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Webs of Care

or: Can (Thinking about) Multispecies Forests Redeem Information Technology?

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Figure 1. Powell's Books, Portland, OR, Fall 2021. Photo by the author.

This forest was like the Internet too—the World Wide Web. But instead of computers linked by wires or radio waves, these trees were connected by mycorrhizal fungi. The forest seemed like a system of centers and satellites, where the old trees were the biggest communication hubs and

> the smaller ones the less-busy nodes, with messages transmitting back and forth through the fungal links.[1] Forests show us how the internet could be, because the Wood Wide Web is a network where nobody is ever left to fend for themselves.[2]

An audience has assembled at The Shed at Hudson Yards in New York City, ready to hear another panel about decentralization, democracy, and the future of networked digital technologies. This panel is entitled "What can the internet learn from trees?" Tech writer and musician Claire Evans is reprising points made from her article "The Word for Web is Forest," written for tech nonprofit New_Public's magazine, and telling the audience about the 1997 publication of scientist Suzanne Simard's landmark study of mycorrhizal networks. The study established that these networks passed carbon between different tree species in British Columbia, and landed on the cover of *Nature* under the editor's moniker, "the wood-wide web."[3] But things have changed online since 1997, Evans reminds the audience. Corporations "have kind of algorithmically weeded the forest, if you will, into a field of commercial timber… trolls, like mountain pine beetles, proliferate. Controversy sparks like wildfire, scorching the earth. And all around us we see these practices that privilege factions over coalitions. Over the mutualistic, interdependent, healthy relationships that bind healthy systems and societies." Evans suggests we take inspiration from the cooperative and naturally decentralized forest to reimagine the internet. Another speaker, founder of New_Public Eli Pariser, supports the call for technologists to consider such patterns and network dynamics in nature "because right now, honestly, it's very easy to feel down about this whole project. Maybe even kind of hopeless about digital life."

This vision of a better internet also underlies Taeyoon Choi's garden.local project, an art installation and essay. garden.local is part of the Distributed Web of Care initiative, an ongoing set of workshops, creative interventions, and texts exploring how to enact a more accessible and less environmentally damaging internet. Choi asks:

> What if the Internet is like a garden, full of moss, lichens, and mushrooms? What would it be like if humans could visit this lush, natural environment and listen to the tales of the software-plants, and rest against the hardware-earth, and exchange vital forms of care with various data-creatures?[4]

The essay appears in a recent issue of *Branch* magazine, a publication building a community around the intersection of tech and climate—work that is vital to redefine the types of relation and mutual care that technologies can foster—and which itself, of course, evokes a ramifying techno-natural web.[5]

This essay considers the ideal of the networked forest as a model for digital networks, and specifically as a model for networks that might facilitate mutualistic relationships, reciprocity, and collective well-being. Not so long ago, social theorists tended to talk about trees—at least in their capacity as imaginative resources for thinking through design, technology, politics, and collective life—as too hierarchical or too ordered.[6] This moment seems long gone. Developments in biology and ecology, wider acknowledgement of indigenous knowledge about specific plant communities, and the cascading failures of industrial forestry have transformed mainstream understanding of forests.[7] In recent popular writing, trees are discussed not as isolated entities, but as nodal, networked agencies in communicative multispecies assemblages. Simard's research on biological mutualism among Douglas firs, paper birch, and mycorrhizal fungi has hit a cultural nerve, and technologists, like the general public, have been enthralled with her vision of resource sharing, resilience, and cooperation. This new image of the networked forest has, in turn, been ventured as a hopeful vision for technologies and media systems.

Writing about mycorrhizal networks, artist James Bridle muses at the fact that, thanks to the application of network theory in the sciences, we can see that "these intelligences have been here all along, and are becoming undeniable, just at the moment when the newfound sophistication of our own technologies threatens to supersede us."[8] I agree that the timing of this widespread awakening to networked mutualism is curious. Is it a coincidence? Indigenous knowings about these sorts of relations, for instance (often cited in newer popular works), are much older, and have described them in very different idioms.[9] What if nonhuman networks of care were especially intuitive and compelling precisely because of the clear threats to life and well-being posed by current networked technologies? Patricia De Vries argues that the Wood Wide Web even provides a way out for media theorists caught in a totalizing story of capitalist domination, offering "a new framework in which to rethink media scholar's limiting and paralyzing understanding of the societies of control."[10] Previous shifts in how the public has imagined environments, however—such as with the *Earthrise*

photograph, as Jennifer Gabrys has noted with reference to Fred Turner's work, or with whale music, as Max Ritts has described—show how countercultural imaginations of shared fates and interspecies communication can appear in retrospect as rather politically ambiguous.[11] In what follows, then, I reflect on moments when the invocation of a networked forest seems to legitimize existing informatic market formations rather than to challenge them.

The backdrop for this reflection is an outpouring of popular anglophone writing in recent years on trees, forest communities, and fungal symbionts in North American forest landscapes. We could think of the success of Simard's 2021 memoir, *Finding the Mother Tree,* which recounts her path to the 1997 article, more recent work demonstrating that the oldest "mother trees" in a forest are the most connected "nodes" in these networks, and her persistence in the face of disciplinary conservativism. [12] This research has made her one of the most well-known scientists in North America—featured on *Radiolab* and Talks at Google, in countless newspaper and magazine profiles, and in a forthcoming Hollywood film.[13] We could also think of Richard Powers's Pulitzer Prize-winning 2018 novel *The Overstory,* a fractal clustering of the lives of various characters and their proliferating relationships with trees and each other, including a character based on Simard.[14] In Powers's rendition, an outcast scientist causes controversy studying the communication of trees releasing volatile organic compounds as "airborne semaphores," later entering collaborative scientific networks with others studying mycorrhiza. Her life intertwines with characters like an early Silicon Valley game developer who finds inspiration for programming lively new worlds in the florescence of branching trees. (Both Simard and Powers are, in turn, touchstones for Bridle in their charming recent book *Ways of Being,* on plant, animal, and computational intelligences.[15]) A third bestselling text on forest communication is German forester Peter Wohlleben's 2016 *The Hidden Life of Trees: What They Feel, How They Communicate: Discoveries from a Secret World*.[16] And in academia, we could think of the interdisciplinary popularity of Eduardo Kohn's *How Forests Think: Toward an Anthropology Beyond the Human,* a passionate argument for understanding life as semiosis, or Anna Tsing's *The Mushroom at the End of the World*: *On the Possibility of Life in Capitalist Ruins*, which introduces readers to the matsutake mushrooms that thrive in symbiotic relationships with lodgepole pines, and the precarious livelihoods they enable.[17] I should out myself here as a plant person, too; in my other work, I write about similar topics from the midst of a turn to forests, trees, and wood in media studies (itself part of a larger

vegetal turn in the humanities, social sciences, and philosophy[18]) which runs alongside the wider cultural fascination with sylvan communication and arboreal co-dependencies described above.[19]

This essay is not a critique of these texts or the research undergirding them—I think each has much to offer, and interested readers can follow the debate about whether the popular media and the scientific community has gotten just a bit carried away elsewhere.[20] It is rather a reflection on the connection between their wide appeal and anxieties about networked communications technologies. Why are forests privileged sites for making sense of concepts like communication, collaboration, and mutuality today? Forests' nonhuman entanglements have become affectively charged as models of care and reciprocity, even as the technosocial formations in whose image they are retroactively understood—through the application of network theory developed in computer science—can appear more dangerous than ever.

Environmental humanities scholar Rob Nixon has endorsed the "meme" of the cooperative, networked forest as "a scientifically informed allegory" offering hope and a vision of justice and redistribution in the face of a hollowing out of collective institutions.[21] Citing the influence of the 2008 financial crash in increasing this appeal, he notes that "people pine for a fealty to something larger than the barricaded self but smaller than the global marketplace."[22] The discourse about mycorrhizal networks has gradually accelerated alongside not only economic developments, of course, but also technological changes. The appearance of the Wood Wide Web on the cover of *Nature* in 1997 speaks to a particular moment in public excitement about the internet, but the real burst in popular media coverage of mycorrhizal science would come almost two decades later, around the same time that the public slowly began to sour on social networks and view growing tech consolidation with trepidation.[23] Even as the Cambridge Analytica scandal unfolded and Shoshana Zuboff's *Surveillance Capitalism* became a bestseller, language borrowed from networked telecoms became ubiquitous in both popular writing and scientific papers about interactions between plants and fungi. Mycorrhizal networks have been described as an "ancestral social network,"[24] their filaments working like "fiber-optic Internet cables"[25] to allow the sharing of news, signals, and information. Imaginaries of organic life draw on understandings of media-technological forms, whose shapes and structures become mobile explanatory tools. What happens when

imaginaries of sylvan care are grafted back onto technological arrangements, as in the panel described at the beginning of this essay?

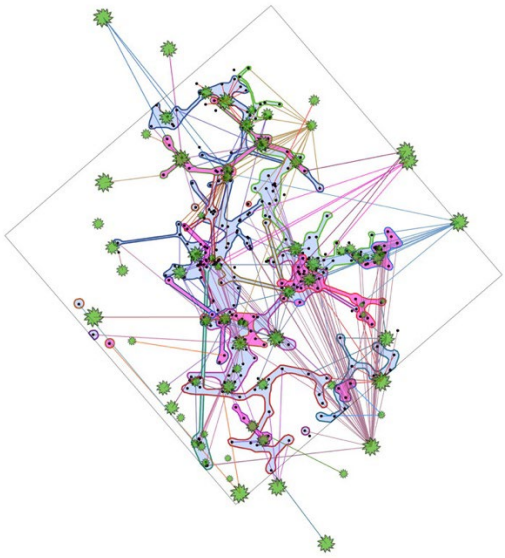


Figure 2. Architecture of the wood-wide web: Rhizopogon spp. genets link multiple Douglas-fir cohorts. From Kevin J. Beiler et al., "Architecture of the Wood-Wide Web," *New Phytologist* 185, no. 2 (2010): 543–53

I started exploring these questions in earnest during research into digitized timber construction in the Pacific Northwest of North America. It did not come as a surprise to me that forests here would carry so much complex affective and symbolic weight for so many people; forests here are home and stolen homelands, the heritage of a settler resource industry, political battlegrounds, spaces for leisure and healing, economic resources, and guarantors of the future. Yet I did not anticipate the peculiar way in which forests and digital media would be held together so comfortably. I did not expect that texts like Simard's, Powers's, and Tsing's would be shared references connecting me with interlocutors working in digital fabrication and engineering, and occasions for conversation on tours of postindustrial forests and industrial factories in Oregon and Washington.

At a major industry conference for timber construction in Portland, Oregon, I listened to a presenter make use of concepts from Simard's research to make a heartfelt appeal for mass producing modular housing in offsite factories. "The forest is a highly collaborative place," an architect explained to her audience of developers, structural engineers, and construction managers, contending that sharing creates abundance. "How can the building system

work more like an ecosystem," she asked, "and how can the built environment behave more like a forest?" Using the same metaphors as the speakers at the Shed, she passionately extolled her audience to adopt the Original Equipment Manufacturer model used in electronics and automotive manufacturing, where a central product concept or chassis drives demand, serving as a core platform and around which other components are competitively bid out to distributed producers.

The remarkable aspect of the talk was not the interest in automated manufacturing or in coordinating design and global supply chains through digital tools; all of these are widely shared among people designing and working with structural timber.[26] It was the conviction with which ecological metaphors were used to imagine this new frontier for construction, and the intensity of the emphasis placed on care, cooperation, and mutuality at a professional trade show. "The forest," the audience was told, "is not just a place of competition; it's a place of collaboration and support. A robust network of interrelationships is essential to resist systems risk; like a multispecies forest, can we set up this manufacturing ecosystem for collaborations?" This imagined ecosystem would revolve around "the platform concept," which, "at its best, can be like a mother tree," a central node guaranteeing systemic connections across the network. How did it become possible for a business model for industrially mass-producing housing to be analogized as a life-sustaining node in a multispecies assemblage? How, particularly when the impacts of the forest products industry on the old growth, multi-aged stands studied by scientists like Simard have been neither metaphorical nor nourishing?[27]

Figure 3. Portland International Airport during construction of a new mass timber roof, Summer 2022. Photo by the author.

One way to tackle this bizarre presentation would be to treat it as a problem of stretching or abusing a metaphor. But as many scholars have shown, the language of ecosystems and networks has long bridged conversations in ecology with corporate and military operations research—both indebted to concepts drawn from cybernetics.[28] The conceptual borrowings between ecology and managerial informatics are so deeply rooted in the origins of both of these fields that patrolling the appropriate domains of concepts could miss the point.

Another would be to cite the peril of anthropomorphism, echoing a common critique of Simard and Wohlleben. While this is a real concern, I share with feminists, indigenous commentators, and anthropologists the sense that critiques of anthropomorphism can have their own problems and tend to be rather selective.[29] It is not unusual for people to notice forms, behaviors, and patterns in biological, atmospheric, or geological phenomena and then invest these with normative significance for understanding the affairs of humans. The implications of these borrowings have been widely recognized, problematized, and celebrated, but the form they take and their ultimate impacts are not inevitable.[30] Trees alone have spawned countless models of knowledge, history, and politics. As Bridle notes, network theory spawning from the study of the internet laid the foundation for the study of scale-free network dynamics in forest ecologies. While the hegemony of network science might close our eyes to some possibilities, it has opened them to others.

Rather, the question seems to be around the performative function of these analogies as a way of mediating fears and desires within a determinate cultural condition. We can compare biological systems with technology, and often do—but what work do these comparisons do, and for who? This is closer to a question raised by Alexander Galloway in another context: what does it mean when thinkers, "holding up a mirror to nature, see the mode of production reflected back at them?"[31] To unpack this trade in metaphors between the imagined forest and informatic economic arrangements, consider the frequency with which communication collapses into exchange, in descriptions of "trading on the arbuscular mycorrhiza market," the "basic exchange of goods," or how networks "allows plants to distribute resources."[32] Is this mutual aid or a market?[33] As Nixon points out, "Neoliberal economics and cooperative biology thus converge on the same systemic metaphor"–the networked, intelligent superorganism.[34] What

accounts for the different political valences, in his view, is the attitude towards interdependence, and the tendency of neoliberalism to "view the individual as a unit of being."[35] Certainly, neoliberalism privileges the individual agent in a complex system rather than a "self… always already symbiotic, social, collectivized."[36] But the difference between connectivity and collectivity is easy to gloss over. Wendy Chun has recently noted that "network science differs from other sciences in its positive evaluation of dependency and structure" and argued that, while network scientists are not responsible for neoliberalism, "many of network science's insights are intertwined with the economic system they presuppose."[37] Simard herself, meanwhile, even notes that collaboration and competition are extremely limited ways of understanding relation, terms that constrain our thinking about what types of entanglements and communication might be involved.[38]

Figure 4. Screenshot from www.openforestprotocol.org, a blockchain data project for forestation projects. October 2022.

One point to stress here is that the explicit analogizing between informatic technologies and multispecies assemblages constitutes a kind of relationality between these two domains that tends to reproduce their separation rather than explore their actual interconnections. The reification of separate domains of meaning enacted in the very process of metaphorization can be a productive impetus to thought, but it might also stand in the way of other forms of relation and mutual encounter. Forests and the internet may be considered allegorically, but as part of intersecting economic formations, they are also connected in quite non-allegorical ways. Networks are ecological infrastructures, and particular forests, as Jennifer Gabrys demonstrates, concrese in their entanglements with sensing networks, researchers, and publics.[39] Literary scholar Souhei Tanaka explores how "ecological network aesthetics" are taken up in artistic and literary projects as well as by techno-utopian smart-forest start-ups, arguing that only the former, grounded in "the recognition that nonhumans constitute their own

media," points the way to multispecies flourishing.[40] Although Tanaka's primary concern is "forest futures," not technological ones, I share his sense that the material continuities between human and nonhuman systems are just as important as their use as allegories for each other, and that "apprehending the political ecology of networks requires probing the terms and conditions of agency and power that are reconfigured with each network variance."[41]

This leads to another point about the proliferating ways in which other beings—in all their porosity, dynamism, and interdependences—are called on to perform labor. As ecosystem services and natural capital, they are now expected to provide instrumental solutions to the imbalances and harms of industrial, colonial, and informatic capitalism. Trees, for instance, get enrolled in carbon offset projects or corporate initiatives like the Trillion Trees Campaign, in what Shannon Mattern lucidly terms "techno-vegetal solutionism" or "sylvan solutions to systemic snafus."[42] But they are also called on to perform what we might think of as creative, cognitive, and affective forms of labor. We look to trees for design inspiration, mental and spiritual renewal, and care for the generic human subject presupposed in the use of terms like biophilia. I draw here on philosopher Margaret Grebowitz's argument that

> The complexity of the exhaustion of environments in late capitalism…. isn't just material; it's also cultural. The cultural meaning of environments is another "resource" humans use up. And we have not yet begun to theorize how these different aspects of environmental exhaustion and loss are connected.[43]

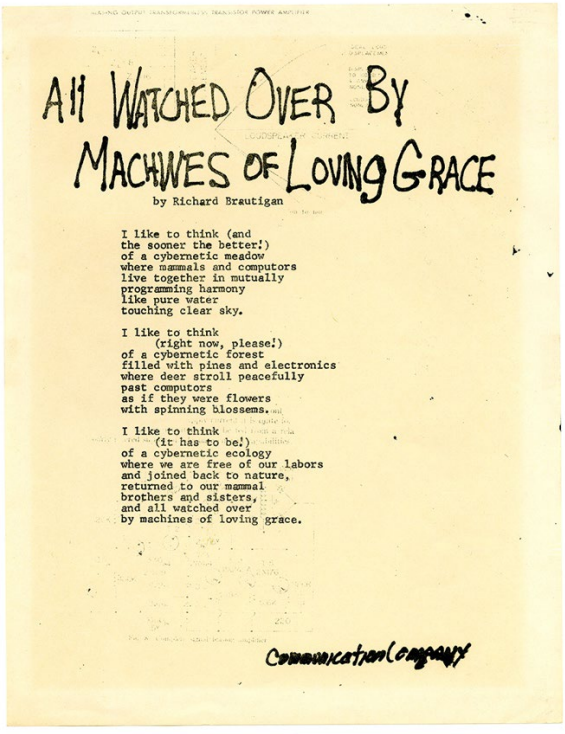
As scholar of biomimicry Elizabeth Johnson observes, design predicated on mimicry of natural systems promises "a way toward an alternative future free from human hubris and ecological catastrophe—and a way out of the conditions that have created the Anthropocene" but in fact "too easily serves as a double mirror—rather than transform production, nonhuman life at the level of biology becomes a force for production."[44]

Figure 5. Rendering of Willow Village, Meta's proposed mass timber development. Meta and Signature Development Group.

To return for a moment to that industry tradeshow, we can see that this blend of instrumental and affective labor is at work in the vision of a wooden built environment as a global carbon sink; companies like Google, Sidewalk Labs, Amazon, Facebook, and Walmart are among those who have explored or invested in mass timber campuses. Some people in the industry envision transforming supply chains to source more sustainably, promoting biodiversity and structural variation on postindustrial lands. But even as discourse shifts to restoration, diversity, and complexity, existing supplies of timber in North America remain dependent on industrial monocultures that sequester carbon at much lower rates than mature forests.[45] These are forests with no paper birch, let alone bigleaf maple, cascara, bitter cherry, or yew. Their soils, as I have seen for myself, lack the white threads of mycorrhizal networks that form such a vivid picture of communication and collaboration for audiences at the Shed or Talks at Google. Workers inhabiting corporate campuses built of wood might imagine themselves as embedded within harmonious new ecologies that restore rather than deplete the climate, but this remains far from the reality.

Corporate arboreal affect has parallels in avant-garde technologist circles, too. Forests are powerfully evocative and legitimating for the Regenerative Finance (or ReFi) crowd "decentralizing conservation" by trading carbon offset, afforestation, and biodiversity commodities on the blockchain,[46] as well as for start-ups citing mycelia as the original "exchange network as a service" and mother trees as "federation operators."[47] Berlin-based artist

collective Terra0 has widely exhibited artwork related to their speculative protocol for an "augmented forest" to become "a shareholder of its own economic unit."[48] More precisely, they imagine a piece of land registered as a party in a blockchain-enabled smart contract, able to sell automated concessions to log itself, using the proceeds to repay its debt to the humans who had initiated the contract, eventually acquiring autonomy. Framing their work not as satire but as an "appropriation of capitalist and cultural mechanisms" to overcome a split between nature and culture through emergent processes, they rather correctly follow classical liberal conceptions of personhood as self-ownership to their most extreme conclusions. Their website greets its viewer with excerpts of Richard Brautigan's 1967 poem, "All Watched Over by Machines of Loving Grace" against a background of satellite imagery and footage of misty forests distorted through a cathode ray display: "I like to think of a cybernetic forest" and "Right now, please! It has to be!" Brautigan's playful, post-work envisioning of a luxuriant, symbiotic accord between organisms and machines has been recognized by Fred Turner as an early sign of the latent neoliberalism of elements of the 1960s counterculture.[49] Why rehash this vision today?



All Watched Over By Machines of Loving Grace

by Richard Brautigan

I like to think (and
the sooner the better!)
of a cybernetic meadow
where mammals and computors
live together in mutually
programming harmony
like pure water
touching clear sky.

I like to think
(right now, please!)
of a cybernetic forest
filled with pines and electronics
where deer stroll peacefully
past computors
as if they were flowers
with spinning blossems.

I like to think
(it has to be!)
of a cybernetic ecology
where we are free of our labors
and joined back to nature,
returned to our mammal
brothers and sisters,
and all watched over
by machines of loving grace.

Communication Company

Figure 6. Richard Brautigan. "All Watched Over by Machines of Loving Grace," 1967. Image courtesy of University of Delaware Special Collections.

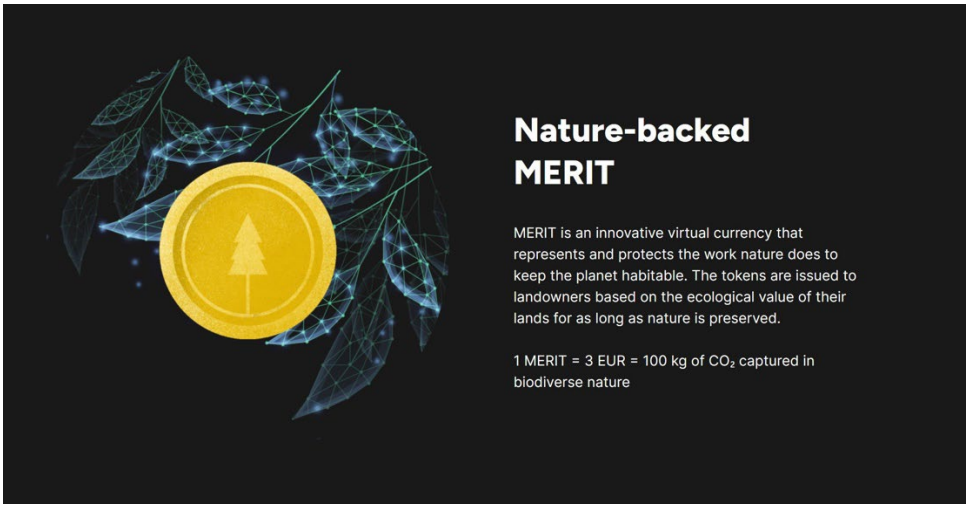


Figure 7. Screenshot from single.earth/nature-token-merit, website of a nature-based solutions blockchain financialization project. April 2023.

We would do well to interrogate the seductiveness of forest ecologies as ready-to-hand images of caring exchange and communication between distributed agents that seem—unlike, for instance, the bankrupt dream of a "sharing economy," the crowdsourced hate and self-surveillance of social media, or the opaque networks of globalized logistics networks—free from abuse and extractive profiteering. Care, as Maria Puig de la Bellacasa cautions, "can be easily idealized as a moral disposition, or turned into a fairly empty normative stance disconnected from its critical signification of a laborious and devalued material doing."[50] Can we ensure that invocations of the forest establish the conditions of material accountability rather than legitimize their networked integration into existing forms of capitalist production?[51] To generate radical openings for mutual care and for doing networks differently, we may even need to look beyond allegories of mutualism in forest networks, directly at the strange, upsetting, and remarkable diversity of relations that already bind technologies and ecologies together today.

Notes

1 Suzanne Simard, *Finding the Mother Tree: Uncovering the Wisdom and Intelligence of the Forest* (London, UK: Allen Lane, 2021), 272.

2 Claire L. Evans, Eli Pariser, and Amelia Winger-Bearskin, "What the Internet Can Learn

From Trees," *Unfinished Live*, 22 Sept 2023, unfinished.com/news/what-the-internet-can-learn-from-trees/.

3 Suzanne W. Simard et al., "Net Transfer of Carbon between Ectomycorrhizal Tree Species in the Field," *Nature* 388, no. 6642 (1997): 579–82, doi.org/10.1038/41557.

4 Taeyoon Choi, "Garden.Local," *Branch*, 26 August 2022, branch.climateaction.tech/issues/issue-4/garden-local/.

5 Thanks to Shannon Mattern for saving me from missing this connection!

6 "The structural simplicity of trees is like the compulsive desire for neatness and order … The semi-lattice, by comparison, is the structure of a complex fabric; it is the structure of living things—of great paintings and symphonies." Christopher Alexander, "A City Is Not a Tree.," *Design*, no. 206 (1965): 9. "The tree and root inspire a sad image of thought that is forever imitating the multiple on the basis of a centered or segmented higher unity." Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia* (Minneapolis: University of Minnesota Press, 1987), 16. Of course, Deleuze and Guattari suggest their famous tree/rhizome distinction is "valid less as a designation for things than as a mode of calculation applied to things." 17.

7 James C. Scott, *Seeing like a State: How Certain Schemes to Improve the Human Condition Have Failed*, Yale Agrarian Studies (New Haven, CT: Yale University Press, 1998); Robin Wall Kimmerer, *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge and the Teachings of Plants*, First edition. (Minneapolis, MN: Milkweed Editions, 2013).

8 James Bridle, *Ways of Being: Beyond Human Intelligence* (London: Allen Lane an imprint of Penguin Books, 2022), 83.

9 For recent overviews of much older such ideas from North America, see Gregory Cajete, *Native Science: Natural Laws of Interdependence* (Clear Light Publishers, 2000); Kimmerer, *Braiding Sweetgrass*.

10 Patricia de Vries, "When Fungus Punched Anthropos in the Gut: On Crap, Fish-Eating Trees, Rhizomes and Organized Networks," *Rhizomes: Cultural Studies in Emerging Knowledge*, no. 34 (2018): 8, doi.org/10.20415/rhiz/034.e04.

11 Jennifer Gabrys, *Program Earth: Environmental Sensing Technology and the Making of a Computational Planet* (Minneapolis: University of Minnesota Press, 2016), 14; Max Ritts, "Environmentalists Abide: Listening to Whale Music – 1965–1985," *Environment and Planning D: Society and Space* 35, no. 6 (2017): 1096–1114, doi.org/10.1177/0263775817711706.

12 Simard, *Finding the Mother Tree*, 2021; Kevin J. Beiler et al., "Architecture of the Wood-Wide Web: Rhizopogon Spp. Genets Link Multiple Douglas-Fir Cohorts," *New Phytologist* 185, no. 2 (2010): 543–53, doi.org/10.1111/j.1469-8137.2009.03069.x.

13 Ferris Jabr, "The Social Life of Forests," *The New York Times*, 2 December 2020, sec. Magazine, www.nytimes.com/interactive/2020/12/02/magazine/tree-communication-mycorrhiza.html; Radiolab, *From Tree to Shining Tree*, 2016, www.radiolab.org/episodes/from-tree-to-shining-tree; Suzanne Simard, "Finding the Mother Tree," www.youtube.com/watch?v=lDehr7JpyP8; Suzanne Simard, "How Trees Talk to Each Other," www.ted.com/talks/suzanne_simard_how_trees_talk_to_each_other; Emma Marris, "It Takes a Wood to Raise a Tree: A Memoir," *Nature* 594, no. 7862 (2021): 171–72, doi.org/10.1038/d41586-021-01512-y; Robert Moor, "Suzanne Simard Changed How the World Sees Trees," *Intelligencer*, 6 May 2021, nymag.com/intelligencer/article/suzanne-simard-interview.html; Rebecca Giggs, "A Better Way to Look at Trees," *The Atlantic*, 17 June 2021,

www.theatlantic.com/magazine/archive/2021/07/social-trees-meg-lowman-suzanne-simard/619015/; Kate Kellaway, "Secrets of a Tree Whisperer: 'They Get Along, They Listen – They're Attuned,'" *The Observer*, 24 April 2021, sec. Environment, www.theguardian.com/environment/2021/apr/24/suzanne-simard-finding-the-mother-tree-woodwide-web-book-interview; Jonathan C. Slaght, "The Woman Who Looked at a Forest and Saw a Community," *The New York Times*, 3 May 2021, www.nytimes.com/2021/05/03/books/review/finding-the-mother-tree-suzanne-simard.html.

14 Richard Powers, *The Overstory* (New York: W.W. Norton, 2018).

15 Bridle, *Ways of Being*.

16 Peter Wohlleben, *The Hidden Life of Trees: What They Feel, How They Communicate: Discoveries from a Secret World* (Vancouver, BC: Greystone Books Ltd, 2016).

17 Anna Lowenhaupt Tsing, *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins* (Princeton, NJ: Princeton University Press, 2015); Eduardo Kohn, *How Forests Think: Toward an Anthropology beyond the Human* (Berkeley: University of California Press, 2013). Kohn makes an argument that aligns with the one made here: "… in the hopeful politics we seek to cultivate, we privilege heterarchy over hierarchy, the rhizomatic over the arborescent, and we celebrate the fact that such horizontal processes—lateral gene transfer, symbiosis, commensalism, and the like—can be found in the nonhuman living world. I believe this is the wrong way to ground politics…. Projecting our morality, which rightfully privileges equality, on a relational landscape composed in part of nested and unidirectional associations of a logical and ontological, but not a moral, nature is a form of anthropocentric narcissism that renders us blind to some of the properties of that world beyond the human" (34).

18 See for instance Emanuele Coccia, *The Life of Plants: A Metaphysics of Mixture*, English edition (Medford, MA: Polity, 2019); Matthew Gandy and Sandra Jasper, *The Botanical City* (Berlin: Jovis, 2020); Germaine Greer, *Botanical Drift: Protagonists of the Invasive Herbarium*, ed. Khadija von Zinnenburg Carroll (Berlin: Sternberg Press, 2017); Luce Irigaray and Michael Marder, *Through Vegetal Being: Two Philosophical Perspectives*, Critical Life Studies (New York: Columbia University Press, 2016).

19 Jennifer Gabrys and Cindy Lin have opened up the imbrication of forest ecosystems with the infrastructures of sensing and surveillance that constitute them as objects of knowledge and governance; Rafico Ruiz and Aleksandra Kaminska's postulation of xylomedia and John Stamm's *Dead Tree Media* both explore the colonial and financial empires of the Canadian pulp and paper industries (and in both cases, revive the legacy of early media theorist Harold Innis's attention to empire and resource markets); and Shannon Mattern and Matteo Pasquellini have asked how the symbolism and material forms of trees have undergirded political formations and taxonomic systems. Part of my hope for this reflection is to situate this interest in the intersection of forest ecologies and mediation (an interest I share) within a larger cultural landscape of arboreal affect. Jennifer Gabrys, "Sensing an Experimental Forest: Processing Environments and Distributing Relations," *Computational Culture*, no. 2 (28 September 2012), computationalculture.net/sensing-an-experimental-forest-processing-environments-and-distributing-relations/; Cindy Lin, "How to Make a Forest," *E-Flux Architecture*, 20 April 2020, www.e-flux.com/architecture/at-the-border/325757/how-to-make-a-forest/; Aleksandra Kaminska and Rafico Ruiz, "Mediating the Tree: Infrastructures of Pulp and Paper Modernity in The Bowater Papers," *Canadian Journal of Communication* 46, no. 2 (21 June 2021): 29 , doi.org/10.22230/cjc.2021v46n2a3859; Matteo Pasquinelli, "The Arborescent Mind: The Intelligence of an Inverted Tree," in *Botanical*

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20 Robert Moor, "The German Forester Who Wants the World to Idolize Trees," *The New Yorker*, 10 June 2021, www.newyorker.com/books/under-review/the-german-forester-who-wants-the-world-to-idolize-trees; Justine Karst, Melanie D. Jones, and Jason D. Hoeksema, "Positive Citation Bias and Overinterpreted Results Lead to Misinformation on Common Mycorrhizal Networks in Forests," *Nature Ecology & Evolution* 7, no. 4 (2023): 501–11, doi.org/10.1038/s41559-023-01986-1; Kathryn Flinn, "The Idea That Trees Talk to Cooperate Is Misleading," *Scientific American*, 19 July 2021, www.scientificamerican.com/article/the-idea-that-trees-talk-to-cooperate-is-misleading/; Emily Magkourilou and Katie Field, "Do Trees Really Stay in Touch via a 'Wood-Wide Web'? Here's What the Evidence Says," *The Conversation*, 13 February 2023, theconversation.com/do-trees-really-stay-in-touch-via-a-wood-wide-web-heres-what-the-evidence-says-199806; Sarah Kaplan, "Scientists Tangle over 'Wood Wide Web' Connecting Forests and Fungi," *Washington Post*, 14 February 2023, www.washingtonpost.com/climate-environment/2023/02/14/trees-fungi-share-messages-resources/; "FAQ," *The Mother Tree Project* (blog), accessed 22 April 2023, mothertreeproject.org/about-mother-trees/faq/.

21 Rob Nixon, "The Less Selfish Gene," *Environmental Humanities* 13, no. 2 (2021): 367, doi.org/10.1215/22011919-9320189.

22 Nixon, "The Less Selfish Gene," 365.

23 The same year, *Time* ran its "Welcome to the Wired World" cover, and *Wired* its "Long Boom" cover, foretelling a quarter century of networked prosperity and sustainability.

24 Muthusubramanian Venkateshwaran et al., "Symbiosis and the Social Network of Higher Plants," *Current Opinion in Plant Biology*, Growth and development, 16, no. 1 (2013): 118–27, doi.org/10.1016/j.pbi.2012.11.007.

25 Wohlleben, *The Hidden Life of Trees*, 10.

26 See Stephen Kieran and James Timberlake, *Refabricating Architecture* (New York: McGraw-Hill, 2004). for an influential elaboration of this idea.

27 While architects designing in wood are increasingly concerned about the environmental impacts of sourcing and the complexity of claims that wood sequesters carbon, meaningful attempts to source cross-laminated timber from low-impact or multi-objective forestry remain the exception; the conference was picketed in a previous year by local environmental groups.

28 Daniel B. Botkin, *Discordant Harmonies: A New Ecology for the Twenty-First Century* (Oxford: Oxford University Press, 1990); Bruce Clarke, *Gaian Systems: Lynn Margulis, Neocybernetics, and the End of the Anthropocene,* Posthumanities 60 (Minneapolis: University of Minnesota Press, 2020); Tega Brain, "The Environment Is Not A System," *A Peer-Reviewed Journal About* 7, no. 1 (2018): 152–65, doi.org/10.7146/aprja.v7i1.116062; Gabrys, *Program Earth*.

29 Marshall Sahlins, "On the Ontological Scheme of *Beyond Nature and Culture*," *HAU: Journal of Ethnographic Theory* 4, no. 1 (2014): 281–90, doi.org/10.14318/hau4.1.013; Natasha Myers, "Ungrid-Able Ecologies: Decolonizing the Ecological Sensorium in a 10,000 Year-Old NaturalCultural Happening," *Catalyst: Feminism, Theory, Technoscience* 3, no. 2 (2017): 7; Donna Jeanne Haraway, *Manifestly Haraway*, Posthumanities 37 (Minneapolis: University of Minnesota Press, 2016), 225; Bridle, *Ways of Being*, 70;

Kimmerer, *Braiding Sweetgrass*, 57; Val Plumwood, "Nature in the Active Voice," *Australian Humanities Review*, no. May (2009): 126, australianhumanitiesreview.org/2009/05/01/nature-in-the-active-voice/ Plumwood notes, "artistic integrity, honesty and truthfulness to experience are crucial in any re-discovery of 'tongues in trees'."

30 For instance, see Gaston Bachelard, *The Formation of the Scientific Mind*, trans. Mary McAllister Jones (Manchester: Clinamen Press, 2002); Donna Jeanne Haraway, *Crystals, Fabrics, and Fields: Metaphors That Shape Embryos* (Berkeley, CA: North Atlantic Books, 2004); Stefan Helmreich, *Silicon Second Nature: Culturing Artificial Life in a Digital World* (Berkeley: University of California Press, 1998).

31 Alexander Galloway, "The Poverty of Philosophy: Realism and Post-Fordism," *Critical Inquiry* 39, no. 2 (2013): 347, doi.org/10.1086/668529.

32 Robert Macfarlane, "The Secrets of the Wood Wide Web," *The New Yorker*, 7 August 2016, www.newyorker.com/tech/annals-of-technology/the-secrets-of-the-wood-wide-web.

33 This slipperiness, and biologist Merlin Sheldrake's criticism of the latter view, is also discussed by Macfarlane. It might be considered the latest chapter of a debate around the appropriate balance in using terms like competition or cooperation to describe nonhuman life which goes back at least to Peter Kropotkin's 1902 *Mutual Aid: A Factor in Evolution*. This work emphasized cooperative formations to challenge the dominant Anglo-American emphasis on competition in evolution, but also critiqued Rousseauian fantasies of harmony. The parallels between Simard and Kroptokin are obvious (Nixon has also noted them) but not exact. Kropotkin, for instance, was a politically active anarchist for most of his life, as well as a scientist, and *Mutual Aid* is not related to own work as a geographer.

34 Nixon, "The Less Selfish Gene," 356.

35 Nixon, "The Less Selfish Gene," 358.

36 Nixon, "The Less Selfish Gene," 362.

37 Wendy Hui Kyong Chun, *Discriminating Data: Correlation, Neighborhoods, and the New Politics of Recognition* (Cambridge, MA: The MIT Press, 2021), 91–92.

38 Krista Tippett and Suzanne Simard, "Forests Are Wired For Wisdom," *On Being*, accessed 22 April 2023, onbeing.org/programs/suzanne-simard-forests-are-wired-for-wisdom/.

39 Gabrys, *Program Earth*, 38.

40 Shouhei Tanaka, "Ecological Network Aesthetics and the Wood Wide Web," *ASAP/Journal* 7, no. 1 (2022): 137, doi.org/10.1353/asa.2022.0013.

41 Tanaka, "Ecological Network Aesthetics," 139.

42 Mattern, "Tree Thinking."

43 Margret Grebowicz, "Free Solo, or Climbing in Posthuman Times," *The Avery Review*, no. 41 (2019): 6.

44 Elizabeth R. Johnson, "Reconsidering Mimesis: Freedom and Acquiescence in the Anthropocene," *South Atlantic Quarterly* 115, no. 2 (2016): 269–70, doi.org/10.1215/00382876-3488409.

45 The coexistence of production-oriented forest monocultures (and mass production) with practices and rhetoric around complexity and multiplicity deserves further attention, as this paradox seems to feed industry rather than upset it. As Tsing notes, complexity and diversity are productive resources for capital, even as it destroy the conditions that could reproduce them. Anna Tsing, "Supply Chains and the Human Condition," *Rethinking Marxism* 21, no. 2 (2009): 148–76, doi.org/10.1080/08935690902743088; Tsing, *The Mushroom at the End of the World*.

46 "KlimaDAO," KlimaDAO, accessed 22 April 2023, www.klimadao.finance/; "MCO2 Token - MOSS Earth," accessed 22 April 2023, mco2token.moss.earth/; "Tokenized Carbon Credits | Infrastructure to Tokenize Carbon Credits," Toucan, accessed 22 April 2023, toucan.earth/; "Saving Nature with MERIT Tokens — Single.Earth," accessed 22 April 2023, www.single.earth/; "Open Forest Protocol | Measure, Report, Verify and Fund Forestation Projects with Digital Transparency," Open Forest Protocol, accessed 22 April 2023, www.openforestprotocol.org; Mary Beth "Mouse" Skylis, "Can Blockchain Help Save the Wilderness? These Groups Think So.," *Outside Business Journal*, 8 April 2022, www.outsidebusinessjournal.com/issues/can-blockchain-help-save-the-wilderness-these-groups-think-so/.

47 "Basically, they have signed a type of 'smart contract' that operates over the mycelium network. As someone might expect, the network provider will charge 'sugars' fees for the service, which will allow the mycelium network to grow in size and create new connections with other neighbours in a self-sustainable manner." Covacich, Daniel S. "Decentralised Community-Based Networks and the Teachings of a Wood Wide Web." *Medium.com* (blog), 3 May, 2019. medium.com/braincities/decentralised-community-based-networks-and-the-teachings-of-a-wood-wide-web-4b5c562af645.

48 Paul Seidler, Paul Kolling, and Max Hampshire, "Can an Augmented Forest Own and Utilise Itself?," n.d., 2.

49 Specifically, those "New Communalist" elements that rejected the politics of the New Left. Fred Turner, *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism* (Chicago: University of Chicago Press, 2006).

50 Maria Puig de la Bellacasa, "Matters of Care in Technoscience: Assembling Neglected Things," *Social Studies of Science* 41, no. 1 (2011): 96, doi.org/10.1177/0306312710380301.

51 Projects like Distributed Web of Care and Branch Magazine point to what it might mean to inflect care with this critical, material doing. Another example of work invoking relational entanglements with other forms of life in the name of justice is "Comrades Against Extinction," a collaboration between artist Jonas Staal and law professor and activist Radha D'Souza. This creative, public work stages an unapologetically anthropomorphic call for solidarities across species lines as part of their ongoing project, "Court for Intergenerational Climate Crimes." Jonas Staal, "Comrades Against Extinction," Jonas Staal, accessed 23 April 2023, www.jonasstaal.nl/projects/comrades-against-extinction/.

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