Field Notes

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Passion and Nature

MARIA DUNLAVEY AND ANDY WOOD

Field Notes usually features essays that orbit a theme: creativity, optimism, energy, synthesis. This year we opted to forgo a theme, asking contributors instead to explore natural history topics they were passionate about. Our trust in their talent and passion paid off — a theme emerged.

Our writers take us on remarkable journeys, from the Arctic Ocean and the mountains of Costa Rica to Burlington's own parks and backyards. But beyond their geographical spread, these essays speak to deeper themes in our lives: curiosity, adventure, friendship, mystery, and hope. They remind us of the enduring power of natural history to bring people and ideas together.

It might be easy for a naturalist to get discouraged about the future. Whether grappling with national politics or the fate of our graduate program, we've found refuge in the natural world: in birds, ice, blueberries, floodplains, and ferns. Not only is nature the bedrock of conviction that guides our work, it gives us the surprise and delight that quickens our pulse. It also connects us with other people, whether they are schoolchildren, birders, ranchers, or modern dancers.

As you read on, consider your own personal passions. What do you care about? What drives you forward? How does your own life intersect with natural history — and what do you intend to do about it?

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Deane Wang's Legacy and Your Support

JEFFREY HUGHES

Image: Bryan Pfeiffer

As you may have heard, Professor Deane Wang, founder and director of the Ecological Planning Program, retired this spring. If you're wondering what happens now to Ecological Planning, the answer may depend on you, and on the actions of other alumni and friends of our programs. It also may depend on whether you let Deane settle peacefully into his new life in Seattle. Do not let Deane Wang settle peacefully!

Anyone who has been touched by Deane's kindness, generosity, humility, integrity, and big thinking will understand what we've lost. Deane Wang — single-handedly, behind the scenes, and without fanfare — has found ways to help fund and launch the careers of countless graduate students. Because of him, ecological planners are now leaders in conservation organizations, environmental NGOs, and state and federal agencies. They, like Deane, are making the world a better, saner place for all of us. It's now up to us to continue Deane's legacy.

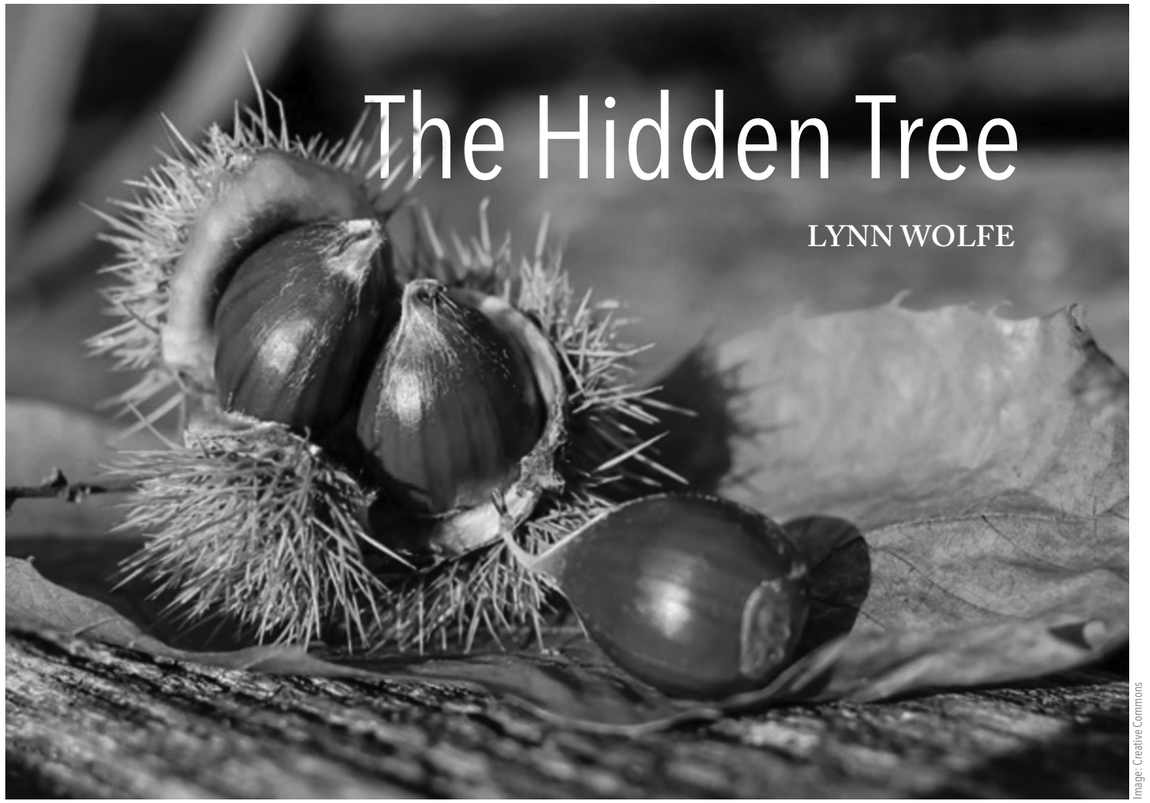
Other than mobilizing your energy to move Ecological Planning forward, there's one other action that I hope you'll consider: giving generously to the Field Naturalist and Ecological Planning programs. As you know, money talks. In fact, nothing about a program's value is more convincing to administrators than financial gifts. Even small gifts make a real difference: they make our professional writing program possible, for example, and allow us to replace broken soil samplers and sharpen dull increment borers. Your contributions enable us to print *Field Notes* and mail copies to alumni and friends.

Please note that this is only the second time in 30 years that I have asked you to contribute. As the future of the Field Naturalist and Ecological Planning programs is being decided, your generous gift will make a difference in so many tangible ways — not the least of which is a better world. To make your contribution, please use the envelope we've included in this edition of Field Notes; the envelope also has instructions for giving online.

What does my appeal have to do with Deane retiring? Everything. Deane poured his energy and passion and intellect into the lives and careers of ecological planners and field naturalists — for many, he made their futures possible. Now it's time to show how much we all appreciate his efforts. Supporting the Field Naturalist and Ecological Planning programs, which Deane helped to build and nurture, is the best way to do that.

Thank you!

Jeffrey Hughes is the director of the Field Naturalist Program.



The Hidden Tree

LYNN WOLFE

Image: Creative Commons

Ethan Allen Park shouldn't hold many mysteries. This wooded refuge in urban Burlington is frequented by many knowledgeable naturalists who use the park as a lab to identify bryophytes, ferns, and angiosperms. It's common to stumble across someone peering through a hand lens at the spores of a bulblet fern (*Cystopteris bulbifera*) or examining the seeds of enchanter's-nightshade (*Circaea canadensis*). As a community, we claim to know Ethan Allen Park. But can we ever truly know a place?

Although skilled naturalists have been visiting Ethan Allen Park for decades, they've managed to overlook one noteworthy species. Hidden among commonplace beech (*Fagus grandifolia*) and white pines (*Pinus strobus*) is one of the most legendary and majestic trees of our forests: an American chestnut (*Castanea dentata*). And it was discovered by a first grader on a school trip to the park.

While C.P. Smith Elementary School students were playing in the forest, first grader Adrienne Stanley noticed a round spikey husk camouflaged amid the leaf litter. Not knowing what it was, the bouncy girl with brown hair gently picked up the prickly, baseball-sized bur and brought it to her teacher, Shelley Spinner.

Shelley had never seen anything like the mystery husk before. She rotated it in her hand and wondered if perhaps it could be a hedgehog rolled up in a ball. Unable to locate a mouth or any legs, she quickly dismissed the idea. The class was intrigued by the unusual discovery, though, and made it their mission to identify the unfamiliar bur. They launched into action, looking in books, searching on the internet, and sending out photographs. It wasn't long before they identified the husk as part of an American chestnut seed. When they returned to the park, they found the tree it had fallen from, standing tall in the canopy. Its very existence was remarkable, though it would once have been common.

A relic of our past forests, the American chestnut was the dominant canopy tree in the eastern forest before succumbing to chestnut blight, a lethal fungal disease, in the early 1900s. It was once distributed over millions of acres and outcompeted most other forest trees for resources, reaching heights of 100 feet and diameters of 10 feet or more. The tree's abundant, late-blooming white blossoms made hillsides look as if they were covered in snow.

However, the most magnificent feature of this tree was its fruit. Each October when the chestnuts ripened, their prickly husks would split open to reveal the glimmering dark brown nuts within. These plentiful nuts coated the forest floor with delicious morsels for humans, turkeys, bears, white-tailed deer, and many other species.

The chestnut's reign was cut short in 1904, when an Asian chestnut carrying the fungus that causes chestnut blight arrived in New York. The fungus swept through eastern forests, spreading up to 50 miles per year, infecting and killing the American chestnuts in its wake. By 1950, only a handful of chestnuts remained scattered across the East. Since that time, many researchers have dedicated themselves to breeding blight-resistant American chestnuts for reintroduction. For now, though, most of our wild chestnuts are feeble stump sprouts that die long before they can bear fruit. Remarkably, the chestnut tree in Ethan Allen Park has reached a diameter of 15 inches, and its bark remains unblemished. Perhaps it has some natural resistance, or perhaps it is just lucky.

The tree's abundant, late-blooming white blossoms made hillsides look as if they were covered in snow.

With each passing generation, the once-common memories of the American chestnut continue to fade. Thanks to the children's natural curiosity and innate interest and wonder, this surviving chestnut is etching new memories in the minds of these young Vermonters. It offers a focal point for their outings and provides for hours of play. Students stack the prickly husks like layers of Velcro, pretend they are cooking a cauldron of warm bubbling chestnut soup, and peel back the spikey capsules to reveal the soft, velvety inner lining.

As naturalists, we tend to revisit the same areas time and again, leaning on our past knowledge and experiences to guide us through a landscape. This familiarity allows us to be confident in what we can expect to find. We gain comfort in our knowledge with each visit, and new discoveries become fewer and farther between. The American chestnut in Ethan Allen Park is a wonderful reminder that even the most familiar forests can still hold secrets.

Too often we visit natural areas with agendas and expectations, hoping to hear the nasal *peent* of a woodcock or catch a particular flower in bloom. Encroaching deadlines and scheduling conflicts blur our vision, distracting us from potential new observations. Yet surprises still abound in seemingly familiar woods and meadows. Sometimes it takes a child's eyes and a troubled tree to remind us how little we know a place.

Image: Shelley Spinner

Rebuilding

BRYAN PFEIFFER

Image: Bryan Pfeiffer

Never is nature writing as good as actual nature, and nowhere is that more frustrating for me than in the Grand Canyon. Words go to their graves beneath these walls and buttes. Photographs of rock and river seem phony here. Anything I might use to convey the canyon is feeble.

Except for the caddisfly.

I discovered it in a creek during one of my hikes below the South Rim. As adults, caddisflies look a lot like drab moths with wiry antenna. But as larvae they spend most of their lives as underwater woodworkers and stone masons, assembling protective chambers of sticks and stones. In streams and rivers, ponds and lakes, caddisflies crawl around like caterpillars shrouded in disheveled log cabins or in masonry sleeping bags.

My canyon caddisfly was one of the stone workers. Good thing: there may be no better place on Earth to find stone than in the Grand Canyon. Stacked in three dozen layers around us, the canyon's rock formations mark a turbulent span of the earth's history. And it is all coming apart.

As the Colorado River slices through the oldest basement rock a mile below the rim, the canyon walls crumble. Summertime's torrential rains drive rivers of rock and sediment down side canyons toward the Colorado. In winter, water in cracks freezes, expands, and pries away slabs that tumble and shear off yet more rock on the way down. Erosion is what makes this place so wide and big and beautiful. For millions of years its pace has been slow, relentless. And there is no putting the rock back.

Except for the caddisfly.

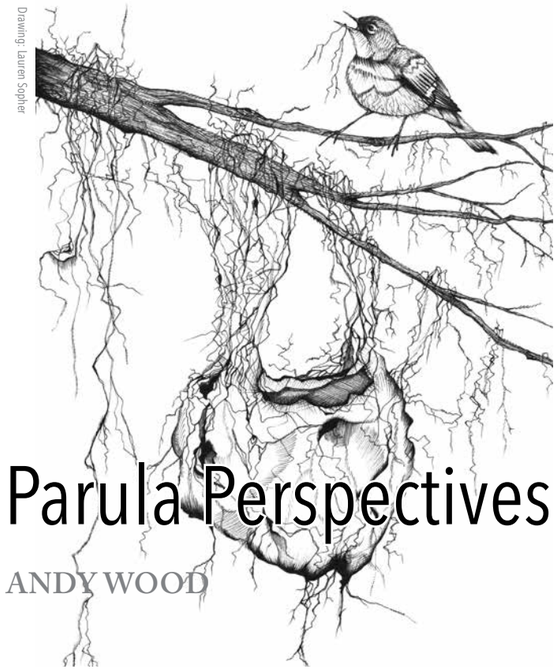
In this one insect's stone hut I find rock samples gathered from across the eons. A speck of Zoroaster Granite — 1.8 billion years old. A grain of Tapeats Sandstone — 545 million years old. A slice of Hermit Shale — 265 million years old. The temporary quarters of the caddisfly, which will live as an adult for only a week or two, can embody epic events in Earth's history: collisions of continents, eruptions of volcanoes, the advance of a desert, the rise and retreat of oceans, and three mass extinctions.

We ourselves cannot know these cataclysms, not in the same way we know spring migration or an alpine meadow in bloom. The closest we might get to the action, to the past and present and future of the Grand Canyon, to the birth and breathing and fate of its rock, is in the geology left behind as canyon walls — or maybe in bits of fallen stone gathered up by an ephemeral insect.

Erosion builds a canyon. It creates void and beauty. And no phrase or photograph or poem of mine can bring the place to life. So instead I bring you an insect. Contrary to entropy, it unwittingly puts a small portion of the canyon back together again. In the audacity of its lonely deed, the caddisfly builds a monument to a canyon we can neither describe nor comprehend, a monument to this place, made of this place. And it can sit in the palm of my hand.

That is one of the delightful paradoxes of nature. Even during upheaval, whether it's as grand as the carving of a canyon or as grotesque as the ruin now at hand in Washington, we can always escape into nature's little things. When natural and political events crash around us, a prosaic insect might offer us respite — even inspiration to rebuild a world.

Bryan Pfeiffer is the writing instructor in the Field Naturalist and Ecological Planning programs.



Drawing: Lauren Sopher

Parula Perspectives

ANDY WOOD

Traveling 5,000 kilometers on a diet of hairy caterpillars is not my idea of a fun road trip, but it's the regular commute for northern parulas (*Setophaga americana*). Last spring, several of these wood warblers took a pit stop in my backyard along their northbound migration. They're stunners: think blue suede along the head and wings, a burst of marmalade at the throat, and a grass-green patch high on the back.

These tiny birds' migration ends high in the forest canopy, where they build nests from *Usnea* lichens. During our brief summer, they lay a clutch of cream-colored eggs and raise a brood destined to travel the western hemisphere. Come fall, parulas stream south towards their wintering habitat in Central America and the Caribbean. They will pass through cities, wetlands, and backyards. And virtually no one takes notice of their passage and the vital message it carries.

For three days, I watched parulas nonstop as they broadcast their buzzy, insect-like songs from the droopy boxelders. And then they were gone, leaving me with a bright blue memory. It was my best bird sighting of the year. Not because they were the rarest of birds, or the prettiest. These parulas were special because they brought the tropics to my back door, and reminded me of another way to view the world.

Twenty years earlier, my family traded our beloved maples of Virginia for the mangos of Costa Rica. After three years among iridescent wildlife, I became thoroughly imprinted on the place. We eventually left Costa Rica, but I always dreamed of returning to the tropics, and managed to do so several times. Ultimately, though, I grew to love the lakes and forests of New England, and my desire to return to the tropics dimmed. I settled in to my local delights: winter flurries, loon calls, and cool mountain brooks.

The parulas jolted me out of my dreamy New England mindset. It seems clear that living locally connects us to our neighbors, farmers, and top-notch swimming holes. But if we focus too much on what's local, do we risk losing sight of the rest of the world? My local world encompasses northern New England, but local to the parula might include everything between Quebec and Guatemala. That's a big frame. No matter what our motives, putting local concerns first will inevitably ripple across the globe. We see that happening now as political rhetoric divides us along geographic boundaries. Our leaders encourage us to distrust others, to wall ourselves in ideologically and literally. As Prussian explorer and naturalist Alexander von Humboldt once said, "The most dangerous worldview is the worldview of those who have not viewed the world."

But the parulas blur the literal and figurative boundaries we construct. These birds don't belong to our backyards, or to any one place along their migration route. They travel the globe, ignoring our nationalities, languages, and opinions, focusing instead on what it takes to make a life: the right food, companionship, a place to make a home. These plucky little birds, seeking fulfillment across nations, can be a symbol for weaving together our seemingly separate worlds. A symbol doesn't change the hard work of integrating our lives with others around the globe, but it can serve as a touchstone — a steady source of inspiration — while we grapple with the world's tough issues: identity, place, conflict.

Whether or not migratory birds become our new political symbols, their declines are alarming. Fortunately, many people are working to bridge the gap between local and global concerns. Biologists at Manomet[1] cross cultural barriers as they track shorebirds from Hudson Bay to the Strait of Magellan. Scientists from the Vermont Center for Ecostudies[2] tail bobolinks through the pan-American grasslands. Poet and artist Susanna Byrd[3] sketches portraits of life and natural history across continents. It makes no difference which tools we use — binoculars, paintbrushes, or Spanish-English dictionaries — as long as we're willing to take on the challenge of connecting the dots between near and far.

I'll continue to look for parulas: for the warbler kind in my backyard, but also for the metaphorical kind that help me walk through our terribly complicated world. It's spring again. The parulas are on their way north, and I'm feeling hopeful.

1. https://www.manomet.org/
2. http://vtecostudies.org/
3. https://migratorybyrd.wordpress.com/

Image: Maria Dunlavey

To Mark the Sparrow's Fall

Birds, bison, and the future of American grasslands

MARIA DUNLAVEY

Somewhere high above me, a Sprague's pipit is singing. I'm cooking dinner, though, with my usual audience of cows, and don't stop to search the sky. I'd be lucky to spot it if I did — it's the size of a sparrow, 100 feet or more above the earth, and liable to stay airborne for hours. Its song is a descending whirl of notes laden with harmonics, almost veery-like but thinner, metallic; a grassland song, spare as the planes of earth below it and sky above. I hope it will be singing in the morning when I begin to count birds.

From the pipit's vantage above this lonely expanse of northern Montana's plains, my camp must seem like an anomaly of titanic scale. The cows certainly think so. They're half-wild and brimming with curiosity, unsure whether my presence heralds danger or food or simple intrigue. Outside my camp, the closest people might be in the jet liner cutting a path across the evening sky. The cows probably haven't seen a human in weeks. For me, it's been five days. I've gotten used to this remoteness, to the stares of cows and unseen pipits' songs.

I'm here for the pipit, among other prairie birds. I'm surveying them at their North American epicenter; of the dozen endemic bird species of the Great Plains, 11 breed here in north-central Montana, the Sprague's pipit among them. Most are vanishing. The pipit's population has dwindled by nearly 80 percent in the last half century; other grassland birds have seen similar declines. When I set out a week ago, I wasn't sure I would find them at all.

Now that I'm here, out on the lush tablelands north of the Milk River, my doubts have vanished. My challenge here is not finding birds, but counting them, tracing each thread of song through the dawn clamor. Prairie birds' habitat may have disappeared elsewhere, victim to fragmentation and overgrazing, but this pipit doesn't seem particularly bothered by his local cattle herd. I'm learning by now to perceive beauty as I imagine he might — in blue grama and needle-and-thread grass, the brighter green of dips and hollows in the prairie's face, the slivers of sky mirrored in every stock pond and slough. Later, I'll find that all my photos are really pictures of sky — cows, landmarks, even wildflowers, luminous in the slant of clear morning sunlight. The prairie blurs boundaries like that, demands a new way of seeing. It is a wilderness of birdsong, wind, and grass.

It is also not a wilderness at all. You can't criss-cross this landscape as I have without the growing awareness that there's a post-apocalyptic quality to it — that you're living in a cautionary tale. Before it was gridded in barbed wire, this was the bison country of American myth: vast herds darkening the horizon, senseless slaughter by white men in train cars. Plains Indians and their forebears trailed the herds' seasonal migrations for hundreds of miles across the prairie. Rings of tipi stones still lie undisturbed on ridgetops near likely hunting grounds, weathering quietly in the sun. Enormous skulls still wash out of riverbanks after a heavy rain. When the bison were here, they were the architects of their ecosystem, trampling a given area into dust one year and leaving their dung to fertilize vigorous new regrowth the next. Prairie birds evolved in the patchwork shaped by their hooves.

Some conservationists believe the prairie is an ecosystem fallen from grace and can only be saved by the bison's return. If their loss was an apocalypse, though, it was hardly the first one to transpire here. Bison are merely the holdouts of a 10,000-year-old wave of extinctions. Dozens of large herbivore species used to graze these plains, until they were driven from existence by human hunting, environmental change, or both. Before that, this landscape was literally wiped off the map, temporarily overrun by the Laurentide Ice Sheet during the last glacial maximum. The grassland biome itself is a disruption, a weedy Miocene invention that rode the coattails of climate change to take over vast tracts of the globe. Even today's familiar diversity of birds and mammals is a response to the vacuum left by the last mass extinction, 65 million years ago. I'm walking around on bedrock that predates it — somewhere under my feet are fossils of dinosaurs, mosasaurs, ammonites. This was their country once too. Every landscape that's ever existed here sprang up in the ashes of another. These plains — like every ecosystem on Earth — are a testament to nature's resilience, to the endless inventiveness of biology.

Resilience is a popular topic in conservation these days. The urge to protect the wildest places and the most charismatic megafauna looks less relevant by the day. In the face of climate change, more and more conservationists are seeking not to restore the natural landscape to its previous iteration but to help it on its way to the next one. We can't possibly return every ecosystem to some mythical, primordial state, they argue. We *can* give nature a fighting chance to change and adapt. That means embracing our role as its human partners and actively managing for the future we want.

In northern Montana, for now, it seems to be working. Elsewhere in their range, Sprague's pipits are still declining, but their numbers here have held strong. Many ranchers have begun to manage their cattle like bison, using intensive grazing rotations that mimic the effects of a large, nomadic herd on the landscape. In the process, they create their own habitat mosaic and feed their cattle better, too. They have every economic reason to do so, but they also have human ones: the prairie is their home, and they know its value better than anyone. The land I'm on now has been owned by the same family for more than a century. They've always run cattle here, and they're as proud of their pipits as they are of their calves. It's easy to get swept up in the glow of their success and in the freedom of the future it offers.

Still — I'm wary. I'm not sure I can settle comfortably into treating nature like an overgrown garden, tangled and lovely but under human control. Even here at my campsite among the cows, there's an indelible wildness to these plains. It prickles stubbornly at your senses, a reminder that you are a feeble thing against the immensity of the world. The ranchers who live here know that they don't govern this place's fate any more than it decides theirs. An ill-timed hailstorm in June might halve their ration of winter hay; a few years of drought might bankrupt them, sever a generations-long bond with the land. Lives and livelihoods turn on the weather, the grass, and the sky. No one harbors illusions of omnipotence any more than they do of irrelevance. Wallace Stegner, who spent his childhood on these plains, once wrote:

It is a country to breed mystical people, egocentric people, perhaps poetic people. But not humble ones. At noon the total sun pours on your single head; at sunrise or sunset you throw a shadow a hundred yards long. It was not prairie dwellers who invented the indifferent universe or impotent man. Puny you may feel there, and vulnerable, but not unnoticed. This is a land to mark the sparrow's fall.

There might be a lesson in that paradox of power and frailty. Our modern environmental catastrophe has been heralded as the earth's sixth great mass extinction — but nature will, in the long run, be fine. Even if we render the earth unrecognizable — if the pipits are gone, the sparrows and longspurs, even the grass itself — I have a geologist's faith that something else will spring up to fill their place. It might take millions of years, but it will be something worth having in the world, something as beautiful and improbable as life itself.

We might not be there to see it, though. Even if we are, we'll still carry the inherited loss, in legends or in bones: birds and grasslands, cowboys, bison. Our species bears the twin curses of hubris and memory. We've had the audacity to meddle, to plant seeds and split atoms and bring on an apocalypse or three. Our egotism might destroy the world as we know it. It's also what might save it.

So let's be so bold as to believe in wildness, too — to persist in our illogical, personal passions, to fight for a ghost bird somewhere in the Montana sky, for empty miles and the bite of a restless wind. Our human perspective may be limited, but it's the only one we've got.

Image: Maria Dunlavey

Little Pekin

In praise of floodplains and tiny streams

LIZ THOMPSON

On a crisp February morning, my colleague Nina and I set out from our office in Richmond, bound for Calais on the other side of the Green Mountains.

We followed the Winooski River upstream, then drove north to join the Kingsbury Branch, and finally northwest along Pekin Brook. We'd gained about 600 feet in elevation since leaving Richmond.

We crossed the wildly meandering Pekin Brook, parked on the edge of a muddy and rutted one-lane road, and set off across a snowy field. The snow was deep and, where the sun had not yet reached it, topped with ice.

We walked gingerly into a small valley, in search of a stream that we had seen clearly on aerial photographs, but which was not shown on any topographic map or data layer. The land was about to be conserved by the Vermont Land Trust, and we needed to know where the waterways were in order to make sure they were protected. But I also went to learn more about streams and their floodplains

I find riparian systems — streams, rivers, floodplains, and their associated wetlands — endlessly fascinating, perplexing, and mysterious. They are among my favorite natural systems. And here I was again in a floodplain forest, a thread woven through my career as a Vermont ecologist. One of my first assignments out of graduate school was to visit the floodplain forest on the Winooski River in Richmond. On a low-lying outer bend of the river sits a 30-acre patch of floodplain forest. When I first visited that forest, I was impressed with its open, park-like feel, its large silver maples, and its tall ostrich ferns.

As the years rolled on, I had the opportunity to visit many more floodplain forests, adding the Lamoille River, the Missisquoi, West River, and White River to my repertoire. My concept of floodplain forest expanded beyond that first iconic image of silver maples and ostrich ferns to include forests where sensitive fern is the dominant herb, forests dominated by sycamore, forests with black cherry in the canopy, forests with thick tangles of vines, and forests on higher terraces where sugar maple dominates. My colleagues have broadened my horizons yet further, describing, for example, conifer-dominated floodplain forests in the Northeast Kingdom.

But lately I've turned toward smaller streams and yearned to know about their floodplains. How are they different from the floodplains of larger rivers? What is their flooding regime? What is their natural vegetation? Are there recurring patterns of flood cycles, soils, and vegetation?

Nina and I felt as if we were in a magic kingdom, a secret hidden-away place where humans rarely ventured.

In the search for answers, here I was at an unmapped and unnamed stream in Calais. Let's call it Little Pekin. The stream has carved a tiny valley out of ancient lake-edge and lake-bottom sediments of Glacial Lake Winooski, a high-level glacial lake that covered present-day Montpelier and the valleys emanating outward. The valley walls are steep and densely forested, and the floodplain is narrow, only 35 or so feet at its widest. Nina and I felt as if we were in a magic kingdom, a secret hidden-away place where humans rarely ventured. The tiny stream meandered through the narrow floodplain, just as the lower Winooski meanders through its broad valley. But here, it was all in miniature.

Image Lauren Sophier

With 18 inches of snow on the ground and a hard crust on top, we couldn't discern the ground vegetation, and digging a soil pit was out of the question. But we could see what trees were growing there. Black ash was the most common tree. Some were festooned with lungwort lichens (*Lobaria pulmonaria*), which grow best where moisture is abundant, or *Neckera* moss, which grows best on old trees. The ash and its moisture-loving epiphytes held an important clue. Black ash almost always grows where groundwater seepage is present. Perhaps this place is as much like a seepage swamp as a floodplain forest. Perhaps there is groundwater oozing out of the sandy terrace where it hits a denser clay layer. What would this place look like in the spring? Would we find plants typical of larger floodplain forests, like ostrich fern and sensitive fern? Or would we find plants that grow where groundwater seepage is present? Would we see marsh-marigold, foamflower, golden saxifrage, or seep sedge? The mystery would have to remain until the snow melted and new growth emerged.

Pleasantly mystified, we left the tiny valley, scrambling up the steep slope of the valley wall. We walked back across the field of snow, now softened by the afternoon sun, and returned to our car. We drove back across Pekin Brook, down the hill to Montpelier, and back across the Green Mountains to the bare fields of Richmond, peering up other tiny valleys, looking for more tiny floodplains.

Come spring, we'll go back to Little Pekin and see what's growing there. I'm banking on some lush marsh-marigold. But who knows? Every time I see a new place, in a new season, I learn something.

Thanks to Eric Sorenson, who provided some background for this article.

Liz Thompson is an ecologist with the Vermont Land Trust. She is the co-author of *Wetland, Woodland, Wildland, A Guide to the Natural Communities of Vermont,* and an instructor in botany at the University of Vermont.

Melting Boundaries

CHELSEA CLARKE

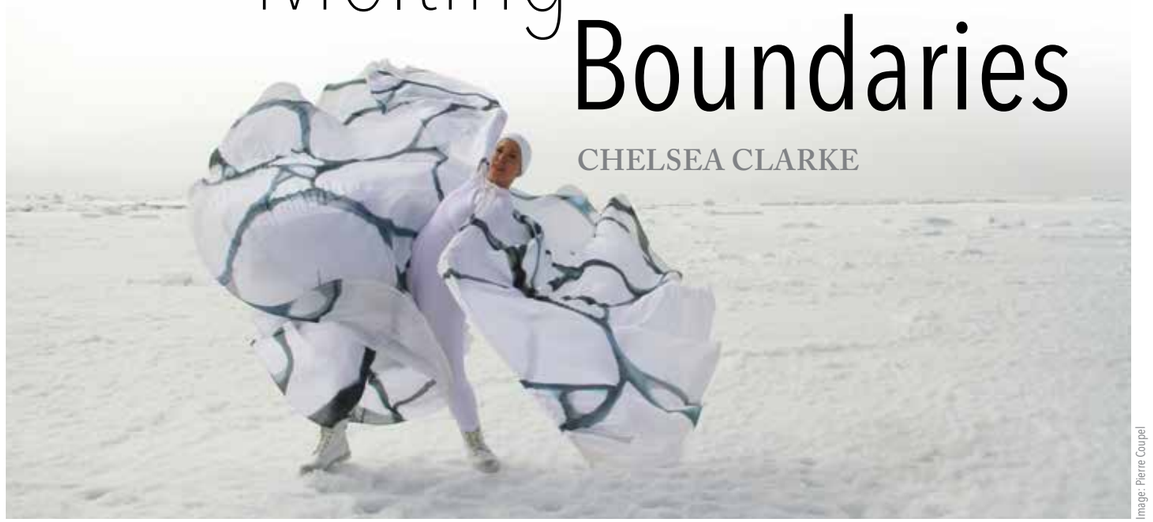


Image: Pierre Coupel

Miles out to sea, somewhere between Alaska, Russia, and the North Pole, Jody Sperling is watching the ice. From the bridge of the Coast Guard icebreaker *Healy*, ice stretches to the horizon in every direction. It's the only thing visible besides the pale sky and the occasional distant bird. Even below deck, its constant slushy crunch against the hull is inescapable. Jody looks out at the endless icescape and writes: *60% pancake ice*, *30% grease ice, 10% open water*. She adds her data sheet to the growing ice watch binder: two weeks and counting of round-the-clock sea ice data.

In this surreal world of ever changing light and ice, where the sun never sets, it's easy to lose all sense of time, direction, and even distance. It's far from featureless, though — ice forms seasonal patterns visible across the vast scale of the Chukchi Sea. Grease ice, like a barely visible oil slick on the water's surface, is so thin it can bend and flex with the waves. Finger ice, slightly thicker, forms interlocking fingers when sheets collide. Round plates of pancake ice, with the occasional walrus passenger, bob across the water. Cataloguing and recording this diversity is the reason the *Healy* is here, and Jody is doing her part.

Jody's no climate researcher, though. She's a choreographer and modern dancer. She and I are here as members of the outreach team on this research vessel. I'm an illustrator, but I walk transects and catalogue ice cores, too, gleaning information about the ice and marine life that I draw in my tiny shipboard studio. While the science party collects ice cores and water samples, our job is to help explain sea ice loss, under-ice plankton blooms, and the effects of climate change in the Arctic to the public.

The science party embraced my presence immediately. After all, scientific illustration is as old as science itself, and scientists have been bringing artists to sea with them for centuries. Darwin himself was an artist-naturalist. Besides, for the ship's scientists, whose subjects are microscopic and often regarded as unappealing and slimy, it makes sense to involve someone who can make the invisible not just visible, but beautiful.

As far as we know, no dancers sailed on the HMS *Beagle*. The *Healy*'s scientists were considerably more skeptical about Jody's presence. What could a dancer possibly have to offer science? How exactly would she explain to the world why the timing of plankton blooms is important to the entire Arctic ecosystem, or how the thinning sea ice affects underwater photosynthesis?

Instead of writing Jody off, though, the scientists did what good scientists do. They set aside their bias and got to work collecting data on Jody and her dancing. They dropped by her practice sessions in the helicopter hangar where she swooped and twirled among the heavy equipment; during meals in the mess hall they grilled her on her choreography plans and methods. With time, Jody's dedication to her work and intense interest in the science of sea ice started to make an impression. The more the scientists learned about Jody the more they started taking chances, allowing her to go out onto the ice and dance at monitoring stations — and eventually to participate in ice watches.

As she danced on the sea ice, Jody's all-white costume, with its giant silk wings, made her look like some kind of Arctic butterfly fighting the wind. On the bridge, she impressed the scientists with her attention to detail by describing subtleties in the ice that they themselves had been unable to articulate, features that might help the public connect to something they might otherwise never see. By the end of the cruise, the chief scientists were even taking Jody's needs into consideration as they planned their data collection, debating the best location for her to dance at each station.

Back in New York City, far from the *Healy* and the Chukchi Sea, Jody choreographed a dance piece titled Ice Cycle, which is still being performed. The dancers' flowing costumes serve as screens for projected ice imagery, while recorded ice sounds mix with the music. The dancers mimic the dynamic movements of the ice, simultaneously violent and fragile. In the two years since the cruise, Jody and her dance company have performed Ice Cycle 36 times across the country, reaching more than 6,000 people. Most performances include lectures by climate scientists about the consequences of Arctic ice melt. Even more importantly, the dance itself gives audiences an emotional connection to the ice and an investment in its future. The performances express something that statistics, graphs, and peer-reviewed data cannot capture: the mesmerizing experience of being surrounded by a constantly shifting landscape of ice, and the idea that this experience may not exist in the future.

These kinds of collaborations between art and science are becoming more and more important, especially in this era of public suspicion toward science. Art can reach people who don't follow science and touch their hearts as well as their minds. It can reveal the beauty of the invisible, microscopic, or faraway wonders of the natural world and bring awareness and sympathy to their plights. An article about Jody's project in Dance Teacher Magazine quoted Robert Pickart of the Woods Hole Oceanographic Institution, one of the chief scientists on the cruise, enthusiastically explaining how Jody's work is helping his cause:

"She can portray how exotic it is up there: the beauty of the landscape — this part of the world that no one really tends to think about so much. And then to start to realize it's all in jeopardy. If we can get people thinking about how fragile the Arctic Ocean is, that's huge."

I found the scientists' embrace of Jody's work especially striking in contrast to some of my experiences in the art

Image: Chelsea Clarke

world, a culture that has built its identity on the idea of its own open-mindedness. In art it's okay to cross almost any social boundary in pursuit of the novel or rebellious. Anything can be embraced as long as it is conceptual enough. But that open-mindedness has its limits. To many artists, science falls into the same category as traditional landscape painting and mainstream religion — not innovative or meaningful enough to inspire "real art." Science is viewed as analytical, dry, and far too concerned with facts to mesh with true artistic endeavor.

If artists gave science a chance, though, they might find an opportunity to give it the meaning and emotion that they feel it lacks. Artists, in return, could gain something from the kind of open-mindedness demonstrated by the *Healy*'s scientists — the kind where decision-making is based on emotions and facts, creativity, and observation. They might even find value not only in science itself, but also in some of the other things relegated to the "not real art" list.

"I've always cared about climate change and I've always been a choreographer, but the *Healy* mission was when those two things came together for me in a deeply meaningful way," Jody recalled, two years after the expedition.

Art and science are both ways of observing and studying the world. The difference is what each does with those observations. While scientists use details to infer facts, artists use tiny details to build emotional connections and convey universal truths. We'll never find those truths, though, if we aren't willing to behave a little more like scientists, set aside our personal bias, and take chances in the first place.

Thank you to Dr. Robert Pickart of the Woods Hole Oceanographic Institution for his commitment to scientific outreach and his generosity. Jody Sperling's dance company is Time Lapse Dance based in New York City.

Transients and Old-timers in the Plant World

A lifetime of observations

DAVE BARRINGTON

Lately I have been thinking about the longevity of individual plants and seeking to understand the influences that determine their fates.

The plant I've known the longest is a highbush blueberry (*Vaccinium corymbosum*) at the edge of Long Lake in southwestern Maine. This plant grows in front of our family summer camp, where we walk down to the dock. I remember it because it was the easiest place to find berries to eat as a kid. I first visited the camp in 1953; the blueberry was there then, and, as far as I can remember, much the same size and shape. It has remained there for 64 years.

There are, of course, famously old plants, such as the 80,000-year-old quaking aspen (*Populus tremuloides*) clone in Utah. I'm focusing, though, on my personal experience of longevity. At one end of the spectrum lies the blueberry. Looking to the other extreme, I again return to Maine. On the ledges overlooking the river by my family's old house, a colony of pale corydalis (*Capnoides sempervirens*) grows. These annuals have persisted there for the whole of my experience — now 50 years — but no individual plant lasts more than a single year, perhaps occasionally two. On the nearby rocks, for many decades, I could always find rock spike-moss (*Selaginella rupestris*). No individual lasted more than a few years, but for a long time the colony persisted. Now, all traces of the plants are gone. In both cases, I am impressed with the contrasting long-term presence of the plants and the brief life of any single individual.

Image: Dave Barrington

Focusing on the colonies of transients that have ceased to exist leads me to consider the ferns in a borrow pit on the top of Cerro de la Muerte, in the Talamanca Range above the highest point on Costa Rica's stretch of the Pan-American Highway. The plant community there is exotic to a Vermonter's eyes, dominated by a bamboo shrub six feet high. Among them grow small trees of the heath family, about the size of the bamboo but akin to the western madrone, and 15-foot-tall woody umbellifers that look like trees out of a Dr. Seuss book. One afternoon in 1983, near the 3,400-meter summit of the Cerro, Peter Zika and I wandered off from a fine group of students who had come on my third of 20 Tropical Plant Systematics field trips to Costa Rica. As the sun set in the mist over the summit to the west, we climbed up through a pasture in the bamboo and over a fence to discover a completely open bit of slope covered with crumbling subsoil: the remnant of a borrow pit used in the construction of a nearby road to a communication tower. The rubble the construction crew had left behind was covered with *Polystichum* ferns. I counted some 200 individuals, ranging from young plants only six inches high to big ones that came up to my waist. *Polystichum* is the same genus as our own Christmas fern but reaches far greater diversity in the American tropics. In the years since, I have visited this borrow pit many times; in the end I have recorded three species and two hybrids of *Polystichum* there.

As of this January, the old-timer is still there, prospering on the bare slope above the road. It is at least 37 years old.

Once again, this past January, I visited Cerro de la Muerte with my field trip crew. Children of the students I had on the 1983 trip have since taken my courses and graduated from the University of Vermont. I again sought out the borrow pit, trailing students behind me as I groped through the bamboo thicket, so much denser now. I got lost a couple of times but finally found what had once been the borrow pit. Now, the bamboo is ascendant. The rubble is hidden under a rich carpet of alpine shrubs and herbs. Not one *Polystichum* remains on this little slope. That rich array of species and their hybrids had developed, flourished, and disappeared over the course of perhaps 50 years, as the disturbance caused by human activity gradually stabilized and returned to the typical vegetation of the alpine zone.

Elsewhere on the Cerro de la Muerte, a single *Polystichum* persists. It is an unusual hybrid, growing on a high roadbank of the Pan-American Highway, around 3,300 meters above sea level. I found it in 1980 and have kept track of it all this time. As of this January, the old-timer is still there, prospering on the bare slope above the road. It is at least 37 years old. As the highway is maintained and improved, its niche remains in a sort of chronically disturbed state — and there the fern flourishes.

I find it enormously satisfying to build from my own observation of plants to a sense of how their fates vary over time and space. The persistence of one hybrid on a permanently disturbed roadcut, while others in the same lineage succumb to competition as a borrow pit recovers from succession, illustrates the importance of habitat features in the survival of plants.

Contrasting histories of persistence — of single individuals or of generations of short-lived individuals maintaining a local population — gives me an appreciation of the varied routes to survival. Different life forms and reproductive biologies work in different habitats. Only over time can we discern the key elements of the many histories that can lead a lineage to prosper.

Dave Barrington is the chair of the Plant Biology Department at UVM.

Pavement to Soil

LAUREN SOPHER

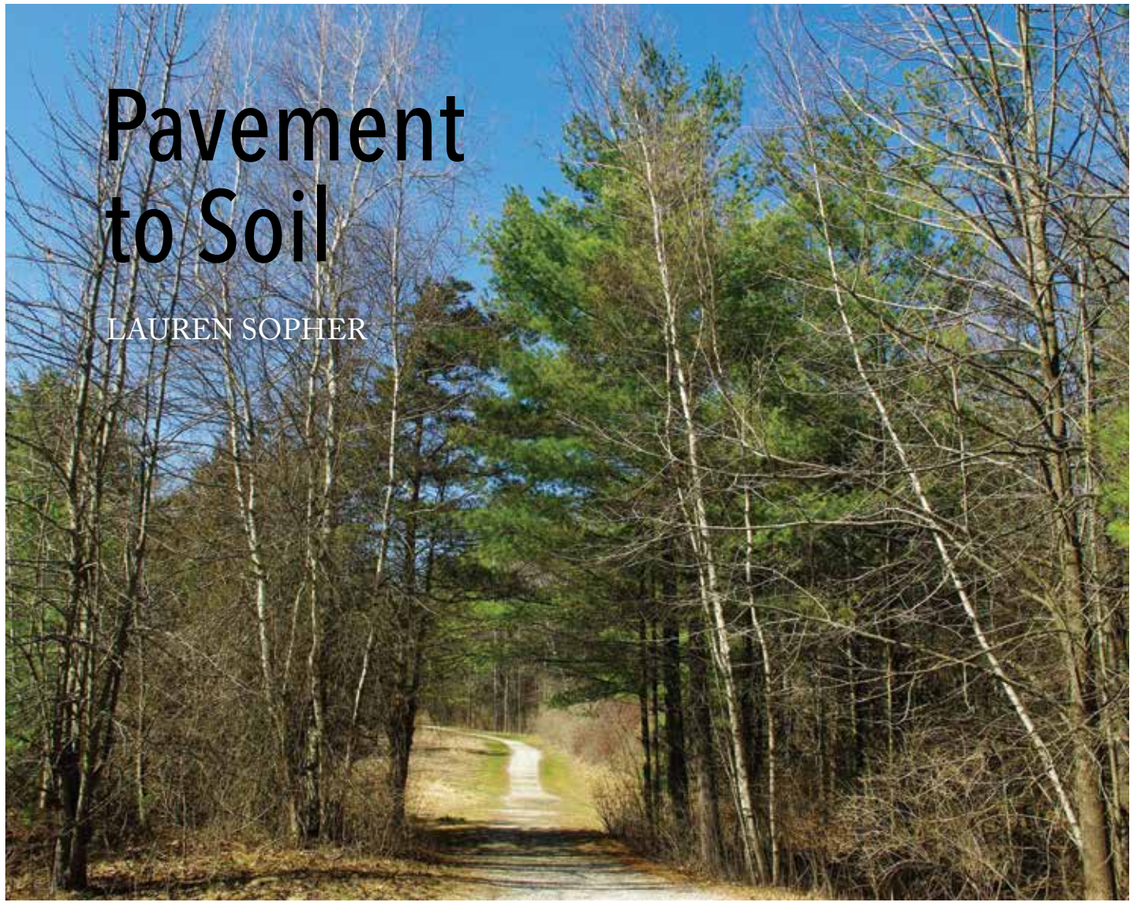


Image: Lauren Sopher

Ian dresses to the nines, has a meticulous apartment, and owns an adorable dog, Beatrice. Like many folks with intellectual disability, Ian's daily routines are anything but routine. Shopping for food or clothes can be an ordeal.

Negotiating the developed world of commerce — pavement, Price Chopper, plastic tiles, Macy's, parking lots, Pet Food Warehouse — is challenging enough. Getting Ian into wilder places is unthinkable.

That's not to say there isn't potential for nature in Ian's life. Although Ian achieves a lot through the exchange of material goods, there's another opportunity to help Ian develop a sense of belonging and value in the world: nature.

Nature is a space for social inclusion. Yet as a society, we too often overlook the natural world as a resource for human health and well-being, especially for adults with intellectual disability. These folks are often termed as an "underserved population." Advocates need to serve them. Nature is one way to do it.

As a former social-work employee who now focuses on the natural sciences, I believe these two fields can come together to serve more people like Ian.

When Ian met his community support worker, the groundcover and locations were familiar. Their outings achieved physiological needs — food and drink — and psychological needs — safety and a sense of accomplishment. The duo successfully implemented a client-centered approach to spending time in the community.

Ian was content, but wanted to take Beatrice to more locations in the community. To venture beyond his porch was like stepping into a dump. Beatrice's health and well-being were of paramount importance to Ian. Of equal significance was the security and intimate human-animal bond that Beatrice offered to Ian.

In three years, Ian had never walked on the sidewalk next to his apartment. But one week he made it 25 yards, the next week one block, and eventually two blocks on a consistent basis. When Beatrice came along on walks, she was gleeful, but unruly. Ian realized that dog training skills could be helpful at all of their frequent stops: dog parks, downtown Burlington, and the barbershop.

Ian and Beatrice's bond, trust in his community support worker, and dog training were his entry points into becoming comfortable with unfamiliar places. Ian stepped beyond his self-implemented five-yard perimeter around his porch, as if he was stepping onto a new planet — one timid step, five nervous laughter-filled steps, a speed walk (pulled by Beatrice), and finally, consistent wandering, guided by Beatrice's nose. Suggestions from a dog trainer informed these movements; Ian had learned new practical skills about his dog's general care and natural instincts. Ian was a new fan of grass.

In the scientific literature, psychologists Roger Ulrich, Rachel Kaplan, and Stephen Kaplan have concluded that nature can indeed be restorative, but not without challenges.[1] Folks with intellectual disability encounter remarkable health inequalities compared to the general population, including obesity and shorter life expectancies.[2] Many factors constrain health-promoting physical activity by adults with intellectual disability.[3] Providers need to seek out alternative spaces of social inclusion and belonging: such as gaming groups, visual arts organizations, and outdoor clubs.[4]

As they walked, Ian commented on the visual beauty of the trees and lake, the sound of the rustling leaves, and his physical sense of calm.

Ian's barriers to independence include anxiety, obsessive-compulsive behavior, a history of physical abuse, and intellectual disability. Intellectual disability is defined by DSM-5 (a standard classification system for diagnosing mental disorders) as: "A disorder with onset during the developmental period that includes both intellectual and adaptive functioning deficits in conceptual, social, and practical domains." Intellectual disability can occur independently or co-occur with conditions, such as autism spectrum disorder, Down syndrome, and cerebral palsy. In many cases, the individual's life is further complicated by a physical disability. Ian represents a snippet of the population with intellectual disability. No individual fits into the box of their diagnosis.

Inclusivity depends on building relationships and trust over time. Providers should identify individual-level entry points to nature for this population. What connections does the person already have and how can they realistically be expanded?

The day Ian, Beatrice, and his community support worker went to Shelburne Bay Park — a recreational haven along Lake Champlain's shoreline, containing nearly four miles of interconnected, crushed stone and packed soil pathways — the trio was in uncharted territory. Several factors made this location more accessible to Ian than other locations: Ian and Beatrice got a ride from his community support worker, the support worker was familiar with this park, the park requires no fees, it is pet-friendly, and there are pathways with gentle terrain. Waves of anxiety exuded from Ian, but in reality, months of indirect prep work would support him on this excursion.

As they walked, Ian commented on the visual beauty of the trees and lake, the sound of the rustling leaves, and his physical sense of calm. He felt safe, supported, accomplished, and proud of this new feat.

Ian and his community support worker continued to shop for clothes, but a new and practical type of activity — nature exploration — was added to Ian's routine. These are the types of experiences that should be accessible to underserved populations throughout Vermont. All people deserve the opportunity to interact with nature — it is a basic need, like food, water, and shelter. No barrier is too great to overcome. Next time you head outside, imagine that you're in Ian's shoes.

"Let's go shopping in the woods today."

Note: Elements of Ian's identity and circumstances have been changed in order to protect his privacy.

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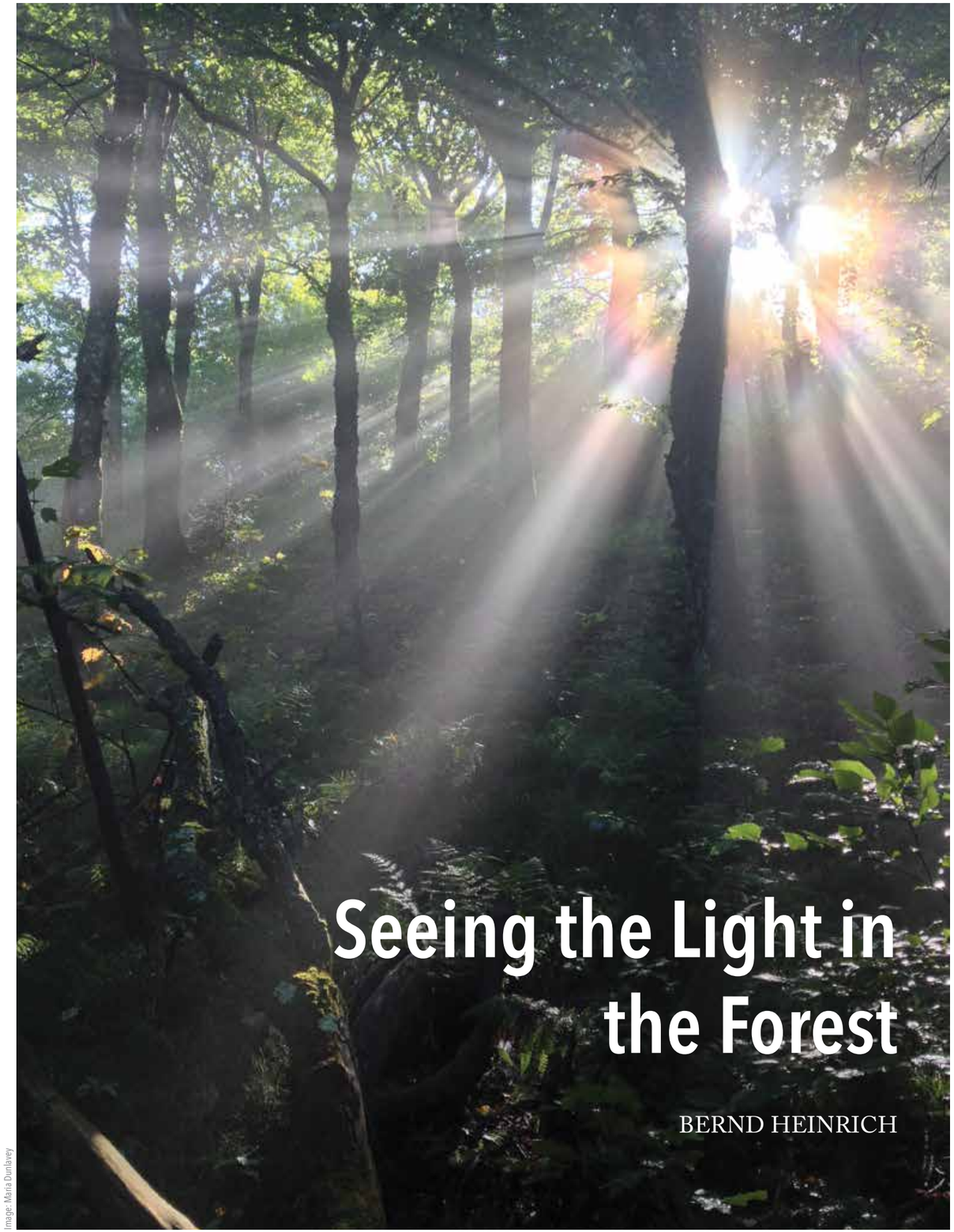


Seeing the Light in the Forest

BERND HEINRICH

Image: Maria Dunlavey

18 February, 2017. At dawn, a chickadee sings, a downy woodpecker drums, and a red eastern horizon turns yellow. The Beatles put it this way:

Here comes the sun …
It's been a long, cold, lonely winter
It feels like years since it's been here.

During the last months there has been a scarcity of light. Scarcity can be a good thing, because it draws our attention to what we may take for granted when immersed. Scarcity forces us to fixate on what we miss. Right now I really notice and appreciate the light. Most mornings throughout the winter I've gotten up in the dark, anxiously awaiting that glow on the horizon. In the meantime, I've had to make do with a faint flickering of rays from the woodstove onto the cabin floor.

Light is a band of the electromagnetic spectrum, and only part of it is visible to us. We can't see the ultraviolet nor the woodstove's heat. But they are there by evidence in real time. The light from the stove comes from sunlight stored the year before. The light I used while reading last evening had been captured the previous day by a 7x7 centimeter photovoltaic wafer on a $20 inflatable "Luci Light" lamp, a marvel of technology that catches and releases light by the push of a little button. This lamp's light supply, captured the previous afternoon, first travelled eight minutes and 20 seconds through space from the sun, where it was produced by the collision of hydrogen atoms to create helium by nuclear fusion.

The marvel of what a Luci light does is performed routinely by the trees all around me. They store the energy of sunlight in molecular bonds in their wood, and hold it until they die and decay, or until I release it through combustion in our stove. But this light is captured by the chlorophyll molecule, a bio-light-catcher, in a reaction that grabs carbon dioxide molecules out of the air while also releasing oxygen. Photosynthesis stores the energy of the sun's deep atomic fusion in the molecular fusion of the tree's wood.

Wood is an adaptation of the most amazing plants on Earth, a scaffolding that hoists solar-catching leaves high into the air. Each tree races for sunlight against others doing the same thing. The piece of maple burning in the stove next to me came from a tree I culled over a year ago, enabling others near it to grow. It was made from light and carbon dioxide captured decades earlier.

Stored sunlight in the form of wood makes life possible here in my off-the-grid cabin in the winter. Meanwhile, tanker trucks drive daily up and down the road near us, delivering cargoes of hydrocarbons — from stored sunlight that was captured by chlorophyll long before maple trees existed. We now mine that light and energy out of the ground, and are suddenly, and apparently irretrievably, committed to putting back into the atmosphere what took hundreds of millions of years to sequester.

The oldest fossils on Earth are those of photosynthetic organisms. The magic process made possible by chlorophyll put oxygen into our atmosphere and enabled the evolution of aerobic life. Oxygen now comes to us mainly via plants, and forest plants are the major atmospheric keepers. Forests also create soil, and by way of their root networks, they capture and store water that would not otherwise stay on the land. They create atmosphere, climate, and habitat, the home and food for millions of species. It is no wonder that we may reflexively balk at the idea of cutting trees to burn them, and perhaps we should. However, at the same time, considering the rest of the forest is just as crucial.

Stored sunlight in the form of wood makes life possible here in my off-the-grid cabin in the winter.

Trees are the most visible, but they are only one component of a forest. Obviously, we need more trees, and clear-cutting and plantations of vast tracts of land are poor substitutes for the ecological complexity of forests. But leaving them untouched isn't the answer, either.

We keep and grow forests because they have a direct and clearly perceived value. I'm passionate about trees, and not only because they are light incarnate. I also like paper, pears, apples and oranges, hazelnuts, timber frames and wooden boats. I care about forests, too, for their trees and for all that lives in, on, and around them. Growing a forest means harvesting trees by leaving trees, including the biggest of the best and the rare as well as the common, and allowing them to stay in place for their entire life spans.

The problem is not that we exploit trees. The problem is not use, but misuse, by destroying forests and replacing them with trees only. But if misuse were a reason to categorically abstain by credo, then one might as well prohibit having animals as companions, or having children. There is necessarily a cost to everything. It is the balance that counts, not just the ballast. Maybe that's seeing the light.

Bernd Heinrich is a scientist, writer, and professor emeritus at UVM.

The 21st Century Field Naturalist

DEANE WANG

Naturalis Historia, a series of volumes begun in 77 A.D. by Roman author and naval commander Pliny the Elder, covers the "natural world, or life." While a lot has changed in the last 2000 years of human history, our need to know about natural history is as important as ever. However, our 21st Century naval commanders, lawyers, engineers, politicians, and doctors may have a disciplinary disconnect with nature stemming from our penchant for specialization. Our growing awareness of complexity in ecosystems may also make it daunting for the non-naturalist to pursue knowledge in nature.

Perhaps the role of modern field naturalists has changed. We need to be both seekers of natural mysteries and persuasive communicators. As keen observers, we take a transdisciplinary approach by seeing what is around us, attempting a "sense making," and telling stories that help connect people to nature.

In a world where people of power and privilege seem ever more unaware of how ecosystems support their fundamental survival, the role of the field naturalist is now more crucial and challenging. With 54 percent of the global population (82 percent in the U.S.) more familiar with the bus system than the ecosystem[1], making real connections deeper than the virtual experiences of watching "Nature" on public television may be critical to society's survival. Without a fundamental affinity for nature and the ability to see that the concrete jungle is sucking the life out of the biosphere, we will continue to believe that the inventions of modern life can guarantee a perpetual prosperity.

The role for the modern Field Naturalist is clear: eschew the doomsday stories, engage the public, and recruit the next generation of naval commanders into the fold.

1. World Bank and US Census data on population living in urban areas http://data.worldbank.org

Deane Wang is the former director of the Ecological Planning Program.

The Practice of Collaboration

ALICIA DANIEL

Imagine a Field Naturalist and Ecological Planning Program where the best and the brightest candidates were thrown into direct competition. What if people on the same "team" were sent out into the landscape and asked to outshine their peers by coming to a more exact understanding of its pieces, patterns, and processes without consulting one another? The program could have gone this way — and almost did. But when Jeffrey Hughes became the director, and I became the associate director, we decided to practice cultivating teamwork in the program. The Field Naturalist Practicum was born. Yes, the practicum teaches the layer cake approach, but it is also designed to build a strong, resilient learning community.

We live in a time when bragging and alleged supremacy have been elevated to a new art. Building communities, large and small, creates an attractive alternative to this divisive "me first" attitude. But the question remains: what leads to a successful learning community? After decades spent reading the research and thousands of field hours spent practicing team building with FNEP students, I still don't know. But here are some things we practice in the practicum and that research shows helps people work and learn well together:

Share food. Eating the same food together builds trust. Dr. Ayelet Fishbach, who studies social psychology at the University of Chicago, said on NPR this spring: "I think that food really connects people. . . to eat the same food suggests that we are both willing to bring the same thing into our bodies. People just feel closer to people who are eating the same food as they do. And then trust, cooperation — these are just consequences of feeling close to someone." So, in the early 1990s, when FNEPs first began our field days with bakery stops, we were years ahead of the social scientists!

Use peer mentors. Peer mentoring takes place between a person who has lived through a specific experience and a person who is new to that experience. Harvard physicist Eric Mazur has found during nearly 20 years of using peer instruction that many more students choose the right answer after they have talked with their peers. "And it's not because they're blindly following their neighbor's lead," Mazur writes. "By the end of the semester, students have a deeper understanding of the fundamental concepts of physics than they did when they only listen to an expert explain it." In the Field Naturalist Practicum, having the second-year students — and even third, fourth and twenty-fifth year students — come in and lead for a day has enriched the course beyond measure. When peer teachers draw on their strengths in art (event maps!) and science (debris flow!), the days unfold in diverse and meaningful ways.

Image Lauren Sopher

Encourage humor and play. "Play is the important work of childhood and base from which all learning grows," says Dr. Candace B. Pert, the author of *Molecules of Emotion.* "Environments that include pleasure, movement, and creativity are truly the most successful for learning." In the case of FNEPs, this practice comes naturally. An early observer of the program said, "You people have a knack for seeing and remembering the ridiculous." I can remember one fall laughing so hard that I collapsed on the forest floor after trying endless ways, and unsuccessfully, to light *Lycopodium* spores on fire. Too damp? Wrong kind? Need more heat? Who cares? This spontaneous experiment gone wrong ended in joyful connection.

Get outside yourselves and focus on something bigger. One new study from researchers at the University of North Carolina at Chapel Hill found that people need meaning to thrive. "Meaning" was defined as an orientation to something bigger than the self. Researchers measured meaning by asking questions like, "How often did you feel that you had something to contribute to society?" The more people endorsed these measures of "eudaimonic well-being" — or, simply put, virtue — the more meaning they felt in life. It turns out that meaning is a greater predictor of positive health than happiness. FNEPs are drawn to service in different ways: conservation, education, art, stewardship, and raising awesome kids. Having something bigger than ourselves to focus on is uplifting.

And just get outside. Besides studies on meaning, countless other studies reveal the health benefits of being outside. Hiking through beautiful landscapes engages all of our senses and encourages people to let go. So when we focus on nature and meaning, two things bigger than ourselves, and when we do it with other people, it's a spectacular and powerful combination.

How successful have our FNEP team-building efforts been? I am sure that the results have been mixed. Our good intentions, however, have paved the way to many enduring friendships over the years. The evidence is all over Facebook: the AA cohort sitting on a giant hay bale teddy bear, FNEPs on a canoe trip to the Boundary Waters together, announcements of marriages and babies, and posts congratulating job and education successes.

You may have heard about the Field Naturalist Symposium in May 2017. We hope you were there and saw some old friends. If you couldn't make it, perhaps you can reach out to your teammates. Please take stock of your current community. What kind of resilient communities are you working to build?

Alicia Daniel divides her time between teaching UVM courses on reading the landscape, working as a field naturalist for the City of Burlington at Parks, Recreation and Waterfront, and raising her daughters (although they are mostly grown). She now teaches the layer cake approach to citizens who are training to be Master Naturalists and who give back to Burlington through volunteer projects like addressing the unsustainable harvest of fiddlehead ferns.

FIELD WORK | CLASS OF 2017

Gabe Andrews

It's easy to find a sense of identity within the bounds of your town – through community meetings, town forests, or Saturday markets. A watershed doesn't normally attract the same sense of belonging. Water doesn't recognize town borders or county lines; its flow affects different places in the same way – especially during floods. Residents of the New Haven River Watershed are no strangers to the devastating effects of rising waters. Gabe's mission was to change the way we see ourselves in places affected by water's path through the land. He collected and mapped stories, assessed riverbanks and floodplains, and puzzled at municipal planning – all to enhance a sense of place in the New Haven River Watershed in western Vermont. Gabe organized school field trips and presented to town commissions, but storytelling was soul of his project. He interviewed life-long residents of Bristol, New Haven, and Lincoln, to record firsthand stories of floods, but also to understand what people value about the New Haven River. Along the way, Gabe found common narratives in each experience: riverside denizens are mindful of upstream and downstream relationships, flooding destroys things but brings people together, and to quote a resident, "We have all kinds of people that have all kinds of interests, but we all connect with each other in a special way, and it always comes back to the river, because the river is such an integral part of the community."

Sean Beckett

Somehow oysters have everything to do with railroads, lightbulbs glow because of Mount Mansfield's forests, and Merino sheep explain the African melons at the market. Our landscape is so layered, complex, and perplexingly interconnected that it's tough to make sense of. Yet weaving together these seemingly disparate features is key to connecting people to their landscape and to each other. Community health surges when residents share a deep and collective sense of place.

Last fall the PLACE (Place-based Landscape Analysis and Community Engagement) Program launched a community-wide celebration of natural and cultural history called Burlington Geographic. In this program series, we explored the curious and compelling expressions of Burlington's identity, trying to understand the clockwork that makes this city tick. We hosted evening presentations, field trips, high school classes, and professional development programs for educators on topics spanning geology to food, energy to ethnicity, all rooted in local place-based education and community engagement. Meanwhile, we worked with the Burlington Department of Parks, Recreation & Waterfront to conduct place-based landscape analyses of several little-known city parks. We compiled and showcased the histories, ecologies, and ethnographies of these urban forests to encourage neighbors to explore and share these local treasures.

We are now building on this momentum to position Burlington Geographic and its local partners as Vermont leaders in place-based learning, and as an international Center of Expertise in Education for Sustainable Development.

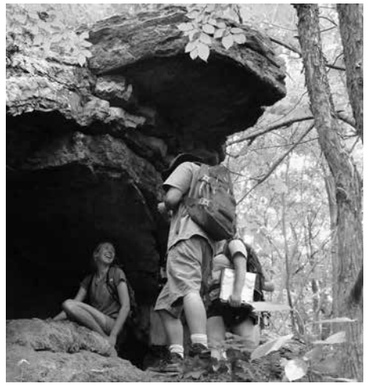
Lyra Brennan

Before mapping natural communities on thousands of acres of property, Lyra Brennan was warned about ticks, poison ivy, poison parsnip, rabid coyotes, quicksand swamp muck, rogue wolves, bear cubs, large snakes, territorial dogs, mosquitoes, and ghosts. She encountered approximately 75 percent of these threats, but was handsomely rewarded in return. Sponsored by the Agricultural and Natural Areas Committee (ANAC) of Monkton, Vermont, Lyra conducted an ecological assessment of the town's Pond Brook Watershed by visiting a diverse sampling of privately owned parcels and surveying the 300-acre town-owned wetland. The intensive parcelization of this watershed had limited ecologists' abilities to conduct a landscape-scale field assessment or determine significant natural resources within the area.

After gaining access to this landscape, Lyra found rare orchids nestled in northern cedar swamp hollows, chestnut oaks perched on dry ridge tops, and vivid oral historys from families with ancestors who moved to Monkton in the 1700s. Focusing on rare species, wildlife habitat, and state-significant natural communities, she generated maps and property reports that will support ANAC and future town conservation planning. Using photographs taken in the field, Lyra also created a Key Species Guide to share the species and stories of the watershed with the community.

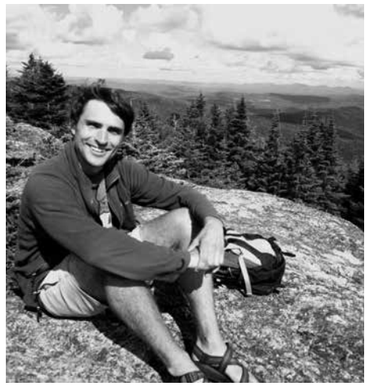
Sonia DeYoung

Blue Hill Farm in Chester, Vermont, hasn't been a farm since the early 1900s; instead, out-of-staters have summered there and admired the cows grazing in the fields they leased to other farmers. But the new owners plan to change that. Blue Hill will soon incubate new farming business models while protecting much of the forest that now covers four-fifths of the property. Last summer, Sonia traipsed through these 130 acres of woods and meadows, surveying breeding birds, mapping stone walls and streams, delineating natural communities, and researching past human land use. Her landscape inventory and assessment will guide the owners as they prepare their land to be plowed once again, conscious of what makes the place special. Down by the Williams River, a three-acre floodplain forest struck by Tropical Storm Irene remains a potentially rare example of its natural community type. A game camera lashed to a tree within sight of the farmhouse took 800 photos of wildlife over four months, including black bears, bobcats, fishers, coyotes, red foxes, and numerous other animals. In a nearby field, a pair of bobolinks made their nest – a living demonstration of the potential conflict between wildlife habitat and agriculture. The second part of Sonia's report makes recommendations on how, with the help of various Vermont land-use programs, the owners can reconcile their dream of farming with their commitment to protecting the land – an encouragingly attainable goal.



Ellen Gawarkiewicz

In 1938, Aldo Leopold delivered an address at the University of Missouri on "Natural History, The Forgotten Science." Leopold challenged the way science "relegated natural history to the dusty backroom at a time when society needed it most." Since Leopold's speech, field-based natural history studies have continued to wane as academics specialize and move from outside to online. During the summer, Ellen was sponsored by the Rubenstein School of Environment and Natural Resources to work towards reversing this trend by creating and piloting a curriculum for a University of Vermont undergraduate field naturalist summer program. Over eight weeks, four students explored wild places in Chittenden County and developed an array of lenses to read the landscape. The budding field naturalist team members applied their training to community service projects ranging from natural and cultural interpretation to invasive species management. The program allowed students to reflect on their enhanced attentiveness, slowness, humility, wonder, confidence, curiosity, and connection to place. Ellen used the summer experience to help guide a proposal for an undergraduate field naturalist concentration in natural resources. The goal is to reverse what Leopold criticized as "the lop-sidedness and sterility of biological education as a means of building citizens."

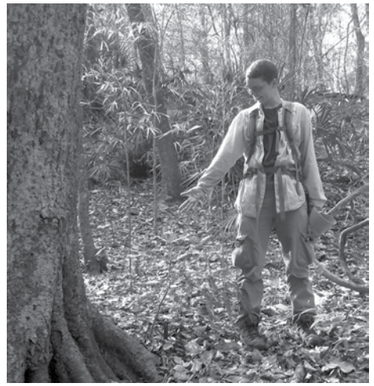


Jamie Ervin

Like many western North Carolinians, Jamie grew up with the misconception that most, if not all of our mountain forests had been logged at one time or another. Our region is known for having set the stage for the birth of American forestry, with Gifford Pinchot developing his discipline in the Great Balsam Mountains just outside of Asheville (now Pisgah National Forest). Evidence of logging is everywhere, from old railroad grades in the highest reaches of the mountains to paper mills still operating in towns like Canton and Sylva. Historical photographs of the mountain region from the early 1900s help sustain this misconception with depictions of barren hillsides stretching away from Asheville in every direction.

As it turns out, the Blue Ridge Mountains contain roughly 250,000 acres of unlogged forests, including several of the largest old growth remnants in the eastern U.S. Jamie worked with a regional conservation group called Mountaintrue to study these forests' structure using an active remote sensing tool called LiDAR (Light Detection and Ranging). Using LiDAR-derived models of forest canopy height, he created a method for remotely estimating the location of old growth Appalachian Cove Forests, a mid-elevation mesic forest community present throughout the southern and central Appalachians. Jamie's results will be useful to land managers seeking insight into the spatial characteristics of unlogged cove forests, and to others searching for pockets of structurally complex forests throughout the Southern Blue Ridge region.

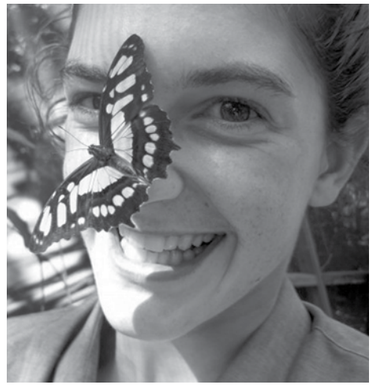
Drawing: Chelsea Clarke



Katherine Hale

Once abundant along the Apalachicola River in the Florida panhandle, the endemic Florida Torreya – a spiky, Christmas tree-like cousin to the yew – was decimated by a fungal disease that kept it from reproducing in native habitat. Now, the Torreya is getting a chance to be fruitful and multiply in a new seed orchard managed by the Sarah P. Duke Gardens in Durham, North Carolina. But where do you put 250 trees representing one of the rarest conifers in North America? And what do they need to be happy? After reading up on the literature, Katherine took a thousand-mile road trip across three states to examine *Torreya taxifolia* in the wild and interview the conservationists, propagators, horticulturalists, and citizen activists planting the trees across the southern Appalachians. On her return, Katherine analyzed potential sites in Durham to find the right spot for the trees to go into the ground in the fall of 2017. She designed the orchard to maximize plant health and seed production with a minimum of upkeep and maintenance for the garden staff, and wrote a management plan explaining the ecological reasoning behind the set-up. A Durham native, Katherine is reclaiming her roots here as these Torreya find roots of their own in a setting that re-creates as closely as possible the landscape they left behind.

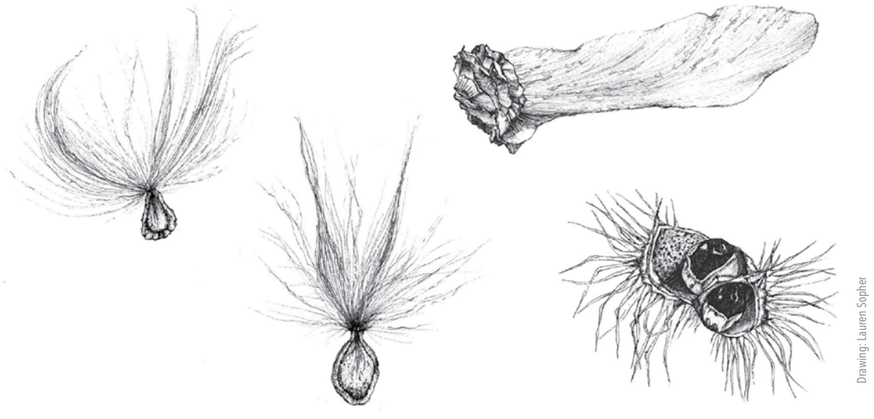
Drawing: Lauren Sopher



Hannah Phillips

Vermont's second largest timber holding is for sale. Flanking the remote summits of the northern Green Mountains, the Atlas Timberlands comprise nearly 26,000 acres of forest, which for the last 20 years have been owned by The Nature Conservancy (TNC) and the Vermont Land Trust (VLT). Originally acquired from the Atlas Plywood Corporation in an effort to understand the economic pinch-points of ecological forest management, VLT and TNC will now sell the lands to a new generation of land stewards.

But while the land will change hands, the ecologically important sites will remain protected by conservation easements. Hannah Phillips spent her summer traversing the Atlas lands in search of these sites. Along the way, she mapped bear-marked beech and bog orchids, creeping *Chrysosplenium* and forest seeps. This fall she produced detailed maps and comprehensive field reports of state-significant natural communities and wildlife habitat on nearly 17,000 acres of the Atlas lands. She has emerged from the project with an appreciation for the role our northern hardwood forest plays in sustaining Vermont's tradition of working lands – and with a fondness for black ash.



Drawing: Lauren Sopher

Julia Runcie

On December 28, 2016, a series of 5.6-magnitude earthquakes transformed the hydrology of Travertine Hot Springs Area of Critical Environmental Concern. These 160 acres of eastern California were the site of Julia's master's project, a collaboration with the Bureau of Land Management (BLM) to concentrate visitor use and protect fragile alkali meadow habitat. Julia and the BLM had designed a trail system, a series of interpretive signs, and a suite of infrastructure enhancements to mitigate the impacts of the site's tens of thousands of annual visitors. Now, with new springs appearing in the parking lot and the most popular hot tubs nearly dry, it seems impossible to predict how recreational use patterns will change.

Drawing: Lynn Wolfe

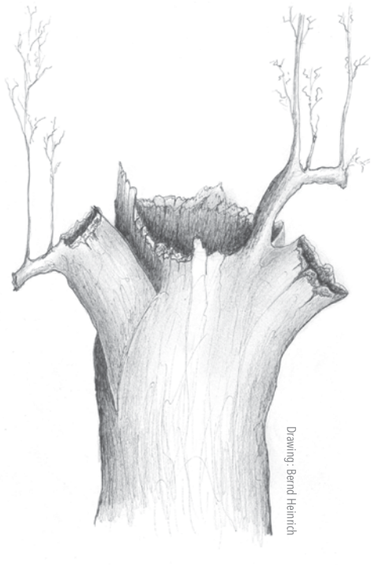
But of course, it's never possible to anticipate all the changes that lie in store for a natural area. Monitoring and adaptive management provide land managers with a means to respond to these changes as they occur. To that end, Julia developed a photo monitoring protocol that allows assessment of vegetation recovery and soil stability at key sites. By integrating photo points into interpretive signs along the designated trail, she hopes to encourage visitors to take and share their own monitoring photos. In addition to producing a wealth of data, visitor participation may inspire a new ethic of stewardship at the site. While they won't predict the next earthquake, these photos will provide an eloquent record of Travertine Hot Springs through time, and a sense for where we can best focus our efforts to protect it.

Anya Tyson

The raucous squawks of the Clark's nutcracker may not be musical, but they are capable of calling adventurers to action. Anya launched an innovative partnership with the National Outdoor Leadership School (NOLS) to engage young outdoor leaders as citizen scientists at high elevations in western Wyoming. The rugged whitebark pine and its charismatic avian seed-disperser, the Clark's nutcracker, starred in this effort: two keystone species facing the devastating effects of climate change and invasive species.

With face-to-face trainings and accordion performances, Anya taught wilderness instructors about the crucial link between Clark's nutcrackers and the imperiled whitebark pine. Over the course of month-long expeditions, instructors and their students explored the natural history of both species using Anya's custom-made identification guides and tiny iPod shuffles loaded with nutcracker song. These placed-based lessons came with a mission: each of us can contribute to conservation through our observations. Students stepped up to the challenge by conducting short surveys to detect nutcrackers and describe their surroundings. In turn, the data will fuel a critical warning system to reveal how nutcracker habitat use is changing in response to widespread forest decline.

Using the summer's successes and pitfalls, Anya intends to guide the field of citizen science deeper into the backcountry. With the Clark's Nutcracker Project as a case study, Anya's research on strategic project design will help other practitioners navigate the uneven terrain of new partnerships in citizen science. By encouraging collaboration with outdoor leadership organizations, Anya ultimately hopes to mobilize a new generation of conservation-literate adventurers.



Drawing: Bernd Heinrich

COHORT AH | CLASS OF 2018

Chelsea Clarke

Chelsea's journey to the Field Naturalist Program began when she encountered a red eft while backpacking in the Green Mountains. The thrill of this discovery led her to research efts, which took her on a detour to the FNEP website. From there, Chelsea set out on yet another journey to understand and interpret the natural world.

Chelsea initially chose to pursue her passions through art. After studying printmaking at Maine College of Art, she spent the past several years roaming the country working, adventuring, and searching for ways to use her artwork to spark red-eft-like moments of excitement and discovery for others. Her artwork fed off her experiences working on organic farms in Down East Maine, on wildlife tours on Prince William Sound, and in a silkscreen studio in Woods Hole.

In between meeting the red eft and arriving in Vermont, Chelsea joined a scientific research cruise off Alaska. At sea, she used art and writing to translate the beauty and importance of arctic plankton to audiences back on land. One goal was to make plankton a little more exciting and arctic preservation a little more urgent. Now she is anxious to fill in the gaps in knowledge left by her self-guided studies and continue to pursue this combination of art, science, conservation, and outreach. Chelsea's heart has always pointed north, so Vermont seems like the perfect place for her next adventure.

Maria Dunlavey

Maria grew up between two mountains on a stream called Hemlock Brook, down the road from the wood frog pond, and up the trail from the clay banks. Western Massachusetts is still the landscape she knows best, but she's found her bearings in a few others. As a geology student, she measured her way up mesas in New Mexico, mapped moraines in the Sangre de Cristo mountains, and led trips everywhere from the rim of the Grand Canyon to the floor of Death Valley. In the parched savanna of southern Kenya, she tracked a dying stream from spring to diverted spring and wondered how long its hornbills, bushbabies, and yellow-barked acacias might survive their human neighbors' struggle for a better life. As an environmental consultant in Seattle, Maria learned to view a place for its man-made story, combing through maps and old records in pursuit of polluted sites. In Montana, she searched for tiger beetles in the sandhills and pipits in the prairies, both the beneficiaries of another man-made story: that of deep-rooted ranching families and their care for the land.

Maria came to UVM to fill the gaps between these glimpses. Her passion is for the tangled tales of landscapes as a whole, in all their contradictory glory. On the trail of those stories, she'll wade into some of the thorniest questions in conservation: What is a landscape? Where does it come from, and how does it work – and what can a Field Naturalist do to conserve it?

Lauren Sopher

Ink and dirt have covered Lauren's hands since she was a child. Markers strewn at the kitchen table and wildflowers collected from fields were a classic pairing. Art and nature kindled her sense of wonder and connection to place. Lauren studied art, design, and environmental science at the University of Michigan so she could explore nature from multiple perspectives.

Lauren stumbled upon welwitschia, a peculiar plant endemic to the Namib Desert, while tracking black rhinos in Namibia. The landscape's plants reeked with opportunity for inquiry, catapulting her into a new chapter. With the Green Mountains beckoning, Lauren found a way to overlap her vocations in Vermont. In Burlington, she hovered over botanical books and dried plant specimens at The University of Vermont's Pringle Herbarium. In the Northeast Kingdom, Lauren developed Vermont Harvest of the Month, a statewide program connecting classrooms, cafeterias, and communities to local food. She wore many hats: illustrator, designer, writer, classroom teacher, gardener, and cook. Yearning to make personal relationships central to her workday, she changed professions. At the Howard Center, Lauren supported individuals with intellectual disabilities and autism spectrum disorders to access their community, build meaningful social connections, and maximize independence.

In the Field Naturalist Program, Lauren seeks to exchange place-based knowledge of the landscape with the general public, in formats that are accessible, creative, and collaborative. She will likely be singing while doing this.

Drawing: Lynn Wolfe

Lynn Wolfe

Growing up on the rocky Maine coast, Lynn often found herself knee-deep in tide pools and almost always covered in mud. While studying ecology, Lynn realized that she could build a career where it was acceptable to almost always be covered in mud. She's never turned back.

After graduating from college, Lynn hopped on her bicycle, ready to trade Maine's rock and pine for desert and cactus. Reaching the Pacific, she hung up her helmet and traded in her bike cleats for footing more suitable for tide-pooling. Lynn spent a season guiding school groups as they scampered along the rocks in search of moray eels. In Arizona's scorching heat, she planted cottonwoods along the shores of the shrinking Colorado River. In the floodplain forests of Vermont, trudging through streams, Lynn collected seeds and cuttings for plant propagation. Her willingness to crawl through thorn-covered shrubs was put to good use as she searched for the elusive New England cottontail along Maine's coast. Eventually, Lynn settled at Shelburne Farms on Lake Champlain's shores, where she raised vegetables, tapped maples, and developed a new sense of community. Her growing exposure to work in natural resources drove Lynn's urge to contribute to conservation.

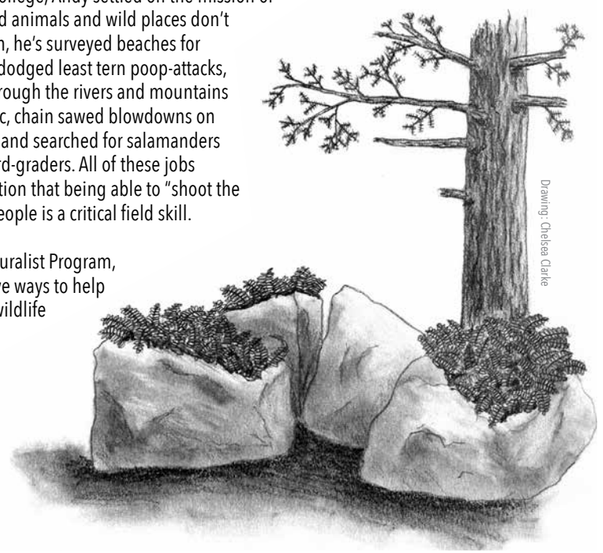
As a graduate student in the Ecological Planning Program, Lynn's got her hand lens and binoculars ready to examine the flora and fauna of Vermont. And if she gets a little muddy along the way, so be it.

Andy Wood

Andy has always been curious about animals, from the rowdy opossums living in his childhood bedroom ceiling to the flashy treetop warblers. With roots in Latin America and in New England, Andy's migrations stoked his curiosity for the amazing diversity of life across the planet. In his work today, Andy draws on that curiosity and global perspective to guide his thinking.

After leaving Bates College, Andy settled on the mission of making sure that wild animals and wild places don't disappear. Since then, he's surveyed beaches for piping plover nests, dodged least tern poop-attacks, guided teenagers through the rivers and mountains of Maine and Quebec, chain sawed blowdowns on backwoods ski trails, and searched for salamanders with enthusiastic third-graders. All of these jobs reinforced his conviction that being able to "shoot the breeze" with other people is a critical field skill.

Here in the Field Naturalist Program, Andy seeks innovative ways to help people understand wildlife and manage land so wildlife and people can thrive. In his spare time Andy likes to look for birds (and 'possums) in the backyard.



Drawing: Chelsea Clarke

Marcy Mahr

I-Team

Marcy Mahr is the stewardship coordinator for the Kootenay Conservation Program and the principal owner of EcoMosaic Environmental Consulting in British Columbia. She's a founding researcher of the Slocan Wetlands Assessment & Monitoring Project, and tracks western toads by headlamp to keep them off the road as part of an ecology and mortality project she co-developed with the Valhalla Wilderness Society. After graduating from the FN program, Marcy developed a conservation design for the Centennial Valley in Montana, worked as an ecologist with the U.S. Forest Service, defined habitat suitability for grizzly bear recovery in central Idaho, led Yellowstone to Yukon Conservation Initiative's science and conservation planning program, and served as a land protection specialist with the Flathead Land Trust.

Marcy lives with her family on a permaculture farm in BC's Slocan Valley with a small herd of dairy goats, who are botanically savvy contrary to popular belief that goats will eat anything.

In 2007, my family and I followed the path of transborder grizzlies and wolves: we dispersed from northern Montana, crossed the 49th parallel, and immigrated to the Kootenay region of southeast British Columbia. I'd be lying if I said I never looked back. I do look back, and frequently, because sometimes I feel there's a thread running through my life that only makes sense when I turn around and see that my choices actually link up rationally.

My love of Vermont developed while I was a student at Middlebury College and the Center for Northern Studies in Wolcott. My first full-time job was working for the Vermont Natural Resources Council (VNRC) from 1987 to 1991, during a time when Vermont was taking a hard look at how development could impact the future of its natural and working landscapes. During that time, I met Hub Vogelmann, who was advising VNRC on the ecological values of a wetland slated for a large mall and parking lot. His blue eyes sparkled as he talked about the needs of nature and how scientists need more "moxie" to share what they know and champion conservation. Hub was a big help in our case, and I was hooked by the idea of applying to the FN program.

It took me several years to articulate the power of Hub's hook and one of the greatest gifts of the FN program for me: a framework for how I could combine my scientific knowledge with my values and passion for conservation. It wasn't until the late 1990s when I started managing the science program of the Yellowstone to Yukon Conservation Initiative that I started calling myself a conservation biologist. I still feel deep comfort in knowing I can help define nature's needs through science and do something meaningful to protect species and ecosystems at risk.

Several FN nuggets have stuck with me through the years. I think "bedrock to buds" whenever conducting biological assessments of candidate conservation properties. Sometimes during long nights locating toads and GPSing their crossing locations on the highway, I remember "know your fish" and am reassured, "Okay, I'm knowing my toad." And there are those situations when I feel pleased when someone asks me, "So what? Why should I care?" because, thanks to Jeffrey, those are great questions that every FNEP should have answers for.

I think what has set the FNEP program apart since its beginning and what continues to carry it forth is honoring the call we feel to protect nature. I know that my professional contribution to conserving large landscapes is due to the support I felt in the FNEP program to have strong convictions backed by strong science — while keeping a sparkle in my eye.

Rosemary Mosco

Field Naturalist, Z-10 Class

Rosemary Mosco is a science communicator. She combines art, writing, and other media to connect people with the natural sciences. Rosemary has written for popular science publications, served as the marketing coordinator at Mass Audubon, and created acclaimed nature comics. She recently finished her first science graphic novel, to be published through First Second Books in 2019.

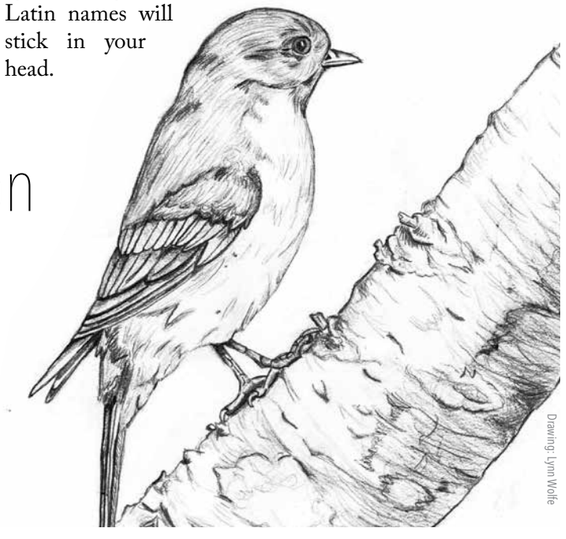
When I was young, I wanted to pursue both the arts and the sciences. I couldn't choose just one. I loved them both too much, and I sensed important connections between them. When I got my acceptance letter to the Field Naturalist Program in 2008, I felt the pieces falling into place.

As a FNEP, I honed my writing skills, met scientists who deeply appreciated the possibilities presented by the arts, and built the science foundations I needed to connect with researchers. I learned that it's key to simultaneously view the landscape through historical, sociological, and ecological lenses. I feverishly studied every piece, pattern, process, and Latin name, eager to take it all in. Vermont's natural beauty filled my soul.

The lessons I learned at the Field Naturalist Program underlie every part of my work. Through my comics and writing, I seek to reach general audiences while respecting and celebrating the science. Humor is a big part of my work; adding humor to science outreach can make it more appealing and relatable. In 2015, a museum turned my comics into an award-winning exhibit. I wanted to travel back in time and tell my younger self: yes, the art and science combination works! In 2016, I started working on my first graphic novel, *Solar Systems: Your Place in Space*. A second book is in the works.

Along the way, I've had strange opportunities I couldn't have predicted. I served as a judge for a festival of bad ad-hoc hypotheses, built a computer game about poison ivy identification, and designed a bacteria-themed field walk. The Field Naturalist Program taught me to dive into opportunities of all types. It also introduced me to friends whom I cherish: three FNEPs performed music at my wedding, and I keep in touch with many more.

Here's my advice for future FNEP alums: consider that life doesn't follow a predictable arc. Shortly after completing grad school, I dealt with a life-threatening illness. The timing seemed especially unfair since I was so ready to try new career paths. Now, several years later and healthy, I make sure to enjoy the now even as I work toward the future. Quiet moments with nature make all the difference. You'll be surprised by how many of those Latin names will stick in your head.



Drawing: Lynn Wolfe

FNEP Alumni Association

With more than 150 alumni and scores of collaborators, it is high time to formalize our impressive network of conservation leaders. The UVM Field Naturalist and Ecological Planning Alumni Association welcomes alumni, partners, friends, and regional conservation groups as members. **Learn more at fnepalumni.wordpress.com or contact us at uvm.fnep.program@gmail.com.**

Call for Proposals

The Field Naturalist and Ecological Planning (FNEP) programs seek to match graduate students with organizations working at the frontiers of conservation science. Our students investigate the natural world, find answers, and use their intensive training to solve real-world problems.

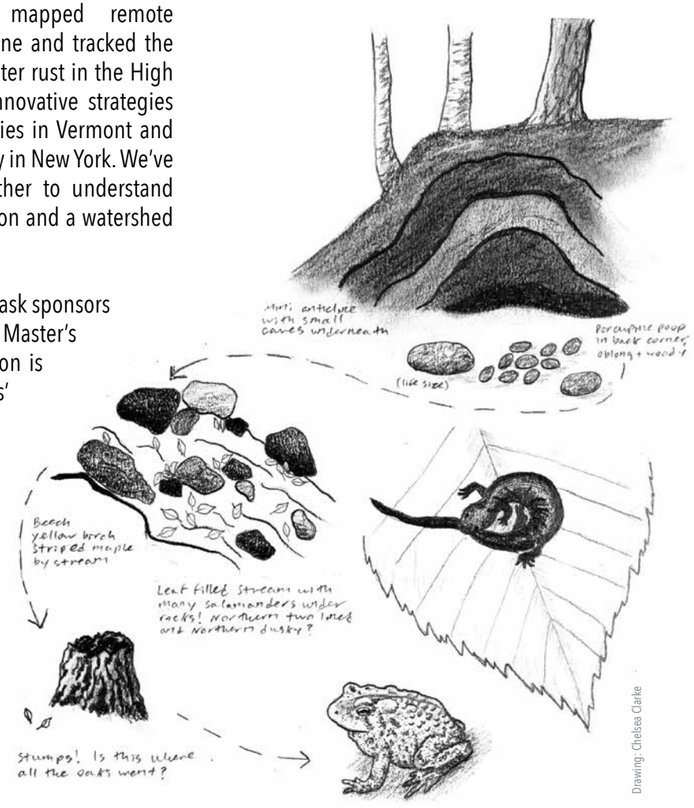
Our partnerships serve two core functions: First, we offer professional-level research and field work to non-profit organizations and government agencies at a fraction of market costs. Next, we blend academic excellence in the natural sciences with practical conservation on the ground.

FNEP researchers have mapped remote natural communities in Maine and tracked the expansion of white pine blister rust in the High Sierras. We've developed innovative strategies for controlling invasive species in Vermont and modeled wildlife connectivity in New York. We've brought communities together to understand and enhance a river in Oregon and a watershed in Puerto Rico.

In return for our services, we ask sponsors to contribute $5,000 to our Master's Project Fund. This contribution is used to help defray students' tuition expenses.

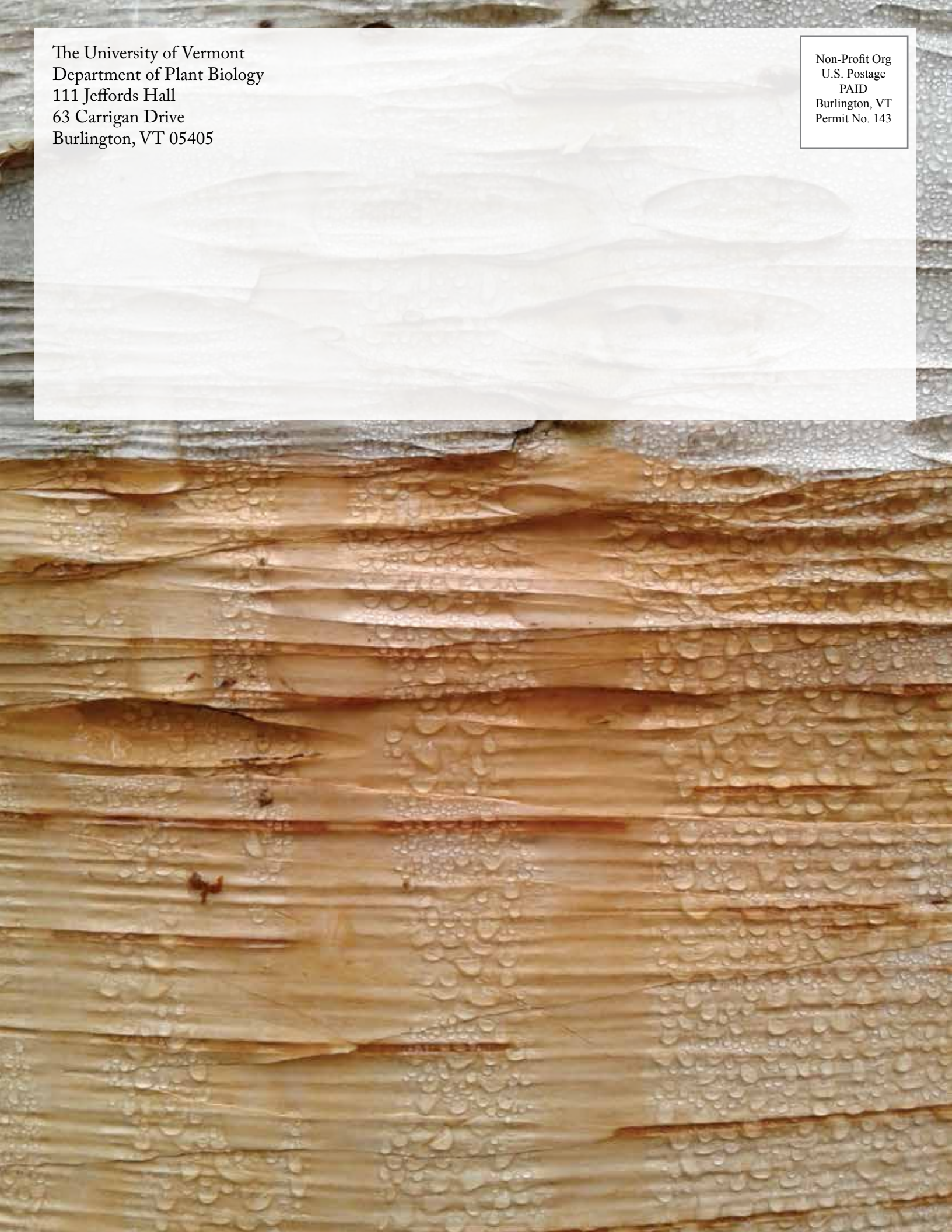
We now welcome project proposals for the coming year. We expect to link students with projects by January 2018, with planning and details wrapped up in time for the summer field season. Data analysis and report writing continue into the fall semester of 2018. Final products will be delivered to sponsors between December 2018 and May 2019.

If you are interested in having a field naturalist or ecological planner work with your organization, please contact Jeffrey Hughes at Jeffrey.Hughes@uvm.edu or 802-656-0708.



Drawing: Chelsea Clarke

Illustration: Rosemary Mosco



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