





On the Cover: CT DEEP biologist Paul Fusco captures a quiet moment with a large black bear.



Youth are leading the global climate justice movement, page 8

Spotlight



For **Declan McCabe**, a professor of biology at Saint Michael's College in Vermont, science storytelling presents an opportunity communicate science to a wide audience. An ecologist by training, he specializes in the biological diversity of freshwater lakes and streams. In addition to his scientific research and academic duties, McCabe is a regular contributor to "The Outside Story" in Northern Woodlands magazine. His first book, "Turning Stones: Exploring Life in Freshwater," a collection of essays about the natural world, will be published by McDonald & Woodward this spring.

We caught up with Declan to learn more about his research and passion for science writing.

What kind of scientific research do you do?

I'm interested in the effects of disturbances in streams.

Disturbances can be either human or natural, caused by the movement of stones, for example. Some of my research questions are: Does the number of species decline in a disturbed stream? and, What are the differences in biological diversity between an urban stream and one in a forest?



Beetles are nature's recyclers, page 16



Climate change presents new challenges for Connecticut's foresters, page 19

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I grew up in Ireland fishing on the River Shannon (the longest river in the British Isles) with my dad. When I was 12, I did a big

What first attracted you to aquatic insects?

science project on caddisflies, and I was hooked.

Do you still fish?

As an aquatic insect person, people often assume that I fish, but I'm actually allergic to fish.

You've published extensively in academic journals. What drew you to science writing?

It was accidental. A middle school teacher contacted me about a centipede that was running loose in their school. It became a fascinating story and I thought, "This should be written up." So I wrote the story and it was published in Northern Woodlands magazine. I got a lot of positive feedback about that piece, and I thought, "I'd like to keep doing that."

Of course, this type of science writing is not always respected by the academy.

That's right. I only started doing this type of writing once I was tenured. I think it's important for liberal arts institutions to reconsider what their priorities are. It's important for us to reach a broader audience, not only to communicate science, but also for the survival of the academic institution. You can write and publish a dozen academic papers, but they're unlikely to catch a parent or a prospective student and get them interested in your program. My goal is to excite people about science.



Editor's Note

On March 24, 1989, the Exxon Valdez ran aground in Prince William Sound, spewing 11 million gallons of crude oil into the cold, Alaskan waters. For the next several days, the nightly news broadcast grisly images of bald eagles, sea otters, and seals coated in oil. Workers sprayed chemical dispersants along the rocky shore. Countless seabirds and schools of herring and salmon perished in the slick. Eventually, the oil would contaminate 1,000 miles of coastline. Despite a decades-long clean-up effort, raw crude still lies just below the surface of many Alaskan beaches.

At the time of the accident, I was a freshman in high school, a Boy Scout and an experienced backcountry camper who loved being outdoors. Watching the Valdez disaster unfold on television had a profound effect on me. No longer was it sufficient to simply love nature; suddenly I felt a moral imperative to help protect it. I became an environmentalist.

There is no one right way to be an environmentalist. Some people practice conservation; others engage in politics or philanthropy. Some use education or art to inspire change, while others take to the streets in peaceful protest. Environmentalists may be driven by their moral conviction, scientific curiosity, concerns about public health or by a business imperative. But despite our differences, all environmentalists share one thing in common—a commitment to protect and defend the natural world.

Today, the climate crisis is inspiring a new, diverse generation of environmentalists. Globally, youth are leading this movement. Unlike my generation, which relied heavily on traditional media and established NGOs, as Renee Jiang writes in this issue, today's youth are using social media and political savvy to organize, engage leaders, and demand climate justice now. We grown-ups would be wise to hear—and heed—their clarion call.

Timothy Brown

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From the Statehouse

By Eric Hammerling

How Words Matter to Forests

At CFPA, we know that words matter, and so we take care to be accurate in how we present information in Connecticut Woodlands, at the Capitol, in our email and social media, and elsewhere. But as the old axiom goes: "Sometimes it's not what you say, it's what people hear."

The original public review draft of the Forests Report to the Governor's Council on Climate Change (G3) evoked some surprisingly intense responses to the following forest-related terms: forest protection, forest resilience, forest management, forest reserve or preserve, and sustainable forest management.

Because of conflicting interpretations of these and other terms and the strong reactions they triggered, some of the recommendations that we had tried to highlight in the Forests Report were lost in the drama. Some reviewers of the Forests Report argued from one perspective that a forest cannot be both "actively managed" and "protected;" others suggested the opposite position that a forest cannot be adequately "protected" without being "actively managed."

As Chair of the Forests Subgroup, I took responsibility for mediating between opposing positions, between people who each cared intensely about the current and future well-being of Connecticut's forests. But it became clear that we could not find recommendations that could be broadly embraced until we were more specific in defining what key terms meant in the context of the report.

Without revisiting the various ways in which these and other terms were interpreted, I offer the definitions for these terms (edited slightly for length) that were ultimately published in the glossary of the updated final Forests Subgroup Report:

Forest protection: Forest land withdrawn from conversion to other uses such as commercial, industrial, or residential development through statute or administrative regulation.

Forest resilience: The rate of recovery from a disturbance. The ability of forest to absorb impacts over time. The capacity of an ecosystem to return to its previous pre-disturbance condition.

Forest management: The process of planning and implementing practices for the stewardship and use of forests to meet specific environmental, economic, social, and cultural objectives. It deals with the administrative, economic, legal, social, technical, and scientific aspects of managing natural and planted forests with varying degrees of deliberate human interventions.

Forest reserve or preserve: An area of land that is protected and managed in order to preserve a particular type of habitat and its flora and fauna, which are often rare or endangered. Natural Area Preserves are defined in the Connecticut General Statutes (Section 23-5b) as "an area ... containing, or potentially containing, plant or animal life or features of biological, scientific, educational, geological, paleontological, or scenic value worthy of preservation in their natural condition."

Sustainable forest management: Ensures forests contribute maximally to mitigating and adapting to climate change during the next 30 years as seen through a systems lens that includes in-forest carbon, forest product carbon storage, and substitution benefits, while also maintaining the ability of forests to help current and future generations to meet their social, economic, ecological, cultural, and spiritual needs.

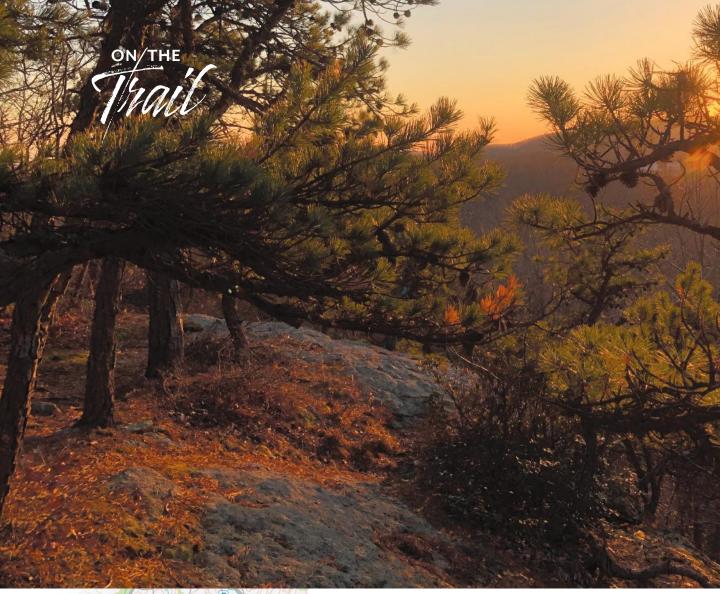
As a hopeful epitaph, eight recommendations from the Forests Report were incorporated into "Taking Action on Climate Change and Building a More Resilient Connecticut for All," the summary of the GC3's top near-term priorities for Connecticut to implement in 2021 and 2022.

The ambitious "Taking Action" report released in January lays out 61 critical actions that Connecticut needs to consider as we respond to the urgency of climate change. However, as we continue our work to transform these recommendations into real change, we will do so mindful of how much words matter to ensure that what we say is also what people hear.

Eric Hammerling has served as the Executive Director at the Connecticut Forest & Park Association since 2008.



Scan this code to read the "Taking Action on Climate Change" report.



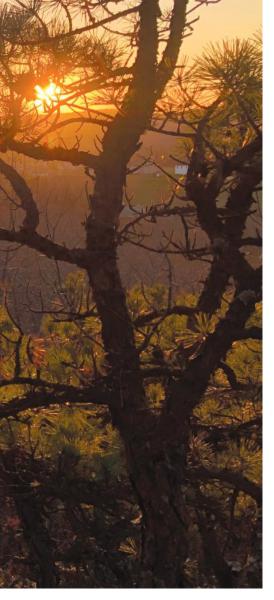
Braemore Preserve Long Pine Trill Rock I and Preserve Rock I and Preserve Find the complete map in the Connecticut Walk Book, published by CFPA.

The New England Trail: Broomstick Ledges to Selectmen's Stones

By David Bell

little-known section of the New England Trail, or NET, lies tucked away in the rocky hills of northern Guilford and Madison. It is situated east of Route 77, across the street from the more popular Bluff Head with its dramatic vistas. The Eastern Border Fault lies beneath the highway here, marking a place where continents once collided. This spot also marks where the V-shaped Mattabesett Trail reaches its southernmost point before turning northeast and meandering toward the Connecticut River nearly 30 miles away.

A hike on this eastern segment climbs steeply into an area known as the Broomstick Ledges, so named for their long, finger-like shapes carved during the last Ice Age. The trail winds over or around several of these ledges on its way to where the Mattabesett intersects with the Menunkatuck Trail, the southern extension of



At the Mica Ledges, hikers are rewarding with stunning views and the sweet smell of pitch pine.



the NET which leads to Long Island Sound. This junction is unique as the NET is the only national scenic trail with three termini.

The Mattabesett Trail continues on to some lovely, wooded glades and eventually to Madison's Rockland Preserve where it meets the Lone Pine Trail before passing by the site of an old charcoal furnace. From there it follows some abandoned farm roads with nostalgic names like Crooked Hill and Cream Pot. A gradual climb leads to the Mica Ledges, a series of granite ledges flecked with quartz and mica, where you're rewarded with a panoramic view of the bucolic Coginchaug Valley. Gazing toward the western horizon one can get an eyeful of Pistapaug and Beseck Mountains, two ridges which mark the other arm of the Mattabesett—a good day's walk from here if you're thru-hiking. After climbing in and out of some scenic gorges, the segment ends at the Selectmen's Stones, a pile of rocks marking where the borders of Guilford, Madison, and Durham meet. Some of the stones date from the 1800s and are covered with chiseled letters and dates, a memorial to a time when selectmen carved their initials into stones to prove they had inspected the town boundaries.

y interest in maintaining trails grew out of many years of long-distance hiking. I also have a passion for creating and connecting trails to form longer ones. I joined CFPA after doing a thru-hike of the Mattabesett/Metacomet/Monadnock Trails five years before they were collectively designated as the New England National Scenic Trail. I became interested in trying to eliminate some of the road walks I had endured on my hike and began exploring possible off-road routes. CFPA provided support for this work. Eventually I volunteered to help with maintenance of the trails and was assigned this section of the NET, just a few miles from my home. One might think that walking the same stretch of trail again and again would become boring, but I have discovered that it is never the same experience twice. Each season, each weather event, changes the landscape. Vernal pools fill and dry out. Trees grow and die. Old woods roads succumb to forest growth and fade away. Even the trail itself has changed over the years. It has widened with increased use and eroded in certain areas. I have had to perform three trail relocations and am currently working on a fourth. Hopefully, these projects have enhanced the hiking experience for those who pass through.

The work of trail maintenance has become something of an art for me. How wide should the treadway be? Which branches do I cut? Which tree should I nail that next blaze on? Although CFPA provides guidance, there are aesthetic considerations on which no two trail managers seem to agree. I have noticed that my fellow maintainers each have their own style and answers to these questions. And although their opinions sometimes influence my own, I have my own approach. But I continue to learn and evolve as I work with the CFPA staff and other volunteers.

David Bell has been a Guilford resident for the past 30 years, and a volunteer with CFPA since 2005. He is a professional musician, ordained minister, avid hiker and cyclist, and enjoys being in natural surroundings more than anything else.

Explore the Blue-Blazed Hiking Trails Interactive Map on the CFPA website.

Youth On Fire

Around the globe, youth activists are leading the path to climate justice.

By Renee Jiang

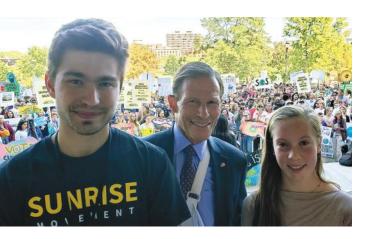
he sun illuminates my skin as I gaze into the blazing horizon. Standing atop Sleeping Giant, my arms spread wide in ecstasy, a wave of despair drowns my moment of bliss. Nature has long been my place of comfort, yet I cannot fully enjoy this moment without being overwhelmed by the thought of losing all of this to human-caused climate change. I'm frustrated too. Why should I, a teenager, have to worry so much about a habitable future?

In 2019, Greta Thunberg, just 16-years-old at the time, addressed the United Nations Climate Action Summit in New York City. "My message is that we'll be watching you," she began. A leading voice of the youth climate movement, Greta, as she is known, started the Fridays for Future school strikes in 2018. A year later she became the youngest person ever to be named Time magazine's Person of the Year. While Greta may be the most recognizable face of the youth climate movement, millions of young people across the globe are demanding climate justice now.

Many youths, including me, have felt compelled to climate activism because we don't see adults taking decisive action to address climate change. We are frustrated and disappointed to inherit this crisis, which is a failure of preceding generations to limit consumption, reduce fossil fuel emissions, and to protect people and the planet. Moreover, we see climate as not purely an environmental issue, but also one of justice. Despite the fact that this crisis is not of our making, the failure of our leaders to fight climate change has not made us cynical but rather served as a rallying cry, pushing youths around the world to demand action and justice. After all, our future is at stake.

The last five years have seen a blossoming of the youth climate activists. Spearheading these grassroots efforts is the Sunrise Movement. Founded in 2017 by youth from diverse backgrounds, the movement aims to advance pro-climate policy through direct-action protests and political lobbying.





In 2018, Sunrise organized a sit-in at House Speaker Nancy Pelosi's office. The protesters demanded that House Democrats refuse donations from the fossil fuel industry, and that they advocate for a Green New Deal. The event gained nationwide attention, thanks to social media posts by then-Representative-elect Alexandria Ocasio-Cortez. The movement gained momentum, swelling to over 400 hubs, similar to local chapters, in various locations around the country.

That same year, the movement spread to Connecticut. UConn undergrads Mitchel Kvedar and Sena Wazer were inspired to start a statewide hub, a safe space for any youth interested in climate advocacy. Kvedar joined the movement to help create a more livable future, especially for those local frontline communities most impacted by clmate change. "We're going to be the people living through the worst effects of climate change," he said. "I think we can all agree that we'd rather be enjoying our lives as young folks than spending as much time and energy as we do with this."

Kvedar believes Sunrise is unique because, unlike many traditional environmental organizations, individuals can get involved in the ways they best see fit. "There's always a place for you. The majority of us are unpaid volunteers who just want to dedicate our time to a brighter future," he said.

Social media and peaceful protests have been critical to raise awareness about climate change. Above, Sen. Richard Blumenthal poses for a photo with Sunrise Movement CT cofounders, Mitchel Kvedar and

Sena Wazer, at a climate rally at the statehouse. Photos courtesy of Sunrise Movement Connecticut

The Sunrise Movement has made great strides in spreading environmental awareness and engaging political leaders through campaigns and direct action protests. In early December 2019, some 2000 youths gathered at the Connecticut statehouse for a climate strike, demanding pro-climate policy from legislators. While Kvedar acknowledges that advocating for policy solutions is critical, he also believes that protests and media attention can be equally powerful. "I think we found a very good balance of when to have a protest, when to be social, and when to go along with the policy sides of things," he said.

The road, however, has not always been easy. Every event requires a monthslong planning process, and unexpected circumstances invariably arise. "There's always hiccups along the way, and it's really just trial and error," Wazer said. "It can range from small inconveniences like not knowing where to park or missing a podium, to larger issues such as having to call the Capitol security."

outh are also advocating for climate action with Earth Uprising, a global environmental justice organization focused on climate education.

"I think we can all agree that we'd rather be enjoying our lives as young folks than spending as much time and energy as we do with this."

Mitchel Kvedar Cofounder, Sunrise Connecticut









Left: Climate justice activists on their way to hearings in the Connecticut statehouse at the 2020 Youth Lobby Day.

Founded only a year ago and entirely youth-run, the organization has already spread to 35 cities across the U.S. and to over 20 countries around the world. The success of Earth Uprising is largely thanks to the determination of its members and the expansiveness of social media. "We hoped to establish a youth group that could talk about the issue of the lack of climate education, which is critical because people should really know about the problem if anything is to be done about it," said 16-year-old cofounder, Anisa Nanavati.

What separates Earth Uprising from other climate movements is that all ideas, and the execution of those ideas, come from youth stretching across the globe. One might think that such a scattered approach would hinder communication and cause division. But decentralization has actually generated trust, flexibility, and innovation among the movement, allowing Earth Uprising to localize

more diverse communities under the leadership of City Coordinators who run and initiate actions within their own chapters.

"We've created a space where doing the work is not a burden but something that is productive and even fun," said Nanavati. Keeping youths engaged among this diffused movement has been surprisingly easy. "Some people are just really passionate about the planet and really want to make a change in their community," she said.

In merely one year, the group has organized impactful campaigns and secured partnerships with other organizations. They gathered over 100,000 signatures demanding that climate change be included in the 2020 Presidential Debates, and they have received a micro grant from the search engine company, Ecosia. Behind the scenes of these successes are months of preparation and hard work. "We set a lot of deadlines to make sure everyone gets their work done on time. We coordinate with all of the different members to see if they need any help from our technical, finance, partnerships, or social media branches," explained Nanavati. "To put it shortly: we brainstorm, research, organize, then execute."

The success of these youth movements reveals just how much power we all hold in creating positive change. We must all join the fight for climate justice. No matter your age, it's easy to get involved. Join the Sunrise Movement.

Spread the word on social media. Attend local town meetings and speak your truth. And follow the youth leaders who are sacrificing their time to ensure we all have a chance for a future.

Renee Jiang is a high school junior at Choate Rosemary Hall where she is Associate Editor of the Choate News. Her critical piece on the fossil fuel industry recently won the CT Regionals Scholastic Writing Gold Key Award.





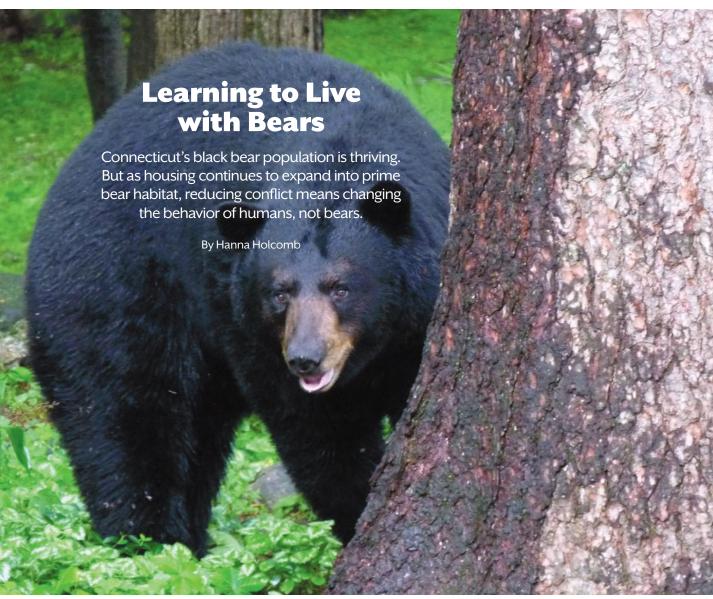


Photo by Ginny Apple

ew animals have captured our collective imaginations like the American black bear. Spotting a black bear in the wild, especially for the first time, feels monumental. Watching one of these massive mammals lumber through the woods—or your backyard—can inspire both fear and fascination.

For Ginny Apple, a Master Wildlife Conservationist with the Department of Energy and Environmental Protection (DEEP), black bears have been a common backyard sight since she moved to Barkhamsted in 2005. "I had my closing and came here at night," she recalled. "I looked out into the yard and there was a sow with three yearlings. From that point on, they just seemed to be appearing to me in a lot of places that I would go."

Apple is not alone in her sightings. Despite being the fourth most urbanized state in the nation, Connecticut is bear country. In 2020, the Department of Energy and Environmental Protection (DEEP) fielded more than 11,000 reported bear sightings, mostly in northwestern Connecticut. Though it's unclear how many of these sightings were valid sightings, or repeated sightings of the same bear, scientists say our black bear population is on the rise.

Conflicts between bears and people have risen as well. Between 2008 and 2012, DEEP received 1500 reports of bears damaging property. Last July, a DEEP press release stated that there had been 25 reports of bears entering homes and that the state was on track to more than triple the average number of bear break-ins from the preceding year.

"The biggest problem with our bear population is the human-wildlife interaction, and it really is largely caused by humans," said Apple.

"Their highest motivation, aside from a sow taking care of her young, is probably food. And if we make it easy for them, we're really endangering them."

Ginny Apple

Black bears haven't always been present in Connecticut. They lived here prior to European colonization, but as settlers cleared forests, black bears lost crucial habitat. "At the same time there was no protection for bears. They were not a welcome part of the landscape," said Paul Rego, a wildlife biologist at DEEP. "Many residents were farmers, and bears were seen as a threat." By 1840, no stable population existed in the state.

But as Connecticut's economy shifted away from agriculture, and forests returned, habitat became more suitable for bears. Likewise, reforestation in neighboring states allowed for growth and expansion of their black bear populations. By the 1980s, Connecticut once again had resident black bears.

oday, DEEP estimates that about 1,000 black bears call the Nutmeg State home. The population is currently concentrated in the northwestern part of the state, but biologists say it's doubling every 5-to-7 years and spreading to the south and east. By quantifying the amount of suitable habitat, DEEP estimates that Connecticut could support about 1900 bears.

As a doctoral student at the University of Connecticut, Michael Evans collected hair samples from individual bears to estimate the size and distribution of the state's black bears. Using a noninvasive mark recapture technique, Evans' team constructed multiple 5-by-5 meter barbed wire corrals and placed a non-nutritional attractant—fish oil or beaver castor—in the middle. "Bears navigate by their

sense of smell and are very curious," said Evans, now a conservation data scientist at Defenders of Wildlife.
"When they go to check out the smelly thing, they have to step over the wire and the barbs snag some of their hair."

The corrals were distributed across four sampling areas throughout northwestern Connecticut with different average housing densities. Using DNA analysis of the hair samples, the researchers identified 235 individual bears who came through the corrals over two seasons of research.

Evans found that the number of bears is strongly related to the density of housing. The highest concentrations occur in exurban areas. "Exurban housing densities are places where you've got quite a bit of forest and natural land cover kind of pockmarked with houses," said Evans. "A mixture of forest cover and those resources with some human food around is a really attractive balance to bears."

The amount of exurban housing development has been increasing nationwide. According to the United States Forest Service, wildland-urban interface areas, places where houses and other development mix with natural areas, grew by over 40 percent from 1990 to 2010.

In addition, the Connecticut's Changing Landscape project says that between 1985 and 2015 roughly 5 percent of the state's forest and agricultural land was converted to buildings, lawns, parking lots, and other development. Much of this development occurred in forested areas. Today, some 70 percent of

Connecticut's landscape is intermixed housing and undeveloped open space, bringing people directly into the bears' natural habitat.

lack bears are opportunistic omnivores who typically feed on grasses, berries, and insects. They're also intelligent, curious, and adaptable and will readily exploit foods like garbage, bird feed, and pet food. "If somebody has a food source out in the yard, black bears tend to be pretty lazy. They'll take the easy feed," said Apple.

Black bears are also naturally wary of humans, but repeated exposure to people can lead to habituation. "We observe and receive many reports of very habituated bears; bears that just have no hesitation to walk near people and through neighborhoods," said Rego.

If a bear gains access to human food sources, it can become "food-conditioned" and may associate developed areas with easy calories. They may also begin to exhibit bolder behaviors to access more food. A bear who exhibits such behaviors may be deemed a threat to public safety by DEEP and ultimately euthanized.

"Their highest motivation, aside from a sow taking care of her young, is probably food," said Apple. "And if we make it easy for them, we're really endangering them."

When a human-bear conflict is reported, officers first try aversive conditioning, techniques intended to scare away the bear by creating a negative association with human food and developed areas.

"I start off by yelling at them: 'Go bear, go home, get back in the woods.
Go!" said Mark Rudewicz, an animal control officer in Simsbury. If shouting isn't effective, Rudewicz will use increasingly disruptive techniques, like discharging shell cracker rounds that make loud booms and whistles. If loud noises are unsuccessful, he tries non-lethal ammunition like a rubber buckshot to scare off the bear.

According to a report on humanblack bear conflict management by the Association of Fish and Wildlife Agencies, aversive conditioning is most effective on bears that have had few experiences with human-provided food rewards. Aversive conditioning



Today, some 70 percent of Connecticut's landscape is intermixed housing and undeveloped open space, bringing people directly into the bears' natural habitat.

A DEEP biologist weighs a black bear cub, while, nearby, other scientists assess the health of its mother. Such data is critical in tracking the overall health of Connecticut's bear population. Photo courtesy of Paul Fusco.

may reduce conflicts in the short-term by temporarily changing the bear's behavior, but bears will often alter their behavior to forage at night and avoid the hazing. Further, for aversive conditioning to be effective, a bear needs to experience a negative stimulus every time they access human foods, which is nearly impossible.

Most conflicts could be prevented by properly storing food attractants. Data suggests that about 85 percent of conflicts are caused by access to stored food, garbage, and bird feed. Wildlife officials create brochures and signs and give presentations to convince people to properly store attractants.

But studies have shown that alone such educational methods are often insufficient to inspire change. Rather, an enforced ordinance, or a direct and negative interaction with a bear, makes compliance more likely. "Public education does have limits; not everybody complies," said Rego. "That's why ordinances and regulations are made."

any Connecticut towns have adopted ordinances that ban the intentional—or unintentional—feeding of black bears, and leverage fines for noncompliance. Simsbury, for example, adopted an ordinance last July that bans the intentional feeding of wildlife; improper

storage of attractants like trash, food, and pet food; and bird feeders, except for a few kinds of seed, from April 1 to November 30. Violations may lead to a \$250 fine.

While bear resistant trash cans are not required by any ordinances, Paine's Inc. Recycling & Rubbish Removal, which serves communities in the greater Hartford and northwestern Connecticut regions, now offers these cans as a service to their customers. According to Vice President Julie Paine-Miller, the receptacles had become a necessity.

"The bears knew the trash routes as well as the drivers who drove them every day," said Paine-Miller. "This meant residents were reluctant to put barrels out early, causing missed pickups. And when they did get barrels out early, the bears were enthusiastically dining on the contents of the barrels, leaving a trail of waste on the streets."

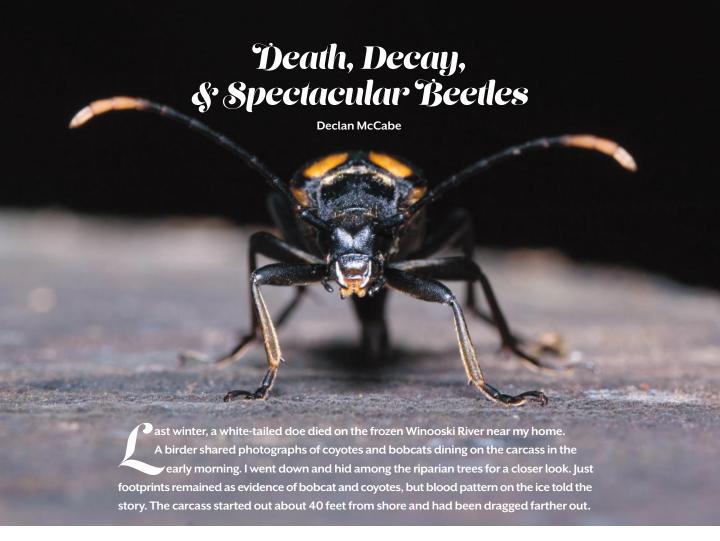
Following customers' requests, Paine's began offering cans certified by the Interagency Grizzly Bear Committee that are user-friendly for both the residents and truck drivers. While bear resistant cans often cost four to five times more than regular ones, Paine's customers pay just an additional 5 dollars per month, providing a cost-effective way to curb many human-bear conflicts.

Just forty years after returning to the state, black bears are again threatened by humans. Interactions between bears and people are likely to increase as the bear population grows and development in forested areas continues. While aversive conditioning and euthanasia provide temporary solutions for individual "problem" bears, they won't prevent members of the population from becoming habituated or food-conditioned. Ultimately, it is up to all Connecticut residents to help reduce human-bear conflicts and live compatibly with our local population of black bears.

Hanna Holcomb, a native of Woodstock, Conn., has written for Woodlands since 2017.







By the time I arrived the crow and raven shift was playing its cleanup role. Within two days only bones were left. Regardless of the sequence of events, the deer provided for several animals before the ice melted, providing additional meals for submerged macroinvertebrates.

Nothing in nature is wasted. The death of the deer provided food for other animals, plants, fungi, and microorganisms. In my classes, I take advantage of this phenomenon to lure some truly spectacular beetles to grab student attention. Carrion beetles and burying beetles (family *Silphidae*) are large black beetles with bright orange markings or a distinctive pale straw-colored segment behind the head with a central black spot. The beetles illustrate important concepts including food web linkages, life cycles, insect classification, and even parental care. The mites that hitch-hike on their bodies demonstrate *phoresis*: one animal using another just for transport.

A week before I need beetles, I place two or three frozen chicken wings in a can and hang it in the woods. I drill drainage holes, add a few damp paper towels for shelter, and leave the rest to nature. A succession of organisms arrives at my trap within hours or days and, aside from a disagreeable smell, it's a great way to diversify student insect collections.

Attracted by the aroma, blowflies arrive first followed shortly by carrion and burying beetles in a succession much studied by forensic scientists. Rotting flesh is rare on the landscape, and scavengers large and small have adapted to find this valuable resource. Carrion beetles and turkey vultures alike use scent to locate delectable food sources. Like us, vultures breathe and smell food through their noses. But beetles breathe through spiracles, small openings along their abdominal segments that are irrelevant to their sense of smell. Beetles smell using their antennae.

Following subtle plumes of volatile chemicals released by freshly dead animals, carrion beetles fly significant distances to find their preferred food. Once beetles locate a carcass, they begin laying eggs and dining on the flesh, or on fly larvae consuming the carcass. Meanwhile their mite passengers disembark in search of fly maggots to parasitize. Beetles live in and under larger deer-size carcasses, but their fascinating approach to eating smaller mouse-sized animals earns them the common name "burying beetles," or in the British Isles, the more poetic "sexton beetles."

Burying beetle family life is quite unique. Male beetles compete for the small carcasses of mice and birds and then use their prize to attract a mate. The couple excavate soil from beneath the carcass causing it to fall into the resulting hole where they cover it and meticulously embalm it using antibacterial saliva. Some species bury food using soil; one uses leaf litter; another has the unique habit of raising its young on the eggs of black rat snakes. Female beetles lay eggs near the carcass. Once they hatch, both male and female attend to their larvae by regurgitating partially digested food for them.

take advantage of these wonderful beetles in an entirely different way for my classes. Students in my evolution class use skull characteristics to place related mammals on a tree of life. But this lesson requires more skulls than course budgets provide. This is where roadkill is actually useful.

Biologists typically use skin beetles or carpet beetles to remove flesh from bones. These gentle beetles eat just the flesh leaving even the most delicate bones intact. But even in a biology department, the stench of roadkill tested the tolerance of my colleagues, and so I fell back on carrion beetles and other insects to clean skulls for class. In a suitably remote corner of campus, I constructed a "bone cage" from old pallets and chicken mesh to exclude larger scavengers that might make off with my prized skulls.

A few weeks in the cage followed by several days in hydrogen peroxide—never bleach—produces a clean skull. Some Elmer's glue to fasten the lower jaws together and secure teeth, and my specimens are every bit as good as those from a biological supply house. Word has gotten around to friends

and neighbors that I'm in the market for roadkill, so it was not too surprising when I heard a voice from across my garden ask, "Declan, could you use a bear skull for your teaching?"

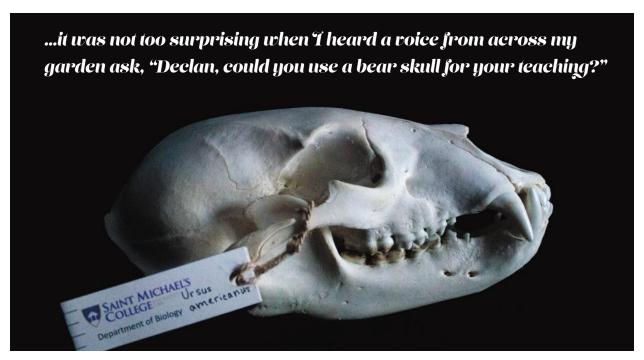
I relied on smaller organisms to clean the bear skull to reduce risk of damage to the delicate nasal bones by larger insects or mice in the bone cage.

Then I placed the bear skull in a simple bucket of water; bacterial action during decomposition produces enough acid to clean the skull down to bare bone.

After a few days in hydrogen peroxide, I added the bear skull to my teaching collection.

Nature wastes nothing. Beetles recycle deceased mice and birds; a deer lives on at a molecular level in bobcats and crows; a bear will leave a lesson for college students long after I retire and eventually pass on. Regardless of your belief system, death is not the end.

Declan McCabe is a professor of biology at Saint Michael's College. His work with student researchers on insect communities is funded by Vermont ESPCoR's Grant NSF EPS Award #1556770 from the National Science Foundation.





rowing up in northwestern Connecticut, my brother and I spent hours playing in the woods around Lake Waramaug. I remember finding a beautiful flower one spring day—a splash of bright color emerging from the mat of dead leaves. I was so thrilled by the royal-red bloom that I brought it home and placed it in a vase of water, only to be disappointed when it promptly began to droop. Also, it smelled bad. Such is the dual nature of Trillium erectum, the red trillium. Beautiful to look at, it has a scent more attractive to carrion flies than to people.

Aroma aside, *T. erectum* is a well-loved spring wildflower. It emerges in mixed deciduous forests before the trees are fully in leaf, well before most other flowers. It's easy to spot because of its size and showy beauty. Shooting up 8 to 16 inches above the leaf litter, its large, solitary blossom sits upon a whorl of contrasting green leaves. A welcome sight on an early spring hike.

The red trillium is one of nearly 40 North American trillium species, one of four found in Connecticut. Its flowers can be burgundy, rose-pink, white, or even yellow-green. It relies on its dead meat-like smell for pollination. Carrion flies are attracted to the plant's scent and lay their eggs on its leaves, which the larvae then feed on. In the process, the flies move pollen from one individual to another. The plant also is spread by ants in an

underground process called myrmecochory, or ant farming, a common propagation process for many wildflowers, including violets.

Trillium erectum is a plant with many names, including whip-poor-will flower, stinking Benjamin, and stinking Willie. Benjamin is not someone's name in this case, however, but a form of "benzoin" or "benjoin," a Sumatran plant which was used in making perfume. It also is called nosebleed or birthroot (corrupted to bethroot) for its early medicinal uses, and trinity lily because its three leaves correspond to the Christian trinity. My father called this flower a wake-robin, a name I thought sounded magical. Its Latin name, Trillium, comes from the words for three and leaf; the flower has three petals, and its leaves (technically bracts) come in trios as well.

Possibly even lovelier than the red trillium is the painted trillium (*T. undulatum*), also known as painted lady and striped wake-robin. The flower is white with a splotch of purple or dark pink in the center. The delicate, colored lines extend onto the petals, which have slightly wavy edges.

Another white-flowered trillium is the great white (*T. grandiflorum*), sometimes called wood lily. Reaching up to 17 inches in height, with larger flowers than the red or painted, the great white trillium occurs from Quebec to Georgia and forms spectacular

displays in the Blue Ridge Mountains. Also occasionally seen in the Connecticut woodlands is the nodding trillium (*T. cernuum*), which has flowers that hang downwards and may be hidden by the plant's leaves.

After flowering, the leaves and stem of the trillium start to wilt, and by midsummer, the plants go dormant. Interestingly, trilliums take several years to look like trilliums. Once a fertilized seed germinates, the plant spends its first summer or two as one tiny leaf. After finally reaching its three-leaved form, it stays flowerless for a season or more.

Trilliums are always a welcome sight and not hard to come by. The American Legion State Forest along the Farmington River in Barkhamstead and the nearby People's State Forest are great places to see spring wildflowers, including wake-robins.

If you admire trilliums in the wild, however, don't be tempted to dig them up. If you want wake-robins in your shade garden, you can buy rootstock from White Flower Farm in Litchfield and other select nurseries.

Laurie D. Morrissey is a New Hampshirebased writer of articles, essays, and poetry. Her love of nature comes from her father, William P. Dougal, who was the ranger at Lake Waramaug State Park and Mount Tom State Park.



TAKE A WALK IN THE WOODS with a forester, and likely you'll be asked to do a bit time travel. "To know these woods," they might tell you, "you have to know a little of their history."

Imagine walking with me in early spring through one patch of woods in Northford where I grew up. A few steps in the trees are slender and flexible, mixed-together and packed tight like a box of new crayons. Here, a farm tractor has pushed up some soil. The bare earth came back quickly to maple, birch, and aspen saplings, all broad-leaf trees the thickness of a broomstick, with no side branches except near the top.

In this young forest the leaf buds are mostly near the trees' tops. When the leaves emerge later in the spring, they will block the sun. Dead leaves crunch underfoot. Despite having to wedge and weave to advance, pushing breast-stroke style, one can see what lies ahead. Just 200 feet away dense, green aromatic foliage is hanging from curving, interlocked branches that run from the sky down to below your ankles.

The aroma of old field Eastern red cedar and ground-juniper fills your lungs. You hear the cooing of a mourning dove. Rabbit trails are everywhere, but you have to make yourself small to explore through dark thickets and groves, places tight and dark and dense. You find a few, widely scattered, broad-trunked oaks and hickories with far-spreading branches that seem to have held back the cedar, giving you a chance to get back in the sunlight.

The young forest I first described, with its dense, straight, slender trees, is much like a forest that arises when plowed farmland is abandoned without going through a period of pasture, or when a forest resprouts after a major disturbance, such as a violent windstorm or an intensive tree

harvest. These formative disturbance events set the stage for site characteristics such as the tree species mix and age class. They also drive much of the action that will occur in the forest over the next century.

orests in different places are different. They are shaped by growing conditions such as geology, soils, water availability, and the amount and intensity of sunlight; by disturbances, including actions of humans; by their genetics and seeds from nearby trees and plants; and by activities of all types of wildlife. The work of these forest-forming influences is quite apparent in the history of the two groves we just explored. Our forests are complex and dynamic ecosystems. They are constantly changing over time.

Few of today's forests were planted. Most grew back naturally from seed, stumps, or roots on land that was tilled, pastured, or repeatedly harvested in various combinations. Our steepest and rockiest lands were never tilled, but the trees that grew there were repeatedly harvested as firewood or fence posts, or conversion into charcoal for industry. Human actions have altered virtually all of our original forests.

Foresters specialize in how different forests came to be, and how forests develop and change. We learn from scientific research and from practical experience, and there is always something new to consider: a new forest pest; new knowledge about trees or soils; loss of a particular species of tree, or

Shelterwood Forestry System

Many of Connecticut's oak-dominated forests are approaching the end of their natural life span. As the largest trees begin to decline, getting young oaks to grow back is important to maintain biodiversity. To create young versions of these forests, foresters design a sequence of harvests that match site conditions and goals for the property. It is important to start this sequence while some of the old trees are still healthy.



Mixed-oak forest after the first cut in a planned shelterwood sequence. Note the generally open conditions from ground level to the base of the trees' canopies.



After two harvests, there are fewer tall trees with larger crowns. Note the growth of small tree seedlings in the foreground. Oak and other desired trees are starting to take hold.



The shelterwood sequence is complete and thousands of young trees growing. Note some large trees are retained for biological value and grow to their maximum potential.

Photos courtesy of Connor Hogan.

several. More deer. Fewer beavers. The list is long. We must keep an open mind as we plan for the future health of our forests.

limate change is presenting new challenges for forest managers. There will be dramatic consequences for our forests, and these changes could happen much faster and over a broader area than past changes in growing conditions.

To understand how forestry might change, it is necessary to consider forest management methods that have long been understood and practiced. In Connecticut, improvements in the way we provide for forests over the past century have resulted in a remarkably widespread cover of forests with diverse tree types and sizes. This didn't happen by accident. CFPA played a major role in advancing effective policies and advocating forest management throughout our state, a story that the archives of this magazine document well.

Foresters rely on a handful of techniques to enhance trees' natural abilities to grow and thrive. When thinning young to middle-age forests (20 to 80 years for oak), they harvest a small percentage of trees and leave most. This provides the remaining trees more sunlight, nutrients, and more soil-growing space, enhancing their vigor and resistance to most pests. During thinning, adjustments can be made in the proportion of the tree species removed to deal with differences in trees' lifespans or soil preferences.

As the forests age (generally starting at age 90), we remove a greater percentage of the trees in harvests designed to encourage young trees to arise from seeds, root-suckers, or sprouts. For our oak forests—once our predominant tree species, but now in decline—these "regeneration" harvests are often the most dramatic. Oak forests are critical to the maintenance of biological diversity in our state. Absent active management, they will be lost, so despite the visual impacts of oak management, the best forestry includes carefully planned more intensive harvests. Protection from fire, vigilance for insect or disease pests, treatments to control invasive plants, and consideration of soil and water quality are common forestry practices that built and sustain our current forests.

bout a year ago, foresters and forest scientists in southern New England began a major effort to better understand climate change implications for our forests. We sought to address both adaptation and mitigation, two main aspects of forestry's climate change paradox. "Adaptation" involves efforts to help sustain forests and their benefits as the climate changes. "Mitigation" involves ways that forests and their products

absorb and store carbon so that the climate changes might be slowed or reduced. Our forests here are at risk, but traditional forestry methods, with some adjustments, can help address the crisis.

Foresters and forest managers are learning methods to store more carbon in forests, forest soils, and forest products, and how to help improve the ability of forests to withstand changes in climate and other factors that can harm or kill trees such as insects or windstorms. This "carbon-storage and resilience" work must be done in ways that balance carbon sequestration with other benefits from our forests. We must consider issues at many scales—from a single tree to entire landscapes—and the biophysical, social, and economic systems within which we all exist.

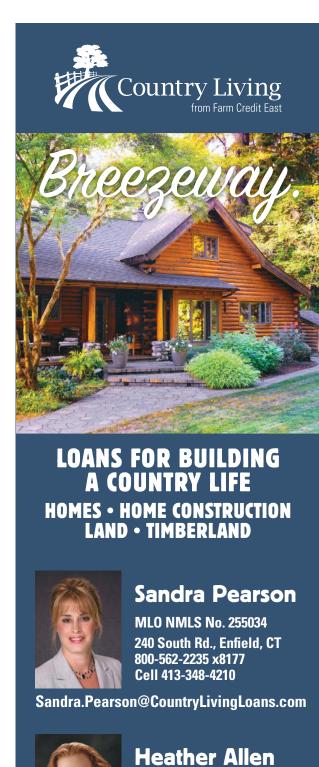
Some of the practical suggestions from our new, carbonaware forestry include: keeping our forests as forests, avoiding conversion to other purposes such as development; promoting increased use of wood for buildings and to provide a source of local heat; anticipating the changes our forests will face, then adjusting management methods to improve the long-term health our forests; supporting the inevitable northward shift of the ranges of some of our tree species; and continuing to implement best management practices to protect forest soils and water resources.

The professional foresters of southern New England are eager to share what we have learned. We seek to help forest landowners, natural resource professionals, people who work in the forests or rely on them for wood and other resources, as well as policymakers and the general public to better understand the trends, needs, and the opportunities before us.

Foresters and forest scientists are planning tours this year to forests where active management and research occurs, where you can see our successes and our challenges. We are engaging the public through social media. We are collaborating with government and environmental organizations to be more effective at management and outreach. And we are asking people to learn about our wonderful forests and woodlands and how we can all work to conserve them.

So, if given a chance, walk in the woods with a forester, and perhaps do some time-travel along the way.

Mike Ferrucci has forestry degrees from the University of Maine and from Yale, where he taught forestry classes for 25 years. He has forestry experience in 37 states and four other countries. Mike is Chair of the Forestry and Climate Change Working Group of the Yankee Society of American Foresters.



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Pathways



or more than a century, the Bronson family has played a critical role in the protection and conservation of Connecticut's forests and parks. Elliott B. Bronson, born in 1858, was a fire warden, forester, and two-term legislator. An eloquent and persuasive speaker, the Winchester Center native was involved in the purchase of three-quarters of the land that became our state parks and forests, including the Pachaug and People's state forests. While working in the woods, Mr. Bronson, whose family settled in Connecticut in the



 $Photos\ courtesy\ of\ Jody\ Bronson.$

mid-1600s, was known to always carry an axe and a bugle, in case he fell and needed help. He died in 1931. Both his son, Elliott P., and his grandson, Elliott C., were career civil servants devoted to the protection of Connecticut's natural resources.

In 1909, a year before the fire warden photo was taken (above), Mr. Bronson sold approximately 300 acres to Fredric Walcott and Starling Childs. Today, that parcel is part of the Great Mountain Forest where Mr. Bronson's great-grandson, Joel (Jody) Bronson, serves as forester.





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