

Field Notes

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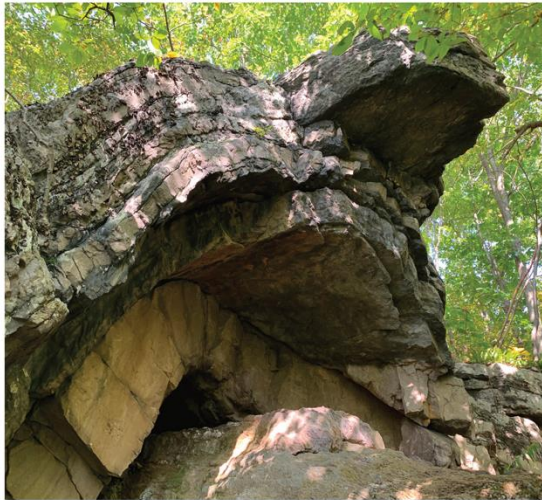
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COHORT AO



Cultures have long told stories about how humans, other animals, the earth, and the cosmos came to be, finding wisdom in nature and the relationships therein. Stories become myths, larger than life, their narratives allowing us to keep track of what's important to us. Our sense of purpose. Who we care about. How we relate to and make room for the more-than-human.

We, the long-eared owls (*Asio otus*, Cohort AO), were drawn to the idea of “mythologies” as a theme for this year’s issue because of the creative latitude it provided us. We spend so much time as Field Naturalists struggling over what makes good science, well, “good.” Is it necessary that good science be removed from emotional ties? We humbly reject this idea and prefer to slip ourselves, if only a toe or two, into the awe and majesty that drew us to become naturalists in the first place.

Image: Ben Applegate

Before the development of the scientific method, it was close observation, pattern-finding, and participation in the natural world—the work of naturalists—that informed mythology. As science and industrialization developed, the transformation of raw materials has grown in sophistication and by orders of magnitude. Humans have modified the world on scales that would seem fantastical to the first mythmakers and storytellers. In such a time, what is the role of a Field Naturalist?

Naturalists walk in the diamond tracks of gray fox, the waddling prints of beaver, and the slimy squiggle left by a snail. We follow in the ridged bootmarks of the naturalists that walked before us. We document the pieces, patterns, and processes driven by the laws of chemistry, physics, and biology. We are in the field verifying the validity of models and hypotheses. We inspire research by witnessing phenomena that do not arise spontaneously in a lab. Each observation informs the stories we tell about how the world works: the flight of crows at night, the movement of a new beech disease through the landscape, or water raging into the basement at night as the rivers flood. As naturalists, we are the charismatic megafauna, getting people to bite on something they can relate to.

Greg Streveler, beloved instructor in the Field Naturalist Program, described naturalists in true mythic fashion as those who communicate the love and “deep ecology of a place, allowing us to sense what we cannot [yet] measure.”

In this issue of Field Notes, Cohort AO, program alumni, and other illustrious contributors follow their curiosity, explore the natural world, and try to make sense of its complexity through the essays in your hands. We, like Odysseus and Beowulf and Alice and Dorothy, have sought out adventures outside of our comfort zones and come out the other side ready to share our thoughts with you.



Image: Ben Applegate

WALTER POLEMAN

One of the enduring and beloved traditions of the Field Naturalist Program is the weekly series of Friday Field Walks that takes place each spring semester. Organized by the current students, these informal excursions bring together natural history enthusiasts from across campus and around Vermont for a few hours of botanizing, tracking, birding, and sleuthing mysteries at natural areas within striking distance of UVM. These events tend to attract alumni living in the vicinity, and it is not unusual to have Field Naturalists and Ecological Planners (FNEP) from five or six cohorts join in. This multi-generational mix was on full display at Peacham Bog one Friday this past April, and I was deeply moved by the teaching, learning, mentoring, and networking that unfolded throughout the day.

The organizers wisely invited Jill Bubier (E Team) and Brett Engstrom (C Team) to lead the expedition through this fascinating wetland complex in Vermont's Northeast Kingdom, and our group of 20 spent the day learning the finer points of sedge identification, speculating about the post-glacial origins of the bog, and viewing dwarf mistletoe through our hand lenses. Jill, who studied law before coming to the FN Program in 1988, shared her deep knowledge of bog ecosystems nurtured through a subsequent PhD at McGill and two decades researching peatlands as a faculty member at Mt. Holyoke. Recently retired, she contacted me a couple of years ago to say she missed working with students and wondered if there might be an opportunity to mentor current FNs. I jumped at the chance. Jill has now served on student committees with the past three cohorts and is co-teaching a module on research design as a part of the Fundamentals of Field Science course in the first semester. Brett, who lives just west of Peacham Bog in the town of Marshfield, is deeply respected throughout the FN world as a “naturalist’s naturalist” who is always willing to share his vast knowledge of Vermont’s natural communities with newer FNs. As we ate our lunches at the bog viewing platform, surrounded by sphagnum and pitcher plants, Brett told stories of his recently deceased mentor, Greg Streveler, whose profound legacy with the FN Program was honored at a symposium in Gustavus, Alaska, that I attended this summer. (You can read more about Greg and his FN connection in this issue.) According to Brett, “looking back on it now, Greg and Glacier Bay meld into one another: I can’t think of Glacier Bay without Greg, or Greg without Glacier Bay. Both instructors of the highest level.”

I came away from our day at Peacham Bog with similar thoughts about Jill and Brett, and of how blessed we are in the FN Program to be surrounded by such amazing outdoor classrooms and elders dedicated to deepening our connections with these ecosystems. I was gratified that—as is often the case on these Fridays—two prospective students had joined our expedition and had the chance to experience the powerful relationships at the heart of the FNEP community. As we learn through the study of forest communities, canopy trees play essential roles in the recruitment of new cohorts into the understory.

This relational synergy was once again on display two weeks later as we celebrated the graduation of our 40th cohort at Rock Point on May 10. Surrounded by family, faculty, friends—and all the members of the 39th and 41st cohorts—the Boxelders were lovingly launched into the next phase of their careers as integral members of a robust network of naturalists dedicated to fostering deep and healing connections between people and place.



Walter Poleman (Cohort K, '95) is the program director and teaches Landscape Inventory & Assessment. He is the founding director of the PLACE Program and co-coordinator of the Greater Burlington Sustainability Education Network. He is also a faculty member in UVM's Rubenstein School of Environment & Natural Resources and teaches ecology to lawyers in training each summer at Vermont Law & Graduate School.

DICHOTOMOUS KEY TO THE LONG-EARED OWLS (Cohort AO)

i. Home range within 1 mile of Jeffords

ii. Primarily a floraphile

iii. Mode of locomotion: frequent long walks.

Common associates: Cyperaceae *DeAlto emily*

iii. Mode of locomotion: social dance.

Common associates: Orchidaceae *Costello laura*

ii. Primarily a faunaphile. Common associates: Aves *Sirch matthias*

i. Home range beyond 1 mile from Jeffords

iv. Apically hirsute.

v. Montane.

Common associates: Canidae *Banerjee naya*

v. Subterranean.

Common associates: Castoridae *Aiken greta*

iv. Apically glabrous.

Common associates: *Malus* *Applegate ben*



1. **DeAlto emily** (T. DeAlto & D. DeAlto). FN wrangler and bringer of sunshine. Fens and shallow emergent marshes. Chittenden and Washington Co., VT.

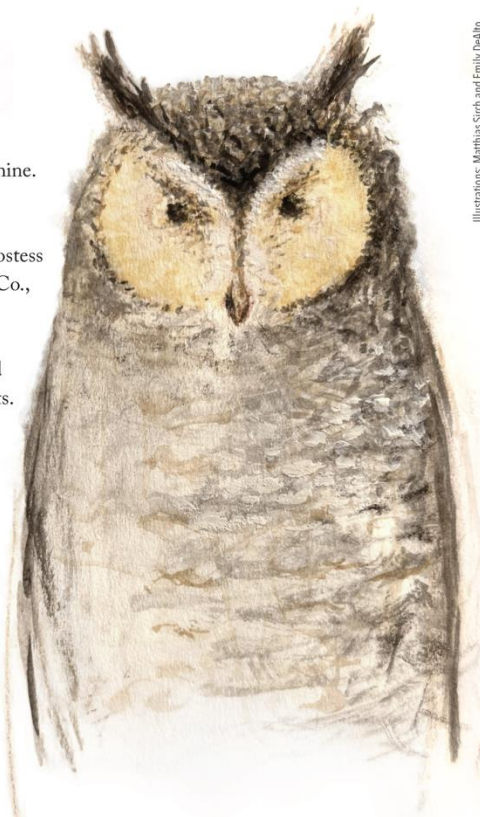
2. **Costello laura** (M. T. Costello & J. J. Costello). Dancer, sweet tooth, and hostess with the mostest. Wild places both urban and rural. Chittenden and Orange Co., VT; Hillsborough Co., NH; Middlesex Co., MA.

3. **Sirch matthias** (D. Ludwig, S. Sirch & C. Wilford). Artist in residence and avid frugivore. Champlain Valley clayplain and rich northern hardwood forests. Chittenden Co., VT.

4. **Banerjee naya** (R. Bhatnagar & N. Banerjee). Speaks with the plants and runs with the wolves. Barefoot in the forest or climbing a pile of rocks, naturalized to Windsor Co., VT.

5. **Aiken greta** (C. Aiken; S. Aiken & R. Aiken). Feeder of the masses, devotee of the soil and the furbearer. Padding around the woods at night. Caledonia Co. and Chittenden Co., VT.

6. **Applegate ben** (H. Applegate, R. Applegate & R. Batt). Tree- and human-hugger. Found in a wide variety of habitats but increasingly common in riparian forests and wetlands. Orleans Co., VT.



Illustrations: Matthias Sirch and Emily DeAlto

Teeth

MATTHIAS SIRCH

Ancient as pines, somewhere between an octopus and a clam, a soft mass of curious cells crawls out of the brine, a mouth full of a green glaze that covers the rocks: a primordial stew of fungus and algae. With time, these relationships have held fast. A mouth still full. The algae has burrowed into the fungi, cradled and intertwined so that the two once-distinct organisms now share the same scientific name.

Today, etched onto the paper-flat lichen that paints the hardwoods of western Maine, are a cuneiform of triangles, row after row, teeth marks like beavers' nipping at aspen but small as insect scratches. Once you see them, they're everywhere. But who has seen the scribe?

"Slugs or snails," concludes Jason Mazurowski (Cohort AI) who recently stepped into the role of Winter Ecology instructor alongside naturalist legend Bernd Heinrich. Jason is the next guide in the long lineage of large boots to fill. He shares a photo from Charley Eiseman (Team V) and Noah Charney's *Tracks & Sign of Insects and Other Invertebrates* and a passage that accompanies the marks we see.

"I've paid them little attention," says Bernd, a man who pays attention to everything.

The creature in question is now under leaves, dormant through winter. Or surviving the freeze in egg form. And each wet, warm non-winter's night, when the moisture has softened the pale lichen, the soft mass stirs silently in its slow mollusk body from the damp logs, drawn upward by the smell that drips down the trunks to continue to etch its story, only now partially deciphered.

"I don't know how to tell snail and slug feeding tracks apart," says Tim Pierce, a lifelong snail enthusiast and head of the Section of Mollusks at the Carnegie Museum of Natural History in Pennsylvania. "Most stylommatophoran radular teeth are boringly similar." Stylommatophora, *stylo* (stalk) + *omma* (eye) + *phoros* (bearing), or stalk-eye-bearing, refers to the protruding eye appendages shared by the thousands of air-breathing slugs and snails, for those not well versed in mollusk terminology.

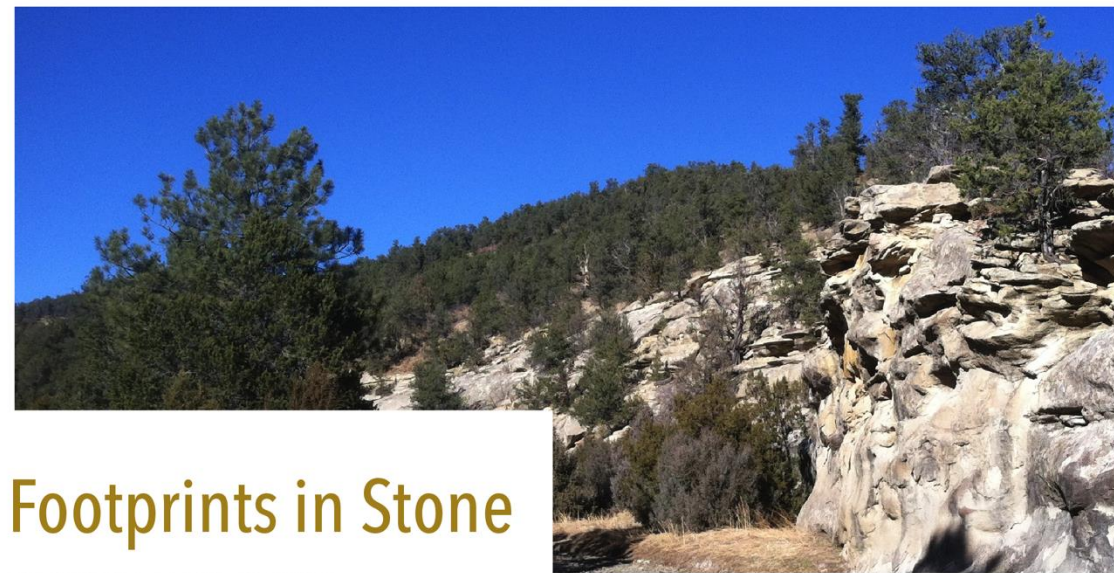
The creature's peculiar tongue-like radula rasps across vegetation



thousands of teeth at a time to devour the algae's sunbaked nutrients and protein- and calcium-rich fungal fragments. The creature sways as it feeds, inching forward for the next series of bites, chiseling off columns and bundles of pre-packaged material on the lichen's surface. Partially digested deposits are cast out from a hole atop the creature's head. The fragments disappear into the soil or wash down the bark with the next rain. Snail, the disperser. And the cycle continues.

We piece together this natural history during Winter Ecology, painting with broad strokes the stories in our heads however they will stick, now millions of years into the tale of concentric relationships, guided down the trails of the unknown, poised to sink our own teeth into the world of ecology.

Matthias Sirch (Cohort AO, '26) has come to appreciate work that makes data meaningful.



Footprints in Stone

JASON MAZUROWSKI

In a sandstone canyon, willows wave in the dry July air. Clouds form over the snowcapped peaks to the north as I rock-hop down the dusty trail. It's the cusp of monsoon season, and each afternoon fluffy clouds converge into a roiling, black maelstrom that unleashes curtains of rain and hail onto the parched pinyon-juniper hills.

Here in the high desert of northern New Mexico, I stop to admire Anasazi petroglyphs etched into the canyon walls: depictions of shamans and antelopes, black bears and rattlesnakes, and concentric circles shaped like targets. Some walls are dotted with pockmarks, bullet holes left by cowboys as they sat around their campfire drinking whiskey and rolling cigarettes. The bullet holes are more than a century old, and they've defaced ancient writings carved into stone deposited 65 million years ago. It's to that time, the late Cretaceous Period, where my curiosity brings me today.

Pulling a map from my running vest, I confirm that I have arrived at the mouth of the canyon I'm looking for. I venture off trail into the talus, vigilant for rattlesnakes, and scan the surface of every boulder. Erosion of the soft shale layers beneath the white sandstone has caused large blocks to fall, now jumbled together at the base of the drainage. I am particularly interested in boulders that have recently fallen and landed upside down, revealing imprints of a natural community that have been hidden for millennia. Fossilized palmetto leaves and horsetail stems tell me this must have been a large floodplain at the edge of the inland sea. I run my hand along ancient, petrified ripples and imagine the shoreline of a humid subtropical estuary teeming with life, contrasting starkly with the dry, dusty creek bed of today.

I clamber over the top of an SUV-sized boulder and finally

spot what I have come for: dinosaur tracks meandering across the fractured stone. My expertise is limited, but I can tell the tracks are from a mix of hadrosaurs (duck-billed herbivores) and theropods (small carnivores with an upright posture closely related to the velociraptors and T-rexes of pop-culture fame). Evidence of these charismatic megafauna can be surprisingly common in the Southwest, once you get into the habit of knowing where to look. In fact, the first known footprint of a tyrannosaur, the apex predator of its ancient ecosystem, was discovered on a similar overturned boulder just a few miles south.

This canyon is special not just because of its sheer abundance of dinosaur fossils but also because of the fossils' proximity to the K-Pg boundary. Also known as the Cretaceous-Paleogene boundary, the K-Pg boundary is a thin layer of ash and iridium that memorializes the asteroid impact that triggered Earth's last mass extinction event. Below the thin black line lies a rich record of the diversity and abundance of dinosaur fauna. Above the line, no evidence of terrestrial dinosaurs has ever been found. The footprints I'm staring at were left by some of the last of their kind.

A distant rumble of thunder pulls me from my reverie. I turn to leave and find myself facing the K-Pg boundary, right at eye level. I touch the thin jagged layer and realize this celestial dust and I have more in common than I would like to admit. I am a member of a species that, like the asteroid, has set a mass extinction event into motion.

The sounds of thunder draw nearer. I fumble through talus, then begin to jog back to the trailhead. When I approach a creek crossing, I stop to fill up water and check the map. Crouched in the creek while filtering water into my CamelBak, I glance at the

wet sand and gravel bank beside me. That's when I see the fresh, unmistakable pawprints of this modern ecosystem's apex predator. *Puma concolor*.

Image: Jason Mazurowski



Image: Jason Mazurowski

Those tracks must have been there before, I tell myself. Maybe I missed them earlier? My own footprints are just a few feet away, and I see the mountain lion had headed in the same direction. The surreal feeling of being watched sets in.

Trying to outrun the impending storm and not act like prey, I am more alert than I have ever been. My mind no longer wanders to ancient civilizations or prehistoric natural communities. Each squirrel rustling the scrub oaks, each snap of willow branches in the wind, jars me back to the present moment, the mindfulness of imminent danger.

I reach the trailhead right before the sky opens up. Lightning strikes the ridgetops on either side of the canyon, and golf-ball-sized hail hammers the roof of my little Pontiac as I fishtail through the mud down a Forest Service road.



A decade later, in the humid, forested mountains of the Northeast, I still reflect on how it felt to be in the presence of a large carnivore. The "ecology of fear" concept describes how a predator can influence an ecosystem with its mere presence. Just having the knowledge that there are predators on the landscape causes prey species to change their behavior significantly, and the associated downstream ecological effects are profound. I certainly act differently when in the presence of big cats.

In 2011, the eastern cougar, a subspecies of the mountain lion, was officially declared extinct after having been absent from North America since the 1930s. Extinct is a heavy word. It immediately places these big cats into the same mythic category as the dinosaurs, woolly mammoth, and passenger pigeon. Extinction implies finality.

The eastern cougar's return is possible, however, though on a timescale we humans cannot fully comprehend. The return will not be due to fantastical cloning processes, nor to the mind-numbingly complex bureaucracies of state agencies. Rather, the eastern cougar's next iteration will be the result of the same forces that have driven evolution and extinction for millions of years.



The tracks I left by the New Mexico canyon, as well as those of the mountain lion, were almost certainly washed away by the rain. But what if they weren't? What if, by some miracle, a flash flood buried our footprints and permanently preserved them in the fossil record? What if, millennia from now, our tracks appear together side by side? What kind of story would they tell?

Would my human footprints be interpreted as a harbinger of extinction, in the same way the K-Pg boundary signals the demise of the dinosaurs and the bullet holes in the canyon wall portend the fate of the canyon's indigenous human inhabitants?

Or, perhaps, would my footprints be interpreted as steps toward coexistence? If big cat tracks can once again be found among the cellar holes, stone walls, and granite balds of New England, will the century in which they were absent there appear as nothing but a blip in geologic time?

Jason Mazurowski (Cohort Al, '19) is a Wildlands Ecologist at Northeast Wilderness Trust and an instructor in the Field Naturalist Program.

A Walk in My Younger Self's Footsteps

JUDITH D. SCHWARTZ

I was scrolling through rentals, a place to hole up for two weeks within visiting range of our son in LA, when a listing caught my eye: a 250-square-foot unit by *Windansea*. Now, 250 square feet is barely big enough to stretch your legs after a beach walk. But the notion of Windansea Beach lit a spark in me. Once I saw the place was affordable, I decided this was our spot. Back in 1991, my husband, Tony, and I had rented a tiny beach house two short blocks away. I remembered that California interlude: long hikes in the chaparral, sandwiches piled high with avocado, the sound of the ocean at night. And, of course, the daily ritual of viewing the sunset, holding your breath while you watch for the elusive green flash. Tony and I toyed with the idea of staying in coastal San Diego before a teaching job pulled us back east.

The prospect of revisiting our past amused us, and we went in good spirits. We were relieved to find that unlike much of the area, where condos upon condos fill every buildable space, the neighborhood largely retained its atmosphere. There was the same surf shack covered with palm frond thatch and, at the bottom of our street, the pump house made famous by Tom Wolfe's quasi-anthropological writing on feral surfer youth. Some of the remaining bungalows were getting a mansion upgrade—which meant constant construction clamor—but the neighborhood had the same easygoing feel.

There were some happy surprises, like the raucous colonies of seals and sea lions basking on the cliffs by the La Jolla beaches, more—and rowdier—than I recalled. And the multitudes of brown pelicans sailing in great squadrons (yes, that's the proper term for a group of pelicans). A California friend said that when she was growing up, pelicans were endangered, largely due to the impacts of pesticides. While I hadn't known this, I was thrilled to see so many, their arrival heralded by sweeping shadows. Yet I was unnerved to see so few shore birds, like the sanderlings that run into and out of the water, as if on rollers. When we went tide-pooling at Bird Rock, Tony was dismayed to find no brittle stars.

I was struck by the extent to which my body remembered the place, especially my feet. I seamlessly fell into the rhythm of strolling along Neptune Place, the promenade above the beach where people show off their toned physiques and swanky dogs. Once down by the ocean I scrambled on the rocks, sure of foot as though I'd memorized the shapes of the boulders. It was as if I were stepping into the skin of the person I was

30-odd years ago, when I was in my late twenties. This sense of dipping into the past reminded me that I was, indeed, this same person in the same body.

But oh, so much has changed.

More than anything, what's different is how I see the world, and myself in relationship to the world. Back then I trusted that the system we lived under made sense, that there were sensible rules to follow and grown-ups in charge. People cared about pollution and those grown-ups were doing something about it. To wit, the Clean Air Act, the Endangered Species Act, and public service ads that everyone saw. Sure, I'd witnessed lapses, like the Vietnam War and Watergate. But the bad guys in Watergate, including the president, were held accountable, weren't they? As for Vietnam, protests made clear that young people—by definition our future leaders—preferred love to war. As a nation, we'd wised up. I couldn't imagine our government getting us mired in such a cruel and pointless conflict.

* * *

We inherit the myths of our time. I grew up in the '60s and '70s in a suburb near the General Electric headquarters in Schenectady. I dwelled in a world steeped in confidence. Science and technological advances would make life better for all. The nuclear family was the pinnacle of social organization. The United States occupied the moral high ground and was by all accounts the best place to live. Journalists were truth-tellers and, as Watergate taught us, could be heroes. Schools were good and opportunities for women



Image: Tony Egnile

were opening up, including at top-tier colleges that had recently gone “co-ed.” If I studied and worked hard, I would succeed, and success, by definition, would be “meaningful and fulfilling.”

There were hints of dark undercurrents. People shrugged at the race-baiting of the Reagan and elder Bush years and the folly of trickle-down wealth. The first Gulf War was presented as a grand spectacle of America's weaponry. While living at Windansea for the first time, I learned hostilities had started when I glimpsed a neighbor's television screen, emblazoned with colorful graphics. Few talked about pollution anymore. Rather, you could be a good environmentalist by donating to organizations that subsequently thanked you with tote bags and calendars. The grown-ups knowingly told us to conserve electricity and buy better light bulbs. Fortunately for my hometown, General Electric, built by the light bulb, had moved on to more lucrative fare, like financial services and healthcare.

As we breached the 2000s, the myths I'd held began to crumble. With dubious elections and poorly executed, needless wars, I could no longer claim—even to myself—that my country was fair or benign. Add to that the inevitable disenchantment with people in my personal life to whom I had granted authority, a disillusionment everyone faces. As I sloughed off outworn assumptions, I began asking questions about conventions and structures I'd once taken for granted.

Painful as this shedding was (how I longed to believe smart people could assure me all was okay!), it was also freeing. It felt like the cerebral equivalent of clambering over rocks, confident I'd find a toehold despite cracks amidst the stepping-stones. In time, I tripped and lost my footing: I'd bumped into those myths, in this case about those smart people who evidently knew better than I.

But did they?

You see, I started asking questions about economics: economies that humans create, economies of nature, and how the two intersect. And about climate, asking the basic question: how does the earth manage heat? It seemed to me that biology—life—was missing from some important conversations. For example, climate was considered the purview of physics, and climate *change* was all about greenhouse gas emissions. I remember the moment when, chugging through an assignment, I penned a line that contradicted everything the professionals said about climate change. I wrote: *We could remove all the carbon we want from the atmosphere and still suffer the floods, droughts, and wildfires attributed to CO₂-driven climate impacts.* Oh my! This is true: what creates and regulates the conditions we call climate is the interplay of water and land; flora, fauna, and fungi. I looked at the sentence and the sentence looked back at me. *Am I allowed to say this?*

The experts I interviewed confirmed that I'm not, at least if I wanted to be taken seriously. Several solemnly assured me that the workings of the water cycle and the state of the soil—factors where we have agency—may affect local climate, but as for Global Climate Change it's only CO₂ that needs watching. But after all those years I'd gotten used to dispensing with myths and not letting myself be seduced by certainty. It has long troubled me that climate change was presented to the public as revolving solely around carbon, as if we could adjust the climate by dialing up or dialing down the amount of CO₂ in the atmosphere. As if we could fix the planet without touching anything. But I knew that to mend the harm we've caused we need to touch the earth. Perhaps more importantly, we need to be touched by the earth, to be alive to its patterns and propensities, its wisdom and mystery.

This quest to explore climate through the lens of nature propelled me through writing three books on, respectively, soil, water (focusing on “water” as a verb), and the growing grassroots ecosystem restoration movement. In the beginning, this pursuit was kind of lonely. But now I have plenty of companionship as more people want to talk about things like the social lives of fungi, how animals create landscapes, and how healthy forests drive the movement of moisture around the globe.

* * *

When we got back to Vermont it had turned to spring. We missed the crocuses, now just a tangle of stems, but soon the bloodroot emerge. Then trillium, then Jack-in-the-pulpit. I prowl the edges of the forest to catch glimpses of these ephemerals, as if on a safari. They keep me company while I grieve the state of the world, the dark currents I'd sensed earlier now swelled to rogue waves, seething and rolling and telling the same stories that make less and less sense. Increasingly, I pay more attention to those who ask questions than to those who proffer answers. At times I lament the absence of grown-ups to reassure me everything will be fine.

It's time to let go of the myth that I could outsource my own knowing, that someone else can promise me everything will be okay, and in so doing make it so. I can own my commitment to working with nature and my belief that every bit of ecological healing matters. I can trust my intuition and where it takes me, just as I trust my feet.

Judith D. Schwartz is an author who tells stories to explore and illuminate scientific concepts and cultural nuance. She takes a clear-eyed look at global environmental, economic, and social challenges and finds insights and solutions in natural systems. She writes for numerous publications, including *The American Prospect*, *The Guardian*, *Discover*, *Scientific American*, and *YaleE360*. Her latest book, *The Reindeer Chronicles*, is a global tour of earth repair, featuring stops in Norway, Spain, Hawai'i, New Mexico, and beyond.

Sketching to Connect

LARA CALL GASTINGER

How do you connect with nature and attune yourself fully to its wonders? You can study, read, and talk about nature, but is that enough? What should you do when you notice glimmers of nature's magic and want to work with that mystery, understand it, and instill it in your memory?

As a botanical artist and illustrator, I have found that closely observing and drawing specimens can lead to a deeper (some might say spiritual) connection with nature. Transferring information from eye to hand to paper is an embodiment of the specimen's original attraction and wonder on the page.

How to Begin Nature Sketching

How do you begin to sketch nature when it feels intimidating?

First, know that you do not need to be an artist, scientist, or naturalist to create a rewarding field sketch. The only prerequisites are curiosity and appreciation for nature.

I start by fully noticing my surroundings...slowing down (putting my phone away), peering at the ground, then up at the trees, and observing shapes, colors, and textures. Questions swirl in my head. What is different today? What does this plant remind me of? Why is this leaf this color? Who is this pollinator?...



Once something has caught my eye or intrigued me, I stop and give it a moment of reflection and gratitude. Then, I use a pen (Micron Sepia size 005 [0.2mm]) to record date, location, weather, habitat, and any other observations in my journal.

Just describing the specimen can be enough. Note whether leaves are alternately or oppositely arranged, how many parts there are in flower or fruit, how the leaf is shaped, what its margin looks like, etc. Consider sketching a small part of the specimen first, starting with a single leaf or petal. Keep your hand light and remember: this does not need to be a precious or perfect drawing. Embrace mistakes and redraw several times if you are not happy with the initial sketch. Then, you might consider adding more of the specimen to your drawing, adding darker values, or even including color or more text. The important part of this exercise is the time spent in close observation of your specimen, not what your drawing looks like. You will remember this moment and your specimen's details for a long time. This is how you begin.

The Perpetual Journal Practice

Over the past 25 years, I have created a sketchbook practice called the Perpetual Journal. This technique, which involves weekly journal sketches, has helped me connect more deeply with and better understand the plants of the Piedmont of Virginia.

In my Perpetual Journal, I label each spread with the dates of every week of the year, starting with the first week of January and continuing until I fill the journal. My goal is to add a single drawing or observation each week, with no pressure to fill an entire two page spread. A year after starting the Perpetual Journal, I return to the beginning of the journal and add new observations to the previous year's content. The following year I do the same.

Over time, each spread becomes layered with multiple observations from consecutive years. Some drawings are simple, while others are very detailed or are in full color. Dividing the Perpetual Journal into weekly entries provides a forgiving and manageable drawing pace and allows you to slowly but consistently build up your spreads over the years.

A Perpetual Journal practice is rewarding and powerful. It helps you remember a plant you noticed one week in May and anticipate what you might see next week. It helps you appreciate the subtle



and magical changes in the seasons, such as the swelling of a bud, formation of seeds, change in color of a berry or leaf, or return of a migratory bird. Artists, gardeners, naturalists, and teachers have all used this approach to increase their understanding of and connection to the natural environment. With each year's additions to your Perpetual Journal, you will connect with magical moments and find previously overlooked beauty.



Lara Call Gastinger is an artist and botanical illustrator from Charlottesville, Virginia. She is a lecturer in the University of Virginia Department of Landscape Architecture and the chief illustrator of *Flora of Virginia*. Her art appears in *Peterson Field Guide to Mushrooms of North America* and the *American Society of Botanical Artists' Botanical Art Techniques*. She has been awarded two gold medals (2007, 2018) at the Royal Horticultural Society Botanical Art Show in London and her work is in the Hunt Institute for Botanical Documentation at Carnegie Mellon University. Gastinger is renowned on Instagram (@laragastinger) for teaching her perpetual journal process.

This essay includes excerpts from Lara Call Gastinger's upcoming book, *A Perpetual Journal Practice: Building a Connection with Nature through Art*, to be published in June 2026 by Timber Press. The excerpts have been edited and abridged for the purposes of this publication.



Die Geruchswelt

NAYA BANERJEE

On a bright morning in February, I crouch on all fours, nose almost to snow, sniffing a spray of lemon-yellow urine. Overnight, the animal that left it walked across this field and chose to mark a lone high point before continuing on towards a strip of forest. The shape and size of the tracks are indications that they belong to a gray fox. But it is our tracking instructor's offhand remark that catches my attention. If you smell the pee, says Dave Muska, and it smells like cheese—like a strong camembert—it's a gray fox. I inhale deeply. The cheesy odor is unmistakable.

With visions of compiling a field guide to the scent markings of New England wildlife, in the following days I walk with my dog in the woods. He sniffs certain branches poking up through the snow while ignoring others. I sniff the same branches dutifully, hoping that this creature, straddling the boundary between wild and domesticated, will be my intermediary to the animal world. Most often, I smell nothing. One day, persisting, I smell a downed branch across the path that caught his attention, searching for differences across its length. I find a short section that smells oily and dull, while the rest smells verdant: green and “planty.” Encountering tracks left

by an animal—even when they are days old—he shakes off his amiable trot and becomes focused. Every few steps, he plunges his entire snout into the track, even in a foot of snow, staying submerged for some seconds. He comes up for air, white crystals flecking his face, nose to the wind, drawing air in and out in short bursts. When dogs exhale, the flap-like slits of their nostrils create vortices that direct fresh samples of odorous air back into their noses. I plunge my face into the snow, aiming for the print, but come up blinded and sputtering. Instead, I carefully brush aside fluffy snow, clear the track, and then inhale. Sometimes I discern a mild scent that is different from the smell of just snow, especially in the tracks left by deer. Later, I learn that deer have interdigital glands between the toes of their hooves which they use to leave a



sour-smelling substance that can indicate the timing and direction of travel as well as their receptivity to breeding.

One afternoon when it is still winter, I come across a great white pine, the largest tree I can see in the patch of forest, with an area of the bark rubbed raw by squirrels. I take a moment to sniff at it, and, being rewarded with a mild and sweet oily odor, I start to take care to look at the bases of larger trees for squirrel stripes. On one of the first lush days of spring, the fiddleheads are just starting to unfurl and the slender sporophyte stalks of a patch of lime-green golden thread moss dazzle with raindrops. Ignoring all this, my dog runs in a frenzy to a hefty hemlock with the reddish inner layer of bark showing where the outer bark has been rubbed off. It reeks of urine, along with a sweet oily odor and a whiff of something spice-like, the combination strong enough to make my stomach turn. When I visit some weeks later, the smell of urine

has dissipated and the sweet notes are more noticeable, the changing intensities perhaps tied to the timing of mating.

* * *

The odor of a gray fox's urine is distinct, and yet in the English language, there are no words to describe it other than through the comparison with cheese. But humans are not hopelessly confined by their physiology or culture to a visual-aural-tactile perception of the world. In the Malay Peninsula, the Jahai and Maniq people, traditional nomadic hunter-gatherers, have heightened abilities to perceive odors as well as the vocabulary to name them, as they do for colors. The Jahai language has a dozen frequently used odor-verbs, translating to descriptors such as

crnjr (“to smell roasted”), hančj (“to have a urine-like smell”), and plʔej (“to have a smell of blood which attracts tigers”). Dave Muska tells me how his sense of smell becomes heightened after he has spent a month in the woods away from the smells of civilization, and he relies more on his nose for understanding and survival. He was able to smell the scents left by beavers from a distance of 40 feet, and on another occasion he followed the scent of porcupine urine, which smelled of conifer needles and cumin, to the animal's winter food source.

Olfaction and gustation—the sense of taste—have their antecedents in the abilities of single-celled organisms like bacteria to detect and react to chemicals. Reduced to its basics, olfaction

is the ability to detect, recognize, and interpret information about the environment from the molecules washing about in it. African elephants, who are able to distinguish thirty different members of their family by smell, have around 2,000 genes coding for olfactory receptors. While this number does not fully explain how well an animal distinguishes odors, for comparison, humans have almost 400 genes, dogs about 800, rats a respectable 1,200, and fruit flies 60. Elephants are the savants of the smell world. They have been found to be able to distinguish particular quantities of seeds in an opaque bucket by odor, a task that confounded dogs and was impossible for humans. Biochemist Bets Rasmussen made a lifelong study of chemical communication in elephants. In her work, she describes anecdotal evidence that elephants retained chemical memories of the paths, landscapes, mineral and salt deposits, waterholes, flooding rivers and trees from their long-distance migrations, and that these memories were critical to their survival.

* * *

It's a warm spring day in March, and I am balance-beaming across a beaver dam three feet tall, below which rush the sounds of a muted waterfall. In an extensive network of ponds and dams off the north branch of the Winooski River, the conical mound of the beavers' lodge rises seven or eight feet above the surface of a murky pond. I'm hoping I'll find deposits of the sweet, musky fragrance that beavers leave in a glandular substance called castoreum to mark their territory. Descriptions call it vanilla-like and note its use in ice cream and high-end perfume.

The marshy ground is dense with willow shoots, clumps of speckled alder and large cottonwoods leaning precariously in the shifting mud. A beaver-chewed alder stem looks like a giant crayon stuck in the ground, its orange inner wood smelling acrid. Suddenly, the spirit of the beaver in me, I am moved to taste it: bracingly bitter, befitting the acrid smell. I try the willows next: bitter as well.

From the edge of the pond, the imprints of the beavers' large webbed hind feet are visible on the lodge. I cross a log bridge and venture onto it. It is sturdy, not squishy as I feared. Prostrating myself, I inhale. Mud, impregnated with old urine that has been

baking in the sun. The whole edifice smells of pee from the bottom to the top and all the way around. Crossing back across the log, I stop to sniff all across its length. I catch the briefest dash of something muskily pleasant—the castoreum!—which stands out from the smell of urine emanating from the log.

The beavers have lined the edge of the pond with a mud embankment that stretches for several hundreds of feet and then more, out of sight. I stop to smell it, wanting to understand the architecture of this place. Uniformly, it smells like the pee-soaked mud of the lodge. Standing and taking in the scene, it strikes

me that every inch of every built surface is permeated with beaver urine. It could not be clearer had there been a billboard with flashing lights proclaiming: the beavers live here! If you thought to smell it.

* * *

Intersecting over time and space, the animals leave scents on rocks, at trail junctions, on the bark of trees, in gouged holes or snags, in the soil, layered

on the scent markings of other animals, and varying by season. Perhaps they tell the tale of when an animal passed, why it chose a route, its physiological state, or its claim to the territory. The ethologist Jakob von Uexküll proposed that each organism has an *umwelt*—“the world around”—a lens, shaped uniquely by its senses, through which it perceives the world and acts in it. The pieces of the *geruchswelt*—the smell world—come into sharper focus. But with an experience largely informed by sight, removed from the need to hunt for prey or communicate through scent, I wish for more context from which to make a comprehensive story from the pieces. Whether or not my collection of observations and anecdotes can be neatly packaged into a field guide, how could I not still be intrigued by the possibility of encountering, say, bobcat urine—a substance that researchers learned strikes abject fear into the minds of rodents—whose smell I've seen described tantalizingly as being “like rotten meat combined with sweat, with something indescribably feral underlying it”?

Naya Banerjee (Cohort A0, '26) worked as a mathematician before training to be a field naturalist. Her love of observing the patterns that shape our world connects these endeavors.

Image: Naya Banerjee

Image: Naya Banerjee



River Language

GRETA AIKEN

It wasn't day or night; the sky had turned green. My coworker at the other end of our Zoom call couldn't hear me over the rain buffeting her house, so we wished each other luck and hung up.

It was July 10, 2024, exactly one year to the day after 500-year floods ravaged much of Vermont. At this point, we'd gone a whole year with no major natural disasters, and my mind clung to its protective logic:

My phone hasn't said anything about tornados or major flooding.

The odds of a catastrophic storm happening on the first anniversary of the "Great Vermont Flood" are low.

This is real life, not a parable—

I'm not some character in a story about right and wrong that's juiced up with literary devices like temporal patterning and tantalizingly sentient natural forces!

...Right?

* * *

Later that evening, the tornado warnings finally arrived, belatedly and all at once. I sought shelter in the basement but was greeted by half a foot of dirty water on the floor and a waterfall in the window. I stood on the stairs. Fortunately, there was no tornado that night, at least not where I lived.

The next day I awoke as usual, ripped up sopping carpet with an X-Acto knife, and then took a walk to survey my village. Upon finding a landscape rendered surreal by the forces of water and sediment, I swooned. Blood pounding in my ears, I noted how the sky, a cheerful blue, hung incongruously above my treacherous driveway and the hellish pit that had opened up outside the elementary school. The nearby brook, whose gentleness I had come to love, now thundered down its newly widened channel, entire mature trees and detritus from people's yards—tires, cowboy boots, pots without plants, bags of heating pellets—in tow.

Walking further I came across craters on the moon. I peered inside and found, 10 feet down, small streams, bedrock,

a feeling very like despair. A defunct dam had violently overtopped in the night; its downhill cascades created those craters and snapped public waterlines. I learned from a friend that his son had helped rescue a wheelchair-using man who lived across from the dam, and that as the escape took place, the man's house began to separate from its foundation and float.

* * *

Some people believe rivers are sentient; others don't. That discussion is for another essay and another writer. Rivers do, however, communicate—via flow patterns, flood regimes, relationships with the landscape and wildlife, adjustments both large and small...

Looking out at the local landscape, I began to read the story of natural disaster playing out in my front yard. Before the flood, I'd been blindered, long overtuned to "big C" Climate Change, whose monstrosity oppresses the spirit and dampens the ability to see what's right before us. Floods, however, feature in myths for a reason: They are loud and visceral—impossible to ignore when they come for you. They're nature's version of the clarifying slap in the face or the red pill.

Okay, rivers, I'm ready to bear what you're saying, I decided after the flood. But I first needed to learn to their language.

* * *

And boy, that language is a can of worms. Perhaps that's true for any language, though, if you want to become proficient in it.

As a first step in a journey where I didn't know how much I didn't know, I spoke with Sean Beckett, Field Naturalist Program alum (Cohort AG) and Director of Natural History Programs at North Branch Nature Center (NBNC) in Montpelier. During the Great Vermont Flood of July 10-11, 2023, water filled Montpelier basements and in some cases rose nearly to second floors. Even before that, though, NBNC had started flood attenuation efforts by restoring the floodplain along its side of the Winooski's North Branch.

Sean spoke with me over video call one afternoon in April during a rare hour between meetings. He explained that while people are picking up basic knowledge about how rivers once functioned in the landscape before settlers turned our streams into the fast-moving transport pathways we know today, we can't forget the big picture. "At the end of the day, what we have is a medium-sized problem, which is the disconnect between rivers and their floodplains, nested within a much larger problem," Sean told me. That much larger problem? More water flowing through our river systems. So much more water.

Sean then began to teach me the basics of the Stream Evolution Model but had to leave for a meeting before he was through. "Take the State's Rivers and Roads Training," he advised.

Three months later, I stood in a Danville stream and watched a man stun fish with copper wires submerged unnervingly near our rubber-clad feet. I had enrolled in the training, and over the course of two days, an eclectic mix of attendees from road workers to bureaucrats watched PowerPoint presentations in a salt-truck garage, built mini stream channels out of plastic pellets, and took stock of habitat features in nearby waterways. We learned how industrial and post-industrial Vermonters have manipulated our waterways, exchanging groundwater storage and ecosystem health for power-generating dams and rigid channel structures that shuttle goods and debris *away from here*. Pre-industrialization, some stream stretches moved slowly along a relatively flat channel and regularly overflowed onto their floodplains, while other stretches naturally held higher energy and may have incised their beds to the point that they accessed their floodplains much less frequently. Human intervention over the past 200-300 years has transformed most of our rivers to function like that second category: high-energy, incising, straight and fast. With this context in mind, it suddenly became apparent that the many Vermont towns built along our rivers—often in floodplains in order to be near dam-powered mills—can only exist if our rivers are strictly controlled.

And, at the end of the day, humans can only control so much. At the end of the day, rivers obey physics, and with unpredictable changes in inputs (like precipitation amounts) and complex systems (like Vermont's accordion-like topography, historic development patterns, infrastructure needs, and limited budgets), it's becoming apparent that iron-fisted control of our stream channels is not a workable solution. If a single component of a river system changes, the river will respond accordingly. Sometimes that response is massive flooding and erosion.

* * *

The second anniversary of the Great Vermont Flood happened less than a month after the Rivers and Roads Training. At that point, my town was nearing the end of repairs to the bridge on my road, which dangled precariously into the river after the 2024 floods caused it to fail. I crossed my fingers and toes that another major storm wouldn't wash all that hard work and money away. On July 10, 2025, Vermont held its breath. Most of us released that breath with a sigh. Others could not, like Burke and Sutton, which flooded so badly they had to deploy swiftwater rescue teams.

My work to understand our streams' messages continues, but I've realized that understanding their language, while important, doesn't necessarily mean humans will be able to live in harmony with them any time soon. Sean had noted, "Here we are with modern ecological and sociological knowledge of how we ought to live in relationship with our rivers, and yet we're in a context of 300 years of history of people making different decisions, and we're stuck with that." Over the past 300 years, settlers in Vermont have cleared our forests and drained our wetlands, causing stormwater to sluice over the landscape and straight into our rivers and streams instead of settling into the ground. They've also extirpated the beaver, the catamount, and the wolf—keystone species whose activities once cascaded throughout our lands and waters. (Fortunately, beavers were reintroduced in 1921 and do their good work today, though in a more limited fashion than 300 years ago.) And over the years, settlers built roads, farms, and buildings on floodplains, many of which abruptly end at an edge. Peering over those edges, one can look down into the incised beds of fast-flowing streams.

It's an understatement that Vermont's relationship with its streams is complicated. Yet, little by little, we can listen to what our streams are telling us and make better decisions going forward. "The best thing we can do is make sure we're not making the same mistakes again and gradually move away from being in the path of these river systems when the river is going to rise," Sean told me. "It took us 300 years to get into this mess. We can't get out of it in only three years."

Greta Aiken (Cohort A0, '26) has never met a beaver she didn't like.

Illustration: Mathias Sich

Climbing Beech Trees

BEN APPLEGATE

Twenty-five feet above the forest floor, I open my palms and press them against the tree trunk and slide them up and down, trying to rub off the white woolly flecks that are *Cryptococcus fagisuga*, an exotic scale insect that initiates beech bark disease infection. It is early autumn of 2024, and I am visiting this tree near my home in northeastern Vermont weekly as part of an ecological observation exercise. Below me the bark in the bottom eight feet of the trunk is a patchwork of blisters that remind me of smallpox in the way they leave permanent scars. These cankers are the tree's growth response to the invasion of its cambium by *Neonectria mycelium*, the other culprit in the beech bark disease complex, which gains access via the microscopic portals created by the beech scale. I know my actions are futile, that the ubiquity of these two pathogens makes for the inevitable spread of infection. But up here the bark is still smooth, and I have the urge to keep it that way, holding fast to the beauty that has long attracted me to the sensuous periderm of beech trees.

In my childhood, before I knew them as beech trees, they were the "elephant-skin trees," my first foray into tree ID. The smooth silver-gray bark and low branches were an open invitation to their arboreal world. I loved climbing beech trees, and, in the rich soils of southwestern Ohio, where they can be 80 to 100 feet tall and 3 to 4 feet in diameter at their base, I attained heights in them that felt precarious. At first, I got a rush from being up so high, but it was the change of perspective that I came to truly embrace.

I found an affinity for this bird's eye view of the world, for the ability to see the greater landscape but also the canopy close up. The attraction to this dual perspective has fueled a lifelong interest in tree climbing. While I can climb almost any tree with ropes, I

still prefer free-climbing in beech trees, where lower branches are a ladder to the canopy above.

It's an easy ascent from the ground to where I am dislodging scale insects in this beech tree. Scale insects are the leeches of the plant world, sucking sap for their sustenance. I am conditioned to disrupt them from years spent as an apple orchardist fighting oyster scale. Beech scale adults are only one millimeter in length but have a two-millimeter stylet for penetrating the cork layer of the bark to feed on the contents of an inner bark cell. Seen through a naturalist lens, their overabundance here on American beech is disturbing—as much as 40 times greater than their densities in their native Europe. After 10 minutes of dutifully scrubbing as many woolly flecks as I can from this five-foot section of bark, I climb to a higher perch.

I am struck by how many leaves have already fallen from the upper canopy compared to a clump of red maples nearby. I wonder if this slightly earlier senescence is a reflection of stress from the bark disease. Observing this premature leaf fall leads to a more unsettling fear: there is a new beech-attacking menace on the way. Dark green interveinal banding in beech leaves was first noticed in Lake County, Ohio, in 2012. At first the banding and crinkling symptoms, reminiscent of damage caused by viruses or phytoplasmas, suggested a microbial cause, but instead a novel form of parasitic nematode, a microscopic worm resembling a species from Japan, seems to be the driver of this destruction. Successive years of infection lead to affected buds being aborted, twig and branch dieback, and possible tree mortality. The disease is not here in the North Country yet, but it won't be long. Based on its rapid expansion from northeastern Ohio into New York, Pennsylvania, and southern New England in less than a decade, and its increasing

reach into Vermont, New Hampshire, and Maine in the last four years, it will probably spread throughout the entire northeastern range of beech in short order.



Pictured: fruiting bodies of *Neonectria* sp. (top) and beech leaf disease from nematode infection (bottom)

Image: Jessica Applegate

Before I descend, the western skyline fills with a crepuscular light as the sun sinks behind cumulus clouds above the mountains. I am struck by the juxtaposition of emotions, the joy of witnessing the majestic close of a day with the sadness of a future with fewer beech trees.

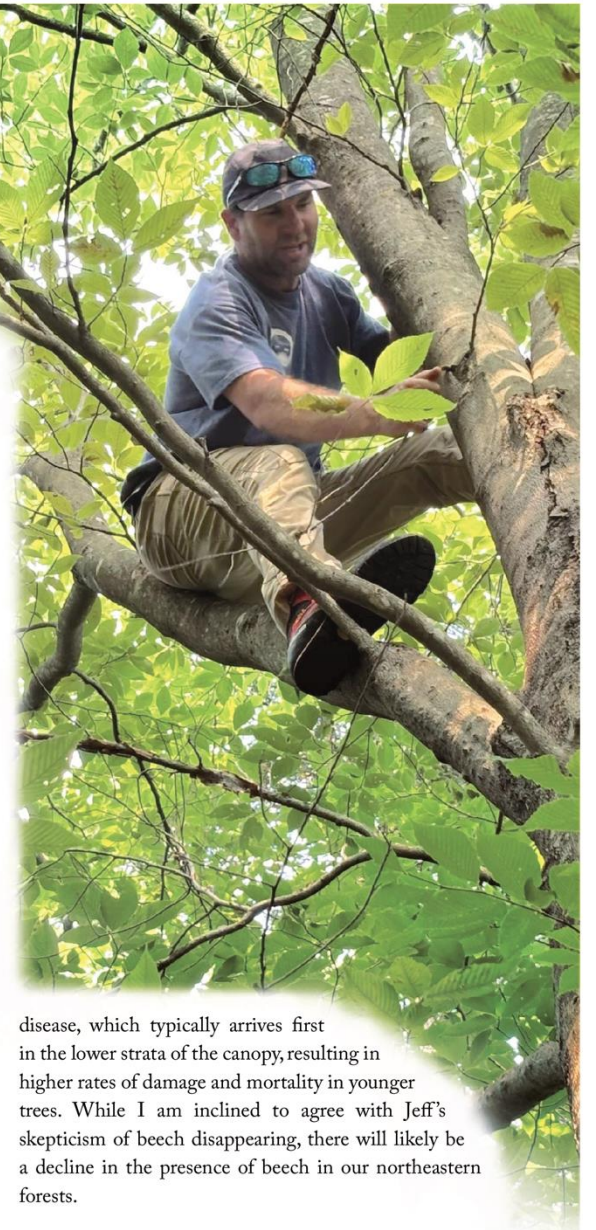
* * *

In early spring 2025, I am back in the canopy of the same beech tree. Once again, I find myself dislodging scale insects as I make my way up the trunk. As I am focused on rubbing them off, the surface of the bark shimmers with movement. There are small black flecks, hundreds of them, crawling around and occasionally springing into the air. Pulling out my hand lens, I see black tubular bodies with six legs, two antennae, and a slightly plumper rear end. I conjecture that they are some kind of springtail, which are common in leaf litter and may be up here on the trunk because of the increased moisture from yesterday's steady light rain. The contrast when they crawl over patches of white crustose lichen is stunning. A raven's croaking from above, along with heavy wingbeats as it veers wide upon noticing me, brings my attention skyward. I stretch out my hands to tree limbs, weight shifts from one leg to the other.

PULL....PUSH, PULL....PUSH.

I relish this dance that is climbing. Toward the top of the canopy, I wedge myself between ascending branches and let the tree hold my weight. I peer out over the valley before me and the mountains to the south. The marsh is filled with water from weeks of snow melt, and the river has taken on its lake form. Geese and mallards honk below, and any day now red-winged blackbirds will return and fill the air with their "ker-chang" proclamations. Snow still hangs on in the higher elevations, and the tops of Bald and Goodwin Mountains are obscured by a low bank of clouds. I have not been climbing since last fall, and it feels good to be off the ground.

As I relax in the treetop, my mind drifts to a conversation I had over the winter with Jeff Garzas, a tree pathologist who studies both beech diseases. In addition to reinforcing that it is just too early to tell what the effect from the leaf disease will be, he was not willing to write beech trees off. He pointed out that when the bark disease was new, many foresters thought beech would be wiped out. Instead their presence in the forest has remained nearly the same pre- and post-infection but with one important difference: many fewer large trees and often an overabundance of saplings. This shift in tree age demographics may be upended by leaf



disease, which typically arrives first in the lower strata of the canopy, resulting in higher rates of damage and mortality in younger trees. While I am inclined to agree with Jeff's skepticism of beech disappearing, there will likely be a decline in the presence of beech in our northeastern forests.

A robin calling in flight above the marsh ushers me back to what is right in front of me, and I savor the view and the comfort I feel in these branches. I am resolved that my path through this potential loss of beech trees is to spend time with them, to soak up their beauty, to feel their embrace, to keep climbing them as long as I can.

Ben Applegate (Cohort A0, '26) has worked with trees for most of his career as a forester, arborist, and most recently apple orchardist, but he is now drawn to stream restoration and watershed conservation.

Image: Ben Applegate

Image: Laura Costello

Of Love and Orchids

LAURA J. COSTELLO

My father is a highly ineffective deer hunter. Now 68, he started hunting at 14, and in all those years he brought home exactly zero deer. But he always returned from “hunting” trips with a pocket full of sparkly rocks, colored leaves, or moss samples. “Look at this, Laura! Isn’t that the most vivid shade of green? Oh, and do you know what I saw at the edge of the parking area? A little red fox!” From Dad, I learned to treasure the details, both rare and commonplace, of the more-than-human world. So of course, when I had the chance, I took him to look for orchids.

I’d gotten the tip about three-birds orchids (*Triphora trianthophora*) from a fellow enthusiast on a native plants Facebook group. I’d been posting my small wildflower discoveries frequently, and I guess I struck Rick as tentatively trustworthy. “Lemon Hill has great plants,” he messaged. “You might see *Platanthera buronensis*, *aquilonis*, and *dilatata*.” None of these were rare species, but they were orchids, and they were new to me.

I wrote back, gushing, two days later. I’d found the *Platanthera aquilonis*—north wind bog orchid, an honestly rather nondescript, small, green-flowering plant—as well as two varieties of spotted coralroot (*Corallorhiza maculata*), a fascinating, yellow-magenta species which eschews photosynthesis (and the color green) entirely in favor of parasitizing fungi in the soil—fungi that are themselves in a mutualistic relationship with tree roots. “Sometimes I regret sharing a spot,” Rick wrote back. “Not this time! Where exactly was the coralroot?” Having established more trust, he shared one of his really special locations in New Hampshire, and I enlisted Dad, visiting from Pennsylvania, to join me on a foray to the White Mountains.

Three-birds orchid is threatened in New Hampshire, though there are several large, seemingly stable populations. Its white-to-pale-pink flowers are the size of my thumbnail and are usually clustered in threes on a plant only a few inches tall. If you don’t have a tip from a friend, your only hope of finding this species is to search for its habitat—dense,



damp stands of beech trees, usually on south-facing slopes—and to look very, very closely.

Each individual flower lasts only a single day, but entire populations of hundreds generally bloom simultaneously, the whole flowering event lasting only a couple of days. Timing is everything with this species, so Dad and I couldn’t afford to let the heavy August rain deter us.

“Dad, Dad, here it is!” I call, scanning the dense, dim forest from under my dripping raincoat hood to see where he had wandered off to. “Watch your step, it’s everywhere—I’m afraid I’ve been tromping all over it.” Duck-walking his way over, trying to watch the ground, Dad kneels in the leaf litter beside me. He pulls off his rain-covered glasses and tries to wipe them on his sodden t-shirt before giving up and bowing his head, nose almost to the ground, to admire the tiny cluster. We’re slightly early: most of the plants are still in bud, a day or two away from full bloom. “Would you look

at that!” Dad exclaims. “I never would have noticed them!”

I have a special attachment to this species. Its three-flowered clusters remind me of myself and my two sisters: flying in different directions yet rooted in the same shared past. But I’m increasingly

Illustration: Mathias Stich
Reference image: Laura Costello



Three-birds orchids (*Triphora trianthophora*)

concerned about its future. Connected as it is to near-pure stands of beech trees, it may soon be devastated by the forthcoming major decline in beech trees in New England from beech leaf disease, which has been blazing north through the region in the past few years. It is hardly alone in this. Of New England’s approximately 56 wild orchid species, almost half are rare, threatened, or endangered, regionally or nationally.

For the wild orchid-lover in New England, beneath the wonders and joys flows a quiet but ever-present undercurrent of grief. Global environmental change is increasing the rate of species decline and extinction worldwide, but in New England, orchid numbers and ranges are declining significantly faster than other plants. Habitat loss, forest succession, human development, and grazing by excessive deer are likely all contributing factors. But in most cases, we don’t fully understand why we’re losing them.

More than most plants, orchids are inextricable from their environments. Their miniscule, dust-like seeds can’t germinate without the help of particular fungi in the soil. They have courted the attention of their specialized pollinators over tens of millions of years, adapting their shape, scent, color, and structure to entice and often to deceive. But only for six percent of orchids do we know who those pollinators actually are. Orchids’ habitat, life history, and relationships are integral to themselves. Yet we know so little about their stories.

Dad recently moved from Pennsylvania to South Carolina, and I from Massachusetts to Vermont. The eight-hour drive to be together is now 18. Woodland wanders will be rarer going forward. And it struck me, as he described (over the phone) a moss he’d found “with tiny grass-like hairs that seem to glow yellow!” that we have a countable number of walks together left.

I don’t mean to sound dramatic. Dad is unusually healthy and vigorous. He’s proud to report that he takes no daily medications, and when Hurricane Helene dropped two enormous oaks on his new roof last year, he hauled a chainsaw up there to remove them himself. In fact, it is Dad’s declared intention to live to 118: one hundred years from the day he enlisted in the Air Force. I’ve told him that I intend to hold him to this. But the fact is that his father died at 49, the falling oaks could easily have taken him with them, and I somehow don’t feel I can count on 50 more years together.

“Dad, I saw FIVE new orchid species this month—I’m up to 35 in New England!” I gushed on the phone with him recently. “I have to show you these fens I’m studying. When are you visiting me in Burlington? You’d love it here.”

Laura J. Costello (Cohort A0, '26) never goes anywhere without consulting iNaturalist.



Image: Jacob DeAlto

Crows and Bros

EMILY DEALTO

I’ve never managed to catch the birding bug. I’ve always been an herbaceous plant person. This winter, though, I may have gotten my shot. Crows got my attention by force, waking me up at dawn every morning in October. Thousands of crows.

Apparently, Burlington’s crows have a devout following. At the February meeting of the Wild Burlington Society—a group of naturalists, scientists, professors, nature nerds—we each introduce ourselves with an observation made over the last month. I reminisce about the lungwort lichens we saw out at Bernd Heinrich’s land in Maine a few weeks ago in our Winter Ecology class. Six out of the 25 others introduce themselves with the location they last saw the local flock of crows in the evening. Some casually notice the crows’ whereabouts and schedules. A select few follow them around. My little brother, Jacob, is a member of the latter group. He’ll wander for hours, letting the flock dictate his turns through town, politely trespassing through a hole in the chain link fence behind the liquor store to keep the birds in sight. He actually likes that part especially.

With each account, a mental map takes form.

Later that month, I admit my own growing curiosity about the crows. What might it be like to be one of these bird nerds, these crow people? I ask Jacob if I can tag along on his next crow walk. On the last Thursday night in February, the first false spring of the year is upon us, and we choose this night to follow the flock.

“I don’t see them,” he texts me.

“I hear one!” I reply. “Turning onto your street now.”

It’s getting dark as we set out due east from the apartment, chattering about our days. I walk a short pace behind him, following his long legs and trying to give him space to lead.

We follow by sound. The distant call of a single crow cues Jacob to turn. The foot of snow that lines the sidewalks is melting into dirty heaps. We step around and jump over puddle after puddle. A few blocks down North Winooski Avenue, we see a crow on the roof of a blue house. I wave at it and ask, “Where’s the party tonight?” The crow stares back. Another crow flies above, guiding us with a few abrupt calls. A third flaps in. We walk a few more blocks and now there are five, then ten, then fifteen crows all flying northeast. We’re on the trail. The sound of their calls is building; layers are forming.

“No way.”

I stop short at the edge of the Old Mount Calvary Cemetery, laughing at the cliché of the scene. Alfred Hitchcock, where are you hiding? Chatting about the crows just yesterday, Jacob reflected that a lot of folks have a fear of crows, their sleek obsidian feathers luring in dark omens in Western culture. Poe’s raven taunts, “Nevermore, nevermore.” The creaks and croaks play well with the backdrop of tombstones. But we wave up at them and giggle together. Instead of somber thoughts, a flush of naturalist’s joy washes the sleeping neural networks of my winter brain. The sound of the cemetery crows we walk under feels welcoming.

Black locusts, maples, and oaks line the northern edge of the cemetery, most dotted with loud, black bodies. Golden yellow lichens pock the granite monuments, glowing loud in the blue light that creeps out from a clouded sky. A croak comes from a

maple branch like a creaky door. As we tromp further along the muddy path, the calling grows louder. The bodies stream in from beyond our field of vision. A constant pour of birds, tiny blurry dots out of the gray sky. The dots grow bigger as they come closer, ten crows at a time joining an expanding roost in the trees we stand directly below.

The sound of 2,000 crows is cacophonous, coming, somehow, from every direction at once. Their voices are as diverse in pitch as human voices filling a busy cafe. One screams higher than any other, like a prepubescent male whining for his mother. A whole bunch cry out in long, exaggerated moans, “Waaah! waaah!” Some pip short, staccato notes. Two ambulances screech down the adjacent road battling to be the dominant call, but the crows fight back—until they don’t. A few blasting honks from one ambulance hushes the crowd to almost total silence. But, 30 seconds after the sirens have faded to whispers, the chattering recommences. At least 23 different vocalizations have been described in the American crow, including “contentment notes, rattling notes, wow-wow notes, carr-carr notes, whisper notes, coo notes, organ notes, wah-oo notes,” as described in a 1971 article from *Ornithology* (called *The Auk* at the time). Standing in the cemetery, I experience their sounds as a foreign language, trying to decipher some grammar, some common vocabulary.

With just one crow walk under my belt, I see how these bird nerds become crow nerds. It’s amazing. The waves of bird sound entice the mind to wonder and wander through the flock. The phenomenon isn’t exclusive to Burlington. Winter roosts of up to 15,000 crows have been reported in Pittsburgh, PA; Poughkeepsie, NY; Bothell, WA; Vancouver, BC; and Lawrence, MA. The Burlington flock—which some people estimate to be over 10,000 birds—comes in from Addison County to the south, the Champlain Islands to the north, and as far as Stowe to the east. They’ll travel over 50 miles



Image: Jacob DeAlto

from their daily feeding sites to join the group each evening.

We wander further northeast, towards my street. It’s 5:45 p.m. They’re starting to move northwest.

“It’s an Intervale day,” Jacob announces. We watch the mass of crows move from these trees downhill toward the agricultural fields of the Intervale Center. Groups abandon a tree together, cruising from one and then clumsily gripping onto the next. The flock is locked in as a group for the night. But they’re leaving the cemetery; it’s just a temporary roost. The crow-flocking literature (yes, there is a crow-flocking literature) calls this first resting spot the “staging area” or “pre-roost” or “pre-roosting aggregation,” used only until a final roosting area is chosen. Who among the flock chooses these stops is unclear.

Corvids have been featured heavily in recent years in both academic literature and pop culture for their dark and refined persona, charismatic behavior, and intellectual savvy. Literature on roosting and pre-roosting habits of the American crow, though, is but a faint speck in the discussion. The most recently published theories on the behavior came out in the early 2000s, with virtually no updates since. The seasonal timing of the movement of the roost seems to depend on the weather, with snow pushing groups to get together faster and earlier, but there is no evidence as to which birds decide where to move the roost each night. The clearest theory for roosting behavior is for protection from predators, but pre-roosting is more unclear. The questions that tuck themselves into my brain as we meander through the cemetery don’t seem to have answers—published answers, anyway.

As it grows darker, the crows are still collecting, but fewer are streaming in from the distance now. Standing among them is a visceral experience—a mass of sound that rests in the body, in the gut. I am replete with sensory input. I grip onto the crows as a reminder of all the other beings that have left us as the cold approaches. In the clouds of crows, I listen to a foreign language above all the senesced plants. We leave the flock at 6 p.m. and Jacob walks me home. We revel in the perfect night we had, our brains alight in the rattlings and wow-wows, carr-carrs and whispers, coos and organ sounds, wah-oo notes and clackings, visitors to a conversation that I do not understand, but which fills me like magic.

Jacob stays to talk a while longer. I’m glad to know of this journey he takes to find himself at home with wonder in the natural world. A week later we go together to feed sunflower seeds to the friendly chickadees out by the Woodside Natural Area. I wonder if each raspy “dee-dee” they spout around us means something too.

Emily DeAlto (Cohort AO, ’26) works as an environmental consultant, and despite her best efforts now really likes birds.

Anthus & Acanthis

TEAGE O'CONNOR

In Greek Mythology for Botanists & Birders (crowspath.org/mythology), I've set out to rewrite Greek and Roman myths that feature heroes, gods, and tragic figures whose names are found scattered throughout our scientific lexicon. Here is a lesser-known story from Antoninus Liberalis's *Metamorphoses*. Several scientific names (e.g. pipits: Anthus and redpolls: Acanthis) are taken directly from this myth.

* * *

Autonous had always desired well in excess of both his needs and abilities. And his union to **Hippodamia**¹ (*hippo*: horse, *damazein*: to tame) perhaps presaged that his desires would be singularly channeled towards turning the stubborn mastic² shrubs of his hill farm into a herd of horses.

On the night of their wedding, Autonous's father, Melaneus, gifted the newlyweds a small herd of horses to help beat back the onslaught of unruly plants encroaching on their small home. When they awoke the next morning to a golden dawn light, the newlyweds walked the land, hands entwined, Hippodamia imagining their children learning to tend the groves of olives, fields of barley, rose hedges, and a thriving vineyard. But Autonous imagined only a throng of horses powerful and glorious enough to rival Poseidon's hippocampi.³

Their herd of children grew quickly in those first few years, Hippodamia giving birth to four healthy boys—Anthus, Erodus, Schoeneus, and Acanthis—and their sister, Acanthis. The children grew up tall and strong, with Hippodamia's bountiful crops filling their bellies. Erodus in particular took a fondness to the horses, and, as Melaneus intended, under Erodus's care the horses tamed the shrubby hills.

Autonous, however, couldn't be bothered with the drudgery of farming, and when he expended any energy at all, he set it only to acquiring new horses. The small herd his father had given them doubled in number and, like a plague of locusts, their callous

hooves and restless jaws overtaxed the land, stomping and chewing the nettles and dandelions down to the bone.

So it was that the land, tired of too many horses, was soon barren of color. The vacant yellow eyes of the sad horses looked longingly at the green gardens on the other side of their fences, and they pestered at the split rails. Erodus did his best to mend the holes, but he was of his father and so, with time, the fence started to rot.

On one bleak morning in August,⁴ Anthus, the eldest of the children, awoke to find Helios late to ride his chariot into the sky. An ashen pallor loomed over the late-summer farm as the frustrated Anthus made his way to the barren meadows where the horses were supposed to be grazing. The static charge of the impending storm prickled his arms. He reached the edge of the pasture just as Zeus's clamorous blows echoed across the land, unleashing a lasting rain that soaked the hillside. The pasture had been abused by too many horses over too many years and the soil washed away under the heavy onslaught of rain.⁵

Anthus wiped the rain from his brow and strained through the darkness to see if the horses were still in their pen. Nothing but yet another hole, and surely the horses would be out stealing grapes. He turned back to the barn for tools to mend the wound in the fence and to see if he could find and wrangle the horses.

But at his second step, he felt the presence of a penetrating stare through the thick rain. He looked up and saw a frightful line of yellowed eyes glowering with fear and hunger. His heart was angered by the horses for eating the crops, by his father for neglecting the care of both his family and the horses, and by Erodus for these dilapidated fences. He knelt slowly down, grabbed a crooked branch, and set out to drive the horses back into their barren pasture.

The horses turned to flee, but then a fierce hunger beset them and they spun around to face Anthus. They were caught in that long moment until a flash of lightning broke the silence, and with a

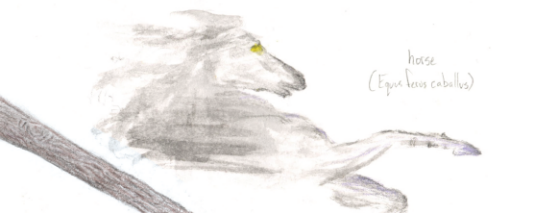


Illustration: Matthias Stich



great cry the horses broke into a gallop charging at the startled Anthus. He had only a heartbeat of realization before he started to run. He was too slow, and the ravenous horses fell upon him, tearing flesh from bone.⁶ His screams for mercy echoed up to the heavens and down to his house.

Autonous heard the cries of anguish and reluctantly ascended the hill. He was quickly overtaken by his wife, Hippodamia, who ran to save her son. Both had grown weak from years of failing crops, but only the cowardly Autonous feared the stinging bite of the horses while his wife fought ferociously to save her son. And she would have kept on fighting until the horses took her own life as well, had the gods not looked down upon the family with pity.

Zeus and Apollo were first to hear the cries of Anthus and swept down from the tumultuous skies. Together they drove Poseidon's storm and the frenzied horses back. The gods of thunder and healing walked into the meadow, seeing a desperate, terrified family afraid of the horses, of the skies, of the land. In a rare moment of empathy, the gods turned each into a bird.

Autonous, who in cowardice turned away from helping his son, became a **quail**, always timid, always scurrying away at the faintest scent of danger.

His wife, Hippodamia, took the form of a **lark**, her small head adorned by Apollo with a crest to honor her courage in attacking the horses.

Acanthis, Autonous's fair daughter, would mourn her family's tragic undoing in those aggrieved fields of thistle and reed as a thistle finch.

Erodus is said to have become a heron.⁷

And lastly, the poor Anthus, who would forever be haunted by those horses, was set to the skies in the plumage of a pipit. And to this day, the bird strikes off at the sight of a horse, fleeing to safety while whistling an inculpatory neighing sound.

Teage O'Connor is a naturalist, educator, and philhellene. As founder and Executive Director of Crow's Path, he works to find creative ways of connecting people to wild-ness.

⁶ Horses, like other grazers, are opportunistic omnivores. Heracles's eighth task was to steal the man-eating Mares of Diomedes (*Diomedidae* is also the family for albatrosses).

⁷ Herons are in the genus *Ardea*, possibly from Erodus.

Wingardium leviosa

LAURA J. COSTELLO

Telekinesis, the Force, summoning charms: the ability to move objects without touching them appears in nearly every system of magic. It is an exotic and mythical skill, held by only a few. When we think of the beings who possess this great ability, we imagine wizards, aliens, and perhaps the rare human of extraordinary mental power.

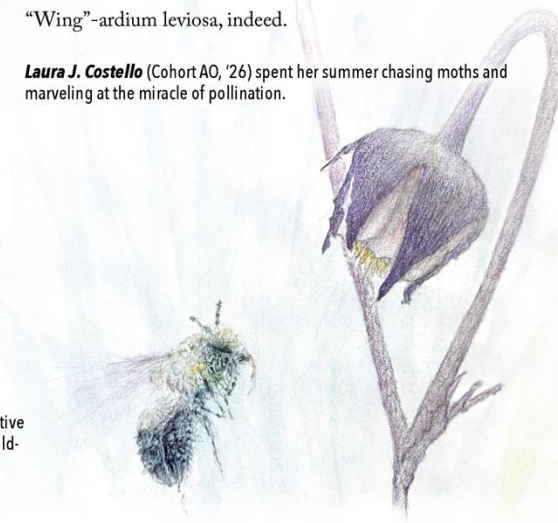
But the amazing truth is that we encounter such beings almost every time we walk through a summer field. Insects—bees, butterflies, and moths—possess this extraordinary power, and they achieve its wonders not with their will but with their wings.

As far back as 600 BC, the ancient Greeks knew that amber, when rubbed with wool, would attract light objects: dust, straw, feathers. Like rubbing a magic lamp to summon a genie, rubbing amber transfers electrons from the wool, causing a small, net-negative charge that attracts positively charged objects. We call this “static electricity.” Indeed, the word “electricity” comes from the Greek word “elektron,” meaning “amber.”

As they fly, insects become positively charged, losing electrons to friction with the air. Plants and their pollen are negatively charged. So when a flying insect approaches a flower, before they even touch it, their telekinetic powers kick in, summoning pollen to their bodies. Without even a conscious effort these tiny creatures achieve what we humans can only dream of.

“Wing”—ardium leviosa, indeed.

Laura J. Costello (Cohort AO, '26) spent her summer chasing moths and marveling at the miracle of pollination.



Bumblebee (bumblebee) approaching a water avens (*Geum rivale*).

¹ *Hippodamia* is the genus of North American lady beetles. In *The Iliad*, Homer frequently refers to Hector as Hippodamia, the breaker of horses.

² Mastic means resinous, particularly in reference to the mastic tree, *Pistacia lentiscus*. The resin was used in Ancient Greece as a chewing gum. From this we get masticate (to chew), mast (the edible nuts of beech, oak, etc.), and masseter (the muscle that clenches the jaw and is used for chewing).

³ Poseidon, god of the horses, had a chariot pulled by the hippocampi (half horse, half fish); *Hippocampus* is the genus for seahorses; the hippocampus is a seahorse-shaped ridge on the temporal lobe of the human brain.

⁴ Augustus Caesar named this month after himself (his forebear, Julius, had already claimed July).

⁵ While it's possible that “erode” comes from Erodus's name, it is more likely the link goes the other way (*roder* is the Latin for “to gnaw,” as in rodent).

In Memory of Naturalist Greg Streveler

1941–2024: The Beating Heart of Glacier Bay

ALICIA DANIEL (E TEAM) & WALTER POLEMAN (K TEAM)

For 11 years, teams of Field Naturalists flew to Glacier Bay in July to study with naturalist Greg Streveler. Greg died last year at the age of 83.

When Greg's daughter shared the news of his passing, she planted the seed of an idea to host a Greg Streveler Symposium: Exploring Connections through Science, Art, and Community to celebrate her father's life and legacy. Field Naturalists traveled to Glacier Bay to attend the symposium, which took place July 17–20, 2025.

Glacier Bay has magnificent tidewater glaciers, ancient snow-capped mountains, whales, Steller sea lions, rare birds such as puffins, coastal bears, wolves, seals, salmon, and bald eagles. As students guided by Greg, we traveled by kayak close to the land/water interface, where glaciers left geomorphic and botanical puzzles for us to solve. With his course Geobotany of Southeast Alaska, Greg was woven deeply into the Glacier Bay landscape and the rich, indelible experiences we had there. For many of us, he and Glacier Bay changed our lives.

Because we spent our initial FN training exploring the Vermont landscape, the opportunity to experience Glacier Bay's dynamic and fully intact ecosystems—complete with large carnivores occupying the highest trophic levels—was awe-inspiring and humbling for the two of us and the other students in the A through K cohorts. Whether we were paddling amidst five-foot dorsal fins of orcas or sitting together by the fire listening to the howls of a nearby wolf pack, Greg opened our minds to the possibility of rewilding landscapes, like those of northern New England, when we returned. It was also incredibly instructive to investigate recently de-glaciated terrain with Greg as we sought to make sense of geologic forces that shaped the Vermont landscape thousands of years ago.

Field Naturalists learned every summer that, in Glacier Bay, there were National Park rules—and then there were Greg Streveler rules. Greg enforced both:

- What you find you leave in place. Greg would make this point by taking us to see a bald eagle skeleton perfectly intact down to the last yellow talon, literally “spread eagle” on the forest moss. Year after year, the eagle bones remained there.
- What you cook you eat, regardless of how much your

hunger might swell your concept of an adequate portion. Limpets from two days ago stayed on the menu until they were gone.

- Don't disturb wildlife. We found molting geese in Weird Bay, so Greg turned the trip around.

- Don't walk on the tidal strand (areas characterized by low-growing, salt-tolerant plants adapted to harsh conditions like strong winds, salt spray, and sandy, saline soils). Your footprints will stay there for years. Park rule: Take only photos; leave only footprints. Greg's rule: Don't even leave footprints.

We could all see the reverence Greg felt for a place that he loved. As a part of the celebration of his life, we curated a book for his family of memories and images from FNs who studied with Greg over the years. Below are excerpts from the book, highlighting a few of the voices of those who had the honor of learning from Greg and the place he loved so well:

Going up bay with Greg was like traveling back in time with a wool-clad Socrates. He led us into stark, post-glacial landscapes and invited us to explain to him what we were seeing, how each place came to be, and what it might yet become. He questioned our assumptions. I had never felt so mentally alive yet so humbled by my own ignorance. Eventually, I came to understand that each beach plant, intertidal meadow, animal track, or ancient piece of wood was part of a greater ongoing story. I've carried these feelings with me ever since.

—Carol Savonen, A Team

The six weeks we spent in Glacier Bay were the most concentrated natural history education I have ever had. Going to Haiti may have had a greater cultural impact on me, but Glacier Bay helped me understand the New England landscape in a way that nothing else could have. It was the ultimate FN experience, and Greg made it all understandable, combining lessons in terrain-based plate tectonics, post-glacial geomorphology and vegetation succession, wildlife adaptations, tidal ecology, and on and on. I have multiple photos (as I imagine we all do) of FNs gathered

around Greg as he examined a plant or wildlife track, grounding the big picture in the local details.

—Dave Publicover, B Team

Greg gave me the word “stochastic,” in the sense that he rooted it. It has echoed ever since we all discussed primary succession in the East and West arms of the Bay. He had thought about it, and stomped around in it, for the better part of two decades. He thought that the differences boiled down to chance. Hemlock seed here, spruce seed there—and the rest is history unfolding. He didn't call it God. He didn't call it chaos. Or order. I still love that he was at peace with the possibility, maybe the evidence, that chance has a role in all of this.

—Marty Peale, D Team

I remember one evening in Glacier Bay, pulling up to the shore to find a spot to make camp after a long day of paddling. We stepped out of the kayaks, looked around for a few minutes, and then Greg said, “Bears are here. We have to move on.” It wasn't, “I am worried about our safety.” It was, “The bears are using this place, so we need to find a place where we won't bother them.” Two lessons here. First, observe. Second, we share this space with others. I have carried those teachings with me for 3+ decades.

—John Sanderson, I Team

Greg gave me the classic Streveler face when I told him my Glacier Bay project required me to find a pack of wolves. His look was slightly wry, a touch paternalistic, somewhat skeptical, but overlain with an encouraging grin. We were camped in Adams Inlet in the days before we would be cast loose to pursue whatever loosely formed ideas we had. He looked at my sneakers, which had delaminated with the soles flopping in the sand. “Are you going to track wolves barefoot?” he said. I handed the stinky things over to Greg where he sat on a log stump at the fire's edge. He rummaged through his kit, locating a needle and some wire, and proceeded to act the cobbler. After the shoes and the last of the whisky were done, I announced I was going to take my renovated shoes for a test drive down the beach. Half a mile from camp, in the soft light of an Alaska summer night, lay some freshly chewed sticks and a scrum of tiny pawprints in the sand. As I bent to check the tracks, a soft whining sound came from the brush at the top of the beach. I froze. Three black wolf pups tumbled out—but were checked by a deep rumble from within the alders that rose to a mournful howl and was quickly joined by two other howls from adults nearby. I retreated excitedly back to camp. Greg wore the same Streveler face when I babbled out my find. Since then I have pursued the essence of wild Alaska for 30 years. As Greg showed me, anything is possible if you have the right attitude and the right shoes.

—Brad Meiklejohn, I Team

The world is a better place because Greg was here.
It helps that there are now so many of us trying to fill his boots.
To this day, his former students walk with him in mind.
He may have left few tracks, but he surely showed us a way
to be in our own corners of the world.



Greg Streveler with the A Team preparing to leave Strawberry Island and paddle to Johnson Cove on Willoughby Island. Left-right: Carol Savonen, Anne Heise, Koren Zimmerman, Greg Streveler, John Kasmer, Ham Davis (July 1984).



The K Team with Greg Streveler at the face of Reid Glacier. Left-right: Doug Bechtel, Hans Estrin, Lyn Baldwin, Greg Streveler, and Walter Poleman (July 1994).

NOTES FROM THE FIELD

COHORT AN ('25): THE BOXELDERS



RACHEL GOLAND

Rachel's project, jointly funded by the Appalachian Mountain Club (AMC) and the National Phenology Network (USA-NPN), was centered around setting up a series of phenology monitoring plots near the weather stations on the Mount Washington Auto Road. Phenology—the study of the timing of ecological events such as flowering or fruiting—is key for understanding how climate change will affect our ecosystems. By pairing phenology monitoring with weather station data, it may be possible to gain a deeper understanding of how temperature cues trigger shifts in plants from one stage of life to the next.

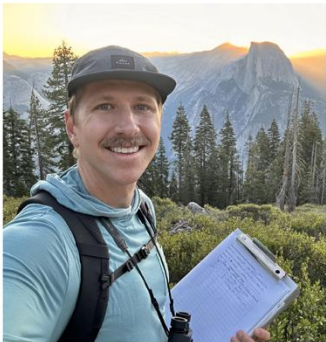
To complete this project, Rachel spent many days traversing the Auto Road and collecting detailed data on eight focal species above and below treeline. Since returning to UVM's campus, she has been analyzing her data alongside AMC's larger phenology dataset and compiling a report detailing best practices that should be adopted when pairing phenology observations with local climate data. This work sets the stage for potential long-term monitoring along the Auto Road by AMC staff and/or volunteer citizen scientists. It also provides insights into how analogous monitoring protocols can be set up on other mountains in the northeast and beyond.



ROBERT LANGELLIER

In northern Alabama and southern Tennessee, the low and flat Eastern Highland Rim meets the high and flat Cumberland Plateau. Despite being neighbors, they are distinct physiographic regions with completely different elevations and ecosystems. Between them is a 100-mile-long slope connecting them: the Cumberland Escarpment. Too thin to appear on most maps, the escarpment is its own poorly studied physiographic region, home to smoketree and redcedar woodlands and small grasslands. Working for the Southeastern Grasslands Institute, Robert mapped and botanically inventoried the majority of grasslands in this long and narrow region.

Separately, Robert worked out the ecological history of the Highland Rim below the escarpment. It was here that early white settlers chose to set up the cotton industry in northern Alabama. Why? Robert's research into original land surveys and witness trees showed that, rather than dense forest, northern Alabama was originally a patchwork of open woodland and savanna. Early land auction data suggest that rich cotton farmers, impatient to plant cotton, preferentially chose open, grassy areas to settle, joining the history of slavery with the history of native grasslands.



STEVE ROOT

Common ravens (*Corvus corax*) in Yosemite National Park have been steadily proliferating since the 1960s, in correlation with increasing human visitation to the park. The consequences of their ballooning population in an ecosystem where they were previously rare are not known. Following up on a 2009 study, Steve conducted over 3,000 minutes of point count surveys and more than 9,000 minutes of behavioral sampling of ravens throughout the park to describe their distribution and their relationship to anthropogenic food resources. He found that ravens are concentrated in the most developed areas of the park and that they are strongly associated with human food. Sponsored by the National Park Service, Steve's research will help wildlife biologists in Yosemite determine appropriate carrying capacities for ravens in the park and aid in developing effective management strategies.



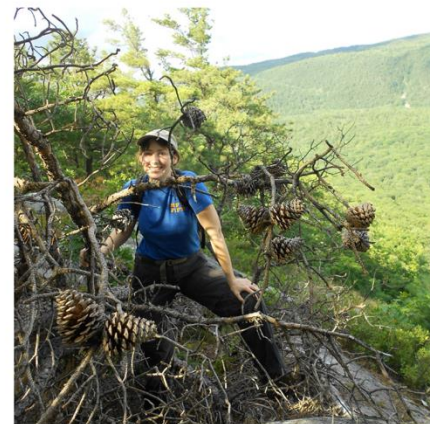
ALYSSA VAN DOORN

Staying local, Alyssa ground-truthed a predictive model of old forest distribution in Vermont. The sponsors of her project—Vermont Agency of Natural Resources, the Wildlands Network, and Northeast Wilderness Trust—were interested in identifying unknown old forests and receiving feedback on the predictive model's effectiveness. To accomplish these goals Alyssa established 108 temporary forest plots across 33 sites throughout the state. Her work involved inventorying standing trees, coarse woody debris, and natural communities, and evaluating a stand's old-growth characteristics. She used her data to explore age-related forest successional trends across forest types and identify undocumented patches of old forest. She found that Vermont's forests are following expected successional trends across different natural communities and discovered five previously unknown old forests.



LUCY GROSS

Lucy spent the field season trekking up the slopes of Jay State Forest's 7,535 acres, mapping its natural communities, recreational resources, and wildlife habitat on behalf of the Vermont Agency of Natural Resources. Her assessment will inform the writing of the state forest's Long-Range Management Plan. Although she identified 145 occurrences of 19 different natural communities, Lucy focused on identifying the northern-hardwood and montane seepage forests that were believed to be in the state forest. She identified over 100 acres of the two variants. She also located wildlife habitat for moose, black bear, American marten, bobcat, and the rare Bicknell's thrush. Luckily, after finding scat throughout the state forest for seven weeks, Lucy was rewarded with a glimpse of a moose foraging among the trees. In addition to her ecological assessments, she discovered illegally cut ski trails and examined the impacts of heavy recreational use on vegetation. Her findings will inform the future management and conservation of the state forest.



VERONICA MAGNER

Skirting the western edge of Vermont's Green Mountains, where warm air rises from the lowlands of the Champlain Valley, a string of fire-adapted natural communities dot the sunbaked edges of a steep escarpment. Many communities present here, such as pitch-pine-oak-heath rocky summit and dry oak forest, reach their northern range limit in Vermont and are seldom found elsewhere in the state. These islands of drought-adapted oaks and pines face varying degrees of encroachment from shade-loving species, a trend brought on by a century of fire suppression.

In collaboration with the Green Mountain National Forest, Veronica used predictive modeling and field-based assessment to tackle the questions of where exactly these communities occur on the northern portion of the escarpment, what drives them, and how they may be changing in the absence of fire. Clarity on these questions will help to guide future management of these ecosystems and to understand the potential for their restoration through reintroduction of fire as an ecological process.



Image: Veronica Magner

Need Ecological Assistance?

Partner with a Field Naturalist

Backed by the resources of the University of Vermont, our graduate students can help your organization accomplish its mission – in the field and in our communities. We are now accepting pre-proposals for Field Naturalist partnerships during the 2026 field season.

Whether your needs involve fire ecology or citizen engagement, natural community mapping or landscape restoration, pre-proposals are simple: In a paragraph or two, summarize your project in an email to our program director, Dr. Walter Poleman (address below). Describe the site for field work and what you hope to accomplish.

If your project seems like a good match for our students, we request a full proposal by December 1, 2025 (we will provide an RFP for your reference). A Field Naturalist's research will form the core of a master's project and offer a practical solution to your needs.

Winning proposals call for a \$6,500 partner contribution to support students with a Field Naturalist Fellowship during their time in the program. Your partnership includes:

- More than a year of collaboration, beginning as soon as early 2026
- Literature and other academic research to support your project
- Field work extending from early spring through fall of 2026
- Continued collaboration culminating in a draft by December and a final report by spring of 2027.

Questions? Contact Dr. Walter Poleman by email (walter.poleman@uvm.edu) or at (802) 318-8441.



FIELD NATURALIST & ECOLOGICAL PLANNING ALUMNI ASSOCIATION

The FNEP Alumni Association helps build the relationships, skills, and ideas necessary for tackling the big environmental issues of our time. We connect students and alumni with professional opportunities and match partners with FN expertise. First and foremost, we support the rigorous, relevant training of Field Naturalists at UVM. Here's how to get involved:

BECOME A MEMBER: Membership dues enable us to host gatherings, support students, provide alumni grants, and more. Members gain access to our full alumni database.

SUPPORT OUR STUDENTS: Donations to the Lillian "Porky" Reade Fund exclusively support current students in overcoming financial barriers that stand in the way of their academic success.

JOIN THE BOARD: We meet virtually four to six evenings per year to plan gatherings, award grants, and advance our support of students and alumni.

Please visit fnepalumni.com for more information.

MAJOR GIVING CAMPAIGN

The FN Program and the FNEP Alumni Association, in close partnership with the UVM Foundation and the College of Agriculture and Life Sciences, are launching a multi-year fundraising campaign to enhance the vitality of the program and secure our capacity to train future generations of Field Naturalists.

The goals of the campaign are to:

1. Develop a robust, endowed student scholarship fund, enabling a solid financial foundation for attracting and supporting a diversity of students.
2. Establish a director's fund to support a permanent director's role in guiding the program into the future.

We need your support to embark upon this ambitious goal! If you are in a position to make a gift or long-term pledge to this campaign, please contact us. If you can contribute your expertise or facilitate connections with interested parties in your networks, we'd love to hear from you. If you have professional success stories that highlight the importance of an FNEP education, please share!

Image: Steve Root

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