

Laudato Si' in an Old Growth Forest

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In *Laudato si'*, Pope Francis offers a vision of moral responsibility rooted in attentiveness to the world around us. He points to St. Francis who “looked with love” on all creatures as a model of this ethos of attentiveness. Pope Francis speaks of an “attitude of the heart, one which approaches life with serene attentiveness, which is capable of being fully present....” He also speaks of the “gaze of science” and calls for an “intense dialogue” between science and religion. The HJ Andrews Experimental Forest in Oregon is one of the most studied ecosystems in the world. Here scientists have cultivated their own gaze of “serene attentiveness.” What can theology learn by looking with scientists at such a complex ecosystem?

Entering an old growth forest can be overwhelming. The sheer, tangled abundance of life is shocking. If John Muir was right to describe these as “cathedrals,” they are messy and riotous ones. Massive trees, centuries old, rise out of heaps of moss and ferns and disappear into the canopy above. Life overlaps everywhere leaving no surface bare. Some trees are so covered with moss, lichen, or fungus that it’s difficult to see their bark or even needles. Curtains of damp moss hush sound. The scent of conifers and the earthy must of soil fill the air. Underfoot, the ground is soft and deep; like a tangle of blankets. There are so many overlapping layers of life, in every shade of green, that it is difficult to take it all in. There are hints at a timescale beyond human reckoning. A single tree bends toward an opening in the canopy that it filled centuries ago. Moss grows very slowly; yet here it covers just about everything.

Encountering this riot of life can be like walking into a loud party full of many conversations (and more than a few fights), or arriving in the middle of the harmonies and dissonance of a complex symphony. It is tempting to focus on just one thing. I reach out to touch an ancient Douglas-fir, instinctively choosing a bare patch of bark stripped of moss. But the tree is far more than a single being. It hosts hundreds of plants and animals and depends on countless ecological interconnections. Thinking like an individual, I miss the relationships. Ecology, like community, requires a gaze attentive to interconnection.

These were once called “decadent forests.” It’s easy to see why. The stunning vertical rise of firs, cedars and hemlocks is coupled with so much falling and decay. Everyday looks like the aftermath of a storm. Strips of lichen, moss, branches and entire trees litter the floor. All of this is being rotted by fungi and chewed by bugs. Fungus sprouts from enormous standing dead snags, revealing the rot within and their impending (in forest time) collapse. What at first sight seems tumbling terrain—a hummock of ferns or even a small terrace—on closer look is revealed to be stumps or fallen trees decaying beneath the blanket of moss. Life and death coincide, overlap and interpenetrate.

For much of the 20th century, forest managers' explicit goal was to clear-cut decadent forests, burn the underbrush and herbicide the soil. They would then plant orderly monoculture plantations of Douglas-fir where trees would grow straight, fast and healthy, freed from competition with undergrowth and safe from the infections harbored by diseased trees and rotting logs. Yes, they wanted timber, but they also wanted order: a simple order they could understand and calculate.

The Andrews is one of the places where scientists dared to gaze more attentively; and out of that sincere gaze emerged the revolution of understanding that far from "decadent," these "old growth" forests possessed their own complex order as mature, biodiverse ecosystems. What appears as mess and decay are an essential part of ecological flourishing.

That lichen cascading from the treetops turns out to be a crucial source of nitrogen in a forest that is still young when the canopy closes and blocks the sun from ground-dwelling nitrogen fixing plants. Without this essential nutrient, these trees would fade long before reaching maturity. It takes nearly a century for this companion species to develop in a forest. Once established, it captures hundreds of pounds of nitrogen per acre each year that enters the soil through the droppings of the slugs and snails that eat the fallen strips.

The moss covering branches and trunks is often as old as the trees themselves. It plays an important role in capturing nutrients from the air and slowing the flow of rainfall down the tree so the nutrients remain near the trees' roots. The fungus rotting and bugs consuming dead trees convert cellulose and lignin into the soil nutrients that feed the astounding rise and near-millennial life span of these massive trees. Rot is itself life, as there is more living tissue—bacteria, fungus, bugs—in a fallen tree than in a living one. Rising and falling, growth and rot, life and death are literally interconnected here.

None of this is obvious to a casual or even sincerely attentive observer. Much of it takes place outside of the range of human sensation. Scientists struggle to broaden our scales of time and space in order to understand the hidden connections and cycles of life. Learning the role of the lichen required chemical analysis and finding a way to work in the canopy in order to painstakingly measure the amount that grows on each branch. Knowledge of the cycle of log decay comes from a decomposition study that will follow the progress of dead logs through the entire 200 years it takes for a fallen log to become soil. Gas emissions and fluid runoff are measured and analyzed. The bacteria, fungi, and bugs involved in the process are microscopically cataloged and their progress through trees' tissue is carefully measured. This devotion and commitment of multiple generations of scientists certainly justifies seeing the scientific gaze as worthy to be described as "serene attentiveness."

This struggle to attend to the fullness of creation has revealed interconnections of astounding complexity. As we walk through the forest, we notice plants and animals around us, but often we literally miss the interconnections of the forest for the trees. The greatest part of its biodiversity lies below ground where thousands upon thousands of species of worms, arthropods and insects live; each hosting a different bacterial community

in its gut. Once we thought of the soil as a test tube full of chemicals, now we understand that it to be a complex living biological network—but we are only beginning to understand its thousands of parts. These are the “trophic” networks: who eats what and whom. The complexity goes far beyond predator and prey. Everything from a fallen evergreen needle to a tree is consumed, and the droppings of the consumers are consumed by yet other species through cycles upon cycles. The forest is a massive silent symphony of nutrient flows through thousands of plants, fungi, insects, bacteria and animals; one to which we are only beginning to learn to listen.

Below ground lives another complex web that facilitates one of the most astounding set of relationships in the forest: mycorrhizal fungi. Unlike saprophytic fungi which live on decaying matter, mycorrhizal fungal fungi live in symbiosis with living plants. Scientists have known these soil fungi are important for more than a century. Only in the past few decades, however, have they found ways to study the astounding complexity of these relationships in detail.

Electron microscopes reveal that their filaments surround and penetrate plants’ root hairs. On the most basic level, trees share sugars with the fungus; the fungus extends the root systems’ reach a thousand-fold into microscopic nooks and crannies. The underground portion of fungi are much larger than the mushrooms we see.

DNA analysis reveals that they can extend for hundreds of yards or even miles linking the root systems of many trees, including different species into a network that shares nutrients, water, chemical alerts and even electrical signals. Using Carbon 14 isotopes, Susan Simard famously found evidence of Douglas-firs sharing sugar with birches in the Spring and Fall, and receiving back from them when they leaf out in the Summer. Older trees not only nurse their young through these networks, they serve as anchor points of complex networks that link entire stands of trees. One study found as many as sixty-five separate fungus species forming root networks in Douglas-fir forests.

This research is breathtaking. Vast, complex, multi-species networks thrive together sharing resources and information. Far from a ruthless competition of individuals for water and nutrients; we find diverse communities supporting their members. The vocabulary used is as consonant with Catholic social thought as the reality. The technical term for these multispecies networks is “cooperative guilds.” There is a common good in the forest.

We learn three related lessons in an old-growth forest: the profoundly interrelated character of creation; the fact that this is not simply a truth about ecology which we observe, but a truth about ourselves in which we participate; and the need for an ethos of attentiveness that brings the limits of our knowledge into our moral imagination.

The first lesson of the forest is scientific confirmation of the key theme of *Laudato si’* “everything is interconnected.” No individual plant or animal, and indeed, no species is an island. Ecological niches aren’t simply patches of ground defended from competitors, but multidimensional relationships. A tree depends upon lichen, fungus, and bugs, as they do upon the tree. Take one key part out and the rest can falter. In ecology, everything really is

connected. For thousands of years, humans have been cutting down the great temperate and tropical forests that once covered much of the earth. This was not merely the loss of trees, but the destruction of massive, complex ecosystems. The effects of deforestation take years, decades and even centuries to appear. On ecological timescales, the agriculture we replace them with often proves frightfully short lived. In so many places, deserts now spread where forests once flourished. Returning to the few remaining ecologically intact ecosystems helps us to glimpse the living complexity of systems we have taken for granted and to face the hard truth that for all their profound robustness, they have limits and tipping points; they can only sustain so much damage without collapse.

We don't simply learn about the world around us, we also learn the truth that we ourselves are part of creation. These ecological relationships support and bind us as well. Pope Francis connects ecological attentiveness to a Trinitarian spirituality: "The divine Persons are subsistent relations, and the world, created according to the divine model, is a web of relationships. This leads us not only to marvel at the manifold connections existing among creatures, but also to discover a key to our own fulfilment."

The beauty of the forest bears the truth of ecological interconnection. This turns out to be a moral truth as well.

"The human person grows more, matures more and is sanctified more to the extent that he or she enters into relationships, going out from themselves to live in communion with God, with others and with all creatures. In this way, they make their own that trinitarian dynamism which God imprinted in them when they were created. Everything is interconnected, and this invites us to develop a spirituality of that global solidarity which flows from the mystery of the Trinity."

We are created amidst communion, for communion with God through the world around us.

Forests and the scientists who study them do more than confirm our religious beliefs about communion. They also challenge us to recognize aspects of our individualism that remain untouched by our professions of faith. We really prefer to ignore the interconnection between decay and life and what this tells us about our connections with others. While we may thrill at the networked community facilitated by the hyphae of "good" mycorrhizal fungi, we shudder at the penetrating tendrils of the fungi of rot. Yet the towering bodies of giant trees are composed of the bodies of countless dead, decayed ancestral generations. As are we.

"Remember you are dust, and to dust you shall return." The Ash Wednesday admonition is a reference to Genesis in which God fashions Adam from "dust" or "clay." We generally read this as an expression of our nothingness without God's animating Spirit. Yet some scripture scholars argue the Hebrew here can and should be rendered "soil." Indeed, Adam's very name is a play on the Hebrew term for soil. As the whole arc of the Eden story presumes, God creates and places us within a system of relationships. Our refusal harms them all. "Cursed is the soil because of you." What if we prayed the more biblically accurate: "Remember you are soil, and to soil you shall return"? Our bodies are not our own, separate from relationships human and natural, but part of cycles that require we give back what we take, even our flesh. Our refusal is institutionalized in our modern death ritual of shutting

“our” bodies off from the rest of creation in metal and concrete boxes, where indeed, rather than return to the soil, they decay to dust.

The final lesson is perhaps the most challenging. Here we learn how very difficult it is to be attentive. On the moral level, we must struggle with the objectifying gaze of what Francis calls the “technocratic paradigm” that sees the rest of creation as a “mere object subjugated to arbitrary human domination.” From the very few remaining fragments of old growth forest, one doesn’t have to look far to see the devastation that such a sinful view of creation produces.

But our moral blindness arises from our finitude as much as sin. Creation is an astoundingly complex web of relationships. Most of these are not easily perceived by the ordinary range of human perception. To play on but one of our limited senses: if the forest is a symphony, its harmonies and dissonances include notes far higher and lower than we can easily imagine let alone perceive: from the atomic vibrations of photosynthesis to bass notes sounding in the millennial rise and fall of trees. On these scales complexity is deepened by the flow of endless adaption and change of dynamic ecological systems. The hard work scientists must do to study dimensions of the life of the forest beyond the range of natural perception alerts us to how much we miss.

The interplay of knowledge, imagination and grace lets us encounter the astounding complexity of forest more fully. Out of this come moments when awareness flickers; each plant, rock and decaying leaf reverberates in its manifold interconnections. Green deepens into the *viriditas* that Hildegard named the Spirit’s work in creation and we catch a glimmer of the harmony that surrounds us. Full comprehension escapes us as both complexity and grace are beyond our ken. But the more knowledge we have of particulars, the more our understanding of complexity grows; and with this awareness of evermore dimensions which we do not comprehend.

We need to incorporate such awareness of our limited perception and knowledge into our daily moral imagination. We act powerfully in the world, seldom knowing the full consequences of our actions. We have been doing so for millennia. The disappearance of large animals from ecosystems has been the hallmark of human activity since the Pleistocene. Humans are the great disrupters: hunting animals too large for any animal predator and reworking entire landscapes with agriculture.

Our disruptions have now reached the planetary scale. Our future, and the future of the countless species along for the ride in the world we are disrupting, depends upon our cultivating a sense of our ignorance and a corresponding temperate hesitance to act in haste. Will we keep our eyes closed in indifference or open them to the astounding complexity of creation and learn anew how to respond in love?

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