Field Notes & Ecolog

A publication of the *Field Naturalist & Ecological Planning* students at the University of Vermont
Volume 24 • May 2012

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Becky Cushing collected and pressed the ferns on the front cover for the course, Field Botany for Natural Resource Professionals, which is taught for first-year FNEPs and other graduate students every fall by Cathy Paris and Liz Thompson. Claire Polfus scanned the ferns and created a graphic using photo editing software. We wanted to represent the energy of both the ferns as they grow from fiddleheads to fronds and the energy we get from learning about our world.

Editors' Note

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It is spring. Blue and white violets blanket backyards. Lusting squirrels chase each other up giant maples and people of all ages dust off their bikes. Just weeks earlier, we were hunkered down eating hearty soups and stoking the woodstove, trying to conserve body heat. It's hard to believe the mental and physical changes that take place when our days become longer and temperatures warmer.

As field naturalists and conservation practitioners, we face many challenging decisions about energy. What should we do about the increasing force and frequency of major floods? If we build a public walking trail through this forest, what wildlife corridors will we interrupt? What nonnative plants will we introduce? Should we site wind turbines on the top of that mountain ridge?

We wrestle with these issues daily, and that takes, well, a lot of energy. We must nourish our personal inspiration or risk burning out altogether. Many of us cite "fresh air", "being outside", and "sunshine" as primary sources of energy. A hike up Camel's Hump or a splash into Lake Champlain reminds us why we want to care for the world around us. Sharing delicious local foods with our housemates grounds us. Biking to Battery Park to watch the sun setting over the Adirondacks quiets us. Helping fellow students or uniting with citizens around a common cause gives us hope.

In some ways, energy is the root of the world's problems, from climate change to nature deficit disorder. But energy is also what gives us life. It enables us to imagine new ways to care for the land; ways that are efficient and sustainable.

This edition of Ecolog explores our complex and complicated love affair with energy. We hope you enjoy it.

Robin Claire Liz BECKY

An Energetic Future

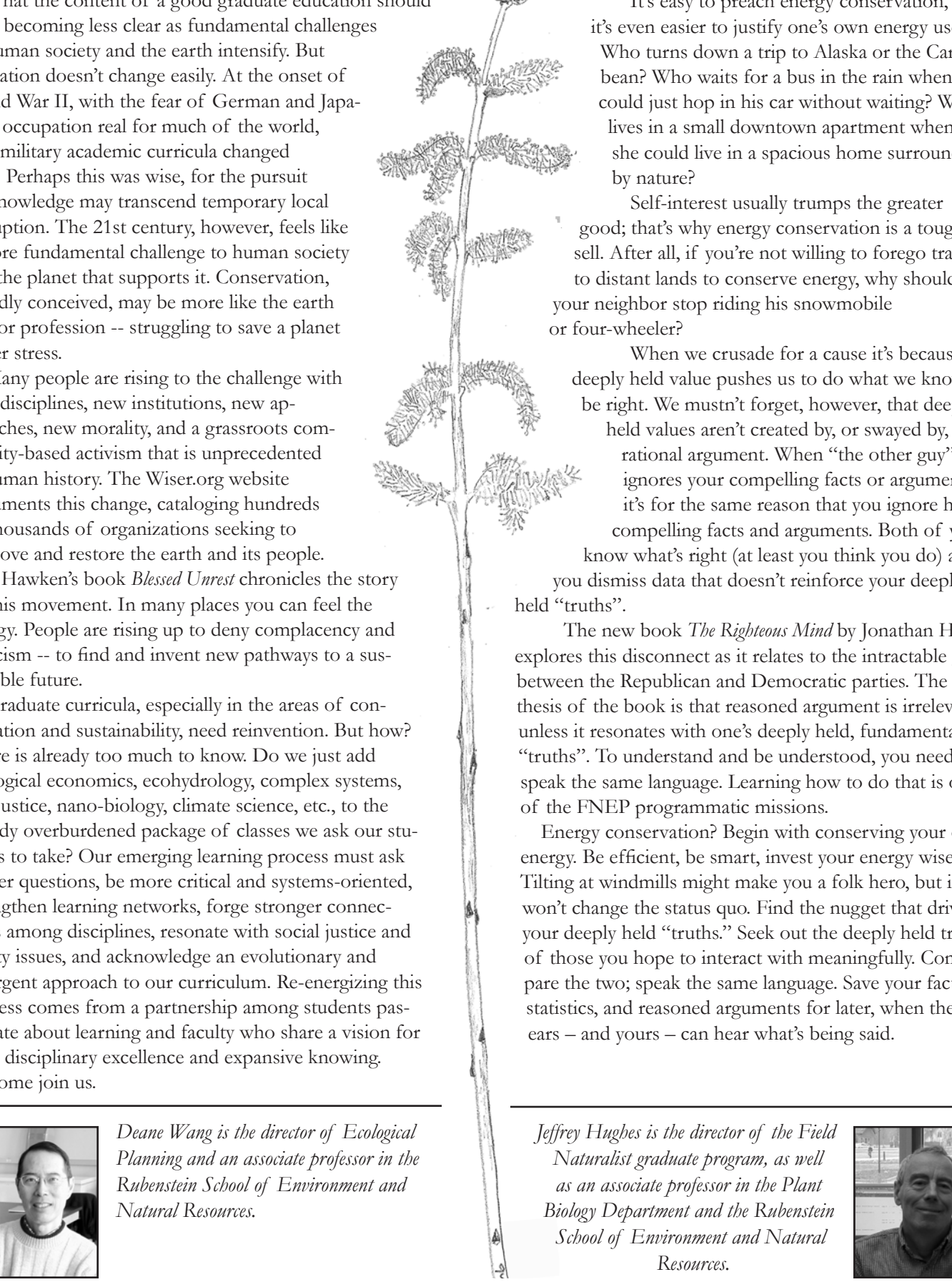
by Deane Wang

What the content of a good graduate education should be is becoming less clear as fundamental challenges to human society and the earth intensify. But education doesn't change easily. At the onset of World War II, with the fear of German and Japanese occupation real for much of the world, non-military academic curricula changed little. Perhaps this was wise, for the pursuit of knowledge may transcend temporary local disruption. The 21st century, however, feels like a more fundamental challenge to human society and the planet that supports it. Conservation, broadly conceived, may be more like the earth doctor profession -- struggling to save a planet under stress.

Many people are rising to the challenge with new disciplines, new institutions, new approaches, new morality, and a grassroots community-based activism that is unprecedented in human history. The Wiser.org website documents this change, cataloging hundreds of thousands of organizations seeking to improve and restore the earth and its people. Paul Hawken's book *Blessed Unrest* chronicles the story of this movement. In many places you can feel the energy. People are rising up to deny complacency and cynicism -- to find and invent new pathways to a sustainable future.

Graduate curricula, especially in the areas of conservation and sustainability, need reinvention. But how? There is already too much to know. Do we just add ecological economics, ecohydrology, complex systems, eco-justice, nano-biology, climate science, etc., to the already overburdened package of classes we ask our students to take? Our emerging learning process must ask harder questions, be more critical and systems-oriented, strengthen learning networks, forge stronger connections among disciplines, resonate with social justice and equity issues, and acknowledge an evolutionary and emergent approach to our curriculum. Re-energizing this process comes from a partnership among students passionate about learning and faculty who share a vision for both disciplinary excellence and expansive knowing.

Come join us.



Deane Wang is the director of Ecological Planning and an associate professor in the Rubenstein School of Environment and Natural Resources.

Energy Crusades

by Jeffrey Hughes

It's easy to preach energy conservation, but it's even easier to justify one's own energy use. Who turns down a trip to Alaska or the Caribbean? Who waits for a bus in the rain when he could just hop in his car without waiting? Who lives in a small downtown apartment when she could live in a spacious home surrounded by nature?

Self-interest usually trumps the greater good; that's why energy conservation is a tough sell. After all, if you're not willing to forego travel to distant lands to conserve energy, why should your neighbor stop riding his snowmobile or four-wheeler?

When we crusade for a cause it's because a deeply held value pushes us to do what we know to be right. We mustn't forget, however, that deeply held values aren't created by, or swayed by, rational argument. When "the other guy" ignores your compelling facts or arguments, it's for the same reason that you ignore his compelling facts and arguments. Both of you know what's right (at least you think you do) and you dismiss data that doesn't reinforce your deeply held "truths".

The new book *The Righteous Mind* by Jonathan Haidt explores this disconnect as it relates to the intractable gulf between the Republican and Democratic parties. The main thesis of the book is that reasoned argument is irrelevant unless it resonates with one's deeply held, fundamental "truths". To understand and be understood, you need to speak the same language. Learning how to do that is one of the FNEP programmatic missions.

Energy conservation? Begin with conserving your own energy. Be efficient, be smart, invest your energy wisely. Tilting at windmills might make you a folk hero, but it won't change the status quo. Find the nugget that drives your deeply held "truths." Seek out the deeply held truths of those you hope to interact with meaningfully. Compare the two; speak the same language. Save your facts, statistics, and reasoned arguments for later, when their ears – and yours – can hear what's being said.

Jeffrey Hughes is the director of the Field Naturalist graduate program, as well as an associate professor in the Plant Biology Department and the Rubenstein School of Environment and Natural Resources.

Inputs, Limits and Possibilities

by Bernd Heinrich

Energy. What is it? According to Albert Einstein, who came up with E = mc2, energy (E) is mass or matter (m), except with a specific relationship to the speed of light (c). But to me right now it is the heat that I'm soaking up by my "Star Keneo" cast iron stove. This energy reduces my shivering rate, and therefore saves me from expending more calories and thus allows me to eat less. For all of that magic I can thank nuclear reactions in the sun, which radiated the energy of disintegrating atoms in all direction, in part as light. A certain wavelength of that light was captured by the green leaves of maple trees of my grove over the last couple of decades, until I cut several of them with my chainsaw powered by more of that energy that had arrived here previously, some half billion years ago, and stored underground until maybe last month when I bought a tank-full of gasoline, schlepped here possibly from Iran or Kuwait. But all this may be trivial to the mundane truth that energy runs the world, and always has.

Winter ecology students, along with Professor Bernd Heinrich and TA Emily Brodsky, smile in the comfort of the Heinrich Cabin in Weld, Maine. At the end of the nine day course the students were well versed in winter twig and track identification, nest cavity explorations, macroinvertebrate searches and night time adventures in the woods surrounding the cabin.

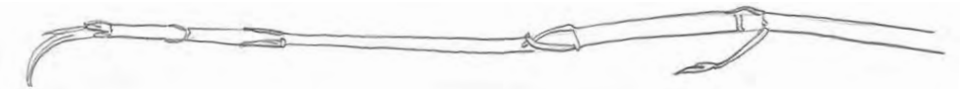
Almost all of the energy captured by life (except that living in ocean vents) comes to us from plants, or from those who eat plants, or from those who eat those who eat the plants. Massive doses of ancient stored energy fueled the Industrial Revolution and it got us into the ecological disaster we may be heading for now, from a massive population explosion. Energy makes all possible -- it allows us to ship our industries to China, rob us of jobs so CEOs can become millionaires, fetch us food from a thousand miles away, and make the stock market gain points. Without energy continuing to gush into our grubby paws we'd revert to the Stone Age. Hey! Anybody ready for the Paleolithic? I think maybe I am. Or trying.

All organisms on average "balance their energy budget," which pretty much means they don't expend more than they make, or take. If they have a temporary surplus they usually divert it to fighting, reproduction, or running around and having fun. On the other hand, if they run low they may starve, although generally they prefer first to just slow down a little, or a lot. An Arctic ground squirrel after it runs out of greens in the fall slows down a lot -- in this case going underground, curling into a ball, and attempting to stay at least a degree or two above the freezing point so it won't turn solid. Wood frogs may on occasion let their body temperature go even lower. They then look, or at least act, as though they are dead, and may indeed be dead except that a day or two after they thaw out in the spring they head for a temporary pool and quickly try to initiate sex.

Back when I was researching the mechanisms and implications of bumblebee economics and was awarded Senator of Wisconsin William Proxmire's Golden Fleece Award ("for wasting government money" because I was awarded a $20,000 NSF grant), I was in fact serious about energy, beyond the obvious and hence trivial. I was measuring and calculating rates of energy production and allocation in part derived from rectal (and thoracic) temperatures during shivering (and non-shivering) bumblebees during their various activities and discovered that when they ran low on energy resources (sugar that they extract from the nectar of flowers) they reduced the energy expenditure that they normally use to try to get even more. Imagine that! What if humans would come up with such a bizarre concept! No way; application of it would slow down the economy. Then we'd have limits, and who could get elected on a platform like that?

Bernd Heinrich is an author, scientist and professor emeritus at UVM. Every January he leads FNEPs on expeditions around his cabin in Maine during his Winter Ecology course.

Home Grown Change



by Hamilton Davis

Any day now, Mark Kimball will plant three acres of seed potatoes at Essex Farm in New York's Champlain Valley. He expects the crop will come in at about 25,000 pounds, enough to serve the members of his full-diet CSA for the coming year.

The potatoes will be organically and sustainably grown. He will use no herbicides or pesticides, and no commercial fertilizers. He will supply nutrients to the soil through a combination of compost, straw from his chicken enclosures, and cover crops, which means that the potatoes will contain significantly more beneficial trace elements than the commercial product.

He will pay a significant price for this ecological virtue, however. If he grew his three acres in the conventional manner, with commercial fertilizers and the full panoply of herbicides and pesticides, he could expect to reap twice the crop. Fifty thousand pounds, and with less human labor.

Is the strategy worth it? Well, it works for Mark. He and his wife Kristin have been remarkably successful in establishing the farm as a model for a full-diet CSA. The first generation of CSAs focused mostly on vegetables supplied over the growing season. Mark and Kristin expanded the concept to include a steady supply of meat and dairy and as well as some fruits and grains. And they are surviving financially.

The Essex Farm project is not about to upend conventional agriculture in the United States, which is built on a massive, industrial scale. But there are lessons to be learned here, and not just for local food production, but at a much larger scale as well.

A volunteer at the Mark and Kristin Kimball's Essex Farm in Essex, New York cleans hay from the barnyard.

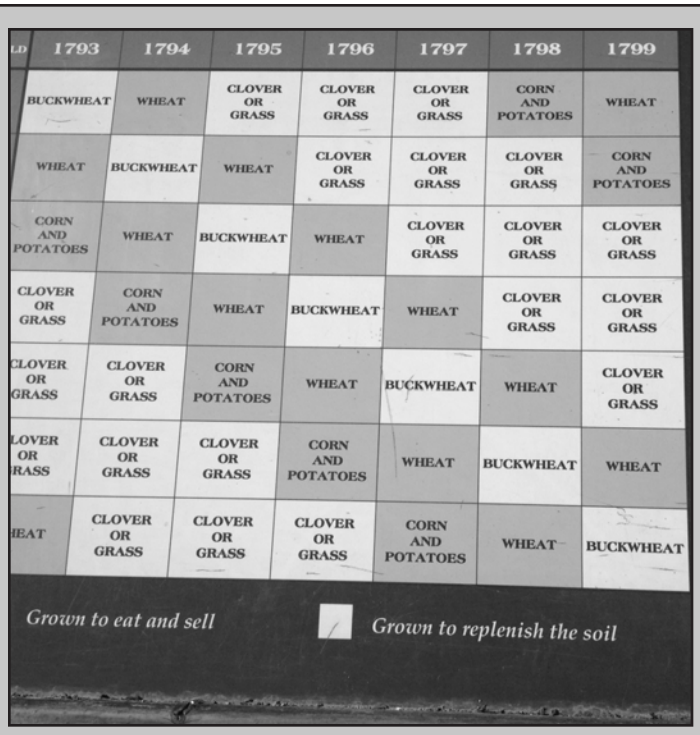
One of the most important involves energy. For what Essex Farm has been doing is dramatically shortening the distance between sunlight falling on the earth and food on the plate.

Virtually all of our food is now produced at a maximum distance, tens of thousands of years, between sunlight and plate. We use petroleum feed stocks to produce nitrogen-based commercial fertilizers, and we use oceans of petroleum products in the growing and harvesting processes as well as the transportation of food around the country. Each morsel of food we eat travels 2,200 miles between the field and the plate.

Even if as a society we decide to be sanguine about the damage to soil and water and air from the use of fossil fuels to feed the planet, the fact is that we are rapidly approaching the point where we may not have enough fossil fuels anyway. Some common metrics on world agriculture production: without fossil fuels, the earth can only produce roughly a third to two-thirds the food it does now.

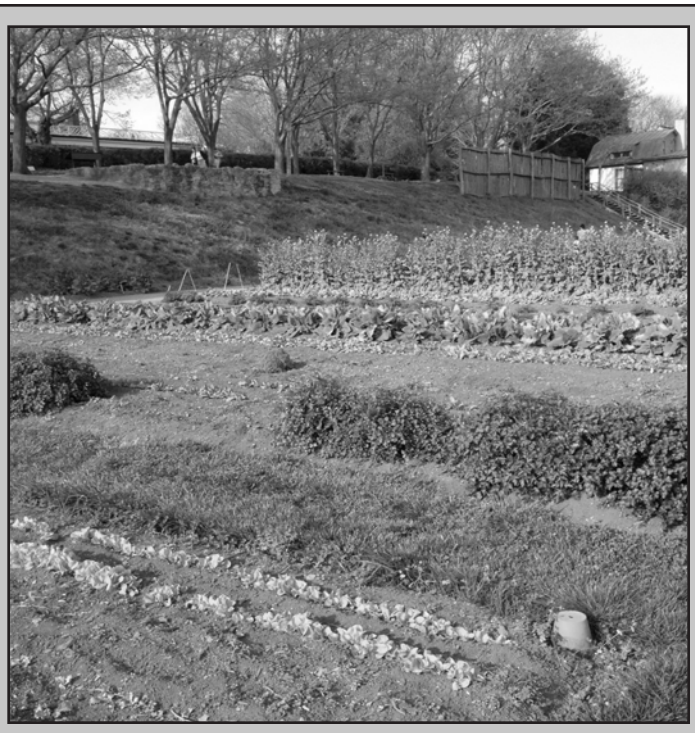
The world population hit seven billion people last year and academic projections are that it will reach nine million by 2050. If that happens, scientists say that we will have to grow more food over the next 40 years than humans have produced in the last 10,000 years, since the birth of agriculture itself. It's important to understand that these projections may be wrong. Malthus may still live. But even if the population of the world doesn't match the projections, the running down of the petroleum reserves available in the world will be a countervailing trend. Energy for agriculture is one of the most serious problems that human beings face.

In addition to posing an enormously difficult environmental and financial problem, energy is a major factor in the toxicity of our political life. Just take a



LD	1793	1794	1795	1796	1797	1798	1799
	BUCKWHEAT	WHEAT	CLOVER OR GRASS	CLOVER OR GRASS	CLOVER OR GRASS	CORN AND POTATOES	WHEAT
	WHEAT	BUCKWHEAT	WHEAT	CLOVER OR GRASS	CLOVER OR GRASS	CLOVER OR GRASS	CORN AND POTATOES
	CORN AND POTATOES	WHEAT	BUCKWHEAT	WHEAT	CLOVER OR GRASS	CLOVER OR GRASS	CLOVER OR GRASS
	CLOVER OR GRASS	CORN AND POTATOES	WHEAT	BUCKWHEAT	WHEAT	CLOVER OR GRASS	CLOVER OR GRASS
	CLOVER OR GRASS	CLOVER OR GRASS	CORN AND POTATOES	WHEAT	BUCKWHEAT	WHEAT	CLOVER OR GRASS
	LOVER OR RASS	CLOVER OR GRASS	CLOVER OR GRASS	CORN AND POTATOES	WHEAT	BUCKWHEAT	WHEAT
	HEAT	CLOVER OR GRASS	CLOVER OR GRASS	CLOVER OR GRASS	CORN AND POTATOES	WHEAT	BUCKWHEAT

Grown to eat and sell *Grown to replenish the soil*



Our founding fathers were not only politicians, but also farmers who knew how to care for the Earth. At left, George Washington's crop plan shows fields left fallow for four years out of seven; at right, Thomas Jefferson's gardens grew food for his dinner table. Today, the link between food, energy, and politicians appears to be broken. When average citizens commit to an environmentally sustainable lifestyle, politicians will follow suit.

look at the current presidential election.

Is there anything the ordinary person can do to repair some of these depredations to the earth, the environment and our polity?

In cosmic terms probably not much. There seems to be no near-term likelihood that our political leaders will effectively address our energy problems. No international effort, from Kyoto to Copenhagen, has amounted to much. In the U.S., even Democrats appear to have drifted away from any pressing concern for the environment. Top-down progress seems now a chimera.

That leaves individual or small unit action. Mark Kimball's potatoes represent the latter. The small farm, sustainable agriculture movement is a plus. We can try to support that. And, in food production on all scales, we can emphasize organic and sustainable methods. We can attack the waste stream in many simple ways. We can conserve carbon and nitrogen by composting and recycling. We can, in a sense, begin to garden the earth and thereby, on our own, shorten the distance between sunlight and food on the plate. I believe that this can, in the long run, be powerfully effective.

These efforts are in fact commonplace; you could call them clichés. But they are what we have and they can gather and grow to the point that they might move the system. In the short run, political leaders lead. In the long run, they follow. As the literary Mr. Dooley noted in another context, the Supreme Court follows the election returns. The more the average private citizen commits in his or her personal life to an environmentally sustainable lifestyle, the more likely it is that political leaders will incline in that direction.

Even if that doesn't seem to be happening now, living a sustainable life style will be essential to avoiding the existential despair limned by the great Irish poet William Butler Yeats in "The Second Coming," in what could be an epitaph for our time:

The best lack all conviction while
The worst are full of passionate intensity.

Hamilton Davis is a veteran Vermont journalist who has served as Managing Editor of the Burlington Free Press and as a Vermont legislator. He is the author of Mocking Justice: Vermont's Biggest Drug Scandal, and two chapters of the book, Howard Dean: A Citizen's Guide to the Man Who Would Be President. He has worked with the FNEP program since its inception, sharing his love of writing and helping generations of FNEP students learn to how to make complex scientific ideas come alive for broad audiences.

Introducing the FNEP Class of 2013

This year's incoming class, Team AC, chose the Cooper's Hawk (*Accipiter cooperii)* as their mascot. Although this doesn't necessarily mean they have red eyes or can fly between trees at high speeds with ease, they like to channel the hawks' grace, agility and intelligence as they navigate through the Field Naturalist and Ecological Planning programs. Early in their first semester they termed themselves 'The Cohort' with the knowledge that, like Captain Planet, they are stronger, smarter and more capable of changing the world together than they are alone. The following are short biographies of where they come from. Where they are going is even more exciting.

Robin Orr

My earliest memories are of playing with hermit crabs in Puerto Rico. I was four when we moved to Vermont, and I was pretty worried at first: it was cold when we got here (June) and before long it started getting colder! It never occurred to my family, who had lived in Montreal until going temporarily south, that I didn't know it would get warm again. What a relief to find out about seasons! Once I caught on, I fell in love with Vermont and no matter where I end up working or living, this will always be home. I grew up outdoors, but never understood how lucky I was to have so much un-built space around me. It didn't take too much traveling for me to realize how quickly it's disappearing across the country and around the globe. I'm here because I want to use my 15 years of public policy experience to protect what's left.

Carly Brown

I was raised in Vermont, convinced that I would settle elsewhere. While I was a reluctant "outside kid," my most poignant memories involve climbing the backyard cottonwood to reach the shed roof, exploring the woods with my dog and rooster. As a UVM undergraduate, I studied Biology, heading in the direction of a lab rat. I took a year off from UVM to swim with the fish of the Pacific at the University of Hawaii at Hilo. Between backpacking through the valley jungles and snorkeling under the ocean waves, my interest in the natural world flourished. After UVM I connected youth to the natural world at the Institute for Applied Ecology in Oregon. Yearning for more education experience, I then taught science and life skills to high school students as a Peace Corps Volunteer in Kenya. While I have enjoyed my travels around the world, and will continue them, Vermont looks pretty good as a home base.

Nancy Olmstead

From 2003-2011, I spent the academic year teaching ecology and environmental science labs at Bowdoin College in Maine. These past two summers I worked for the Maine Natural Areas Program, getting hooked on reading the land and telling its ecological story. Those two summers of fieldwork convinced me that my heart is in practicing ecology rather than in teaching. I came to UVM to learn practical field skills, but have increasingly found myself wrestling with (and enjoying) conceptual questions. In a list, I am: a make-a-list-and-check-stuff-off kind of person; an ISTJ; a spiritual person who is also a scientist; a detail-oriented, implementation type; a writer. I grew up in several different places but I've lived in Maine now longer than I've lived anywhere else – Maine is home.

Claire Polfus

A day that includes skiing in the mountains with my pooch, drinking strong coffee and eating tasty food with friends and family is a good day for me. My quest for these activities has led me from my beautiful home in northern Wisconsin to college in the East and on to adventures in the Rockies from Arizona to British Columbia. Through all this I have learned that caribou have a predilection for inspiring scenery, nesting sage grouse are buggers to find, and there a lot of birds singing in the upper Midwest. Also, I believe that scientific inquiry is our greatest tool for understanding the world, and that learning about the world beyond our computer screens combats the anthropocentric perspective common in our society. I am excited to take what I learn as an ecological planner ino the big old world, fueled by caffeine and with Raven (my dog) at my side.

Connor Stedman

I grew up in the rivers and hills of New England, the streams and fields of the Maryland piedmont, and the mountains and steppes of the inland Northwest. Wilderness experiences in my teens ignited my passion for traditional skills: awareness, tracking, survival, wildcrafting, bird language, and more. In the 10 years since then I've been on a journey of deep nature connection and mentoring; practicing and teaching regenerative agriculture; and learning about social healing and leadership. My primary project in the Ecological Planning program is to develop a beginning grower's manual on agroforestry systems for the Northeast. I love to sing, dance, hunt, fish, propagate plants, connect with people, and have adventures.

Liz Brownlee

I am a native Hoosier: my home place is a farm in the trees and hollows of southern Indiana. Home was a place of snapped beans, canned tomatoes, crawdads, and basketball. My family instilled a deep love of home as well as passion for travel. I have made friends with Alaskan crabs, Maine sheep, California trees, Colorado mountains, Indiana creeks, and some remarkable people as well. Through it all, my agricultural roots have held firm. Since graduating from Hanover College, I've been working as a farmer and an educator. I am thrilled to bring the lens of sustainable agriculture to my Field Naturalist studies. I am smitten with my hubby, Nate, and with life in general.

Ryan Morra

On the classic Myers-Briggs personality test, I scored a 56/60 for extroversion: I get my energy from other people and the external environment (fully, I am an ENFJ, but I am mostly balanced in the three other categories). I am compelled equally to explore the human condition – through my background in theatre – as well as ponder the nature of our wild brothers and sisters, plant and animal alike. I attempt to "live deep and suck out all the marrow of life" through hiking, cycling, camping, and contemplating expansive landscapes. I can burn through energy rather quickly, and thus need copious amounts of food and coffee to keep me going – the higher the quality of food and beverage, the better. In my moments of introversion (remember I was only a 56/60), I love listening to radio programs and taking in a marvelous sunset behind the Adirondacks on Lake Champlain.

Becky Cushing

Although I grew up in Saratoga Springs, N.Y., my interest in nature developed during summers I spent on the coast with my grandparents, watching shorebirds and paddling through New England salt marshes. I recorded wildlife observations on a tiny notepad and kept odorous specimens – mermaid purses, jingle shells and crab claws – in the drawer of my bedside table.Although it seems obvious now, at the time I didn't realize that my love for the outdoors and curiosity about nonhuman life could translate into a career. At Middlebury College I explored other fields, but after a summer stint as a kayaking naturalist and shorebird monitor I realized what I wanted to do. Ever since, I've committed myself to conservation and land/water issues, whether sailing in the Atlantic, farming in Pennsylvania, kayaking in Baja, banding passerines in Alabama, or managing volunteers for Mass Audubon. I'm focused on the interface between people and the environment, and how to make land management decisions in a dynamic, complex world. Ultimately, I hope to understand how these pieces fit together.

Sophie Mazowita

It took me until my first canoe trip, at age twelve, to realize I wanted to spend my life outdoors. Eight years and one environmental science degree later, I headed back to the site of this formative trip, Algonquin Park, to work as a naturalist (or 'geek' as we say in Algonquin). The time since has mainly been filled with adventures there, where the hardwood forests of southern Ontario meet the spruce bogs and Canadian shield of the north. Howling for wolves, pulling bear cubs out of dens, and putting radio collars on moose calves are all highlights. Other projects over the years have found me studying soil nutrient runoff in southern Quebec, radiotracking bats through New Zealand forests, and most recently, running wetland restoration and education programs in Toronto, Ontario. Through the Field Naturalist Program, I hope to learn how to better read landscapes as a living whole and to refine the communication skills needed to get a wide audience, not just park visitors, excited about nature and passionate about protecting their natural environment.

When asked for five words that give them energy, Team Accipiter cooperii cited some mutual and some unique sources. The size of the word corresponds with the number of responses.

Lessons from Busy Beavers

by Ryan Morra

Some of the most innovative engineers in the world take no formal courses in fluid mechanics, materials science, or even basic physics. They also only weigh 40-65 lbs. and can hold their breath for up to 15 minutes. No, I am not speaking about miniature amalgams of Doogie Howser and Michael Phelps. I am speaking of the largest of North American rodents, those curious little wetland mammals known in the scientific community as Castor canadensis, but more commonly referred to as the beaver.

Just beyond my backyard in Burlington, two beavers have been busy changing the flow of a stream running through the Centennial Woods Natural Area. After they successfully completed the dam in the fall, I watched the water rise behind the 4-foot high pile of sticks and mud and nearly flood a popular pedestrian footbridge. As the cold descended, the beavers denned up in their stream bank lodge for the winter to feed from their food cache. The pond they created froze over, and I couldn't see sign of any activity about.

By mid-January, I could hear water trickling through the dam from the stream beneath the ice-covered beaver pond. I suspected that the beavers had left, because the sound of running water is to a beaver like nails on a chalkboard are to humans – it needs to stop! On a particularly warm day (during a particularly warm winter in general), a flush of water breached the dam, and the surface ice of the beaver pond collapsed under its own weight. The gap in the dam continued to widen as record-setting temperatures in late winter continued to increase water flow.

Then one day in mid-March, bright-yellow, freshly chewed sticks began appearing again. It was dawn on the spring equinox when I saw a small head emerging from the water, front feet positioned below its mouth, and heard the familiar slap of its tail as it dove underwater. The beavers were back – or, likely, they never left at all. It seems that they had decided to conserve their energy until the early spring to re-build the dam, when the mud they needed to patch the dam was no longer frozen – smart of them!

Their reconstruction of the dam is equally as fascinating as its original formation. Just as the builders of the Hoover Dam had to first divert the powerful Colorado River from its course before they broke ground, so too did the beavers divert the upstream flow in order to make their repairs.

With their food supply diminishing, they are now favoring red maple and red-osier dogwood, since they have gone through most of the alders – one of their highly preferred foods, as it has more digestible energy and higher protein content. But just yesterday, I noticed activity even farther upstream, indicating that the beavers have decided not to expend their energy rebuilding the dam, given the falling food supply. They have begun building a new stream bank den, knowing that their hard work will be well worth it with a fresh supply of tasty young alders and willows upstream of their former home.

These cute and fuzzy engineers provide lessons about energy efficient work.


Winter Energy
in
Weld, Maine
Carly Brown


Friends around a fire
TREES
TREES
TREES
TREES
TREES
BROWSE

The Power of Citizen Science

by Liz Brownlee

Fifteen-year-old Danika Padilla can scarcely contain her joy. She waits in the sunny driveway on an early March morning near Jericho, Vermont, standing quietly as the other tracking students make small talk. The workshop begins, and she hikes in line with eight other students, ascending into the upland forest. As the group winds past white pines and rocky outcroppings, Danika's unruly brown curls slip out from her hat. As the tracking lesson begins, her enthusiasm escapes, too.

This workshop is Danika's last of seven, making her a fully trained citizen scientist ready to inform development and conservation in her community. She has spent the last two winters learning to read the tracks and behaviors of bobcat, bear, fox, coyote, fisher, and other wildlife. Today, Danika hopes to push her skills even further.

At the intersection of two trails, the trackers spot foot-long scratches on a three-foot wide pine trunk, slivers of yellow inner bark contrasting with the grey and brown winter forest. They stop, and the trackers take turns examining the tree. They run their hands along lines of raised bark where the tree has healed over old scrapes, bumpy like hastily mended jeans. They hold a hand up beside the bark for contrast, and find coarse black hairs. They declare that a bear must have made these marks.

Sue Morse, the wildlife ecologist and professional tracker who teaches these workshops, is pleased, but she wants the students to do more than identify the marks. She wants them to understand what the signs mean. Does this bear raise young or breed here? Does it rely on this upland forest for survival?

Sue founded Keeping Track to help communities answer these questions. Keeping Track is a nonprofit that teaches citizens to monitor their communities for wildlife activity and habitat use.

Sue Morse, expert tracker and founder of Keeping Track, equips citizens to inform local conservation decisions. Above, Sue holds a photo of a Bobcat and a kitten captured on a motion-sensor camera. Bobcat photograph ©Susan C. Morse

Sue has been training citizen scientists since 1994. To date, Keeping Track's trained trackers have used wildlife signs like the scrapes, hairs, and bite marks on this pine tree to help conserve over 31,000 acres across the U.S. and Canada – that's the equivalent of two Manhattan Islands.

Today's workshop is giving eight more individuals the skills to conserve habitats in their communities. These students are typical Keeping Track participants - volunteers and natural resource professionals who are honing their understanding of the natural world, who are excited to become citizen scientists. Danika fits the bill, too. She already volunteers with her local land trust, and now she is learning to collect the field data they need to make wise conservation decisions. However, she is one of only four teenagers ever admitted to the Keeping Track trainings. Sue calls her "especially special."

Sue pulls a bear skull from her pack and challenges the trackers to locate where and how the bear bit the tree. Danika searches for a place where the bear sank an upper incisor into the bark and then scraped the tree with a lower incisor. She finds one set of bite marks, but to get the skull to line up with the markings, Danika has to turn the skull upside down. She contorts her body, attempting to get into the bear's position. She holds the skull up to her face, leans back against the tree, turns her head over her left shoulder, and matches the skull back up with the bite marks.

Sue laughs with the group. Danika's contortions are awkward for a human, but the position is just right for a bear spreading its scent. Sue explains that black bears bite at trees' dark outer bark to reveal inner bark. Te light tans and reds draw attention to the tree, the inner bark holds scent markings better. Other bears notice the signs, and humans should take note, too: bears regularly use this place.

Danika stands up, hands the skull back to Sue, and secures this new piece of information, this new tool for understanding wildlife behavior into her

tracking toolbox. For trackers hoping to conserve land, this tool is especially exciting. If Danika finds a bear's tracks or scat in a forest, she knows a bear has been through the forest once. But if she finds a legacy of signs like on this pine, she knows that generations of bears have relied on this habitat for years – a compelling argument for habitat conservation.

Land trusts and activists in Danika's community rely on this kind of hard data to shape policy. Danika lives in the rolling hills of western Massachusetts. Recently, a developer proposed building condominiums in a hardwood forest near Pontoosuc Lake, in Pittsfield, Massachusetts. Citizen scientists' data showed that bear and deer used the forest regularly. The parcel is their connection route between upland forests and the lake. The Community Development Board and the Pittsfield Planning Board used their information to revise the developer's blueprints. Several condominiums were dropped from the plans entirely, and the access road repositioned to keep the bear and deer corridor intact.

Danika wants to inform and affect conservation decisions, too. That's why she's learning to track. "It's the conservation work. I get to learn what wild species have to teach me, and I get to help them. It only makes sense."

Sue echoes Danika's sentiment. "The beauty of citizens participating is that it really empowers them to shape the conservation destiny of worthy lands in their region."

Citizen science certainly seems like an elegant solution to shrinking conservation budgets and a growing disconnection between people and the land. When community members help collect scientific data, monitor species, or care for a habitat, they learn about the natural world and help achieve real conservation goals. But can volunteer efforts really fuel conservation work in the twenty-first century?

Citizen science requires huge time and energy inputs from volunteer coordinators, scientists who support the projects, and the citizen scientists themselves. Many citizen science programs fall apart after a few months. Volunteers stop showing up, or the budget runs out. Other projects go on monitoring species or creeks for years, but they fail to really engage the volunteers or achieve any real change.

Citizen science can be a powerful conservation tool, but only if it is "energy efficient."

Danika is a perfect example of powerful citizen science because she is matched with a project that fits her community's needs and her needs. This matchmaking is perhaps the most important aspect of energy efficient citizen science. Her community identified conservation as a priority, and her work will inform conservation decisions. Tracking projects take seasons – sometimes years to complete – and it requires commitment and leadership. Danika wants to learn and lead, and she has the time and energy to commit. The match is efficient and effective.

Successful citizen science projects don't have to be long-term projects to be efficient, of course. In Vermont's Champlain Valley, the Lewis Creek Association (LCA) protects and restores their watershed. Citizen science efforts of all shapes and sizes fuel their conservation work.

Marty Illick, the group's straight-talking executive director, says that the group "just started out as residents wanting to know more" about land management and wildlife in their community. "We wanted to provide conservation planning tools," because there simply weren't any resources available to the town officials.

Citizen science solved both problems. The LCA asked the local planning office to prepare a map of the watershed, and avid hunters marked up the map, showing road crossings and important habitats. The group also created a Keeping Track program to survey for key wildlife (bear, bobcat, deer, coyote, mink, otter, fisher) across their watershed. "Fifty people came out to learn how to tell a bobcat from a coyote, and it was fun! It's got to be fun."

The LCA's mapping work demonstrates the best practices of energy efficient citizen science. The work matched the community's need. The organizers

Efficient citizen science has a clear goal. Volunteers in Danika's community collected data that help protect bear habitat in Pittsfield, Massachusetts. Photograph ©Susan C. Morse

recognized the need for fun and fellowship. The LCA partnered with community and professional experts.

Powerful citizen science projects recognize that people are most invested in their own backyards and playgrounds. Here, coordinator Craig Bunten removes an invasive species, European frogbit, from a local wetland.

And yet, Marty says, the tracking efforts "came and went." The project was powerful for their community in the 1990's, but isn't the right fit today. Marty says that developing tracking skills, recording data consistently, and being in the field four times a year became too much for families that also wanted to spend time at the baseball diamond. Keeping Track is obviously still worthwhile and effective – it just doesn't match the LCA's current community needs or commitment level.

Efficient citizen science changes over time. It adapts, always matching community members and nonprofits with work that fits their needs.

The LCA has adapted. They transitioned to local projects that take less time but still address real needs. In 2007, for instance, kayakers reported a new plant species in the shallow, still waters of Town Farm Bay, a wetland on the edge Lake Champlain. By 2009, a carpet of green covered more than half of the wetland. The LCA sent samples of the green stuff to the state and learned that it was European frogbit.

Frogbit is an aquatic plant with heart-shaped leaves and white flowers, like so many miniature lily pads. It can cover the surface of slow moving waters and form an impenetrable mat of roots, leaves, and stems. Frogbit mats can shade out other aquatic plants, and makes it nearly impossible for fish, waterfowl, and kayakers to move through the wetland.

Frogbit is an invasive species, but Marty says that it isn't high on the state's priority list. But frogbit was taking over the much-loved and much-used Town Farm Bay, so the LCA got to work. They consulted with biologists to create a plan for monitoring and removing frogbit. They recruited citizen scientists from around Vermont and headed to the wetland.

Volunteers committed to working for one morning or afternoon. They went out in hip waders or kayaks and pulled the frogbit, plant by plant. In one shift, they cleared frogbit from another quarter mile of wetland.

"Eighty percent of our volunteers are local residents. That was a key lesson for us."

Keeping projects local keeps citizen science projects efficient and meaningful. People are most invested in their own backyards and playgrounds, in projects that genuinely address their community's needs. Volunteers can see and feel why their work mattered – and they can show it off to neighbors and family members. Local projects also make logistics easier. Town Farm Bay is nearby and the shifts are short, so it is easy for potential citizen scientists to commit.

Is this citizen science effort successful? So far, they're making headway, removing frogbit from the wetland and monitoring its return. "But it's a learning process," says Marty, laughing.

Sue has also learned that citizen science is most powerful when the citizens have a vested interest. Land trusts greatly value monitoring data because conserving tracks of land is their primary task. Wildlife data helps them prioritize conservation projects. Land trusts – groups like Danika's – now make up 80 percent of the Keeping Track teams, and the citizen science is effective and efficient.

Back in the field with Sue, a novice tracking student notices a footprint. The group follows the 1.5 inch wide tracks uphill, up the trail. Someone wonders aloud: "Could it be a coyote?"

It's a good guess. Few animals walk in straight lines, along human paths. But the guess is incorrect, so the students keep scouting the scene. Danika crouches, smelling some yellow snow along the track. The other students smell the urine eagerly, but the clue does not elicit new guesses. Danika knows that the urine is the missing piece of the puzzle. The pungent skunk-like mark indicates red fox.

Sue nods her approval to Danika, another trained citizen scientist, ready to serve her community.

What Did You Do Last Summer?

Every summer Field Naturalists and Ecological Planners collaborate with a community partner for their Master's projects. Here is a taste of the variety of projects from team *Abies balsamea* (FNEP '12).

Emily Brodsky

Vermonters are working to develop community-driven, locally-based food systems, but they face challenges including competition from cheap industrial food sources, high land prices and production costs, and limited consumer awareness. For my project, I explored solutions to these challenges in Windham County, Vermont.

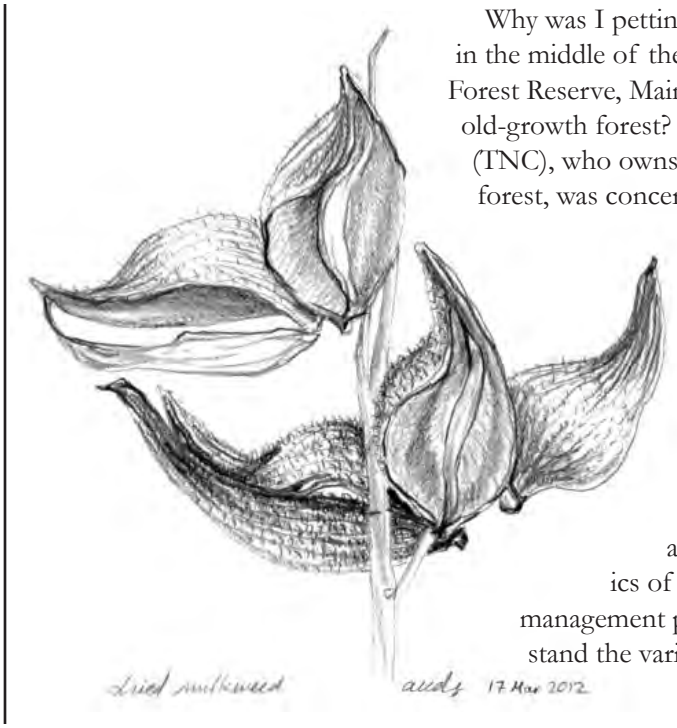
I worked with the Windham Farm and Food Network to find strategies for making more local food available in institutions like hospitals and schools. Based on interviews with farmers, I identified several resource-efficient crops to target for local production, and I used GIS to map out opportunities for sharing land and infrastructure among farmers. I also proposed long-term goals for the WFFN to move toward a broader vision for the Windham County food system, including land acquisition opportunities and marketing of more regionally suitable foods.

I also worked with the Windham Geographic Analysis Project to develop a prototype web-based "food atlas" for Windham County. The atlas will enable food system planners and educators to access and analyze geographic data relating to natural resources, land use, markets, and infrastructure in Windham County, without requiring specialized software or skills.

Both parts of my project will guide decision-making by the Windham Farm and Food Network and other players in the Windham County food system, and may inform localization efforts in other places.

Rachel Garwin

I stuck my head among the sugar maple seedling's branches, knees burning from crouching all day. I pinched a twig where a moose had bitten it, and my other hand traced the twig to the stem, then the stem to the ground. By the time my fingers reached soil, I counted twenty-two terminal bud scars, each signifying a year that the seedling had lived. This tree didn't reach my belly button, but it started growing before 1989.



Why was I petting sugar maple seedlings in the middle of the 5,000-acre Big Reed Forest Reserve, Maine's largest expanse of old-growth forest? The Nature Conservancy (TNC), who owns and manages the forest, was concerned that intense moose browsing was preventing sugar maple seedlings from regenerating into the canopy. I assessed whether moose threatened the old-growth forest.

I surveyed current and past moose browsing on sugar maple to assess when stems were browsed and whether moose prevent a meaningful number from growing into saplings. Moose browsing was common and sometimes severe, but sugar maple seedlings were also damaged by snowshoe hare and unknown abiotic factors. As so often occurs in nature, the population dynamics of sugar maple at Big Reed are affected by many factors, including management practices on surrounding land. My research will help TNC understand the variety of influences on sugar maple regeneration in the old-growth forest at Big Reed.

Cathy Bell

Subfreezing temperatures in mid-July? Carrying a seventy-five pound pack for fifteen miles to my base camp at 11,000 feet? Attempting to learn the flora of the High Sierra—more than a hundred species of plants—with just a few short weeks of herbarium study? Bring it on!

As a national parks junkie with a love of high-elevation ecosystems, I came to the Field Naturalist program hoping to learn more about ecology, field botany, and climate change impacts. My master's project was a perfect fit for my interests: I did my fieldwork in the wilderness of California's Sequoia National Park, studying alpine plant communities to see if they have changed over the past twenty-five years.

Sequoia and its neighbor, Kings Canyon National Park, lie in the southern Sierra Nevada. The forty percent of the two parks that lies in the alpine zone and is home to more plant species than any other continental alpine area in the world. Though change happens slowly in the alpine, my research found subtle shifts in herbaceous ground cover and species distributions since the 1980s. Park resource managers will use my findings to guide a resurvey of nearly 300 high-elevation monitoring plots.

Doug Morin

Local food is all the rage in Vermont these days. Chances are you know a few local farms and maybe even where the vegetables in your refrigerator came from. But do you know a few local foresters? Or where the wood in your desk came from?

Consulting for the Riverledge Foundation of Windham County, Vermont, I conducted my research out of an old farmhouse with the company of Emily Brodsky (team AB), Chaplin the cat (Honorary team AB), and a healthy population of local rodents. I profiled the ecology and economy of the local forest products industry. I interviewed landowners, loggers, foresters, mill operators, and woodworkers to gain an integrative snapshot of the pieces, patterns, and processes at work. Then I identified trends and possible intervention points for those wishing to increase local and sustainable forest use.

Apart from the many Pulitzers my work will undoubtedly win, it will also inform local, county, and state-level discussions about the future of Vermont's working landscapes.

Danielle Owczarski

As development pressures increase, so does the need for conserving land. In Vermont, large charismatic land holdings are being sub-divided and sold, putting their productive potential as working landscapes and wildlife habitat into limbo. How do we conserve these areas and choose which are best suited for conservation?The new Vermont Land Trust (VLT) Common Lands program aims to curtail this dilemma. Using the program as a vehicle, VLT seeks to own, manage, and conserve land that offers multiple-use opportunities, while also demonstrating environmental land stewardship. But the question remains as to how to evaluate these lands for this purpose.

The VLT contracted me to assess a 420-acre property in Hubbardton, VT. In the beginning of the summer I researched the cultural and natural history of the property: the geologic processes that formed the land, population demographics, regional climate data, and historical land-use activities. I spent the next two months in the field mapping and evaluating the property's natural communities, land cover types, and water resources. Using an integrative approach, I created a report that provided a landscape and natural resource overview of the property, an evaluation of the current landscape condition, recommendations for future management and restoration projects, and a model vision for evaluating common lands.

Audrey Clark

Why did the bobcat cross the road? To access resources on the other side, of course. Some animals avoid roads altogether, but millions are road-killed each year. As habitat shrinks and becomes increasingly fragmented, the adverse effects of roads will become even more pronounced. Some wildlife populations are certain to decline to alarming levels.

The goal of my master's project was to locate where black bear, bobcat, and fisher have difficulty crossing roads in the Split Rock Wildway section of New York's northeast Adirondacks. I used roadkill data to identify hotspots of wildlife-vehicle collisions and prioritized them for "roadway mitigation" projects, such as installing underpasses and culverts. When paired with habitat conservation, mitigation projects support landscape-scale connectivity. When landscapes are connected, animals can reach the resources they need, even as climate change forces them into new areas. I am working with partners to plan a website where the lay public can report roadkill and other roadside wildlife sightings in the Northeast. This website, which we anticipate launching next year, can inform future roadway mitigation and habitat conservation.

Leah Mital-Skiff

I am an educator through and through, though that has taken many forms since I was sixteen. I am also an outdoor-junkie-land-conservationist, which too has been a solid part of my lifelong landscape. My master's project has allowed me to combine the two. During the summer, I co-instructed the Land Stewardship Program (LANDS), a 9-week conservation internship for college students and recent graduates. As a consulting team of two instructors and 9 interns, we took on projects such as wetland delineation and identification for the Green Mountain National Forest, and invasive plant species mapping for Burlington Parks and Recreation.

As a complement to my work with LANDS, I am tackling the question of what makes an extended outdoor adventure education program transformative. This centers on participants' ability to make sense of their experience and integrate their learning when they return home. I am putting together practices and tools for outdoor adventure education participants to bridge wilderness and home. Coming full circle, a variation of these practices also have an application for the LANDS program. I will serve as a consultant this summer for LANDS, where I can implement practices to more deeply connect interns with their project landscapes.

Lindsay Watkins

Sometimes you can't see the forest for the trees but I tried to look at both. I traveled all over Vermont, trying to understand forest health on scales as large as the entire state to as small as a single year of growth on a single tree. I worked with the Vermont Department of Forests, Parks, and Recreation investigating possible causes for an increase in tree mortality between the 1997 and 2007 Forest Inventory and Analysis (FIA) surveys. We focused on several species that that showed increases in mortality, including red maple, balsam fir, and american beech.

Working with Vermont's foresters and forest health specialists, I supplemented the FIA assessment by collecting soil samples and increment cores from trees growing at 15 sites. We are incorporating spatial and historical data with measurements of growth rings in the tree cores, to examine the timing of stress events and how they affect growth and survival of trees. What makes a forest "healthy" or "unhealthy" is still unanswered, but hopefully the analysis of 200+ tree cores will provide some insight.

Harvesting Nature's Energy

by Connor Stedman

This winter, I spent a day with Joel Salatin, a farmer from the Shenandoah Valley of Virginia, and heard him speak about sustainable agriculture and local food systems. Joel and his family's farm, Polyface, were made famous by Michael Pollan's bestselling book *The Omnivore's Dilemma* and further popularized by the documentaries *Fresh* and *Food, Inc.* Polyface Farm raises a wide range of livestock – cows, pigs, rabbits, chickens, and turkeys – for meat and eggs. Through sophisticated rotational grazing, Polyface's systems grow topsoil and restore healthy, diverse pastures in a landscape heavily impacted by 200 years of deforestation and overgrazing. The farm has been widely recognized as a national model for diverse, local, "beyond-organic" agriculture, and Joel is an increasingly sought-after speaker and teacher in the US and beyond.

In addition to their well-known grazing practices combining cows and poultry, Polyface also pastures pigs in oak woodlands for part of the year. During this period, short-time-frame rotations build topsoil and mimic the periodic disturbance of the oak forest's natural fire cycle that's been suppressed for centuries. Meanwhile, the pigs fatten for the winter on acorns. Joel described how prairie and savanna species are returning to the understory of these woodlands, invited out of dormancy in the seed bank through the pigs' disturbance cycle. This "pigs in the woods" system is a form of agroforestry, a land use pattern with an ancient history around the planet.

Agroforestry can be loosely defined as "trees with agriculture", and implies a diverse and interconnected system, rather than a monoculture of trees such as an apple orchard. One type of agroforestry is silvopasture (animals under trees) such as Polyface's pigs pastured under oaks. Two others are alley cropping, or growing tree crops in between or above other crops (such as berries, flowers, or vegetables), and forest farming, or growing shade-tolerant crops in the understory of forests. Some references also define riparian buffers and windbreaks as forms of agroforestry, since they combine trees with conventional farming practices.

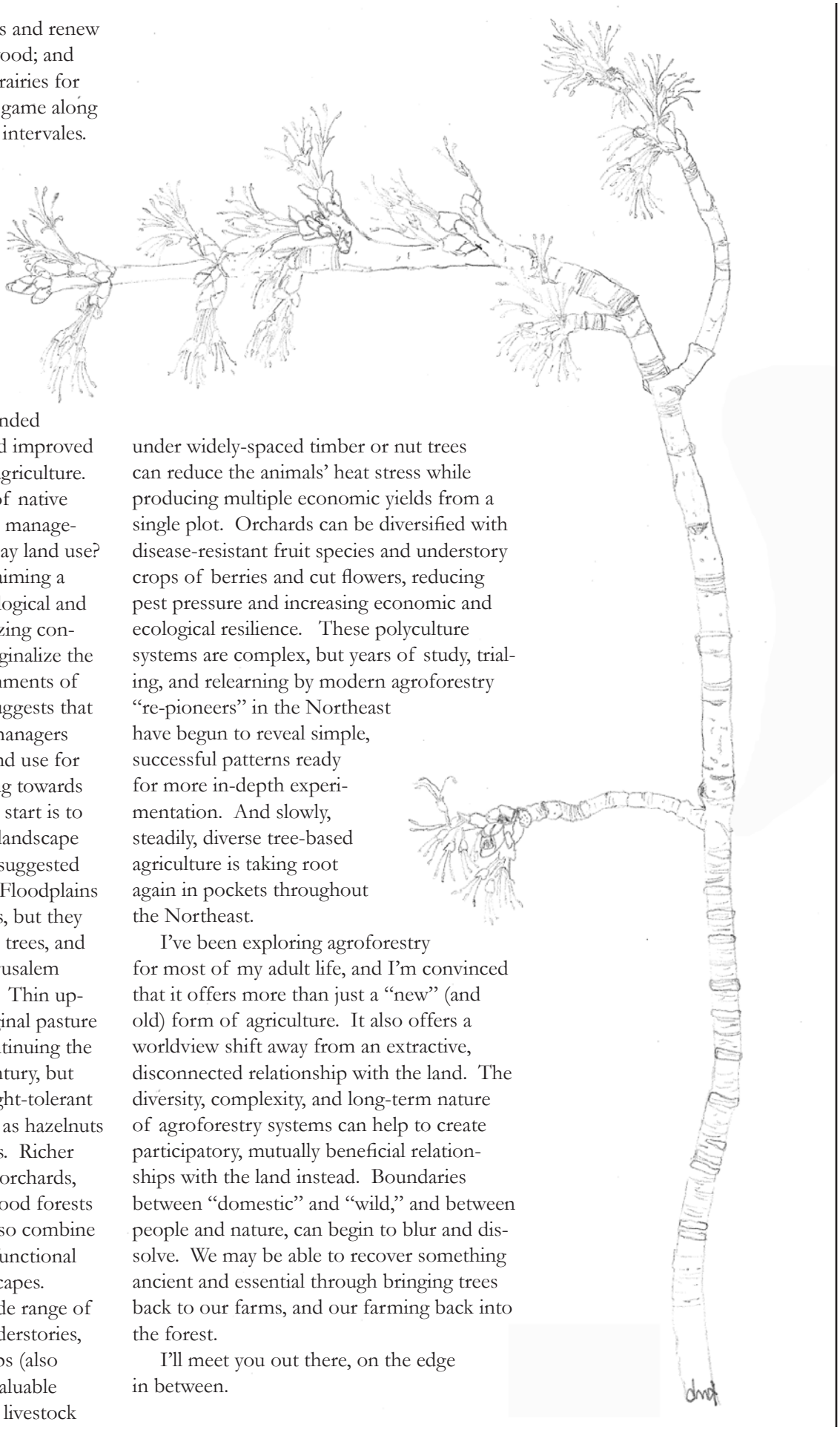
Connor Stedman, FNEP, gathers prairie sage from an open patch in a coniferous forest.

Agroforestry practices are best known from the tropical world, where multi-thousand year traditions of tree-crop agriculture still provide for millions of peoples' livelihood. The history of agroforestry in North America, however, is much less studied and documented. In her groundbreaking book *Tending the Wild: Native American Knowledge and the Management of California's Natural Resources*, Dr. M. Kat Anderson of UC-Davis documents the traditional land management practices of indigenous people throughout California. These included extensive management of oak woodlands, hazelnut thickets, desert palm groves, and other traditional tree crops. Management techniques included clearing, burning, pruning, transplanting, and coppicing tree crops to produce heavily and regenerate over the long term. When I met and spoke with Dr. Anderson several years ago, she emphasized how nearly every "wild" landscape in California has a pre-colonial history of indigenous management. The beauty and abundance of the California seen by John Muir was, in part, a result of these traditional land use practices.

This story can be found in the history of the Northeast United States as well. Native people managed oak, hickory, chestnut, and butternut forests through clearing and fire; burned blueberry barrens and blackberry thickets

to remove encroaching trees and renew the berry shrubs' fruiting wood; and maintained meadows and prairies for growing crops and hunting game along the coast and in river valley intervales. The open, park-like hardwood forests of southern New England, cut for building, fuel, and tannins in the colonial period, had been shaped by many generations of native peoples' management. The rich valley soils that European settlements depended on had been maintained and improved by centuries of traditional agriculture.

What does this history of native agroforestry and ecosystem management suggest for modern-day land use? First, it points towards reclaiming a more whole version of ecological and social history, and decolonizing conventional histories that marginalize the experiences and accomplishments of native people. Second, it suggests that modern farmers and land managers might look to traditional land use for new inspiration in navigating towards sustainability. One place to start is to match the uniqueness of a landscape with regenerative practices suggested by the land's older history. Floodplains can grow corn and potatoes, but they can also grow walnuts, fruit trees, and perennial vegetables like Jerusalem artichoke and ostrich ferns. Thin upland soils can support marginal pasture land for sheep or cows, continuing the overgrazing of the 19th century, but they can also support drought-tolerant native perennial crops such as hazelnuts and many species of berries. Richer midslope soils can support orchards, pastures, gardens, or hardwood forests – but those elements can also combine to create powerfully multi-functional working agroforestry landscapes. Sugarbushes can grow a wide range of full-shade crops in their understories, including mushrooms, ramps (also known as wild leeks), and valuable medicinal plants. Pasturing livestock under widely-spaced timber or nut trees can reduce the animals' heat stress while producing multiple economic yields from a single plot. Orchards can be diversified with disease-resistant fruit species and understory crops of berries and cut flowers, reducing pest pressure and increasing economic and ecological resilience. These polyculture systems are complex, but years of study, trialing, and relearning by modern agroforestry "re-pioneers" in the Northeast have begun to reveal simple, successful patterns ready for more in-depth experimentation. And slowly, steadily, diverse tree-based agriculture is taking root again in pockets throughout the Northeast.



I've been exploring agroforestry for most of my adult life, and I'm convinced that it offers more than just a "new" (and old) form of agriculture. It also offers a worldview shift away from an extractive, disconnected relationship with the land. The diversity, complexity, and long-term nature of agroforestry systems can help to create participatory, mutually beneficial relationships with the land instead. Boundaries between "domestic" and "wild," and between people and nature, can begin to blur and dissolve. We may be able to recover something ancient and essential through bringing trees back to our farms, and our farming back into the forest.

I'll meet you out there, on the edge in between.

Energy to Move the Heart

by Nancy Olmstead

My Conservation and Sustainability class has a guest speaker every week. One recent guest, a hard-working conservation organizer, was wishing that more people would place a high intrinsic value on nature so that her work would be an easier "sell." To this end, she applauded the work of environmental education centers and nature-awareness programs. She expressed her hope that many of us would go on to careers in childhood education, to help children cultivate appreciation for the natural world and a sense of connection with it.

But I'm not sure if she was right. Can that kind of deep-seated value system can be taught or developed in an outdoor education center? I've worked at several nature centers where children come to play outside, have a "break" from the classroom, put their hands on a tree or frog, or see a woodpecker. I do believe that these opportunities can help relieve the "ecophobia" that comes from lack of experience with nature. But our deepest core values and beliefs, the things that give us energy and motivation, seem to come from our families.

One of my extended family members is smart and kind, but she always worries about what others think of her, her family, her house. It is hard for me to relate to her. I tend to be confident, direct, and a little headstrong. I have a solid sense of self-confidence; I don't worry too much about how my personal choices are perceived by people around me. Why are we so different? A friend of mine provided a simple explanation.

My friend is a whip-smart woman who did her Master's degree in Mind, Brain, and Education at Harvard; she's an experienced Waldorf teacher and she understands development in both intuitive and scientific ways. After telling my friend about my family member, I asked her: why does my family member lack self-confidence and sense of self? Where does that rock-solid sense of who you are come from? My friend's reply was immediate and instinctual: "It comes from the parents."

The Heath in Saco, Maine, moves Nancy's heart. What moves yours?

That stopped me in my tracks and made me really consider: what else comes from our parents?

Do our feelings about the natural world, and our beliefs about its value, also come from our parents? How much can non-familial experiences shape and mold our core beliefs about anything? How do those beliefs and values evolve, once they are formed? What does it take to really change your heart?

The only vocabulary I have for radical heart-change comes out of my religious tradition. I know people who have meaningfully changed their lives, including core values and priorities, as a result of experiences with the divine. These are powerful stories of encounter and connection. The energy is mediated through all kinds of channels: other people, animals, sacred space. Only occasionally are these transformative experiences born out of family. What can we learn from religious experience about how our beliefs and values can change?

Most of the conservation practitioners I have met say that the deepest challenges in conservation are not scientific; they are in convincing people of the worth of conservation projects. That won't happen through reasoned argument. Somehow we must move people's hearts.

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Master's Project Call for Proposals

Do you need technical assistance with a high-priority field research project? We seek to match Field Naturalists and Ecological Planners from the class of 2013 with Master's projects sponsored by environmental organizations on the cutting edge of conservation science.

We are looking to link FNs and EPs with projects that challenge them to use their intensive training to its fullest. Our graduate students are professionals who are expected to demonstrate their unique skill sets while working with sponsoring organizations. FNs and EPs work closely with their communities and sponsors throughout the process to ensure that the product directly addresses the sponsor's needs.

In return for the services provided, we ask sponsors to contribute $5,000 to our Sponsored Master's Research Project Fund. This contribution is used in its entirety to help defray tuition expenses of the student.

We plan to match students with projects by January 2012 so that students can work with sponsors during the spring (2012) semester to plan for the summer field season. Data analysis and report writing continue into the fall semester, with products delivered to sponsors between December 2012 and May 2013. If you are interested in having an FN or EP work with your organization, please contact:

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