



VERMONT CENTER FOR ECOSTUDIES

Uniting People and Science for Conservation

ANNUAL REPORT 2025



More Than Meets the Eye

Look a little closer

Uniting People and Science for Conservation

The Vermont Center for
Ecostudies advances
biodiversity conservation
across the Americas through
research, monitoring, and
community engagement.
We envision a society that
sustains healthy ecosystems
through science-based
decision making.



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COVER PHOTO: IMBRICATE NOMAD (*NOMADA IMBRICATA*) ON HAWKWEED ©SPENCER HARDY

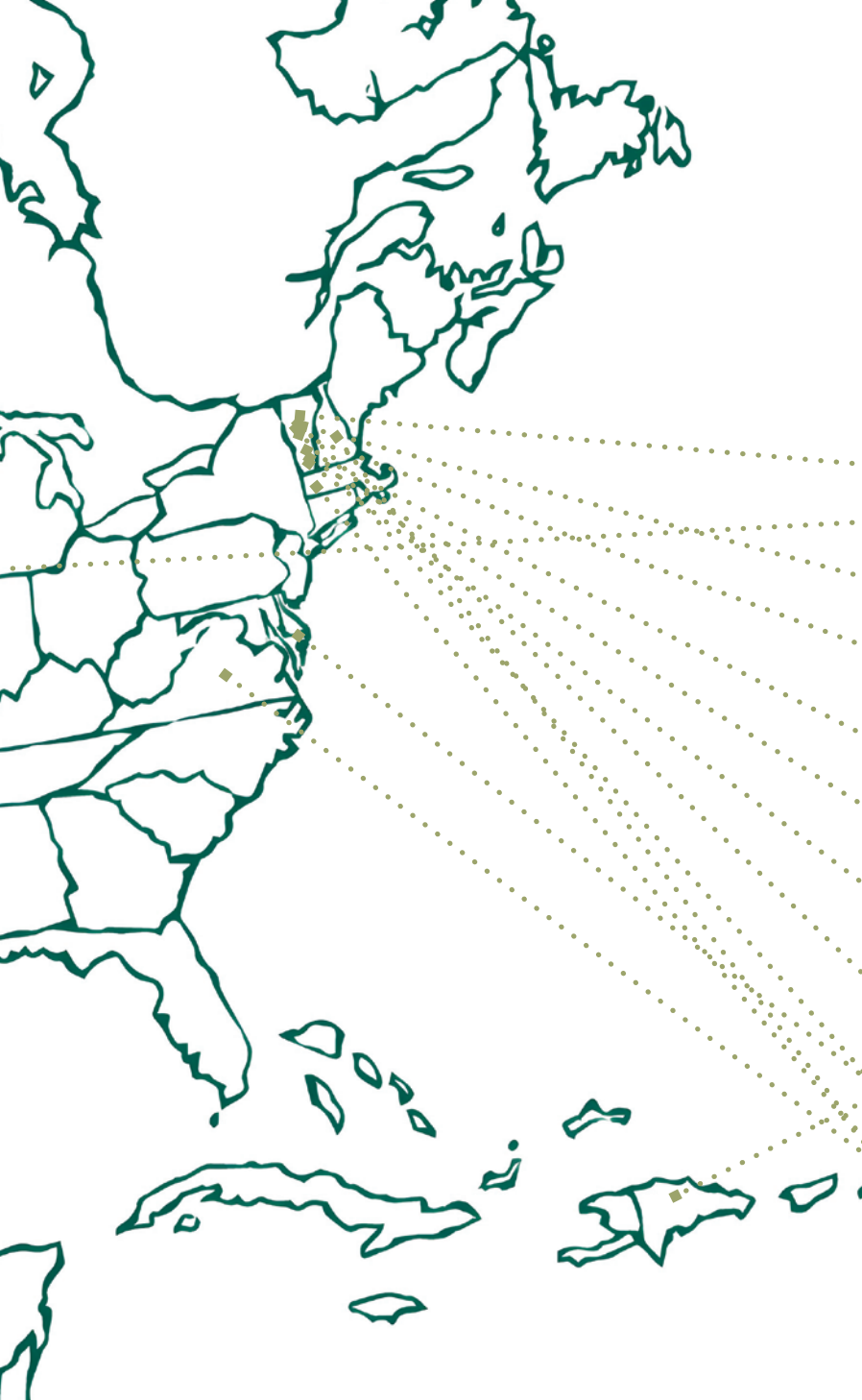


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Look a Little Closer

Dear friends and supporters,

At first glance, the Vermont Center for Ecostudies may look like a small organization. Look a little closer, and something else comes into view: a growing network of scientists, volunteers, and partners generating the data and insight needed to understand a rapidly changing natural world. In 2025, that work gained momentum. With your support, we expanded not just our reach, but the depth and clarity of what we can see.

One of the clearest examples is our Adopt-a-Plant project. What began as a practical question—what to do with surplus plants from an experimental garden study—grew into a regional community science project involving more than 600 participants across three states, many new to VCE. What might seem like a simple act of planting is, if we look deeper, something larger: a richer understanding of how native plants and pollinators interact across real landscapes in real time.

This year marked a breakthrough in how we gather and share data for our Loon Conservation Project. LoonWeb, a new digital platform, brings decades of field observations into an accessible online information source. Built in close collaboration with volunteers, it allows participants to adopt a lake, join LoonCount, and explore a lake's history—a challenge that has defied many attempts through the years, in Vermont and beyond. We are now working with Maine Audubon on a Maine-focused version, a sign of how local effort can ripple outward.

The decadal update of the state's Wildlife Action Plan benefited from both the vast biodiversity database of the Vermont Atlas of Life and the expertise of VCE scientists. Our team provided critical data and helped identify the state's Species of Greatest Conservation Need. Here again, looking closer matters: Careful, long-term data collection makes it possible to see which species are at risk—and to direct



Susan Hindinger

© CHARLES GANGAS



David Mears

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funding and conservation action where it is most needed.

Over the past several years, we've added key staff and built the capacity that our last strategic plan compelled. Today, our expanded team is working across disciplines to bring fresh perspective and cohesion to our research. As ever, from Mountain Birdwatch to the Vermont Butterfly Atlas and Vernal Pool Atlas, community scientists remain at the heart of this work. These programs are designed, built, and run by VCE's scientists, communicators, and data experts. But look a little closer, and you see who gives them life: the community scientists whose observations, time, and care make the work possible.

Progress has not come without challenge. Federal support for conservation is weakening, with significant impacts to programs that have long relied on federal funding, including our Caribbean work and AmeriCorps partnerships. These losses are deeply felt, not only by us, but especially by our collaborators in the Domini-

can Republic and valued federal and state agency partners. Yet even in this shifting landscape, our resolve remains strong. Bolstered by support from committed donors, we continue to advance high-quality science, engage more people than ever before, and adapt where necessary to keep critical research moving forward. Even in this shifting landscape, the resolve of our community remains strong.

VCE's work today is grounded in a sustained commitment to bird research, expanding work on pollinators and biodiversity, technological innovation, and a belief that conservation is strongest when it is shared. Across all of it runs a common thread: making the natural world more visible, more measurable, and more understandable.

Our community is built on both passion and precision. We are serious about our science and joyful in our connection, both to the natural world and with the community of supporters and careful observers who join in our work and help advance our mission.

We invite you to explore all this work in the pages that follow. Thank you for helping to make it all possible.

With deep gratitude,

Susan Hindinger
Executive Director

David Mears
Chair, VCE Board of Directors

A Sharper Focus for Vermont's Wild Future

Vermont will soon publish its updated Wildlife Action Plan, a 10-year road map that sets conservation priorities and helps determine which species can qualify for government funds for conservation planning, recovery work, and further research. Only species included in the plan are eligible for that support, and inclusion requires enough data to make the scientific case.

Five VCE staff members took part in the drafting process through Scientific Advisory Groups, in which much of the

plan's scientific framework is assembled. The draft also cites the Vermont Atlas of Life as a biodiversity resource, highlighting how long-term field data can turn overlooked species into recognized conservation priorities. Using Atlas data, more than 100 species were included in the plan for the first time.

That work comes at a critical moment. Large gaps remain in what the state knows—especially regarding invertebrates and fungi, groups that have historically received less attention. Vermont is among the first states to include fungi on its list of Species of Greatest Conservation Need, a shift that broadens the picture of what biodiversity conservation can include.

By pairing landscape-scale planning with species-level distribution models,

researchers at VCE and elsewhere can see not just where habitat matters, but which species may be overlooked. “We can look at biodiversity conservation at two levels,” says Ryan Rebozo, VCE’s director of conservation science. “There’s the big habitat level, and then the individual species that are falling through the cracks.”

As the picture sharpens, so does the sense of where conservation attention is most needed. Species once absent from the record are now visible in the data and eligible for protection. That shift—from partial knowledge to something more complete—marks a quiet but consequential step forward for conservation in Vermont.



©KENT MCFARLAND

NEXT STEPS

- Complete remaining species distribution models, then provide ground truth through summer fieldwork.
- Use new occurrence records to assess the conservation status of understudied groups—such as lady beetles, grasshoppers, crickets, and katydids—to pinpoint the species most in need of immediate attention.
- Use the updated Wildlife Action Plan to pinpoint species with sparse records or clear data gaps, and target them for future surveys and atlas efforts.

Juniper Hairstreak (*Callophrys gryneus*), a Vermont Species of Greatest Conservation Need

Turning Pollinator Data into Planting Decisions

In 2025, VCE Conservation Biologist Desirée Narango took on a stubborn challenge: how to use large, unruly datasets on plants and pollinators to generate gardening advice people can actually use. Through a working group funded by the National Center for Ecological Analysis and Synthesis, Narango joined researchers and practitioners in California to build a tool that turns complex ecological data into practical planting recommendations.

By combining open community-collected data, machine learning algorithms, and predictive models, the team found ways to fill gaps in incomplete records and identify which plants are likely to be the most beneficial to pollinators in places with different management goals. Some help to extend bloom seasons. Some are especially valuable for specialist bees. Others feed adult pollinators while also supporting caterpillars. The result is guidance that can help gardeners, farmers, and land managers choose plants with greater confidence.

That work now powers new features in the California Native Plant Society's



KAREN FRASER (VIA INATURALIST, PUBLIC DOMAIN)

Yellow-faced Bumble Bee (*Bombus vosnesenskii*) on California Buckwheat (*Eriogonum fasciculatum*)

Calscape tool, offering region-specific recommendations based on local conditions. Instead of asking people to guess which native plants might help, it gives them a clearer, science-based starting point.

The idea could travel well. With more than 650,000 records of plant and pollinator interactions in the Northeast, Narango is already exploring how to bring a

similar approach closer to home, adapting the modeling framework to build a Northeast native plant prioritization tool. You can contribute to that effort by documenting pollinator interactions you see in your own yards and gardens and submitting them to iNaturalist.

NEXT STEPS

- Secure funding to adapt the California modeling framework and build a Northeast native plant prioritization tool.
- Expand datasets and refine predictions for underrepresented interactions, especially caterpillar host plants and moth pollination.
- Develop ecoregion-specific guides, such as seasonal bloom calendars, to make the science accessible to practitioners.

Science Gets a Seat at the Policy Table

As part of VCE's science-to-policy initiative, the organization moved more deliberately in 2025 to put its science to work in public decision-making. It brought field data, species expertise, and ecological insight directly into policy discussions, shifting from occasional input to sustained engagement. With its first dedicated science-to-policy staff, VCE joined working groups, submitted public comments, and built relationships across Vermont's decision-making landscape.

"Providing tools for science-based policy decisions is a key interest right now, and we want to support that," says



©ALDEN WICKER

Emily Anderson, VCE's Science to Policy Manager

VCE Science to Policy Manager Emily Anderson.

VCE staff contributed to the implementation of Act 181, weighed in on wake-boat impacts to loon nests, helped shape discussions on wetland protections, and brought science to bear on grassland bird habitat in permit renewals. It also joined the Environmental Common Agenda process for the first time, helping outline environmental priorities at the state level.

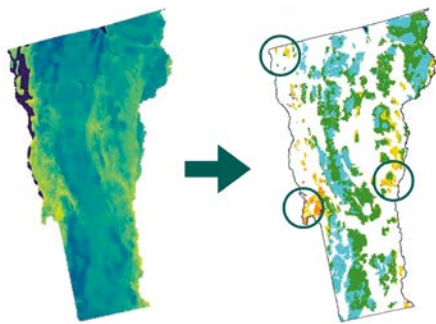
The goal, says Anderson, "is to make

sure the best available science does not just sit on the shelf, but helps shape decisions."

NEXT STEPS

- Expand partnerships and policy networks while staying active in rulemaking and legislative discussions.
- Turn VCE research on pollinators and pesticides into guidance for state decision-makers.
- Secure funding to grow science-to-policy capacity and strengthen long-term policy influence.

More than a Map: A Closer Look at Where Conservation Matters Most



GRAPHIC BY BRIAN KRON

Habitat suitability models (left) help identify areas where species diversity is expected to be high (right).

Vermont Conservation Design is a science-based statewide plan that identifies priority lands and waters for conservation and land-use decisions. In 2025, a VCE team began sharpening that big-picture tool with a new layer of species-level insight, making it more versatile and more powerful on the ground.

VCE scientists launched a major

modeling effort to predict where species live now and where they are most likely to persist as climate and land use change. Using tens of thousands of community science observations, the team is building models for more than 100 species of conservation concern and combining more than 30 environmental variables to map current and future habitat suitability across Vermont.

The aim is to make Vermont Conservation Design a stronger conservation tool. By showing which species are already well represented in the network of conserved lands—as well as which places or species may be slipping through the cracks—the models can help focus protection where it matters most.

“Just having an idea of where the species are predicted to be will help Vermonters manage habitats and protect those species,” says Mike Hallworth, VCE’s conservation and data scientist. “This can lead to land being protected because we

identified that it’s important for biodiversity. That’s just super exciting.”

NEXT STEPS

- Complete species distribution models to identify priority biodiversity areas now and under future conditions.
- Provide ground-truth predictions with fieldwork, acoustic recorders, and camera traps to improve model accuracy.
- Deliver results to land trusts and state partners to guide conservation alongside Vermont Conservation Design.



©SAMMI RIZZO

WHEN AMERICORPS SHUT DOWN, THE WORK CONTINUED

In May, with no warning, the federal government terminated the Eco AmeriCorps program. Members across the country were dismissed immediately, losing pay, health insurance, and, in some cases, housing, months before their terms were meant to end. At VCE, the shutdown came just as the Adopt-a-Plant project, which Onome Ofoman was coordinating, was beginning to reach hundreds of new volunteers across the Northeast.

Thanks to the generosity of VCE donors, we were able to keep Ofoman on through the early summer, covering the remainder of her salary, health insurance, and education award after federal support vanished. She stayed long enough to guide the project through its critical first phase before leaving for her PhD program at the University of Vermont.

Ofoman’s work helped turn a surplus of study plants into an ambitious community science effort, drawing in many people who were new to VCE. The episode was a clear reminder of how much AmeriCorps members give to this work and how much can be lost when that support disappears overnight.

More Than Meets the Eye

VCE's Impact by Numbers

With a staff of just 32, VCE has an outsized impact on conservation in Vermont and beyond.

ILLUSTRATIONS BY FIONA MACLEAN



Rosy Maple Moth
(*Dryocampa rubicunda*)

1 MILLION

research-grade records achieved by October since the beginning of iNaturalist Vermont, contributing to the Vermont Atlas of Life

1,500+ BUTTERFLY OBSERVERS

(10x more than the first Vermont Butterfly Atlas)



Milbert's Tortoiseshell
(*Aglais milberti*)

6 EXPERIMENTAL GARDENS

at partner organizations, including Cedar Circle Farm, Sunrise Farm, the Town of Hartland, Dartmouth Organic Farm, Billings Farm and Museum, and the Vermont Institute of Natural Science

1,650 PLANTS

given to 550 new-to-VCE volunteers for Adopt-a-Plant

ALMOST 1,000 POLLINATOR SURVEYS

submitted across three states by volunteers



Verbena Moth (*Crambodes talidiformis*) on Blue Vervain
(*Verbena hastata*)



Tricolored Bumble Bee (*Bombus ternarius*) on Grass-leaved Goldenrod (*Euthamia graminifolia*)

115 VERMONT SPECIES

whose distribution is being modeled by VCE scientists to improve conservation recommendations

~2,000

VERMONT LADY BEETLE SPECIMENS

whose distribution is being modeled by VCE scientists to improve conservation recommendations

8,500+ OBSERVATIONS

of pollinator interactions with plants by VCE scientists in the experimental gardens

NEARLY 30% OF VERMONT'S BEE SPECIES

documented on less than a 1/4 acre of cultivated space

Second Vermont Butterfly Atlas:

1,884

complete butterfly checklists in eButterfly

MORE THAN 110

butterfly species observed so far, including several new to the state

20 PRESSURE TAGS

applied to Blackpoll Warblers and 19 to Bicknell's Thrush on Mount Mansfield

32,000+ DATA POINTS

of plant-flowering phenology from 1,080 plants

20 PEER-REVIEWED PUBLICATIONS

12 DATA PUBLICATIONS

16 INVASIVE VEGETATION SURVEYS

of grassland bird habitat conducted by Kevin Tolan, across more than 600 acres



Bobolink (*Dolichonyx oryzivorus*)



White Mountain Fritillary
(*Boloria chariclea montinus*)

Our Supporters and Community Scientists



Dana Williams facilitates
a search for bumble bees.



Kevin Tolan leads a
grassland bird field trip.



Participants share a moment during VCE's
Science Fair.



Eloise Girard leads a group of volunteers
as they place loon-nesting signs on the
Green River Reservoir.



Kent McFarland and Janet Hardy talk
butterflies at the VCE Science Fair.

Bicknell's Thrush Race to the Atlantic!

Which BITH will
leave the East
Coast of the U.S.
first?



ILLUSTRATION BY MEGAN MASSA

Our short-term, creative fundraising campaign, Bicknell's Thrush Race to the Atlantic, was a success by multiple measures. It raised \$43,775 for Bicknell's Thrush research from longtime and new supporters—enough to buy and install four new Motus towers in the Dominican Republic, as well as other bird-banding and monitoring supplies. And it brought people into conversation with VCE research in real time. Our community members routinely refreshed the race map to “check on their bird” and emailed us thoughtful questions about Bicknell's Thrush and their route to Hispaniola. It was further proof that our science, communications, and development teams can be nimble, collaborative, and willing to test out new strategies for success.



© ALDEN WICKER

Jason Hill transfers an insect from a participant's net to a vial on a bumble bee walk.



© ALDEN WICKER

Participant on a pollinator walk



© SUSAN HINDINGER

Terry Armata and others work together for the perfect shot during a pollinator safari.



© RYAN REBOZO

Participants in the Community Science Teacher Workshop count aquatic invertebrates in a one-meter quadrant on Mink Brook.

Vermont Center for Ecostudies

74 Common Loons Spotted on Lake Elmore on May 10. Loon Biologist Eric Hanson explains why. ... [See more](#)

Views	Reach	Interactions
86,449	75,101	1,579

Vermont Center for Ecostudies

New Paper Published! VCE Conservation Biologist Desirée Narango gives us another great reason to plant native trees and shrubs.... [See more](#)

Views	Reach	Interactions
94,108	74,147	1,340

Instagram

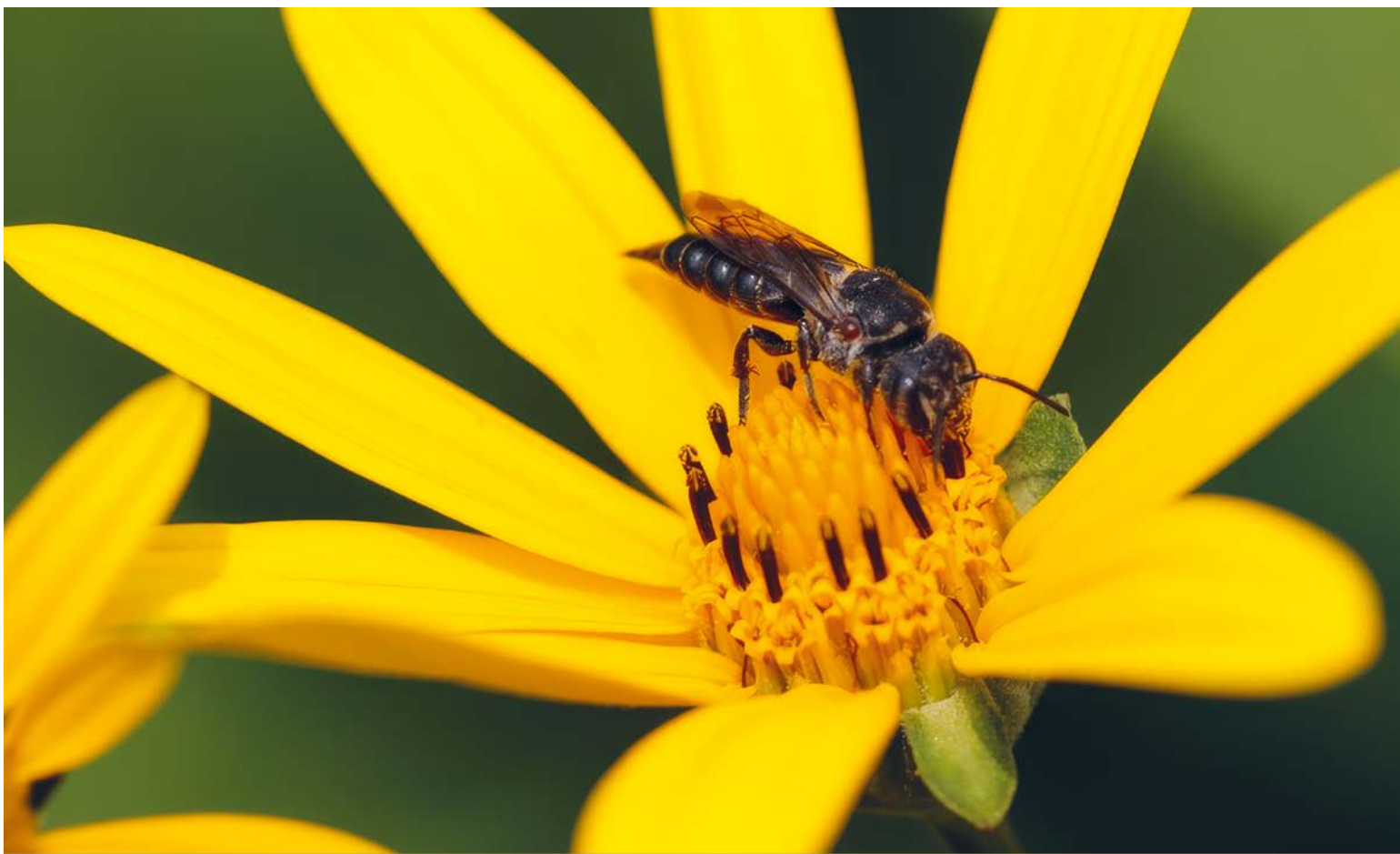
vtcecostudies

A new bee in VT!

Lunate Longhorn-curlew Bee (*Trispodilus lunatus*)

Views	Reach	Interactions
6,182	3,230	305

VCE's top science posts on Facebook & Instagram in 2025



Sunflower Sharptail (*Coelioxys alternatus*)

Hidden in Plain Sight

A Closer Look at Vermont's Wild Bees

In 2019, scientists knew surprisingly little about most of Vermont's bees. The majority of the state's native bees—miners, masons, leafcutters, sweat bees—were, as VCE Bee Biologist Spencer Hardy put it, “an unopened box of treasures.”

Six years later, that box is open.

In 2025, VCE and its partners published the first comprehensive checklist of Vermont's wild bees in more than 60 years: 352 species, backed by a database of roughly 80,000 records drawn from field surveys, museum drawers, private collections, and a swelling tide of community science observations. It is both a roll

call and a reckoning. More than half of those species appear to need conservation attention. And some more may soon merit state protection.

The project began with curiosity, then deepened into something more urgent. Hardy and colleagues spent four years crisscrossing Vermont, stopping at wetlands, roadsides, mountain clearings, and field edges that most people would drive past without a glance. They slept in cars, chased bloom times, tracked down host plants, and learned to think like bees. At the same time, they worked backward through a century of specimens in muse-

ums, asking two deceptively simple questions: Which species were here before, and which are still here now?

These questions changed the scale of the work. The checklist did not merely add names. It revealed patterns, absences, dependencies. Some bees turned out to be tightly bound to a single plant species or small group of plants. Others were hanging on in just one known place. A rare oil-collecting bee, for example, appears tied to Yellow Loosestrife in a preserved riparian park in South Burlington—a tiny outpost that may hold an outsized share of the species' future in Vermont.



©SPENCER HARDY



©SPENCER HARDY

Two-spotted Bumble Bee
(*Bombus bimaculatus*)



©SPENCER HARDY

Least Cellophane-Cuckoo
(*Epeolus minimus*)



©SPENCER HARDY

Spine-shouldered Cellophane Bee
(*Colletes simulans*)

The findings also scrambled a few commonly held assumptions by the public. Not all bees are honey bees. Not all bees are declining. And some of the most important conservation gains may come not from grand gestures, but from small, smart changes: adding the right native flowers to a restoration mix, protecting an overlooked wetland edge, paying attention to what blooms where and when.

For Hardy—who grows native plants and exotic fruit as a co-owner of the Farm Upstream in Jericho, Vermont—the project kept producing moments of delight. After one talk, an artist showed Hardy stationery decorated with a bumble bee she had drawn from a photo she took years earlier. That image turned out to document *Bombus insularis*, a parasitic bumble bee never before recorded in Vermont.

Vermont and its bees now have something they lacked before: a robust baseline for research, monitoring, and conservation. What was once fragmentary is now far more legible, giving scientists a stronger foundation for tracking change and guiding action.

Read the Checklist:

Hardy, S.P., Veit, M., Milam, J., Ascher, J.S., Sharp, N., **Hallworth, M.T.**, Ferguson, M., Richardson, L., Nicholson, C., Ricketts, T.H., Gibbs, J. and **McFarland, K.P.** (2025) "An annotated checklist of the bees (Hymenoptera: Apoidea) of Vermont with conservation status and natural history notes", *Northeastern Naturalist*, 32(mo27), 1–73.

NEXT STEPS

- Survey likely habitats for rare or overlooked bee species still unconfirmed in Vermont.
- Build conservation work around host plants, habitat restoration, and pollinator-friendly land management.
- Pursue protection for high-risk species.

The Joy of Looking Closely at Invertebrates

Every year at VCE's Winter Celebration, we present one member of our community with our Julie Nicholson Community Science Award, recognizing their important contribution to one or more VCE research and monitoring projects. This year, the award went to Bernie Paquette, whose dedicated study and photography of bees has advanced the understanding of Vermont's bee fauna and whose infectious enthusiasm for the study of invertebrates has reverberated throughout his community. Here we share his acceptance speech.

Hello, I'm Bug-eyed Bernie, and I speak for the insects—for they couldn't be here tonight. They may be small, but their importance is vast.

I'm honored to receive the Julie Nicholson Community Science Award. I offer my deep appreciation—and three simple requests.

But first, I want to honor the past recipients of this award, whose curiosity and dedication have strengthened Vermont's understanding of the living world. Their work creates a ripple effect of wonder and stewardship.

I offer my gratitude to everyone at the Vermont Center for Ecostudies. You work tirelessly for nature and share your knowledge with such generosity and joy. You show that learning is a gift meant to be passed on. VCE demonstrates what science becomes when the doors are opened wide—when data are shared, when the public is welcomed in. You've made it clear that anyone can help illuminate the natural world.

Spencer Hardy's coordination of the Vermont Wild Bee Atlas shows exactly what that looks like—from nets to microscopes, from field observations to classroom lessons, from obscure bits of insect anatomy to iNaturalist IDs, bee checklists, and research papers. Desirée Narango's plant-insect interaction study invites the public not only to observe the study but



Hummingbird Clearwing (*Hemaris thysbe*)

©BERNIE PAQUETTE

also to be part of it. And Kent McFarland's leadership across Vermont's many atlas programs—his celebration of life in flight, wings of delight—inspires people to look up, look closely, and appreciate what is usually invisible.

Part of the joy of my work is not just discovering new insects, but also meeting remarkable people like those I've mentioned—guiding lights and mentors, including John Ascher, associate professor at the National University of Singapore, and my dear friend, Don Miller, professor emeritus, Vermont State Colleges.

Many unheralded people work quietly in nature—like Erika Mitchell, with more than 125,000 Vermont iNaturalist observations, and Josh Lincoln, with more than 380,000 IDs.

Which brings me to request number one: Please help confirm bee and insect

identifications on iNaturalist so they reach research grade. My own confidence to share this passion is bolstered by my wife Maeve—a nature advocate, teacher, birder, and author—who reminds me that paying close attention is an act of love.

I try to spread that love through conversations about insects, my VT Bug-eyed blog, and the nature walks we lead. My mission is simple: to introduce more people to the joy of observing invertebrates—especially insects.

I call it inverting.

Maeve and I offer an introduction to inverting through walks, presentations, and Bug Safaris in other people's yards. Because once someone notices an insect for the first time—really notices it—something in them changes. Curiosity awakens. Wonder takes hold.

From that belief, a new chapter has be-

gun: The Vermont Entomology Academy, founded this year. Our mission is to spark curiosity and create nature connections through the world of insects. At VEA, people learn the basics of entomology, use observation tools, explore iNaturalist, and

eling insect museum to deliver hands-on learning.

Which leads to request number two: Will you join us?

We're building a pool of members who volunteer to offer at least one hour-long,

can't speak only to each other. We must reach those who don't yet know what they're missing, those who have never looked closely. When we take people outside and show them how to see, they don't just walk into nature—they belong to it. And they return.

My final request: If you see an insect today, give it a little hug in your heart. It's cold out there, and they're ectothermic.¹ They need more of us to care.

So spread the word: Inverting is the new birding.

Thank you.

Visit Bernie's blog (vtbugeyed.blogspot.com) to read more of his musings, learn about events he offers, and see his gorgeous photography.

¹ Dependent on external sources of body heat

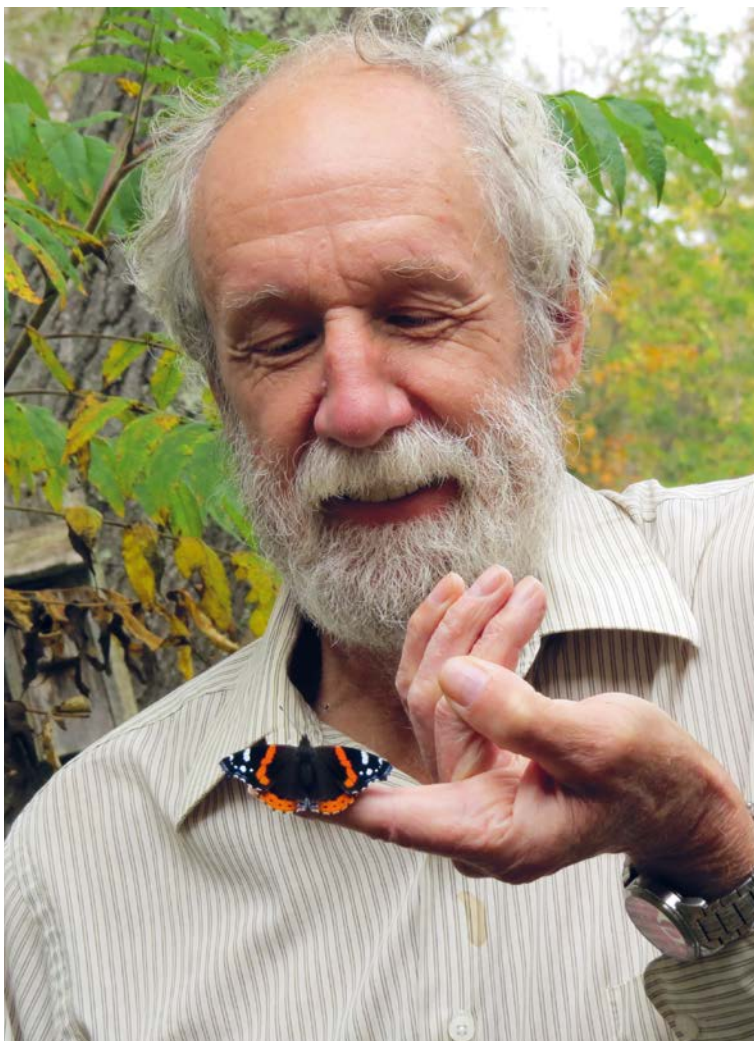
“When you slow down and look closely, the world grows infinitely larger.”

discover the joy of looking closely. Because when you slow down and look closely, the world grows infinitely larger.

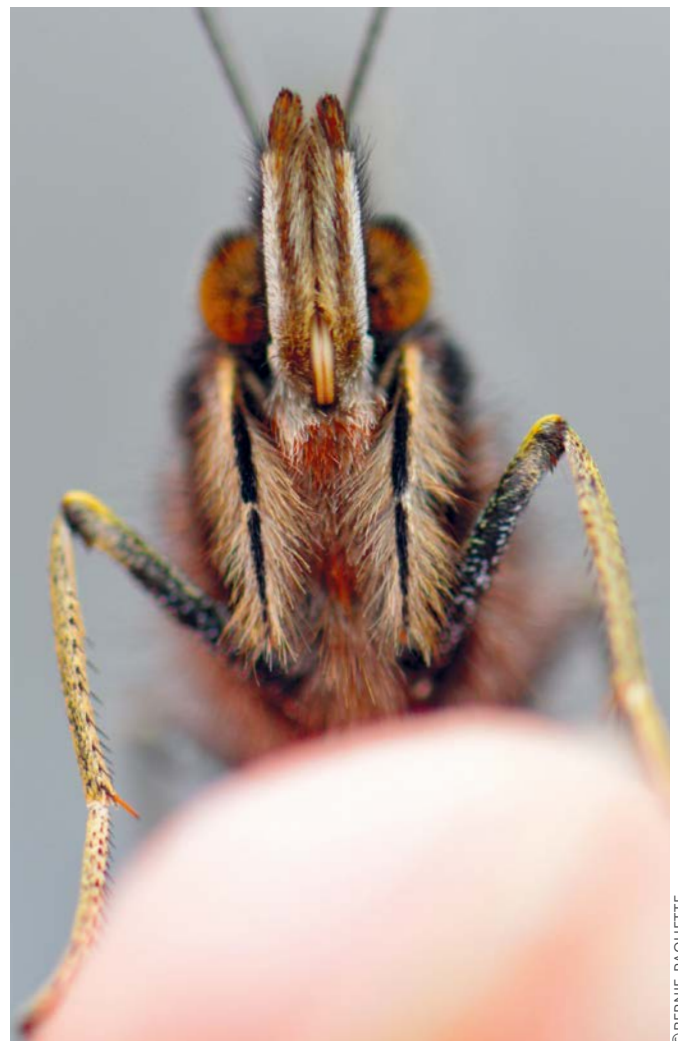
This June, with the support of Bee the Change and Saint Michael's College, we'll hold our first five-day Bug-huggers Adventure Camp led by Declan McCabe. We're also building the BugMobile, a trav-

interactive insect presentation each year. No fixed schedule—just a willingness to share what you love. This academy is built on shared leadership and the belief that everyone has something meaningful to contribute. There is a place for you.

If we want more people to care about insects—and the world they sustain—we



Bernie Paquette holding an American Red Admiral (*Vanessa atalanta rubria*)



The American Red Admiral staring back at Bernie



©EMMA PODOLIN

Eloise Girard hauling a rescue net across the frozen Green River Reservoir during a loon rescue mission last winter

Every Loon Counts *A New App That Both Biologists and Volunteers Love*

On a bitter December day, VCE Loon Biologist Eloise Girard hauled a sled of rescue gear onto the ice at Green River Reservoir toward a shrinking patch of black water. A young loon had been there for days, swimming circles to keep the hole open. But loons are built for open water, not tight quarters. To lift off, they need a runway as long as a quarter mile. Once a loon gets iced in, it can be stranded with no way out.

Girard, joined by volunteer Emma Podolin, stretched a gill net across the hole and waited for the loon to surface. Then came a splash—a tangle of wings and mesh. The rescuers hauled the heavy, thrashing bird from the water, worked it free, and secured it in a padded transport box. Later, VCE Loon Biologist Eric

Hanson drove it to open water on Lake Champlain and released it to join the southbound migration.

Thirty years ago, saving a single loon in Vermont effectively meant saving 10 or 20 percent of the state's entire population. Today, after four decades of patient work, the state supports 115 breeding pairs.

In 2025, VCE carried out nine loon rescues. The work can be technical, cold, and exhausting. It is also deeply communal. Time after time, volunteers spot the birds, report them, help assess conditions, and sometimes assist with the rescue itself.

"Even now, every loon counts," Hanson says. "Saving birds is important, but so is keeping people involved in the work of watching over our lakes."

That spirit of community helped drive

**Today, after
four decades
of patient
work, the state
supports 115
breeding pairs.**

one of the year's biggest advances: LoonWeb, VCE's new digital platform for loon conservation. For decades, loon-monitoring data management has taken the shape of paper forms, spreadsheets, and endless email chains. Several attempts had been made to digitize the process through the years, but none fully worked. LoonWeb did, in part because it was built with input from the people who would actually use it.

"We built it with our volunteers, who



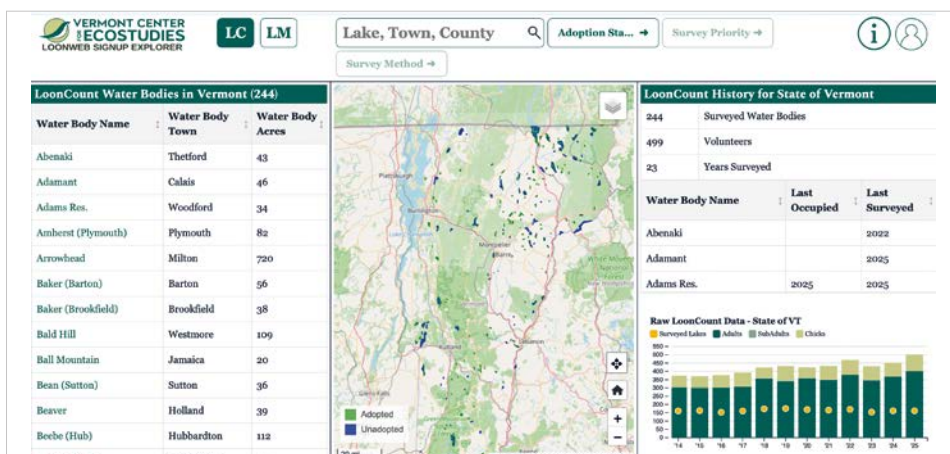
©EMMA PODOLIN

Eloise Girard rescuing a loon from the Green River Reservoir last December



©ELOISE GIRARD

Eric Hanson rescuing a loon in Montgomery, Vermont, last November



Volunteers can adopt lakes and anyone can explore loon data on LoonWeb's homepage.

NEXT STEPS

- Launch LoonWeb trainings statewide.
- Extend LoonWeb to Maine, in partnership with Maine Audubon.
- Beta-test the mobile survey app.
- Remove a small number of artificial nesting rafts to encourage natural nesting.

were involved from the ground up,” says Jason Loomis, VCE’s software developer. “That collaborative process is what made it into something that people can trust, use, and help make it better.”

The payoff is already visible. In its first season, 87 percent of Vermont’s annual LoonCount volunteers used the system. LoonWeb lets volunteers explore historical lake data, adopt survey sites, and enter standardized observations that are immediately more useful to staff and researchers.

In past seasons, Hanson and other VCE staff members spent up to two days a week processing volunteer emails by hand. LoonWeb can return much of that

time to the field, where biologists can interact with volunteers directly. The platform can also improve the data by giving volunteers an intuitive form to record details such as loons’ reactions to nearby predators. Observations like these can help researchers better understand loon behavior, nesting success, and the threats the birds face.

That matters because the work is not over. Lead fishing gear still kills loons, wakeboats threaten nests and fragile shorelines, and increasingly severe summer storms and floods create turbulent water that can make it harder for loons to find food. With a clearer, more complete view of loon behavior, habitat, and

risk, VCE and its volunteers are better equipped to protect a species whose recovery has always depended on careful watching.

“Ecology Is Harder Than Rocket Science”

How Data Are Changing Our Research

We gathered three generations of our scientists in one room to talk about how data—and the research it informs—have changed since VCE’s founding. Kent McFarland is a conservation biologist, VCE co-founder, and founder of the Vermont Atlas of Life. Mike Hallworth is a data scientist and wildlife ecologist who uses cutting-edge migration technology, field research, and data analysis with sophisticated modeling techniques to understand animal movement. Megan Massa is VCE’s data manager, handling data cleaning, storage, and reporting pipelines.

McFarland: Well, when I first started, we used to have to chisel it onto stone. That was the start of the Anthropocene. (Laughs) When I started in biology, the

be like, that was ridiculous!

Massa: Frequentist statistics? *p*-values??

Hallworth: They didn’t have the tool set that’s available today to ask really complex questions. In the 1950s you had to design an experiment that was easy because you were hand-typing it, and you were using a typewriter, and you were calculating things on a calculator. Versus now, you name it. There’s no limit on the questions you can ask or the data you can get your hands on.

Massa: The question really is so fundamental. For my master’s degree, they had this big dataset. You could do basically anything you want with this. So what are you interested in, and what do you think will be useful? In my case, it was: What

“The more we’re able to do, the more we realize what we don’t know.”

fancy thing was spreadsheets. It wasn’t big data. In fact, some of those famous old ecology papers we learned about in school, based on very small datasets, have kind of been debunked.

Massa: Those early studies were using pretty simple statistical methods and usually had a pretty straightforward experimental setup. A lot of that very foundational research turns out to be, by the methods we use today, not something that would be supported. Or definitely not as clear of a narrative as it seemed at the time.

McFarland: It is easy for us to say that right now, looking back. But at the time, it was the best science available. So we’re still standing on the shoulders of giants. Fifty years from now, they’ll probably look back at some of the stuff we’re doing and

do land managers want to know that we could answer with this dataset?

You can model what an effect might be of a certain action, but ultimately, we never have 100% understanding of any system. And so making decisions—especially value decisions about where money should be spent and why—is still, ultimately, a people question.

McFarland: It’s more complicated now because the subject is complicated. I mean, ecology is harder than rocket science. The more we’re able to do, the more we realize what we don’t know.

Take the Bicknell’s Thrush as an example. In 1993, the bands were noted down on paper. In 1994 and 1995, we started putting those bands and data we were collecting on a spreadsheet. So now we could actually look at them, make a little



VCE Conservation Biologist and Co-founder Kent McFarland

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VCE Data Manager Megan Massa

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VCE Data Scientist Mike Hallworth

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“In the 1950s you had to design an experiment that was easy because you were hand-typing it, using a typewriter, and you were calculating things on a calculator.”

graph about what’s going on. Not too long after, we were collecting nest-site stuff, and banding data, and vegetation data. We started using a relational database. In the early 2000s, we realized we can use Mark-recapture statistics in these new programs.

Massa: Mark-recapture statistics are: If you put a band or a tag on a bird and you never see it again, that could mean that the bird is dead, or it could mean that it just left your study area, and you didn’t happen to encounter it again. If you get enough birds, especially at one place over time like on Mount Mansfield, you can start to use these models in a program that is doing much more complicated statistics than you can do on the back of the envelope.

McFarland: We could start to do things like, oh, what’s the survivorship rate of males versus females?

Hallworth: The things you can know about parts of the world that you’re

not currently standing in is something that’s definitely changed in the past 35 to 40 years. When I started, we had bird banding to link populations across the annual cycle, and then the huge advance was using chemical signatures of feathers: stable isotopes.

McFarland: We could say, oh they mixed together in the wintering grounds from different breeding grounds.

Hallworth: The next thing was light-level geolocators.

McFarland: We started figuring out that they don’t migrate until October, and it looks like they stop over somewhere on their way down to the Dominican Republic.

Hallworth: And now we’re using technology on small birds that can show with 10-meter resolution where that bird was across its full annual cycle. We can take those so-called capture histories, integrate all those data from Mount Mansfield with the tracking data that we’re using,

and now with remote-sensing products, like satellite imagery of the world, we can integrate all those things to make predictions and estimates about how the world is changing and how it’s affecting populations across their annual cycle. That wouldn’t have been possible 15 or 20 years ago.

VCE: So, what’s next? Are you using artificial intelligence to process things or ask questions?

McFarland: I think it’s moving so fast that there will be a time soon when you will be able to feed it a whole set of data, and it will help you write code and figure out how you want to model it. You’ll still have to be able to read the code to make sure it’s not making a mistake on the code. There’s always going to be someone driving the ship, but it might be faster.

Hallworth: Someone has to come up with a question that needs to be answered.

McFarland: You still have to be a biologist.

This is an abridged version. Find the entire conversation—including GIS technology, metadata standards, computing power, more on AI, and how VCE’s most recent research showcases what’s now possible—at vtecostudies.org/blog.



Bicknell's Thrush
(*Catharus bicknelli*)

ILLUSTRATION BY FIONA MACLEAN



Seasonal Bee and Butterfly Technician Juno Stahl (far left) and the 2025 VCE interns (left to right) Sammi Rizzo, Massimo Gulino, Camilla Price, and Isabella Soddu at Cedar Circle Farm on media training day

Mentoring Young Biologists

GRADUATE STUDENTS

Every year, VCE scientists provide advice and encouragement to graduate students who assist with our science projects and independently conduct their own research related to VCE's focus areas. This year, Conservation Biologist Desirée Narango advised three graduate students.

Melory Brandao

University of Delaware

Melory Brandao, at University of Delaware, is testing an idea taking root in cities: that dense Miyawaki forests—tiny, fast-growing plantings of closely packed native trees—can outperform traditional plantings. She compares insect communities across these tightly packed urban forests and more conventional green spaces in Boston. Brandao's research is tracing how restoration choices shape the smallest lives, and, by extension, the larger systems they support.

Laura Costello

University of Vermont

Laura Costello studies plants that keep their secrets. A UVM Field Naturalist graduate student, she split her summer between coding pollinator datasets and chasing a mystery: Who pollinates Vermont's White Bog Orchids? Using time-lapse cameras running day and night, she captured a fuller cast of visitors than anyone had documented locally. "Our understanding is still incomplete," she writes. Her images—butterflies by day and moths after dark—are beginning to close that gap.

Kevin Dernier

State University of New York at Plattsburgh

After volunteering on Mount Mansfield and studying Bicknell's Thrush, Kevin Dernier built an independent study around Gray Catbirds at The Putney School, pairing fieldwork with automated telemetry. By tagging birds and reading signals from a Motus tower, he tested whether incubation, normally hidden in dense vegetation, could be tracked remotely, and whether new tools could reveal behavior without disturbing the research subjects. He graduated from SUNY Plattsburgh at the end of 2025.

SUMMER INTERNS

Every year, VCE brings in a small group of students and emerging conservation professionals and drops them into the real work of field ecology: long days outdoors and quick pivots to lab work when the weather turns. This year, 250 applicants competed for positions marked by range, rigor, and hands-on experience. Recent investments—made possible by grants and donor support—in housing and a field vehicle have made these opportunities more accessible to students from a broad range of backgrounds and geographies.

Massimo Gulino

Northern Michigan University

Massimo Gulino came to VCE from the shores of Lake Superior, where he leads student crews studying salamanders. In Vermont, he moved among field-research sites and predawn climbs on Mount Mansfield, learning to band birds and set mist nets in the dark. “Being able to handle a bird was equally nerve-racking, beautiful, and one of the highlights of my young career,” he says. What stays with him are the mornings—the first light over Lake Champlain, a White-throated Sparrow cutting through the dark—and the steady, patient mentoring that sharpened both his science and his sense of direction.

Isabella Soddu

University of Vermont

Isabella Soddu arrived with curiosity but little confidence, worried she had somehow slipped into the internship by mistake. The summer changed that. Through loon surveys, bird banding, insect work, and time in experimental garden plots, she found that good ecologists are built through attention, humility, and sustained wonder. “Two very simple ingredients go a long way,” she says. “Passion and curiosity.” One day, she sent her mother a photo of herself holding a freshly banded bird. “That’s the face of someone who’s found what they love to do,” her mother texted back.

Sammi Rizzo

University of Vermont

Sammi Rizzo moved across a wide sweep of VCE field studies: loon conservation, grassland management, on-farm pollinators, native-plant research, and the Vermont Butterfly Atlas. What stayed with them was the human machinery behind good conservation. In loon monitoring, they saw a project held together not just by science, but by patience, local knowledge, and volunteer effort. Rizzo came away with a clear view of how conservation really happens: through long hours, careful observation, and a community of people willing to keep showing up.

Camilla Price

Colorado State University

Camilla Price’s summer ran on data and miles of pavement. As VCE’s spatial-science intern, she worked through more than 7,000 observations to understand wildlife-vehicle collisions across the Northeast. She built models, mapped migration routes, and translated dense datasets into clear visuals. The work was technical, but the benefits could be tangible: better decisions, safer roads, and fewer dead animals at the edge of the pavement.



Spotted Salamander
(*Ambystoma maculatum*)

ILLUSTRATION BY FIONA MACLEAN



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Anna Peel at VCE's Mount Mansfield banding station holding a Bicknell's Thrush

Keeping Watch

Field Report from the 2025 Mount Mansfield Season

By Anna Peel, Lead Bird Bander

I open my car door and step out into the sun of a new day on Mount Mansfield. There's an urgent list of tasks awaiting me, with a team to coordinate and nets to set up, but there's something I need to do first. I breathe in.

My lungs have been downland all week, full of the smells of a dirty car in summer, sweat and sunscreen in the garden, chicken poop on the porch steps—all the rich human and domestic odors that bloom in the heat of June. Mansfield air is something else entirely. A deep breath of the mountain is medicine that reaches right inside you, all mineral and green. It's full of the kind of indifferent, magnificent wildness that challenges humanity to bend to its power, rather than the other way around.

Summer dawn on Mansfield, when the

wind is warm and sweet and the sun is just beginning to cast strawberry shadows against the net, is another essential moment of peace for me in the busy week. Each morning this year, there's one birdsong in particular that I'm waiting for as the dawn chorus swells around me: the crescendo-decrescendo trill of a male Blackpoll Warbler (*Setophaga striata*) asserting his territory.

When a male Blackpoll first arrives on the mountain in late May, he is immediately in competition with other males to corner the best territory and find a mate. Once he has secured a patch of mountain and a mate, he then has to prevent other males from encroaching upon either. As a result, a researcher armed with a speaker and a recording of a Blackpoll song in May or June is almost guaranteed to pro-

voke nearby males into responding to that recording. This allows us to quickly and efficiently target and capture birds for tag deployment without spending very long in their territory.

However, once fledglings emerge from the nest in July, Blackpolls no longer have any pressing reason to defend a particular territory. This results in a sharp drop in their responsiveness to the song of an unfamiliar male, as well as any interest in our speakers.

In last year's pilot season of a new collaboration between VCE and National Audubon, led by VCE Data Scientist Mike Hallworth and with funding by Massachusetts Clean Energy Center (Mass-CEC), we fitted Blackpolls with harnesses containing tiny archival geolocators with the ability to track their location, speed, and elevation as they made their perilous, days-long transatlantic journey to their nonbreeding territories in South America and back again. The goal is to ascertain whether they are flying at a height that could bring them into contact with offshore windmills.

In 2024, we road tested the concept by deploying fifteen tags on Blackpoll

Warblers throughout the breeding season, which required us to come up with inventive ways to coax the incurious July and August Blackpolls into our nets. This summer, in our first active season for the MassCEC study, we deployed all twenty Blackpoll tags before the end of June in an intense and satisfyingly efficient joint effort.

Each of the Blackpoll Warblers equipped with a geolocator harness also gets a unique combination of colored leg bands to help us identify the bird from afar. As you can see in the photo of a Blackpoll wearing a geolocator, the tag is relatively low profile, with just a light-detecting stalk emerging from the feathers.

Colored leg bands are much easier to spot than the tag itself. They give the bird an appearance of “fat legs,” even with the unassisted human eye. With binoculars to see the unique color-band combination, we can identify individual Blackpolls before we even have them in the hand.

We’ve caught young Golden-Crowned Kinglets and admired the plumage of a male Bay-Breasted Warbler, a handful of Winter Wren fledglings, and two Sharp-Shinned Hawks!

Still, our Slate-Colored Junco capture numbers are half of what they were last year, although all of our other target species are visiting our nets at roughly the same or higher rates as 2024. This downward trend for juncos remains even when capture numbers are adjusted to reflect the total number of active net-hours of banding each season.

Dark-Eyed Juncos are one of North America’s swiftest-declining bird species, despite their wintertime abundance in New England backyards. According to the North American Breeding Bird Survey, their numbers nationwide have dropped by 42% since the late 1960s; our mountaintop trend only reinforces the necessity of keeping watch over even these seemingly common species.

In terms of species diversity, in 2024 we caught birds from 36 species, whereas in 2025 only 29 different species graced our nets. We also haven’t been subject to the remarkable deluge of hatch-year

Pine Siskins that besieged Mansfield in 2024, which was an irruption year for the species—in fact, we didn’t catch a single one in 2025, although on our second July visit to Mansfield, six chatty siskins were hopping busily back and forth across the access road each time we checked our Lake View nets.

After a brief hiatus in August, we returned to Mansfield in September to outfit Bicknell’s Thrushes with Motus and barometric pressure tags. In only three visits to the mountain, we captured and harnessed 18 previously-banded and one new-to-us Bicknell’s Thrush. When these birds return to Mount Mansfield in May, they’ll bring with them precious new information about when they left the mountain, how high they fly while



An adult male Blackpoll Warbler wearing one of our geolocators

©ALICIA BRUNNER

TOTAL CAPTURES PER SPECIES 2025 VERSUS 2024

	<i>Bicknell's Thrush</i>	<i>Swainson's Thrush</i>	<i>Blackpoll Warbler</i>	<i>Myrtle Warbler</i>	<i>White-Throated Sparrow</i>	<i>Slate-Colored Junco</i>
2025	72	29	68	44	34	42
2024	84	34	70	57	36	88

TOTAL CAPTURES PER SPECIES 2025 VERSUS 2024, *divided by total net hours per season and multiplied by 1000*

	<i>Bicknell's Thrush</i>	<i>Swainson's Thrush</i>	<i>Blackpoll Warbler</i>	<i>Myrtle Warbler</i>	<i>White-Throated Sparrow</i>	<i>Slate-Colored Junco</i>
2025	30.68	12.36	28.97	18.75	14.49	17.90
2024	28.39	11.49	23.66	19.26	12.17	29.74

migrating, and how long it takes them to reach Hispaniola after they take off from the mid-Atlantic coast.

We also recaptured one of the Blackpoll Warblers that we had fitted with a barometric pressure tag in June. He was still in the same hundred-meter-square patch of trees where we had caught him three months earlier, and both the bird and the tag looked great. If this tiny athlete

survives his epic journey over the Atlantic Ocean to South America, he’ll return in 2026 with a treasure trove of data affixed to his back. We’ll be listening for his song and setting our nets in that same beloved patch of balsam.



© IVÁN MOTA @CUABIRDING

Bicknell's Thrush photographed by Iván Mota, founder of Cúa Birding in the Dominican Republic

From Mountain Summits to Migration Bottlenecks

Tracking Bicknell's Thrush

Bicknell's Thrush does not give itself away easily. This modest brown bird of foggy ridgelines and dense cover is more often heard than seen, its strange, ringing song floating over spruce-fir summits.

But stealth has not meant safety. The species has declined by nearly 50% since 2010 in northern New England and eastern New York. Where, exactly, the losses are happening has been a mystery.

In 2025, VCE pushed into two of the least understood stretches of the bird's annual cycle: the fall stopover in the mid-Atlantic region and the final leg of southbound migration into the Dominican Republic. Together, those efforts are

sharpening the picture of migration bottlenecks, the places where a species can be most vulnerable.

In January 2025, VCE deployed a Motus receiving station at Reserva Privada Zorzal in the Dominican Republic, the

“This modest brown bird of foggy ridgelines and dense cover is more often heard than seen.”

first Motus station within the Bicknell's Thrush core wintering range. The system detects signals from tiny coded radio tags, allowing researchers to follow movements without recapturing birds.

“These Motus towers help us figure out where we're losing birds,” says Jim Goetz, VCE's Caribbean conservation coordinator. “Are they making it to the coast and failing to fuel up? Are they dying over the ocean? Or are they reaching the Domini-

can Republic and not surviving there?”

Recent tracking suggests that much of the population funnels into the same mid-Atlantic staging areas, especially on the Delmarva Peninsula and parts of

coastal North Carolina, before making the Atlantic crossing.

“We’ve realized that almost the entire population seems to be stopping in the same locations in fall,” VCE Conservation Biologist Desirée Narango says. For a species already confined to a narrow breeding range and a Caribbean winter range, that concentration raises the possibility of a migration choke point.

Narango, Goetz, and VCE Conservation and Data Scientist Mike Hallworth took the search to the field. Working with banding stations in Maryland, they tested new methods to find a bird so hard to study that it leaves only the faintest traces. Blood samples helped distinguish Bicknell’s Thrush from its nearly identical cousin, the Gray-cheeked Thrush, and autonomous recording units (ARUs) cap-

tured call notes in places where human observers would have missed them.

The work is beginning to pinpoint where Bicknell’s Thrush is most vulnerable and where conservation efforts could do the most good. What is emerging is a much clearer map of vulnerability: not just where Bicknell’s Thrush breeds or winters, but where its entire migration may bottleneck. For a species living within such narrow limits, that kind of precision could change its ultimate fate.

NEXT STEPS

- Recover tracking tags on Mount Mansfield that record light and air pressure to pinpoint stopover sites and timing.
- Expand the Motus network in the Dominican Republic to track arrival, departure, and survival of birds crossing the Atlantic.
- Continue mid-Atlantic field work to identify key stopover habitat and threats.



VCE Motus receiver in the Dominican Republic at Reserva Zorzal

©MICHAEL HALLWORTH

More Published Research

From Our Scientists in 2025

Find links to read the full published research on our website, or email the VCE author for a copy.

Peele, A.M., **Massa, M.**, Rohrbaugh, R.W., Harding, S.R., Hunter, E.A., Loope, K.J., Sommers, D.A., Thomas, M.A. and Kane, A.L.

Virginia's Second Breeding Bird Atlas (2016–2020)
vabirdatlas.org

With assistance by VCE Data Manager Megan Massa, this atlas documents the distribution and breeding status of bird species across Virginia from 2016 to 2020, providing an updated baseline for understanding changes in avian populations since the first atlas.

Narango, D.L., Tallamy, D. and Shropshire, K.

Tree composition mitigates the negative effects of urbanization on specialist and generalist forest moth communities

Ecological Solutions and Evidence

Led by VCE Conservation Biologist Desirée Narango, this study of nocturnal moth communities in urban forest fragments finds that urbanization generally harms moth diversity and abundance, but that the presence of Lepidoptera-rich host trees (like oaks) can partially offset these negative effects. Benefits are greatest for specialists that are strongly reliant on a small number of host plants.

Narango, D.L. and Straley, K.

Nonnative congeneric trees are poor quality host plants for a larval Lepidopteran

Ecosphere

Led by VCE Conservation Biologist Desirée Narango, this experiment reared *Promethia* silkworm caterpillars on 14 *Prunus* species (i.e., cherries and plums) and found that non-native cherry trees are poor-quality host plants.

Tosa, M.I., Roberts, A.J., Tegeler, A.K., Devers, P.K., Parker, L., Hunt, P.D., Watts, B.D., Huang, M., Vitz, A.C., Schweitzer, S., Robinson, S., Palumbo, M.D. and **Rebozo, R.**

Design of a monitoring program to advance nightjar conservation along the Atlantic Flyway

Wildlife Society Bulletin

With assistance from VCE Director of Conservation Science Ryan Rebozo, this study compared occupancy estimates from nightjar-specific survey routes and Breeding Bird Survey data across the Atlantic Flyway. Based on that analysis, this study recommends a network of 300 randomly distributed routes as a statistically defensible monitoring program for Common Nighthawk, Chuck-will's-widow, and Eastern Whip-poor-will.

Repenning, M., Jahn, A.E., **Hallworth, M.T.** and Suertegaray Fontana, C.

Tracking tiny migrants: First description of the annual cycle of *Sporophila* seedeaters

Ornithological Research

Using light-level geolocators to track Tropeiro Seedeaters through a complete migration cycle, this study provides the first description of the annual migratory cycle for this threatened South American grassland species.

Morelli, T.L., **Hallworth, M.T.**, Duclos, T., Ells, A., **Faccio, S.D.**, Foster, J.R., **McFarland, K.P.**, Nislow, K., Ralston, J., Ratnaswamy, M., DeLuca, W.V. and Siren, A.P.K.

Does habitat or climate change drive species range shifts?

Ecography

With assistance from VCE Data Scientist Mike Hallworth and VCE Co-founder and Conservation Biologist Kent McFarland, this study uses occupancy analysis of acoustic survey data in the mountains of the northeastern United States to test whether species range shifts are driven by climate change, precipitation change, or forest composition change. It found that habitat change—not climate alone—is a key driver of observed range responses.

Bowden, J.J., Owens, A., Brown, K., Harding, R.W., Graversen, M., Larrivée, M., **McFarland, K.**, Miller, T.A., Warren, J. and Young, J.O.

Moth walls: shedding light on moth biodiversity *FACETS*

This paper describes a novel, low-cost community science method—networks of illuminated “moth walls”—for documenting moth species diversity and distribution, contending that such networks are valuable for biodiversity data collection, invasive species detection, and public engagement about nocturnal insects.

Deckel, S.C., **Narango, D.L.**, DeLuca, W., King, D.I. and Gerson, A. (in press)

Stable isotope analysis and DNA metabarcoding reveals elevational shifts in diet of a montane breeding bird

Journal of Field Ornithology

With assistance on diet methods and analyses by VCE Conservation Biologist Desirée Narango, this study used stable isotope analysis and DNA metabarcoding on Swainson’s Thrush in the White Mountains of New Hampshire to quantify diet shifts. It found that the proportion of detritivore arthropods (e.g., millipedes) in thrush diets increases with elevation, whereas dietary niche width declines, suggesting that high-elevation birds consume lower-quality prey. Postdoc and lead author Sarah Deckel (now director of bird conservation at Audubon Rhode Island) is working with Narango on a study comparing Swainson’s Thrush with Bicknell’s Thrush.

Hostetler, J.A., Cohen, E.B., Bossu, C.M., Scarpignato, A.L., Ruegg, K., Contina, A., Rushing, C.S. and **Hallworth, M.T.**

Challenges and opportunities for data integration to improve estimation of migratory connectivity

Methods in Ecology and Evolution

This study presents new functionality in the MigConnectivity R package that allows integration of intrinsic markers, tracking data, and long-distance reencounter data to improve estimates of population-specific migratory connectivity, demonstrating through simulations and case studies with Painted Bunting, Yellow Warbler, and Bald Eagle that combining data types improves range-wide accuracy.

August, T., Balzan, M., Bodesheim, P., Brehm, G., Cantú-Salazar, L., Castro, S., Chipperfield, J., Ghisbain, G., Gomez-Segura, A., GoulNIK, J., Groom, Q., Hogeweg, L., Huijbers, C., Kamilaris, A., Kazlauskis, K., Koch, W., Korsch, D., Loureiro, J., Martin, Y., Martinou, A., **McFarland, K.**, MestdagH, X., Michez, D., Outhwaite, C., Pegoraro, L., Pernet, N., Pettersson, L.B., Pipek, P., Preda, C., Rolnick, D., Roth, T., Roy, D.B., Roy, H., Runnel, V., Sasic, M., Schigel, D., Sheard, J., Svenningsen, C., Teixeira, H., Titeux, N., Tschulin, T., Tzirkalli, E., van der Velde, M., van Klink, R., Vereecken, N., Vray, S. and Høye, T.T.

Using image-based AI for insect monitoring and conservation – InsectAI COST Action

Research Ideas and Outcomes

This paper introduces the InsectAI COST Action, a European research network bringing together scientists and stakeholders to develop and standardize image-based AI technologies for monitoring insect populations and countering widespread insect declines at national and continental scales.



White-throated Sparrow
(*Zonotrichia albicollis*)

ILLUSTRATION BY FIONA MACLEAN

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 DVM
 Maddy Motta

In honor of Paul Nevin
 Thomas Gutheil
 In honor of Dean Peterson
 Henry Keutmann and Ilene
 Gipson
 In honor of RJ Phelps
 Kayla Buxton
 In honor of Roy Pilcher
 Sue Wetmore
 In honor of Owen Rachampbell
 Anna Gerretson
 In honor of Chris Rimmer
 Anonymous
 David Blockstein
 John and Margot Ernst
 Billi Gosh
 Mark Greenberg
 Mollie and Tom Hoopes
 Carolyn B. Jackson
 Nelson Kasfir and Liz Blum
 Larry Master
 Alyssa Rimmer and Matthew
 Henderson
 Clare C. Rimmer
 In honor of Kenneth Sabotta &
 Jeff Sabotta
 Robert Mallon
 In honor of Carol D. Saunders
 Anonymous
 In honor of David Tobias
 The Tow Foundation
 In honor of Kevin Tolan
 Randy Howell
 In honor of the VCE Staff
 Eduardo E. Iñigo Elias, Ph.D.
 Nancy Osgood
 Ben Williams and Meg
 Darrow Williams
 In honor of Dr. Jessi Waite
 Trish and Roger Bromley
 In honor of Dana Williams
 Larry Klotz
 In honor of Connie
 Youngstrom
 Pamela Darrow

Gifts in Remembrance

In memory of all the loon
 chicks who didn't get to fledge
 Jane MacKugler
 In memory of Raymond D.
 Barnes
 Dr. Elizabeth Moen Alton
 In memory of Ross Bell
 Trish Hanson
 In memory of Beth Brody
 Annette Lieber
 In memory of Holly Bull
 Bruce Bull
 Candace Dane
 The Richard H Lawrence
 and Nancy E Lawrence
 Revocable Trust
 Susan Purpura
 John Wall
 Patricia Walsh
 In memory of Judith Ann
 Cardinal

Anonymous
 In memory of Charlie Catlin
 Wally Malley and Garett
 Allen-Malley
 In memory of Donald and
 Veronica Dalton
 Bill and Joan Janssen
 In memory of Alan Day
 Ann B. Day
 In memory of Eric Dickerson
 Dow Raymond Bicknell and
 Donna Wiegand-Bicknell
 In memory of Alexander Dickey
 John and Lucy Douglas
 Maria and Nathaniel Rundle
 In memory of
 Elizabeth Duncan
 Jennie Savage
 In memory of Patti Eckels
 Keith and Laurie Gee
 In memory of Ed Emmons
 Beverly Emmons
 In memory of Abbott Fenn
 Ethan Fenn
 In memory of Sue Flewelling
 Bruce K. Flewelling
 In memory of Riff Genovese-
 Cater
 Maria Genovese
 In memory of Martha Lamb
 Montgomery Gordon
 Emily Gordon
 In memory of Dean Greenberg
 Kit Hood
 Sally Laughlin
 Chris and Leslie Rimmer
 In memory of Thera
 Hindmarsh
 Beth Hindmarsh
 In memory of Stuart W. Hunt II
 Laurel Copeland
 In memory of Alicia Knoll
 Frank Knoll
 In memory of James Linn
 Jack Linn
 In memory of Margaret Lyons
 Mark and Jill Lyons
 In memory of Dr. Scott MacLachlan
 Mary Jo Teetor
 In memory of Lucia Murphy
 Kathleen Murphy
 In memory of Pat Nye
 Chris Warsaw
 In memory of George C.
 Packard Jr.
 Raymond Bicknell and
 Donna Wiegand-Bicknell
 In memory of Connie Peterson
 Emilie Woodward
 In memory of Pat and Bill Renfro
 Renfro-Pihut Family
 In memory of Ted Richards
 Paula A. Gills
 In memory of Lisa B. Rimmer
 Chris and Leslie Rimmer
 In memory of Charles P. Rimmer
 Alyssa Rimmer and Matthew
 Henderson
 Chris and Leslie Rimmer
 In memory of Janice Robertson

Laura Robertson and
 Kurt Behrens
 In memory of Linere Silloway
 Holly Bull
 In memory of Frederick Snare III
 Derick Snare
 In memory of Fran Utton
 Anonymous
 In memory of Barb Wood
 Debra Stackhouse

PARTNERS

Businesses

Billings Farm
Birds & Beans Coffee
Boarderview Research Farm
Cedar Circle Farm
Chamberlin's Farm
Coaticook River Water Power Co.
Flagg Hill Farm
Great Bay Hydro
Great River Hydro
Hardwick Electric Department
Howling Wolf Farm
Liberty Orchard
Maplemont Farm
Morrisville Water & Light
Sunrise Farm
Sweetland Farm
The Farm Upstream
The Farm at VYCC
Vail Resorts
Wild Earth Farm
Wild Hill Organics

Consortia & Partnerships

Automated Insect Monitoring Group
e-Butterfly.org
Forest Ecosystem Monitoring Cooperative
International Bicknell's Thrush Conservation Group
Northeast Network of Mountain Observatories
Northeast Seed Network
Upper Valley Teaching Place Collaborative
Vermont Biodiversity Alliance

Federal – United States

Green Mountain National Forest
U.S. Fish and Wildlife Service
USDA Forest Service
USDA Forest Service Office of International Programs
U.S. Geological Survey, Northern Prairie Wildlife Research Center
White Mountain National Forest

International

Canadian Forest Service– Atlantic Forestry Centre (Canada)
Consorcio Ambiental Dominicano (Dominican Republic)
Critical Ecosystem Partnership Fund
Environment and Climate Change Canada (Canada)
Grupo Jaragua (Dominican Republic)
Insectarium in Montréal (Canada)
Mila – Quebec Artificial Intelligence Institute (Canada)
UK Centre for Ecology and Hydrology

Non-Profit – Domestic

Adirondack Center for Loon Conservation
Adirondack Mountain Club
Appalachian Mountain Club
Ascutney Mountain Audubon Society
Audubon Vermont
Avian Haven
BirdsCaribbean
California Academy of Sciences
California Native Plant Society
Connecticut Audubon Conservation Biology Institute
Cornell Lab of Ornithology Corporation for National and Community Service (AmeriCorps)
Fairbanks Museum and Planetarium
Friends of the Missisquoi National Wildlife Refuge
Green Mountain Audubon Society
Loon Preservation Committee
Manomet Inc.
National Aviary
National Geographic Society
Native Plant Trust
New Hampshire Audubon
New Hampshire Charitable Foundation
New York Natural Heritage Program

North Branch Nature Center
Northeast Kingdom Audubon Society
Otter Creek Audubon Society
Smithsonian Migratory Bird Center
Sociedad Ornitológica Puertorriqueña Inc
Southern Vermont Natural History Museum
The Nature Conservancy
Vermont Community Foundation
Vermont Conservation Voters
Vermont Entomological Society
Vermont Institute of Natural Science
Vermont Land Trust
Vermont Natural Resources Council
Vermont Reptile and Amphibian Atlas
Village and Wilderness
Woodwell Climate

State – Alaska

Alaska Department of Fish and Game

State – New York

New York State Department of Environmental Conservation

State – Vermont

Vermont Agency of Agriculture and Food Markets
Vermont Agency of Digital Services
Vermont Agency of Transportation
Vermont Department of Environmental Conservation
Vermont Department of Forests, Parks and Recreation
Vermont Fish & Wildlife Department

Municipal

Barre Public Works Department
Town of Hartland

Colleges and Universities

Aarhus University (Denmark)
Alabama Museum of Natural History – OdonataCentral
City University of New York
Cornell University
Dartmouth College
Massachusetts College of Liberal Arts
McGill University (Canada)
Northern Vermont University
SUNY New Paltz
Tufts University Wildlife Clinic
Université Laval (Canada)
University of Delaware
University of California Berkeley
University of Massachusetts
University of Massachusetts Amherst
University of New Hampshire
University of North Carolina Chapel Hill
University of Ottawa (Canada)
Université de Sherbrooke (Canada)
University of Southern California
University of Vermont
University of Vermont Extension
University of Vermont Gund Institute for Environment
University of Vermont Natural History Museum
University of Vermont Spatial Analysis Lab
University of Vermont – The Vermont Bee Lab

STATEMENT OF FINANCIAL POSITION

ASSETS

CASH.....	\$361,286
RECEIVABLES.....	\$272,532
INVESTMENTS.....	\$2,672,067
PROPERTY AND EQUIPMENT (NET).....	\$894,124
OTHER ASSETS.....	\$146,773
TOTAL ASSETS.....	\$4,346,782

LIABILITIES AND NET ASSETS

TOTAL CURRENT LIABILITIES.....	\$284,411
LONG-TERM DEBT, LESS CURRENT PORTION ABOVE.....	\$546,663
TOTAL NET ASSETS.....	\$3,515,708
TOTAL LIABILITIES AND NET ASSETS.....	\$4,346,782

STATEMENT OF ACTIVITIES

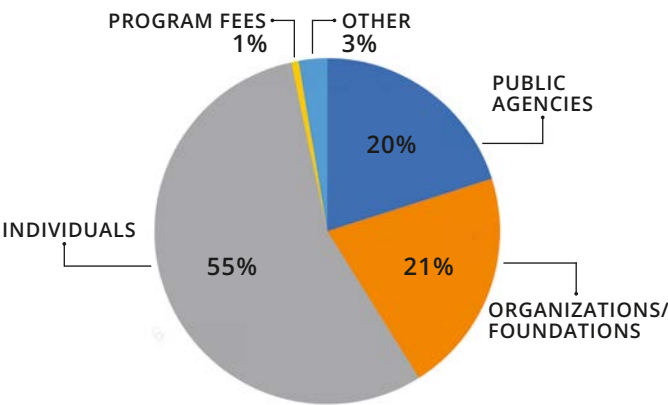
2025 REVENUE

PUBLIC AGENCIES.....	\$321,056
ORGANIZATIONS/FOUNDATIONS.....	\$336,078
INDIVIDUALS.....	\$887,760
PROGRAM FEES.....	\$10,821
OTHER.....	\$42,911
TOTAL REVENUE.....	\$1,598,626

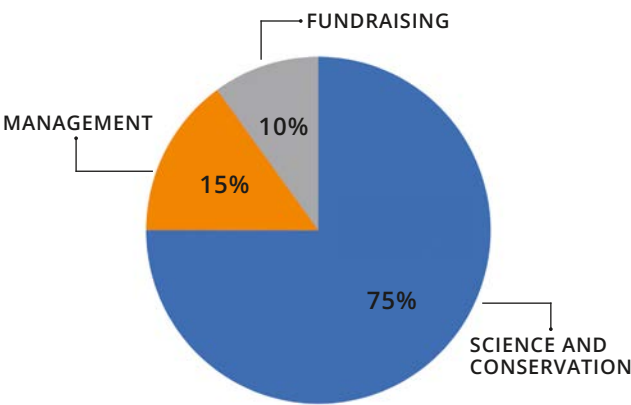
2025 EXPENSES

SCIENCE AND CONSERVATION.....	\$2,024,004
MANAGEMENT.....	\$403,958
FUNDRAISING.....	\$269,913
TOTAL EXPENSES.....	\$2,697,875

2025 OPERATING REVENUE



2025 OPERATING EXPENSES



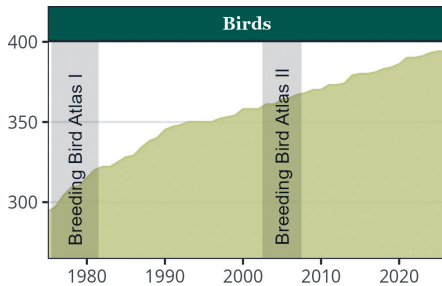
A NOTE ABOUT VCE’S STRATEGIC GROWTH

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.

What We've Discovered by Looking Closer

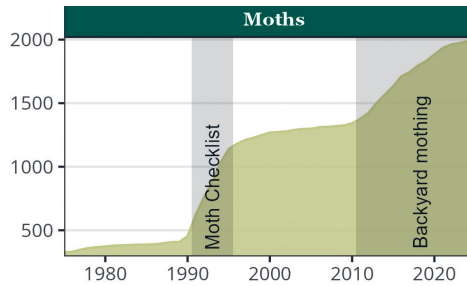
By Megan Massa, VCE Data Manager

The past 50 years have seen the discovery of hundreds of new species in Vermont. The Vermont Atlas of Life has been central to documenting these changes, and with every new survey effort, the list of known species continues to grow.



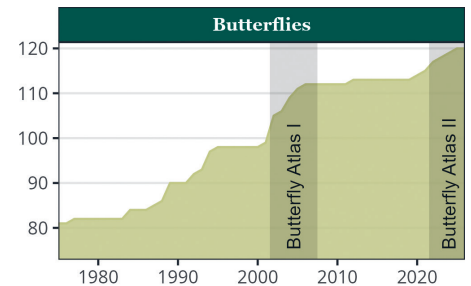
Birds

Typically one or two new bird species are added to Vermont's already impressive state list every year. Most are transient individuals far outside their normal range, discovered by birders and nonbirders alike, such as the Purple Gallinule found in Addison on January 2, 2025, which increased the state total to 394 species. The two Vermont Breeding Bird Atlases focused on documenting breeding distributions and therefore contributed relatively few additions to the overall state list.



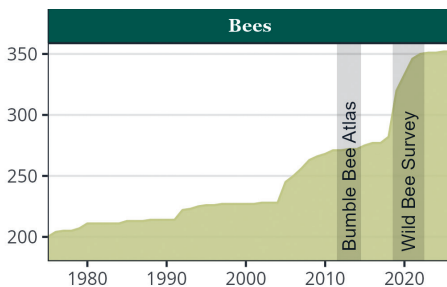
Moths

Preparation of the first Vermont moth checklist in 1994 produced numerous new records. Beginning in the early 2010s, VCE Conservation Biologist Kent McFarland encouraged Vermonters to survey moths in their own backyards, creating a network of nocturnal observers that has expanded the state list to a whopping 1,987 species. McFarland alone has documented 456 species in his backyard!



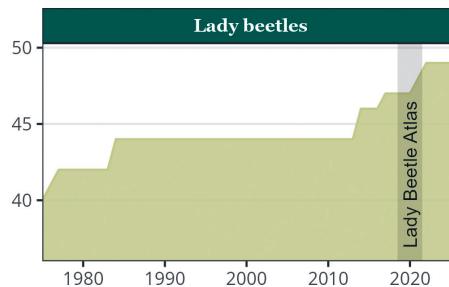
Butterflies

Vermont is nearing completion of the Second Butterfly Atlas, a first-of-its-kind resurvey of the state's butterflies (20 years after the first). Each atlas period has led to rapid discoveries as hundreds of volunteers survey their blocks. In 2025, a Red-banded Hairstreak was recorded for the first time in Vermont, bringing the state butterfly total to 120 species.



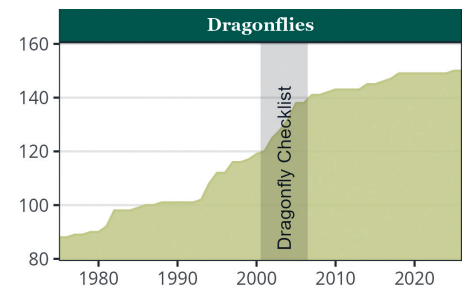
Bees

Many new bee species were documented during the Wild Bee Survey, which in 2025 culminated in the state's first annotated checklist and conservation assessment covering 352 species.



Lady Beetles

The first lady beetle checklist was published in 1976. Although the state list has grown to 49 species, many of these lady beetles have not been seen in decades. Current work aims to rediscover these species or determine whether they have been lost from the state.



Dragonflies

Although there has never been an official atlas of dragonflies in Vermont, in the early 2000s Mike Blust and Bryan Pfeiffer conducted extensive fieldwork while preparing the first state checklist, adding many new records.