Smithsonian Environmental Research Center

ON THE EDGE

News from the Smithsonian Environmental Research Center

Winter 2023

A Living Seawall For San Francisco Bay

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Divers Discover "Barren" Sand Flats Not So Barren

Meet SERC's Three New Hybrid Scientists

First Summer Teacher-Scientist Training Program Takes Off

Staff from SERC and the Chesapeake Bay Foundation dump oysters off the SERC docks, to add to SERC's restoration reef in the Rhode River. (Credit: Karen McDonald/SERC)

DIRECTOR'S LETTER:

The Year Is Your Oyster

What new beginnings does the year hold for you? For me, the first promising sign of a new year came early, on a brisk morning last November. About a dozen of us had gathered on the SERC dock, a mix of staffers from SERC and the Chesapeake Bay Foundation (CBF). We had come to celebrate a new partnership to restore oysters throughout the Bay.

Left to right: CBF scientist Allison Colden, CBF President Hilary Falk, SERC director Tuck Hines, and SERC scientist Matt Ogburn on the SERC dock at the launch of the SERC-CBF oyster partnership. (Credit: A.J. Metcalf/Chesapeake Bay Foundation)

After working through a formal agreement between our two long-standing organizations, we initiated the partnership with a cheerful celebration on the SERC dock. Following brief speeches, we ceremonially dumped nine orange baskets into the water, full of oyster shells with tiny oysters ("spat") attached. The oysters came courtesy of CBF's spat-on-shell program, which places oyster larvae into tanks filled with bags of oyster shell. After a few days for the larvae to settle and attach to the shell, the spat-on-shell can be transferred into the Bay. When we were finished, 206,000 new baby oysters lined the bottom of the Rhode River, ready for SERC scientists to track their growth and survival.

The oyster planting was an addition to a reef SERC and CBF first established in 2006. It heralded an even more important shift. SERC is now the new home for CBF's Maryland oyster restoration center. Once based in Maryland's Shady Side, the center's operations—including its spat-on-shell program and oyster "reef balls"—will live with our waterfront labs. The foundation's restoration vessel, the R/V Patricia Campbell, also sits tied up to our docks.

Oysters play a vital role in Bay health. They filter and purify water, and their shells provide habitat for species like fish and crabs. There's a reason ecologists like myself call them "foundation species." But they've plummeted to less than 1% of their historic levels, victims of overfishing and disease.

Oyster habitat in the Tred Avon River, one Chesapeake oyster restoration that SERC biologists are monitoring. (Credit: SERC)

SERC scientists are monitoring oyster restorations across the Bay with sonar and underwater cameras, to uncover what gives them the best shot at success. Meanwhile, CBF is tirelessly growing and planting new spat, the seeds of a new generation of oysters.

This partnership ushers in a host of new opportunities. Besides bringing restoration and science even closer together, we're excited to engage more students and citizen scientists in oyster restoration.

But I wasn't the only scientist on the dock that day. Nine of us dropped baby oysters into the Rhode River to kick off the partnership. Here's what a few of them had to say:

"We know a lot about how coral reefs work. They're really important to lots of species. We really haven't studied large-scale, structured oyster reefs like what used to be in Chesapeake Bay. But we're beginning to have that opportunity, to really study what an oyster reef looks like when it's on large scale and how that benefits the rest of the Chesapeake Bay." – Matt Ogburn, head of SERC's Fisheries Conservation Lab

"[We] look forward to working together to educate the next generation of Chesapeake Bay stewards, and our oyster volunteers and our oyster advocates, who will become those voices that we need to continue to move Chesapeake Bay restoration forward." – Allison Colden Chesapeake Bay Foundation Maryland Fisheries Scientist

"When our team was talking about where to put our Maryland oyster operations, I couldn't think of a better spot than the Smithsonian Environmental Research Center…The partnership between world-class restoration and world-class science really couldn't be better." – Hilary Falk, Chesapeake Bay Foundation President

I hope, as you pry open whatever the new year holds for you, that you find something wonderful inside. Stay safe, and stay optimistic.

- ANSON "TUCK" HINES, SERC DIRECTOR

Front Cover: A tile deployed at the seawall adjacent to the San Francisco Marina Small Craft Harbor. This type of tile was part of a separate preliminary experiment, before the official "Living Seawall Pilot Project" began. (Credit: Corryn Knapp/SERC)

RESEARCH DISCOVERIES

"BARREN" UNDERWATER SAND FLATS MORE BIODIVERSE THAN WE THOUGHT BY KRISTEN GOODHUE

When choosing key ocean protection sites, many conservationists immediately jump to coral reefs. But there's another habitat that's routinely forgotten. Sand flats harbor disproportionately high levels of species not found in other ecosystems.

In a five-year study, divers from the Smithsonian's MarineGEO network surveyed four habitats in Belize's Carrie Bow Cay: corals, mangroves, seagrasses and sand. Despite having fewer fish species overall, sand flats hosted the highest percentage of unique species—making them irreplaceable components of underwater biodiversity.

Yellowhead jawfish (Opistognathus aurifrons)*, a fish that needs sand habitat to burrow. (Credit: Leah Harper)*

"The going paradigm is, well, sand has fewer fish, smaller fish, and so there's not a whole lot going on there," said lead author Leah Harper. "However, I had been to Carrie Bow and done these sand surveys ….You'd have to completely learn a few new species that you've never seen in hundreds of dives on coral."

LINK TO FULL STUDY: https://onlinelibrary.wiley.com/doi/10.1111/ddi.13632

Leah Harper surveys a reef in Carrie Bow Cay, Belize. (Credit: Zach Foltz)

WE'RE MISSING INVISIBLE PARASITES IN OUR QUEST TO STOP INVASIVE SPECIES BY JAYLENE LOPEZ

You may have heard of invasive species like mitten crabs, emerald ash borers and zebra mussels. But have you ever considered the invasive species that are invisible to the naked eye? A new study found over 100 families of parasites enter the U.S. via international shipping. Some cause disease in fish, seagrasses and other important species.

The International Maritime Organization has guidelines to help ships reduce potential invaders in the ballast water of their hulls. However, the guidelines are very limited for organisms smaller than 10 microns, which is where most parasites fall, lead author Katrina Lohan points out. To prevent future disease outbreaks, the authors say, it's vital to understand how our current strategies measure up against parasites.

LINK TO FULL STUDY:
https://onlinelibrary.wiley.com/doi/10.1111/ddi.13592

Katrina Lohan (right) and other scientists collect ballast water from a ship's hull, to sample it for potential invasive species. (Credit: Kimberly Holzer)

Oysters in Harris Creek, home to a restored reef scientists analyzed as part of the study. (Credit: Keira Heggie/SERC)

FOR OYSTERS, LEGACIES OF PAST STRESS SPILL OVER TO REST OF ENVIRONMENT BY KRISTEN GOODHUE

Scars of past trauma can have lingering effects on many creatures—including oysters, shellfish vital to keeping the Chesapeake Bay healthy. In a new study, SERC ecologists discovered previous stress impacts not only oysters' health, but their ability to keep pollution out of the water months later.

In a two-part experiment, scientists exposed thousands of oysters to low oxygen, warming or both for about two weeks. One year later, they repeated the experiment, testing how well the oysters extracted nitrogen pollution. Under most conditions, oysters exposed to tough conditions early on failed to store as much nitrogen as oysters that had remained stress-free.

"These past environments are influencing an ecosystem service," said lead author Sarah Donelan. "And that's never considered when we're talking about ecosystem service delivery in any system, let alone in oysters."

LINK TO STUDY: https://doi.org/10.1111/gcb.16571

Meet SERC's NEW HYBRID SCIENTISTS

This summer and fall, SERC hired three new scientists to kick start their own labs. All of them defy easy labels: an urban ecologist with a passion for streams, an amphibian tracker taking the temperature of forests, and a microbial ecologist doing futuristic climate change experiments. Learn more about their crosscutting research in these Q&As. Edited for brevity and clarity.

REBECCA HALE: THE FUTURE OF ECOLOGY IN THE CITY

BY KRISTEN GOODHUE

HOW DID YOU GET INVOLVED IN URBAN ECOSYSTEMS?

There was a research project I participated in one summer, and we were looking at restored agricultural systems. And I just remember talking to my mentor there and being really excited about thinking about those feedbacks between humans and their environment….I wanted to do work where there was an opportunity to study that intersection between humans and the environment really closely. And it dawned upon me that cities were actually a place where that happens quite intensely.

HOW HAVE OUR IDEAS ABOUT CITIES AND THE ENVIRONMENT CHANGED?

It doesn't take much to have a really big impact on stream ecosystems. There were people in [a conference] I was in that were saying, the answer is zero population growth…. But it is not the job of an ecologist to make sure that there's less population growth; that's way outside of our wheelhouse. But instead, we can study the cities as they are and work with people to make them to be better…And the efforts to do that work, to work with decision makers, to work with communities, it's been remarkable to see how that's changed over the past 20 years.

SPEAKING OF COMMUNITIES, YOU MENTIONED A CONFERENCE IN AUSTIN WHERE ECOLOGISTS BRAINSTORMED SOLUTIONS WITH COMMUNITY MEMBERS. WHAT WAS ONE OF YOUR BIGGEST TAKEAWAYS FROM THAT?

We like to go into these systems as ecologists or as people from the city who are like, all right, so there's this flooding problem, so we're going to throw all this green infrastructure into it. It's going to be so great. Green infrastructure has all these benefits and it's so wonderful. And this [activist] from the community was like, wait a minute. This is a neighborhood that has been disinvested forever…. Are you giving us green infrastructure because it's cheaper? What the heck? And so she saw it as a continuation of environmental injustice.

ARE THERE WAYS YOU HOPE TO INVOLVE COMMUNITY SCIENCE IN YOUR WORK AT SERC?

I'm excited about talking with Alison [Cawood] about ways that we can do community science where they're contributing to the process, the entire process, and not using people to collect data but instead working with communities to figure out what the important questions are and then working with them to then conduct that research. And that's of course terrifying, because you have no idea what they're going to think is interesting and whether you're going to have the skills to do it. But I think that's also one of the opportunities here that's really exciting.

An urban stream in Salt Lake City, Utah, one of several Rebecca Hale has studied in her career. (Credit: Rebecca Hale)

DO YOU HAVE ANY ADVICE FOR ASPIRING SCIENTISTS?

Don't be scared of feeling stupid. It means you're on the right track…You should have no idea what you're going to find, right? Because that means that you're on the frontier and you're doing something new.

Left: Rebecca Hale sits beside one of SERC's weirs, which tracks pollution and flow in streams. (Credit: Kristen Goodhue/SERC)

JUSTIN NOWAKOWSKI: THE GLOBAL ZOOLOGIST

BY KRISTEN GOODHUE

MUCH OF YOUR CONSERVATION RESEARCH FOCUSES ON HERPS—AMPHIBIANS AND REPTILES. WHAT DREW YOU TO THEM?

We just don't know as much about amphibians and reptiles as we do other vertebrate taxa like birds and mammals. We're still describing about 100 new species of amphibians every year. And some of these species disappear or we don't see again for another 20 years.

…

Another reason I've focused a lot on amphibians, aside from the fact that they have fascinating natural histories, is that they are often among the most abundant vertebrates in terrestrial systems….From an ecological perspective, this makes them important components of ecosystems.

YOUR NEW LAB IS CALLED THE "INTEGRATED SPATIAL ECOLOGY LAB," WHICH SOUNDS PRETTY BROAD. COULD YOU BREAK DOWN WHAT THAT MEANS FOR YOUR WORK?

More and more, understanding and addressing problems of global change requires an integrative approach to research and problem solving. It's important to bring together ideas and teams from across disciplines. Although much of my research includes elements that are traditionally

Justin Nowakowski plants a microclimate sensor to track temperature and soil moisture in the SERC forest. (Credit: Kristen Goodhue/SERC)

in the realm of landscape ecology—things like understanding the effects of land use on animal distributions and movement—I also integrate approaches from other subdisciplines.

WHAT NEW QUESTIONS DO YOU HOPE TO ANSWER AT SERC?

I'm really interested in how restoration, especially forest restoration, is affecting microclimates. And then in turn, how does that influence the reassembly of native vertebrate assemblages, native vertebrate species?

Justin Nowakowski searches for turtles in Point Reyes, California. (Credit: Marylin Veiman Echeverria)

Justin Nowakowski doing microclimate research with REU interns Wendy Zamora (left) and Marylin Lopez (right). (Credit: Wendy Zamora)

WITH SO MUCH URGENCY ON SOLVING GLOBAL CLIMATE CHANGE, WHY IS IT IMPORTANT TO UNDERSTAND "MICROCLIMATES"?

Because microclimates are what people and animals actually experience on the ground….Most of what we know about climate change comes from coarse datasets that are derived from weather stations. And these weather stations tend to be installed in a standardized way. So in open areas that are flat, without vegetation. And this is by design, because it factors out these local variables that influence microclimates… But this "noise" is actually highly important for understanding how animals are responding to changes in land use and climate.

ANY FAVORITE MOMENTS AS A SCIENTIST?

There's a frog [*Atelopus varius*] that disappeared from the mountains of Costa Rica….At the time, it was thought that [it] had completely disappeared from Costa Rica as a result of the pathogenic fungus, Bd. When we went looking for the species, we relied on the knowledge of a local farmer, a landowner we had worked with and who was familiar with the slopes of the volcano, Cacho Negro. This volcano is part of a large wilderness area – so, no roads or trails – in the cordillera central where the species had occurred in the past. Although we searched a number of streams and saw many other amazing species, we ultimately did not find the "rana pintada" [painted frog]. Since then, the species has been rediscovered in other parts of the country, which has been the case for a number of species considered possibly extinct, as scientists have gone searching for lost amphibians.

GENEVIEVE NOYCE: EXPERIMENTING ON THE WETLANDS OF 2100 BY JAYLENE LOPEZ

YOUR EXPERIMENTS ON SERC'S GLOBAL CHANGE RESEARCH WETLAND (GCREW) ARE DESIGNED TO MIMIC THE POSSIBLE TEMPERATURES AND CARBON DIOXIDE LEVELS OF 2100. WHY IS RESEARCH ON WETLAND ECOLOGY IMPORTANT?

We know that global temperatures are rising, and we want to know what the ecosystems and coastal wetlands are going to look like in this warmer environment….That will let us get a bigger picture of what the world will look like in the future.

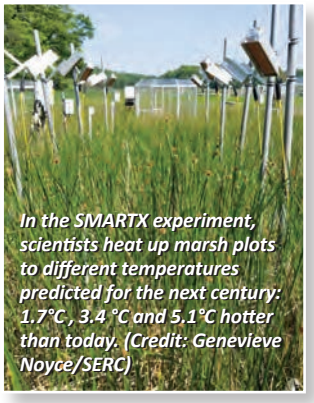
WHAT ARE YOUR INITIAL GOALS FOR YOUR NEW LAB?

What I've been doing during my time at SERC thus far is mostly looking at these warming experiments at GCREW. I want to expand on that a little bit. My background is in microbial ecology, so I am looking at what microbes live in the soil and trying to figure out how they respond to various things, which can include global change.

WHAT BENEFITS WILL THIS NEW LAB HAVE ON GLOBAL CHANGE RESEARCH?

SERC does a lot of global change already. That's kind of one of the things the whole of SERC is looking at—a better understanding of the Chesapeake Bay ecosystem and then understanding how it's going to change in the future.

I think that my lab is bringing just another piece of that, that sort of fits in. We don't have anybody looking at this biogeochemical microbial ecology link in global change right now.



In the SMARTX experiment, scientists heat up marsh plots to different temperatures predicted for the next century: 1.7°C, 3.4 °C and 5.1°C hotter than today. (Credit: Genevieve Noyce/SERC)

WHAT DO YOU PREDICT FOR THE FUTURE OF YOUR NEW GLOBAL CHANGE ECOLOGY LAB, AND GLOBAL CHANGE RESEARCH IN GENERAL?

Right now my lab is very small. It's me and a tech and postdoc, and we work closely with the Biogeochemistry Lab, which I've been in. In the future, I envision bringing in more people to continue doing this kind of research.

…

Starting up new projects and new experiments is the way that global change research is going in the future. SMARTX [one of Noyce's current experiments] does this well in looking at multiple global change factors. We have warming and CO_2 in the same plots. So rather than just looking at what happens when you only have one thing changing, what happens when you have multiple things changing and how that affects the ecosystem as a whole.

WHAT ARE YOU MOST EXCITED ABOUT?

I've been at SERC for almost six and a half years at this point, so [I am excited about] the fact that I can stay at SERC and keep building on all this research and the collaboration that I've made over the past six years. It's nice to know these experiments like SMARTX that I've been working on, or GENX that I've started, can keep going because I'm still going to be here and be able to run them.

GENX (short for "Genevieve's Experiment"), the newest GCREW experiment that measures methane emissions from the soil. The colors represent different temperatures in each chamber. (Credit: Roy Rich/SERC)

Above: Genevieve Noyce beside an experimental chamber on the Global Change Research Wetland, during the summer 2021 plant census. (Credit: Pat Megonigal/SERC)

Creating a "LIVING SEAWALL" in San Francisco Bay

BY JAYLENE LOPEZ

Example of a more textured, complex tile for sea life to settle, in a preliminary experiment leading up to the Living Seawall Pilot Project. (Credit: Corryn Knapp/SERC)

A longer version of this article originally appeared in ECO Magazine*, for their special November issue on Marine Invasions.*

What if there was a way to create a seawall that aided local ecosystems instead of hindering them? This October, the Smithsonian Environmental Research Center's San Francisco branch (SERC-West) launched the Living Seawall Pilot Project with the Port of San Francisco. The project aims to test new materials and design for San Francisco seawalls that may promote biodiversity.

Seawalls are critical urban infrastructures that minimize the effects of flooding and earthquakes. Without the rigid foundation they provide, earthquakes can destabilize the ground, causing flooding, collapsed buildings and cracked roads. In the Bay area, emergency response programs and public transportation like the ferries, BART and MUNI rail systems all depend on seawalls.

But seawalls often consist of a texture that isn't friendly to native sea life. When compared to natural rocky shore, smoother seawalls host less diverse plant and animal communities, according to Corryn Knapp, a Smithsonian graduate fellow working on the project.

Clockwise from front: SERC scientists Chela Zabin, Jessika de Jesus, Corryn Knapp and Jeff Blumenthal survey the existing Port of San Francisco seawall in May 2022. (Credit: Maureen O'Malley)

"[Traditional seawalls] fail to act as a surrogate for natural rocky shore habitat," she said.

Eco-engineering the Bay shoreline combines the need for safety with the possibility of a better ecosystem for wildlife.

Tile frames installed by the Port of San Francisco at the site where researchers will begin to monitor marine community development. (Credit: Corryn Knapp/SERC)

"This project is a unique opportunity to collaborate with the Port to test ways to increase the diversity of ecological communities around these otherwise relatively low-diversity areas," said SERC-West ecologist Andy Chang. "We hope the results will help the Port design a renovated seawall that achieves engineering goals of protecting against threats from seismic activity and rising sea levels, while also promoting ecological diversity."

UNDERWATER TILES ON TRIAL

To make the seawall environment more closely mimic Mother Nature, SERC is testing three kinds of underwater tiles. One replicates the smooth concrete surface of a traditional seawall. The second type, also smooth, is made from a special bio-enhanced mixture (courtesy of ECOncrete, the company that made the tiles). The last type contains ECOncrete's special mix plus a rougher texture to replicate native species habitats.

These special textured tiles may allow species like Olympia oysters, rockweed and Pacific herring to thrive in what resembles their natural homes. "We expect more seaweeds to grow on the textured tiles," said Chela Zabin, an ecologist with SERC-West. "Herring eggs do best when they are on seaweeds."

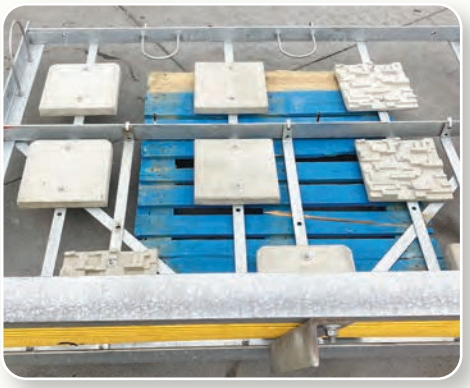
SERC scientists are not completely sure if this approach will work to create wildlife habitat. But if successful, it may tip the balance in favor of native species.

"More diverse surfaces allow more diverse microhabitats to exist, which allows more diverse communities to thrive," said Chang.

On Oct. 12, the first experimental tiles hit the water. The team chose three locations for the experiment: the Agricultural Building Seawall, the Pier 45 East Breakwater and South Beach Harbor East Breakwater. Each site contains 90 one-foot-square tiles and six larger, three-by-six-foot tiles.

The study will last two years. But Chang said scientists will remain on the lookout for new discoveries after the two years are up. They'll be checking to see if other modifications could pay off, like textures that jut out further into the water or adding more fish-friendly habitat to the seawall bottom.

The Port of San Francisco's seawall reconstruction is a vital project that ensures the safety of San Francisco's residents. With this collaboration, we can make the most of an important project. Here's to thinking of not only our own safety, but the safety of the creatures in the bay too.



Three different tile types in the project: smooth normal concrete, smooth bio-enhanced concrete and textured bio-enhanced concrete. (Credit: Corryn Knapp/SERC)

For more information on the Living Seawall Project, visit the Port of San Francisco page
https://sfport.com/wrp/living-seawall

Middle School Teachers Become Researchers In New Summer Training Program

BY ALISON CAWOOD

A longer version of this article first appeared online in the Smithsonian Education section of Smithsonian Voices *(https://www.smithsonianmag.com/blogs/smithsonian-education/).*

Teachers used everyday items, like hula hoops, as measuring devices to explore microhabitats during a professional development session led by SERC education specialist Karen McDonald, second from right. (Credit: SERC)

Every summer, the labs, forests, boats and dorms of the Smithsonian Environmental Research Center (SERC) buzz with activity as over 40 interns participate in environmental science research projects. Traditionally, the vast majority of these interns have been undergraduate science majors. However, this summer those undergraduates were joined by a less familiar group: middle school science teachers.

SERC was one of eight centers around the country awarded grants from the National Science Foundation to run Research Experiences for Teachers programs (RETs) in biology and environmental science. The RET funding offers public school science teachers the chance to engage in hands-on research and work alongside ecologists.

We welcomed eight middle school science teachers from Maryland and the District of Columbia as our first RET cohort. Each teacher spent six weeks embedded in a host lab. They experienced some exciting days going on boats out in Chesapeake Bay, interesting (but kind of icky) days dissecting fish stomachs, and some more boring days doing things like data entry. The teachers also spent one day per week with SERC educators in professional development activities.

Left to right: Teachers Elijah Moore, Candace Taylor and Jennifer Collins examine the organisms that they caught during a seining survey on the SERC beach. (Credit: SERC)

None of the RET teachers had any prior environmental science research experience. Conversely, none of their scientist mentors had any K-12 education experience. Both the scientists and educators gained a new understanding of the challenges in the two fields. Some of the educators were surprised by the amount of data scientists use from big databases. The researchers gained a deeper appreciation of the constraints teachers work under, including the fact that not all the RET teachers were sure what grade or courses they would teach the following year.

At the end of the summer, each teacher spent a week developing classroom content based on their research experience. Draft activities included collaborating with art teachers to build paper orchid models, a class research project to investigate air pollution on wetlands, and lab activities to look at grass shrimp. The teachers also created content to share with their students, including a TikTok-style video of what a lab really looks like.

In the spring, all the teachers will return to SERC to share their experiences implementing their lessons with their students. We plan to share all the final lesson plans, activities and associated content as a Smithsonian Learning Lab collection so other educators can benefit from the RET teachers' experiences.

All the researchers and teachers of the 2022 cohort reported positive experiences. The RET program stands to benefit not only teachers, but also the hundreds of students they engage each year. With the pressing environmental challenges facing the world today, having educators and students better informed about the work being done to understand and mitigate those challenges is vital for all of us. We are so excited to continue to engage with this cohort of teachers, and all those to come in future years.

Volunteer Appreciation Corner

Our research and education programs wouldn't have nearly as much impact without the thousands of volunteers who help us every year. We celebrated the close of fiscal year 2022 with a Volunteer Appreciation Day Oct. 29 on the SERC campus.

Last fiscal year, SERC was fortunate to have:

…299 on-site volunteers

…and 2,320 total volunteers (including virtual)

…who helped run 105 school and group programs

…and contributed 11,252 hours of work!

Thank You

for all your dedication! We can't wait to see all the amazing things you accomplish in 2023.

Photo Credits: Quinn Girasek/SERC

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Coming Soon: 2023 Virtual Earth Optimism Lectures

Get ready for a new year of free science talks! SERC's 2023 series will be all-online, with speakers from the Smithsonian and across the country. Below is a preview of our opening lectures. Lectures run every third Tuesday of the month at 7pm Eastern, January through October. Learn more at https://serc.si.edu/visit/eveninglectures.

MANGROVES AND THE MANGROVE FINCH IN THE GALÁPAGOS

Jan. 17 • 7pm ET

Speaker: Candy Feller, Smithsonian Environmental Research Center, Scientist Emerita

Mangrove finch. (Credit: Michael Dvorak. Creative Commons license: https://creativecommons.org/licenses/by/2.5/deed.en)

Light pollution in the city of Belgrade, Serbia. (Credit: Imeao)

SAVING THE DARKNESS: HOW TO PUT A DIMMER ON LIGHT POLLUTION AND BRING BACK THE NIGHT SKY

Feb. 21 • 7pm ET

Speaker: Kelsey Johnson, University of Virginia, Professor of Astronomy

GROWING CLIMATE-RESILIENT GARDENS IN THE CITY

March 21 • 7pm ET

Speaker: Holly Gallagher, National Wildlife Federation, Director of Conservation Partnerships, Mid-Atlantic

A community garden in Pittsburgh. (Credit: Saeru. Creative Commons license: https://creativecommons.org/licenses/by-sa/2.0/deed.en)

The Smithsonian Environmental Research Center is recognized by the IRS as a 501(c)3 nonprofit organization. Contributions to SERC may be tax-deductible.

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ON THE EDGE
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