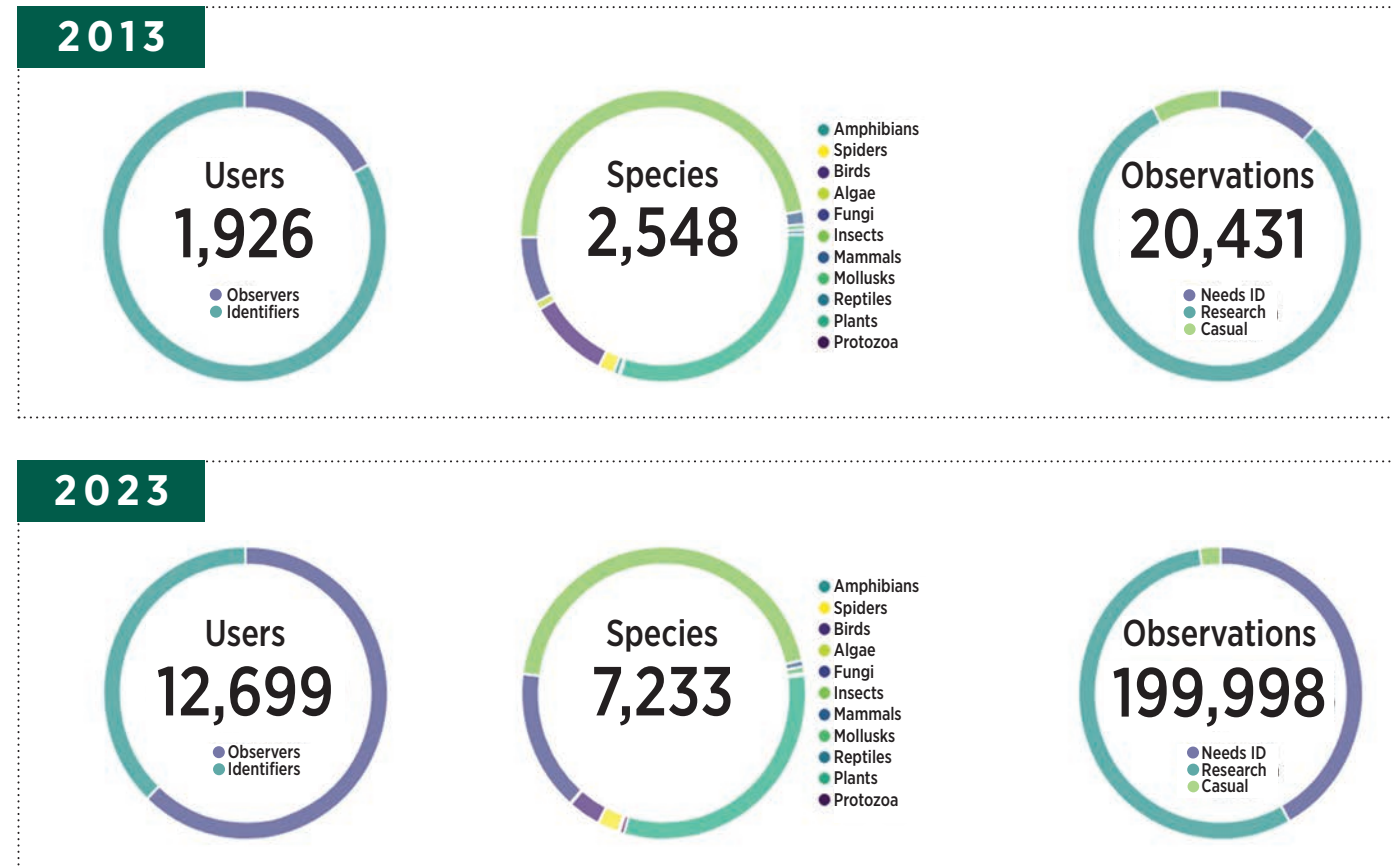


UNITING PEOPLE  
AND SCIENCE  
FOR CONSERVATION

# Leading the Way for Biodiversity

Over the last decade, VCE's Vermont Atlas of Life and community science projects have spurred a sharp increase in use of shared biodiversity databases like iNaturalist. Vermont contributes more observations to this platform per capita than any other state.



A comparison between 2013 and 2023 iNaturalist activity in Vermont



© CHARLES GANGAS

© RUTH BROOKE

## Dear VCE friends and supporters,

This look back on VCE's 2023 accomplishments is dedicated to you. Whether you volunteer for one of our signature projects, provide vital financial support, or contribute in some other way, you're turning this young organization's founding vision—uniting people and science for conservation—into a very effective reality.

Our VCE community is growing by the day. People tell us that our work empowers them to act in favor of the biodiversity they love and value, and that they become inspired by engaging directly with our scientists and projects. To make this work more widely accessible, we are removing some of the socioeconomic barriers that have kept too many people out of conservation science for far too long. In this work, we will always affirm that diversity is strength.

VCE's model of open science and public collaboration benefits everyone. People from all walks of life connect more deeply with their natural environment and, in shared exploration, with each other. Their observations give our biologists the data they need to hone conservation strategies, focus resources, and develop exciting new collaborations with peers. The rigor and transparency of our work inspires trust in landowners and policymakers, who look to us for information to guide their decisions. Teachers use our community science projects to show our youngest stakeholders that science is something they can do, starting now. And when our collective efforts add up to the recovery of a threatened species, restoration of critical habitat, and greater appreciation for the wonders of nature, biodiversity wins.

We hope you'll enjoy the stories of progress, success, and camaraderie on the pages that follow, and that you'll take pride in them. All of it is possible because people who care—people like you—have chosen to participate and make it possible.

With deepest thanks for your partnership,

SUSAN HINDINGER  
EXECUTIVE DIRECTOR

PETER BROOKE  
BOARD PRESIDENT

When our collective efforts add up to the recovery of a threatened species, restoration of critical habitat, and greater appreciation for the wonders of nature, biodiversity wins.

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 Front: © NATHANIEL SHARP  
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# Vermont's Data Powerhouse Turns 10

Back in 2013, VCE Conservation Biologist Kent McFarland had an audacious idea that could revolutionize our ability to protect biodiversity in Vermont and beyond: harness the contributions of community scientists and professional biologists to create a Vermont Atlas of Life (VAL). This online, real-time resource would account for every species in the state. By 2023, the time had come to analyze the whole body of data—nearly 8 million occurrence records covering about 12 thousand species, hundreds of which were documented in Vermont for the first time. The resulting 10th anniversary report shows how VAL is becoming a transformational tool for conservation.

Addressing the biodiversity crisis driven by climate change and other environmental disruptors requires understanding species populations at large scales over long periods of time. But more than a decade into the new millennium, Vermont had no baseline data for most of its species. The VAL team set out to fill those vast knowledge gaps, in large part with community science observations contributed to VAL-supported platforms like iNaturalist, Vermont eBird, and eButterfly.

The *Vermont Atlas of Life 10th Anniversary Report* draws on the resulting data—95% of which was supplied by community scientists—as of April 2023. For most analyses in the report, VCE data scientist and lead author Michael Hallworth coupled that enormous trove of primary occurrence data with climate and other landscape variables to model species compositions for areas of the state that are not well sampled. These predictive models show how species distributions throughout the state are likely to shift under different climate change scenarios. With these in place, scientists and natural resource managers can start to assess where conservation activity has the greatest potential to protect the most species. Here are just a few of the report's key findings:

- ▶ About a quarter of Vermont is conserved, but those lands only protect 13%, 17%, and 12% of the distributions

of vulnerable, imperiled, and critically imperiled species, respectively.

- ▶ By 2100, our current conservation lands may protect as few as 11% of species' ranges, down from 13% today. Private lands will continue to be key for conserving and supporting biodiversity into the future.

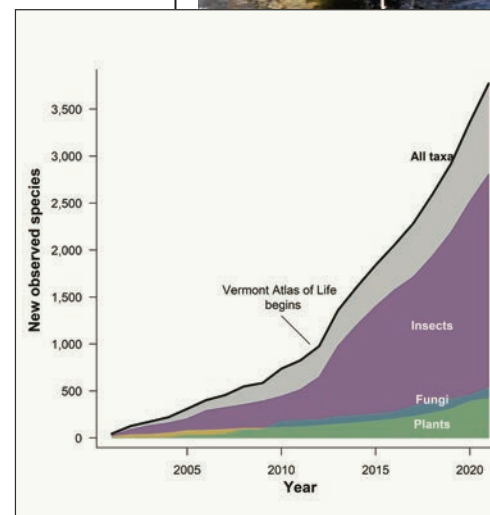
- ▶ Only 28% of Vermont's species have a state conservation rank, and entire taxonomic groups have not been assessed due to insufficient data. Understanding those data gaps will help focus future survey efforts.

- ▶ Areas that support unique communities are critical for maintaining biodiversity. The southern Lake Champlain Basin has more of these than any other region in Vermont. By 2100, unique communities are predicted to be concentrated in Vermont's higher elevations rather than the Lake Champlain Basin.

"Using the vast dataset in VAL, we're able to identify biodiversity hotspots and areas that harbor unique communities found nowhere else in Vermont. We can also predict where they might be in 50 or even 100 years as the climate changes," says Hallworth. "Together, this information will help us target land conservation efforts to mitigate habitat and wildlife loss preemptively, rather than react to crises as they unfold."

Read the full report at [vtcostudies.info/VAL10](http://vtcostudies.info/VAL10).

▶ Species observations gathered by VCE staff, volunteers, and community members alike form a key component of VAL's vast dataset.



## Taking Stock: The Living Vermont Index



The Living Planet Index (LPI) is a measure of the world's vertebrate biodiversity, drawing on data from dozens of contributing research organizations around the world. It functions a lot like a stock market, providing a snapshot of how the overall system is doing at any given time. LPI works so well that the UN Biodiversity Conference uses it to help track progress toward related targets in its Global Biodiversity Framework.

VCE's Vermont Atlas of Life team has begun developing a Living Vermont Index (LVI), inspired by and modeled after the LPI. A key difference is that the LVI will include all of Vermont's wild species, not only vertebrates.

Phase one of the LVI project, currently underway, is to identify and unite as many monitoring projects within Vermont as possible. Species with sufficient monitoring data will serve as building blocks for the index. "Once we figure out where the gaps are," says VCE Conservation Biologist Kent McFarland, "we can think about expanding monitoring efforts to cover understudied taxonomic groups to paint an increasingly clear picture of what's really going on with biodiversity overall."



© RYAN REBOZO

## Cultivating Conservation

Here at VCE, we take an inclusive and hands-on approach to public outreach in support of biodiversity. We provide people of all ages and from all walks of life with the tools, training, and opportunities to understand conservation science and get directly involved with that work in meaningful ways. The more people in our communities who are empowered to become active biodiversity stewards, connected through common purpose, the more likely we'll get the biodiversity outcomes we want and need. Here are a few examples of our outreach efforts in 2023.

### Teach the Teachers Well

During VCE's second annual Community Science Teacher Workshop, we worked with a highly motivated group of Vermont and New Hampshire school teachers to strengthen conservation themes in their curricula and involve their students in community science. We focused on experimental design and field sampling techniques that can be applied to local and regional conservation issues, including ecological questions their students might want to investigate in their own neighborhoods. After all, one of the surest ways to make science relevant for young learners is to create a deeper connection to their everyday environments. We also integrated data-sharing platforms like VCE's Vermont Atlas of Life to demonstrate how hyperlocal data collection can tie students' work into a much larger scientific picture.

*This workshop was made possible by funding from the New Hampshire Charitable Foundation's Wellborn Ecology Fund and Hypertherm's Hope Foundation. Our funders not only supported the program itself but also made it possible to provide stipends to participants.*

▲ Educators participated in hands-on field experiences, such as documenting wild plants, during the weeklong program.

One of the surest ways to make science relevant for young learners is to create a deeper connection to their everyday environments.

### Suds & Science, Anyone?

VCE Conservation Biologist Jason Hill hosts these laid-back community gatherings at which anyone with a curious mind is invited to grab a beverage of choice and engage with guest scientists about their work. For those who think science talks are prone to being a bit dry, Suds & Science is the antidote. No PowerPoints allowed! It's more like meeting a scientist at a barbecue and hitting it off. And these sessions have range, too—from giraffes to urban planning to the use of stone tools by early humans. All Suds & Science events are live, free, and—don't let the name fool you—appropriate and fun for all ages. They are also recorded for the enjoyment of those who can't attend in person.

### Field Triiip!

Every summer, VCE's staff scientists fan out across New England to conduct field-work, which presents an exciting array of opportunities for members of the community to join them, hear about their work, and even roll up their sleeves to help. The thirteen field trips offered in 2023 included revegetating loon rafts, loon nest check-ins, vernal pool exploration, bird-watching, bee-watching, bumble bee capture and handling, long-term forest monitoring, and more. To minimize barriers to participation, all field trips are offered at no charge to attendees.

© HUGH MONTGOMERY



### The Biodiversity Jamboree

There may be no better way to foster a sense of community than enjoying nature in the company of others. In that spirit, VCE was delighted to co-host, with our friends at the North Branch Nature Center in Montpelier, the first annual Biodiversity Jamboree. It was a day packed with activities, workshops, field walks, and displays for all ages and experience levels, staffed by experienced scientists, naturalists, and educators from our two organizations. To cap it all off, renowned entomologist Doug Tallamy gave an inspiring presentation titled "Nature's Best Hope," illuminating key environmental challenges of the developed landscape and showcasing how each of us can make a personal commitment to biodiversity on whatever land is ours to manage. We were especially pleased that so many children joined parents and grandparents for this fun and exciting day of discovery.

▼ VCE field trip participants pause to locate a bird during an outing in Mt. Auburn Cemetery.



© ALEX JOHNSON

### Connecting Policymakers with Scientists

Although VCE is not a lobbying organization, we are committed to ensuring that decision-makers understand the scientific dimensions of key policy issues. Through the Science to Policy Working Group, launched in 2022, we inform ecologically sound policies, connect legislators with our knowledgeable team of biologists, and build collaborations with other policy-minded colleagues across the state.

In 2023, VCE's Director of Conservation Science Ryan Rebozo was invited by the Vermont legislature to provide testimony on House Bill 606, which would become Act 59, the Community Resilience and Biodiversity Protection Act. Act 59 is designed to counteract the increasing fragmentation and parcelization of Vermont's forested land, with the aim of increasing resilience to climate change and protecting biodiversity. Among other things, Act 59 sets a target of conserving 30% of the state by 2030 and 50% by 2050. It was passed into law on June 12, 2023.

VCE is committed to ensuring that decision-makers understand the scientific dimensions of key policy issues.

# Research-guided Recipes for Bee Conservation

In the race to conserve biodiversity, even the best report is only as valuable as the real-world impact it generates. That's why VCE spent 2023 following up on our landmark 2022 report, *The State of Vermont's Wild Bees*, with the first of many concrete steps to protect and support these important insects. Here's what we've accomplished so far.

## VCE cofounds the Vermont Pollinator Working Group

VCE biologist and bee expert Spencer Hardy, along with collaborators at the University of Vermont, cofounded this action-oriented coalition following publication of *The State of Vermont's Wild Bees* report. The group's mission is to unite researchers, conservationists, farmers, and beekeepers to tackle urgent threats to bees and other pollinators in Vermont and elsewhere in the Northeast. In 2023, they launched two pilot projects:

- ▶ **Know Your 5:** This outreach program informs fruit and vegetable growers in Vermont about the five pollinators most closely associated with their specific crop(s) and suggests ways to support those pollinators.
- ▶ **A campaign to tackle "neonics":** Neonicotinoid insecticides, widely used for commercial row crops, are highly toxic to bees and other nontarget insects. The working group has expanded research on the unintended spread of neonics to beehives and wild bees via contaminated pollen and nectar and is sharing that research with growers, policymakers, and advocacy groups. Members of the group were also behind the effort to draft H.706, a bill in the Vermont State House that would ban the use of neonic-treated seeds in row crops in Vermont. A vote is expected in 2024.

## Making protections official

State Wildlife Action Plans (SWAPs) serve as 10-year blueprints for managing species in greatest need of conservation. The wildlife biologists who write, update, and implement these plans rely heavily on previously assigned S-ranks—from S1 (critically



© JACQUELINE HUE/TENNOSER

imperiled) to S5 (secure)—to prioritize species and conservation actions.

But S-ranks can only be assigned when enough information exists to make an assessment of a species' rarity. Fortunately, VCE-led efforts like the first Bumble Bee Atlas and the 2019–2022 Wild Bee Survey—combined with historical records digitized and rolled into the Vermont Atlas of Life—enabled VCE to assign S-ranks to nearly all of Vermont's 352 known wild bee species. And just as the Bumble Bee Atlas resulted in several bumble bee species' inclusion in Vermont's 2015–2025 SWAP, the Wild Bee Survey and subsequent report will add several more wild bee species to the 2025–2035 plan and prompt management actions to protect them.

## A better solution for well-meaning landowners

Given the alarming news of wild bee population declines in recent years, many landowners and gardeners are trying—with good intentions—to address the issue by buying bees from online suppliers and releasing them on their properties. But bees that are bought and introduced can come with several problems for native bees, including pathogens, parasites, and competition for resources.

In response, VCE has launched a public awareness campaign about the potential risks of buying bees and a better alternative: planting for native bees. Our *Habitat Recommendations for Bee-friendly Landscaping in Vermont* describes dozens of host plants that support the needs of native bees—including the 55 at-risk species identified in *The State of Vermont's Wild Bees*—throughout the entire growing season.

## Opportunities beyond Vermont

VCE's leadership in wild bee research and use of that research to inform its State Wildlife Action Plan is providing a model for other states, including Texas, California, and Washington. For the majority of states that don't have a resource equivalent to *The State of Vermont's Wild Bees*, Hardy is helping spearhead a nationwide project, partnering with other organizations across the country to identify sources of existing data for each state and compile it in a format that's friendly to wildlife conservation professionals.

◀ VCE bee biologist Spencer Hardy prepares to capture a bee.



55

AT-RISK BEE SPECIES IDENTIFIED IN THE STATE OF VERMONT

## CROWD-SOURCED COMMUNITY SCIENCE TOOLS



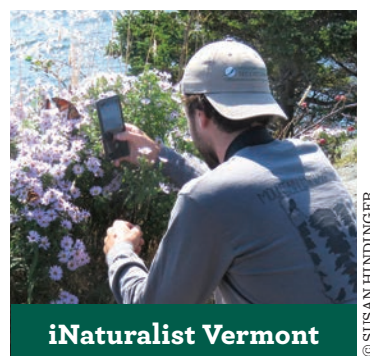
eBird

© KENT MCFARLAND



eButterfly

© KENT MCFARLAND



iNaturalist Vermont

© SUSAN HINDINGER

# Setting Up the Big Tent

As an organization that aims to unite people and science for conservation, VCE is committed to advancing diversity, equity, and inclusion (DEI)—in principle and practice—within our organization and, more broadly, in the field of ecology. Here are just some of the steps we’re taking to make it happen.

## Learning

VCE staff and board members receive regular, professionally guided training to:

- Recognize unconscious biases, welcome diversity in all its expressions, and use thoughtful, constructive language to navigate difficult conversations
- Incorporate DEI best practices into operations, governance, and mission-related activities
- Support the well-being of co-workers, including interns, and facilitate access to mental health care

Participants then share resources and engage in meaningful conversations at staff and board meetings, where DEI is always on the agenda.

## Honoring differences

We have made changes to our personnel practices to improve diversity, equity, and inclusion. For example,

- we adjusted our advertising and outreach to recruit job applicants from groups currently underrepresented on our staff;
- our job postings now include salary ranges and we are careful to remove arbitrary qualifications;
- we require all new hires (as well as existing staff) to learn the basics of fostering an inclusive culture;
- we are revising our benefits programs to improve equity in seasonal positions; and,
- we solicit DEI-specific feedback during exit interviews.

To promote diversity and equity within the broader conservation community,

- our two annual Future Ecologists Internships are offered exclusively to aspiring ecologists who are Black, Indigenous, people of color, or will otherwise add diversity to the field of ecology (see DEI Spotlight);
- we are systematically dismantling barriers to entry—financial, cultural, logistical, and otherwise—for all internships;
- we feature presenters from a wide range of backgrounds and identities in our public programs; and,
- we offer free, guided field trips throughout Vermont, including areas with socioeconomically, racially, and ethnically diverse populations.

## Diversifying the board, staff, and science program

We have made strides toward diversification. For example,

- our board, in the span of five years, successfully recruited five women to serve as trustees, achieving gender balance for the first time while diversifying in other respects; and,
- our newest conservation biologist adds diversity to our science team and specializes in studying urban and suburban landscapes. These areas are underrepresented in most biodiversity research efforts to date, including VCE’s.

We look forward to continuing this crucial and rewarding work. For the most up-to-date information, please visit [vtecostudies.info/DEI](http://vtecostudies.info/DEI).



**“It was great for me to try out many different projects since I don’t have a set goal or niche within ecology that I want to focus on yet. Every single person I worked with wanted to be a mentor in some way.”**

EMILY MARPLE  
2023 FUTURE ECOLOGIST INTERN

© OLIVER PARINI

▼ Marple and Sosa-Negron

## The Future Ecologists Internship

To help increase diversity and equity in the field of ecology, one of the least diverse fields of science, VCE offers two intern positions every summer for undergraduates from underrepresented communities.

“We try to reduce as many barriers to participation as possible,” says VCE Director of Conservation Science Ryan Rebozo about the Future Ecologists program. “That means paying a competitive wage and providing housing, which can be a challenge for interns to find and afford.” VCE also provides training in any outdoor skills the interns will need during their internship instead of requiring those skills as prerequisites.

The Future Ecologist intern experience centers on one of three focus areas: spatial science, field ecology, or an interdisciplinary program that covers conservation work from communications to field sampling to public policy.

“By offering these unique internships,” adds Rebozo, “we’re helping add a whole suite of new voices to the future of ecology, and that will only be good for the field.”



© EMILY MARPLE

## THE 2023 FUTURE ECOLOGIST INTERNS

**PABLO SOSA-NEGRON**  
*University of Puerto Rico-Mayaguez*

Pablo worked with VCE Data Scientist Michael Hallworth on spatial science projects (e.g., flight trajectory maps for migratory songbirds and species distribution models) for use in conservation planning. He also developed an independent project: an investigation of human impacts on the timing of ruby-throated hummingbird migration, which he and Hallworth plan to publish in a scientific journal.

**EMILY MARPLE**  
*Colorado College*

Emily is working on a degree in organismal biology, with minors in environmental studies and race, ethnicity, and immigration studies. She chose an interdisciplinary internship experience with VCE, during which she collected data for fire ecology research, banded songbirds and loons, collected ticks from residential yards, netted butterflies, and more, all in the service of ongoing VCE conservation work.

*The 2023 Future Ecologists Internships were made possible in part by a gift from Paula Richards in memory of her husband, Ted Richards. VCE is grateful to Paula and Ted for their many contributions to our work through the years.*

# The Caretakers: Reflections from Longtime Loon Volunteers

Loon conservation in Vermont is a story as much about people as it is about birds. From the most disheartening days of the state’s loon census in the 1980s—when loons were listed as endangered—through the incredible recovery we’re witnessing today, VCE volunteers on the Vermont Loon Conservation Project have been the beating heart of the stewardship effort and a key to loon recovery.

“My wife, Cathy Murphy, and I looked forward to hiking the mile to Hardwood Pond every LoonWatch Day (starting in 1980) in hope of spotting those noble, handsome, bold creatures. We felt honored beyond words that those beautiful birds chose Hardwood.”

—JON GAILMOR, HARDWOOD POND

“I retrieved an unhatched egg for the Vermont Loon Conservation Project [at VCE’s request]. How often does one get to hold a loon egg? We on the pond are honored to have one of the oldest recorded loons, which was banded as an adult in 1998 and sadly passed away in 2023.”

—LIBBY WELCH, NEWARK POND

“Even though the Vermont loon story is one of recovery, each loon and loon pair are individuals. As a volunteer following their lives, I wonder at and worry about the ones I know. They are more than a statistic, and I feel very grateful to be a part of their stories. And grateful to Eric for being there with his knowledge, experience, skills, and very responsive support.”

— ANN CREAVEN, GLOVER AREA

“In 2002, my husband and I watched [VCE Conservation Biologist] Eric rescue a loon on Shadow Lake



© ABIGAIL REIFSNYDER

“An early-morning paddle in a sparsely populated area is a paradise for the loons and the paddler.”

ALICE FLEER, FLAGG POND

“On the third Saturday of July ... we lift our binoculars with high expectations.”

BILL MINARD, LAKE MOREY

in Concord, Vermont. We snuck up while Eric teetered over the boat’s side, waiting until he could swing a big salmon net under the loon. He threw a towel over the loon’s beak and began carefully cutting the fishing line tightly wrapped around its bill. To be that close to a loon was magic.”

— ELINOR OSBORN, GREAT HOSMER POND

“Usually, it was a no-reward trip around Lake Dunmore (in the late ’80s and ’90s), but one day, we spotted a loon in immature plumage by the spillway. Amazement is an understatement.”

— SUE WETMORE, LAKE DUNMORE AREA

“As efforts to bring loons back to Vermont continued to gain success, we embarked on LoonWatch Day with some hope. We knew we would encounter some loons, and the question became, ‘How many?’ After many years of loon expansion, we were delighted to report the first nesting pair on Lake Morey in 2022. In recent years, our grandchildren have enthusiastically joined us on the third Saturday of July as we lift our binoculars with high expectations.”

— BILL MINARD, LAKE MOREY

“After surveying Shadow Lake and Caspian Lake for many years, Eric suggested I take on Flagg Pond. I was initially disappointed because it is a small, shallow body of water, and I thought there was no way loons could sustain themselves there. Little did I know. An early-morning paddle in a sparsely populated area is a paradise for the loons and the paddler. I have seen a pair of loons there every year for the last six years.”

— ALICE FLEER, FLAGG POND

“I look forward to the return of our lake loons every spring. Their calls, be they beautiful or haunting, are unrivaled in the warming air. I receive so much joy seeing chicks on their parents’ backs, especially when you consider what the parents must go through to get to this point. They must defend an area, find a suitable nest, and keep the eggs warm through all kinds of spring weather. And then there are the predators, boats, kayaks, and even other loons. Today—April 16, 2023—the loons found a spot in the opening water amongst the darkening ice on Seymour Lake. They are back to grace our lake again.”

— DENIS FORTIN, LAKE SEYMOUR



© IAN CLARK

© ERIC HANSON

## 2023 State of the Loons

VCE’s loon biologists and volunteers documented 147 territorial loon pairs in Vermont—the highest count since tracking began in 1978—and a robust 71% chick survival rate in 2023. We are happy to report that the historic flooding in July only inundated six loon nests out of 107 total. Offsetting the loss, six new nesting pairs were also discovered. VCE biologist Eric Hanson speculated that the flood would have been disastrous for the birds if it had occurred just a few weeks earlier, in the height of the nesting season. With extreme weather predicted to become more common, it’s more important than ever to monitor and manage these birds to ensure future success.



147

TERRITORIAL LOON PAIRS IN VERMONT

Highest count since tracking began in 1978

71%

CHICK SURVIVAL RATE

# Tick Control and Collateral Damage

As New England gets warmer and wetter with climate change, conditions are becoming more favorable for a greater year-round presence of ticks. As a result, an emerging—and understudied—industry to control ticks in residential yards is booming. VCE Conservation Biologist Jason Hill is examining two key questions about these lawn treatments: Do they help regulate backyard tick populations, and do they adversely affect nontarget invertebrates such as spiders and insects?

By some accounts, the number of infections originating from tick bites has more than doubled in the last two decades. It's no surprise, then, that landowners are looking to safeguard their properties. But it's unclear, based on a lack of peer-reviewed research, whether spraying to reduce tick populations adversely affects other invertebrates, too—an important consideration in the midst of a global insect decline. We need to know whether the biocides used for tick control are also killing insects and spiders that feed wild birds, pollinate our food and flowers, and eat undesirable pests such as black flies, mosquitoes, and aphids.

To find out, Hill's team surveyed more than 70 properties in the Upper Valley region of Vermont and New Hampshire, roughly half of which received tick control services. They surveyed each property twice; for sprayed properties, they typically surveyed the day before and day after biocides were used. The team walked roughly 19 miles of survey transects across lawns and along lawn edges, collecting 140 ticks in the process. They also sampled shrubs and trees, and identified more than 9,000 nontick invertebrates, including beetles, caterpillars, spiders, and snails.

These results will be combined with a more extensive sampling effort from spring and summer 2024, when Hill's team will sample from a new cohort of residential properties throughout the Upper Valley.

*Special thanks to all landowners who generously participated in this research.*



© HANNAH OBENAU

**We need to know whether the biocides used for tick control are also killing insects and spiders that pollinate plants, feed wild birds, and more.**



© HANNAH OBENAU

▲ VCE Conservation Biologist Jason Hill drags a sheet to collect any ticks hiding in the grass.

◀ Tick samples from a long day of surveying



© KENT MCFARLAND

# Burning Questions about Deer

VCE is partnering with the Green Mountain National Forest to study how use of prescribed fire as a forest management tool influences forest structure and regeneration in dry oak forests. A critical part of that work is understanding how deer density impacts postburn forest recovery. Historically, deer density has been difficult to measure, so in 2023, we took to the skies to detect deer with thermal sensors.

Deer voraciously consume many species of tree seedlings and saplings, so our ability to predict how a forest will regenerate after a disturbance—including prescribed burns—is often limited by what we know about deer density in the area. Methods for estimating local deer density, such as pellet counts and spotlighting, have been useful but have limitations in their applications, particularly in large tracts of difficult-to-access land. To address this shortcoming, we started deploying drones outfitted with thermal sensors that can pick up the heat signatures of deer on the land below.

The greatly improved deer density estimates from heat-sensing drones will complement data collected on our study plots focused on plant species, forest structure, and regeneration. Relating deer density to the observed levels of browse on study plots can help land managers better understand when impacts on forest regeneration can be expected based on their local deer density.

2023

BY THE NUMBERS

COMMUNITY SCIENCE PROJECT VOLUNTEERS



MOUNTAIN BIRDWATCH

84

BUTTERFLY ATLAS

1,071



VERMONT LOON CONSERVATION PROJECT

320

WHIP-POOR-WILL PROJECT

24



VERNAL POOL MONITORING

125



# Meet Your Newfound Neighbors

Discovering species that have never been documented in a state isn't just novel and exciting; it's potentially very important. And because VCE staff and volunteers are so engaged in looking for wildlife, it's no surprise they're making new discoveries every year.

Only when scientists know an organism is present can they focus on its protection. Without protection, species can be lost without us ever knowing about them—or the benefits they provide. And because everything in nature is connected, the loss of a species can set off an ecological chain reaction we can't anticipate and may not be able to control. The resulting impacts can range from barely perceptible (at least to humans) to severe—jeopardizing dependent species, ecosystem balance, food crops, and even local economies. Here are the stories of just three of the many species documented for the first time in Vermont during 2023.

## Indiscriminate Cuckoo Bumblebee

In 2008, artist and naturalist Susan Sawyer took a beautiful photo (below) of a bumblebee in her yard and later used it as the subject of a drawing. Fifteen years after that, while attending a seminar about wild bees led by VCE Staff Biologist Spencer Hardy, she remembered the bee and showed him the drawing. He knew immediately it was a type of cuckoo bumblebee and asked her to post the original photo to the Vermont Atlas of Life on iNaturalist. Right away, a bee expert at the University of Minnesota made the identification—*Bombus insularis*, the Indiscriminate Cuckoo Bumblebee. More experts from the Xerces Society and the American Museum of Natural History concurred, confirming Susan's observation as the first official record of this bee in Vermont.

The Indiscriminate Cuckoo Bumblebee has declined in some areas and disappeared from parts of its



Maria Miner Bee

© SPENCER HARDY

historical range in the western mountains and northern areas of North America. NatureServe ranks the species as globally vulnerable, while Maine ranks it critically imperiled and New York considers it possibly extirpated (locally extinct). Some of its host species have faced significant declines as well.

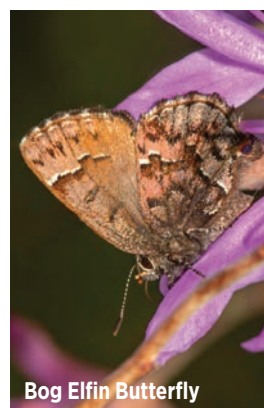
## Bog Elfin Butterfly

Starting in 2002 as a volunteer for the first Vermont Butterfly Atlas, entomologist Bryan Pfeiffer has trekked into some of the most remote bogs across Vermont every spring, searching for one of the smallest and most elusive butterflies on the continent—one nobody had ever seen in Vermont.

Persistence and experience finally paid off on May 19, 2023, when Pfeiffer, alone in northern Vermont, finally spotted it: the Bog Elfin. Until that day, the Bog Elfin had only been known from limited parts of the northeastern U.S. and eastern Canada. It is imperiled or vulnerable across much of its range.

Bryan's discovery coincided with the launch of the second Vermont Butterfly Atlas, which enlists experts and novices alike to search the state for butterflies and report what they find. Kent McFarland, who directs the Vermont Butterfly Atlas for VCE, said "Discovering that elfin illustrates how

Only when scientists know an organism is present can they focus on its protection.



Bog Elfin Butterfly

© BRYAN PFEIFFER

much remains to be known about the state's biological diversity, particularly its insect life."

## Maria Miner Bee

While exploring a swimming hole in Montpelier, VCE's Spencer Hardy stumbled upon a plant that he's been trying for several years to find in flower—the Sandbar Willow. Observing a patch in full bloom, he was surprised by the number and diversity of visiting bees, including many summer-active species never recorded feeding on flowering willows in Vermont. After a few minutes, a bright red bee appeared and captured his attention. Knowing it was likely something unusual, he carefully snapped a few photos and reached for the collection net.

While the photos proved inconclusive, Hardy used a microscope to identify the mystery red bee as *Andrena mariae*, the Maria Miner Bee, a species widely distributed in North America but poorly known in the Northeast and previously undetected in Vermont.

It will take additional work to determine this bee's conservation status and natural history, but in the meantime, it's amazing to think about all the bees that remain to be discovered despite years of historic collections and dedicated searching by the Vermont Wild Bee Survey.



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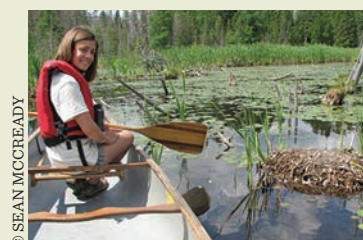
## A SAMPLING OF VCE'S COMMUNITY SCIENCE OPPORTUNITIES



© MIKE ZIMMERMANN

### Mountain Birdwatch

Each June, volunteers hit the trails to complete bird survey routes on 123 mountain ridgelines across the Northeast.



© SEAN MCCREARY

### Loon Conservation

Whether you live alongside a lake or only occasionally visit your favorite pond, VCE offers several options for interested loon volunteers.



© KENT MCFARLAND

### Vernal Pool Monitoring

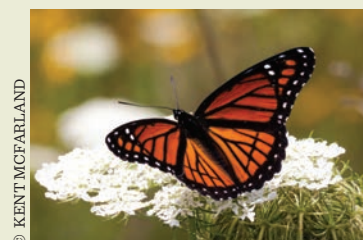
In April, May, and September, volunteers visit and collect data to monitor "adopted" vernal pools following protocols and using VCE-provided equipment.



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### Whip-poor-will Project

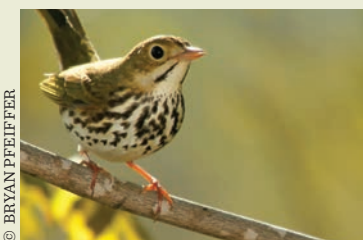
On moonlit nights in early summer, volunteers set out on 17 roadside survey routes to listen for Eastern Whip-poor-wills and record conditions.



© KENT MCFARLAND

### 2nd Vermont Butterfly Atlas

Join us as we search fields and fens, mountains and meadows, and even your own backyard, to document the status of Vermont butterflies.



© BRYAN PFEIFFER

### Forest Bird Monitoring

Each June, volunteers monitor breeding birds on 31 sites across Vermont in one of the continent's longest-running studies of forest bird population trends.



© CHRIS RIMMER

## Beyond Vermont's Borders

Whether chasing migratory birds to their wintering grounds or pursuing solutions to global biodiversity challenges, the Vermont Center for Ecostudies has a growing reach that goes far beyond our namesake state.

### The Caribbean Connection

In January 2023, longtime VCE collaborator and research associate Jim Goetz officially joined the VCE team as our Caribbean Conservation Coordinator. This addition builds on three decades of VCE's collaborative research and training to boost the impact of local conservation actions, which directly benefit Bicknell's Thrush and so many other

amazing Caribbean species. In his role with VCE, Goetz is also spearheading an update to the International Bicknell's Thrush Conservation Group's action plan.

Goetz was part of a VCE contingent that traveled to the Dominican Republic in February 2023 to join research partners from Grupo Jaragua, one of the country's leading conservation organizations. The mission was to net, tag, and release Bicknell's Thrushes.

Each captured bird received a band and a small nanotag. These lightweight radio transmitters—new tools in our research—use the Motus network, a growing array of more than 1,000 radio receivers that ping when a nanotagged bird passes nearby. With each ping, a data point is sent in real time to a central online hub. VCE has a rich history of tracking Bicknell's Thrush throughout its life cycle, and the Motus technology enhances our work's efficiency thanks to the way the data are communicated. Our archival GPS tags must be retrieved from recaptured birds to collect any data, but we don't need to retrieve nanotags to know where the birds have been.

▲ Collaborators Bernadino Alvarado (left) and Egido Sanz (right) assist with banding at Reserva Zorzal in the Dominican Republic.

▼ VCE Caribbean Conservation Coordinator Jim Goetz



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## eButterfly Goes Global

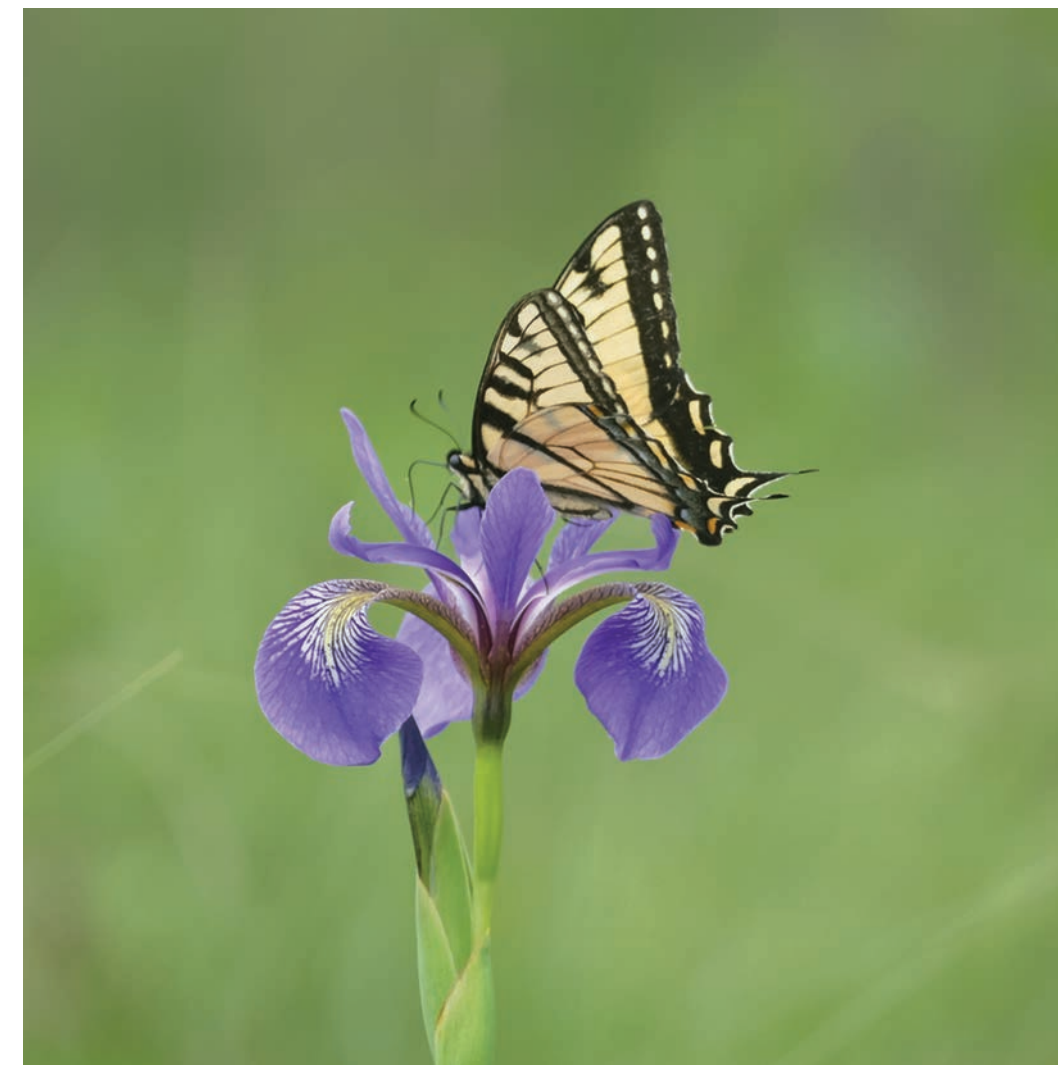
Since 2011, eButterfly—a crowd-sourced, open-data platform codeveloped by VCE Conservation Biologist Kent McFarland—has been archiving butterfly observations from Canada, the U.S., and Central America. In 2023, the platform began accepting butterfly observations from anywhere in the world and now contains data shared from 60 countries.

Butterflies, for all their grace and beauty, are also ecologically vital. They are pollinators and a source of food for birds and other insect eaters. Perhaps most critical for conservation scientists, butterflies often serve as indicators of broader ecosystem health. They are considered bellwether species—providing early warnings about the impacts of habitat degradation, climate change, and other ecological forces. The more scientists know about butterflies and changes

in their populations over time, the better equipped they are to build strategic, effective conservation plans. And there's nothing like community science for learning a lot about species populations in a hurry.

“With eButterfly, we're now building a truly global community of people who are collaborating with scientists to survey and conserve butterfly populations,” says McFarland. “It's the best of the Internet combined with the rigors of science.” The eButterfly database includes all known species of butterflies—nearly 20,000 of them—and the platform employs artificial intelligence (AI) to reliably identify most species based on the uploaded photo and the location.

*eButterfly is supported by the following organizations: the Vermont Center for Ecostudies; Espace pour la vie, a service of the city of Montréal; Mila-Quebec Artificial Intelligence Institute; and the University of Ottawa.*



© DESIRÉE NARANGO



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## So . . . What's a GBIF Again?

The Global Biodiversity Information Facility, or GBIF (“Gee, Biff”), is a long name worth remembering. It was founded in 2001 to meet the pressing need for a single open-access hub where research-grade biodiversity data from all over the world could be shared. By setting universal data standards, curating millions of records from thousands of data publishers, and providing tools to explore, extract, and analyze that information, GBIF enables the international conservation community to work smarter. More than 2,800 institutions around the world—such as the Smithsonian, Atlas of Living Australia, iNaturalist, and scores of universities—share their collections digitally through GBIF.

VCE is proud to be among those data publishers, and our Vermont Atlas of Life (VAL) has enabled the collections of many individual researchers to be digitized, formatted, and published to GBIF, making those datasets accessible to other researchers and attributable to their original authors. In 2023 alone, VAL-mediated datasets were cited in 56 scientific publications.



© DESIRÉE NARANGO

## Leading a Global Approach to Curbing Insect Declines

VCE is part of a new international Research Coordination Network (RCN) addressing one of the most urgent research challenges in biodiversity science: declining insect populations. The network (called Insect-RCN for short) links researchers, educators, conservation professionals, and policymakers from all over the world to spur collaborative solutions.

The first meeting of Insect-RCN took place in February 2023 at the American Museum of Natural History in New York City. Participants, including VCE Conservation Biologist Desirée Narango, shared their research about insect trends in the U.S., Panama, Costa Rica, and South Africa. Dr. Narango presented her work relating insect declines to bird declines.

A recurring theme at the conference was the value of community science for conservation, and Dr. Narango had a lot to contribute on that front. “Through the Vermont Atlas of Life, the Vermont Butterfly Atlas, bumble bee surveys, mountain-based studies, vernal pool monitoring, outreach programs, and more,” she says, “VCE is working on many projects that can directly inform how we address insect conservation, perceptions, and solutions. I’m looking forward to being part of the conversation about steps we can take together in preserving the little things that run the world.”

*Insect-RCN is funded by the National Science Foundation; initial funding to develop the network was provided by the Doris Duke Charitable Foundation.*

**VCE is working on many projects that can directly inform how we address insect conservation, perceptions, and solutions.**



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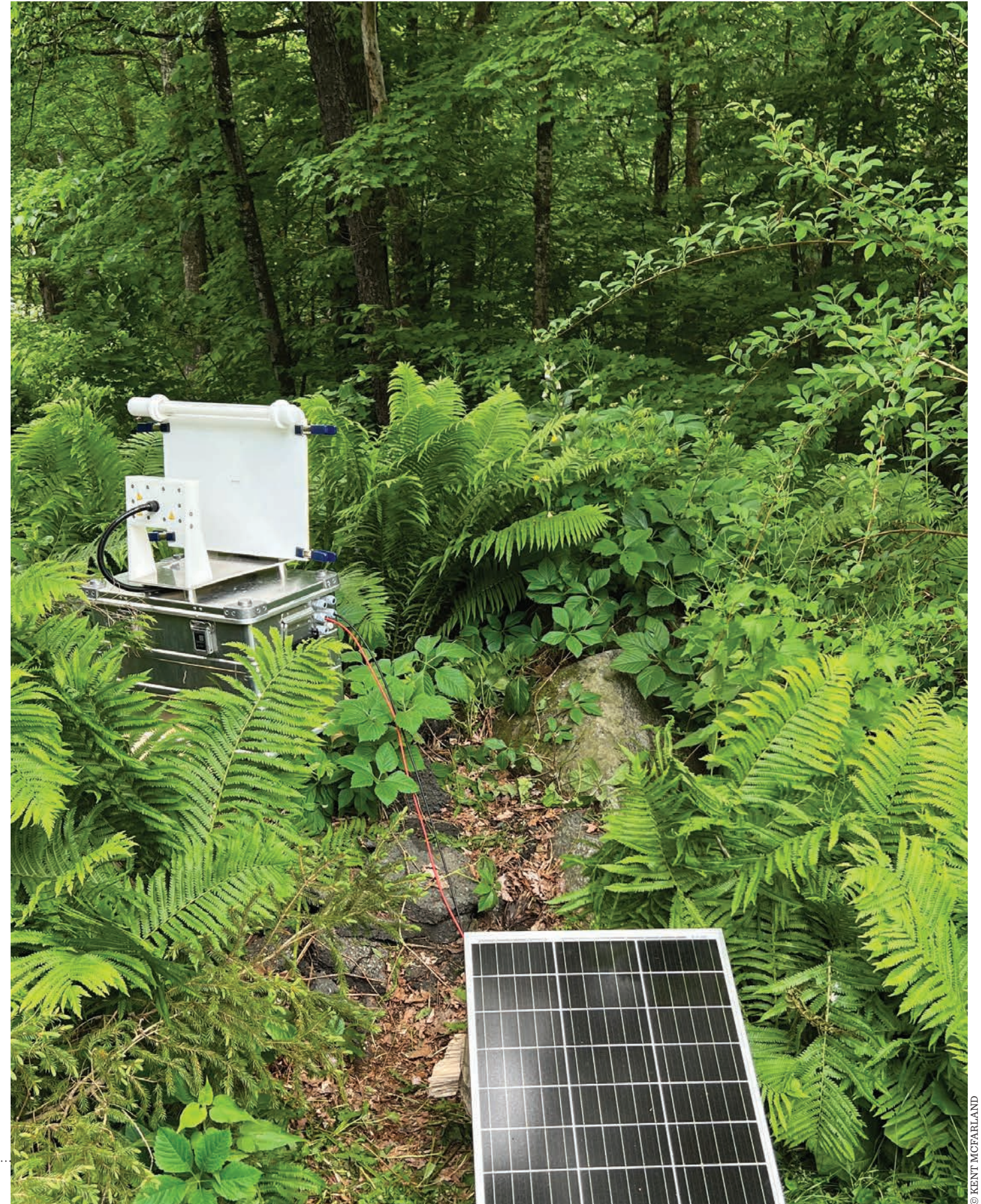
## AI and Remote Biodiversity Monitoring

Since 2021, VCE co-founder and Conservation Biologist Kent McFarland has been working with international partners on a new application of technology that could revolutionize efforts to conserve insect populations: autonomous, computer-controlled monitoring stations that attract and photograph insects, then identify them using AI. These stations can operate for long periods and under conditions that make hands-on research impractical, which means more diverse study areas producing more data in a shorter amount of time.

Machines deployed in more than 30 countries continued to be field-tested in 2023, including tests against traditional methods in a range of situations. A software platform to organize, analyze, display, and store the resulting data was also developed in 2023 by our partners at Mila-Quebec AI Institute. It will be released as a free web app for worldwide use by anyone using automated insect-monitoring machines.

With very encouraging results in hand, we are directing more energy to getting the word out and expanding the international network of collaborators for this exciting new research field.

➤ Field-testing a solar-powered, autonomous, moth-monitoring station



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## Henry Dandeneau

### Awarded the Julie Nicholson Community Science Award

Like many VCE volunteers, this year's winner of the Julie Nicholson Community Science Award turned his curiosity about nature into a decades-long passion. Henry Dandeneau's community science journey started more than 30 years ago when he worked at the Deerfield River Power Company (DRPC). In 1992, the Federal Energy Regulatory Commission (FERC) wanted to relicense the DRPC-operated dam at Somerset Reservoir, which holds water for hydroelectric power stations farther down the Deerfield River. But there was a new stipulation: the pair of nesting loons on the reservoir had to be protected. Figuring out what that would mean and ensuring that it happened became part of Henry's job.

"At the time, my boss told me that the most important part of my job was compliance with our FERC license," Henry said. "However, I had no hope of keeping us in compliance if I knew nothing about the loons."

Through his own observations and learning from experts, Henry quickly became knowledgeable about—and enchanted by—these unique and charismatic birds. He visited Somerset Reservoir nearly every week to keep watch over the nesting pair. "I think we were in total compliance [with FERC] every year I was in charge," Henry said.

Since those early days, Henry has gotten involved with loon work more broadly in Vermont. He joined the LoonWatch program in 1995 and has now dedicated 28 years to the cause as a loon monitor. Almost every week from May through July, Henry still tracks the loons inhabiting Somerset Reservoir—four pairs as of 2023—in a boat he bought for that purpose. He's added several other smaller bodies of water to his rounds as Vermont's loon population has expanded. For LoonWatch Day each July, he drives, hikes, and boats for more than 20 hours to survey two huge reservoirs and another half dozen small ponds. When a loon is in trouble, he is usually one of the first called in to help, sometimes as the primary responder. "I typically only help with the southern Vermont rescues," Henry explained. "However, I'll go pretty much anywhere in Vermont with enough notice."

It's no understatement to say that Henry's contributions have had a large impact on VCE's Vermont Loon Conservation Project. "VCE is so fortunate to be affiliated with a person like Henry," says VCE Loon Biologist Eric Hanson. "I admire his passion for adventure, his love of wildlife, and his sense of responsibility to get a job done well."



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## Roy Pilcher

### Stewardship personified

“Roy Pilcher has arguably volunteered more time, logged more miles, and expended more energy than anyone in the last four decades to advance bird and wildlife conservation in Vermont.”

Those words were written about Roy in 2009, when VCE honored him as the first winner of our Julie Nicholson Community Science Award. All the same accolades hold true today.

Born in Nairobi, Kenya, in 1929 and raised in rural Zimbabwe (at the time known as Southern Rhodesia), Roy spent countless hours roaming his family’s farm and the scrubby vegetation of the surrounding veld. He was a naturalist in training, and training in the most natural way: immersed, always observing, and utterly absorbed. When he started attending boarding school at age seven, his deep connection with nature was already well established, and with newfound kindred spirits, his adventures came to have a more specific focus: birds and their eggs.

In the years that followed, Roy added scientific rigor to his keen observational skills, building a stunning collection of meticulously preserved and documented eggs from hundreds of Zimbabwean and South African bird species. Decades later, after he and his wife, Ruth, and their three children moved to Vermont, Roy’s mother visited from Zimbabwe and brought the cherished eggs with her. Roy eventually donated the collection to the



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Birds of Vermont Museum in Huntington, where they remain today.

Roy earned a civil engineering degree from University of Cape Town in 1951 and spent the next three years camping in remote areas of southwestern Zimbabwe, surveying potential dam sites and canal lines—and studying bird life for his own enjoyment. From there, he went to seminary in New York, fell in love with Vermont, and, in 1965, settled in the Green Mountain State for good. He relished learning about his new environment, documenting its unfamiliar avian species, and meeting fellow birders in the field. He reflects, “While I had to sever my African roots in order to

**“While I had to sever my African roots . . . it was my love of birds and, by extension, Vermont’s community of birders that more than filled the initial void.”**

—ROY PILCHER

start life anew in America, it was my love of birds and, by extension, Vermont’s community of birders that more than filled the initial void.”

A teacher by profession, Roy remained an avid volunteer naturalist outside the classroom. He helped found Rutland County Audubon in 1974 and led the effort to designate the West Rutland Marsh and the Lake Bomoseen/Hubbardton Marshes as Important Bird Areas. He also represented his Audubon chapter in collecting field data for the seminal Vermont Breeding Bird Atlas from 1976 through 1981. Twenty-five years later, Roy collected data for the *second* Vermont Breeding Bird Atlas,

alongside several scientists who would later found VCE.

As Roy’s taxonomic interests expanded, so did the breadth of his volunteer field work, through heavy involvement in the Vermont Butterfly and Bumble Bee Atlases and many of VCE’s other signature projects. When crowd-sourced biodiversity platforms began to appear online, Roy was an early and enthusiastic adopter. In iNaturalist alone, he has contributed more than 9,000 mostly research-grade observations—including 1,395 birdsong recordings—comprising 1,152 species.

Roy’s incredible dedication includes financial contributions, too. Recognizing the essential role of donors in driving the innovative, often long-term work needed to conserve biodiversity, he has made at least one supporting gift to VCE every year since its founding in 2007. In 2015, in an act of generosity and vision, Roy, with the blessing of his three children, announced a planned gift commitment to bequeath most of his estate to our young organization.

In 2023, Roy Pilcher, age 94 and engaged as ever, sent us these inspiring words: “The conservation biologists and support staff at VCE have created and nurtured an amazing legion of community scientists, of which I am a proud member. I am persuaded that the status of this ‘community of scientists’ goes beyond that of ‘community’ to that of ‘family.’”

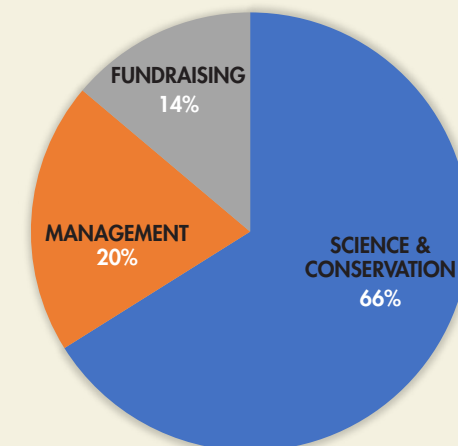
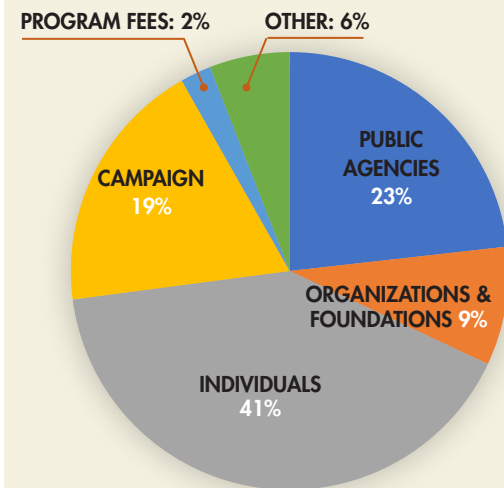
We couldn’t agree more, Roy. And we can’t thank you enough.

### STATEMENT OF FINANCIAL POSITION

ASSETS	AS OF 12/31/23
CASH	\$343,117
RECEIVABLES	\$431,019
<b>TOTAL CURRENT ASSETS</b>	<b>\$774,136</b>
INVESTMENTS	\$3,612,520
PROPERTY AND EQUIPMENT (NET)	\$874,764
OTHER ASSETS	\$66,556
<b>TOTAL ASSETS</b>	<b>\$5,327,976</b>
<b>LIABILITIES AND NET ASSETS</b>	
<b>TOTAL CURRENT LIABILITIES</b>	<b>\$222,963</b>
LONG-TERM DEBT, LESS CURRENT PORTION ABOVE	\$577,069
<b>TOTAL LIABILITIES</b>	<b>\$800,032</b>
<b>TOTAL NET ASSETS</b>	<b>\$4,527,944</b>
<b>TOTAL LIABILITIES AND NET ASSETS</b>	<b>\$5,327,976</b>

### STATEMENT OF ACTIVITIES

2023 REVENUE	2023 EXPENSES
PUBLIC AGENCIES	\$380,339
ORGANIZATIONS/FOUNDATIONS	\$143,624
INDIVIDUALS	\$670,375
CAMPAIGN	\$309,096
PROGRAM FEES	\$37,419
OTHER	\$98,640
<b>TOTAL REVENUE</b>	<b>\$1,639,493</b>
SCIENCE AND CONSERVATION	\$1,550,223
MANAGEMENT	\$470,543
FUNDRAISING	\$325,011
<b>TOTAL EXPENSES</b>	<b>\$2,345,777</b>



#### A NOTE FROM OUR FINANCE COMMITTEE CHAIR

Since our founding in 2007, VCE has approached our financial health conservatively, ending nearly every year in the black. In 2023, VCE entered a period of planned operating deficits to enable strategic expansion of our science, conservation, outreach, and fundraising activities. Expenditures adhere to carefully vetted programmatic and financial plans made possible by the generosity of donors toward our \$5 million ALL IN for Biodiversity Campaign. Funds from this successful campaign are invested and then deployed—along with increasing revenue from grants, contracts, and annual giving—to support unprecedented growth in our work and conservation impact. —BILL HAYES





MISSION

The Vermont Center for Ecostudies advances wildlife conservation across the Americas through research, monitoring, and community engagement.



VERMONT CENTER FOR ECOSTUDIES

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