Community Ecology
https://doi.org/10.1007/s42974-022-00085-8

BOOK REVIEW

How environmental science might contribute to a new worldview

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Accepted: 18 March 2022
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The Arbornaut: A Life Discovering the Eighth Continent in the Trees Above Us Meg Lowman, 2021, Farrar, Straus, and Giroux, New York, NY, USA, 368 pp, $20.00 (paperback), ISBN: 9781250849182

Finding the Mother Tree: Discovering the Wisdom of the Forest Suzanne Simard, 2021, Alfred A. Knopf, New York, NY, USA. 348 pp, $28.95 (hardcover), ISBN: 9780525656098

Philosopher Thomas Kuhn introduced the language of "paradigm shift" into discussions about how science develops over time. While most science proceeds within a "normal" realm, Kuhn suggests, occasionally, a paradigm shift occurs. Such a shift is a change in kind, a quick and radical departure of vision from the way the world is normally viewed. With these two books, ecologists Meg Lowman and Suzanne Simard offer us the foundation of a new way of seeing, and living in, the world.

The parallels between their work and lives are stunning. Both are pioneering women forest scientists of roughly the same age. Both have rural roots. Both are studying previously neglected parts of trees and the forest: Lowman the forest canopy, Simard the opposite in the forest's underground fungal network. As field ecologists, they endured physical hardships brought about by working outdoors: bear attacks, leeches, equipment failures, exposures to toxic chemicals, trucks stuck in the mud. As women scientists, however, they have also endured human-induced hardships: sexual assault and harassment, an unapologetic and at times toxically masculine discipline (forestry), dismissals and attacks from peers and colleagues, overt bullying and physical intimidation, and a world generally unsupportive of women scientists. While the former hardships are inevitable, the latter are embarrassingly inexcusable. And while many of the former hardships have been mitigated through better technologies and safety procedures, the later have not been adequately addressed.

Both Lowman and Simard have had hugely successful and influential careers. Lowman has a mite named after her (*Pilobatella lowmanae*), and Simard's story is scheduled to be made into a feature length movie.

Like the underground mycorrhizal fungi weaving the forest together described in Simard's work, there are wonderful threads of connection between the two books. One way to see these threads is to consider some of the scientific dogma their work challenges, dogma that are the extension of the dominant western worldview. This view of the world asserts nature is purely material and inanimate and that humans are separate, special, and superior to nature. These dogmata include, among other things, the belief that scientists should not be advocates, that nature and natural selection is fueled by competition alone, that it's inappropriate to speak of anything outside the human realm sharing qualities with humans (at the risk of having the charge of anthropomorphism slung at you). Lowman and Simard have different experiences and responses to these charges, and both offer ways to challenge the dominant western worldview and embrace the moral relevance of the non-human world.

Lowman's gift of describing the forest and especially the canopy as wonderous, sparks a normatively rich value-laden response and the desire to protect the forest. She is a master of introducing people to the wonders of the forest through science and experience. She's the force behind many of the world's canopy walks, areal trails allowing visitors to experience the forest in a way that few people in the history of the world ever have, and citizen science expeditions. As Lowman and her fellow Arbornauts have uncovered, "upward of *half* of all terrestrial creatures live about one hundred feet or more above our heads, not at ground level as scientists had previously assumed," [115] and yet "Arbornauts estimate that 90 percent of canopy species remain undiscovered and unclassified." [1101].

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Published online: 13 April 2022

Moving away from the desire to merely understand the workings of the forest and the trees within it, Lowman comes to conservation advocacy and the desire to preserve the forest mid-career. She cites research that "found higher publication output did not correlate to saving more forests. Our current scientific process may not be leading to successful forest conservation; we scientists should not remain content to simply publish results in technical journals as a primary accomplishment." [l233] Affirming the known critique of the information deficit model of behavior change, which mistakenly claims that knowledge leads to action, Lowman asserts that knowledge plus experience "can inspire stewardship of our planet's biodiversity." [l266].

At times the knowledge about and experiences with nature backfired and led to the opposite of conservation: orchids along the Amazon walkway were "pilfered by poachers who sell illegally" [l207]. Yet her optimism is palpable: "If students and citizen scientists develop curiosity about nature…then it seems certain they will be more likely to solve the grand scientific challenges of the near future." [l217] And her work in the world aligns beautifully with those beliefs—she is a person of integrity, matching what she knows and believes with where she puts her effort.

Simard's advocacy awakening came as she puzzled over the failure of clear cut planted seedlings and watched firsthand how the timber industrial complex in British Columbia veered so far from the practices of her own logging family, even in the face of the science she was presenting. Modern logging practices, she writes, embody "an industrial order that felt hugely, terribly misguided." [s4] The reader gets an inside glimpse into the jarring conflicts of interest and how lack of regulation enforcement incentivized cheating and taking more timber than allowed in a contract. Describing timber marking an old-growth stand in her early years working for a timber company, Simard confesses to marking more old trees for destruction than approved: "By the time we were done, we'd stolen at least a dozen elders from the edges of the avalanche tracks." [s43] Slowly as she experienced relentless harvesting practices and as her scientific understanding of the importance of cooperation between trees reshaped her idea of what a forest was, she realized "I was part of something much greater than myself" [s155] and "it was my responsibility to stand up." [s99].

Scientifically, Simard is known for her focus on how trees cooperate, for flatly rejecting the fallacy of false dualism between competition or cooperation. While "the prevailing wisdom was that trees only compete with one another to survive," [s50] she writes, there is really a "two-way exchange. *A mutualism*." [s60] Her career has been a "thirty-year battle over the entrenched dogma that competition was the only interplant interaction that mattered in forests." [s260].

As such, her work also challenges premises underpinning certain management practices, such as removing the competition between trees so that each tree will grow faster. "Are forests structured mainly by competition or is cooperation as or even more important?" she asks, in forestry as well as agriculture "We emphasize domination and competition…We emphasize factions instead of coalitions…the theory of dominance is put into practice through weeding, spacing, thinning…methods that promote growth of the prized individual." [s140].

Predictably, critics have slung the charge of anthropomorphism at her for decades, sometimes misrepresent her work (e.g., suggesting she claims trees "talk" to one another, which she never does). Interesting, those same slingers are selective in the targets: while describing nature as cooperative is branded anthropomorphism, describing nature as competitive is not. The slingers also seem to forget that, in *Descent of Man*, Charles Darwin himself challenges the idea that there really are differences in kind between humans and non-humans, a belief that allows the charge of anthropomorphism off the ground in the first place: "My object in this chapter is solely to shew that there is no fundamental difference between man and the higher mammals in their mental faculties." If there are no uniquely human traits, simply describing nature as possessive of traits that humans also possess does not seem obviously problematic.

More importantly, Simard explores the *meaning* of her scientific findings, something not always done by scientists. At times she outright rejects the core of the dominant western worldview when speaking of forests, "They are complex, self-organizing. They have the hallmarks of *intelligence*. Recognizing that forest ecosystems, like societies, have these elements of intelligence helps us leave behind old notions that they are inert, simple, linear, and predictable. Notions that have helped fuel the justification for rapid exploitation that has risked the future existence of creatures in the forest ecosystem." [s190] "Our modern societies," she writes, "have made the assumption that trees don't have the same capacities as humans." [s277] But, "The scientific evidence is impossible to ignore: the forest is wired for wisdom, sentience, and healing." [S6].

Without naming her changing worldview, Simard begins to articulate an animism of the forest, she begins to animate and personify (i.e., to make into a person, thereby granting moral standing): "I whispered the tree thanks…Then I made it a promise." (s100) She speaks of a harvested tree as one that "had been killed."

Simard's intuitions about cooperation led her to scientific experiments demonstrating this. The first of which came in a flash: first observing a labeled photosynthate moving between a birch and a fir via the complex underground and entwined network of mycorrhiza fungi she "shouted, *Yes!* Deep down…we knew that we'd picked up something miraculous happening between the two tree species…Like intersecting a covert conversation over the airwaves that could

change the course of history." [s156] "A raven flew over and called in a low croak. I remembered that the Nlaka'pamux, on whose land we had performed this experiment, see the raven as a symbol of change." [s157] This personification of the forest and the trees, arrived at through rigorous science, reaches a crescendo when Simard aligns her thinking about tree cooperation with Indigenous perspectives: "The trees are like us? And they're teachers?," she asks her colleague, who responds by explaining how the "Coast Salish say that the trees also teach about their symbiotic nature." [s66] The last part of the book more thoroughly examines the alignment between Simard's work and Indigenous perspectives.

We also see this emerging worldview when she speaks about the *purpose* of her work: "I did the work for the sake of the forest, not because of academic hubris," [s180] "I felt kinship with Mother Trees, grateful for accepting me and giving me these insights." [s230] Planting seedlings with her daughter she instructs, "Touch her bark first, sweetie pie, to show your respect." [s279] And when she speaks of certain trees as mothers:

> "The old trees were the mothers of the forest.
> The hubs were *Mother Trees*.
> Well, mother *and* father trees since each Douglas-fir tree has male pollen cones and female seed cones.
> But…it felt like mothering to me. With the elders tending the young. Yes, that's it. *Mother Trees. Mother Trees connect the forest…*
> *Could information be transmitted across synapses in mycorrhizal networks, the same way it happens in our brains?"* [s294]

A natural extension of this view of the forest is an environmental ethic of inclusion sprinkled through the book. She asserts clearly "They *are* people. The Tree People." [s294] "…trees and plants have agency. They perceive, relate, and communicate: they exercise various behaviors. They cooperate, make decisions, learn, and remember…By noting how trees, animals, and even fungi–any and all nonhuman species—have agency, we can acknowledge that they deserve as much regard as we accord ourselves…mistreatment of one species is mistreatment of all"… "The rest of the planet has been waiting patiently for us to figure that out." [s294].

There are perhaps two obvious yet contrasting reactions readers might have to the messages in these books. First, openness to the message that the non-human world may be more wonderous, connected, cooperative, even animate than the dominant western worldview is willing to admit. This view might represent a yearning for a new way of seeing the world and a new way of being within that world. The second, more colonial view is firmly resistant to the messages in the books; nature cannot have qualities we commonly associate only with humans because humans are separate from nature, special, superior.

Ultimately, beliefs about nature are choices. We can choose to refuse to acknowledge or attribute consciousness or mindedness to nature, to effectively de-animated the world, to make it a non-sacred world. Or we can follow the lead of thinkers like Simard and Lowman who provide us with a different choice, and in turn, a different future.