Smithsonian Environmental Research Center

ON THE EDGE

News from the Smithsonian Environmental Research Center

Fall 2024

Science and Faith Collide for Baltimore Students

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- Detector Dogs Sniff Out Endangered Orchids in Virginia
- U.S. Rolls Out First National Ocean Biodiversity Strategy
- The Volunteer Duo Who Found 1,000 Beetle Species at SERC

DIRECTOR'S LETTER:

Science Is For Everyone

Top to bottom: Charlie and Sue Staines look for fungus beetles. (Credit: Barb Curtis); Samia Towson measures "wet bulb globe temperature" as part of the Science & Faith internship. (Credit: Alison Cawood); Samia Towson, Sierra House and Erica House at an urban farm as part of the Science & Faith internship. (Credit: Olivia Pineda); Encore and Grand, two Labradors who helped sniff out endangered orchids for SERC this summer. (Credit: Melissa McCormick)

There's a persistent stereotype, that scientists wear white coats and work in labs mixing chemicals or staring at microscopes. While we have our share of chem labs and microscopes at SERC, we also have research boats, showers and regular emails about tick bites, where (not) to leave muddy shoes and reminders not to dump soil down sinks—because field work is that dirty. Personally, I have never worn a white lab coat in 50-plus years of ecological research. But I've worn out many wetsuits, foul weather gear, hip boots, hiking boots, t-shirts, baseball hats, insect nets and knee pads.

If you're reading this newsletter, you probably already know lab-coat science is just a drop in the vast ocean of work researchers do. And yet the stereotype endures in American society.

We're working to counter that—and not only regarding how society views professional scientists.

In this issue, you'll find several stories where amateur scientists or volunteers play leading roles. This past school year, hundreds of middle and high school students did orchid experiments via the "Classroom Cultivation" project. They produced real data, which our scientists are using to grow endangered orchids in lab—and hopefully, one day, return them to the wild. Another 20 high school students spent their Saturdays gathering data on green spaces in Baltimore churches. The high school internship is part of SERC's new "Science and Faith" initiative, partnering with faith-based organizations to answer questions that matter to local communities.

We can thank our volunteers for another milestone discovery. Charlie and Sue Staines, a retired entomology duo, have been searching for beetles in SERC forests since 2018. This June they found SERC's 1,000th beetle species, and the number continues to climb.

We've even partnered with canine scientists. Two Labradors joined SERC orchid scientist Melissa McCormick in Virginia this summer. They were searching for the endangered small whorled pogonia. After watching the dogs in the field, McCormick suspects they can detect orchids lying dormant underground—though they'll need to wait at least another year to confirm the dogs' report.

All these stories highlight an often-forgotten truth: Science isn't just for scientists. Science affects everyone—and everyone can play a role in how it gets done. Participating in scientific research makes for good everyday applications of science and better analytical thinking.

Don't get me wrong; we need the scientists in white lab coats. They're the ones creating new medicines, making vaccines and testing the safety of our food. At SERC, they're analyzing hazardous chemicals, looking for DNA markers or searching for carbon in soil samples, to uncover which ecosystems best fight climate change.

But it's a loss when people shy away from science simply because they think they don't fit one narrow label.

Science was once the domain of amateurs—curious people who made discoveries by the power of open minds and keen observations. While society needs professionals, we inhibit ourselves if we don't embrace the enthusiasm of students and volunteers. At the Smithsonian, our mission isn't to be gatekeepers, but to push the gates open wider.

- ANSON "TUCK" HINES, SERC DIRECTOR

Front cover photo: Ulysses Archie, Jr., shows students Samia Towson (left) and Sierra House how to build a newspaper cup to hold seeds and soil at the Baltimore Gift Economy, an urban farm he runs in West Baltimore. (Credit: Alison Cawood)

AMY FREESTONE: The Unexpected World of Underwater Invasions

BY TAYLOR WEV

Amy Freestone joined the Smithsonian Environmental Research Center in May, to help lead the Marine Invasions Research Lab as senior scientist and managing director. Amy previously worked with SERC as a postdoctoral fellow from 2006 to 2009, before working as an assistant professor and later associate professor at Temple University in Philadelphia. In this Q&A, Amy discusses the roots of her love for ecology and her core principles of scientific research.

Edited for brevity and clarity.

Do you have a personal mission that drives your interest in marine ecology?

Those of us who are engaged in ecology often have an environmental ethic that underlies the work that we do. I know for me it's not only about taking care of the natural world for myself, but also just knowing that this is the playground for my kids and wanting to protect those resources for them.

What are some key communities you've focused on in your research? What drew you to them?

A lot of my research has been on sessile [immobile] marine invertebrates. For example, when you go out to a dock at low tide and see all of that "scuzz" on the piling – that is the community that I like to study. It's kind of funny because I think in marine operations...they're considered a nuisance. But when you bring these communities into the lab and look at them under a microscope, they're just fascinating. They are this colorful, diverse community of little critters that have such varied ways of making it through the world—you wouldn't know it unless you spent hours looking at these guys under a microscope.

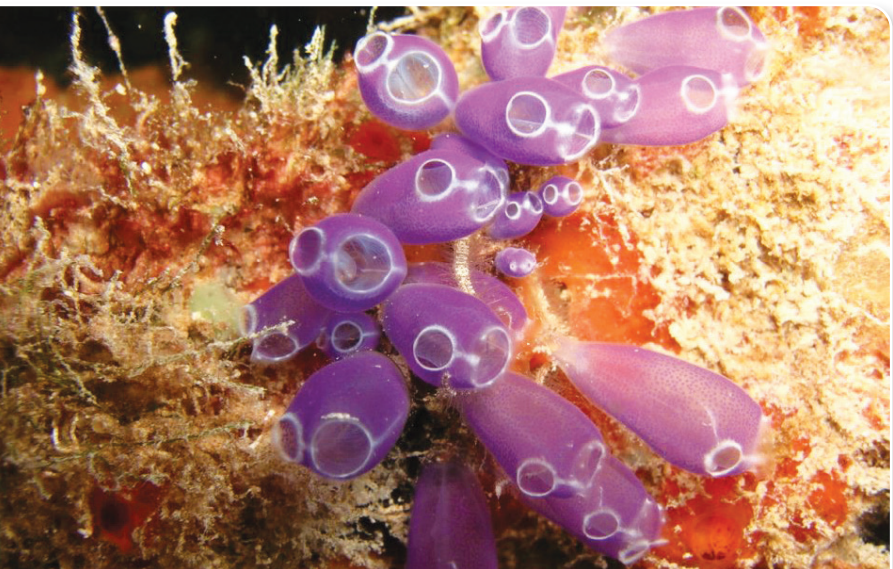
How does your previous postdoctoral work at SERC differ from projects you're working on now and your new role at the Marine Invasions Research Lab?

I have been collaborating with the Invasions Lab for most of my professional career, but one of the things that makes my current role so appealing is being able to take the questions I was previously asking to the next level. As a postdoctoral fellow, I really wanted to take the concepts I was studying as a doctoral student in plant ecology and apply them to marine systems across a broader spatial scale. As the managing director of the Marine Invasions Research Lab, I can continue to expand that work….There are also a lot of elements of the lab that I have worked less with over the years, so it's exciting to get to dig deeper into those collaborations.

Amy Freestone, former associate professor at Temple University and new managing director of SERC's Marine Invasions Research Lab. (Credit: Brent Sewall)

Are there any ways ocean lovers and conservation enthusiasts can help contribute to the success of our local marine communities?

I think there are two important pieces: being an informed citizen and engagement. Our lab, and SERC more broadly, have wonderful participatory science programs where people can come out and help us collect data and actively learn more about what we're doing. It helps inform people about our research, it provides fun experiences, and it also helps demystify science. A lot of excellent data sets have been produced through participatory science.



What would you say are some of the most important principles a scientist should keep in mind when approaching new research questions?

Don't be afraid of the unexpected….When you're dealing with Mother Nature, the unexpected is the expected. As ecologists, we need to lean into that. Instead of saying, "This didn't fit the model of what I was testing," think about it as, "This is what's happening in nature, and we have to follow this line of investigation that's now been put in front of us."

Left: A solitary Clavelina *tunicate, one of Freestone's favorite marine organisms. (Credit: Amy Freestone)*

Top photo: A collection of tunicates, sponges, algae and marine worms on mangrove roots in the Pelican Cays, Belize. (Credit: Amy Freestone)

‘Life in the Ocean Touches Everyone’: U.S. Rolls Out First National Ocean Biodiversity Strategy

BY KRISTEN GOODHUE

Roughly 2 million species live in the world’s ocean. But scientists have only described 10% of them. With extinctions on the rise and biodiversity threatened worldwide, many species are withering away before researchers can identify them or fully grasp the many benefits they provide to people.

Emmett Duffy on a research expedition in Svalbard, Norway. (Credit: Peter Carey)

This summer, the U.S. rolled out its first nationwide strategy to change course. The National Ocean Biodiversity Strategy calls for a stronger, more unified and inclusive approach to conserving ocean life. Written by a team led by the Smithsonian and the National Oceanic and Atmospheric Administration (NOAA), it was officially announced by the White House Office of Science and Technology Policy in June.

The prosperity and health of the U.S. are inextricably tied to the ocean. It contributes nearly $400 billion to the U.S. economy every year. The ocean also provides 2.4 million jobs, including fishing, shipping, tourism and energy. Much of this prosperity comes from the ocean’s diverse species and habitats.

“Biodiversity is the beating heart of the ocean that supports society, but it’s in trouble,” said Emmett Duffy, co-chair of the strategy’s writing team and chief scientist of MarineGEO at the Smithsonian Environmental Research Center. “This strategy is our best chance yet to turn the tide. We need to implement it to reach a future where people and the rest of nature thrive together.”

The National Ocean Biodiversity Strategy outlines a three-fold plan for more inclusive, evidence-based protections in the U.S. ocean and Great Lakes:

1) Coordinate ocean research and conservation across the U.S. The strategy calls on federal agencies with ocean-related missions to join forces and engage other stakeholders. They should seek co-designed solutions, with input from states, Tribes and local communities. This also requires documenting the economic and cultural values of ocean life, to reveal the hidden costs of degrading nature.

2) Strengthen the information pipeline. The U.S. has a wealth of data on ocean life. But much of it is inaccessible to people making decisions on the ground—or water. The strategy advocates for centralized, open-source data clearinghouses, which everyone with a stake in the ocean’s health can find and use. This also requires supporting frontier technologies—like environmental DNA, new satellites and artificial intelligence—to track biodiversity and help reveal undiscovered species.

3) Protect, restore and sustainably use ocean biodiversity. For protection to work over the long term, community input is critical. Listening sessions, such as the Marine Biodiversity Dialogues, are a key starting point. By gathering ideas from local and Tribal governments, nongovernmental organizations and the private sector—including commercial and recreational fishers—managers can co-create solutions that are truly sustainable, with conservation tailored to meet their communities’ needs.

Putting these into practice will be far from simple. The nation’s ocean waters are vast: The total marine territory under U.S. management covers an area larger than all 50 states combined. But that makes community-based approaches even more critical.

“Life in the ocean touches everyone,” said Gabrielle Canonico, leader of the U.S. Marine Biodiversity Observation Network at NOAA and the other writing co-chair. “Every other breath we take comes from the oxygen produced by microscopic ocean plants, and more than a billion people worldwide rely on food from the ocean as their primary source of protein. But these and other benefits will degrade with biodiversity loss, with dire consequences especially for frontline communities.”

Canonico and Duffy emphasized that this strategy is a first step—a roadmap to a more sustainable ocean, which will require input and collaboration from people across society to achieve. An implementation plan is currently in development, with specific actions tailored to regions and communities.

THE FULL STRATEGY IS AVAILABLE AT:
https://www.whitehouse.gov/wp-content/uploads/2024/06/NSTC_National-Ocean-Biodiversity-Strategy.pdf

Left, Top - Bottom: An orange garibaldi fish in California’s Channel Islands. (Credit: NOAA); A sunburst anemone in California’s Channel Islands. (Credit: NOAA); A large sun star in Kodiak Island, Alaska. (Credit: NOAA); A female blue crab takes advantage of seagrass habitat. (Credit: NOAA); Cauliflower coral in a national wildlife refuge in Hawai’i (Credit: Mark Sullivan/USFWS Pacific Region); Background: Chromis fish swim on a stagorn coral reef in Palmyra Atoll National Wildlife Refuge in the Pacific. (Credit: USFWS)

Student Scientists Help Conserve Orchids with "Classroom Cultivation"

BY KRISTEN GOODHUE

What does it take to grow an endangered orchid and return it to the wild? This past school year, the Smithsonian decided to ask hundreds of middle and high school students. It's part of a participatory science project called "Classroom Cultivation," run by the Smithsonian Environmental Research Center (SERC) and Smithsonian Gardens. Its goal: Turn students into scientists and classrooms into botany labs.

Orchids are some of the trickiest plants to grow. This is largely because they are so frustratingly picky about their habitats.

"Orchids can be a bit of a drama queen, a diva," said Shatiyana Dunn, who runs Classroom Cultivation for SERC. "They have very specific elements that they like to grow in."

This year Dunn worked with nine schools in Maryland and the District of Columbia. Each classroom received 32 orchid seedlings. They all belonged to the same species: the grass pink orchid. It prefers to grow in damp meadows and grasslands across eastern North America. When it blooms, a single plant can boast up to 25 magenta or white flowers. But in Maryland, the grass pink orchid has become endangered, a victim of habitat loss and overzealous collectors. It has disappeared entirely from the District of Columbia.

The Classroom Cultivation students are helping discover what soil type helps the orchid grow best. Dunn supplied them with four soils to test: a complex soil with sphagnum moss, wood chips and other coarse materials; a finely milled soil; and versions of both soils combined with fungi. Many orchids depend on fungi for nutrition for their entire lives, so scientists suspect they are a critical ingredient.

The classrooms sent their data to Melissa McCormick, SERC plant ecologist and director of the North American Orchid Conservation Center. McCormick is using the students' discoveries to determine how to best grow the orchids in lab, with the hope of eventually returning them to the wild.

"There's not a lot of programs out here where the lead researchers are trusting the students to do that citizen science piece, to actually be contributing to the project," said science educator Delonta Davis. "And that's very exciting."

Davis teaches sixth-grade science at Maryland's Gwynn Park Middle School. This past academic year, he brought Classroom Cultivation to over 100 students divided into four classes.

Throughout the school year, students recorded the plants' height, the number of leaves and the number of any flowers that emerged. Davis' students added a few extra elements, including personal "orchid research journals" where they jotted down their own observations every week.

But his classroom encountered another surprise—one many scientists are all too familiar with.

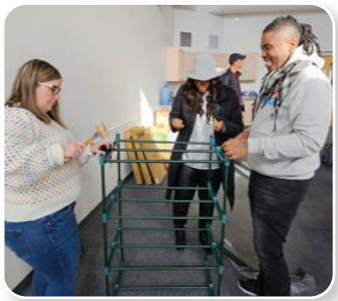
"None of our plants grew. None of them," Davis said. It caused some anxiety among the students. "What's going on? Did we do something wrong?"

However, when Dunn heard the news, she wasn't worried. To her mind, it's all useful data, and knowing what doesn't work is as important as knowing what does.

"There's no such thing as failure….It's about discovery," Dunn said. "Even noes will sometimes tell you a lot more than yesses."

This January, Classroom Cultivation will expand to Delaware, Minnesota and Alaska. Those states will study a different orchid: ladies' tresses. Each classroom will work with a ladies' tresses species native to their region. They'll team up with local botanical centers: the Minnesota Landscape Arboretum, Mt. Cuba Center in Delaware and the Kachemak Bay National Estuarine Research Reserve in Alaska.

As for the grass pink orchids? They seem to like the uber-complex soil with materials like sand, peat and sphagnum. McCormick's team is duplicating the experiment to see if they need anything else to satisfy this finnicky orchid.



Photos L-R: Shatiyana Dunn helps students prepare nursery pots and trays at Non-Traditional Program South. (Credit: Karen McDonlad); Delonta Davis (right) puts together experiment shelves with fellow educators Heather Carter (left) and Tamelyn Perry. (Credit: Rachael Mady); Hooded ladies' tresses, Spiranthes romanzoffiana. *(Credit: Scott Yarger); Portable bog for classrooms to plant surviving orchids at the end of their experiments. (Credit: Shatiyana Dunn)*

Top Photos L-R: Students at Gwynn Park Middle School receive cotton balls with fungi for the orchids. (Credit: Gwynn Park Middle School); Grass pink orchid, Calopogon tuberosus. *(Credit: Glenn Berry)*

DETECTOR DOGS *Sniff Out* ENDANGERED ORCHIDS IN VIRGINIA

BY MONA PATTERSON AND KRISTEN GOODHUE

Carl Dunnock (left) with his detector dog, Encore, and Carl Messick with his detector dog, Grand. (Credit: USDA)

Dogs, with their ability to sniff out unseen objects, have become key players for many teams, from search and rescue missions to hunting. But lately, they've received a new welcome—onto the team of plant conservation. This summer, orchid scientist Melissa McCormick embarked on a search for the endangered orchid *Isotria medeoloides*, commonly known as the "small whorled pogonia." Accompanied by two Labradors and their handlers, McCormick set out to survey Fort Walker, Virginia, for any sign of the elusive orchid.

The small whorled pogonia hasn't been seen in Maryland or D.C. for at least two decades. Federally listed as "threatened," the orchid is endangered or imperiled in almost every state where it still occurs. Recently, however, scientists discovered a significant population in Virginia, where it's also listed as endangered.

Surveying the small whorled pogonia can be tricky, since their small size and green color make them blend into their surroundings. To make matters worse, it has a doppelganger: Medeola virginiana, the cucumber root. Both plants share a similar leaf pattern and color when not flowering, making them difficult to distinguish with the naked eye.

Trevor Michaels and his canine Bradie search for small whorled pogonias on an earlier survey in 2022. (Credit: USDA)

"It's not super obvious," said McCormick, a biologist with the Smithsonian Environmental Research Center (SERC). "But to a dog's nose, apparently it is."

TRAINING PAW PATROL

Two dogs joined McCormick in the field: Encore, a 9-and-a-half-year-old black Labrador, and Grand, a 7-year-old chocolate Labrador. The North American Orchid Conservation Center, a coalition that McCormick leads, spearheaded the effort, with support from the U.S. Botanic Garden.

"Encore is a little bit more of a timid dog," said Carl Dunnock, Encore's handler. "Very high energy, but as we are surveying, he tends to stay a little bit closer to me." Grand, on the other hand, tended to wander a bit farther from his handler, Carl Messick.

Both dogs learned to sniff out orchids as recruits for the Maryland Detector Dog Program, run by the U.S. Department of Agriculture (USDA). The USDA looks specifically for high-energy adult dogs, and nearly always recruits them from shelters. They're generally not too picky about breeds in the recruitment stage, according to Trevor Michaels, a USDA wildlife biologist who works with the dogs. The dog's personality and abilities—and enthusiasm for toys as a reward—matter more. Breed comes into play when deciding which environments are best for the dogs.

"We wouldn't want a Chihuahua working in the marsh with us in Alaska," Michaels said. "It's probably not going to work well."

Grand and Encore already had experience with animals, sniffing out red-tailed boas, feral swine and the droppings of invasive nutria rodents. But the small whorled pogonia was their first plant.

To train them on the orchid, Dunnock and Messick began indoors. First, they exposed the Labradors to the scent of small whorled pogonia leaves in small vials. Gradually they moved outdoors, where the dogs searched for dried pogonia leaves in tea bags. Finally, they took the dogs to Fort Walker and Prince William Forest Park to see if they could find live, already-known populations of small whorled pogonias in the wild. Upon sniffing out the orchids' scents, Grand and Encore would sit by the suspected orchid, waiting for their handlers' approval—and their requisite toy prize.

Left to right: Carl Messick with dog Grand, Liz Keily, Brian Josey, Melissa McCormick and Carl Dunnock with dog Encore. (Credit: Melissa McCormick)

SNIFFING OUT THE SLEEPING FLOWERS

Once field training was over, McCormick, Dunnock and Messick moved on to the real test: finding orchids the scientists didn't yet know about. In their most recent expedition, Grand and Encore found several new *Isotria* orchids just outside populations scientists had already been surveying.

"We've also had them cue in on some areas that, as far as we know, there are no plants there," McCormick said. "And often both dogs will cue in on the same spot."

Small whorled pogonia, Isotria medeoloides*. (Credit: SERC)*

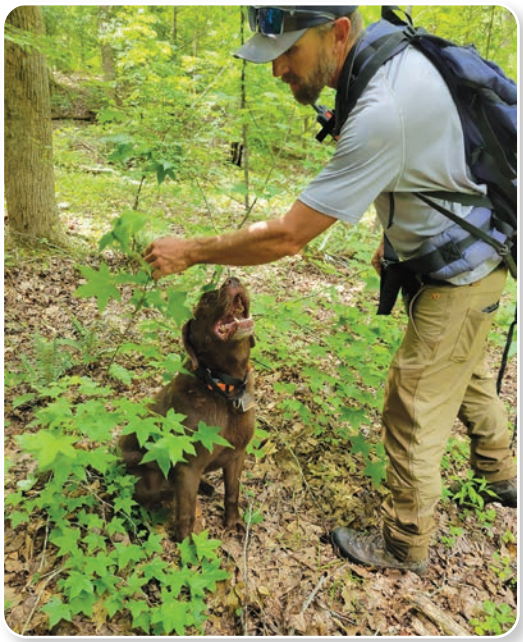
McCormick suspects—though cannot yet confirm—that the dogs were finding dormant orchids underground. Some orchid species can enter a dormant phase that can last for years, likely living off stored nutrients and relying on their relationships with soil fungi.

Because orchids are so fragile, scientists can't dig them up without endangering the orchids' lives. Instead, McCormick's team marked the areas the dogs identified with flags. Next year, they will return to the marked locations to see if any small whorled pogonias have reemerged.

Once Encore and Grand "retire," they'll almost certainly spend their remaining days in a dog-loving home. Handlers always get first dibs on adopting their canine partners. And if for some reason a handler can't adopt, there are plenty of eager households waiting on the sidelines. Even dogs that fail their training and wash out of the program get adopted out, according to Michaels.

"There's always a long waiting list for these dogs," he said.

Carl Dunnock holds a tennis ball while his detector dog, Encore, surveys a potential orchid site. Handlers use toys as rewards for dogs identifying their targets. (Credit: Melissa McCormick)



Carl Messick inspects a spot singled out by his detector dog, Grand. (Credit: Melissa McCormick)

Students Denim Fisher (left) and Narcia Jackson look at pinned insects under a microscope at Sweet Hope Free Will Baptist Church. (Credit: Alison Cawood)

In Baltimore, High School Interns Link Science, Religion and Race

BY KRISTEN GOODHUE

As a young student drawn to the intuitive side of things, Denim Fisher never felt completely at home in the science world. But she always had a deep love for nature. That love, she acknowledged, comes with trauma.

"The act of engaging with nature can be a daunting, frightening experience for most Black people," she said. "This fear response stems from historical racism and the awful things that we endured in these forests."

Denim Fisher holds up a newspaper cup she made to hold seeds and soil at a Baltimore urban farm (Credit: Olivia Pineda)

Last winter and spring, Fisher joined a high school internship program run on Saturdays by the Smithsonian Environmental Research Center (SERC) and Temple X. One Saturday stands out, walking through Gwynns Falls Park with her mentor, Alfie Chambers.

"We saw a poplar tree," Fisher said. "Alfie taught me that Black bodies were lynched on this tree. This tree has gigantic branches, and mobs intentionally used these trees because of the increased likelihood of someone's death."

For Fisher, the internship offered a chance to explore new ways to reconnect her community with nature, and to create spaces for healing.

Science and Faith Collide

SERC and Temple X ran two six-week internships in Baltimore this year. They're part of the new Science & Faith initiative, exploring how scientists and faith communities can work together.

In 21st-century America, it's common to shoehorn religion and science into opposing camps. However, this stereotype ignores the vast overlap in their missions. Many faiths see environmental stewardship as a moral duty. Local religious groups also often have their fingers on the pulses of their communities.

"We've got faith leaders who often see their jobs as understanding their community and knowing what it needs," said Rylee Wernoch, SERC's Science & Faith program manager. Many take on a more active role, advocating for better housing, food security or environmental health. "[This] is a really nice complement to scientists, who are interested in providing empirical evidence for some of these challenges."

Temple X—a Baltimore school system that focuses on outdoor education at faith-based organizations—was a natural partner.

A total of 20 students joined the program. Some wanted to explore how their local environments were affecting people's health. Others wanted to be lawyers or fashion designers. Some were simply looking for a paid opportunity, and the outdoor environment aspect piqued their curiosity.

"We're hoping that we get kids who are excited about learning and curious about the scientific process," Wernoch said. "But we think it's really important that you have teachers and beauticians and lawyers and all different sorts of people who understand what science is and how it's done."

Ulysses Archie, Jr., shows a student an egg at the Baltimore Gift Economy, his urban farm in West Baltimore. (Credit: Alison Cawood)

Disciples of Nature and Society

Every Saturday the interns gathered in a Baltimore church. The first cohort in February and March focused on environmental justice. They visited parks, urban farms and other landmarks that have shaped Baltimore culture. The second cohort in April through June did research at the churches' green spaces. Some students, like Fisher, participated in both.

Not everything went according to plan.

"Of our 12 weeks in the spring, it rained for six," Wernoch said. "So that was pretty challenging, I think, for morale and logistics."

The students collected data from two local Baptist churches: Liberty Grace Church of God and Sweet Hope Free Will Baptist Church. When deciding what to measure, Wernoch tried to keep the focus on things that mattered to the community. "Wet bulb globe temperature"—a measure of how hot it *feels*, not just how hot a regular thermometer says it is—can help answer some of the most pressing questions.

"How many trees do we need to plant to cool our neighborhood? How much work do we need to do so that way our people around us feel a difference?" Wernoch asked.

Fisher said she feels more confident now in her ability to do science. But the barriers have deep roots in American society writ large.

"When I thought about STEM, I envisioned Whiteness, lab coats, et cetera," said Fisher. "As a society, we need to examine why that is. Why don't our Black children feel accepted or inclined to study STEM concepts? Who are we centering? Who are we overlooking?"

At the end of each internship, the students presented proposals for environmental projects that could improve their communities. The ideas were myriad: eco-friendly cosmetics, trash cleanups, and classroom activities about pollinators. Fisher imagined a "sacred salon"—not for hair styling, but the 17th-century kind, where philosophers once debated radical ideas. In Fisher's salon, called "Black Liberation and Nature," high school students would have a safe space to discuss their experiences with race and the environment.

Samia Towson (left) and Sierra House take data from the wet bulb experiment at Sweet Hope Free Will Baptist Church. (Credit: Alison Cawood)

Despite the rhetoric, Fisher says she believes faith and science can work in tandem.

"What I think about, what I am curious about, is faith, faith that there are new ideas and concepts that exist in this world," Fisher said. "And science is pushing those things out to society and making them a reality."

Students Abreyah Thompson (left) and Jakiyah Dillard collect data about insects from pitfall traps at Liberty Grace Church. (Credit: Alison Cawood)

The scarab beetle Nipponoserica peregrina, *the 1,000th beetle species found at SERC. (Credit: Frode Jacobsen, via iNaturalist, https://creativecommons.org/licenses/by-nc/4.0/)*

How Charlie and Sue Staines Found Over 1,000 Beetle Species at SERC

BY MONA PATTERSON

Charlie Staines (right) and his wife, Sue Staines. (Credit: Cheryl Harner)

Beetles quietly underpin the health of ecosystems around the globe. But do we even know what beetles roam our backyards? As of July 2024, the bug-catching duo Charlie and Sue Staines have identified over 1,000 beetle species on the campus of the Smithsonian Environmental Research Center (SERC), unveiling a dazzling array of nature's tiny marvels.

Over 25,000 beetle species live in North America alone. As decomposers, they break down forest matter and recycle nutrient-rich material back into the ecosystem. As predators, they reduce populations of problem insects like aphids. By studying beetles at SERC, we can better understand their populations and the overall health of the environments they inhabit.

The Beetle Search Begins

Always fascinated with the smaller side of life, Charlie and Sue Staines have immersed themselves in the tiny worlds of beetles for decades. After 32 years classifying insects at the Smithsonian's National Museum of Natural History, Charlie and Sue were eager to pursue their passion for discovering beetles in the field. Through a participatory science program, they took on the challenge of identifying and recording beetle species at SERC. That task, begun in 2018, is now entering its seventh year.

"I was out working in the garden when he found his thousandth species," Sue said. "And he ran outside to tell me about it." The 1,000th beetle species on the SERC campus was *Nipponoserica peregrina*, a scarab beetle from Japan which Charlie later identified in his makeshift lab at home.

A maculated scarab beetle, Gnorimella maculosa, *that the Staines found at SERC. (Credit: Charlie Staines)*

Throughout their time collecting, Charlie and Sue have closely monitored the health of beetles and the broader ecosystem at SERC.

"So far, it looks like it's a pretty robust, well-functioning ecosystem," Charlie said.

However, they have also seen drops in some beetle species that were abundant just 20 or 30 years ago. Firefly populations are experiencing drastic declines, largely due to light pollution and habitat loss. Artificial lights disrupt firefly flash patterns, hindering their ability to find mates. More than 60% of beetle species tracked by the International Union for Conservation of Nature are in decline, according to the Xerces Society for Invertebrate Conservation.

"It was surprising that things that were normally just everywhere—you could beat them out of trees…we couldn't find one," said Sue.

Tiny Lessons

By overlooking common species, both Charlie and Sue stressed, we can miss vital information about how our ecosystems are evolving.

"We try to encourage people to look at things…simple things that otherwise appear common," Sue said.

Their work has also inspired new research here at SERC. Charlie will soon begin working with the Spatial Ecology and Conservation Lab on a new ground-beetle project at BiodiversiTREE, SERC's massive forest restoration experiment. He is also working extensively on a beetle identification aid.

Charlie and Sue's love for beetles extends beyond mere fascination. It's woven intricately into both their professional lives and personal hobbies.

"When we travel and we stop at roadside rest areas, we go to the dog areas and look for dung beetles," said Sue. "When we stop for gas at night, we check the light at the gas station because the insects come to the lights, hit the poles and drop."

Since 2018, Charlie and Sue identified over 1,000 beetle species within the 2,654 acres of SERC land here in Maryland. Imagine the magical world we could unlock, if we all just looked a little closer to our gardens or the insects drawn to the night lights.

HOT MOMENTS:
Predicting the Unpredictable in Coastal Wetlands

BY COLE JOHNSON

Coastal wetlands are vital to our planet's health. They store carbon, filter pollution and protect our shorelines. But they also can *emit* large pulses of greenhouse gases into the atmosphere, in sudden events known as "hot moments." These fleeting events are challenging to predict; yet understanding them is crucial in humanity's fight against climate change.

Genevieve Noyce examines the chairmaker's bulrush, the wetland sedge they are growing for the experiment.

Genevieve Noyce, a senior scientist at the Smithsonian Environmental Research Center (SERC), is leading an innovative project to better understand these hot moments in coastal wetlands.

"Coastal wetlands are incredibly resilient yet vulnerable," Noyce said. "Our goal is to identify what causes these hot moments and how they affect greenhouse gas emissions."

Noyce works on the project with SERC scientists Roy Rich and Alia Al-Haj. Supported by the U.S. Department of Energy and private donors, the experiment aims to uncover the triggers behind these events. The team is investigating how natural events like heat waves and flooding could generate greenhouse gas spikes. The data they collect will help us predict future hot moments and improve how they're represented in the models we use to combat climate change.

The project lives in SERC's experimental garden, a vast open field surrounded by trees. Inside 20 tall, open-top chambers, the scientists are growing a wetland plant called "chairmaker's bulrush" (*Schoenoplectus americanus* to scientists). Chairmaker's bulrush is one of the most common sedges on Chesapeake wetlands. What triggers a hot moment in this plant is a good benchmark for wetlands overall.

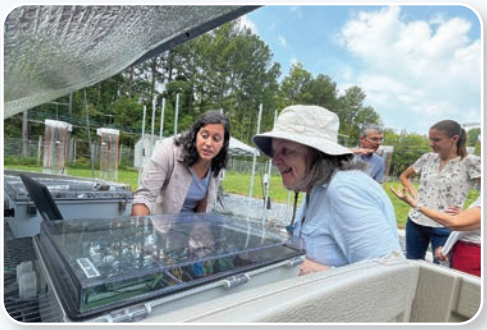
To simulate extreme events, the team exposes the chambers to three-day pulses of heat, flooding (both saltwater and freshwater) or rapid influxes of soil nitrogen—a common side effect of fertilizer runoff. Thanks to an automated system engineered by Rich, they can detect whether these events lead to spikes of greenhouse gases. About every 2.5 hours, each chamber seals shut for five minutes, recording data on carbon dioxide, methane and nitrous oxide.

Open-top chambers, where scientists are growing wetland plants exposed to extreme events and measuring greenhouse gases.

"Our automated flux chambers allow us to capture real-time data on greenhouse gas emissions," Rich said. "These high-resolution measurements are critical for observing the rapid changes that define hot moments."

In addition to federal funding, the project also benefits from the generosity of several donors who recognize its importance.

"I am proud to support this work," said Paul Popick, who donated to the project with his wife, Joan Muzillo. "It's essential to advance our understanding of these ecosystems and develop practical solutions to protect them."

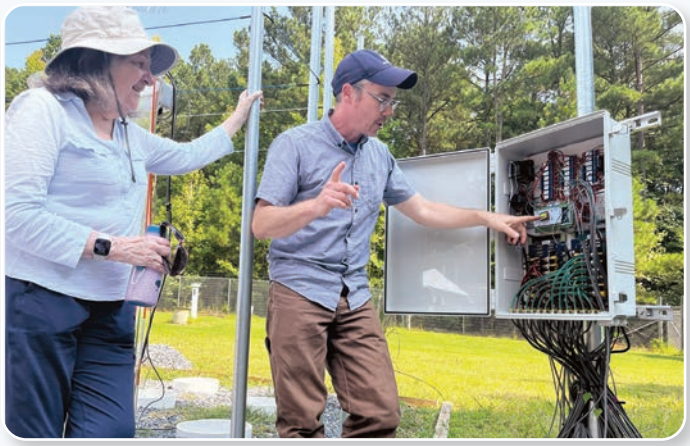


Alia Al-Haj (left) shows Marie McGlone real-time data from the experiment's dataloggers.

The "hot moments" experiment wrapped up its first season this year. Now Noyce, Rich and Al-Haj are busy processing the thousands of data points collected from the chambers. These data will help forecast how wetlands will respond to climate change, and how we can help them trap more carbon and emit less. The team will continue the project for another summer season and use the new facility in the experimental garden for future research.

"The support we've received is enabling us to push the boundaries of ecosystem modeling," said Rich. "It's about more than just understanding what's happening now; it's about preparing for the future."

Want to join our team of supporters and make climate experiments like this one possible? Contact Cole Johnson at JohnsonC@si.edu.



Roy Rich (right) shows the manifold his lab designed to help automate the experiment to supporter Marie McGlone.

Alia Al-Haj (left) shows one of the chambers to project supporter Joan Muzillo. Behind them, fellow supporter Paul Popick (back left) talks to Roy Rich.

Photos by Kristen Goodhue

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A Legacy of Environmental Stewardship

BY COLE JOHNSON

Anne Bradshaw's bequest of her beloved West River home to the Smithsonian Environmental Research Center (SERC) exemplifies her lifelong commitment to environmental stewardship. Born in 1937 in Elizabethtown, Pennsylvania, Bradshaw's deep appreciation for nature blossomed into a passion for art and conservation. After her death last December, her house passed to the Smithsonian, along with the proceeds of some of the nature-based artwork she created during her life.

Anne Bradshaw's home on Muddy Creek Road that she willed to SERC.

Photo courtesy of Anne Bradshaw estate.

Artwork by Anne Bradshaw.

This remarkable gift reflects Bradshaw's love for the natural world and her dedication to scientific endeavors. It has enabled SERC to develop plans for a much-needed convening center, to enhance its capacity to address environmental challenges. The center will serve as a collaborative hub for scientists, educators, policymakers and other community voices, embodying her vision for environmental protection.

Bradshaw's legacy, rooted in her ability to find inspiration in everyday beauty, will continue to support SERC's crucial work for years to come. Her foresight ensures that her passion for conservation will inspire future generations of environmental stewards.

Consider following in Anne's footsteps by including SERC in your estate plans. Your planned gift can help shape the future of environmental research and conservation. By leaving a legacy to SERC, you become an integral part of a mission to preserve our planet, creating an enduring impact that will benefit the world for generations to come. To learn more, contact Christine Buckley at BuckleyC@si.edu.

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Kristen Goodhue – *writer, editor*
Stacey Saadeh Smith – *graphic designer*
Mona Patterson – *science writing intern*
Taylor Wev – *contributing writer*
Cole Johnson – *senior advancement officer*
Christine Dunham – *copy editor*

To send a comment or unsubscribe, please email Kristen Goodhue at GoodhueK@si.edu.