The Canadian Field-Naturalist

Book Reviews

Book Review Editor's Note: The Canadian Field-Naturalist is a peer-reviewed scientific journal publishing papers on ecology, behaviour, taxonomy, conservation, and other topics relevant to Canadian natural history. In line with this mandate, we review books with a Canadian connection, including those on any species (native or non-native) that inhabits Canada, as well as books covering topics of global relevance, including climate change, biodiversity, species extinction, habitat loss, evolution, and field research experiences.

Currency Codes: CAD Canadian Dollars, USD United States Dollars, EUR Euros, AUD Australian Dollars, GBP British Pounds.

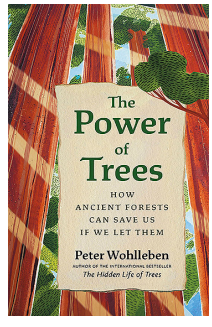
Conservation and Climate Change

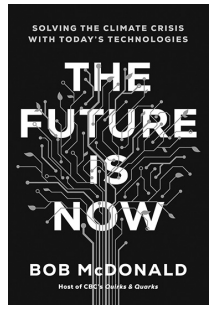
The Power of Trees: How Ancient Forests Can Save Us if We Let Them

By Peter Wohlleben. Translated by Jane Billinghurst. 2023. Greystone Books in association with the David Suzuki Institute. 280 pages, 34.95 CAD, Hardcover, 27.99 CAD, E-book.

The Future is Now: Solving the Climate Crisis with Today's Technologies

By Bob McDonald. 2022. Penguin Random House Canada. 304 pages, 32.95 CAD, Hardcover, 23.00 CAD, Paper, 15.99 CAD, E-book.





The two books under review here cover different categories—old-growth trees and so-called green technologies—but both wander into the same ecological neighbourhood: a human-caused climate crisis. Peter Wohlleben (*The Power of Trees*) is far more skeptical than Bob McDonald (*The Future is Now*) of the need for human innovation to solve this crisis, but both authors share a disdain for certain kinds of human interventions. Unfortunately, evidence is accumulating that indicates global catastrophe is imminent (Fiekowsky and Douglis 2022; Hansen *et al.* 2023; Dyer 2024). The timelines are tight, and neither ancient trees nor today's technologies will solve the climate crisis quickly enough.

Wohlleben has many supporters (including the David Suzuki Foundation, *A Trillion Trees* [Greystone Books, 2022] author Fred Pearce, and climate writer Tim Flannery), and he has sold millions of books. Wohlleben believes that humans should not interrupt the natural processes that have enabled old-growth trees to thrive—a welcome message. I feel obliged, however, to offer some dissent.

His narratives are frequently called into question for their persistent anthropomorphic characterizations of nature. Sharon Kingsland (2018) for this reason has written a harsh critique of his earlier bestseller, *The Hidden Life of Trees* (Greystone Books, 2016). In *The Power of Trees*, Wohlleben claims that trees are "just like people … they don't all learn at the same speed or draw the right conclusions from their life experiences" (p. 1). He writes about "panicky" chestnuts (p. 11); tree roots that "tell" the leaves to "shut their small, mouthlike openings [i.e., stomata]" (p. 17); and mother trees that cast shade "intentionally" to protect their offspring (p. 72). Trees that learn and pass "knowledge down to the next generation" (p. 22). Old trees that can "remember their ancestral homeland" (p. 31). Others that "worry" (p. 53), are "selfish" (p. 73), inherit "wisdom" (a contortion of epigenetics), or "continue to learn until their dying breath" (pp. 33–38).

You get the idea. It's distracting. One problem with this enthusiasm for analogy is the reader learns too little about how natural processes actually work.

Plant cells at root tips do not "function a bit like a plant brain" (p. 16), and that they don't is what makes them so interesting.

A controversial claim rehashed by Wohlleben is that trees can distinguish their relatives from strangers by sight. Canadian scientist Suzanne Simard—cited by Wohlleben in *The Power of Trees*—has reported how tree roots "share food, exchange information and even recognize their own seedlings" (p. 75). She has also been criticized for anthropomorphic thinking (Pollan 2013; Kingsland 2018; Taiz *et al.* 2019). This should not diminish the important work she does evaluating clear-cutting impacts exacerbated by climate change (Simard 2020). Wohlleben also approvingly refers to Monica Gagliano's claims of Pavlovian conditioning by pea plants (pp. 27–28). Gagliano's work extends to theories of plant consciousness, and some have challenged her claims due to experiment replication failure (Taiz *et al.* 2019; Markel 2020a,b).

Wohlleben admits that he doesn't know of any research supporting his idea that plantation trees show less inclination to "respect each other's space" than those in natural forests. But he assures readers that he "will keep an eye out for this behaviour when [he visits] ancient forests in the future" (p. 77).

Several of these shadier theories fit into the pseudo-discipline of plant neurobiology and sentience. Lincoln Taiz and his co-authors write:

> There is no evidence that plants require, and thus have evolved, energy-expensive mental faculties, such as consciousness, feelings, and intentionality, to survive or to reproduce. Plant development and behavior can be regarded as a series of nonintended consequences emerging from internal and external signaling networks that have evolved through natural selection. (Taiz *et al.* 2019: 684)

Much of Wohlleben's allegorical framing is intended to deliver one of his central messages, which is that old forests should be preserved at all costs. What is certainly true is that it takes decades to completely restore clear-cut forests (p. 69), and industrialized forestry can be disruptive of regional rainfall levels (p. 67). Yet wildfire (and insect) destruction of trees outpaces harvesting by a significant margin. In 2023, a record year in Canada, at least 185 000 km^2 of forest burned. In 2021, only about 7000 km^2 were harvested, and about 159 000 km^2 were defoliated by insects—although most defoliations do not cause large-scale tree mortality (NRC 2023).

Wohlleben agrees that humans will continue to use wood and forests can regenerate over time, even the Brazilian rainforest (pp. 69–70). In his view, however, "protecting forests is more important than using wood as a raw material, and [therefore] we need to cut back drastically on our consumption of planks and paper" (p. 69). It is "impossible to extract raw materials in a way that benefits nature" (p. 142).

The worst culprit according to *The Power of Trees* is, unsurprisingly, the forest industry and its clear-cutting policies (particularly where practices have not been modernized). Left to their own devices (and natural succession), Wohlleben is convinced that forests will thrive. He calls for logging to be "banned immediately in all intact deciduous forests" (p. 171) and that we stop burning wood for fuel.

On the climate crisis front, Wohlleben supports a carbon tax and argues that it should be extended to wood products (pp. 150–151). But he draws a line at deploying engineering to restrain greenhouse gases. "Instead of believing that smart engineers with their technological solutions" will save us, we can "turn to trees" that feed on carbon dioxide while we transition from traditional to ecological forest management practices (pp. 206, 243).

He is therefore also critical of carbon capture and storage (CCS) technologies. They compare unfavourably, he argues, to certain types of trees (such as species of beech and oak) storing tonnes of CO_2 per km^2 per year in their trunks and branches. However, this claim by Wohlleben cannot be generalized to all species, nor every ecological zone.

The Future is Now is a very different book than *The Power of Trees*. Bob McDonald (of CBC Radio's *Quirks & Quarks* fame) lays out a convincing argument for adopting—quickly—an array of technologies to transition global economies away from greenhouse gas-producing energies and lifestyles. While current solar power infrastructure alone could in theory supply the world's energy requirements, it would require an area the size of Spain to be saturated with solar panels (p. 17). The price of panels has dropped by 99% since the 1970s, mostly thanks to Chinese engineering (p. 25). While panels are only about 20% efficient in converting the sun's radiation to usable energy, this has been improving with time. Some researchers are looking into incorporating photovoltaics in greenhouse glass so that farmers can grow food and produce electricity simultaneously (p. 31). Photovoltaics capture the sun's radiation for conversion to electricity far more efficiently than plants do in their conversion to biomass through photosynthesis (Blankenship *et al.* 2011).

Biofuels utilize several biomass-generated options, from trees and other organic materials (including corn, canola, and sugarcane) to methane in waste dumps. McDonald claims that wood pellet combustion produces "90 percent fewer emissions than coal and 50 percent less than natural gas" (p. 45). Wood

pellets are controversial, however, because they require transport to power plants, large tracts of scrub or damaged forests, and elaborate pelleting technology—for chipping, heating, drying, powdering, and compressing. In the case of the Drax facility in the United Kingdom—which produced 14.1 TW hours of power in 2020—much of the pellet stock was sourced from Mississippi, as mentioned in *A Trillion Trees* (Collins 2022). Sustainable aviation fuel may become the most significant role for biofuels, assuming jet passenger flights continue in the new decarbonized future (pp. 50–52). McDonald acknowledges that biofuels should only buy time while systems transition to something other than fossil fuels (p. 55).

Wind farms are now more familiar but constitute only about 7% of global energy production. The greatest challenge is finding areas where the wind blows frequently and steadily (such as the foothills of the Rockies, coastal areas, and offshore). One of the largest wind machines, the General Electric Haliade-X, costs about $13 million USD and produces 12 MW of power, or enough to light up 16 000 homes (p. 63). Future 20 MW models are considered possible, but 50 MW models are thought to be overly optimistic. Aside from their whishing noise, there is a well-known problem of rotating turbine blades killing bats and birds. But the big selling point of wind energy is that 1 kW-h of its electricity generates only 11 g of carbon dioxide, compared to 465 g for natural gas and 980 g for coal (pp. 76–77). And wind farms can be installed away from bird routes or disconnected during migratory seasons. Ultrasonic generators can emit sounds that deter bats and don't disturb humans.

Ocean wave power generation is mostly dismissed by McDonald as too expensive and difficult, even though waves roll day and night. It is disadvantaged because storms and corrosion are significant impediments (p. 85). Tidal power has better credentials, is more efficient than wind and extremely predictable, but it only works well in a few locales. Different environmentalists are pro- or anti-tidal power (p. 101), and in the latter camp concerns include threats to marine life, such as seals and Humpback Whales (*Megaptera novaeangliae*) being trapped behind barrage-style tidal projects. The largest tidal array is in Scotland with 250 turbines, and it is expected to eventually generate enough electricity for 175 000 homes (p. 97). McDonald suggests that North Atlantic Right Whales (*Eubalaena glacialis*) at risk in the Bay of Fundy can be protected using sonar tracking systems that would indicate when to shut down the turbines when the whales approach (p. 99).

The Future is Now devotes a chapter to energy storage technologies, including electric vehicle batteries. The challenges include their limiting range and charging times, particularly in cold climates, but also the availability of critical minerals (especially lithium, nickel, cobalt, and graphite). McDonald spends little time discouraging the use of personal vehicles entirely and more on promoting electric cars. He does agree, however, that personal cars "do not really belong in cities" (p. 241). High-speed trains and public transit are better alternatives, and he devotes several pages to that consideration.

While there is an 'infinite' amount of heat stored beneath the Earth's surface, geothermal energy is most accessible near tectonic plate boundaries such as those found in Italy, Iceland, Kenya, Ethiopia, and the Pacific Ocean's Ring of Fire. Ninety percent of Iceland's homes are heated geothermally, but only about 1% of energy is generated this way globally. One concern is that poorly drilled wells can cause localized earthquakes (p. 138).

Household heat pumps at smaller scales are expected to play a growing role as low-carbon, low-energy substitutes, particularly for new buildings. For much of Canada, both air- and (costlier) ground-source versions can almost entirely replace existing oil and gas furnaces. McDonald claims they lose their efficiency below –10º C (p. 140), but recent cold-climate versions that are popular in Sweden and utilize new inverter technology are said to operate down to –30º C, at which point they may need to be supplemented with other sources. One goal of the carbon tax is to help people transition to electrically powered heat pumps (Chung 2023).

McDonald makes a strong case for nuclear power in general and small modular reactors in particular. Nuclear is the "most dense fuel of all" (p. 145) and therefore technically the most efficient, second only to futuristic fusion power. But nuclear power has its unfortunate association with mushroom clouds, even though "a nuclear power generating station cannot explode like a nuclear bomb" and despite its proven "potential to provide plentiful, 24/7, emissions-free power" having the "best safety record of any energy production" (pp. 145–151).

Other technologies under consideration in *The Future is Now* are carbon capture, where CO_2 is pumped underground or into oceans—the concern is whether it will stay there, or possibly acidify the oceans—and substitutions for current cement manufacturing processes. Portland cement produced by kiln-heating limestone contributes 8% globally to CO_2 emissions, although locking carbon into concrete is being evaluated at scale (pp. 221–222). McDonald is also skeptical about direct air capture, which some believe requires too much energy to remove too little carbon (p. 224).

But he is supportive of upgrading building codes.

The Intergovernmental Panel on Climate Change claims that "50–90% energy savings have been achieved throughout the world through deep retrofits" (p. 230). Efficiency is already the world's greatest source of energy, "bigger than oil" (p. 231).

It is in the book's rejection of geoengineering (also known as climate restoration, or Solar Radiation Modification [SRM]) where I have a real bone to pick. "The outrageous scale and cost of extreme ideas [like SRM] underlines how much simpler it is to address the climate problem at its root cause", McDonald writes. "It's not the sun that needs to be dimmed down, it's the excess amount of carbon dioxide we're putting into the air that needs to be lowered" (p. 266).

These words are dated, in my view, because discussion of SRM engineering has come some distance. It is still controversial, but considering the accelerated global temperature rise, the frequency and extent of wildfires, and the warming of ocean surfaces, geoengineering now requires serious attention, not flippant dismissal (Collins 2024). The scientists involved do not see their proposals as substitutions for other necessary measures, but as means to buy time while the root of the problem is addressed through energy, transportation, and industrial transitioning and carbon capture technologies—many elements of which are addressed by McDonald in his book.

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