SPRING 2019

Field Notes

VERMONT CENTER FOR ECOSTUDIES | *Uniting People and Science for Conservation*

IN SEARCH OF BICKNELL'S THRUSH

Breaking New Ground in Cuba

VCE's expedition to the remote, untrammeled mountains of eastern Cuba yields answers—and raises more questions.

BY CHRIS RIMMER

VCE's conservation work in the Caribbean Greater Antilles over the past 25 years is a blend of cutting-edge science, on-the-ground habitat protection, and capacity-building of local partners. This approach has produced remarkable discoveries, helped focus attention on threatened biodiversity hotspots, and trained a new cadre of conservation professionals. Our efforts have centered on Hispaniola—especially the Dominican Republic—where 80-90% of the planet's ~100,000 Bicknell's Thrushes (BITH) overwinter. Elucidating this globally

(continued on page 10)

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A trio of banded female Black-throated Blue Warblers on Pico Bayamesa.

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The Vermont Center for Ecostudies (VCE) is a nonprofit organization whose mission is to advance the conservation of wildlife across the Americas through research, monitoring, and citizen engagement. With a reach extending from Canada and northern New England through the Caribbean and South America, our work unites people and science for conservation.

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As I write this in early April, the long-awaited return of migratory birds is underway. New species are appearing daily. Some, like Bicknell's Thrushes in Cuba or Scarlet Tanagers in Colombia, have not yet departed their distant Neotropical wintering grounds. Others, like Eastern Phoebes and Fox Sparrows, have just arrived and are now dealing with the climatic vagaries of early spring in northern New England.

As we celebrate the annual miracle of this "homecoming," and the migratory feats underlying it, how many of us ponder circumstances that these avian itinerants faced during the preceding few months? Or how their condition upon arrival here—and outlook for the impending breeding season—may reflect events that took place in their far-flung winter habitats? A growing body of research has increasingly made clear that all phases of the annual cycles of birds, and in fact of all migratory creatures, are intricately linked. Monarch butterflies, restricted to a tiny and dwindling area of high-elevation oyamel forest in central Mexico during winter, epitomize a vulnerable non-avian species for which a "full life cycle" approach to conservation is fundamental and crucial.

Reinforcing two-plus decades of work on Hispaniola, my recent field trips to eastern Cuba (see lead article) have underscored this tenet of VCE's hemispheric efforts to conserve Bicknell's Thrush. Without understanding the complexities of this songbird's overwinter habitat use and ecology, we are stymied in addressing the myriad threats it faces at all stages of its annual cycle. Do males and females segregate in Cuba, as they do on Hispaniola? Do birds depart their mid-winter territories in March or April and move to new pre-migratory sites? If so, what are the conservation implications of those behaviors? We need to know.

These ecological complexities, intriguing and enigmatic as they are, further highlight the imperative of establishing strong bonds with local partners, whether in Cuba and the Dominican Republic for Bicknell's Thrush, or in Mexico's Michoacan mountains for Monarchs. Conservation always comes down to people, and there is no more effective strategy to achieve full life cycle conservation than to build enduring relationships. VCE seeks to engage, equip, inspire, and support our partners. There is great power in that approach, and lasting rewards.

So, as avian migrants filter in during the weeks ahead, we all need to celebrate not only their arrival, and the extraordinary passages that brought them back, but the vital connections—ecological and human—upon which their futures rely. FN

Chris Rimmer
EXECUTIVE DIRECTOR

Silky Striped Sweat Bee © K.P. MCFARLAND

What's all the Buzz About?

VCE Launches First-ever Vermont Wild Bee Survey.

BY KENT MCFARLAND

Recently, there has been a lot of attention focused on the decline of non-native Western Honey Bees and the resulting detrimental effect on crop pollination nationwide. But did you know there are more than 4,000 native bee species in the U.S. that also play a critical role in supporting our food web?

Here in Vermont, we estimate there are about 250 species of wild bees. However, there has never been a comprehensive bee survey undertaken in this state, so there are likely many more species living here. How can we monitor the health of our wild bees if we don't even know which species to look for, their relative abundance, or where exactly they live?

Enter the Vermont Wild Bee Survey (VTBees). This new project represents the first step in assessing bee populations across the state—and a new opportunity for citizen scientists to help make conservation history! With the help of volunteer naturalists over the next five years (2019 - 2023), we'll survey bees from the shorelines of Lake Champlain to Green Mountain summits. These new specimen records will be added to digitized historic records from museums throughout the region to build the first comprehensive database of Vermont's bee fauna. This year, we'll launch our effort by concentrating surveys in Chittenden County. After our first successful season, we'll expand the survey to the rest of Vermont in 2020 and beyond. Anyone interested in participating can find out more at http://val.vtecostudies.org/ projects/vtbees. FN

CITIZEN SCIENCE OPPORTUNITIES

© K.P. MCFARLAND

If you enjoy watching wildlife and wish to contribute to protecting our natural heritage, then join the VCE team!

Consider becoming a citizen scientist.

E-BUTTERFLY

Leader: Kent McFarland
Season: Spring-Fall
Beginner to expert

Report and explore sightings of all Vermont butterflies with the innovative online tool, e-Butterfly.

www.e-butterfly.org
email: kmcfarland@vtecostudies.org

MOUNTAIN BIRDWATCH

Leader: Jason Hill
Season: June
Beginner to expert/hiking required

Adopt a mountain and survey Bicknell's Thrush and other mountain songbirds.

https://mountainbirdwatch.org
email: jhill@vtecostudies.org

VERNAL POOL MONITORING

Leader: Alex Wells
Season: April-September
Beginner to expert

Adopt a vernal pool, collect data, contribute to science.

https://vtecostudies.org/projects/forests/vernal-pool-conservation/vermont-vernal-pool-monitoring-project/
email: awells@vtecostudies.org

VERMONT LOON CONSERVATION PROGRAM

Leader: Eric Hanson
Season: Spring-Summer
Beginner to expert

Help monitor loon nests and lakes.

vtecostudies.org/projects/lakes-ponds/common-loon-conservation/
email: ehanson@vtecostudies.org

Visit vtecostudies.org/volunteer to find the citizen science project that's right for you.

© BRETT AMY THELEN

Spotted Salamanders and other amphibians are especially vulnerable to roads because they move slowly, are difficult for motorists to see, and migrate seasonally between upland forests and wetland sites.

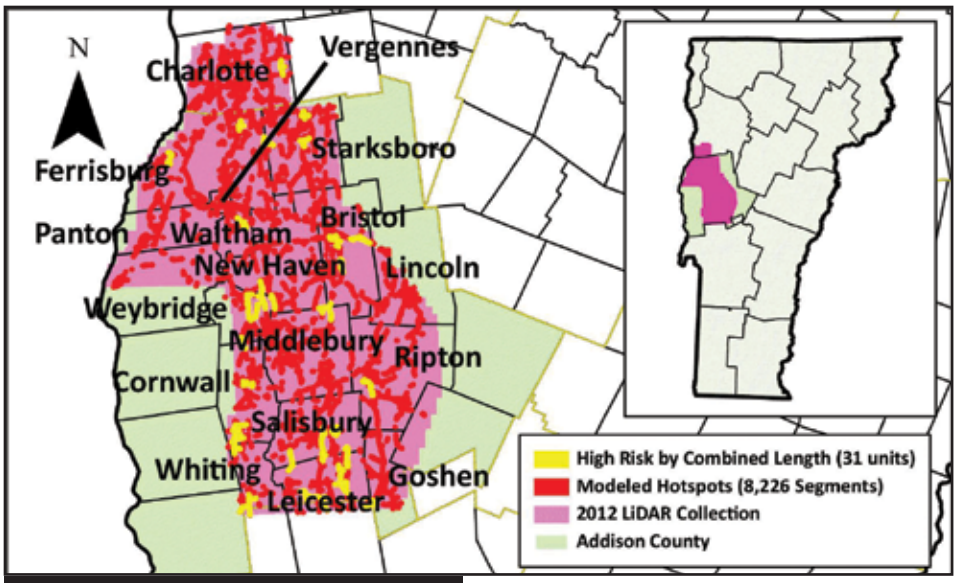
Where do Salamanders Cross the Road?

Development of a GIS Model to Identify Amphibian Road-crossing "Hotspots"

BY STEVE FACCIO

When roads pass through wildlife corridors, the consequences can be serious, particularly for wildlife. Amphibians are especially vulnerable—their life histories involve seasonal movements between wetland and upland habitats, they move quite slowly, and are extremely difficult for motorists to see from behind the wheel. As a result, frogs and salamanders may be killed by the thousands where roads bisect breeding sites and adjacent upland habitats, raising concerns about the sustainability of populations without efforts to mitigate losses. In the Vermont Wildlife Action Plan, direct road mortality is considered a significant threat for five amphibians listed as Species of Greatest Conservation Need, and "identification and mitigation of road crossing sites" is a critical conservation need. Wildlife crossing tunnels, such as the two recently installed in Monkton, Vermont, can be very effective at reducing amphibian mortality. However, tunnels are quite expensive to design and install, making it imperative to identify where amphibian crossing "hotspots" are located and prioritize mitigation efforts. VCE recently took the first step in that conservation equation by completing a pilot study to develop a GIS model that identifies these amphibian crossing hotspots.

With funding from the Vermont Department of Transportation and the Davis Conservation Fund, we partnered with two GIS modeling experts at the University of Vermont Spatial Analysis Lab—Sean MacFaden and Ernie Buford—to carry out a pilot study in Addison County. The process consisted of three primary phases: developing the model of road-crossing hotspots, conducting a risk assessment to rank the potential severity of hotspots, and field-verifying a sample of modeled hotspots, which would be used to refine the final model.



HOTSPOT ROAD SEGMENTS

AMPHIBIAN POPULATIONS CAN SUFFER HIGH MORTALITY EVEN ON LOW-INTENSITY ROADS.

➤ **Developing the model:** At the risk of grossly over-simplifying the complexity of GIS modeling, Sean first divided the roads in the study area into 50m segments, then, using a combination of LiDAR and high-resolution (1m) land cover data, he modeled potential crossing hotspots and came up with 8,226 segments (25% of the total road segments in the study area).

➤ **Conducting a risk assessment:** Ernie conducted a risk assessment based on a suite of variables to isolate the most important crossing locations. Of the 8,226 segments, 27% were ranked as High Risk, 30% as Medium, and 43% as Low Risk. When the 2,134 High Risk segments were combined into single road units, 31 separate hotspots were identified across the study area (see Figure).

➤ **Field-verifying the model:** I searched roads in the study area for amphibians following rainy nights in spring, when they move from overwintering areas to wetland breeding sites. I visited a total of 46 sites, encompassing 730 50-meter road segments. I found 57 individual amphibians (53 dead, 4 alive) of at least eight species, including Spotted Salamander (5), Blue-spotted Salamander (2), Four-toed Salamander (2), Eastern Newt (7), Green Frog (1), Spring Peeper (21), American Toad (2), Wood Frog (6), and unidentifiable (11). Of the 730 visited road segments, only 30 (4%) showed direct evidence of amphibian movement (dead or alive amphibians present) and most were relatively narrow backroads with low traffic volume.

The most significant hotspot documented during field verification was on Bean Road in Charlotte, where 33 dead amphibians (62% of all dead amphibians encountered) and two live newts were discovered over a 1.5 km section of a low-traffic dirt road. This underscores the fact that populations can suffer high mortality even on low-intensity roads.

Our model provides broad-scale data that can be used to identify potential road segments that may negatively impact amphibian populations in other regions of Vermont, or for the entire state. While this represents a good starting point for future mitigation projects, field visits will be essential to verify the presence and significance of individual crossing locations. FN

A pair of Upland Sandpipers returns to Fort Riley, Kansas, in mid-April.

Lighting the Way

VCE biologists provide critical insight into the year-round ecology of declining grassland birds.

BY JASON HILL

We all know that birds move, and many of them migrate. Through the course of a year, migrating birds may encounter a vast array of conditions, threats, and natural processes, sometimes across thousands of miles. To effectively conserve bird populations, we must understand their patterns of movement—how they move and where they go. My VCE colleague Roz Renfrew and I recently published our research findings aimed at uncovering this information for three grassland bird species in the Open Access journal, *Ecology and Evolution*. Since 2015, we have been intensively focused on bringing knowledge to the table that may help permanently transform the way grassland bird populations are managed, both across international borders and throughout their annual cycle. With support from the U.S. Department of Defense Legacy Resource Management Program, Roz and I carried out a three-year investigation into the lives of Grasshopper Sparrows (*Ammodramus savannarum*), Eastern Meadowlarks (*Sturnella magna*), and Upland Sandpipers (*Bartramia longicauda*). These three species have experienced dramatic population declines over the last 60 years, likely driven by habitat loss stemming from the intensification of agricultural practices, as my colleagues and I documented in a PLOS ONE research paper published in 2014. Here's a quick summary of what we have learned, and what it means for future conservation efforts aimed at these species.

Grasshopper Sparrows are cryptic and easy to miss when they are not singing—actually, even when they are singing—as their soft, buzzy song can be difficult to hear. We mist-netted Grasshopper Sparrows on their breeding grounds in six states and fitted them with tiny backpack-style sensors that record sunlight levels. After recapturing many of those same birds a year later, we removed their backpacks

and analyzed the sunlight data, which allowed us to estimate location every morning and evening during the past year. Those data were surprising.

First, we found that Grasshopper Sparrows arrived on their breeding grounds one to two months before the presumed start of the breeding season, and left one to two months later than biologists had previously assumed—did we mention how hard these cryptic brown sparrows are to detect when they are not singing? Second, migration flights consisted of short (~70 km) daily movements, and there was little mixing between Midwest and East Coast breeding populations—Midwest sparrows wintered in Texas and Mexico, while East Coast birds wintered in Florida and the northern Caribbean. These results have important conservation implications:

- The duration of management activities should be extended to cover our newly-discovered timeframe when Grasshopper Sparrows are on the breeding grounds.
- Short daily migration flights suggest that these sparrows use a diverse array of habitats during migration, as it is unlikely they are encountering traditional grasslands at 70 km intervals between Massachusetts and Florida, for example. What are these stopover habitats and how can we manage them to support Grasshopper Sparrow populations during migration?
- The difference between East Coast and Midwest migration patterns suggests that management actions in one area of the wintering grounds will only influence sparrows in one population or the other. In essence, we will likely need year-round and region-specific conservation strategies for this species.

We also attached backpack-style satellite geolocator tags to Eastern Meadowlarks and Upland Sandpipers. The resulting data further documented a partial migration strategy for Eastern Meadowlarks: some individuals were resident on their territories year round, while other meadowlarks migrated up to 1,000 km away. Similarly, Upland Sandpipers demonstrated dramatic variation in habitat-use patterns and migration strategies. Sandpipers breeding in Massachusetts used airport grasslands during breeding and migration, with one sandpiper spending more than a month at Baltimore Washington International Airport. All of the sandpipers undertook dramatic two- to four-day nonstop overwater migration flights between North and South America during both fall and spring migrations. Our study surprisingly documented one Upland Sandpiper overwintering on flooded grassy islands within the Amazon River of Brazil—a region not previously known to harbor Upland Sandpipers. Taken together, our results suggest that we still have a lot to learn about the habitat requirements and movement patterns of this large shorebird species. The Upland Sandpiper results will be submitted to an upcoming special issue of *Frontiers in Ecology and Evolution*, and you can read more on our website at vtecostudies.org/grasslands/grassland-bird-migration-project/. FN

Take a Deep Dive into VCE's Grassland Bird Migration Research—at Your Own Pace!

We've created an interactive presentation highlighting our recent grassland bird migration research for you to explore. Experience the sights and sounds of Grasshopper Sparrow and Upland Sandpiper research from the field, and delve into full-color maps displaying location data we received from our geolocator-toting birds. It's fun and educational!
Enjoy "Fantastic Flights—Technology Tells the Tale of Avian Travels" at: https://vtecostudies.org/infographics/

Jason Hill prepares to release a satellite-tagged Eastern Meadowlark at Konza Prairie, Kansas.

© CLAY GRAHAM

© JASON HILL

© KAREN BOURQUE

John Lloyd

Farewell to a colleague.

BY SUSAN HINDINGER

VCE bid a reluctant but fond farewell to Dr. John Lloyd in March. A long-time scientific colleague and collaborator, John joined the staff in 2014 as VCE's first Director of Science. His impact was immediate and significant. His expertise in cutting-edge data analysis added sophistication and rigor to every science program. Under his leadership, VCE's commitment to "open data" grew and dozens of datasets were published, rendering them accessible, useable, and citable by other scientists and the public. A strong strategic thinker, John chaired the International Bicknell's Thrush Conservation Group and was lead author on the first 5-year revision of the International Bicknell's Thrush Conservation Plan. Overseeing VCE's Caribbean program, John worked closely with our partners in the Dominican Republic to accomplish multi-stakeholder strategic planning in a UNESCO Biosphere Reserve that provides critical Bicknell's Thrush habitat, securing several grants to support our partners' on-the-ground conservation activities. We will miss John's wit and wisdom around the office and wish him well in his new role at the American Wind Wildlife Institute. FN

Alex Wells in a vernal pool.

© DARON TANSLEY

Citizen Science in Action

VCE's first full season of vernal pool monitoring.

BY ALEX WELLS

As rainstorms begin to outnumber snowstorms here in Vermont, countless amphibians will complete an annual pilgrimage back to their vernal pools to breed. As in every spring, females will set their egg masses safely in a pool, ushering in a new generation of frogs and salamanders—but this year there will be another new generation there to greet (and count) these egg masses: freshly-trained Vernal Pool Monitors.

VCE's Vermont Vernal Pool Monitoring Project (VPMon) is ramping up for its first full season of data collection. Through a series of seven citizen scientist trainings held across the state, we've trained more than 200 Vermonters in the VPMon methodology. With their help, we will not only know where the pools are, but we will learn how they—and the species that rely upon them—are faring. FN

VCE Biothon

Join us on May 18!

New!

When spring prevails over winter, VCE's staff marks the transition with our annual Birdathon fundraiser. This year, we've added a twist: we're expanding geographically and taxonomically, and we invite you to come along! VCE's statewide Biothon quest is May 18, and we'd like to give our extended VCE family the option to join in the fun. VCE's biologists will lead teams of volunteers (like you!) on varying quests in different locations across the state. Please see the list of outings and learn how you can participate and support our efforts at vtbirdathon.org. If you would like to learn about natural history, meet new people, and help maximize the number of species we can find, considering joining a team! FN

Mourning Cloak © K.P. MCFARLAND

VOLUNTEER SPOTLIGHT

© STEVEN KERSTING

Uniting Passion with Purpose

"If I did not volunteer, my life would be far less rich."

BY KAREN BOURQUE

With a wide smile and boundless energy, Micki Colbeck bursts into the VCE office most Thursdays to volunteer her time and talents. These days she's applying her GIS skills and artistic prowess to create an interactive online presentation for Mountain Birdwatch. But Micki's tenure as a VCE volunteer started years—and even a generation—earlier.

Micki describes her experience with VCE as a form of "migratory connectivity." Micki grew up in St. Louis, Missouri, earning a Bachelor of Arts and Master of Arts in Teaching from Webster University. She served as a public-school art teacher for 19 years, where she fused a love of nature and art to inspire her students. At that time, her volunteer work found her sandbagging banks along the Mississippi River and participating in the annual St. Joaquim River spring cleanup.

In 1997, Micki migrated from rural Missouri to Strafford, Vermont. Having come to the state to visit a friend, she fell in love with Vermont's mix of wilderness and strong cultural values. She married that friend, her husband Carl Yirka, then Director of the Vermont Law School Library. In Strafford, Micki helped manage the Full Moon Café and then pursued a career as a visual artist for 10 years.

Micki's son Gabe and daughter Casey migrated with her to Vermont. As a teenager, Gabe worked as a groundskeeper at the Vermont Institute of Natural Science, where he met future VCE suspects the likes of Chris Rimmer, Kent McFarland, and Steve Faccio—who later took Gabe under their wings as an intern to study Bicknell's Thrush on Stratton Mountain. Gabe went on to earn a PhD in zoology with a focus on migratory songbirds—and Micki gained a real fondness for VCE as a result.

Heeding her own call to help the environment, Micki went back to school to study environmental science at Community College of Vermont, and then on to Antioch University New England, where she earned her MS in environmental studies conservation biology in 2018. She joined the Strafford Conservation Commission, helping to map potential renewable energy projects concerned with protecting large forest blocks. Meanwhile, she juggled a part-time job as barista at King Arthur Flour Baker Berry Café at Dartmouth College.

King Arthur Flour is a B Corp, entitling all employees to 40 hours of paid volunteer work annually. "I felt such a strong connection with VCE from the days when Gabe was on the mountain that I always donated my 40 hours here." Micki's first assignment (with biologist Sara Zahendra) was entering data from historic, hand-written bird observation notes, which she continued for several years. "It was never very glamorous, just data entry. However, I loved being here with this wonderful group of biologists."

Micki enlisted VCE's Jason Hill to supervise her graduate internship project—modeling Blackpoll Warbler habitat and overlaying that with potential wind energy siting. Coming into the VCE office once a week became a habit. After her assignment was complete, Micki continued to stay on as a weekly volunteer. "Volunteering became a part of who I am. If I did not volunteer, my life would be far less rich."

When Micki is not in the VCE office, or outside studying bryophytes and wildflowers, you can still find her making cappuccinos at the King Arthur Flour Café at Dartmouth. Or she might be playing the accordion, taking long walks with her little brown dogs, reading books about nature, or working on her latest piece as a contributing writer to the Valley News Perspectives page (her column is entitled, "A Solitary Walker.") Thank you, Micki, for all your contributions to conserving our natural world! FN

Citizen Scientist

Micki is also an avid iNaturalist contributor. She snapped this photograph of a beautiful patch of Delicate Fern Moss (*Thuidium delicatulum*) in Hyde Park, Vermont and submitted it to the Vermont Atlas of Life on iNaturalist, immortalizing it as the project's 250,000th observation.

© JORGE TAMAYO

The VCE-BIOECO team loaded up for its hike to Pico Bayamesa. Far Left: Chris Rimmer with a mist-netted and banded Bicknell's Thrush on a freshly-cut trail below Pico Bayamesa .

© CHRIS RIMMER

vulnerable species' complex ecology has underscored an urgent need to protect and restore its fragile winter habitats. The odds often seem insurmountable, but VCE and our many conservation allies are working hard to stem the tide of habitat loss on Hispaniola.

But, what about the other three islands where BITH spend six to seven months each year—Puerto Rico, Jamaica, and Cuba? We must understand the species' status across its entire winter range if we are to effectively conserve it. VCE and other members of the International Bicknell's Thrush Conservation Group have long suspected that eastern Cuba might harbor a secondary "mother lode" of thrushes. With remote high-elevation forests of Sierra Maestra and the Humboldt range as prime suspects, our colleagues at Canadian Wildlife Service (CWS) conducted field surveys in four winters between 1999–2005. They discovered upwards of 15 BITH in Sierra Maestra's cloud forests, laying the groundwork for follow-up efforts to determine the species' status islandwide.

Enter VCE. Never one to shy away from a challenge, always eager to exercise our "brute force biology" tactics, we undertook what has now become a three-year effort to clarify the distribution, habitat selection, and relative abundance of BITH in eastern Cuba. Our first step was to identify a reliable local partner with a strong ornithological resumé—we found that and much more in Centro Oriental de Ecosistemas y Biodiversidad (BIOECO), with whom we now have a formal collaborative agreement. Next, using our 2013 winter habitat model as a guide, we targeted regions of wet, mid- to high-elevation forest, including nearly all of Sierra Maestra, for field surveys. Armed with standardized protocols and funding from CWS, we just needed to obtain visas and in-country permits to work in Cuba. That turned out to be our greatest obstacle!

After weeks of uncertain waiting during early 2017, our visas suspended in bureaucratic limbo, John Lloyd and I finally touched Cuban soil in late March. Two days later we were straining under heavy backpacks on the steep ascent to Pico Turquino, Cuba's highest elevation at 1,974 m (6,476 ft). Retracing the footsteps of our CWS colleagues and enveloped by lush, pristine cloud forest—as Cuban Trogons, Todies, and

SO IT WAS THAT I FOUND MYSELF THIS PAST JANUARY WITH FOUR BIOECO TEAM MEMBERS, ALL OF US SHOULDERING HEAVY BACKPACKS, PLODDING RESOLUTELY UPSLOPE TO THE UNTRAMMELED (AND TRAILLESS) WILDERNESS OF PARQUE NACIONAL BAYAMESA.

Solitaires serenaded us—we sallied forth daily in the pre-dawn with headlamps, conducting playback surveys of >100 points for BITH. And, we found... exactly zero birds. Disappointing, yes. Surprising, not really. Intriguing, definitely. We knew our timing was late and that some thrushes in the Dominican Republic begin moving off their overwinter territories in April. We suspect BITH relocate when these montane cloud forests cease

Clouds swirl across the remote southern peaks of Parque Nacional Bayamesa, a true untrammeled wilderness in Cuba's eastern Sierra Maestra.

Below: Yunier Caignet (aka Fis) wielding a machete on a freshly-cut trail below Pico Bayamesa.

© CHRIS RIMMER

© JORGE TAMAYO

to provide enough high-quality arthropod food resources to enable them to prepare adequately for northward migration. Had we arrived a month or two earlier as planned, we're guessing we'd have found birds. As always, questions outnumbered answers, and the BITH mystery deepened. A second winter beckoned.

Undaunted, I returned in January 2018, rejoining our BIOECO colleagues for another foray to Pico Turquino's uppermost slopes. This time, we found BITH—seven to be exact, two of which we banded—in the cloud-drenched forests at elevations of 1,700-1,900 m. Not exactly a mother lode, but a respectable total, though fewer than half of the 15+ BITH previously discovered by our CWS colleagues. As is so often the case with this enigmatic bird, we left Turquino feeling both encouraged and perplexed, but determined to persevere in our quest. To our east, the island's largest tract of unbroken cloud forest in Parque Nacional Bayamesa awaited exploration.

So it was that I found myself this past January with four BIOECO team members, all of us shouldering heavy backpacks, plodding resolutely upslope to the untrammeled (and trailless) wilderness of Parque Nacional Bayamesa. Specifically, we hoped to reach two peaks that, as far as anyone can determine, had never been visited by humans. If any region of Sierra Maestra harbored a mother lode of overwintering BITH, Bayamesa's virgin cloud forests seemed like our best bet. Over the next week, from a base camp at 1,500 m, we hiked up and over Pico Bayamesa each day, braving rain, chilly temperatures, treacherously steep slopes, soaked vegetation, and chronically wet boots. My machete-wielding colleagues made steady but slow progress, but we had to call it quits well short of our goal—the 10-km distant Pico Maceo. However, we claimed a measure of victory with the discovery of seven BITH and the banding of 33 birds (including three BITH and three Swainson's Warblers) in our mist nets. Instant mashed potatoes and freeze-dried spaghetti never tasted so good, and our team camaraderie forged memories of a lifetime.

What can we say about the elusive BITH in eastern Cuba after three winters on the island? First, it seems clear that Cuba offers BITH nowhere near the stronghold that Hispaniola does, despite a seeming abundance of suitable, intact cloud forest habitat. Second, Cuba's protected areas are in remarkably good shape and provide BITH a far more secure overwinter refuge than elsewhere in its restricted winter range. And third, we are far from having all the answers and need to carefully search other areas of the island (spoiler: we later found two BITH in "non-traditional" disturbed forest at ~400 m elevation on the south slope of Humboldt—but that's another story...), as well as more deeply inside Bayamesa.

I'm left with a genuine sense of humility from my experiences on Cuba, not only for the opportunity to penetrate the island's most remote wilderness, but by my extraordinarily good fortune to advance conservation science with VCE's dedicated, talented, and fun-loving Cuban colleagues. I strongly suspect our work there is far from done, and that suits me just fine. FN

FIELD NOTES
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Halictid Bees {Family *Halictidae*}

The brilliantly colored Pure Green Sweat Bee (*Augochlora pura*) gathering pollen and nectar. Below: A Ligated Furrow Bee (*Halictus ligatus*) pauses on a finger, perhaps in search of nutrients and salts found in sweat.

Halicitid bees are diminutive, barely larger than a pushpin.

BY NATHANIEL SHARP

Familiar bees that many people know and love share a few common traits: bumble bees, honeybees, and carpenter bees are all fuzzy, cute, and fairly bulky, as bees go. In contrast, a group of bees that buzz about largely unnoticed—but no less deserving of appreciation—are sweat bees.

Earning their unique nickname due to their penchant for perspiration, sweat bees are diminutive, barely larger than a pushpin. This diverse family, comprising over 2,000 known species, has an equally diverse color palette, with shades of metallic green, gold, black, copper, and even blue!

Around a dozen species of Halictid bees have been reported to the Vermont Atlas of Life on iNaturalist, but their small size and notoriously difficult identification means there are more species to be found. Like many temperate zone pollinators, many sweat bees are "generalists," meaning they collect pollen at a variety of plants rather than depending on a single species. Most live and breed in burrows, which they excavate in sand, silt, or rotting logs, and enter diapause, or suspended development, to survive the winter.

The Pure Green Sweat Bee (*Augochlora pura*) is a solitary nester. The female creates brood chambers using rotting wood held together by waxy secretions from a gland in her abdomen. She then gathers pollen and nectar to make "loaves" to provision each chamber, and lays a single egg on each pollen loaf before sealing it off to protect the developing bee from predators.

The most common species of sweat bee in Vermont, the Ligated Furrow Bee (*Halictus ligatus*), lives a more social life. These bees form underground colonies headed by a queen and populated by workers of both sexes. Workers harvest pollen and nectar to supply the queen's offspring and maintain the structural integrity of the burrows and brood chambers, which are often used for several years. These bees can even shift their social behavior in response to shifting environmental conditions, adopting more social and altruistic habits in lean years, and more solitary ones in years of abundance.

Another sweat bee common in Vermont uses a combination of solitary and social strategies. The Bicolored Striped Sweat Bee (*Agapostemon virescens*) is a communal nester. Several female bees share the same entrance hole, but create a complex maze of branching tunnels on their own, eventually creating private brood chambers at the end of each tunnel.

Whether living in their own private homes, operating a subterranean daycare, or choosing an apartment-style living situation, these busy bees live fascinating lives and fill a unique niche in ecosystems throughout Vermont. The next time you're outside and a small, shimmering bee lands on you, don't be afraid to let it lap up some nutritious salty sweat while you admire an industrious little pollinator. FN