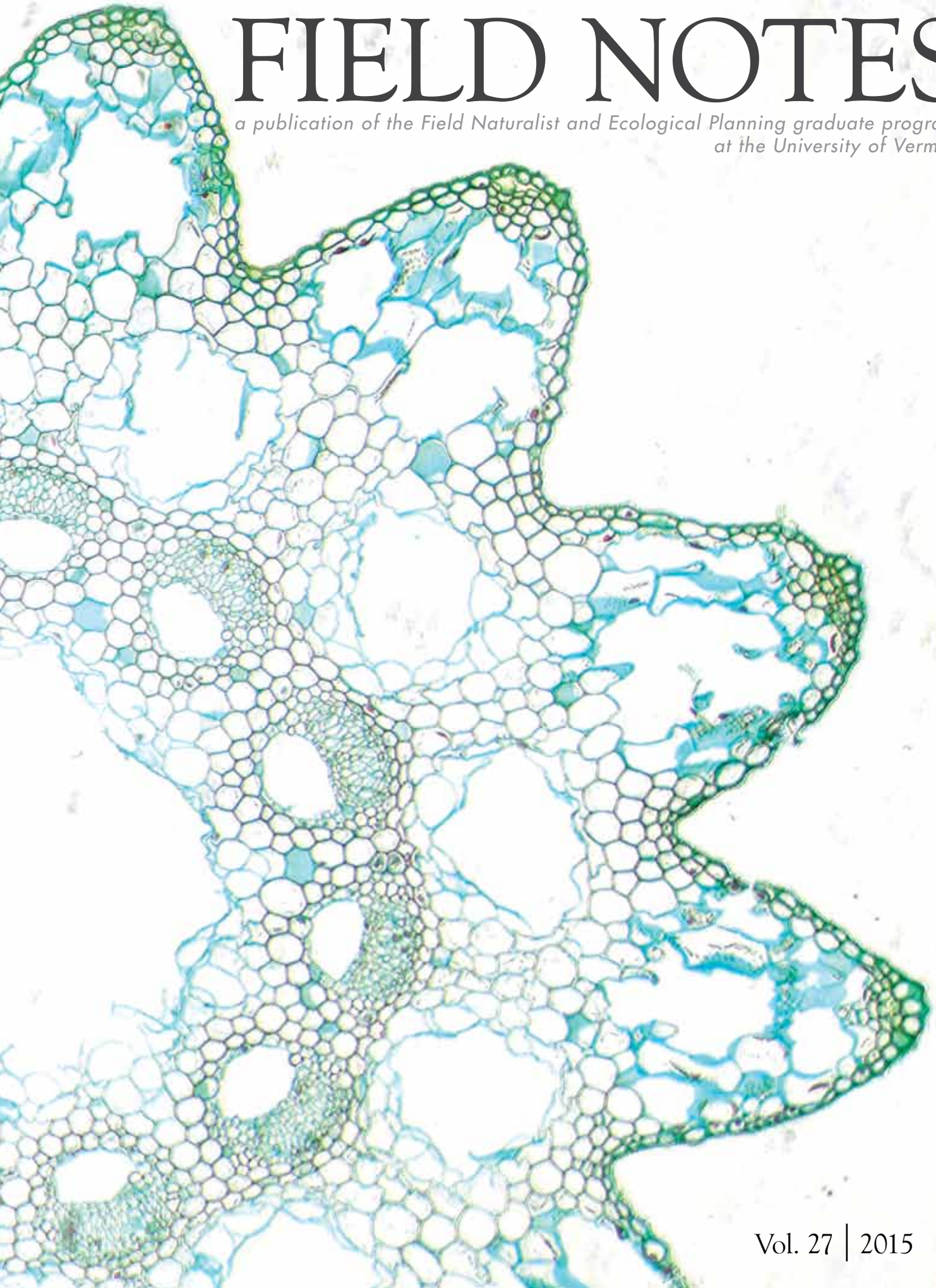
FIELD NOTES

a publication of the Field Naturalist and Ecological Planning graduate programs at the University of Vermont



Vol. 27 | 2015

2015

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Editor's Note

SONIA DEYOUNG

Nature is in peril. Biodiversity is plummeting. Species are going extinct 100 to 1000 times faster than normal.

How many times have you read an introduction beginning that way? It's depressing because it's true. The ensuing article or book usually offers plenty of advice on what actions we must take to stem the tide of extinction and climate change and how to convince the uninformed public to care about it. But what about us—conservationists who already care about the deterioration of the natural world as we know it and who struggle with it emotionally? How can we find solace?

Last fall I stumbled on Bill McKibben's *The End of Nature* in the library and read the last 30 pages right there in the stacks. One passage concludes with the words, "There is no future in loving nature." I found myself thinking after reading this line that it would be impossible to be happy ever again.

That feeling was unacceptable. So I emailed McKibben to ask him what he thought about that statement now, 26 years later.

"In philosophical terms, I think my point stands," he wrote back. "Many contend we now live in 'the Anthropocene.' One can't step outside without at some cellular level being aware that this is an increasingly human-dominated world. But that said, our job in part is to witness the beauty of what remains—to understand and care for it, because the world will never be more intact than it is right now. Witnessing is serious work, and [work] for which our species is well equipped. And the hope, perhaps, is that having done that witnessing faithfully we will be made strong in the fight to limit the damage."

I agree. But I can't help feeling that we should do more than just witness. We need the natural world to bring us joy, no matter what. How could any of us go on in this field if it didn't? This issue of *Field Notes* reflects on how we can continue to delight in nature even as we stare these sobering environmental issues in the face.

Each of these essays deals with the author's personal experience. We all find ways to cope, even rejoice. Some of us do it through our passions: photography, botany, ice fishing. A few essays suggest that the very fact of our degrading landscape makes what remains all the more precious—especially if that place happens to be our home. Other authors try to broaden our Anthropocene horizons by celebrating organisms that thrive in human civilization, organisms we often dismiss as commonplace or even bad. Still others find hope in the idea that despite overwhelming change, our actions do make a difference, whether they're as small as unplugging a charger or as monumental as deciding how many children to have.

Our department chair zooms out to the scale of evolutionary time, reminding us that changes in climate and episodes of extinction have occurred before and will occur again, regardless of cause. His essay helps me to remember that we are merely another species on the earth, and that after we're gone, nature—in whatever form—will carry on, as it has for the last three and a half billion years.

But while we're still here, let's take to heart the words of poet and environmentalist Gary Snyder: "A person with a clear heart and open mind can experience the wilderness anywhere on earth. It is a quality of one's own consciousness. The planet is a wild place and always will be." ♦

'THIS ISSUE OF *FIELD NOTES* REFLECTS ON HOW WE CAN CONTINUE TO DELIGHT IN NATURE EVEN AS WE STARE THESE SOBERING ENVIRONMENTAL ISSUES IN THE FACE.'

European starling illustration by Bernd Heinrich

From the Program Directors

DEANE WANG

In its Global Trends 2025 report, the National Intelligence Council warns of a "transformed world" that will provide both opportunities and challenges for humanity. This top U.S. intelligence organization has the mission to integrate intelligence information at the national and global scale in order to protect the country's security. In a globalizing economy—with population growth, water and food scarcity, climate change, peak oil, Middle East nuclear proliferation, and terrorism being the top concerns—the rising importance of the environment as a national security risk marks a dramatic change for environmental issues in national policy debates. In 2012, then-Defense Secretary Leon E. Panetta stated that "climate change has a dramatic impact on national security."

Humans have always been part of nature, but the relationship has changed such that our shared fate is even more inexorably linked. In order to avoid changes at the scale of the dinosaur extinctions, humans and nature must coevolve from their parasitic character into a more mutualistic relationship. Nature is now colored by the people who have become as integral to nature as mitochondria to a cell. While we can't kill the host, we can certainly damage its health—and thus our own.

In fact we are already changing. While biodiversity is declining (and must recover), genetic diversity is increasing. Breeder selection and now bioengineering have created new plant and animal life forms that "serve" the planet through oxygen production, carbon cycling, food web diversification, etc. Ecological design, restoration, and engineering continue to evolve new agro-ecosystems, urban forms, and open spaces. As we redesign and recycle waste streams and product flows, the earth's metabolism will continue to adjust and adapt, reaching a new equilibrium. Earth is a social-ecological system, and we are starting to understand how to play our part.

Can we learn how to play it fast enough? Formal education is a huge part of that learning process, and the curriculum of the University of Vermont is beginning to respond. The ever-evolving Field Naturalist and Ecological Planning programs seek to better prepare our students for this uncertain future by instilling a more "ecological intelligence" that fosters security through sustainability. ♦

JEFFREY HUGHES

Marsh-Billings-Rockefeller National Historical Park in southern Vermont holds a forest of towering spruce trees. Visiting this sheltered world of virgin giants is magical—a transformative experience that could never be matched by human artifice.

Who needs a stronger reason than the Marsh-Billings-Rockefeller forest to understand why we must protect our natural treasures? Who could deny that an old-growth forest is more special than a stand of planted trees?

As it turns out, lots of people. You might be one of them. The magical old-growth forest at Marsh-Billings isn't old-growth at all. It's not even natural. The trees, planted as seedlings in rows, are Norway spruce from across the Atlantic.

If conservationists, forest ecologists, and field naturalists are easily smitten by a phony forest (which we are), maybe "losing nature" isn't so catastrophic after all. Maybe we should follow the lead of landscape artists and worry less about preserving unadulterated versions of nature. Maybe we should rejoice in our ability to control the elements that we choose to include or exclude. After all, it's our experiences with a place that move us, not whether—after extensive scientific analysis—we determine that the place developed without human interference.

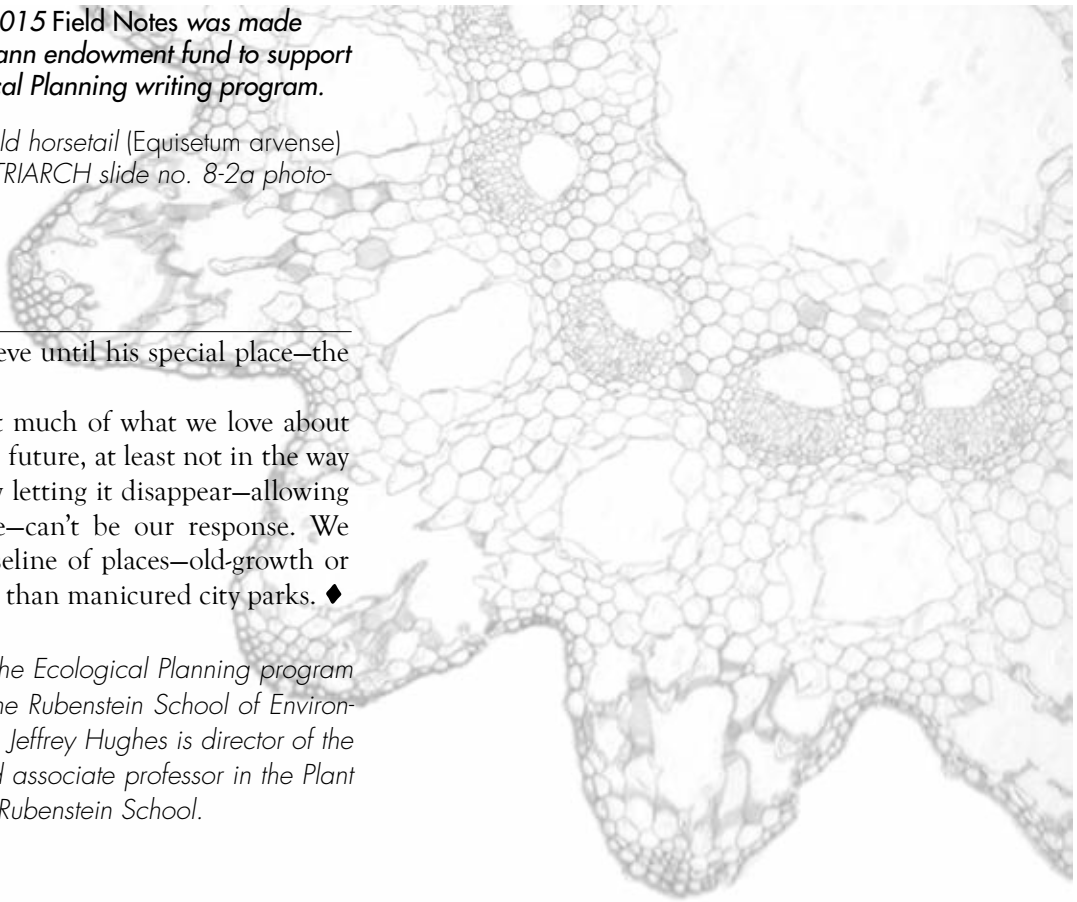
Imagine returning to your hometown to find that your favorite patch of woods is now a manicured city park. You'd feel a sense of loss, of course. Now fast-forward 30 years. Imagine that your kids, returning home after being away for a while, find that their favorite city park has been replaced by a sprawling Toyota dealership. Like you three decades earlier, they too would feel a genuine sense of loss.

If our sense of "specialness" about a place evolves as the world around us changes, why should we worry about today's natural places not being around tomorrow? Our grandkids won't miss what they don't know.

Do I buy into that? Dispassionate logic says I should, but I can't. My hang-up is "creeping incrementalism." I fear it. Loss of nature resets the baseline of a place, which is what happens when the backyard forest becomes a city park, or the city park becomes a car dealership. A person who grows up hanging out in the park doesn't miss the forest because it's not part of his consciousness. The city park is

This second printing of the 2015 Field Notes *was made possible by the Hub Vogelmann endowment fund to support the Field Naturalist/Ecological Planning writing program.*

At right and cover image: field horsetail (Equisetum arvense) *sterile stem in cross section. TRIARCH slide no. 8-2a photographed by Ben Lemmond.*



his baseline; he doesn't grieve until his special place—the park—ceases to be.

There's no denying that much of what we love about nature may not exist in the future, at least not in the way we're used to. But passively letting it disappear—allowing incremental loss of nature—can't be our response. We must fight to keep our baseline of places—old-growth or otherwise—as forests rather than manicured city parks. ♦

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IN THIS ISSUE

FEATURES

ET CETERA

Order Found, Lost, and Reclaimed: A Botanical Journey

by Jessie Griffen

This winter, I flew to Costa Rica, then rode a bus all over the country, chopping down plants in the name of botany. For three weeks, I followed my machete-wielding professor, Dave Barrington, in a herd of hand-lens-wielding students. We observed, drew, and meticulously recorded the genus, family, order, and clade of plant after plant. During our pre-departure meeting, Dave had asked us if we had prepared a strategy to cope with the sheer amount of knowledge he would impart to us during the trip. At the time I laughed, but each night in Costa Rica I felt exhausted, in the same way that I am when immersed in a foreign language—my head heavy from trying to connect new words to meaning.

Our basic plan of attack each day was the same. We walked until we found something interesting, usually not more than 10 feet at a time. Then Dave hacked off flowers, fruits, and leaves for us to examine. We rattled off the features we could see: connate corolla, bilateral symmetry, banner large, other four petals reduced, fruit a coiled legume, leaves odd pinnate.

Based on the combination of features, we guessed where the plant might fit in the puzzle of vascular plant diversity. We moved quickly from plant to plant, leaving behind a trail of discarded specimens. We jumped all over evolutionary history; plants are not concerned with arranging themselves in phylogenetic order for pedagogy's sake.

My field notebook was a mess by the end of each day—full of half-rotted specimens, misspelled scientific names, and smears of sweat and dirt. Each night, I relished restoring order to that chaos by placing each plant on the phylogenetic tree according to the elegant, logical theory of evolution. Slowly, the foreign names of clades and orders became a language I could read in patterns of features in the field.

Now, back in Vermont, I crave that cathartic routine of cleaning up my notebook and restoring order. I can find no equivalent structure underlying wildlife management or land conservation—no linear way to make sense of the information I learn and try to apply. My first reading from this semester exemplified the bewildering nature of applied science. It outlined principles for wildlife habitat protection, asking me to subscribe to certain inalienable truths of conservation: "Realize that all models are wrong, but some are useful. Be willing to use rules of thumb based on scientific findings that may someday prove to be false. Understand that complex environmental problems do not have a single, scientific solution founded on 'truth.'"

'MY FIELD NOTEBOOK WAS A MESS BY THE END OF EACH DAY—FULL OF HALF-ROTTED SPECIMENS, MISSPELLED SCIENTIFIC NAMES, AND SMEARS OF SWEAT AND DIRT.'

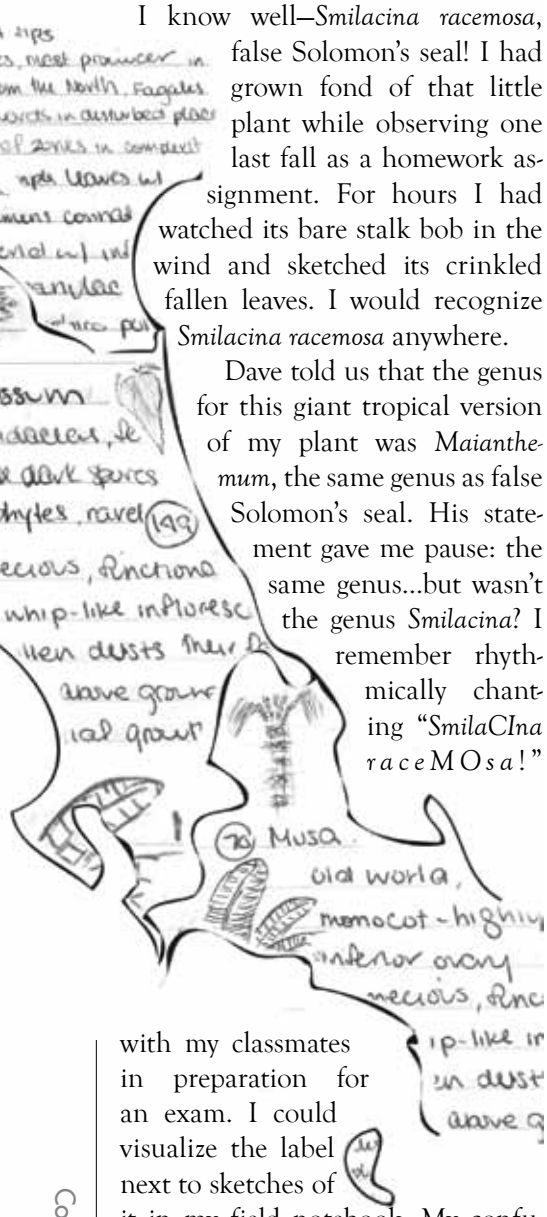
Instead of a phylogenetic tree, we draw spaghetti diagrams, spiraling off the whiteboard and into an abstract language I struggle to grasp. We weigh economics, politics, human values, biodiversity, and climate change with each management recommendation. My nightly routine of restoring order has transformed into a nightly routine of producing more questions than answers.

These days, when my head starts spinning from too many questions, I retreat to the campus greenhouse. I revel in the sunshine and warmth while I look for patterns in form among the lush array of tropical plants. I find comfort in recognizing a family or guessing where in the story of evolution a plant might fit, based on the arrangement of veins or petals. I linger at the bromeliads, marveling at all the ways they have adapted to live without soil on tree limbs in the cloud forest. I notice how perfectly their overlapping leaves channel and conserve water, and I examine the specialized cells that allow them to absorb water and nutrients directly through their leaves. The diversity of plants reminds me of the incredible resilience, adaptability, and order underlying life.

That same habit of searching for family patterns led me to an unsettling discovery on my first day in Costa Rica. In a country fabled for its biodiversity, the odds were ap-

Illustrations by Jessie Griffen

proximately one in 25,000 that I would instantly recognize one of the first plants we encountered. Yet there, half a world away from Vermont in the high-altitude oak forest, stood a giant version of a plant I know well—*Smilacina racemosa*, false Solomon's seal! I had grown fond of that little plant while observing one last fall as a homework assignment. For hours I had watched its bare stalk bob in the wind and sketched its crinkled fallen leaves. I would recognize *Smilacina racemosa* anywhere.



Dave told us that the genus for this giant tropical version of my plant was *Maianthemum*, the same genus as false Solomon's seal. His statement gave me pause: the same genus...but wasn't the genus *Smilacina*? I remember rhythmically chanting "*SmilaCIna raceMOsa*!" with my classmates in preparation for an exam. I could visualize the label next to sketches of it in my field notebook. My confusion deepened as Dave went on to say that *Maianthemum* belonged to the asparagus family. As I had learned it, this was a classic lily, with its parallel veins and three-parted flowers.

I suddenly remembered that Cathy Paris, our field botany professor in the fall, had taught us the lily family *in sensu lato*: "in the wider sense." She alluded to recent changes in plant classification based on new molecular evidence but protected us from excess confusion as we struggled to grasp the basics. Tacking on the Latin disclaimer, she focused on identifiable field characters and taught several recently reclassified plants as members of the lily family.

There, on my first day in Costa Rica, as I unlearned *Smilacina racemosa*, I began to feel unsettled. For hundreds of years, botanists have meticulously classified plants based on similarities in their anatomy. New molecular techniques call these classifications into question. How many of the family characters I am learning echo underlying evolutionary relationships, and how many are merely superficial similarities of form that will later be discredited by molecular evidence? More troubling still, will molecular evidence unravel the precious, tangible trace of order I see manifested in plants?

I have found some solace in scientific journals. Although a review in *Taxon* confirmed what I suspected from my first day in Costa Rica—evidence from molecular techniques has caused "several major overhauls of angiosperm classifications"—the authors assert that "many of the earlier suggestions for phylogenetic classification, based on morphological and anatomical studies, have been supported." Reviews in *Taxon* and *Systematic Botany* agreed that new methods could complement morphological studies to yield better resolution in phylogenetic trees.

Though the reviews validated the importance of morphology, they didn't address my concern directly enough to quell my unease. I sought my answer in an office with a picture on the door of a radiant, pink-flowering canopy tree. Despite the abundance of tropical plants, Dave seemed slightly out of his element there, wielding a computer instead of a machete in a clean, comfortable, bug-free space. But he lit up at the mention of Costa Rica. He put the molecular revolution in context by pointing out that it's just one of several major overhauls since Linnaeus. He has made peace with the shifting classifications because he believes that each shift represents a step closer to discerning the truth. With some trepidation, I asked him to what extent he thought molecular evidence would discredit field characters. To my relief he told me, "At the family level, most characters witness history." Once you try to trace evolution further back, the plants "hide their history" and you cannot rely on morphological characters alone to determine relationships.

'THERE, ON MY FIRST DAY IN COSTA RICA, AS I UNLEARNED *SMILACINA RACEMOSA*, I BEGAN TO FEEL UNSETTLED.'

My exploration of the degree of evolutionary truth underlying field characters has given me a new appreciation for the axiom that once irked me: "Realize that all models are wrong, but some are useful." In this regard, field botany is more similar to the tricky world of applied science than I had thought. Identifying plant families based on field characters can be helpful, even if the patterns do not always accurately reflect evolutionary relationships. Regardless of the recent reclassification of *Maianthemum*, I recognized the familiar genus thousands of miles away. I will undoubtedly have to relearn many patterns and names as botanists fine-tune the phylogeny of plants. But in Costa Rica, where no complete flora exists to key out unfamiliar species, field characters are essential to making sense of the overwhelming biodiversity. Instead of focusing on what's incomplete or inaccurate about our current knowledge, I am learning to be grateful for what's useful.

Costa Rica map graphic by Ben Lemmond

Nothing Is So Constant as Change

by David Barrington

Three very different plants, all of which are dear to me and which I first encountered in the North Country, inform my understanding of the natural world.

One is the alpine azalea (*Harrimanella hypnoides*). The first time I saw this plant was up above Tuckerman Ravine in the White Mountains, more than 40 years ago. We clambered up the steep trail, passing droves of skiers still plummeting down the slope of the cirque. At the top, in the bright light and calm of a June day, bloomed the azalea, with its soft, moss-like shoots and tiny, salmon-pink flowers.

HARRIMANELLA HYPNOIDES

The second plant I encountered on a now legendary 1984 trip to Mt. Albert, the great serpentine mountain in the heart of Quebec's Gaspé Peninsula, home to so many Arctic plants and its own caribou herd. Along the banks of the fabled Ruisseau du Diable, which empties the mountain's great interior ravine complex, I first encountered the club spikemoss (*Selaginella selaginoides*). Looking like it can't quite make up its mind whether to be a clubmoss or a spikemoss, this *Selaginella* is a denizen of springs and seeps across the far north.

The third plant, the northern white mountain-avens (*Dryas integrifolia*), I had wanted to find for years. Not until we were out in the Alaskan tundra two years ago, deep in Denali National Park, did I lay eyes on these low-growing, primrose-like Arctic roses for the first time. Seeing *Dryas*, so emblematic of the flora of the High Arctic that the brief reversal of global warming at the end of the Pleistocene is called the "lower Dryas," was a huge treat.

'SO WHAT DO THESE THREE PLANTS HAVE IN COMMON?'

SELAGINELLA SELAGINOIDES

So what do these three plants have in common? They have all been found in Vermont—not as living plants, but as fossils from the beginning of the Holocene, 10,000 years ago. As the climate warmed with the melting of the glaciers, these cold-climate characters, among many others, moved into the newly open lands across Vermont to establish tundra communities like those in the far north today. With continued warming, the plants now in our forests arrived one by one from refugia on the southeastern coastal plain and in the Mississippi Valley. My trio of favorites continued their northern migration, eventually abandoning Vermont altogether.

The reality is that the flora, and thus the fauna, of our state is constantly changing. Yes, there has recently been a great deal of extinction—genuine loss of diversity—across the globe. But migration, yielding relentless loss (and gain) of biodiversity here in Vermont and abroad, is a different matter altogether: it has been the normal course of affairs throughout the entire history of our planet. We need to accept local extinction by climate change as ordinary, so that we can focus on global extinction—true reduction in total diversity—and its causes. ♦

DRYAS INTEGRIFOLIA

David Barrington is the chair of the Plant Biology department at UVM.

Illustrations by Shelby Perry

On Math, Faith, and Drinking Straws

by Emma Stuhl

"TAKE THE FIRST STEP IN FAITH. YOU DON'T HAVE TO SEE THE WHOLE STAIRCASE—JUST TAKE THE FIRST STEP."

—DR. MARTIN LUTHER KING JR.

When I was a senior in high school, math subversively changed my life. In my environmental science class, we used math to figure out the cumulative effects of small, common behaviors in the United States. The numbers were powerful: If the country stopped using drinking straws, we'd save how much energy? How much less waste would go into landfills? How many fewer eighteen-wheelers would transport that waste? How much less exhaust would be released into the atmosphere? How many fewer asthma attacks would plague low-income neighborhoods each year? Even when our answers were imprecise, the math drove me to action, elucidating the chain reactions of our planet. It made me feel like I was a contributing member of society—that I was part of the problem and could be part of the solution.

Take one common example: The United States Department of Energy estimates that most households in America waste $130 worth of electricity every year powering electronics while they are turned off. Most modern appliances are "vampires," drawing energy whenever they're plugged in, whether we're using them or not. Add this up for the entire country, and we are wasting $4 billion worth of electricity each year. That is a lot of fracked land, burned coal, and dammed rivers. No matter where that electricity comes from, its production has cascading ecological and social repercussions. In this math puzzle, I don't know exactly how the wasted electricity causes exactly what damage, but I do know that I am going to unplug all of my electronics as often as I can. If we can build this habit as a household, region, or nation, then it will really add up. This easy action cheers me on, since I know it will only help.

TOP IMAGE DEPICTS **1.14 MILLION** BROWN PAPER SUPERMARKET BAGS, THE NUMBER USED IN THE US **EVERY HOUR.**

Paper Bags *(2007) by Chris Jordan, actual size 60x80". From the series* Running the Numbers, *used with the artist's permission.*

Some people argue that small actions don't make enough of a difference, that collectively they are trivial when stacked against global warming, the biodiversity crisis, or even one airplane flight. While I agree that we need large-scale policy changes to address global and regional issues, the magnitude of one problem should not invalidate the actions that tackle another. If we use fewer straws and thus improve air quality, someone will breathe more easily. Eliminating even one asthma attack matters: for the individual, for her family, and for their medical bills. People feel these impacts, whether they are global or local. Often they feel the local impacts more.

Let's consider a classic Vermont example: local, sustainably grown food. According to Steven Hopp in *Animal, Vegetable, Miracle*, a book he co-authored with Barbara Kingsolver, it takes an average of 400 gallons of oil to feed a North American for a year. The trip from the farm to the plate uses most of the oil, and some agricultural practices use more fossil fuels than others. Given these different carbon footprints, Hopp argues that if every U.S. citizen ate a single organic, locally produced meal just once, the country would reduce its oil use by 46 million gallons. If everyone did this once a week for a year, we would save over 2.4 billion gallons of oil. Think about it for a minute. That's equivalent to keeping 18.3 million tons of carbon dioxide out of the atmosphere, the same as the annual emissions from 3.9 million cars—just by purchasing some different food. It's so simple that it feels empowering. That's one meal, and it doesn't have to be complicated.

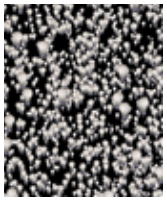
Light Bulbs *(2008) by Chris Jordan, actual size 72x96".*

The power of collective action has now entered the national conversation, backed by more than high-school-level math. *The New York Times* recently published an article entitled "How Idealism, Expressed in Concrete Steps, Can Fight Climate Change," which describes the rise of economic theories that show how small actions are critical to slowing climate change. Inspired by the fact that half the commuters in Copenhagen travel by bicycle, Harvard economist Martin L. Weitzman and Gernot Wagner of the Environmental Defense Fund say leaders should be "asking people to volunteer to save our climate by taking many small, individual actions." And they are. Elinor Ostrom, who won a Nobel Prize in economics in 2009, called for people to slow global warming at every scale, including at the individual level. Yale economist William D. Nordhaus promotes the creation of "climate clubs," international diplomacy efforts that create incentives for individuals to reduce climate emissions. Economists have confirmed that our choices do add up and that communities such as Copenhagen drastically reduce emissions by bicycling, one day at a time.

So what keeps me going when the strife and degradation of the world are staring me in the face? Partly, it is faith—faith that comes from the math I did in high school, which others continue to explore. This math led me to trust that our small actions do add up and that we can make a difference. Some days, I have to distance myself mentally from the tragedies of our times. But other days, I have a little faith and drink straight from the glass. ♦

To learn more about Chris Jordan and the Running the Numbers *series, visit www.chrisjordan.com*

TOP IMAGE DEPICTS **320,000** LIGHT BULBS, THE NUMBER OF KILOWATT HOURS OF ELEC-



TRICITY WASTED IN THE UNITED STATES **EVERY MINUTE** FROM INEFFICIENT RESIDENTIAL

ELECTRICITY USAGE (INEFFICIENT WIRING, COMPUTERS IN SLEEP MODE, ETC.).

Love Your Enemies (and Spare No Arrows)

by Sonia DeYoung

In my second week of work at a wildlife refuge in south Florida, my boss handed me a .22-caliber rifle. "You know how to shoot a gun, right?" he said. "Just load the bullets here and aim between the eyes, at the back of the neck."

Standing on the empty beach, I recalled those scant instructions as my wobbly hands tried to line up the bead in the sight. At the other end of the barrel, a young raccoon cowered inside a trap. I had fired a gun once in my life, five years earlier, at a paper target taped to a cardboard box.

I'd been warned that one of my internship responsibilities would be to "dispatch" raccoons that preyed on endangered sea turtle eggs. Though native to the region, raccoons are nonetheless an invasive species on the Gulf Shore islands. They have boomed along with humans and threaten other species, just like the more familiar non-natives that have invaded Florida more severely than any other state in the country. Without annual culls, raccoons gobble up almost all the eggs laid in the sand by loggerhead and green sea turtles.

Raccoons, with their spindly legs and beguiling masks, have always been one of my favorite animals. I grew up in a suburb where a nighttime glimpse of a raccoon waddling across the backyard felt like a brush with the wild. Raised in a family that abhorred guns and hunting, I feared that shooting one would be the most traumatic thing I'd ever had to do.

As I pushed the rifle through the bars, the raccoon backed away until her hind legs began to climb up the back of the cage. I fired a shot. *Pop!*

The raccoon did not move; the only sign that I had shot her was a small red hole between her eyes. With a dazed expression she turned her head and stared off to the right, as though still able to wonder blankly about an escape route. I fired a second, third, and fourth shot. I remember reloading in a cold panic for a fifth shot at a bloody, gurgling, breathing mass lying on the floor of the trap. Finally, she died. I managed to hold it together for the rest of the morning.

By the afternoon I was a wreck. No way could I ever bring myself to shoot another raccoon, I thought. But I did. In fact, I killed plenty more. Once I learned how to dispatch them instantly with one shot, my horror and guilt lifted.

Killing raccoons was the most concretely valuable service I performed at that refuge. After the culling program began, the number of predated turtle nests dropped from 90 percent to under 15 percent. Meanwhile, I continued to delight in the raccoons I spotted swaggering around headquarters or peering out from inside a hollow tree. I will always adore raccoons.

Invasive species—native and non-native—change ecosystems in ways we don't like. The Everglades' dismantled hydrology has allowed Florida's iconic, native cabbage palms to transform open pine flatwoods into dense jungle. Here in Vermont, native cormorants have overrun Lake Champlain and reduced several lush islands to barren piles of rock and guano. Non-native Japanese knotweed and purple loosestrife choke riverbanks. European starlings and house sparrows—the latter is now the most widespread bird in the world—drive bluebirds from their nests.

Not surprisingly, this track record has led many conservationists to loathe invasives. In my first experience with invasive control, girdling Australian pines, our project leader told us he hated seeing these trees more than litter. I understood how he felt. Litter you can pick up and throw in the garbage when you get home. To the untrained eye, invasive plants and animals blend in, deceptively innocuous features of the landscape. But actually they crowd out other species, and trying to control them is all but futile.

Native invasive species are easier

'BY THE AFTERNOON I WAS A WRECK. NO WAY COULD I EVER BRING MYSELF TO SHOOT ANOTHER RACCOON, I THOUGHT. BUT I DID.'

Raccoon illustration by the author

to accept than non-native invasives. They seem to have more of a claim on the resources they share with other native species. But most ecologists understand that it is a species' potential to damage ecosystems that matters, not its native or non-native status. Most arrivals from overseas find the climate inhospitable and die immediately. Those that can survive here usually establish limited, relatively harmless populations that simply aren't worth bothering about. Only around 10 percent actually invade our ecosystems, and not even all of those threaten the survival of other species.

Ecologist Mark A. Davis points this out in his definitive—yet provocative—2009 book *Invasion Biology*. He heads a controversial faction of ecologists urging the North American conservation community to adopt the new "LTL" method of control for those non-natives that are changing, but not necessarily destroying, our ecosystems: Learn to Love 'Em. "For some readers," he writes, "this may require a mind shift beyond what is possible at this point. If you can't Learn To Love 'Em, then perhaps you can Learn To Like 'Em, or at the very least you can try to Learn To Live with 'Em." Given their increasing prevalence, Davis argues, hatred of non-natives will only frustrate and disappoint us.

Scientific research corroborates this point. A 2014 study from the University of Massachusetts at Amherst suggests that non-native species are now more widely distributed in the United States than natives. We should not imagine that we are going to successfully reverse this trend, at least not anywhere except in heavily managed, restricted areas. Even if it were possible to rid our land of non-natives, that money would be far better spent on other projects, like large-scale habitat conservation.

But let's put aside our ecological concerns for a minute. Davis's "LTL" advice, though it may be a mind-bender for some, nevertheless falls short of the advice we really need to follow in order to preserve our emotional relationship with nature. Even as we continue our efforts to stop invasion by harmful species, we must learn to love not only the benign non-natives, but also those invasives that have transformed our riverbanks and islands beyond recognition.

There is nothing to be gained by hating these organisms. Instead, we should breathe deeply the perfume of Japanese knotweed and admire the extravagant color of a wetland blooming with purple loosestrife—and then rip up these plants by the roots. We should marvel at a cormorant's deep-water dives but oil its eggs if we need to. We should thrill at the moxie and motion of a flock of starlings overhead even as we tear their nests from our birdhouses.

This strange cognitive dissonance of love and extermination is a new requirement of our current ecological age. We know that invasive species are here to stay. So if we refuse to love them, if we refuse to let them inspire in us the same wonder and joy that other plants and animals do, our endpoint is a world where the majority of nature depresses us. I can't imagine a worse fate than that.

Senegalese conservationist Baba Dioum famously said, "In the end we will conserve only what we love; we will love only what we understand; and we will understand only what we are taught." Invasion biology throws this axiom into a tailspin. When we understand what some invasives are doing to our ecosystems, our reaction, naturally enough, is to hate them. Indeed, that is what the general public is taught: that invasive species, especially non-native ones, are evil, insidious interlopers that must be destroyed. Where does that leave us in the future, surrounded by mostly invasives, disgusted by beautiful purple flowers and iridescent feathers? We must teach ourselves to love all species so we can rejoice in whatever nature we are lucky enough to find around us. But it's not that simple: we cannot then turn that love into a desire to conserve, for we understand the science of invasives well enough to know that they can be dangerous to the health of our ecosystems.

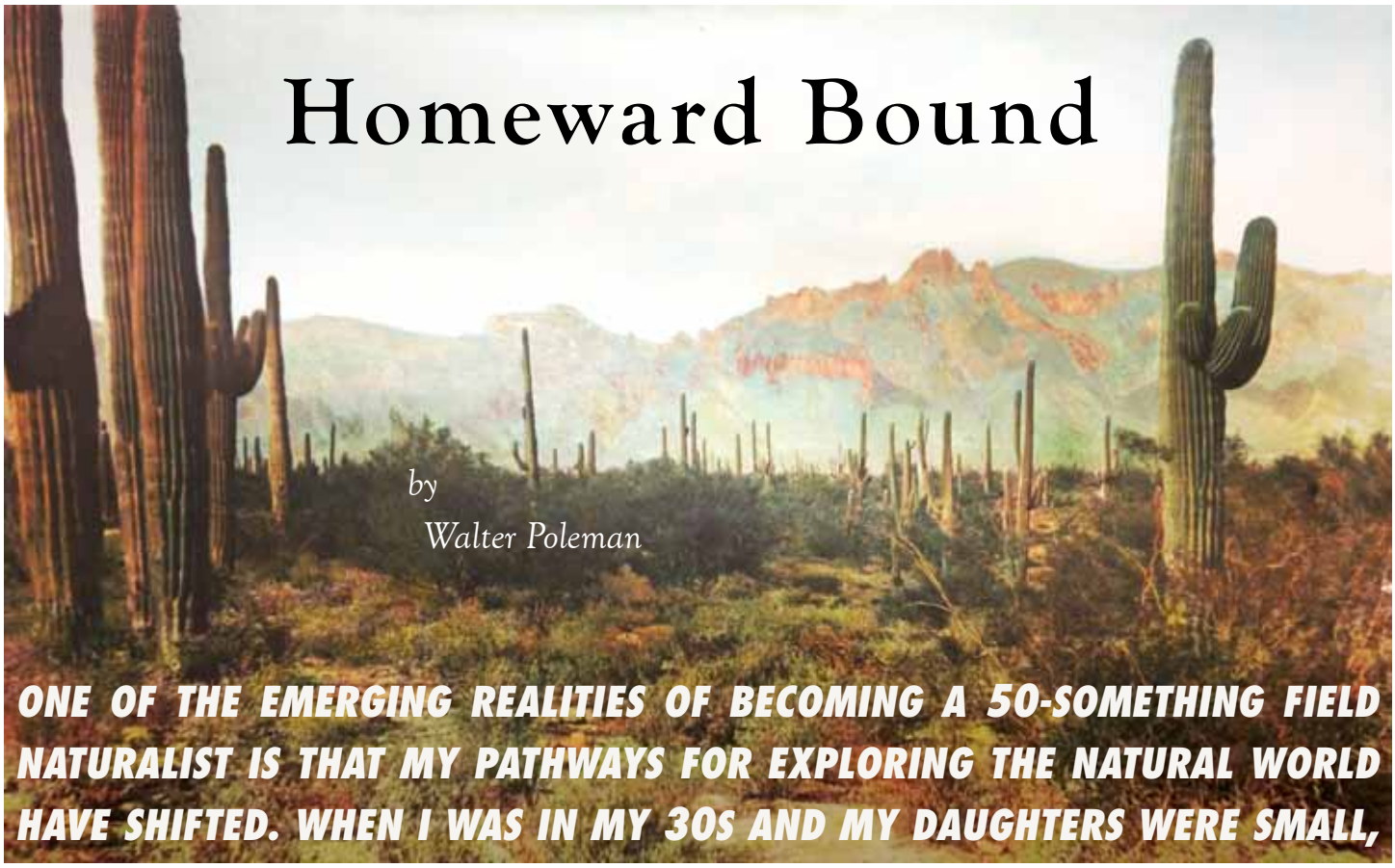
I've been asked in job interviews about the hardest thing I've ever had to do for work; I always use shooting raccoons as my answer. A friend of mine once jokingly suggested I respond, "Murdering something I loved"—and it would not be a lie. It will be even harder to learn to love what I must murder. Still, I'm going to give it a try.

Next time you are out walking and see one of those ubiquitous house sparrows, stop and watch it for a minute. Watch it take a dust bath or eat a crumb. Admire the male's striking plumage: his black bib, white collar, and chestnut cape. His song is plain, yet somehow endearing. He is industrious in his efforts to secure a mate and provide a home for his chicks. He is a living creature like any other, and we must love him without reservation, as we love chickadees and song sparrows and even bluebirds. Yet, when we have to, we must also be willing to steady our hands, line up the sights, and pull the trigger. ♦

House sparrow illustrations by Shelby Perry

'THERE IS NOTHING TO BE GAINED BY HATING THESE ORGANISMS.'

Homeward Bound



by
Walter Poleman

ONE OF THE EMERGING REALITIES OF BECOMING A 50-SOMETHING FIELD NATURALIST IS THAT MY PATHWAYS FOR EXPLORING THE NATURAL WORLD HAVE SHIFTED. WHEN I WAS IN MY 30S AND MY DAUGHTERS WERE SMALL, my most meaningful moments of nature connection came when I led them on adventures—learning to swim in the Huntington River, searching for porcupine quills in the cliffs behind our house—and explored the world through their eyes. Twenty years later, I now find myself connecting to the landscape through the eyes and experiences of my parents. As they advance in age, they can no longer easily navigate the world on their own. Just as I once facilitated my children's explorations, I now do the same for my parents. And it is the landscapes of their childhoods that are calling them. Even as their vision fades, their yearning for the places with which they first connected intensifies.

This became clear to me when I escorted my mother on a pilgrimage to the Sonoran desert of southern Arizona, where she was born 83 years ago but had not set foot in 75 years. We managed to find the location of her first home on the eastern flank of Tumamoc Hill, the site of the desert biological laboratory where my grandfather worked as a plant ecologist during the Great Depression. Though houses and shopping malls have overtaken much of the desert west of Tucson, the hill itself has been conserved, and my mother rejoiced at the sight of hundreds of saguaro cacti that still dotted the landscape. Since the majestic *Carnegiea gigantea* can live to be 150 to 200 years old, it's possible that she was getting reacquainted with the same individuals she had first met as a child. As we traversed Arizona's varied terrain in our rented black Chrysler, the venerable saguaro, with its occasionally comical human-like forms, became our companion. Its absence told us we had gained too much elevation, and its reappearance served as a welcome sign that we were once again re-entering my mother's home range.

We had originally planned to undertake this Southwest adventure a year earlier, but my father's cancer diagnosis in February 2014 put everything on hold. I spent that spring migrating back and forth between northern Vermont and western North Carolina, the place my father had chosen to retire because of a love he had developed for the mountains there when he was a boy going to overnight camp. He made clear during his final months, however, that he wanted his final resting place to be his beloved Lake Charlevoix near the family summer home in northern Michigan. So the day after his June memorial service, I drove with his ashes to the Greenville Airport,

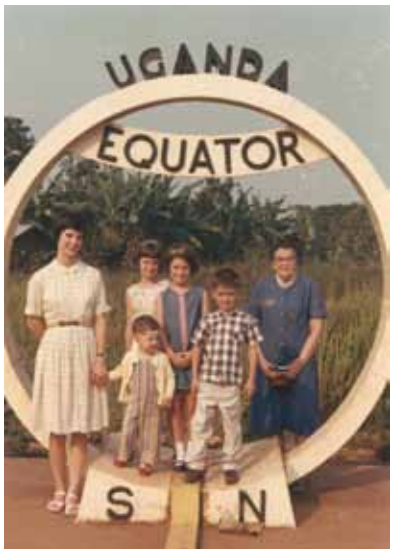
Sonoran desert photograph (above) by the author's grandfather, 1936. At right, the author's mother, Charlotte, in 2015.

THE TSA OFFICER STOPPED THE CONVEYER BELT AND DISAPPEARED FOR A MINUTE, EVENTUALLY RETURNING WITH A RED VELVET CUSHION ON WHICH HE CAREFULLY PLACED THE BOX CONTAINING MY FATHER'S ASHES.

where we went through security together. The Thanksgiving before, I had offered to drive him north to the family reunion in Charlevoix, and I smiled to think that we were making the journey after all. As I removed my belt and shoes, the TSA officer stopped the conveyer belt and disappeared for a minute, eventually returning with a red velvet cushion on which he carefully placed the box containing my father's ashes. "I'm so sorry about your daddy," he said in a rich southern accent as the box passed through the x-ray. Tears finally came.

The next day, with my cousins circling in kayaks and my aunt sitting next to me in the wooden motorboat built the year of his birth, I scattered my father's ashes into the familiar waters of Lake Charlevoix as a ceremonial balloon lifted his spirit into the air.

An agricultural economist with an abiding interest in world hunger issues, my father had travelled extensively in his lifetime—sometimes taking the whole family with him. During his sabbatical from Cornell in 1967, all six of us relocated from Ithaca to Uganda while he studied East African food systems. He made time to take us on incredible safaris, and it was no wonder that the African elephant became our official family totem. (We returned with a portrait entitled "Wise Old Elephant," which has always hung in a place of honor in each of our subsequent homes.) Though I was only six, I remember vividly three particular encounters: viewing a nearby herd through binoculars from the open roof of a Land Rover, driving through a thunderous elephant crossing in the



The author (in plaid) with his family in Uganda, 1967

middle of the night, and watching my father attend to a dying elephant, recently poached of its tusks, that we discovered lying on the banks of the Nile. This summer my siblings and I plan to return to Uganda after almost 50 years to honor my father's life by working in rural villages on water-purification projects and raising money for elephant conservation.

As formative as my childhood experiences in Africa were in my life's journey, I am already feeling the steady gravitational pull of a landscape much less exotic: the Finger Lakes of central New York, where I grew up. The dairy farms and the blooming forsythia, the small towns and the deeply dissected gorges of shale, the sycamores and the wild turkeys—they beckon. I have had the privilege of exploring many amazing places on this planet, and I feel blessed to have been raised in a place that I want to rediscover; I recognize that not everyone is so lucky. My emerging plan is to move back to Ithaca when I retire and engage with the community in an investigation of the local landscape and its stories. Though I don't expect that things will be exactly the same as they were when I was a young Ithaca resident, I relish the opportunity to discover fragments of my past, make new connections, heal old wounds, and re-inhabit a still-familiar town. After all, it is my home. ♦

Walter Poleman '96 teaches landscape natural history at UVM. His work focuses on community engagement with the land.

Songs of the Winsome Opossum

by Glenn Etter

Last fall, not long after I moved to Vermont with my family, an unexpected visitor arrived at our house: a possum. Technically a Virginia opossum (*Didelphis virginiana*), the small creature most often arrived at dusk, waddling its way towards the compost bucket we kept outside our glass kitchen door.

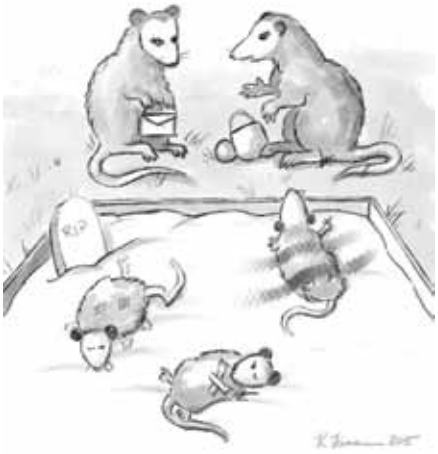
For several days, we were quite enchanted with our new neighbor. "It's the possum!" one of us would shout as it arrived, and we would gather wide-eyed, like parents outside an incubator, to watch it through the glass. True, it looked slightly alien with its patchy white fur, its pointy snout, and its disturbingly naked tail. But it was also cute—particularly when it stopped nibbling on apple peels and moldy potatoes to cock its head and stare at its reflection in the door. "It's funny!" concluded Finn, my four-year-old son, who soon came to regard the opossum as another wonder of Vermont, alongside moose, maple sugar, icicles, and hockey pucks.

However, one night as I crossed the deck lost in thought, I almost stepped on the feeding opossum. In a whirlwind of alarm, it bared its teeth, raised its naked tail, squealed, and roared like a werewolf before scuttling around the corner. I may also have jumped and squealed, although I will not mention that here. My realization that our new "friend" was also a wild animal was not particularly profound—one shared, perhaps, by anyone who has been bitten by a monkey. Still, it was not soothing when I learned, later that night, that the opossum sports 50 teeth ("the most of any North American mammal") and that opossum bites often become "seriously infected."

Illustration by Kelly Finan '14, kellyfinan.com

The encounter split my emotional bond with the opossum. Was the creature an adorable pet substitute? Or was it instead a ghostly, half-demented varmint? Surely a more nuanced understanding was possible, outside these two binary options. So I began to read what I could find, including Carl Hartman's *Possums*, a compendium of opossum fact, fiction, and folklore.

My initial reaction to the opossum as strange and alien was partly accurate, for the opossum is not exactly a local. Three million years ago, when North and South America merged, animals from the formerly separated



"They play so well together!"

continents began to intermingle. This event, known as the "Great American Interchange," had a profound effect, partly because northern predators (which included cats and dogs) proved much stronger than their southern counterparts (which included the frighteningly named Terror Birds). Many South American animals were exterminated, and after further pressures from climate change and human activity, only three mammals from South America flourished up north: the armadillo, the porcupine, and the opossum. It is hard for me not to imagine that the three animals still meet in shady nooks to exchange knowing glances, talk about the old times, and perhaps celebrate the demise of the Terror Birds.

Out of these three animals, the opossum was by far the most successful in eastern North America. Opossums are now present throughout the eastern states except for Maine. They do not thrive in Canada, for the opossum is not built for extreme cold, and its naked tail is vulnerable to frostbite, just like our own.

In early encounters with the marsupial, European explorers generally struggled to make sense of the creature's strangeness. "An opossum hath a head like a swine, and a taile like a rat, and is of the bignes of a cat. Under her belly she hath a bagge, wherein she lodgeth, carrieth, and sucketh her young." So wrote John Smith, describing the opossum in terms of more familiar animals. Smith's "bagge," the opossum's external pouch, proved a particularly wondrous feature to many Western travelers. When the explorer Pinzón presented an opossum to the Spanish rulers Ferdinand and Isabella, they "placed their royal fingers in the pouch and marvelled at so strange a contrivance of nature."

Perhaps even more unsettling, though, was the opossum's most famous defense mechanism, "playing possum." This behavior is actually rather involved: when feigning death, the opossum not only falls on its side but also foams at the mouth, secretes a foul-smelling green liquid from its anal glands, and bares its teeth in a death grimace—in short, acts like a soccer player after a foul. In the opossum's case, the idea is that most

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MEET THE CLASS OF '16

SONIA DEYOUNG

Sonia might be the first Field Naturalist to say that the indoors is as important to her as the outdoors. Outdoors has given her almost all the euphoric moments of her life. After graduating from Harvard, she pursued job prospects based on how much time she would get to spend outside. Her seasons on wildlife research crews took her to national parks and wildlife refuges across the country, from the Everglades to the Tetons.

But indoors has provided many of her moments of deepest contentment. It's where she keeps her books, writes letters, wraps presents, listens to the radio, tucks little children into bed, and stays up talking till late—as so many others do and have done, in some analogous form, for millennia, a fact that never fails to tug at her heartstrings.

Indoor and outdoor life intersect in Sonia's master's project. Working with the Vermont River Conservancy, she will design a watershed-level version of the PLACE program (Place-based Landscape Analysis and Community Engagement) to engage the communities along the New Haven River with their natural and cultural history and to raise awareness about flood resiliency. Her summer will involve both collecting data in the woods and interviewing farmers—as well as a few trips home to Massachusetts to hang out with her family and read bedtime stories to her little niece and cousins.

GLENN ETTER

Glenn grew up in Chattanooga, Tennessee, on the southern tip of the Appalachian Mountains. Perhaps because of this green, mountainous heritage, he has always felt oddly at home in Vermont.

Before coming to UVM, Glenn spent more than 10 seasons working as a whitewater rafting guide in California and Oregon. He eventually decided to learn something about the plants and animals he observed every day, when he wasn't too frightened or distracted.

Glenn also has a Ph.D. in Cultural Anthropology from UC-Berkeley and is serving as a sort of "experimental post-doc" participant in the Field Naturalist Program. After his doctorate, when he wasn't on the river, Glenn spent years studying and performing improvisational theater. He later taught outdoor education, creative writing, and English in a variety of schools (one in Vermont), where he regularly "improvised" responses to student questions. He is currently figuring out how to combine his interests in creativity, community-building, natural history, and outdoor education.

JESSIE GRIFFEN

Jessie majored in linguistics at Dartmouth College in order to study many subjects at once: languages, literature, and science. In New Zealand, while researching plant names in an ancient Polynesian language, she found herself more interested in exploring the mountains than working alone at her desk. During her senior year, ecology was a revelation: academics, outside! But with graduation on the horizon, pursuing additional education in ecology would have to wait.

Jessie went on to manage the Moosilauke Ravine Lodge in the White Mountains, where she learned to conserve a fragile alpine ecosystem, motivate a team, and run a kitchen. Her passion for food began there. In Lyon, the gastronomic capital of France, she taught college students French. Eager to make delicious, sustainably grown food accessible to all people, she moved to the Northeast Kingdom of Vermont to coordinate a local food hub.

As an Ecological Planner, she's finally living her dream of formally studying the ecosystems, plants, and wildlife of New England. This summer, she will share her enthusiasm for ecology with guests at Kripalu, a yoga retreat center in the Berkshires. There, she'll conduct an ecological inventory and partner with Mass Audubon to find creative ways to connect guests with nature.

BEN LEMMOND

Ben grew up in Charlotte, North Carolina, a city that is somewhere between mountains and coast, small town and big city, old-timey and new-fangled. College took him to the Evergreen State College in Olympia, Washington. There, Ben took the notion of "broadening your horizons" as literally as possible, traveling to India, banding birds in Mexico and Oregon, and sailing the Oregon coast aboard a tall ship as part of his studies. After graduating, Ben moved to Ahmedabad, India, where he interned for a year at an arts academy that used the arts as a catalyst for social change. There he kept busy writing grants, gaining some web design know-how, and learning a bit of Hindi. Returning to Charlotte, Ben's life took an entrepreneurial turn

as he helped with several start-up businesses and did some freelance graphic design on his own.

In 2014, Ben moved to Vermont to reunite with an old flame: academia. For his master's project, Ben will be working on Hurricane Island in Maine, sharpening his field science skills while also diving headlong into the questions of how people connect with places, whether that has anything to do with how people connect to other people, and how these questions might shape our approach to conservation.

SHELBY PERRY

Born and raised in rural Vermont, Shelby spent her youngest years feeding chickens, catching fireflies, climbing trees, and eating dirt. Eventually her love of science and nature led her to the field of environmental engineering, which she assumed to be a combination of the two. After graduating from Rensselaer Polytechnic Institute, however, she decided that engineering didn't provide the freedom she craved. She rebelled against an impending desk job by joining the U.S. Peace Corps and moving to West Africa. After a life-changing 15 months in Mauritania, where she found a whole second family and learned how to eat rice by the handful, she was abruptly and swiftly evacuated as a result of political unrest and potential violence.

Having committed to two years of volunteering, Shelby next enrolled in AmeriCorps, moved to California, and spent a year doing fieldwork in the beautiful Lake Tahoe Basin. Then she decided it was time to search for a job that came with pay. She found her way to the Red Desert of southern Wyoming, where she spent two years advocating for wilderness. Now that she's back in her home state, Shelby will complete an ecological inventory this summer of 14,000 acres of timberland for the Vermont Land Trust. When she's not in the field, Shelby enjoys drawing, cooking, taking pictures, and spoiling her dog, Mia.

EMMA STUHL

Except for that year when she was afraid of rabid raccoons, Emma spent her childhood frolicking through backyards and playgrounds. When she left her Massachusetts hometown to attend Cornell University, she discovered backpacking, met salamanders, and learned loads about dirt. She was hooked. Since then, she has sought out opportunities to understand what is happening around her and to share that knowledge with others. This quest led her to teach environmental education across New England and in Wyoming and to farm organically in the hills of the Berkshires. She filled her summers with swimming holes, vistas, and only one bear encounter as she instructed wilderness trips in the White and Mahoosuc Mountains. Here in Vermont, Emma is finding ways to share her love and understanding of natural systems with people in a positive, impactful way. She'll be working with Shelburne Farms this summer to implement the PLACE Program (Place-based Landscape Analysis and Community Engagement) in the town of New Haven, Vermont.

In her free time, you can find Emma playing outside, cooking beautiful vegetables, or eating meals with friends. She especially enjoys bicycling, running, and cross-country skiing. Inside or out, she loves to dance and eat cheese, usually at separate times.

SAM TALBOT

While working on a Student Conservation Association trail crew several years ago, Sam always found time between sharpening tools and dinnertime to sneak off for some fishing. These clandestine excursions often resulted in little or no fish. Nevertheless, Sam believes any time spent doing what you love is time well spent. He used this principle to build a professional life involving conservation, working lands, and people.

Before his stint with the SCA, Sam began a northward migration through western Massachusetts, from his hometown of Westfield along the Connecticut River corridor to UMass-Amherst. After college, his journey continued to Shelburne Falls, where he spent three years at the Franklin Land Trust. Here he viewed the landscape through maps, deeds, conversations with landowners, and fieldwork as a land steward.

The most recent leg of his migration has taken him much farther north. Although he has traveled all over the country, his deep roots remain in the rocky glacial till of the New England soil. There are many places to explore here in Vermont, but Sam remembers to leave time for fishing, wood carving, and the occasional bike repair.

One such place to explore lies between Lake Champlain and Lake George. This summer, Sam will investigate the wildlife corridors in this region using spatial analysis, habitat modeling, and fieldwork. The results will help inform future landscape-scale conservation planning.

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predators do not eat carrion and will turn away from their previously delicious meal, now apparently rotting and foul. Of course, some predators do eat carrion, so it's not an incredibly effective defense.

Anthropologists tell us that creatures that subvert our categories (such as life and death), or that don't fit easily into our classification schemes, are often endowed with sinister, magical, or sacred power. However, this doesn't seem to be the case with the opossum, which we rarely find perched on a sorcerer's shoulder or added to a witch's cauldron. Indeed, we are more likely to find the opossum on the dinner plate, for in many places, including the American South, the opossum is definitely not too weird to eat. In fact, "possum and taters" were a historical staple in some southern households, and internet recipes for opossum are easy enough to find today. Most such recipes claim that opossums are delicious, but one concludes with this ominous advice: "Before serving make sure you have enough bread, milk, and toilet paper for after dinner."

If the opossum could be eaten, could it be loved? Historically, there were efforts to bring the opossum into the circle of beloved American animal symbols. Br'er Possum, for example, is a sympathetic, kindly character in the "Uncle Remus" folktales—though granted, in most of these stories, Br'er Possum is either eaten or bitten by a snake. In the early 1900s, entrepreneurs even attempted to popularize an opossum alternative to the Teddy Bear. According to the plan, Billy Possum, named after incoming president William Taft, would replace Teddy Bear, named after outgoing Teddy Roosevelt, in American hearts and cribs. Alas for the future of cuddly opossum toys, the popularity of Billy Possum, like that of the new president himself, faded about one year after Taft took office.

This endeavor, though, fared better than last year's attempt to institute "Otey the Swamp Possum" as a mascot for an Arkansas minor league baseball team. "A possum? Why not just make it roadkill and be done with it?" was one local reaction. Another internet post offered this analysis: "If you wanted to stereotype Arkansas, a toothless meth head would be less offensive." Fear of a similar response likely explains why no high school or college in the United States has ever selected an opossum as its mascot. There are Banana Slugs and Boll Weevils but sadly no Opossums, which are apparently still too creepy for most Americans to embrace as their totem animal.

In short, popular culture and history offered few models, but I hoped that science would help me bond more deeply with my marsupial friend. To be sure, opossums are fertile ground for "fun" scientific facts. Opossums are also literally fertile, producing one or two litters of twenty joeys each year, though only thirteen in each litter can survive due to a nipple shortage. Still, that's a lot of possum and taters! More striking: to conceive so many offspring, opossums use their two-headed penises and double vaginas. For those wondering, this anatomical curiosity was not part of Otey's costume.

The opossum's tail is perhaps as remarkable as its genitals. The opossum uses its prehensile tail to grip branches and dangle upside down, as well as to carry objects for nesting. The tail also stores fat and may contain up to 30 percent of the opossum's energy reserve. Perhaps most unusually, the opossum's tail sometimes coils and uncoils rapidly, resembling a snake, when the animal is threatened.

Sadly, the opossum has a lifespan of only two years, even in gentle captivity, perhaps because it has such limited defenses that evolving a longer lifespan would be pointless. Noting this fact, Hartman points out repeatedly that the opossum has limited intelligence—his first chapter introduces "this unique, albeit extremely stupid species of animal," and elsewhere he asserts that the opossum is "forbiddingly stupid" and "the stupidest of all animals." Hartman's claims are backed up by some evidence: the opossum's brain is one fifth the size of a raccoon's.

Curiously, it was only at this point, after reading these repeated insults, that I truly began to feel a deep compassion and admiration for the plucky opossum. Tiny-brained and slow-moving, a creature whose greatest defense is remaining motionless while oozing a green liquid out of its butthole, the opossum has nevertheless outlived the Terror Birds, the saber-toothed cats, and the dire wolves. It has steadily expanded its range, all the while feeding humans, foxes, and a slew of other carnivores with its steady production of waddling joeys. Watch your words, Hartman! Our visitor is doing the best it can in its ephemeral time on earth.

Perhaps not surprisingly, our next-door opossum disappeared for a few weeks following the shrieking incident. To compensate, I tried drawing opossums and even wrote a few poems on the opossum theme, although some degenerated into lines like "The teeth of the opossum? I want to floss 'em." Others included mock-profound questions, such as "Who sings the songs of the winsome opossum?"

Later, when the snows of winter came, I found opossum tracks in our yard. Learning their pattern helped me feel closer to our erstwhile neighbor, and now, in the waning days of the snow season, I am trying to locate a nursing mother opossum. It's a surprisingly satisfying mission. In the end, I do feel a kinship with our odd, South American friend, whose life is startlingly brief, who nevertheless helps feed a forest before succumbing to predator or car. I even long, at least a little, to hear its eerie, disturbing roar, one of the many songs of the winsome opossum. ♦

Through the Viewfinder

by Shelby Perry

When I was in high school, I took my first photography class. I know that hiding in a darkroom fiddling with chemicals and enlargers sounds about as far from appreciating nature as you can get, but for me it was quite the opposite. Each new assignment trained my eye to look for beauty in a different way, and it didn't take long for me to develop a preference for photos showing no signs of people. Years behind the viewfinder of a film camera primed me for affordable digital photography and the joys of macrophotography without the cost of a new lens. I began to seek out beautiful moments on an even finer scale.

My fascination with the intricate details of nature began with one memorable photograph. I was hiking up Catamount Mountain in the Adirondacks with my father when a tree drenched in dew caught my eye. I snapped two or three quick shots of the end of a branch, then ran to catch up with my dad. When I got home and uploaded the photos to my computer, I was hooked. I began to immortalize tiny moments of magic with my camera while waiting for class, hiking in the woods, or wandering through my mother's garden.

Although I have taken thousands of photos, I've never sold even one—and that's okay, because for me taking pictures has been a gift rather than a vocation. Photography has taught me to be always on the lookout for the most beautiful moments in nature, no matter how small.

That gift certainly played a role in my decision to pursue conservation as a career. I spent two years inventorying and advocating for wilderness in Wyoming's Red Desert, a job that can be utterly discouraging in the best of times. To watch and document the construction of new roads, pipelines, and gas wells in my precious desert devastated me. After two summers living in my truck in that desert, each new road felt like an open wound on my body. If I hadn't had the ability to look beyond the destruction, I never would have lasted the season.

Fortunately, moments of beauty were abundant in the desert. I reveled in every sunrise stained red by nearby forest fires, every night sky lit up by thousands of stars, and each tiny wildflower able to bloom so beautifully in this desiccated environment. In fact,

All photographs by the author

> 'I CAN WALK THROUGH THE SAME WOODS EVERY DAY AND STILL BE DAZZLED BY WHAT I FIND, BECAUSE PHOTOGRAPHY TAUGHT ME WHERE TO LOOK.'

during a summer inventory of the unprotected areas surrounding the Adobe Town Wilderness Study Area, there were moments when the wildflowers were all that kept me going. That year spring rains hung over the desert late into May, delaying my field season but bringing to life the sand's dormant seeds. When field season began in June, the desert had come alive with vivid colors and unexpected blooms.

Despite its name, Adobe Town is not an ancient settlement, and there are no adobe buildings. It got the name because its first Western explorers thought the towering rims and rock hoodoos of the badlands looked like the adobe villages found in deserts farther south. The rock formations outside the designated Wilderness Study Area are no less beautiful and delicate than those inside, but they're located on the wrong side of a human political boundary and are being leveled at an astonishing rate. Roads and pipelines are bulldozed into crumbling rims, well pads are flattened to accommodate the dozens of tanker and pumper trucks required for fracking. Each time I left for town to resupply, I would return to find new roads and pipelines carved into the landscapes I loved. The hum of fracking pumps provided the soundtrack to my usually silent days, and their floodlights lit up my normally dark nights. But all the while I could focus on the flowers. And mercifully, miraculously, their blooms held on until my inventories took me to less heavily impacted parts of the desert.

I've gotten so practiced at finding natural beauty anywhere that I take far fewer pictures these days—I don't need to look through a viewfinder or at a screen to see the splendor. I can walk through the same woods every day and still be dazzled by what I find, because photography taught me where to look. I climb trees to look in nests, lie on my belly to peek under ice, and wander

through thickets in the dark to see the moon through their branches. Finding these moments has become a vital part of how I navigate my world. I may be uncertain of the future of nature as I have come to know it, but I am confident that I will still find reasons to love nature—even as it changes. ♦

Ice Fishing for Renewal:

Adaptive Cycling and the Human Experience

by Sam Talbot

After four hours on the frozen lake, most of the action remained hidden below my feet. The only wildlife I'd seen all day arrived strapped to cross-country skis. One of the skiers, whose impressive beard was now fully frozen and reflecting the mid-day sun, asked about the process of ice fishing. "Not much to it," I replied. "Just wait for a tip-up, run over, and hope there's a lunker on the other end."

Fundamentally it is that simple. However, I didn't tell my new acquaintances about the advancing pile of grading and steady influx of emails that awaited me when I returned to Burlington. Taking six hours out of the day to stare at frozen water and stoke the occasional campfire can be the most challenging part of ice fishing—and the most rewarding.

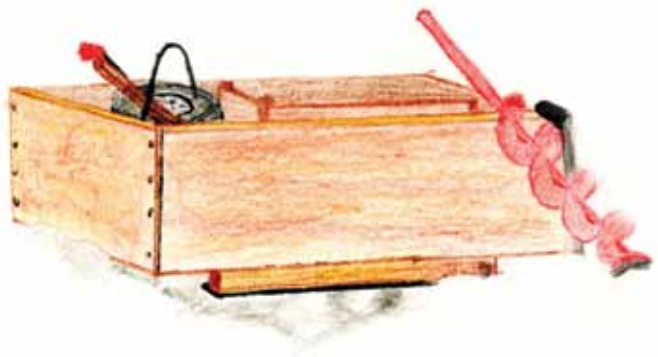
New England is known for its seemingly infinite ways to plunge into winter. Some require unfettered concentration, while others foster tranquility. To those not in the mood for the adrenaline rush of snowmobiling and backcountry skiing, ice fishing offers a calm alternative. A 360-degree view of snow met by rolling hills of conifer, washed in rays of light, provides a vast canvas on which to draw your thoughts. Scheduling conflicts and encroaching deadlines can be pushed aside for the ethereal. These clandestine excursions to the outdoors allow us to "get away from it all," the cant persuasion offered by most travel advertisements.

I've come to wonder, as I wait for a perch to strike my line, why I choose to steal away for afternoons of fishing. I found a possible answer in the research of ecologists who have tried to understand resilient landscapes in the face of climate change. In their primer *Resilience Thinking*, Brian Walker and David Salt describe an important component of resilience theory: the adaptive cycle. This involves four stages—growth, conservation, release, and renewal—that apply not only to a warming planet but to our own distracted lives as well.

Take the familiar pitch pine (*Pinus rigida*) as an example of this adaptive cycle. During the growth phase, individual trees germinate and thrive on less fertile soil. They also add an armor of thick bark to protect dormant buds. The key to the next phase, conservation, lies within buds and cones that persist well into maturity, waiting to produce subsequent growth. Next, fire acts as a catalyst for release. Cones that have remained closed in anticipation begin to open as the heat reaches them. Dormant buds stimulated by fire develop into shoots. In the fourth stage, renewal gives rise to succeeding generations and the continued growth of the remaining tree.

We are not very different from pitch pines. As they accrue dormant buds and store cones, we gather knowledge (growth) and accept responsibilities (conservation). These growth and conservation stages can be the most outwardly productive of the four, yielding hours spent writing papers and crafting maps. Yet the final stages, release and renewal, are necessary to the well-being of both ecosystems and humans. As a forest fire releases the pine stand from late succession, we too may find release and ultimately renewal in a natural environment. On this particular day in March, my shift from conserva-

""NOT MUCH TO IT," I REPLIED. "JUST WAIT FOR A TIP-UP, RUN OVER, AND HOPE THERE'S A LUNKER ON THE OTHER END."'



'ON THIS PARTICULAR DAY IN MARCH, MY SHIFT FROM CONSERVATION TO RELEASE OCCURRED AS I TRADED THE STEADY GLOW OF A LAPTOP FOR A SLED FULL OF WELL-SEASONED FISHING GEAR.'

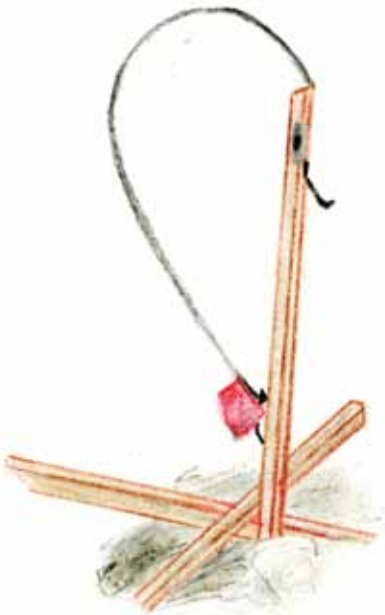
tion to release occurred as I traded the steady glow of a laptop for a sled full of well-seasoned fishing gear.

Besides an inherent need for renewal, there may be another reason why I have chosen to go fishing—one revealed in candid family photos and holiday cards on my fridge at home. A picture of my dad looking out over the Maine coast shows the same contentment and intangible presence I feel while gliding down a snowy trail or looking out over a sheet of ice. After tireless hours of crab fishing off Alaskan shores and the trials of being a U.S. Marine, he was no stranger to the perturbations of life. Yet there are these moments trapped in time, illustrated by photographs and family stories, when the expanse of nature clearly provided him with an outlet for personal resurgence.

My childhood hobbies of fishing, hunting, and exploring the backwoods of western Massachusetts quite possibly led my pursuit of calmness in a frozen pond. But something more than my worldview drives me during this stage of the adaptive cycle. By analyzing the results of spending time in nature, scientists have shown its inherent benefits to cognitive function. In a 2008 paper, University of Michigan researchers Marc Berman, John Jonides, and Stephen Kaplan write, "There is an important peaceful element to nature…[and] this peacefulness is driven by natural environments capturing attention modestly and limiting directed attention—not to sheer quiescence alone."

It's hard to say which avenue of renewal is best, since the approaches are limitless. There's nothing wrong with watching the Patriots on a Sunday, catching up with an old friend over coffee, or going for a quick jog as a means to prepare your body and mind for impending responsibilities. I've developed an intermittent running routine that takes me along the bike trail in Burlington. Something interesting happens, however, when I leave the paved path for a jaunt around the golf course. Although this landscape is highly modified, towering pines and migrating birds still bring me far away from the busy road and houses that lie just beyond the hedgerow.

So, as I take advantage of the waning afternoon sun on the lake, I'm brought back once more to the phenomenon of "directed attention" described by Berman, Jonides, and Kaplan. After I've drilled holes, baited hooks, and chatted up skiers, my focus has narrowed to the slow descent of the sun over the mountains. A look of contentment falls over my face—a reflection of my dad looking out over the shores of Maine. ♦



Illustrations by the author

OPTIMISM

BY BERND HEINRICH

There is doom and gloom all around. What are we to think and, more pertinently, do? Is this a topic for philosophers only, or can some of us do something about it—and if so, who?

I'm a biologist. It seems to me that this doom and gloom pervading our social consciousness concerns the Life of the Planet. That means everything. All of Life. Okay, this is serious. It includes not just you and me. It includes the birds! And if they go—well, that's the end.

Birds are the crown jewels of creation. They bring us joy and beauty—and even if they don't, they are here just the same. But the world would be no worse if it had one fewer species of bird, or one fewer species of hominid for that matter, even the one who presumes to be the most worthy.

Living here in the Maine woods, I see a lot of birds. Last year, for the first time ever, I saw a pair of cardinals at my feeder. A northern shrike stopped by one day, as did a snow bunting. For the first time in a century or more, wild turkeys ranged through the woods. Bald eagles now nest nearby at the lake; there were none there when I was a child. But I seldom see chimney swifts now, and barn swallows are scarce. Should I be glad, or sad?

Tree swallow Illustrations by the author

My instinctive reaction to any loss heralding a possible change is alarm. We're hard-wired that way. Our emotional responses are geared to maintain the status quo. After all, that's how we've adapted—by evolution, by learning, by living. We get excited and alarmed by something that goes missing because it shakes our understanding of the state of nature that we know. It could be a threat. Deep down in our primal nature, we fear it means we could be the next to go.

It is natural to view the world first from our own personal perspective, and less so from that of ever-larger encompassing groups, such as natives of Amazonia, our species, the world, the cosmos. That makes sense because control begins with ourselves. We have no control whatsoever over the cosmos. But where, between ourselves and the cosmos, are our limits—beyond which it's no longer pertinent to worry? There is no point in worrying when we have no influence. It's just a senseless use of time that drains energy.

Frustration and unhappiness are derived from loss of control, not lack of control. I'm not the least bit unhappy that the sun is running out of fuel, or that the Andromeda Galaxy is on its way to collide with our Milky Way Galaxy, each with probably millions of worlds built on exactly the same laws as ours. It's totally irrelevant to almost everything I can think of, except for the beauty and value of perspective: as far as nature is concerned, we have next to no value whatsoever.

But we do have some control over our own world—as a species. This is a brand-new concept, and a scary one precisely because we now have the power to make a change, a power that was unthinkable not long ago. And we're aware of that power.

Yet change is not necessar-

'OKAY, THIS IS SERIOUS. IT INCLUDES NOT JUST YOU AND ME. IT INCLUDES THE BIRDS! AND IF THEY GO—WELL, THAT'S THE END.'

ily something frightening. I love the idea that we now have starlings here, even though they are from Europe, and that turkeys now roam our woods where they were absent for generations. The fact is that many birds are here because of us (despite other birds no longer being here for the same reason). Without us, there would be no meadows in Maine—and thus no meadowlarks, savannah sparrows, bobolinks, phoebes, or barn swallows. No pigeons or house sparrows either, and far fewer mallards and Canada geese.

Change is almost always followed by replacement. A chickadee's brain cells die in order that new ones, coding new memories of where food is stored in winter, can grow. Forests are "destroyed," and new growth, where moose and deer browse, replaces them. Elephants demolish trees and brush and create the grass plain where the antelope roam. As Aristotle supposedly said, "Nature abhors a vacuum." I work hard to cut down trees in my clearing, to create an island where chestnut-sided warblers, yellowthroats, tree swallows, bluebirds, indigo buntings, goldfinches, cedar waxwings, and woodcocks can come in. I provide space for viburnum, chokecherry, winterberry, and blueberry—bushes that feed birds migrating through in the fall.

Nature is too complex and too big to make extrapolations from here to eternity. So am I therefore not worried about the gyre "as big as the state of Texas" in the Pacific Ocean? Isn't that an extrapolation of the effects of making plastics without regard for how to dispose of them? Absolutely—it's a huge problem. But I rejoice: we recognize it. That's the first step toward any solution, and the first step is the most important of any enterprise.

Here is the punch-line: basically all our environmental problems have the same root. It's overpopulation. Solve that one, and we solve most others. And it's so easy to solve: just stop having kids. We know how to do it. All we need is adequate incentive. All we need is a change of attitude. And everyone can take that responsibility. It's a personal choice with huge implications. Although we can recycle plastic and tin cans, these are short-term, feel-good diversions, not fixes. None reduce the effects of overpopulation.

Overpopulation is nothing new on Earth. It happens all the time, and the results are always the same: ecosystems collapse. There is beauty and power here for all of us. We don't need to wrack our brains to make the ocean clean, bring back the sperm whales, bring back the eagle and the elephant. One solution fits all. All could be fixed (pun intended) in less than a century. Imagine! Each one of us could do something constructive to make it happen.

In the meantime, we still have Nature as always. I wish I had some bluebirds in my clearing. They are not here. But I have tree swallows. As Stephen Stills sang, "If you can't be with the one you love, love the one you're with." ♦

'THE FACT IS THAT MANY BIRDS ARE HERE BECAUSE OF US (DESPITE OTHER BIRDS NO LONGER BEING HERE FOR THE SAME REASON).'

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

Arrest This Development

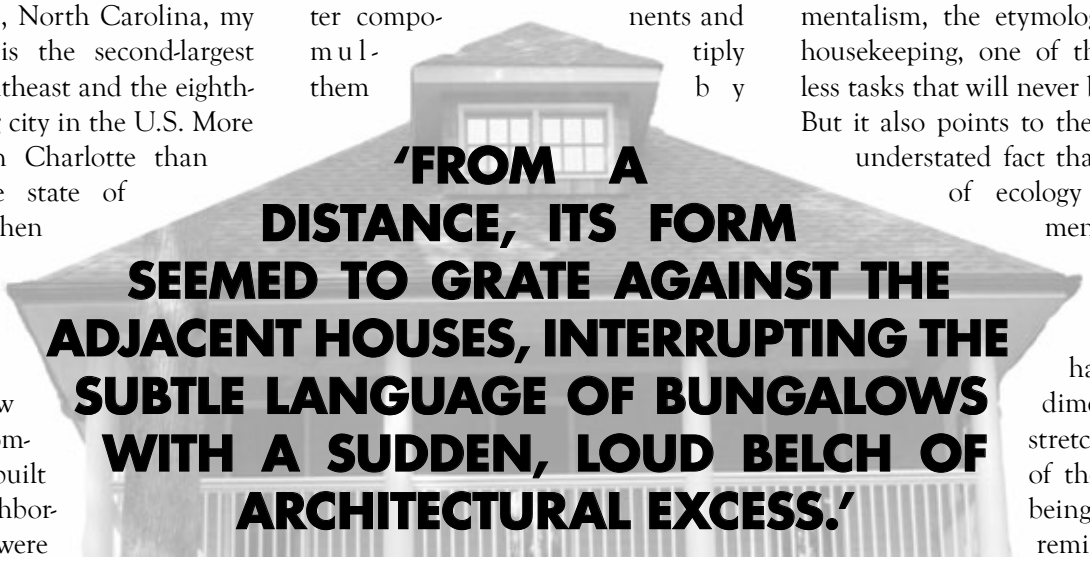
by Ben Lemmond

The new house on my street was a jarring reminder of how quickly familiar terrain can go rogue. It towered above all the other houses, its double-decker porches rising higher than any nearby rooftop, replacing the simple charm of a southern veranda with an eerie Neighborhood Watch vibe. Showy and extravagant up front, the house abandoned all sense of panache in its sides, where only a window or two broke the monotony of a few thousand square feet of vinyl. From a distance, its form seemed to grate against the adjacent houses, interrupting the subtle language of bungalows with a sudden, loud belch of architectural excess.

To my great satisfaction, the house sat empty for more than a year. Occasionally the developer would come by and leave the lights on: a ploy to make the house look more inviting, perhaps. It seemed like a wistful, defeated gesture—who looks for real estate at midnight? I kept my fingers crossed.

But then it sold. How could it not? Charlotte, North Carolina, my home town, is the second-largest city in the Southeast and the eighth-fastest-growing city in the U.S. More people live in Charlotte than in the entire state of Vermont. When I took a trip home this year, there were at least a half dozen new apartment complexes being built in my neighborhood. There were plenty of new houses, too. I walked around one night to check them out; their dramatically uplit, landscaped profiles looked back at me, spooky and hollow, like the face of someone holding a flashlight under his chin to add atmosphere to a ghost story.

As a student of ecology now and environmental health as an undergraduate, I felt I had plenty of tools at my disposal to legitimize my distaste for these new developments and to separate critique from nostalgia. I began to look up statistics on new single-family housing units, intending to build a convincing environmental case against the kind of new house spreading clonally throughout my neighborhood. Should I look at energy use, or the chemical rap sheet of contemporary building materials, or the ecological consequences of replacing every vestigial wild element in yards with ChemLawn? In 2014 alone, the U.S. gained 620,000 new homes averaging 2500 square feet apiece, a third of them wrapped in vinyl siding and nearly all chilled to the bone with air conditioning. It would be easy to take any number of their ecologically sinister components and multiply them by 620,000, proving a point millions of times larger than what was happening in this one house on my street.



But I kept getting hung up on a hunch that I didn't want to turn these real places into abstractions, to impose statistics on my gut reaction to the changing landscape of my home town. There is a lot more power in the experiences we live through than the experiences we read about in journals or add up in Excel spreadsheets, and I wonder how ecology can stay connected to that power even as it becomes a field that is increasingly data-driven. Could there be some other connection between ecology and houses worth exploring, something that has more to do with my direct experience of them and less to do with their existence *en masse*?

I was recently reminded that the "eco" in ecology comes to the English language from *oikos*, the Greek word for house. At first glance, that etymological insight tells us nothing we don't already know: ecology is the study of creatures and their connection with where they live. Perhaps, in ecology's association with environmentalism, the etymology hints at housekeeping, one of those thankless tasks that will never be finished. But it also points to the relevant if understated fact that the study of ecology is fundamentally about contexts: all living things have a spatial dimension that stretches outside of their physical being. Ecology reminds us that

'I WISH THAT NEW HOUSES COULD BE DESIGNED THIS WAY: AS EXPRESSIONS OF THE PLACES THEY INHABIT RATHER THAN IMPOSITIONS ON THEM.'

a bear cannot really, truly, be a bear without a genetically diverse population of its kin roaming around in a bear-sized habitat. A part of every living thing is stored in the space around it, in the structures as well as in the possibilities.

Our houses, similarly, are more than just a habitat: they carry a part of our existence for us. They're the superhero phone booths where we don and shed the identities we walk around in each day. For some of us, a house holds the memory of where we come from, our personal origin story woven into physical space. I feel this vividly whenever I come back to my old neighborhood, this sense of remembering and authenticating some consistent idea of who I am. This is no small matter for someone like me who habitually explores new story lines in his life: novice chef, graphic designer, ballet dancer, field ecologist. The ability to occupy many roles and stories is uniquely human; however, our dependence on actual places to keep that narrative intact bespeaks our creatureness and links us with something common to all living things.

But I don't believe that our houses are the full story of the space we need in order to keep our identities intact. In fact, this is exactly the problem with the way the houses in my neighborhood have been built. It's as if they're trying to enclose an entire world within their walls. Of all the ways that new buildings are inefficient, the demand placed on them to be consummately entertaining and inspirational and transformative is one of the most needless wastes of resources I can think of.

In the summer of 2011, five families in my neighborhood designed and built an outdoor pizza oven in a backyard playground at the center of the block, adorned it with mosaic and christened it the "Château Dough." A long oak table crafted around the posts of an old swing set now seats at least 20. Most of these families have been living there for my entire life and have kids my age whom I played with in that playground growing up. As I see it, building the oven was the manifestation of a sentiment that was already there. I wish that new houses could be designed this way: as expressions of the places they inhabit rather than impositions on them. It's more efficient, after all, to negotiate with the world around us for what we need than to try to find everything in one place. Any ecologist can tell you that. ♦

"Château Dough" photographs by the author

Seeing the Forest in the Trees

by Alicia Daniel

Photograph by Shelby Perry

No trails lead to Daniel's Notch in the Green Mountains,

and I haven't been there in 20 years. Today I am meeting fellow naturalist Brian in Underhill Center, beneath Saint Thomas Church, which looms over the village green. We are setting out on this June morning to search for something much harder to find in Vermont than a church. We're hiking up into Daniel's Notch to look for old-growth forest, armed only with a 1994 Field Naturalist report and a GPS unit Brian's sister loaned him.

To find an old-growth forest in Vermont requires a hunt. Very little forest escaped logging in the 1800s; the few stands that remain often grow on steep escarpments or mountainsides. Some old-growth forest patches were left by chance, a few by design. The old-growth forest I know best is Battell Research Forest, owned by Middlebury College, where giant hemlocks stand on Cheshire quartzite ledges separated by steep vertical drops. Some scientists argue that forests like Battell are more accurately called "uncut" because they have a history of fire and high wind that keeps the overall forest younger than the maximum age of its trees. Scarred red pines show that fire roars through Battell Forest in 150-year cycles.

Twenty minutes north of Underhill, Brian and I park on a back road under a large "No Parking" sign. The road is freshly graded and free of snow, so we decide to take our chances with a parking ticket. We plunge into the woods.

Middle-aged hardwoods make up the canopy; sugar maples and yellow birches shade a rich herb layer. The metallic golden bark of young yellow birch gleams in shafts of sunlight. I trail my fingers through maidenhair ferns, indicators of rich soil. Giddy with spring excitement, I shove things under Brian's nose to smell: the fresh-cut-grass aroma of hay-scented fern, the garlic odor of wild leeks, and the wintergreen smell of yellow birch.

We hop on rocks across a four-foot-wide creek onto an old logging road now used as an ATV trail. Since old-growth forest, by definition, has never been logged, we know that a logging road will not take us where we want to go. An arrow on the GPS unit shows us the direction to Daniel's Notch as the crow flies. We soon start to wish we were crows when we run out of road and then out of trail. The path evaporates into a boggy meadow scattered with tight bunches of violets. Moose tracks we've been following along the logging road converge here with others to create a veritable moose wallow.

Slogging upslope out of the clear-

CONTINUED ON P. 30

IN THE FIELD: CLASS OF '15

EVERY SUMMER, FIELD NATURALISTS AND ECOLOGICAL PLANNERS COLLABORATE WITH A COMMUNITY PARTNER FOR THEIR MASTER'S PROJECTS. HERE MEMBERS OF THE CLASS OF 2015 DISCUSS THEIR WORK.

NIKKI BAUMAN

A river is only as healthy as its watershed. This summer, I trekked the rugged terrain of the Nulhegan Basin in Vermont's Northeast Kingdom to understand the landscape and its inhabitants: plant, animal, and human alike. When property lines divide the land, effective communication is critical to any conservation strategy. I collaborated with state, federal, and private groups to promote open communication lines and agreement upon conservation priorities for the Nulhegan River.

The Vermont River Conservancy sought recommendations on how to establish itself as a partner among the other organizations and landowners in the area who wish to see the Nulhegan River retain its wilderness character. I made these recommendations based on my summer fieldwork organizing and participating in stream restoration assessments, surveying for public access, consulting with local foresters, and more. My conclusions are tailored to balance conservation, recreation, and utility, all of which are essential to the culture of the Northeast Kingdom.

The Vermont River Conservancy and partnering interest groups, community members, and government agencies are working together to ensure the restoration and sustainable longevity of these vital working landscapes in Vermont. The Nulhegan River Corridor Conservation Project is an assembly of river corridor easements and fee-simple interest purchases to conserve the riverfront. Upon completion, the 17-mile river corridor will be protected—from the headwaters in Brighton, Vermont, to the confluence with the Connecticut River.

MICHAEL BLOUIN

In the summer of 2014, the New Hampshire chapter of the Nature Conservancy stood ready to finalize a purchase that would add 1300 acres to its most popular preserve in the state. The Green Hills Preserve lies in the shadow of Mount Washington and features several rare plants, unusual fire-dependent ecosystems, and 10 miles of multi-use trails that draw visitors from throughout the region.

To help construct an intelligent management plan for this newly added parcel, I worked with local Conservancy staff to organize two full-day ecological inventories called Bioblitzes. During the first event, naturalists and biologists documented more than 600 species—from plants to birds to butterflies. During the second, nearly 70 community members joined local experts and educators to learn about the Green Hills. They spied on birds and poked at coyote scat, discerned grasses from sedges, sketched vistas and oak leaves, and heard tall tales at twilight.

Based on our Bioblitz findings, I authored a comprehensive report to aid in future management decisions. I also developed an interactive web-based map to share what we learned with the wider world and created a "mysteries guide" to help future visitors dive more deeply into the natural wonders of the Green Hills.

KAT DEELY

What makes Merck Forest and Farmland Center so special is simply that it exists. It tells the story of Vermont through tap scars on the maples and through rock walls of yesterday's fields now scattered through hardwood forests. It perfectly captures the essence of Vermont. Three thousand acres of contiguous forested landscape is a sight to behold and to preserve. That's why Merck Forest's board of trustees is working with the Vermont Land Trust (VLT) to protect this land through a conservation easement in perpetuity—those lovely words that will give our grandchildren and their grandchildren a place to traverse the hillsides for observation, contemplation, and enjoyment.

Before conserving the land, VLT and Merck Forest need to know what's on this five-square-mile property. And that's why I was there, transecting every hillside of the three 2500-foot mountains—observing, mapping, and contemplating the ecological value of this landscape. Following the guidelines set by the Vermont Natural Heritage Program, I determined the rarity of each natural community and provided recommendations on management for the property. Using the criteria of habitat connectivity, landscape complexity, and resiliency, I assessed the current and potential ecological value of this parcel in a regional context. I recommended a conservation strategy that follows a combined approach of preserved areas within a larger matrix of conserved, actively managed land.

TEAM Ae

MADDY MORGAN

The "Hort Farm" has more to offer than just horticulture. That's the message the Friends of the Horticulture Farm want to spread to the Burlington community. The 97-acre UVM property has something for everyone. Trackers, gardeners, birders, farmers, and people who just want to get outside can all find the resources they need at the Hort Farm.

The Horticulture Research and Education Center (as the site is formally known) is home to the Catamount Farm, collections of ornamental plants and unusual trees, a thriving wetland, orchards, a Woodland Walk complete with a fern garden, and more. The Friends are the Hort Farm's public face.

A small non-profit group, the Friends formed in 1994 at a time when the Hort Farm's future looked uncertain. Since saving the Hort Farm from being sold by the university, the Friends have devoted themselves to spreading the word about the diverse and beautiful offerings of this natural area located off of bustling Shelburne Road in South Burlington. Working with the Friends, I designed ways to enhance community engagement and educational programming at the Hort Farm. I investigated how the Friends could meet the needs of the community so that this untapped resource can become a useful and well-loved part of the greater Burlington area.

LEVI OLD

East of Oregon's cascades, the Fall River emerges from volcanic bedrock. Birders, bikers, hikers, and trout-chasing anglers flock to the river each year to enjoy its wildness. Over the course of the summer, I launched a grassroots movement with Trout Unlimited to restore, monitor, and sustain the distinct character of this 11-mile river.

In community forums, residents shared their love of the river's old-growth forest, scenic vistas, and fishing. However, they were concerned about degraded stream banks, development potential, and the health of the fisheries.

Trout Unlimited and I partnered with agencies, businesses, locals, and visitors to tackle these issues. We built a river stewardship network and conducted an inventory of damaged stream banks to inform habitat restoration. We also investigated the watershed's natural history for conservation management.

In July, we launched a redband trout mark-recapture study to engage anglers and better understand fish movement in the river. In August, we piloted a restoration project on private land, as well as the first annual citizen-driven macroinvertebrate study. We also charted the path for stream bank restoration and environmental education programs to begin in summer 2015.

This all transpired between kayaking to meet riverside homeowners, botanizing the orchid-lined stream banks, casting flies at trout hidden in basalt riffles, admiring nighthawks and swallows as they darted through the air at dusk, and tracking stories left in the sand by elk and cougars.

KATHRYN WRIGLEY

Bolton Backcountry in Bolton, Vermont, is an 1140-acre cross-country ski paradise. Its first ski trails date from the 1920s. But in 2011, the property was almost sold to a private landowner who planned to limit access to the trails. A group of loyal skiers calling themselves the Old Goats rallied together to form the Friends of Bolton Backcountry. With the help of Vermont Land Trust, the Friends were able to raise $1.85 million in 15 months to purchase the land. In 2013, Vermont Land Trust transferred the land to the Vermont Department of Forests, Parks, and Recreation (FPR).

Backcountry skiers are flocking to Vermont's mountains and little is known about their ecological impact. I created a project with FPR to study how cutting gladed ski trails affects wildlife habitat. I spent the summer bushwhacking around Bolton Backcountry, scrambling over talus and squishing through sphagnum moss. I analyzed the data in the fall and found that in glades, forest structure tends to be simplified, with less fern cover, lower herbaceous biodiversity, and fewer understory saplings. This affects creatures such as black bears, which depend on a diversity of herbaceous berry plants for summer food. The skiers themselves also disrupt wildlife in the winter and cause it to relocate. Bolton Backcountry offers an excellent outside classroom to host educational workshops that foster best practices and land stewardship for those skiing in Vermont's wild woods.

CONTINUED FROM P. 27

ing, we run into our first big, old trees. Here the yellow birches are squat and twisted by the wind. The steep slope faces southwest, so it is no doubt drier than the notch. We find a clearing and stop to eat nuts and gulp down water. Warblers sing above our heads. We hear the wheezy *I am so la-zee* song of the black-throated blue. I left home without my binoculars, which is just as well—we are short of the notch and short on time. Brian decides to climb up over a knoll, which the GPS unit suggests we do.

I follow him into a dog-hair thicket of spruce but soon lose his trail. In the meadow he left big muddy prints, but here his trail is faint. Tracking him slows to a crawl. The black flies are worse up here. I decide to drop back down the mountain and enjoy the big trees below us.

As the sun peaks, I settle back against an old yellow birch tree to write in my journal. Writing and swatting at black flies, I continue to peek upslope for Brian's return. He surprises me by arriving from below. I feel ridiculously glad to see him—experienced hikers can still get hurt on a mountain.

"Thanks for waiting," he says, as if my sitting here were a favor to him. "Turns out the best trees are over here on a trail. I want to show you an old birch with a big cancer-like growth on it." I calculate the ground he has covered since I lost sight of him and realize how much I'm slowing him down. I try to pick up the pace.

We discover a trail practically paved with moose scat. Suddenly, we cross effortlessly into the notch. During our morning hike upward in elevation, the season has rolled back to early spring. The trail is awash in trout lily. I stoop to examine a dwarf ginseng, with its tiny ball of white flowers and delicate leaves. I peer at the pink flowers hanging from the stem of a plant aptly called rosybells.

An old-growth forests pulses with magic: the diversity and texture of the flora, the presence of dead wood, the absence of cut stumps, and something more intangible, a deep energetic hum. The forest has grown up attuned to its environment. Things just seem to be at home and in place.

Cutting a forest, or, in the case of Vermont, practically the whole forested landscape, destroys the natural patterns that once existed there. Forest communities naturally respond to their environment: their bedrock, aspect, slope, topography, hydrology, and soils. Once that forest is removed, generalist species take hold. Then the forest no longer shows a long-term faithfulness to its site. In Vermont, trees like red maple become more abundant while yellow birch decline. The whole landscape becomes more homogeneous. Throughout New England, the forests have regrown in the last century, giving the Northeast a closer approximation to its wild character. However, almost all of these forests, public and private, are cut as part of their management. Vermonters are just not growing old trees. In fact, forestry data indicates that each year our forests are getting younger. Are we working our "working forests" too hard?

I rise from admiring flowers to see that the towering old trees around us are just beginning to leaf out. The hardwoods have a bright halo of green as the sun lights up the tiny new leaves. Red spruces rocket up into the sky, taller than any we've seen before. Tucked in the notch, they grow to amazing heights as they reach for the sun.

"Wow. I thought that had to be a hemlock," says Brian, craning his neck at a huge red spruce. His recent encounter with this same species growing in the dog-hair thicket on the knoll gives him a true appreciation of this giant tree. The spruces are intermixed with yellow birches and statuesque maples. One old birch has toppled, and its scaly bark snakes along the forest floor like a giant serpent. The warblers sing in the canopy; the sun dapples the forest floor. Beauty surrounds us. We have walked up into heaven.

Enlightenment—and I confess this is second-hand knowledge—creates steady feelings of great tenderness toward other living beings. It drenches one in the desire to let things be as they are. The Sufi poet Rumi wrote, "Out beyond ideas of wrongdoing and rightdoing, there is a field. I will meet you there." I imagine meeting Rumi on a hike one day—not in a field, but in an old-growth forest, where he has been waiting patiently for a long, long time. Since the 13th century. Long enough to grow some very old trees. When I do find him, he will be radiant and bedazzled and in love with the wild earth. Surely an enlightened culture will grow more old trees and have the tenderness to allow more forests to just be. How long will I have to live to see it?

Brian disappears somewhere. He has a watch or a phone or both. He will know when it is time to go. I look around, wondering whether to bring my class up to Daniel's Notch next year. With happy thoughts of fall adventures, I take off my reading-the-landscape glasses and fall back among the flowers. Surrounded by shaggy trees, I gaze up through their swaying branches at the vast, unknowable sky. ♦

With thanks to Lyn Baldwin, Eveline Leon, and Adam Sherman, all class of '95, for their Daniel's Notch report; to Dan Mann, Brett Engstrom '87, and Jill Bubier '89 for their research on Battell Forest; and to Michael Snyder for thoughts on the current state of Vermont forests.

Alicia Daniel '89 teaches courses at UVM on reading the landscape.

Purple Loosestrife (Lythrum salicaria)
illustration by Shelby Perry

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IF YOU ARE INTERESTED IN HAVING A FIELD NATURALIST OR ECOLOGICAL PLANNER WORK WITH YOUR ORGANIZATION, PLEASE CONTACT:

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