Zoologies: On Animals and the Human Spirit

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Owl Watching in the Experimental Forest

Steve Akers and I clamber over vine maple and Oregon grape, a tangled mess of scrub that covers Hardy Ridge high over Cougar Reservoir. This terrain is better suited to flying squirrels and red-backed voles than to a mildly arthritic, bipedal primate. But here I am on a sun-drenched morning in May, hiking with the head of the northern spotted owl research team from the H. J. Andrews Experimental Forest and filled with unaccountable joy. Last night Steve was orienteering toward an owl that was calling from a mile away. He set a compass point and hiked into the dark forest toward the call but never found the bird. He's been working on the owl study for seven years, on wildlife fieldwork for twenty-one. Today we're looking for a spotted owl that has been in the study for twelve years, one habituated to the visits of field scientists.

Extensive field study of this species had been conducted for at least a decade prior to its 1990 designation as threatened under the Endangered Species Act. The northern spotted owl is perhaps the most studied bird in the world, inspiring unprecedented collaboration among scientists, governmental agencies, universities, and landowners.

We break into an opening shaded by a small stand of firs—trees not super old, as we've seen along the McKenzie River Trail where there are giants over six hundred years old, but stately elders nonetheless. The ground is dappled with light, the air cool and damp. The hillside slopes steeply below. Ahead of me, Steve hoots the four-note location call.

Hooh-hoohoo-hooooh. The last syllable descends with a slight warble. No response. Then he turns and a quiet smile opens on his face. He has the bright and easy look of a man who knows how lucky he is to love his work. He points over my left shoulder.

Silent, she's perched on a small understory branch twenty feet up. She's watching us, waiting for us to notice her. She knows the contract. She will give us data, we will give her mice. After three decades of research on the northern spotted owl, scientists have gained a wealth of understanding about this creature's life history. Each spring the field crew checks nesting pairs for their reproductive status and bands fledglings to include them in future surveys. The data led in 1994 to the Northwest Forest Plan, which decreased the rate of logging and altered how it is done, giving the owls and their entire ecosystem a better chance at survival. But data cannot compare to the experience of that deep well of attention, quiet, and presence that is the owl. She has a spotted breast, a long barred tail, and tawny facial disks with brown semicircles fringing her face and back-to-back white parentheses framing her eyes. These markings give the impression that her eyes are the size of her head. The blackness of her pupils is so pure that they look like portals into the universe.

When Steve takes the first mouse out of his aerated Tupperware container, lifting it by its tail and placing it on a log, the owl drops, silent as air, down through the branches and closes her talons. She lofts back up to the branch and scans around. She may be looking to see if a goshawk is near. Whatever constitutes a threat to her does not include us. How rare it is to have more than a fleeting glimpse of a creature in the wild. Still clutching the mouse, she burps up a pellet that plops to the ground, gives us a nonchalant look, then gulps down her meal.

"You want to see the parachute-drop?" Steve asks with a grin. The white mice have been raised in captivity and their

sense of space has been so constrained that when he unsnaps the lid, they stretch their heads up and look around but make no attempt to run away. The world to them is the size of the container in which they find themselves. He places the second mouse on the log, and the owl billows out her wings, buoying herself down to us. It takes a moment to understand why her flight catches me each time by surprise. No riffle, no flutter of resistance through the feathers, she's evolved for this easy drop onto her prey. The spotted owl is a sit-and-wait hunter, unlike the goshawk, which will tear through the woods in pursuit. The fringed edge to her wing reduces noise and increases drag, making this strategy a good match of form with function.

Steve collects the pellet and we poke the slimy gray glob of indigestible fur and bones from the past day. The bones are very delicate, still shiny with the life that left them, some nearly two inches long.

"Maybe a wood rat," Steve says. Through binoculars he can see the owl's identification band. Last year a male was keeping this female company, a two-year-old from nearby Kings Creek. This year, so far, she appears to be alone. The owl team's last visit to this site was one month ago.

"How about the side grab?" He might be a dad boasting about the agility of his soccer-playing daughter. He isn't making the owl perform for our enjoyment. These flight skills are as natural to the owl as stepping over a crack in a sidewalk is for us. The mouse is barely out of his hand, scurrying in confusion on the tree trunk that rises beside me, when the owl swoops onto it, talons leading, and picks it off right beside my shoulder. The catch happens so fast that she's flying away by the time I realize she's grabbed the prey, killing it instantly in her grip. She flies up to a snag broken off forty feet above the ground and tucks the mouse carefully into the jagged wood. This is a cache, not a nest. If she'd been delivering food to her young, the nest would be a natural platform high in a

tree. She checks to be sure the mouse is well hidden. If she does have nestlings, she'll come back later for takeout.

The spotted owl research protocol demands that we spend an hour with the bird. She's had her limit of commercially raised albino mice, so now we sit to see what she does and if what she does will tell us whether she has a mate or nestlings. This suits my research protocol just fine. I am here as part of the Long-Term Ecological Reflections project initiated by the writer and philosopher Kathleen Dean Moore, who works out of Oregon State University, and U.S. Forest Service geologist Fred Swanson. Like many of the experiments conducted in and around the Andrews forest, my humanistic assignment is part of a project intended to last two hundred years. This time frame was inspired by a hallmark study being conducted in the Andrews, the log decomposition study. Two hundred years is roughly the lifetime of the giant logs left to rot on the forest floor, and during that time successive teams of scientists will observe and measure the dead wood's contributions to forest regeneration. Writers too are invited to visit several sites in the forest and to leave an account of their experience. The hope of this project is that by careful and sustained observation, a testimony on behalf of the forest will have kept it alive.

The owl doesn't make a sound. She perches on a branch high above us. She is still. She watches us. She reaches her head forward—"the pre-pounce lean," Steve calls it—as if she has seen some prey on the ground. The song of a thrush flutters through the quiet, the auditory equivalent of seeing an orchid in the forest. Beauty is what I came here for, a beauty enhanced, not diminished, by science. If I had only my senses to work with, how much thinner would be the experience. What a record we might have of the world's hidden beauty, if field scientists and poets routinely spent time in one another's company.

A young tree, broken and caught between two others,

creaks to the rhythm of the wind. How well the owl must know this sound. Does she anticipate the crash of its falling? What is the consciousness of a spotted owl? There she perches perceiving us, and here we sit perceiving her. We exchange the long, slow interspecies stare—no fear, no threat, only the confusing mystery of the other. Steve knows her language well enough to speak a few words: the location call, the bark of aggression. Perhaps that means she thinks we are owls. We do not look like owls. But we do, briefly, behave like owls, catching and offering prey, being still, and turning our eyes to the forest.

"What are you?"

"What are you?"

That's the conversation we have with our eyes.

"What will you do next?"

"What will you do next?"

I keep falling into the owl's eyes. Then we stand up and hike down from that high place.

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When the fifth and sixth graders from the McKenzie River Christian School arrive at forest headquarters, each kid wears a name tag made from a slice of wood that looks like a sugar cookie. The cookies hang around their necks, announcing the camp names they have chosen for the field trip: Fang, Dark Dragon, Caos, Monkey Girl, Money Maker. They show little interest in the weather station that measures temperature, wind, chemistry of rain, weight of snow, the sensors downloading data every hour. They perk up at the sight of a stainless steel mercury collector, the tank sporting robotic arms that slide its cover into place to protect a rain sample. They don't seem to hear the weatherman's words as I copy them down in my field notebook. "Rain in Ohio comes down strong as vinegar and eats paint." "Some of the best rain in America comes down right here in Oregon." The kids shuffle, uninterested in the meteorologist's homily.

Asked if they ever have seen an old-growth forest, the children look blankly at their guide, children who live in the shade of five-hundred-year-old Douglas firs. How can it be that children do not recognize these giant beings that live in their neighborhood, that have stood here, tough and serene, since before science discovered its method?

Freed from the entrapment of an adult lecture, the kids tumble like puppies down the forest lane. When one spots the rough-skinned newt sauntering on wet asphalt, they all freeze, stare, and go silent, magnetized by the oddness of its orange belly, brown back, and translucent hand-like appendages. They especially love hearing that the newt is poisonous, that after handling it they must all wash their hands. They love the danger, the taming power of the small. It sets loose a featherweight bout of animal stories.

"That's nothing. You should see the Pacific giants!" says Fang, gesturing wider than his torso to demonstrate their impressive size. He recounts how the salamanders, black and vicious, swaggered up when he and his father went fishing, how they grabbed the fish guts, thrashing their heads all around like monsters to consume the slime.

"Yeah? Well, I've seen lamprey eels that swam up the McKenzie all the way into Lookout Creek!" brags Caos. He points to the rivulet tumbling past the parking lot.

The newt has brought them back from their boredom into what Walt Whitman called the "costless, divine, original concrete."

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The H. J. Andrews Experimental Forest flanks the western slope of the Cascade Range and occupies the drainage basin of Lookout Creek, a tributary of the Blue River, the McKenzie River, the Willamette, and finally the Columbia, which dumps out into the Pacific Ocean. This is one of the most studied forests in the world, a 15,800-acre research

site established in 1948 when "sawlog foresters" helped the postwar nation rebuild through a grand investment on the domestic front.

Among the forest's more famous subjects of scrutiny are its dead logs. Begun in 1985, the log decomposition study focuses on two-foot-diameter timbers placed on the forest floor to rot. Every month or so researchers slice a giant cookie off the end of the logs, taking note of rot, fungus, bark beetles. They analyze the cookies in the lab. Dead logs are one of the most critical components of the forest ecosystem within the first few years of a tree's death, as organisms take advantage of new resources. Ongoing studies will look at how much nutrition logs contribute to the forest and how much carbon dioxide they release into the atmosphere. The study spawned the term "morticulture," connoting that attention to the dead has relevance to the nurture of the living.

Another celebrity of the Andrews is the northern spotted owl, a keystone species for Northwest forest health. If owls go, that loss is a sign that an essential life-supporting complexity has gone. The northern spotted owl has been vilified, polemicized, eco-terrorized, and reduced to the size of a bumper sticker. Eco-extremists who advocate a no-touch purity for the forest haven't helped by sabotaging forest road lockboxes with broken glass and in one case a loaded firearm aimed at the ranger unlocking the box. Pragmatists say that more loggers have lost their jobs to the industrialization of logging and plywood manufacture than to ecosystem protection. Try asking a lumberjack on unemployment to take comfort in that reasoning. It's easier for him to blame the regulator than the operator who might give him a job. The words *northern spotted owl* barely refer to the creature any longer, so debased have they become with political rhetoric. Who still sees the owl when its name is spoken? I'm drawn to the place in order to detox from such politics, to see the bird and the place, to understand the terms of their existence.

I welcomed the invitation to spend time and conversation with Fred Swanson, a man who seems to have quieted into the place after spending decades getting to know it through the scientific research conducted on site and simply from being in the presence of its great ancient trees. I admit that the idea of an "experimental forest" mystified and compelled me. I had no idea what that term meant.

In science an experiment is governed by a method. There are controls, limitations, rules, hypotheses. It must produce empirical evidence. Its conclusions must be verifiable, repeatable by another scientist. An experiment in science adds to collective knowledge. Earth is round, not flat, and circles the sun. Nearly everyone on Earth knows this, one would hope, and these facts are not subject to reasonable argument, aesthetic judgment, or cultural relativism.

In correspondence, I asked Fred Swanson what he means when he uses the word *experiment.*

"Funny you should ask," he replied. "Some local scientists have been discussing this (with some heat). In a narrow science sense an experiment uses alternative treatments to test hypotheses—properties of a standard agronomic experiment include several rather different treatments (for example, levels of fertilization or cutting), replication (multiple plots with the same treatment), random assignment of treatments to plots, pretreatment measurements . . .

"On the other hand," Swanson continued, "we have the more casual use of *experiment,* as if just trying something out and seeing how it works. In field ecology and geology it can be very difficult to conduct good experiments. One usually just starts out observing to get the drift of how the world is working. Creative flashes in science often step beyond the rigidity of the experimental process, coming in leaps of wonderment and faith."

In the arts, an experiment is governed by freedom from tradition, or at least resistance to it. Experimentation in

poetry dispenses with received forms, levels of diction, metrical conventions, and even syntactical rules. It may favor process over product, music over meaning, disjunction over coherence, invented constraints over received ones. It is unique, unrepeatable. An experiment in poetry adds to the sense of depth, complexity, mystery, and feeling in the world. If there is a "poetic method," it is to free oneself from method and enter into the excitement of creating something new and true to a very individual experience and voice. Poetry's subversive practitioners (from Dada to L=A=N=G=U=A=G=E to Fib to Flarf to the documentary poem) challenge rationality through pranks, games, data, and erasure of "artistic" "value." They use method to leap beyond method, perhaps in the same way scientists often make their surprise findings through leaps.

The hope in the Andrews is that by careful and sustained observation—using methods of applied science, applied humanities, applied poetics—researchers will work here side by side as equal partners in apprehending the place and learning how to protect it. But I wondered, if poetry is to be the equal partner of science in this project, would I need a hypothesis? Can an aesthetic desire, an intuition toward artistic form, be a hypothesis? Is there a literacy of equal value to scientific literacy that comes from aesthetic experience?

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On a warm May afternoon, Fred drives me upslope along Forest Road 130 behind the Andrews headquarters through a collage of forest types that are the result of varied logging strategies tried out over recent years. He is a tall, lean timber of a man, gray-bearded as the licheny Northwest trees, with a gentle yet intense manner. He tells me about the sites he'd like me to visit.

"You might want to go sit on that gravel bar in Lookout Creek."

It feels more like conversation than instruction, though I know each writer who comes over the duration of the project will be asked to visit the same locations: creek, log decomposition, and clear-cut sites. I'm expecting science to be the boss here. After all, my host has been studying this terrain for decades. It takes me a few interchanges before I realize that he really means to make me a full partner in the enterprise of understanding this place.

We park at the Blue River Face Timber Sale Unit, an area partially cut one year, then burned the next, and planted with seedlings the following year. The cutting prescription was set on a 180-year rotation with 30 percent live tree retention. Fewer cuts were made close to the river to decrease erosion and silting. Snags were left standing as habitat for voles and flying squirrels.

Fred strides down into the cut, peering at stumps, scanning the tree rings for signs of an earlier wildfire in these firs that had lived five hundred years. I wander along the charred ground, trying to hold onto his language for the place. I write "patch cutting," "too much edge," "min frag," "owl injunction," "new forestry." Fred has an excited mind and verbal acuity that are hard to keep up with, especially when his commentary is filled with a lifetime of learning about this forest. But what really interests him are volcanoes. He calls himself a "closet volcanologist." He's visited eruptions in Hawaii, the Galapagos Islands, and Mount St. Helens to see how such a scale of disturbance registers in the forest. He says that "the organism perceives the mechanism of disturbance and makes a genetic interpretation of the mechanism." All the way down to the molecules, nature is a self-correcting process.

Ten days after Mount St. Helens blew off her top in the catastrophic 1980 eruption that leveled everything within an eight-mile radius, the entire terrain white with ash from the fire and pyroclastic flow, Fred watched colleagues digging

holes to study the mineral deposits. He happened to gaze down into one. He saw spidery, translucent threads of mycorrhizal fungi fluttering in the wind, threads so fine he couldn't have seen them if they had not been dusted with fine volcanic ash. Ten days after the cataclysm, the forest had raced back to work. It was as if fire had said to dirt, "Go forth and multiply."

Fred rejoins me at the roadside where I've been standing to study the landscape, a gentle slope leading toward the seam below where water flows and tiers of brocaded hillsides rise beyond.

"What do you see?" he asks. There's a beat or two of silence in which I realize that my lack of experience and specialized language are part of his hypothesis in this collaborative experiment: she will see it new.

"It looks messy. There's brush left on the ground, tree-sized logs, snags. It looks natural," I answer. "This landscape reminds me of our family's summer home in Canada where we haven't cut anything for fifty years, unless it threatened to fall on our house. The woods there is such a mess of overgrowth and downfall, you can hardly make your way through it anymore. I've come to think of nature unhindered as messy."

I try to describe what I notice at the cut site. Brush, snag, stump, char, feathery seedlings, bear grass, salal, tiny red-stalked clusters of something that grows as dense as streptococcus on an agar plate.

"Yes," he says, "the whole landscape is organizing itself."

A flash of words pops into my mind, giving shape to something I've felt for years.

"This cut keeps intact the wisdom of Earth. Nature, to me, means deep time—what Earth has learned through long trial and error . . . of course, I'm speaking poetically," I add apologetically, imagining how useless such words would be in a grant application to the National Science Foundation. But Fred does not dismiss them.

As a poet working in the house of science, I feel responsible to bear forward some remnant of the romantic tradition, the sense that out of the particular the transcendent may arise and that language can embody such experience. The poet of our time has a complicated task. She lives with a divided mind, remaining as skeptical as a scientist about the tools of her trade. Hasn't language been used to manipulate, oppress, deceive, and betray more consistently than it has ever served as a vessel for aesthetic or spiritual feeling? How can poetic language be called to the world's aid during these days of threat and peril? Can poetry carry our love, as a mine canary carries our fear, into the world? If this is my hypothesis, by what measure do I know the results of the experiment?

Fred nods and explains the site this way: "In the current ecological approach to forestry, you try to keep more of the complexity of nature in the disturbance you create. A little bit of chaos is a good thing."

We talk about the failures of language in both purviews, how so little of what we've said and done has protected what we love. When the Northwest Forest Plan was written, its architects looked for words to describe the forests they hoped to save from the blade so that the land could fulfill its fullest evolutionary possibility.

Ancient forest. Virgin forest. Old growth. Everyone agreed that if those words were the best they could do to inspire conservation, the last stands of North America's forest legacy were doomed.

"Is this a good landscape or a bad landscape?" Fred asks as we gaze over the green tapestry. I'm speechless. I want to think that beauty makes a landscape good, but that trivializes the complexity that makes life work. This mess too is good for the scrutinizing attention it brings out in us and for the ecological possibility it gives to flora and fauna.

I thread my gaze through the scrub, slash, and snags. So much of the process of regeneration on disturbed land

occurs beyond the apprehension of the senses. There is a wholeness to a forest that the damaged area cannot help but seek. The forest is reaching to complete itself, just as we are reaching for the words to describe what lies just past our comprehension. What is going on out there might be described by a graph, an equation, a poem sequence, or a conversation. All would fall short of explaining the complexity of relationships that constitute a forest. Paying attention means more than engaging in empirical study. It asks also for intuition and feeling. It asks for attending *to,* as one would do in the care of one's home, livestock, garden, or beloved.

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"Natural forces and human forces have intertwined," writes geoscientist Paul Crutzen in defining the new geologic epoch of the Anthropocene, "so that the fate of one determines the fate of the other." The enormity of this change in the history of Earth places a new challenge before the human imagination in defining ourselves and the nature of the work we are called to. Communicating information about climate change has hardly brought the forces of greed, guns, and gutting of the planet to their knees. Information doesn't change people. Ask the alcoholic or the addict. Sometimes passion changes people. Sometimes empathy does. Sometimes the unconscious yanks you up by your heels, turns you upside down, and gets you straight with reality. Sometimes social cues ripple out from an event or a scientific finding and a cultural norm becomes abnormal. Sometimes the cue is grief. Sometimes the cue is love. Both tell us what we can't bear losing and create a resonance that can harden into conviction.

This brings me to art. Adam Gopnik writes that "art is a way of expanding our resonances, civilization our way of resonating to those expansions." Art has been in the kit of adaptive strategies for at least thirty thousand years of human history. The late Pleistocene. That's when the great animal

paintings of Lascaux and Chauvet were made, when the animal miniatures of the Swabian Mountains were carved from mammoth tusks. In truth, art's time horizon is probably much more deeply buried in the mystery of the past. I have a postcard taped above my desk, a photograph of a hand ax, a hefty tool meant to fit into the palm for carving flesh from bone. This flint is from Norfolk, England, made by *Homo erectus* some two hundred and fifty thousand years ago. The flint has been carefully flaked to create the utilitarian shape, but the maker has fashioned the carving to highlight a fossil mollusk in the center of one face of the teardrop-shaped ax. There sits the small scallop shell, rays fanning out in an arc, as if a little sunrise had been inlaid in stone. What eye caught this anomaly in the rock? What hand mastered the craft to chip away the surrounding stone, mindful of the beauty and mystery the fossil shell gave to the object in hand? At least three other such hand axes are known from Europe. Archaic hunters spent artful hours getting the symmetry and edge and heft just right. The statement of beauty made by this object translates easily across the geologic eras. The skill and love of beauty is all the more impressive, as Denis Dutton illuminated in his rock-star TED talk "A Darwinian Theory of Beauty," when one considers that such hand axes were being made by hominid ancestors before language had developed.

So what might art, this primal skill set, have to do with our adaptation to climate change? Climate skeptics sway public opinion because they appeal to emotions of fear of change, anger at authority, and denial of grief over loss. What good is a poem in a world of weapons and wounds and wastefulness? Art takes up such feelings as a given. Athletics provide a ritualized way for people to act out violence and competition while doing minimal harm to one another. Art provides a ritualized way to choose beauty over use, to use dissonance as a way to find harmony, to express something in a way that will draw a community together. Art cleanses the spirit of

toxins that have weakened it. Art lets one inner life speak to another across vast spans of time and distance. It's not art's task to convey information, though it may interrogate the usefulness or truthfulness of information. Art is empathy. Empathy gets in the way of objective science, which is not to say that a scientist does not feel empathy. But scientists do not cultivate their empathy as an instrument to employ in their professional practice. Art tries to do just that. It weaves connective tissue between fact and feeling, self and world, individual and collective good. Art in a time of radical loss is an elegy. It teaches us how to mourn, whether in the context of family loss or the larger losses brought about by the extreme sport of anthropogenic climate change.

Art can use the power of grief to speak of the depth of one's love for what we would protect and sustain. It can expose the failure of the old myths and raise the appetite for new myths that can guide us. Poems that spring from the ecotone between art and science can document the spirit of the age, as poetry has done since the first campers sat around a campfire dwelling in a shared sense of feeling and purpose. I cannot prove empirically the efficacy of poetry or any other form of art. I write because to do so is an experiment in being present. Climate change is here. It is messy. Change is coming fast. No one is in control. Even our best intentions fall into a process of complex change that we could not have anticipated. "Attention must be paid," Willy Loman's wife laments. "He's not to be allowed to fall into his grave like an old dog." She feels as if sorrow were an imperative for insurrection.

"What are words good for?" asks Brazilian poet Antonio Carlos Secchin:

> Perhaps to insist that there are always left-overs, mistakes, failures, and fractures in our interactions with the real world. To ignore them is to believe in a harmonious con-

nection between words and things, in the existence of a homogenic discourse that would deny each and every one of us the possibility of negotiating the openings and cracks that conflict and change can offer and which both the words and human beings need to be kept alive.

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Something strange is going on up in the Andrews Experimental Forest. Decades of research, education, and policy have worked to protect the northern spotted owl as a keystone species signifying the health of the old-growth forest. Since these reclusive birds require old-growth forest to thrive, protecting them has required preserving magnificent ancient forests. But as more and more habitat is disturbed elsewhere, barred owls, larger and more aggressive birds, have been moving from the east across Canada's boreal forest into the Northwest. Barred owls can outcompete the spotted owls for prey. And they do better on logged-out land than the spotted owls. They usurp spotted owl nests. They breed with spotted owls, producing offspring known as "sparred owls" that look and sound like neither parent. They're a mixed-up natural hybrid and thus not protected as an endangered species. Should the barred owls be killed to protect the spotted owl? Will the barred owls prove more fit for a less fit forest, taking over the habitat, wiping out the protected species and opening the way for more aggressive and unsustainable logging? The questions fly as the Earth experiment continues to unfold.

Hood River Oyster

I'm not sure when I began to notice the absence of birds. I had come to Los Angeles for the weekend to speak about science and the Western American imagination. I lamented the split between science and religion that has widened since Darwin. I might have said that as an animist I see nature as god. Or I might not have said this, because it would have made me feel undressed in public. God is like sex, best experienced with a very small audience or none at all. A Native American man in the audience complained that we could not solve the problems in our relationship with nature until we solved the problems of dominance and rank. I said we followed the pathway of the chimp with chest thumping, ground drumming, bullying, assault, and mutilation as very old habits in the primate line. That doesn't mean this is the only path we can follow through the genetic undergrowth. Bonobos, with whom we also share a common ancestor, resolve conflicts by defusing hostility with affection and sexual play. They are mutualists. I am a "sci-animist," I concluded, the word bubbling up from nowhere, from the same old mind that split from apes. The audience laughed. What I meant was that I thought science could return us to an animistic sense of the natural world, a place where transformation was expected, part of the pattern and flow.

I'm not sure when I began to notice the absence of birds. Certainly not when I checked into the Los Angeles Biltmore, craning at the sky-high tropical fool-the-eye mural depicting split-leaf philodendrons and birds of paradise. Not when I

Page 139
"Liberating the Lobster"

Some material is recycled from an interview with Todd Davis: "The World, the Word, and the Inevitable Beauty of Change: An Interview with Alison Hawthorne Deming," *Interdisciplinary Literary Studies*, Vol.14, no. 1, 2012. Pennsylvania State University, University Park, PA, and from an editorial in terrain.org titled "Ruin and Renewal."

L. K. Ingersoll, "Grand Manan at the Turn of the Century" and "Lobsters Galore," Grand Manan Historical Society

The *New York Times* reports that forests are dying in Canada, Russia, Australia, the Amazon basin, and the American Southwest. The pines of Greece and the cedars of North Africa are dying. For more information, see: http://www.nytimes.com/2011/10/01/science/earth/01forest.html?pagewanted=all&_r=0

The ending echoes the end of Dante's *Purgatorio*, which W. S. win translates, with Virgil speaking:

> Now you can tell how great
> must be the love for you that burns in me
> when it escapes my mind that we are empty
>
> and treat a shade as a solid thing.

Page 149
"Trumpeter Swan"

See the Cornell Ornithological Laboratory and Minnesota Department of Natural Resources websites and Neil Russack and Joseph L. Henderson, *Animal Guides* (p. 31).

Plato reports on Socrates's reflections about death and swans in his *Phaedo.*

Page 170
"Feral Children"

Giorgio Agamben, *The Open: Man and Animal*

Douglas Candland, *Feral Children and Clever Animals: Reflections on Human Nature*

Henry David Thoreau, "Walking"

Rita Carter, Susan Aldridge, Martyn Page, Steve Parker, *The Human Brain Book*, London. Dorling Kindersley Limited, 2009

Page 178
"Vervet"

Donald R. Griffin, *Animal Minds* (p. 154-5, 201, 233)

Page 184
"Chimera"

J.B.S. Haldane, *Daedelus, or Science and the Future*
Giovanni Aloi, *Art and Animals*

Page 190
"Letter from Mars"

For the arresting images sent by *Curiosity*, start here:
http://www.nasa.gov/mission_pages/mars/main/index.html

Check out *Curiosity*'s Twitter feed here:
https://twitter.com/MarsCuriosity

The letter was inspired by the December 20, 2012, Twitter feeds, as well as cursory research into the concepts of "the singularity" and "friendly artificial intelligence." See the Singularity Institute for Artificial Intelligence or *The Transhumanist Reader* for a deeper dive.

Page 195
"Owl Watching in the Experimental Forest"

The H. J. Andrews Experimental Forest is one of twenty-six Long Term Ecological Research sites ranging from Alaska to the Caribbean to Antarctica funded by the National Science Foundation. Under the leadership of philosopher Kathleen Dean Moore and geoscientist Fred Swanson, the site has expanded its focus to include Long Term Ecological Reflections, a two-hundred-year project bringing arts and philosophers into the research site. I'm indebted to their leadership and friendship. Our many rich conversations about science and art, while we were walking among the old giants there, have been deeply nourishing.

For information about the NSF's Long Term Ecological Research sites see: http://www.lternet.edu/.

For information about the loose network of sites doing Long Term Ecological Reflections see: http://www.ecologicalreflections.com/.

Paul Crutzen, *ibid*

Adam Gopnik, *Winter*