [of human] engagement with the world as body-mind entanglement” (Taylor, 2016, p. 201). OOO, however, specifically resides within a philosophical approach to understanding visible reality that is known as speculative realism.

Speculative realism attempts to move continental philosophy beyond the correlationism (a term coined by speculative realist and French philosopher Quentin Meillassoux¹¹) of Kant and all philosophers post-Kant where most philosophers in this lineage have attempted to understand observable reality via either idealism or correlationism. The latter explains positions that hold that yes, there’s an observable world, but this observable world is always mediated through the mind in some way or is mediated through language or regimes of social power, or by a mind making sense of phenomenology. Whatever the process, there is a form of mediation, and therefore, there is no pure way to access the world: the observable and experienced world is always mediated via some correlation between mind and reality, where the human is still in some regard seen or understood as separate, or transcendent or uniquely special compared to what is being observed and described.

¹¹ For more on this term, see <https://eupublishingblog.com/2014/12/12/correlationism-an-extract-from-the-meillassoux-dictionary/> (accessed 17 March 2023).

Speculative realism challenges this, and thus understandings of humans as special in some way, and within OOO does this by claiming there are objects that exist in a realist sense (including humans-as-objects), but these objects are inexhaustible in efforts to fully know and describe them. Yes, humans can interact with objects that are materially real and other and can partially describe them and manipulate them, but even so, humans can never fully know them. This is because OOO recognizes that objects cannot be described down to further collections of parts (such as it is all just atoms); nor are objects an emergent property of some holistic superstructure, or of entangled co-becomings, which collapse and explain away the very individual objects upon which OOO focuses. This creates the epistemological ground for OOO, where objects have their own orientation towards other objects and via their respective (but autonomous) surfaces can interact¹²; that objects have their own situatedness within an observable universe and that they are a category “object” (and are actual physical objects, but can include ideas that also impact other objects) that exist that humans can speculate about, but never fully know, in human efforts of trying to know reality. Objects remain, according to Timothy Morton, what they call “strange strangers” to one another (Morton, 2010, 2013). Yet within that, “objects are not opposed to subjects. [Rather t]hey include any entity whatsoever, whether simple, complex, natural, artificial, self-aware, insentient, etc. There is no subject/object dualism for OOO. Accordingly, OOO is against any kind of objectification that would treat an object as lacking agency, intrinsic value, or interpretive capacity” (Mickey, 2023, p. 262). Mickey continues, explaining in their summary of hyperobjects that “Hyperobjects emit multiple, spatiotemporal scales as well as their own causality” (2023, p. 266). Or as Graham Harman, the philosopher credited with beginning OOO, shares, there are two central ideas to OOO: “First, there is the...principle that all relations are on equal footing...[second is the understanding that the] world is filled with a vast array of objects receding from mutual contact into strange private vacuums, but somehow making contact through indirect or vicarious means” (Harman, 2010, pp. 772–773). According to the attributes of OOO and hyperobjects covered in this paragraph, soil exists at multiple spatiotemporal scale and has its own causality; given soil’s centrality to both life, and death, there is no subject/object dualism between soil and other subjects and objects, and soil as its own object can never be fully known or experienced (in terms of OOO, it recedes via an “implosive holism” [Mickey, 2023, p. 266]) by any other object.

Harman’s work on OOO has influenced a variety of other writers, including (at time of the writing of this article) Rita Shea Guffey Professor of English at Rice University, Timothy Morton. In my opinion, one of the most important humanities-based books on human/more-than-human interactions written this century is

12 On this, see Taylor’s summary of Harman’s OOO (2016, pp. 205–207), especially where they write, “So, to summarize Harman, what is real are things – objects; objects are where speculation originates; things are real beyond how humans access them; objects can relate to other objects but only to some part of them with other parts remaining infinitely withdrawn. The question arises, to what extent is this position shared by new material feminism?” (2016, p. 207). They also summarize new material feminists (a leading subset of new materialism and new materialisms, as one can be a feminist without being a new material feminist without being a new material feminist) as “no less a disparate bunch than speculative realists. Nevertheless they share a view that matter and discourses are co-constitutive and neither is foundational, that matter is agentic, that the human as the principal ground for knowledge production has to be displaced, and that all beings come to being through dynamic processes of co-constitutive emergence. New material feminists, like speculative realists, adhere to a non-dualist, flat ontology, which at the same time reworks epistemology but, unlike speculative realists, they have been particularly exercised by ethics as engaged, embodied, situated, and *gendered* [italics in original] meaning-making practices which necessarily displace objectivity, ‘truth,’ and ‘reason’” (2016, p. 208). I am a new materialist feminist in my theoretical orientations, including in this article, so am in agreement with Taylor’s summary of the criticisms of OOO/speculative realism. To me, the latter does not provide the tools needed to grapple with the ethical issues, including around agency and material co-becomings and entanglements, that the former does via the former’s specific intersectional foregrounding of such issues in its applied theorizing. However, for a helpful philosophical critique of Barad’s agential realism, and that could thus be in part applied to my theoretical positionality, refer to the study by Harman (2016). For further new materialistic and feminist approaches to agential co-becomings and intersectional ethics surrounding such processes, see also Tuana’s concept of “viscous porosity” and how “intersectionist attention [must be paid] to the processes of becoming in which unity is dynamic and always interactive and agency is diffusely enacted in complex networks of relations” (2008, pp. 188–189). The concept of “transcorporeality” from Alaimo (2008) is also another helpful feminist new materialist approach that can be applied to thinking and feeling through and about the ethics of material co-becomings. Here, their insight that “trans-corporeality” is “the time-space where human corporeality, in all its material fleshiness, is inseparable from ‘nature’ or ‘environment,’” (2008, p. 238) can extend to a *solium-corporality*, too. I thank the anonymous reviewer for suggesting engagement with both Tuana and Alaimo in this footnote.

Morton's *Hyperobjects: Philosophy and Ecology after the End of the World* (2013).¹³ Here, I build an understanding of soil as a hyperobject by using this book as my key ingredient. "Hyperobject" is a term and concept Morton coined, building on Harman's OOO theory. However, Harman refers to objects as being relatively constrained in size and often uses the object "table" in explaining OOO. Morton, however, wants to understand how objects at vast scales and sizes (their "hyperobject") can potentially be known and understood, and thus, they theorize how such hyperobjects influence objects at smaller scales and how hyperobjects interact with one another given their vast scales. For Morton, hyperobject refers to "things that are massively distributed in time and space relative to humans...Hyperobjects are not just collections, systems, or assemblages of other objects. They are objects in their own right" (2013, pp. 1–2). As Morton created this concept within the larger philosophy of OOO, to which they ascribe, they explain how OOO is "a unique form of realism and nonanthropocentric thinking" (2013, p. 2) where OOO "is a form of realism that asserts that real things exist—these things are objects...We've become used to hearing 'object' in relation to 'subject' that it takes some time to acclimatize to a view in which there are only objects, one of which is ourselves" (Morton, 2011, pp. 164–165). For Morton, hyperobjects portend a transition to an ecological age, based on "Ecological Thought" because "Hyperobjects don't inhabit some conceptual beyond in our heads or out there. They are real objects that affect other objects" (2011, p. 73).

Key for this story within the story of my overall article is the first part of Morton's 2013 book where they provide an overview of five key attributes held by hyperobjects:

1. Viscosity: hyperobjects are near, "uncanny" (Morton, 2013, p. 28) and are already here. They are agents through which "causalities flow" (Morton, 2013, p. 29). Key, for Morton, as they develop their larger project of "Ecological Thought" is that "Knowledge of the hyperobject Earth, and of the hyperobject biosphere, presents us with viscous surfaces from which nothing can be forcibly peeled. There is no Away [sic] on this surface, no here and no there" (2013, p. 31). Important to this aspect of hyperobjects is that "time emanates from objects, rather than being a continuum in which they float" (2013, p. 33). For Morton, viscosity means that any and all objects are ontologically inexhaustible (2013, p. 36) as all objects exist in multiple ways, always already here and present to other objects.
2. Nonlocality: this concept relates to "how entities manifest for other entities" (2013, p. 39), where "Objects withdraw from each other at a profound physical level" (2013, p. 41) per quantum theory, because per nonlocality "Nothing is radically external to anything else" (2013, p. 41). A nonlocal understanding of hyperobjects states that an atomistic understanding of reality is flawed, that there is no eternal or static or discrete spacetime, and instead that "objects have blurred boundaries at scales considerably larger than we used to think" (2013, p. 42). Here, Morton explains how "Nonlocality is precisely a theory of textuality at the quantum level, in which information is dispersed among particles seemingly occupying different regions of spacetime" (2013, p. 46).
3. Temporal Undulation: space, and spacetime, are radically within and of the universe, so that "Hyperobjects are time-stretched to such a vast extent that they become almost impossible to hold in mind" (2013, p. 58). As they explain, "These gigantic timescales are truly humiliating in the sense that they force us to realize how close to Earth we are...hyperobjects are not forever. What they offer instead is a *very large finitude*" (2013, p. 60, italics in original). Overall, objects, especially those that are larger and longer in their existence, mean that "Spacetime isn't an empty box, but rather an undulating force field that emanates from objects...

¹³ I first heard Morton speak at the American Academy of Religion's 2013 meeting in Baltimore, MD (USA), on a panel titled "Querying Natural Religion: Immanence, Gaia, and the Parliament of Lively Things" which was a roundtable response to Bruno Latour's 2013 Gifford Lectures "Facing Gaia." I was unfamiliar with Morton's work prior to this panel, and left with the promise to read their work, which brought me to *Hyperobjects*. I was so impressed with the book that I loaned it to my colleague, an internationally known soil scientist with whom I co-teach sustainability courses. This colleague had the opposite experience as I did, feeling Morton's book was densely written and took forever to get to any points of import (a fair critique, to be honest – it is almost purposefully turgid and rambling at times, using "insider" speak throughout much of it, including framing rhetoric unique to Morton's overall corpus). I am reminded by this experience of Pirsig's *Zen and the Art of Motorcycle Maintenance* (1974) and how humans seem to be in two different frames of understanding the world. Morton's work probably fits better with arts and humanities frames, and at least by an anecdote of one, less with the natural sciences frame.

relativity is hardwired into things themselves. Objects entangle one another in a crisscrossing mesh of spacetime fluctuations” (2013, pp. 64–65).

4. Phasing: “Hyperobjects are *phased*: they occupy a high-dimensional *phase space* that makes them impossible to see as a whole on a regular three-dimensional human-scale basis” (2013, p. 70, italics in original). According to Morton, “We can only see pieces of hyperobjects at a time [because] of our less than adequate perception of higher dimensions of structure, which is where the hyperobjects live” (2013, p. 70).
5. Interobjectivity: the fifth and final attribute of hyperobjects is how spacetime is created by objects interacting in “interobjective” mesh fields that allow for “the strange interconnectedness of things, an interconnectedness that does not allow for perfect, lossless transmission of information, but is instead full of gaps and absences. When an object is born it is instantly enmeshed into a relationship with other objects in the mesh” (2013, p. 83). Here for Morton causality occurs in this meshed interobjective spacetime of objects interacting, and within that for humans “what is called *subject* and what is called *mind* just are interobjective effects, emergent properties of relationships between enmeshed objects” (2013, p. 84, italics in original). Key too for Morton is that because of how hyperobjects exist and interact, “nothing is ever experienced directly, but only as mediated through other entities in some shared sensual space” (2013, p. 86).

Morton points out that humans “are always inside an object” (2013, p. 17) but “the problem called anthropocentrism” (2013, p. 18) occludes that “every decision we make is in some sense related to hyperobjects” (2013, p. 20). And given that spacetime is made of interobjective meshes, “no entity at all has a world” (2013, p. 108), so that what is left, is “Intimacy” (2013, p. 108) where “the entities that coexist with us obtrude on our awareness with greater and greater urgency” (2013, p. 108). Hyperobjects, for Morton, radically decenter the human (even though humans are objects), and force us to accept the “end of the world:” the end of an assumed world of human separation, of speculative realism and correlationism and Cartesian dualisms, and an end “of the human dream that reality is significant for them alone” (2013, p. 108). For Morton this is freeing and the beginning of history, for “We now have the prospect of forging new alliances between humans and non-humans alike, now that we have stepped out of the cocoon of *world*” (2013, p. 108, italics in original) where this world was based on falsely assumed discrete subjects, and where humans epistemologically assumed themselves separate from it all. Rather, for Morton, “it’s all a world picture...we need to smash the aestheticization” (2013, p. 127) that has guided post-1970s environmental thinking and recognize there is “an already-existing intimacy with all lifeforms” (2013, p. 124) in the spacetime of hyperobjects interacting in meshes.

Given the above, how may soil be a hyperobject?¹⁴

1. Viscosity: soil is everywhere – its particles even enter the jet stream and are dispersed around the planet. It is also nowhere – able to be washed or blown away, or to fall into microscopic component parts that are no longer identifiable as soil, and blown away to leave bare rock...but that rock, over time, may weather or be crushed, to once again create the object of soil in that location. Soil is also, of course, present in many other objects: forests, mountains, whole species of animals, fungi, rivers, oceans, and the sun. Soil is an object that many other objects interact with, and upon which they even depend, and are within – hence, there is no “away” from soil, for many other objects.
2. Nonlocality – here I have less facility (as in almost none) with quantum theory, so I am unable to analyze soil from this part of a hyperobject lens. Yet, within the category of nonlocality, the soil is not external to everything else: it mixes with the object of water; it is blown by the object of wind; it ends up in the stomach of those that eat, as soil microbes are on almost all food items imbibed by others. It is then even defecated, back into soil. Soil also contains within it information – chemical, hydrologic, fungal, temperature – and these are forms of OOO-centered information flows.
3. Temporal Undulation – soil has been forming and will continue to be formed, for millions upon millions of years on the hyperobject of earth. Over this time period, other objects have been and will continue to be, entangled in the hyperobject of soil.

¹⁴ For a compelling and thorough approach of applying the lens of hyperobject to groundwater, refer to Wardle (2019).

4. Phasing – most of what makes soil, soil, is naked to the visible human eye. The phasing of it as object is actually largely microscopic and radically dispersed over whole ecosystems of soil substrate.
5. Interobjective – soil is an object, presenting itself to countless other objects, over vast distances and time scales. It is also impacted by other objects, including rain, rivers, glaciation, drought/sun, humans-as-objects (especially humans with plows and irrigation and seeds), and entire herds of grazing animals. However, and here my own criticism of Morton emerges, is that soil (and other objects) can be directly encountered.

Other readers can for sure add to this list; and should a group gather and systematically study more in-depth what are hyperobjects via Morton and other scholars' work on them, I am sure further attributes would readily emerge.

So where does this get us, to cultivate views of soil via both new materialist and OOO/hyperobject lenses? How may such views better inform plant-centered scholarship and the formation of a *soliumpoietics*? And how may such views on soil be extended to plants, with implications for the academy during rapid climate changes, more broadly?

5 Soil and Cultivation

Hyperobjects (story five) and new materialisms (story four), both separately and/or put into a dialogue together (while noting they are clearly not the same thing, and as shared above are at odds with one another both epistemologically and ontologically), are respective analytical lenses that can help scholars better and more accurately understand who and what has agency on earth. Moreso, both analytical approaches can help move beyond inherited dualisms of Nature/Culture and Human/Nature; in fact, such a move directly informs how both have been created and developed. They are also analytics that can better assist scholars with understanding the enormity, immensity, viscosity, phasing, temporal undulation, interobjectivity, and non-locality of plants, given the special topic theme of this issue; of rapid global heating, which already is and will continue to impact all plants, everywhere; and the material and agential impacts such heating will have on human lifeways (story three, on rapid climate changes, that underlies this article). This includes the emplaced performance of academic work, as well as teaching at biophysical campuses, where such campuses will have to adapt (if possible) to runaway climate heating. There is no more immunity, or protection, from the material agency of earth – those lucky enough to have tenure will not have such job security to stop the water from drying up.¹⁵ Nor will academic standing stop sea levels from inundating a campus,¹⁶ to say nothing of how rising oceans and seas will impact groundwater salinity and thus agriculture, as well as coastal ecosystems and the various plant life found therein.

Such rapid, in geological time, and moving forward, even in a single human lifetime, biogeochemical and thus physical shifts are sobering, threatening, and alarming. Life will never be the same, when looking back at Holocene biodiversity and weather stability. We are now in the pick your -cene nomenclature, all that recognize the Holocene commons are done (that same era when we domesticated all the species of plants and animals we currently eat): Anthropocene; Capitalocene; Carboncene; Manthropocene; Plantationcene. My own nomenclature is we are entering into the “We’reF*ckedCene.” I say this of course tongue-in-cheek, but not really, once I sit with the data and its implications. Once I bring my own attention towards the biogeochemical shifts that are “baked in” and reflect that we are only as a planet at 1.3–1.4°C warming over industrial baselines¹⁷ and heading to best case scenario a 2°C warming, is when I think about the “We’reF*ckedCene” reality.

¹⁵ As seen in Europe in August 2022, where numerous rivers and reservoirs, both, were at 30% volume or less; or Mexico City in March of 2024, which was effectively out of water.

¹⁶ A likelihood for too many campuses to name throughout coastal areas in the USA in the decades to come.

¹⁷ A 2024 study that uses sea sponges suggests we have actually overshot 1.5°C already and are at 1.7°C above pre-industrial baseline temperatures (McCulloch et al., 2024).

Why does this matter to this special issue on plants? Because it also means Holocene-era domesticated and bred plants, and maybe even animals, are also highly compromised and facing radically impoverished futures – this is implied evolutionarily, ecologically, but also implied in insights from both new materialisms and OOO. If one were to turn their oven to 120°F and put their arm in there for one hour, it would not do well – one’s arm would bake and dry out. Yet this is precisely what we are doing to many of our agricultural fields the world over: just as our arms will suffer in a baking oven, plants will have a hard time flourishing in consistent, dry 120°F weather. That is a climate more akin to a desert or to Joshua Tree National Monument in southern California. It is not a climate conducive for most of the plants and fruit trees and nut trees we currently use as the basis of our food supplies,¹⁸ or the soils within which they interact, whether that interaction is theorized via a new materialist or a hyperobject analytical lens.

Here, I return to my own stories in this article that pivot around soil, soul, cultivation, and *soliumpoietics* and point out I use cultivation here not in the sense where etymologically it means to prepare crops via tillage. Rather, I strategically use it for its other meaning that developed later in the word’s usage, which is to pay attention to something, to bring a focused awareness to something. This usage is also central to engaged *soliumpoietics*. In this way, as I cultivate awareness of climate changes and models of, and how rapidly things are changing, it is clear that things are not what they were. Case in point: even the natural sciences are unable to cultivate proper models of how fast things are changing! The rain events of Pakistan in August of 2022, where three-quarters of the country was subsumed by rain, represent in some models 780% more rain than normal for that region at this time of year – how is it possible to model such an anomaly, as no one can even predict that we would see a non-hurricane induced rain event with 780% more rain than is normal for Pakistan, to even model this possibility, to begin with?

I have an old student who is now a good friend, who double majored in religious studies and geology. They ended up getting a Ph.D. in earth geosciences, studying fire regimes from hundreds of millions of years ago and using the oxygen content found in the fossils from that era, to run models on what fire in that climate of elevated CO₂ may portend for our future. I pointed out via a WhatsApp discussion with them the absurdity of the above Pakistan rain %, and they responded, “The inability of models to reproduce, let alone predict, climate change impacts is the greatest paradigmatic challenge in science in my opinion; so many people, scientists and public and policymakers, etc. who honestly believe the best kind of science is a model, and put so much weight into model outputs, ignoring all of this evidence that the boundary conditions and behaviors that are changing are totally outside of our current model’s capacity. And people are like, “Well, we’ll just improve the models.” I’m like, no, these are the improved models!” (personal communication,¹⁹ September 1, 2022).

Science is not the only human domain that will be adapting to our new, shared post-Holocene era of climate catastrophes. What people do with both plants and the soil will shift in response, as well, including how soil and plant health may be conceived (LeVasseur, 2017). Therefore, how academics undertake work within the academy will also shift (LeVasseur, 2015a, 2021a), for on one level we are biologically derived animals dependent upon plant and soil health for our own survival. Climate changes will also create an opening for scholarship centered on both plants and soils to become centered in interdisciplinary research on adaptation. Thus, a *soliumpoietics*-based cultivation where this cultivation is both a deeper paying attention and an engaged effort of building healthy soil communities, matters – both figuratively and literally. Or, to return to the insights shared earlier by Wendell Berry, I have also in the stories in this article “been groping for connections – that I think are indissoluble, though obscured by modern ambitions – between the spirit of the body, the body and other bodies, the body and the earth,” where soils, and by default, plants, are central to such connections.

In closing, I want to focus a bit more on cultivating an awareness of soil, within the material hyperobject context of runaway climate change (therefore bringing together stories one to five that have been layered

¹⁸ There are of course plant scientists working to breed, and/or genetically engineer, plant species that can withstand conditions of prolonged drought and extreme heat. Sorghum shows potential. See also the breeding of perennial grains being undertaken at the Land Institute in Kansas (USA).

¹⁹ For more on Dr. Garrett Boudinot, see <https://www.linkedin.com/in/garrett-boudinot/>.

throughout this article). How soil is treated by humans becomes of greater import with each passing year that brings further drought, increased “1,000 year” flood and rain bomb events and predicted increases in climate refugees. The ability of humanity to feed itself via plants and animals²⁰ in a hotter, drier future will be paramount to social stability, and the process of such feeding will have to be undertaken in ways that do not threaten nonhuman others and their ability to thrive, or the fertility of soil itself (McGreevy et al., 2022).

As humans are interobjectively interacting with the materiality of soil, with the hyperobject of that soil dispersed across time and place at massive scales that make the human as objects fairly insignificant, it seems that cultivating care of such soil should be a paramount survivability concern. Moreso, it should be a cultural concern, one that aids the movement “toward a society which uses finite fuels as a transition toward a sunshine future” (Jackson, 2011, p. 26), that is based on both nature as a measure and becoming native to our places (Jackson, 2011). This is why for me I am more aligned with the interagental intra-becoming of feminist posthuman new materialist insights, rather than with the “strange stranger” of hyperobjects. The latter implies a turning away, a cold distance that can never be bridged, whereas the former implies an affective, care-based potential for mutual flourishing. Given the sobering reality of climate changes, and the phenomenological immediacy of co-becoming in materialist meshworks, I come down on the latter, given soil is able to be engaged, interacted with, and cherished.²¹ Cultivation of care for the soil is therefore one of the most important things a community can do, to aid this process of becoming native to places, while also generating a possibility of resilience in the face of great climate disruptions. That using nature as a measure and understanding cultural health as being derivative of soil health (and thus from where plant and animal and ecosystem health also derives) are not primary operating concerns of college campuses and the academy to date shows how far we have to go, in very little time allowed to us before we pass 2 °C warming and beyond (LeVasseur, 2014).

I return, then, at the end of this short but layered (academic) story on soil, and the centrality of soil to terrestrial plants and theorizing about plants, to Wendell Berry. I do so as I emotionally and effectively navigate my own dwelling within the onset of the We’reF*ckedCene, where soil communities (and whole plant-based ecosystems, and food supplies, and thus civilization itself) are under very real and measurable threat by the materially changing biogeochemical cycles of our common, earthen home. Here, I share his 2008 poem, simply titled *XII*, for it points to the predicament we materially find ourselves in, as both academics and soil-bound and plant-based people. May our scholarship, efforts, and care help cultivate activist-based answers (LeVasseur, 2021b), to this most important of riddles:

We forget the land we stand on
and live from. We set ourselves
free in an economy founded
on nothing, on greed verified
by fantasy, on which we entirely
depend. We depend on fire
that consumes the world without
lighting it. To this dark blaze
driving the inert metal
of our most high desire
we offer our land as fuel,
thus offering ourselves at last
to be burned. This is our riddle
to which the answer is a life
that none of us has lived.

²⁰ Leaving aside synthetic and hydroponic technologies, which will be part of some human diets, but will not be able to scale to 8 billion.

²¹ Can soil be known/is soil knowable? This to me is a different question, and Morton may be on to something with hyperobjects being unknowable.

Funding information: Author states no funding involved.

Author contribution: The author confirms the sole responsibility for the conception of the study, presented results and manuscript preparation.

Conflict of interest: Author states no conflict of interest.

References

- Afzaal, A. (2023). *Teaching at twilight: The meaning of education in the age of collapse*. Cascade Books.
- Alaimo, S. (2008). Trans-corporeal feminisms and the ethical space of nature. In S. Alaimo & S. Hekman (Eds.), *Material feminisms* (pp. 237–263). Indiana University Press.
- Ashman, M., & Puri, G. (2002). *Essential soil science: A clear and concise introduction to soil science*. Blackwell Publishing.
- Bardgett, R. (2005). *The biology of soil: A community and ecosystem approach*. Biology of Habitats (Oxford, online edition, Oxford Academic, April 2010).
- Bennett, J. (2010). *Vibrant matter: A political ecology of things*. Duke University Press.
- Bergthaller, H., Emmett, R., Johns-Putra, A., Kneitz, A., Lidström, S., McCorristine, S., Pérez Ramos, I., Phillips, D., Rigby, K., & Robin, L. (2014). Mapping common ground: Ecocriticism, environmental history, and the environmental humanities. *Environmental Humanities*, 5, 261–276.
- Berry, (2019). *Wendell berry: Essays 1969–1990*. The Library of America.
- Bhattacharjee, A., Velickovic, D., Wietsma, T. W., Bell, S. L., Jansson, J. K., Hofmockel, K. S., & Anderton, C. R. (2020). Visualizing microbial community dynamics via controllable soil environment. *mSystems: American Society for Microbiology*, 5, e00645–19. doi: 10.1128/mSystems.00645–19.
- Breu, C. (2019). Materialisms. In J. Di Leo (Ed.), *The bloomsbury handbook of literary and cultural theory* (pp. 296–309). Bloomsbury Academic.
- Burger, D. J., Bauke, S. L., Amelung, W., & Sommer, M. (2023). Fast agricultural topsoil re-formation after complete topsoil loss: Evidence from a unique historical field experiment. *Geoderma*, 434, 116492.
- Cajete, G. (2016). *Native science: Natural laws of interdependence*. Clear Light Publishers.
- Gantzer, C. J., Anderson, S. H., Thompson, A. L., & Brown, J. R. (1991). Evaluation of soil loss after 100 years of soil and crop management. *Agronomy Journal*, 11, 165.
- Ghosh, A. (2016). *The great derangement: Climate change and the unthinkable*. Penguin.
- Ghosh, A. (2021). *The cutmeg's curse: Parables for a planet in crisis*. John Murray.
- Haraway. (2016). *Staying with the trouble: Making kin in the chthulucene*. Duke University Press.
- Harding, S. (2006). *Animate earth: Science, intuition and gaia*. Chelsea Green Publishing.
- Harman, G. (2010). I am also of the opinion that materialism must be destroyed. *Environment and Planning D: Society and Space*, 28, 772–790.
- Harman, G. (2016). Agential and speculative realism: Remarks on barad's ontology. *Rhizomes: Cultural Studies in Emerging Knowledge*, (30). doi: 10.20415/rhiz/030.e10.
- Ingold, T. (2022). *The perception of the environment: Essays on livelihood, dwelling and skill*. Routledge Press.
- Jackson, W. (2011). *Nature as measure: The selected essays of wes jackson*. Counterpoint.
- Kimbrell, A. (2002). *The fatal harvest reader: The tragedy of industrial agriculture*. Island Press.
- Kinol, A., Miller, E., Axtell, H., Hirschfeld, I., Leggett, S., Si, Y., & Stephens, J. C. (2023). Climate justice in higher education: A proposed paradigm shift towards a transformative role for colleges and universities. *Climatic Change*, 1765, 15.
- Kissman, U. T., & van Loon, J. (2019). New materialism and its methodological consequences: An introduction. In U. T. Kissman & J. van Loon (Eds.), *Discussing new materialism: Methodological implications for the study of materialities* (pp. 3–18). Palgrave MacMillan.
- LeVasseur, T. (2012). The production of post-supernaturalistic *mythopoesis* in contemporary nature religion. *Worldviews: Environment, Culture, Religion*, 16(1), 50–72.
- LeVasseur, T. (2014). Environmental philosophy in a post-ice cap north polar world. *Environmental Ethics*, 36, 303–317.
- LeVasseur, T. (2015a). “The earth is *sui generis*”: Destabilizing the climate of our field. *Journal of the American Academy of Religion*, 83(2), 300–319.
- LeVasseur, T. (2015b). Deforestation for agriculture. In K. Albala (Ed.), *The SAGE encyclopedia of food issues*. SAGE Reference.
- LeVasseur, T. (2017). *Religious agrarianism and the return of place: From values to practice in sustainable agriculture*. SUNY Press.
- LeVasseur, T. (2021a). *Climate change, religion, and our bodily future*. Lexington Books.
- LeVasseur, T. (2021b). Activism, religious studies, and embodied teaching in an era of rapid climate changes. *Worldviews: Global Religions, Culture, and Ecology*, 25(1), 1–16.

- Mayes, E., & Holdsworth, R. (2022). Learning from contemporary student activism: Towards a curriculum of fervent concern and critical hope. *Curriculum Perspectives*, 40, 99–103.
- McCulloch, M. T., Winter, A., Sherman, C. E., & Trotter, J. A. (2024). 300 years of sclerosponge thermometry shows global warming has exceeded 1.5°C. *Nature Climate Change*, 14, 171–177.
- McGreevy, S. R., Rupprecht, C. D., Niles, D., Wiek, A., Carolan, M., Kallis, G., Kantamaturapoj, K., Mangnus, A., Jehlička, P., Taherzadeh, O., & Sahakian, M. (2022). Sustainable agrifood systems for a post-growth world. *Nature Sustainability*, 5(12), 1011–1017. doi: 10.1038/s41893-022-00933-5.
- McIntosh, A. (2001). *Soil and soul: People versus corporate power*. Aurum Press.
- Meier, I. C., Pritchard, S. G., Brzostek, E. R., McCormack, M. L., & Phillips, R. P. (2015). The rhizosphere and hyphosphere differ in their impacts on carbon and nitrogen cycling in forests exposed to elevated CO₂. *New Phytologist*, 205, 1164–1174.
- Merchant, C. (1980). *The death of nature: Women, ecology and the scientific revolution*. San Francisco: Harper.
- Mickey, S. (2023). Solidarity with nonhumans: Being ecological with object-oriented ontology. In K. Bray, H. Eaton, & W. Bauman (Eds.), *Earthly things: Immanence, new materialisms and planetary thinking* (pp. 260–273). Fordham University Press.
- Monbiot, G. (2022). *Regenesi: Feeding the world without devouring the planet*. Penguin Books.
- Morton, T. (2010). *The ecological thought*. Harvard University Press.
- Morton, T. (2011). Here comes everything: The promise of object-oriented ontology. *Qui Parle*, 19(2), 163–190.
- Morton, T. (2013). *Hyperobjects: Philosophy and ecology after the end of the world*. University of Minnesota Press.
- Pascoe, B. (2014). *Dark emu*. Magabala Books.
- Penniman, L. (2018). *Farming while black: Soul fire farm's practical guide to liberation on the Land*. Chelsea Green Publishing.
- Pirsig, R. (1974). *Zen and the art of motorcycle maintenance*. William Morrow.
- Ryan, J. (2023). Phytopoetics. In J. Fiedorczuk, et al. (Eds.), *The routledge companion to ecopoetics* (pp. 117–126). Routledge.
- Sasaki, R. (2021). *A new introduction to karl marx: New materialism, critique of political economy, and the concept of metabolism*. Palgrave MacMillan.
- Sellberg, K. (2021). Corporeal creativity and queer gaps in time. In S. Moslund, et al. (Eds.), *How literature comes to matter: Post-anthropocentric approaches to fiction* (pp. 172–190). Edinburgh University Press.
- Shiva, V. (2016). *Staying alive: Women, ecology, and development*. North Atlantic Books.
- Taylor, C. (2016). Close encounters of a critical kind: A diffractive musing in/between new material feminism and object-oriented ontology. *Cultural Studies? Critical Methodologies*, 16(2), 201–212.
- Tsing, A. (2012). Unruly edges: Mushrooms as companion species. *Environmental Humanities*, 1, 141–154.
- Tuana, N. (2008). Viscous porosity: Witnessing katrina. In S. Alaimo & S. Hekman (Eds.), *Material feminisms* (pp. 188–213). Indiana University Press.
- Wardle, D. (2019). Groundwater as hyperobject. *Mosaic: An Interdisciplinary Critical Journal*, 52(2), 1–16.
- Wong, J., & Plett, J. (2019). Root renovation: How an improved understanding of basic root biology could inform the development of elite crops that foster sustainable soil health. *Functional Plant Biology*, 46, 597–612.
- Yusuff, K. (2018). *A billion black anthropocenes or none*. University of Minnesota Press.