

Inscriptive energetics: climate change, energy, inscription

Nathaniel Otjen

Journal of Environmental Studies and Sciences

ISSN 2190-6483

Volume 9

Number 1

J Environ Stud Sci (2019) 9:45-53

DOI 10.1007/s13412-018-0516-3



Your article is protected by copyright and all rights are held exclusively by AESS. This e-offprint is for personal use only and shall not be self-archived in electronic repositories. If you wish to self-archive your article, please use the accepted manuscript version for posting on your own website. You may further deposit the accepted manuscript version in any repository, provided it is only made publicly available 12 months after official publication or later and provided acknowledgement is given to the original source of publication and a link is inserted to the published article on Springer's website. The link must be accompanied by the following text: "The final publication is available at link.springer.com".



Inscriptive energetics: climate change, energy, inscription

Nathaniel Otjen¹

Published online: 10 September 2018
© AEES 2018

Abstract

Scholars often observe that climate change is difficult to engage with and theorize. Rather than admit theoretical defeat, this article proposes that examining climate disruption through the framework of energy offers a way of thinking *through*, *with*, and *against* anthropogenic climate change. As I argue, climate change is an assemblage of shifting energies that includes pressure systems, temperature gradients, and storms. Climate change-as-energy inscribes itself onto material bodies, writing itself into the geologic record, leaving its imprint in plants, and stamping its presence in the flesh of the human and more-than-human. I call this ability of climate energetics to inscribe earthly bodies inscriptive energetics. The material traces of climate change, or inscriptive energetics, can be read on, in, and through bodies. Writers and artists have considered the inscriptive energetics imprinted upon forms—but implicitly, without identifying their own theorization of climate change as a problem of energy. Lynda Mapes' *Witness Tree: Seasons of Change with a Century-Old Oak* is a nodal point through which to explore how climate change itself acts as a form of energy that re-writes the world. Her book becomes a touchstone for a larger theory of inscriptive energetics, which expands out to consider examples of literary, artistic, and scientific discourse. As such, this article makes two primary contributions. First, it introduces the concept of inscriptive energetics, offering a theory of climate change based upon the interrelated study of energy and materiality. Second, it provides a way to conceptualize and understand the material impacts of climate change.

Keywords Climate change · Energy · Inscriptive energetics · Energy humanities · Plant studies · *Quercus*

Introduction

Climate change, as scholars of the humanities and social sciences often observe, is difficult to engage with and theorize. Timothy Morton, for example, argues that global warming is “intrinsically tricky” to think with because it is a “hyperobject,” something immensely distributed in space and time relative to humans (2013, 4).¹ Stephen M. Gardiner (2011) argues that climate change's global, intergenerational, and theoretical dimensions frustrate humanity's ability to understand and act on this urgent crisis. Amitav Ghosh, in *The Great Derangement: Climate Change and the Unthinkable*

(2017), suggests that human epistemologies cannot grapple with the extremity of contemporary climate events. In short, climate change is difficult to think because it is globally distributed, complex, nonlinear, abstract, unpredictable, violent, and intergenerational. Rather than admit theoretical defeat, however, this article proposes that thinking climate change through the framework of energy offers a productive way into the concept, a way of thinking *through*, *with*, and *against* anthropogenic climate change. As I argue, climate change is an interconnected constellation, an assemblage, of shifting energies. Solar energy becomes trapped by rising quantities of greenhouse gases (the byproducts of fossil fuel extraction and combustion). This surplus energy is then distributed around the globe, interrupting and displacing typical Holocene energy systems. Some of this extra energy concentrates and disperses itself in the form of weather events. Anthropogenic climate change, therefore, is a global assemblage of energy flows. In addition, climate change as energy inscribes itself on material bodies. These global energetics write themselves into the geologic record, leave their imprint in plants, and stamp their presence in the flesh of the human and more-than-human.

¹ Morton refuses to subscribe to the term “climate change” because he believes this phrase evades concern and supports denial. Instead, he uses the term “global warming” to describe recent alterations in climate patterns caused by humans.

✉ Nathaniel Otjen
notjen@uoregon.edu

¹ Environmental Studies Program, University of Oregon, 5223
University of Oregon, Eugene, OR 97403, USA

I call this ability of climate energetics to inscribe earthly bodies inscriptive energetics. To study the ways climate change writes itself onto the material world, one must begin with an analysis of inscribed bodies. Writers and artists, among others, have read and reflected upon the inscriptive energetics imprinted on and within human, more-than-human, and material bodies.² As a practitioner of material ecocriticism, I am interested in studying the matter inscribed by climate change both *in* texts and *as* a text. “Bodies, both human and nonhuman,” write Serenella Iovino and Serpil Oppermann, “provide an eloquent example of the way matter can be read as a text. Being the ‘middle place’ where matter enmeshes in . . . discursive forces . . . , bodies are compounds of flesh, elemental properties, and symbolic imaginaries. . . . [B]odies are living texts that recount *naturalcultural* stories” (2014, 6). Inscriptive energetics, the material traces of climate change, can be read *on*, *in*, and *through* bodies. Lynda V. Mapes, an environmental journalist, explores the material manifestations of inscriptive energetics in her most recent book of nonfiction titled *Witness Tree: Seasons of Change with a Century-Old Oak* (2017). Seeking “a fresh way to understand and tell the climate-change story” (2017, 6) Mapes discovered that “you could tell the story of climate change—and more—through a single, beloved living thing, a tree” (2017, 17). To tell the complex story of anthropogenic climate disturbance, Mapes lives with a century-old oak tree in the Harvard Forest for nearly 2 years. During this time, she notices that the tree’s rings and leaves bear the inscription of climate change energetics, and she learns to read the inscriptive energetics carved into this oak tree. *Witness Tree* becomes a nodal point through which to explore how climate change itself acts as a form of energy that re-writes the world.

This article is energized by and contributes to the energy humanities, material ecocriticism, plant studies, and biosemiotics. While diverse in scope and critical development, these fields share an interest in the ways nonhuman actants engage others. By examining the agents of arboreal inscription, this essay seeks to forge connections between these fields. In particular, redirecting attention to the act of inscription aims to bring material ecocriticism and biosemiotics together under a shared rubric, one that

² There have been a growing number of art projects and narratives produced in recent years that grapple with the bodily effects of climate change. Authors are writing climate fiction (popularly known as “cli-fi”), along with speculative and science fiction narratives about the changing climate and the ways it marks bodies. Artists are exploring new ways to experience intense climate disruption, creating interactive exhibits that emphasize the bodily impacts of climate change. Playwrights and theater directors are orchestrating human and nonhuman bodies in performative acts of becoming. Finally, digital humanists are creating ecological digital humanities (or, “EcoDH”) projects that strive to use “multimodal rhetoric” to investigate and teach the bodily effects of climate change (Cohen and LeMenager 2016, 345).

emphasizes communicational processes.³ As such, the article makes two primary contributions to the environmental humanities, broadly conceived. First, it introduces the concept of inscriptive energetics, offering a theory of climate change based upon the interrelated study of energy and materiality. By reading the various ways in which energy inscribes itself onto and within bodily forms, we can begin to think climate change in the contemporary era.⁴ Second, the study of energy and its inscriptive capacities offers a valuable way to read contemporary climate change narratives. These stories—at once *about* and *shaped by* climate disturbance—investigate and trace the impacts of displaced energy on physical bodies. Inscriptive energetics, as a mode of inquiry and thought, offers a way to conceptualize and study the material impacts of climate change.

Theorizing inscriptive energetics

Climate change is a global, interconnected system of unevenly distributed energy. While stopping short of declaring climate change an assemblage of swirling energy, the Intergovernmental Panel on Climate Change (IPCC) defines this deepening crisis using the language of energetics. In the Fifth Assessment Report (2014), they write:

Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period,

³ Biosemiotics, the study of semiotic communication between organisms, aims to “restore the ‘subjectness’ or agency of living organisms” (Maran 2016, 29). The field emerged from the work of Jakob von Uexküll (2010) and has been particularly inspired by his concept of *Umwelt*, or, as Wendy Wheeler succinctly defines it: “a species environment which *signifies*” (2006, 101). Charles S. Peirce’s work on semiotics was also crucial to the development of the field. Biosemiotics became recognized with Thomas A. Sebeok’s research (2001) that synthesized Uexküll and Peirce (Sagan 2010, 4). In recent years biosemiotics has turned to other disciplines, including ecocriticism. Wheeler is particularly interested in placing the two fields in conversation, noting that ecocritical scholarship “reflects a properly provocative attempt to reframe critical understandings of the relationship between signs, texts, languages, and world” (2008, 139; 2014). Additionally, Timo Maran (2014) has sought to uncover and promote common ground between biosemiotics and material ecocriticism. According to Maran, “[T]here is a crucial difference between material ecocriticism and biosemiotics: whereas the former has taken a critical approach to human social and cultural processes, the latter has not” (2014, 141). This article brings an emphasis on anthropogenic disturbance to the study of biosemiotic processes.

⁴ Mike Hulme shares this reimaginative ambition, calling for a reconceptualization of climate itself. In his most recent monograph, *Weathered: Cultures of Climate*, Hulme argues that climate is a cultural construction designed by humans to cope with the volatility of weather (2017). Unlike Hulme, however, I see value in studying climate, particularly climate change, as a system of physical and material processes. This materialist study renders climate change thinkable.

typically decades or longer. Climate change may be due to natural internal *processes* or external *forcings* such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use. (Mach et al., 120; emphasis added)

The terms “processes” and “forcings” are bound up in energy flows and their associated transformations. Here, energy flows—processes and forcings—cause the large-scale alteration of the climate. Solar cycles, volcanic eruptions, and anthropogenic alterations in the composition of the atmosphere and landscape are all energy events. In this sense, these forcings and processes are caused by energy displacement and they also release this displaced energy. The released energetics, in turn, contributes to global climate alteration. Climate change, therefore, consists of numerous energy streams, including forcings and processes.

How else might we conceptualize climate change as a system of energetics? Jane Bennett’s theorization of the electrical power grid provides a particularly useful model. The power grid, Bennett writes, “is a material cluster of charged parts that have indeed affiliated, remaining in sufficient proximity and coordination to produce distinctive effects. The elements of the assemblage work together, although their coordination does not rise to the level of an organism. Rather, its jelling endures alongside energies and factions that fly out from it and disturb it from within” (2009, 24). Like the power grid, a transportation system for electrical energy, climate change is “a material cluster of charged parts,” or energetics. These energy flows collide and “jell” to “produce distinctive effects.” Climate change is a mass of swirling energies that remain loosely connected while other forms of energy (e.g., hurricanes, tropical storms, rain, blizzards, droughts, or tornadoes) “fly out” from the dominant cluster and “disturb it from within.” These flows that abandon the central mass of energy temporarily disperse only to later rejoin the primary energy flow.

In addition to Bennett’s power grid, Gilles Deleuze and Félix Guattari’s theorization of “machinic phylum” further aids this redefining endeavor. For Deleuze and Guattari, the constant flux of matter in earthly assemblages—“matter-movement,” “matter-energy,” or “matter-flow”—is always already entangled with the human (1987). Like anthropogenic climate change, machinic phylum is “materiality, natural or artificial, and both simultaneously; it is matter in movement, in flux, in variation, matter as a conveyor of singularities and traits of expression” (Deleuze and Guattari 1987, 409). This “destratified, deterritorialized matter” fluidly “enters assemblages and leaves them” (Deleuze and Guattari 1987, 407). Read in this way, anthropogenic climate change is an assemblage of energies, a swirl of active flows.

Other scholars and writers have considered the connections between energy and climate change in more direct terms. Imre

Szeman and Dominic Boyer, for example, succinctly point out: “The problem of global warming is, at its core, an energy problem” (2017, 2). In other words, climate change is caused by the rapid release of energy via fossil fuel combustion and global warming is a system composed of these released energetics. Mapes, in *Witness Tree*, also conceptualizes climate change as a collection of energy flows:

The earth is an intricately connected system of physical and biogeochemical cycles and interactions. The chemistry and temperature of the air, the winds, the mixing of ocean currents, the pH of the seas, the mechanics of food chains, the interactions of plants and animals in their home ranges, the fate of forests and the breathing of trees—these are all connected. . . . It isn’t just that we have warmed the atmosphere. We have created an entirely *new system*, with feedbacks of its own. (2017, 195)

This “new system” of climate change is an assemblage of energies. Mapes understands earthly ecological processes to be energy flows and extends this conceptualization to climate change. While Vaclav Smil wryly observes that “[e]verything in the observable universe can be seen, analyzed, and explained in energy terms” (2008, 365), climate change is particularly compelling to consider as a form of energy.

How might we think of climate change energetics as *inscriptive*? Sigmund Freud provides a useful entry point into a theory of inscription. Imagining the human psyche as a physical object upon which memories are written and stored, Freud conceptualizes the act of inscription as a fundamentally material process. He writes about the “Mystic Writing Pad”: an early twentieth century invention composed of a wax layer covered by a sheet of celluloid that he believes approximates “the structure of the perceptive apparatus of the mind” (2008, 214). According to Freud, the Mystic Pad imitates the human psyche by repeatedly receiving and storing markings (i.e., memories and thoughts). He offers a detailed description of the Pad:

[T]he writing does not depend on material being deposited upon the receptive surface. It is a return to the ancient method of writing upon tablets of clay or wax: a pointed stylus scratches the surface, the depressions upon which constitute the ‘writing.’ In the case of the Mystic Pad this scratching is not effected directly, but through the medium of the covering-sheet. At the points upon which the stylus touches, it presses the lower surface of the waxed paper onto the wax slab, and the grooves are visible as dark writing upon the otherwise smooth whitish-grey surface of the celluloid. If one wishes to destroy what has been written, all that is necessary is to raise the double covering-sheet from the wax

slab by a light pull. . . . The close contact between the waxed paper and the wax slab at the places which have been scratched (upon which the visibility of the writing depended) is thus brought to an end and it does not recur when the two surfaces come together once more. (2008, 214)

A number of observations can be made. First, at a fundamental level, the inscriptive process is twofold; it requires *a performing action* and *a receiving material*. An inscription, therefore, is created where two interfaces—the performing action and receiving material—meet. Simply put, an inscription is the result of a pressing action contacting a receptive surface. The receptive surface both *receives* and *displays* the inscription while the performing action only *marks*. Second, the inscription is created not by adding material, but rather by *displacing* existing material. The receiving substrate becomes physically transformed or scarred by the inscriptive act. Therefore, in order to inscribe, a material must be displaced. Finally, inscriptions can become hidden. By refiguring the receiving surface, the inscription can be erased. However, as Freud is quick to point out, the inscription remains in the receiving substrate and can still be traced. “[T]he Pad provides not only a receptive surface that can be used over and over again, like a slate,” he writes, “but also permanent traces of what has been written, like an ordinary paper pad” (2008, 215). In summation, the inscriptive process requires a performing action and a receiving material; the inscription is where these two interfaces meet; an inscription can only be created by displacing material; and inscriptions can become hidden yet can always be traced.⁵

Material bodies are the sites of inscription, and plants, particularly trees, have a long history as receptive apparatuses. Indeed, the carving of marks into the bark of trees has existed for millennia. The “lingering presences” of arboreal inscription are held on and within the tree or plant itself (Oliver and Neal 2010, 15). Trees, like all bodies, are constantly being inscribed upon: “The forms of trees, as of other beings, emerge from relations with others” (Matthews 2017, G151). As Katherine Wright explains, “timber flesh is intricately moulded in the shape of all it has experienced — a material memory of organic life on earth” (2017, 80). In this sense, trees are an archive of inscription; they record worldly cohabitation. “[P]lants hold memory in their flesh: an index of weather, an archive of growth and becoming, sequence and synchrony,

carved into the material world. This ‘material remembering’ . . . reminds us that time is not abstract linearity, but a visceral, worldly and granulated thing that flows through our bodies and lives” (Wright 2017, 79). The “material remembering” archived by the tree is a record of bodily, fleshy inscription. It is no mistake that Sandra Steingraber, in *Living Downstream: An Ecologist's Personal Investigation of Cancer and the Environment* (2010), uses the metaphor of tree rings to describe the inscriptive process that occurs when toxins enter and inhabit the human body. For Steingraber, both human and tree bodies are “living scrolls” (2010, 239). As she puts it, “What is written there—inside the fibers of our cells and chromosomes—is a record of our exposure to environmental contaminants. Like the rings of trees, our tissues are historical documents that can be read by those who know how to decipher the code” (2010, 240). Arboreal (and human) bodies preserve messages of past activity. Trees are written upon by human and more-than-human actants; they bear the marks of inscriptive processes.

While trees, and plants more generally, are inscribed upon, they can also inscribe other bodies. As Patrícia Vieira notes: “All beings inscribe themselves in their environment and in the existence of those who surround them” (2017, 217). Vieira coins the term “phytographia” to describe “vegetal inscription” (2017, 218) or “plant writing” (2017, 223).⁶ Recognizing that plants inscribe themselves in literary texts, Vieira defines *phytographia* as “the coming together of the wordless, physically inscribed language of plants with an aesthetically mediated form of human language in literature” (2017, 223). Texts, therefore, are “spaces of inscription” where “we find traces of vegetal language” (Vieira 2017, 230). The notion of inscription, according to Vieira, provides “a possible bridge over the abyss separating humans from the plant world” (2017, 217). This way of thinking about plant inscription is particularly generative. *Phytographia*, or plant writing, describes literature about plants and the ways plants write upon and can be read within human cultural productions. I would also add, however, that plant writing must include the intertextual inscriptions written upon the plant body itself. In this sense, *phytographia* is a *literary product*, a *mode of inscription*, and a *vegetal record of inscription*. Mapes’ *Witness Tree* provides a way to think through this triptych.

With this background in place, we can now theorize “inscriptive energetics.” In short, inscriptive energetics describes the ability of material energy flows (i.e., climate change) to inscribe bodies. More specifically, and for the

⁵ At least two additional, and secondary, observations about Freud’s theory of inscription can be made. First, the surface or material receiving and displaying the inscription is passive. For Freud, the individual controlling the stylus possesses complete agency and power. Second, the Mystic Pad is both a technology of inscription and a text: it reproduces coded messages.

⁶ In a later work, Vieira, along with Monica Gagliano and John C. Ryan, offer a third term for the inscription of plants found in narratives: “vegetal textuality” (2016, xvi).

purposes of this article, inscriptive energetics describes the ways climate change inscribes itself on and in the bodies of trees. The inscriptions of climate energy are written into arboreal bodies, displacing plant flesh and leaving marks of inhabitation behind.⁷ The etchings left by climate energetics can be read and studied. Authors such as Mapes learn how to read these energy inscriptions, practicing “arts of attentiveness” (van Dooren et al. 2016) in the arboreal landscape. It also must be noted, however, that the tree is not a passive surface upon which climate energetics write. As Mapes demonstrates, the tree possesses the agency to inscribe itself upon other bodies. Indeed, the witness tree in the Harvard Forest inscribes the human, writing itself into our daily lives, onto our bodies, and into our narratives.

Reading inscriptive energetics in Mapes' *Witness Tree*

The century-old oak tree that Mapes grows to recognize as a companion species has long witnessed climate change. For Mapes, the large oak represents “a living marker, from which to understand our past, interpret our perplexing present, and regard our future” (2017, 7). The tree is “a wizened witness to the story of our changing world” (Mapes 2017, 14), a vegetal “witness to all the changes that had come over this [Massachusetts] landscape” (Mapes 2017, 18). As a witness to changing seasons, increasing greenhouse gas levels, and extreme weather events, this “witness tree” has weathered the swirling energetics of climate change for over a century.⁸ The ability to witness (and therefore record) implies that the oak tree can speak truths. The trope of the “talking tree” has long existed in literature and Mapes draws from this tradition, writing at one point: “the Witness Tree is . . . speaking truth about the changing atmosphere” (2017, 167).⁹ Furthermore, a witness is one who has seen a crime. In this sense, like the oak tree in Ursula Le Guin's short story “Direction of the Road” (1975), the oak has witnessed the global crime of climate

change and the devastation of earth. *Witness Tree*, therefore, can be read as a detective narrative that seeks to expose the catalyst of inscriptive energetics. Stephanie LeMenager, in *Living Oil: Petroleum Culture in the American Century* (2014), points out that oil narratives often participate within the genre of detective fiction as they seek to expose and render fossil fuels visible. Similarly, Mapes uses the detective genre to uncover the climate energetics that inscribes arboreal bodies. Like other authors engaging with vegetal entanglements, Mapes takes “the plant perspective” (Vieira et al. 2016, xii) and attempts to witness the world from the viewpoint of the oak tree.

The tree rings of the century-old oak are a primary site of inscriptive energetics investigated by Mapes. She explains that climate change has caused red oaks to grow “faster and more efficiently than ever recorded” (2017, 12). The global energetics of anthropogenic climate disruption establishes shorter winters and warmer seasons, and this increases the size of the oak's rings (Mapes 2017). Mapes explains:

Long-term carbon-sequestration measurements at the forest show that trees at the Harvard Forest—dominated by red oak—have been growing faster since the 1990s, as global average temperatures and carbon dioxide levels began their most rapid rise. By now, red oak is putting on more mass than any other tree species in the Forest, and faster. . . . [T]he red oak's surge is . . . the result of climate change, manifest in warmer temperatures in winter, increased rainfall, and growing seasons lasting longer than at any point before the last two decades. (2017, 166)

The increased mass is calculated by tree coring which enables researchers to measure the width of rings. Here, in the rings of the oak trees in Harvard Forest, inscriptive energetics can be read. The energetics of climate change—warmer winter temperatures, increased rainfall, and longer growing seasons—are inscribed into the flesh of oaks. As Peter Young succinctly notes: “Climate change is recorded in [oak] tree rings” (2013, 12).

Just a few pages later, Mapes elaborates on the inscriptive energetics found within the oak body. She suggests that the tree rings reveal a messy story of human, geologic, and plant entanglement.

The trees are changing their inner workings, using less water even as they put on more growth as temperatures warm and carbon dioxide levels rise. . . . [T]he picture that begins to emerge from all this is of human fingerprints now on the most grand to the most intimate scales of our planet. From the sky and its atmosphere, to seasonal timing, and deeper still, all the way into the structure, cellular function, and photosynthetic process of

⁷ One may be wondering how inscriptive energetics differs from Stacy Alaimo's transcorporeality (2010). While both concern the movement and bodily becoming-with of “dark” matter, I see three primary distinctions. First, the inscription of climate energetics is a text that can be read. Transcorporeality is a messy entanglement that often frustrates human modes of interpretation. Second, acts of inscription are associated with acts of reading and writing while transcorporeality is associated with biological and more-than-human becoming. Finally, an inscription is a material displacement. Transcorporeality often concerns the material transformation of bodies, not simply a physical displacement or restructuring.

⁸ The phrase “witness tree” was originally used by European colonists to describe the arboreal landmarks that established the metes and bounds of newly claimed colonial land (Mapes 2017, 7; Young 2013, 131). The witness tree, therefore, is a form of settler colonialism, representing both a colonial technology that enabled strategies of indigenous land dispossession and a body inscribed by colonialism-induced climate change (Whyte 2017).

⁹ For a discussion of talking trees, see Marder (2017).

individual leaves. This is the story of the big oak and, wrapped within it, our own. (2017, 168)

The trees' rings have been the sites of inscription: warming temperatures and rising carbon dioxide levels are etched in the arboreal body, in the "structure, cellular function, and photosynthetic process." In the true character of a detective story, the "human fingerprints" of fossil energy can be discovered, analyzed, and traced. Furthermore, this ecological crime scene tells a complicated and uneasy story of human and more-than-human imbrication. Reading the tree rings provides "the story of the big oak and, wrapped within it, our own." By uncovering the material manifestation of anthropogenic climate change in tree rings, the human must reckon with the scale and impact of this disaster. Perhaps most interesting, however, is that tree rings bearing the marks of climate change (i.e., inscriptive energetics) can be read. Moreover, these rings reveal a narrative of multispecies togetherness. As Erin James explains: "[T]ree rings are sites of narrativity that suggest that trees are capable of producing their own meanings. They are, in other words, examples of a material language at work—a plant language that can in turn inspire human language and new human imaginations" (2017, 267).¹⁰ A form of "plant language," or *phytographia*, tree rings inspire "new human imaginations," including a dark form of multispecies togetherness where the human, fossil, and plant coexist in the ecological crime scene caused by climate change.

Like the oak's tree rings, the leaves also function as a "site of narrativity" where inscriptive energetics can be examined. A careful practitioner of phenology (the study of seasonal variation observed from visible changes in vegetal bodies), Mapes reads the oak leaf as a dynamic surface that reveals the shifting temporality of seasons. While the oak tree has long been studied "as a guide to the weather outlook" (Young 2013, 99) climate change "has increased interest in phenology" (Young 2013, 178). Mapes participates in this renewed interest, observing and narrating the inscriptive energetics of changing seasonality found upon and within the leaves of the Harvard Forest.¹¹

Trees both affect and are affected by climate change in ways that are measurable—and important. Leaves are

¹⁰ While writing about fossils, Kathryn Yusoff refers to mineralized bodies as "narrativistic devices" (2013, 787). Fossils, for Yusoff, tell stories of more-than-human becoming and being. In this sense, James's "sites of narrativity" and Yusoff's "narrativistic devices" function in similar ways and can be thought together. Wheeler makes a similar point about narrativity, noting: "All living things are in constant creative semiotic interaction with their environments: each makes the other in a continual process" (2014, 122).

¹¹ While the visual apparatus is the preferred method to study the inscriptive energetics found on and within the oak tree, various technologies were also used to examine inscriptions and these technologies left marks on the tree. For example, the "Witness Tree Cam" is installed to survey the tree at all hours; climbing gear is used to scale the tree; and coring instruments are used to extract tissue samples from the oak.

wonderfully legible indicators that reveal the workings of the forest, and influence of the environment. Budburst is sensitive to temperature, and the warmer it is, the earlier it comes. Once trees begin photosynthesizing, they also gobble carbon dioxide. . . . [C]limate change is altering the seasonal timing of the forest. Leaf-out is coming earlier, with an advance of spring by nearly five days on average [in the last twenty-five years]. . . . The onset of the first frost had changed even more. . . . On average, spring is coming earlier. Fall is coming later. And winter is being squeezed on both ends. (Mapes 2017, 125)

The inscriptive energetics of climate change can be glimpsed on and within the leaves. As "wonderfully legible indicators," tree leaves bear the marks of climate change energetics. According to Mapes, leaves receive inscriptions throughout their entire, seasonal life cycle. Inscriptive energetics is a "lingering presence," one that extends through budburst in the spring and photosynthesis in the summer.

Mapes renders the physical inscription of climate change even more explicit in a subsequent consideration of tree leaves and shifting seasons. As she notes in the above passage, the lengthening of the arboreal growing season is having profound impacts on tree bodies. Mapes elaborates further, describing the "combat zone" of inscription found within the canopy of the century-old oak.

Leaves also take a beating up there, and the earlier they unfurl, the more abuse they are subjected to and the sooner they fall apart. I know that from leaves squirrels had chewed down on the big oak, which I'd seen on twigs on the ground, or up in the tree when I'd climbed it for a closer look. It's a combat zone up there. Almost from the minute they grow out, leaves are studded with galls, chewed and mined and shredded by bugs, lashed by the wind, and baked by the sun. Is it any wonder they are checked out by the end of a normal year and can't keep going throughout our new super-size growing seasons, weeks longer than these trees evolved for? Still, for me, the idea of seasons that lasted longer than the leaves could stay on the trees was a lot to take in. Something about it seemed unnatural—because it *is* unnatural. It's a human-caused forcing of the climate system, imposed on a natural physiological cycle with its own timing. (2017, 165–66)

Here the inscriptions of climate energetics are clearly on display. Beaten and battered by the agents of inscription (i.e., the wind and sunlight), the oak's leaves are subjected to a tyranny of "abuse." The violent marks inscribed upon the leaves point to climate change as the culprit. Moreover, in this excerpt inscriptive energetics represents a form of violence against

bodies, a violence that threatens the well-being of more-than-human life and the possibility of multispecies flourishing. Indeed, the leaves “take a beating,” are subjected to “abuse,” are “lashed,” are “baked,” and eventually become “checked out.” The green leafy canopy is, in short, a “combat zone,” an ecological crime scene characterized by violence, mutilation, and death. Seasons become, for Mapes, a haunting form of slow violence (Nixon 2011); their duration tortures and kills. Energy as inscriptive can be pernicious. An ethics of care develops within this narrative moment as Mapes counts the casualties and inspects the scars of inscriptive energetics.¹² Among the battered leaves of the oak, a way of thinking against anthropogenic climate change emerges. Like the sleuthing protagonist of a detective narrative, Mapes tracks down the culprit (climate change) and seeks justice for the crime committed.

Contemplating the physical disfigurement caused by inscriptive energetics entangles Mapes in a multispecies collectivity, which, in turn, cultivates an ethics of care. Cognizant of the “human-caused forcing of the climate system” that has caused “new super-size growing seasons,” Mapes mourns the damages wrought by climate change energetics. This ethics of care reveals the oak tree’s capacity to write, or *inscribe*, itself onto Mapes. In this sense, the oak tree writes itself into Mapes’ thoughts, feelings, and even her book. This *phytographia* has a profound effect. “The longer I lived in the woods,” Mapes writes, “the more I felt I was gradually not just observing the Forest, but becoming it” (2017, 49). Trees, in other words, inscribe the human, implicating us within their worlds. Michael Marder explains: “The human body and subjectivity alike are not pure expressions of Spirit but strange archives, surfaces of inscription for the vestiges of the inorganic world, of plant growth, and of animality—all of which survive and lead a clandestine afterlife in us, as us” (2017, 10). Humans, as “surfaces of inscription,” are written upon by vegetal beings and become participants in multispecies collectivities. LeMenager, while considering the future of Anthropocene narratives, asks: “Will there be love in the era of climate collapse?” (2017, 235). If *Witness Tree*, like the Anthropocene novel, “is at best a project of paying close attention to what it means to live through climate shift, moment by moment, in individual, fragile bodies” (LeMenager 2017, 225), then love, established by an ethics of care, will persist through climate destruction.

¹² As Jeff Oliver and Tim Neal point out, the physical disfigurement of trees has long been viewed with abhorrence. They observe that tree carving, in particular, “damages trees, it spoils the natural beauty of the bark, it is messy and clutters the view with scripts that obscure the picturesque” (2010, 17). Mapes subscribes to this view while discussing the “combat zone” caused by inscriptive energetics.

Conclusion

Trees, particularly the *Quercus* genus described in *Witness Tree*, are powerful narrators of inscriptive energetics. As James points out, “the material language of many trees is one type of vegetal signification that is immediately recognizable and even familiar to humans” (2017, 266). Most recently, for example, Chris Turney et al. proposed a single Sitka spruce tree living on Campbell Island south of New Zealand as a “golden spike” to mark the onset of the Anthropocene. Reading the carbon inscribed within the tree’s heartwood, this team of climate researchers argue that “the world’s loneliest tree” on Campbell Island provides “geological stratigraphic material” capable of defining the Anthropocene as an epoch (2018, 5).¹³ This single tree was selected as the defining marker of the contemporary climate moment; trees have potent “vegetal signification.” Additionally, oaks are influential narrators of climate change inscription because they have long been entangled in fossil energy systems. Indeed, the ancestors of today’s oak trees formed the coal deposits that now contribute to climate change energetics and climate inscription.¹⁴ Oak lumber was also used to prop up coal mine tunnels, to add structural support to the machines of the Industrial Revolution, and to construct the first automobiles (Young 2013, 80). The arboreal body, and oaks in particular, provide a compelling point of departure for the study of inscriptive energetics.

Reading the marks of inscriptive energetics on and within the arboreal, human, and textual body renders climate change comprehensible, which, in turn, enables us to think through, with, and against anthropogenic climate disruption. As Mapes demonstrates, the difficult-to-comprehend crisis of global climate change can be observed in the rings and leaves of local trees. *Witness Tree* serves as a guide to spotting the marks of inscriptive energetics; once one knows how and what to observe, the effects of anthropogenic climate disruption become apparent and decipherable. If climate change is experienced as the disruption of the everyday, as LeMenager contends, then paying careful attention to these changes as they manifest themselves in quotidian material bodies provides a way into the problem and stimulates response. Reading inscriptive energetics makes it clear that human actions are harming the beings and things closest to us, the figures we most take for granted. This realization, in turn, exposes vulnerabilities and encourages people to act in ways that promote the well-being of others. Mapes, after all, develops an ethics of care that she attempts to disseminate to a broader readership. In short, studying climate change as a global assemblage of shifting

¹³ The *BBC* (Amos 2018) reported on this scientific article and news outlets around the world quickly followed. Trees and their inscriptive capacities fascinate people.

¹⁴ Mapes, for example, describes in detail the ancient forests that created fossil fuel deposits (2017, 186–87).

energetics that inscribes itself upon human and more-than-human bodies offers an entry point into this difficult-to-think crisis. Inscriptive energetics leaves its mark on bodies, discourses, and literary productions. Examining these inscriptions offers a necessary heuristic for thinking through the literatures of climate change.

Acknowledgements Many thanks to Stephanie LeMenager for providing valuable feedback and guidance on previous drafts, and to the anonymous reviewer who helped strengthen the argument. Earlier versions of this essay were presented at the virtual symposium A Clockwork Green: Ecomedia in the Anthropocene and the 7th Annual University of Oregon Climate Change Research Symposium. The essay benefitted from the questions and comments provided by conference attendees at these two events.

References

- Alaimo S (2010) *Bodily natures: science, environment and the material self*. Indiana University Press, Bloomington
- Amos J (2018) 'Loneliest tree' records human epoch. BBC. <http://www.bbc.com/news/science-environment-43113900>. Accessed 20 February 2018
- Bennett J (2009) *Vibrant matter: a political ecology of things*. Duke University Press, Durham
- Cohen J, LeMenager S (2016) Introduction: assembling the ecological digital humanities. *PMLA* 131:340–346. <https://doi.org/10.1632/pmla.2016.131.2.340>
- Deleuze G, Guattari F (1987) *A thousand plateaus: capitalism and schizophrenia*. University of Minnesota Press, Minneapolis
- Freud S (2008) A note upon the 'mystic writing-pad'. In: Rieff P (ed) *General psychological theory: papers on metapsychology*. Touchstone, New York, pp 211–216
- Gardiner S (2011) *A perfect moral storm: the ethical tragedy of climate change*. Oxford University Press, Oxford
- Ghosh A (2017) *The great derangement: climate change and the unthinkable*. University of Chicago Press, Chicago
- Hulme M (2017) *Weathered: cultures of climate*. SAGE Publications Ltd., Thousand Oaks
- Iovino S, Oppermann S (2014) *Material ecocriticism*. Indiana University Press, Bloomington
- James E (2017) What the plant says: plant narrators and the ecosocial imaginary. In: Gagliano M, Ryan J, Vieira P (eds) *The language of plants: science, philosophy, and literature*. University of Minnesota Press, Minneapolis, pp 253–257
- Le Guin U (1975) Direction of the road. In: *The wind's twelve quarters: short stories*. Harper & Row, New York, pp 267–274
- LeMenager S (2014) *Living oil: petroleum culture in the American century*. Oxford University Press, Oxford
- LeMenager S (2017) Climate change and the struggle for genre. In: Menely T, Taylor J (eds) *Anthropocene reading: literary history in geologic times*. The Pennsylvania State University Press, State College, pp 220–238
- Mach K, Serge P, von Stechow C (2014) Annex II: glossary. Climate change 2014: synthesis report. Contribution of working groups I, II, and III to the fifth assessment report of the intergovernmental panel on climate change. https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_Glossary.pdf. Accessed 9 November 2017
- Mapes L (2017) *Witness tree: seasons of change with a century-old oak*. Bloomsbury, New York
- Maran T (2014) Semiotization of matter: a hybrid zone between biosemiotics and material ecocriticism. In: Iovino S, Oppermann S (eds) *Material ecocriticism*. Indiana University Press, Bloomington, pp 141–156
- Maran T (2016) Biosemiotics. In: Adamson J, Gleason W, Pellow D (eds) *Keywords for environmental studies*. New York University Press, New York, pp 29–31
- Marder M (2017) To hear plants speak. In: Gagliano M, Ryan J, Vieira P (eds) *The language of plants: science, philosophy, and literature*. University of Minnesota Press, Minneapolis, pp 103–125
- Matthews A (2017) Ghostly forms and forest histories. In: Tsing A, Swanson H, Gan E, Bubandt N (eds) *Arts of living on a damaged planet*. University of Minnesota Press, Minneapolis, pp G145–G156
- Morton T (2013) *Hyperobjects: philosophy and ecology after the end of the world*. University of Minnesota Press, Minneapolis
- Nixon R (2011) *Slow violence and the environmentalism of the poor*. Harvard University Press, Cambridge
- Oliver J, Neal T (2010) Elbow grease and time to spare: the place of tree carving. In: *Wild signs: graffiti in archaeology and history*. Hadrian Books, pp 15–22
- Sagan D (2010) Introduction. In: Uexküll J (ed) *A foray into the worlds of animals and humans: with a theory of meaning*. University of Minnesota Press, Minneapolis, pp 1–34
- Sebeok T (2001) Biosemiotics: its roots, proliferation, and prospects. *Semiotica* 134:61–78. <https://doi.org/10.1515/semi.2001.014>
- Smil V (2008) *Energy in nature and society: general energetics of complex systems*. The MIT Press, Cambridge
- Steingraber S (2010) *Living downstream: an ecologist's personal investigation of cancer and the environment*. Da Capo Press, Cambridge
- Szeman I, Boyer D (2017) *Energy humanities: an anthology*. Johns Hopkins University Press, Baltimore
- Turney C, Palmer J, Maslin M, Hogg A, Fogwill C, Southon J, Fenwick P, Helle G, Wilmschurst J, Mcglone M, Bronk C, Thomas Z, Lipson M, Beaven B, Jones R, Andrews O, Hua Q (2018) Global peak in atmospheric radiocarbon provides a potential definition for the onset of the Anthropocene epoch in 1965. *Sci Rep* 8:1–10. <https://doi.org/10.1038/s41598-018-20970-5>
- Uexküll J (2010) *A foray into the worlds of animals and humans: with a theory of meaning*. University of Minnesota Press, Minneapolis
- van Dooren T, Kirskey E, Münster U (2016) Multispecies studies: cultivating arts of attentiveness. *Environmental Humanities* 8:1–23. <https://doi.org/10.1215/22011919-3527695>
- Vieira P (2017) *Phytographia: literature as plant writing*. In: Gagliano M, Ryan J, Vieira P (eds) *The language of plants: science, philosophy, and literature*. University of Minnesota Press, Minneapolis, pp 215–233
- Vieira P, Gagliano M, Ryan J (2016) *The Green thread: dialogues with the vegetal world*. Lexington Books, Latham
- Wheeler W (2006) Figures in a landscape: biosemiotics and the ecological evolution of cultural creativity. *L'Esprit Créateur* 46:100–110. <https://doi.org/10.1353/esp.2006.0029>
- Wheeler W (2008) Postscript on biosemiotics: reading beyond words — and ecocriticism. *New Formations* 64:137–154
- Wheeler W (2014) 'Tongues I'll hang on every tree': biosemiotics and the book of nature. In: Westling L (ed) *The Cambridge companion to literature and the environment*. Cambridge University Press, New York, pp 121–135
- Whyte K (2017) Our ancestors' dystopia now: indigenous conservation and the Anthropocene. In: Heise U, Christensen J, Niemann M (eds) *The Routledge companion to the environmental humanities*. Routledge, Abingdon, pp 206–215

Wright K (2017) *Transdisciplinary journeys in the Anthropocene: more-than-human encounters*. Routledge, Abingdon

Young P (2013) *Oak*. Reaktion Books, Islington

Yusoff, K (2013) Geologic life: prehistory, climate, futures in the Anthropocene environment and planning D: society and space. 31: 779–95. <https://doi.org/10.1068/d11512>