



Smithsonian Environmental
Research Center

ON THE EDGE

News from the Smithsonian Environmental Research Center

Summer 2019

Stories of Hope, from the Conservation Commons

*A new movement in the Smithsonian is building conservation
successes by finding common ground*

ALSO INSIDE

Invasive Species: Surprise Discovery in the Galapagos

Education: Sharks Debut on SERC Field Trip Menu

Climate Change: "Invisible Flood" of Saltwater Intrusion Threatens Farms



Interns Amanda Martinez (left) and Morgan Jones (right) survey for aquatic life in the river with SERC scientist Midge Parker. (Credit: Emily Li/SERC)

THE DIRECTOR'S LETTER



Science That Reaches Everyone

This spring, I was fortunate to be part of something inspiring. SERC hosted a two-day symposium called the Conservation Commons conference ("Con Com" for short). We heard stories from scientists and communicators both inside and outside the Smithsonian, finding creative ways to build a more livable future. But one moment in particular stands out. Toward the end of the first day, a young high school student named Garreth Bartholomew stood up with a group of fellow teenage activists and addressed an audience of SERC and Smithsonian staff.

"Help us," he said. "Be our aqueduct."

He was referring to ancient Rome and its vast network of aqueducts that channeled life-giving water throughout the empire. The young activists at the Conservation Commons conference were full of energy and ideas. What they needed was a way to channel them—a place like the Smithsonian, to help them spread their ambitions beyond their immediate communities.

We are eager to rise to the challenge at SERC. Because we believe that science belongs to everyone—not just the scientists.

The students who visit SERC on school field trips come from all walks of life. Some have never visited a forest or a stream in nature before. Our education team is continually inventing new ways to make science exciting. This year, they launched a new station about sharks, and the education interns are working on an e-book to reach schools beyond the Chesapeake.

Our citizen science team is also finding more ways to mobilize nature enthusiasts. Their Invader ID project, which began last year as a simple website to identify creatures on underwater SERC tiles, is now allowing residents in the Chesapeake to hang tiles from their own docks and watch life grow on them.



Visiting middle school students practice inserting tags into a "banana shark" in SERC's newest engineering and design STEM program. (Credit: SSP/Linda Doane)

ideas and explore possibilities. Experiences like this can help transform minds and break down barriers.

We are working to build the aqueduct Garreth envisioned, one that allows everyone to benefit from the power of science. With your help, we can make it a reality.

— ANSON "TUCK" HINES, SERC DIRECTOR



High school senior and activist Garreth Bartholomew. (Photo courtesy of Garreth Bartholomew)



An education volunteer teaches students about the Bay on a SERC field trip. (Credit: SERC)

We're equally fortunate that for decades, we've been able to offer paid internships to students seeking hands-on training. Much of that funding comes from the National Science Foundation, whose Research Experiences for Undergraduates program specifically reaches out to minorities and students from schools with limited research opportunities. And some of our internships focus on education and journalism as well as research, allowing us to show how science can impact society in other fields as well.

There is still far more we would like to do. With the right spaces, we could bring even more people together to share knowledge and ideas. We could allow citizen scientists to visit not for a single morning, but for days. We could provide a hub for students like Garreth to test their

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*Front Cover Photo: SERC ecologist
Kim Komatsu, a researcher with the
Smithsonian's Conservation Commons,
studies beneficial bacteria in soy fields.
(Credit: Kelsey McGurrian)*

RESEARCH DISCOVERIES

SAFEGUARDING FEMALE CRABS MAY LEAVE THEM SHORT ON SPERM

BY ALISON HAIGH

When a fishery is in danger, the first line of defense is often protecting reproductive females—because generally, more mothers means more babies. But a literature review published in *Invertebrate Reproduction & Development* by SERC scientist Matt Ogburn suggests that for crustaceans, it might be a little more complicated.



Female blue crabs can make several "egg sponges" like this throughout their lives to reproduce, but they mate only once. (Credit: SERC)

From lobsters to blue crabs, some crustacean fisheries might be short on males because of sex-biased fishing policies. Fewer males means less sperm, and experiments show it can take days to replenish crustaceans' sperm stores. Yet females of many species can only mate in a short window after molting. Female blue crabs rely on that sperm for the rest of their lives. Scientists are still studying how this might affect reproduction in the wild. Meanwhile, Ogburn recommends that policies consider the sex lives of our seafood when managing for sustainable fisheries.

Link to full paper: <https://dx.doi.org/10.1080/07924259.2019.1612787>

GALÁPAGOS HAVE 10 TIMES MORE MARINE NON-NATIVES THAN WE THOUGHT

BY KRISTEN MINOGUE

More than 50 non-native marine species have found their way to the Galápagos Islands, the island chain off the coast of Ecuador made famous by Charles Darwin. Before this study, published in the journal *Aquatic Invasions*, scientists knew about only five.



Biologists Linda McCann (top) and Wilson Iñiguez retrieve underwater plates on a Galápagos survey. (Credit: Kristen Larson/SERC)

Nearly a quarter-million tourists visit the Galápagos each year. That traffic can bring some unwanted hitchhikers. SERC's Marine Invasions Lab teamed up with Williams College and the Charles Darwin Foundation surveying two of the larger islands: Santa Cruz and Baltra. They found 48 additional non-natives in the water. Sea squirts, marine worms and bryozoans made up the bulk, including the "spaghetti bryozoan" known for fouling equipment and killing seagrasses. Most were new discoveries that could have survived decades under the radar, but some were species scientists previously thought were native.

Link to full paper: <http://www.aquaticinvasions.net/2019/issue1.html>

INSIDE TROPICAL LEAVES, ONE BACTERIA FAMILY REIGNS SUPREME

BY KRISTEN MINOGUE

Tropical forests shelter some of the most diverse trees on Earth. But inside, those trees may be more alike than we thought. In a paper in the July issue of *Journal of Ecology*, SERC postdoc Eric Griffin discovered tropical trees share a "core microbiome" of bacteria in their leaves.



Eric Griffin samples leaves in a Panama forest at the Smithsonian Tropical Research Institute. (Credit: Sarah Pasquini)

Working in the Smithsonian Tropical Research Institute in Panama, Griffin and his colleagues extracted DNA from leaves of nearly 500 tree saplings from five families. The team uncovered over 300 bacteria families inside the leaves. But one family appeared in 95% of the trees: *Mycobacteriaceae*. Why they're so common is a mystery. They could be better at moving across leaves, or possess enzymes that open leaf pores. For now, it appears *Mycobacteriaceae* are a silent but potentially underestimated force in the tropics.

Link to full paper: <https://dx.doi.org/10.1111/1365-2745.13145>

Can a house divided save itself? New stories emerge almost daily of America's opposing camps. Meanwhile, biodiversity loss and climate change are accelerating, and the polarization threatens to halt any meaningful action to heal our planet. Unseen by many, a collection of scientists, educators and communicators is seeking to defy that narrative. Positive change is possible, they say. More than possible—it is already happening and, with the right support, it can spread.

The movement is called the Conservation Commons. Led by Ruth Anna Stolk of the Smithsonian Institution, the Commons brings together teams from across the Smithsonian who share a single purpose: Find solutions to ensure our planet can sustain itself, and the billions of people who rely on it.

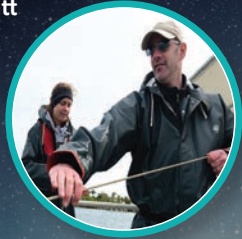
This spring the Conservation Commons held its first conference on Chesapeake Bay, at the Smithsonian Environmental Research Center. For two days, teams traded stories of conserving biodiversity, tracking animal migrations, and creating more sustainable farms and fisheries. Student activists shared experiences mobilizing their communities. Scientists and videographers described working with ranchers on both sides of the political spectrum.

Bringing different voices to the table forms the core of the Commons' strategy. As the ongoing projects splashed across these pages show, when the conversation turns to solutions, the nation may not be as divided as we thought.

"The kinds of questions that we're trying to answer are things like, 'How will climate change alter migrations?'"

— Matt Ogburn, Smithsonian Environmental Research Center (Movement of Life Initiative)

It's not easy to follow animals underwater. But in the ocean, seasonal migrations shape the lives of fishers and all who rely on the sea's bounty. Biologist Matt Ogburn's lab tracks creatures like sharks and cownose rays with sound, using small "acoustic tags" placed inside the animals that send out signals to receivers along the shore. Their discoveries are helping guide decisions on how to preserve some of the most critical players in the ocean's food web.



Bridging the Green Divide: The

"Food is for everyone. Everyone has to eat. And somehow we all have to figure out how to reduce the adverse impact of industrial agriculture and protect and increase the biodiversity in food itself."

— Kate Christen, Conservation Commons (Sustainable Food Systems Initiative)

By 2040, Earth will hold an expected 9 billion people. Kate Christen leads the Sustainable Food Systems Initiative (SFS), helping the Smithsonian support healthy food systems that equitably feed humanity and benefit Earth's environments. At the Smithsonian Migratory Bird Center, scientists like Ruth Bennett work with over 4,000 coffee producers growing certified Bird Friendly Coffee on plantations that often shelter hundreds of bird species. SFS also works with Smithsonian Facilities to improve and highlight food sustainability Smithsonian-wide. And at the Smithsonian Science Education Center, Amy D'Amico and others create student "community research guides," like *FOOD: Toward Better Nutrition For All*.



Top L - R: Matt Ogburn on a Florida tagging expedition. (Credit: Jay Fleming/Smithsonian); Ecosystem conservation ecologist Kim Komatsu. (Credit: Arjun Potter); Peter Byck, creator of Carbon Cowboys. (Photo courtesy of Peter Byck); **Bottom L-R:** Kate Christen in Mongolia. (Credit: Nancy Langston); Brian Coyle at an EcoTeen Action Network event at the National Zoo. (Credit: Turkish American TV); High school senior and activist Garreth Bartholomew. (Photo courtesy of Garreth Bartholomew)

Background: Smithsonian Conservation Commons

"We need to listen to stories of these land managers from the very beginning."

– Kim Komatsu, Smithsonian Environmental Research Center (Working Land and Seascapes Initiative)

In the Great Plains, droughts are growing more severe. Future cases of multiyear droughts are expected to double or even quadruple in some places. Grassland ecologist Kim Komatsu is working with cattle ranchers in Montana and Wyoming to test different grazing strategies to cope with droughts. With the ranchers' input, scientists revised their original experiment to allow moderate instead of light grazing in control plots. This summer, they'll start collecting data from their first simulated drought year in a five-year experiment.



"Soil health is purple....The common ground is the ground."

– Peter Byck, science filmmaker

In his two-decade filming career, Peter Byck has discovered the red-blue divide in America isn't as deep as it may seem. His latest project, "Carbon Cowboys," works with ranchers and scientists across the U.S. to research grazing methods that can regenerate the soil and sequester carbon. He's also creating short documentary films about the cattle ranchers. Focusing on solutions is the key: By setting aside the politics of climate change, Byck has found most people genuinely want to create a cleaner, more efficient and healthier economy for all. View the project at www.carboncowboys.org



The Four Pillars of the Conservation Commons

- Earth Optimism
- Working Land and Seascapes
- Movement of Life
- Sustainable Food Systems

Conservation Commons

BY KRISTEN MINOGUE

"The Earth Optimism Initiative is really about transforming society, so that we can save the planet and save ourselves."

– Brian Coyle, Conservation Commons (Earth Optimism Initiative)

Earth Optimism was born to combat the discouraging environmental stories flooding the news. It's a child of the "Ocean Optimism" campaign launched by Nancy Knowlton and other environmentalists. Far from naïvely imagining a rosy future, Earth Optimism inspires positive change by highlighting what's working in conservation and sustainability. Conservation biologist Brian Coyle has witnessed such successes. He works on an endangered red siskin recovery effort in Guyana and Venezuela, and with youth and outside organizations to build more collaborations. The first Earth Optimism summit occurred on Earth Day 2017. A larger festival will mark Earth Day's 50th anniversary in 2020.



"It's so important that you get over the inertia, that you get to step one. Once you start something, it's so much easier to continue it and build on it than it is to start something new."

– Garreth Bartholomew, student activist

Roughly one-third of the world's food goes uneaten, costing hundreds of billions of dollars and gigatons of carbon dioxide. Were food waste a country, it would rank third for greenhouse gas emissions. Garreth Bartholomew, a senior at Virginia's George C. Marshall High School, channeled his energies into slashing this. He founded his school's Food and Hunger Task Force, which tracked cafeteria food waste and organized a concert to combat hunger in his community. He's also a Zero Hunger ambassador for the Teens Dream Global Co Lab, a network where teenagers work towards one of the 17 U. N. Sustainable Development Goals.



The Invisible Flood: Saltwater Intrusion Endangers Our Food

BY QUINN BURKHART

Most people need to visit the ocean to get their sea water fix. But beneath their feet, those waters may already be closer than they think. "Saltwater intrusion," which occurs when the sea level rises and pushes large amounts of saltwater onto the coast, is one of the most prominent—and least talked about—effects of climate change.

As the planet heats up, ice melts and warming water expands, leading to saltwater flooding on the coast. This causes problems for plants and animals that aren't used to living in salty environments.

"Because of how quickly the sea levels are already rising, it's impossible for affected plants and animals in these areas to adapt to the saltwater," said Tom Jordan, a SERC senior scientist who co-authored a BioScience report on the problem this spring. "What we can do is modify our own practices."

American agriculture is especially vulnerable to saltwater intrusion from water irrigation and storm surges, to the point where farmers consider abandoning old fields where it's impossible to grow healthy crops. Classic crops like corn and wheat have little salt tolerance and die in places where the salinity is too high. Meanwhile, invasive species that thrive in saltier soil can take over areas once used for



Corn fields in America's coastal south are continuously hurt by saltwater flooding. Crops like corn and wheat can't tolerate high levels of salt in the water. (Credit: Katherine Tully/University of Maryland)

regular crops, overshadowing and killing the field's harvest.

Solutions exist, and some are already in the works. Many farmers use tide gates, which are designed to drain tidelands in an effort to prevent low-lying ground from flooding. Others switch over to plants that can tolerate saltier water, like tomatoes and rice.

However, time may not be on our side. For Jordan, saltwater intrusion is a phenomenon that needs immediate attention to reverse. "We will not be able to fix this in one or two generations," he said. "Our problem is that we may no longer have land to protect in three generations."

Link to full paper: <https://doi.org/10.1093/biosci/biz027>

Top photo: Trees can suffer from saltwater flooding, as sharp increases in salinity disrupt plant communities that aren't adapted to them. (Credit: Tom Jordan/SERC)

Sharks Debut on SERC Field Trip Menu

BY KRISTEN MINOGUE

Move over, blue crabs. There's a new predator in the education department.

This spring, SERC added a shark station to its "Shoreline Connections" field trip. Shoreline Connections guides third- through eighth-grade students through hands-on activities at different stations, all designed to fit the Next Generation Science Standards.

The theme for the 45-minute shark station is *balance*. As top predators, sharks are key to

balancing the food web. Students learn what sharks eat by dissecting a stuffed (not real) shark and examining its "stomach" contents. But besides fish and crabs, educators also stuffed the sharks with candy wrappers and other bits of plastic to illustrate plastic pollution.

"A larger shark, like a bull shark, might accidentally swallow a bottle thinking it's a fish," said Karen McDonald, director of SERC's education department.

Some schools are looking to go deeper. For them, SERC offers a day-long STEM program called "Movement of Life: Shark and Shark Migration." The program challenges students to imitate scientists: Examine real shark migration data, plan a shark tagging expedition and design a working shark tag.

The shark tag they're designing—a tag attached to a shark fin that naturally "pops off" and floats to the surface—is still a work in progress in the real world.

"We're giving students a real-life problem that hasn't been solved yet," McDonald said. "It gives them that look into, hey, this is



Karen McDonald (front) and intern Katherine Harris (red shirt) help middle-school Broadcom MASTERS students test a shark tag. (Credit: SSP/Linda Doane)

something scientists haven't figured out. Can you figure it out?"

Besides dispelling shark myths, the challenge also helps dispel another misconception: In truth, engineering takes imagination. Students often have to think outside the box to find a design that works. And there's more than one right answer.

"There's also a creative component to all of these processes and designing new technologies," said Katherine Harris, an education intern who co-created the program. "There's a lot of creativity that has to go into it."



SERC education coordinator Karen McDonald shows the contents in a stuffed shark stomach: bits of bone, a toy turtle and plastic. (Credit: Kristen Minogue/SERC)

Volunteers Expand “Invader ID” By Deploying Tiles in Chesapeake Bay

BY STEPHANIE FOX



Each year thousands of invasive organisms cling to the bottoms of boats, traveling hundreds of miles to distant bays. It's difficult for scientists to investigate every invaded harbor. So researchers at the Smithsonian Environmental Research Center (SERC) are looking to citizen scientists for help.

Over the last year, volunteers assisted from the comfort of their homes, helping identify invasive species online. But this summer, a small group of citizen scientists will get their hands dirty doing experiments in Chesapeake Bay.

INVADER ID ON THE WEB

For over two decades, SERC's Marine Invasions Lab has deployed hand-sized panels in bays around the world to see what underwater creatures grew on them, watching carefully for invasive species. But time spent traveling from harbor to harbor, and photographing and inspecting each panel, was stretching scientists thin.

“We have an entire archive of unutilized resources in the photographs, but we don't have the manpower to go back and look [at them all],” said SERC biologist Brianna Tracy. “I'm talking thousands and thousands of photographs.”



That's why in spring of 2018, Tracy and fellow technician Katy Newcomer suggested uploading the photos onto Zooniverse, an online citizen science platform. They called their project Invader ID. For the pilot phase, they asked the public to help identify creatures on 200 tiles scientists had deployed in San Francisco Bay. So far, citizen scientists have finished about 80 percent of the identifications. Alison Cawood, SERC's citizen science coordinator, attributes the program's success to accessibility.

“You can do 15 or 20 images in five or 10 minutes, and that's a really helpful thing,” she said. “And anybody, anywhere, can do that.”

VOLUNTEERS TAKE TO THE DOCKS

They're taking the project one step further this summer. This year, citizen

scientists are deploying their own panels in Chesapeake Bay similar to ones biologists use.

First, volunteers must acquire their materials:

- A ceramic tile (often either sold for under \$1 or given away as free samples at home improvement stores)
- Rope (a few yards cost under \$5)
- A car dent remover (usually available for about \$7)
- A weight (purchasable at fitness stores for as little as \$5)

“Twenty dollars per set up is what we were going for,” Cawood said, though she noted prices vary by location.

For deployment, volunteers stick the dent remover to the tile and tie a weighted rope around the dent remover. The entire contraption gets tied to a local harbor and dropped into Chesapeake Bay. Three months later, the volunteers retrieve their tiles. If they followed the instructions correctly, the tiles should still be connected to the dent remover and (hopefully) covered with underwater creatures, ready to be photographed and uploaded to Invader ID.



The SERC team made sure to choose materials that can't do significant damage if volunteers lose any tiles.

“When a tile falls, it's fine. Those are made of natural materials. They generally will provide habitats. They're non-pollutants,” Newcomer said. The primary concern is losing the dent remover. To combat this, SERC plans to provide training materials to ensure proper deployment.

Cawood hopes to do a global launch of the project by 2020. If this Chesapeake trial succeeds, Invader ID could empower communities worldwide to catch invasive species before they take root.

Top L-R: Visitors to the Invader ID website try to identify creatures on panels from San Francisco like this one. (Credit: SERC); Technicians Brianna Tracy (pictured) and Katy Newcomer spearheaded the launch of the online version of Invader ID in spring 2018. (Credit: Kristen Minogue/SERC); Volunteer Sheren Riker assembled these two settlement panels on her dock at Church Creek. (Credit: Sheren Riker).

Donor Spotlight: David Gens Honors Late Wife's Passion for Fighting Invaders

BY KRISTEN MINOGUE

Rose Marie Ver Elst loved caring for local plants, and was willing to get her hands dirty to protect them from invasive species.

“She was so passionate about the invasive species that she pulled up several acres of invasive English ivy and Japanese maples in our community, single handed,” said her husband, David Gens. During her life Ver Elst also volunteered at SERC, until a back injury forced her to give up many of the outdoor activities she once enjoyed. When she passed away, Gens said the best tribute he could imagine



Rose Marie Ver Elst. (Courtesy of David Gens)

was to start an endowment at SERC dedicated to invasive species research.



Kaleigh Blair, the first intern sponsored by the Gens' new endowment, in SERC's warming gardens. (Credit: Jamie Pullen/SERC)

Gens donated \$100,000 this spring to create the Rose Ver Elst/Gens Family Endowment. SERC plans to use the money to fund intern research at its plant-based projects. This year the endowment is sponsoring Kaleigh Blair, a graduate student studying environmental anthropology. Blair is spending her summer with SERC's Terrestrial Ecology Lab, researching



Rose Marie Ver Elst (left) and her husband David Gens in Arizona in January 2010. (Courtesy of David Gens)

what shapes the public's perceptions of different invaders.

“I know that what she wanted was to continue her work,” Gens said of his wife. “I could think of no better way to keep her passion alive than to establish an endowment in her name, something that will last forever.”



647 Contees Wharf Road
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Upcoming Events

CHESAPEAKE MUSIC FESTIVAL

Saturday, September 14
2–6pm



(Credit: Nicole Campbell/SERC)

Celebrate the Bay's rich heritage in a festival dedicated to Chesapeake folk music! Enjoy songs and storytelling from local bands, while taking in the view from SERC's 18th-century mansion ruins overlooking the Bay. Food, beer and non-alcoholic beverages available for purchase. This is a zero-waste event, so we encourage participants to bring reusable water bottles.

\$20/car online | \$30 at gate. Cash only.

Details at

<https://serc.si.edu/chesapeake-music-festival>



(Credit: Mark Haddon/SERC)

EVENING LECTURES

Project Owlnet: Following the Secretive Journeys of Saw-Whet Owls

Tuesday, September 17 • 7–8pm | **Speaker:** Melissa Acuti, Maryland Department of Natural Resources | **Place:** Smithsonian Environmental Research Center, Schmidt Conference Center



(Credit: Chuck Fuller)

Maryland's smallest owl, the Northern Saw-whet, weighs less than a bar of soap yet travels thousands of miles over its life. Each fall these tiny birds pass through Maryland on their migrations. For the last two years, biologist Melissa Acuti has run a Project OwlNet station at SERC, staying up until midnight with volunteers hoping to tag them.

The Ocean: Our Future

Tuesday, October 15 • 6–9pm | **Speaker:** Jane Lubchenco, Oregon State University | **NEW PLACE:** St. John's College, Francis Scott Key Auditorium

Our grand finale lecture features marine biologist Jane Lubchenco, the first female administrator of NOAA. In this talk, Dr. Lubchenco will highlight solutions that are already underway to create a healthier ocean, and reveal how our health and prosperity are tied to the ocean's. Lecture begins at 7pm, with a dessert reception at 6pm. Free and open to all. This project received support from the Smithsonian American Women's History Initiative.



(Credit: NOAA)

Details at <https://serc.si.edu/visit/eveninglectures>

BECAUSE OF HER STORY

Smithsonian

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ON THE EDGE

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