

# 2023 Annual Report

A Year in Review

ENHANCING NATURE IN PUBLIC SPACES

## WHAT WE DO

Stroud Water Research Center produces the **trusted science** needed for successful stream and river conservation while fostering people's passion for the water in their lives.

## WHY WE DO IT

The future of clean fresh water depends on **unbiased research** to help people care for land and water.

## OUR PRIORITIES

1



**We are dedicated to clean water and healthy streams.**

Key findings about how to protect and restore rivers and streams are made possible by long-term research: 56 years in White Clay Creek, 33 years at the Maritza Biological Station in Costa Rica, and 15 years at the Stroud Preserve.

2



**We recognize water moves beyond boundaries**

In 2023, we reduced pollution into waterways through water-friendly practices on nearly 3,000 acres of farmland.

3



**We are globally active and globally relevant.**

In 2023, we authored 17 peer-reviewed scientific publications, expanding the reach of our research findings.

4



**We integrate research into all our actions.**

We created an education team in 1992 and a watershed restoration team in 2012 to put our research findings into action.

5



**We have seen change for the good.**

In 2023, we secured funding that enabled 252 best management practices for better land use.

# MESSAGE FROM THE EXECUTIVE DIRECTOR



IF YOU ARE LIKE ME AND MY FAMILY, you appreciate the natural beauty, wildlife, and recreation found in public outdoor spaces. At Stroud Water Research Center, we are proud of the partnerships we have built to inform stewardship of these spaces – from local schoolyards to national parks. Through these relationships, we apply our expertise in freshwater research to improve the conservation of streams and rivers.

Your support enhances our ability to bring our scientific findings to life for the benefit of everyone touched by shared natural spaces. In this annual report, you'll read about some of the ways we help sustain these spaces – from researching streams in the national parks of the National Capital Region, to developing outdoor classrooms, to restoring a stream in a Lancaster County park. All of the positive environmental changes this work yields are based on findings from our rigorous scientific research that your support makes possible.

I hope you enjoy this collection of highlights from 2023!

Executive Director, President, and Research Scientist

*“Are you bowed down in heart?*

*Do you but hear the clashing  
discords and the din of life?*

*Then come away, come to the  
peaceful wood,*

*Here bathe your soul in silence.”*

– JAMES WELDON JOHNSON, AUTHOR, POET,  
AND ORGANIZER FOR THE NAACP

what you  
can do

To learn about our latest work and to share it with others, sign up for our newsletter at [stroudcenter.org/subscribe](https://stroudcenter.org/subscribe) and follow us on social media.

# RESEARCH

**“ We can’t protect what we don’t understand. If we value our national parks, we have to invest in them, and part of that investment includes ecosystem monitoring to ensure that resource management decisions are based on the best available science.”**

**– LIZ MATTHEWS, Ph.D., PROGRAM MANAGER AND ECOLOGIST, NATIONAL PARK SERVICE**



## PRIORITIES





# Conserving National Park Streams

## Scientists Discover Threats to National Park Streams and What Park Managers Can Do About Them

By Daniel Myers, Ph.D., and Diane Huskinson

U.S. national parks are among the most treasured public outdoor spaces in the nation and even the world, drawing hundreds of millions of visitors to more than 400 parks annually. Within a couple hours' drive from Washington, D.C., are some of the most cherished and visited among them: visitors can exercise in the winding D.C. cityscape of Rock Creek Park, be mesmerized by the cool bubbling brooks of Maryland's Catoctin Mountain Park, and explore endless trails through the deciduous lowlands of Virginia's Prince William Forest Park.

People were reminded of the value of these parks during the height of the coronavirus pandemic, when isolation, lockdowns, and the fear of crowded indoor quarters brought an overwhelming urge to reconnect with the great outdoors.

In times of stress, national parks provide a sanctuary from the rush and clamor of everyday life. In times of celebration, they offer a pleasing backdrop for hikes, picnics, bird watching, bike rides, and fishing with friends. Without them, there would be few places where people of any means or background could still discover the vast and wild beauty of nature.

"If it weren't for these places, we would have forgotten what these landscapes used to look like and what we have actually lost elsewhere," says Marc Peipoch, Ph.D., assistant research scientist at Stroud Water Research Center.

Yet as wonderful as national parks are for solace and recreation, they can be equally valuable as ecological refuges for vulnerable fish, wildlife, plants, and water resources – if they are properly cared for.

"We naively think of national parks as having pristine, undisturbed streams," says Diana Oviedo Vargas, Ph.D., assistant research scientist at the Stroud Center. "However, stream ecosystems in national parks can be vulnerable to certain land uses and climate change, particularly when a stream's watershed extends beyond park boundaries."

Scientists Marc Peipoch and Laura Zgleszewski collect rock biofilm and sediment samples from a stream in Rock Creek Park in Washington, D.C.



To ensure the long-term conservation of national parks, including the streams that flow through them, park managers must know what ecological resources exist in the parks, what condition they are in, and how they are changing, for better or worse, over time.

Enter the Inventory & Monitoring (I&M) Division of the National Park Service. Established in the 1990s, this science-focused division encompasses 32 networks of parks across the United States.

In the National Capital Region, I&M has collected more than 15 years of water quality and biological data. However, limited in-house expertise in hydrology and aquatic ecology has made it challenging for I&M to analyze stream data and provide conclusions that would help park managers make informed decisions about aquatic resources.

#### A COLLABORATIVE APPROACH

Through cooperative agreements with the park service, the Stroud Center has been collaborating with I&M in the National Capital Region to support monitoring and analysis of park stream ecosystems.

Starting in 2019, Stroud Center scientists Stephanie Bernasconi, Laura Zgleszewski, and Kristen McCarthy spent a few weeks each summer wading into park streams to monitor fish and their habitats.

Stroud Center educators including Steve Kerlin, Ph.D., Kathryn Metzker, and David Kline also have been working with National Capital Region parks to enhance their watershed education programming.

“This is a very synergistic collaboration where we’re fulfilling a big need that the parks have,” says Oviedo, who leads the research collaboration.

Scott Ensign, Ph.D., assistant director and research scientist, explains, “The National Park Service can’t measure everything, everywhere, all the time. They have to be selective for the indefinite future; in addition to analyzing the data they have so far, we are helping I&M develop cost-effective stream monitoring.”

One aspect of the collaboration involves analyzing water quality data on pollutants such as salts from urban stormwater and nutrients from agricultural runoff in the watersheds upstream of the parks. After assisting with data clean-up and protocol refinement, Stroud Center scientists have begun analyzing nearly two decades of data about water quality in the region’s parks. Already, a story is emerging: some, but not all, of the park streams are suffering from salinization from the use of road salt in combination with historic stormwater runoff in these watersheds.

Further insights will come from the Stroud Center’s recent collaboration with NASA DEVELOP. During the summer of 2023, Goddard Space Flight Center scientists Zach Kinloch, Divina Lade, Haydee Portillo, and Xavier Garcia Lopez used NASA satellite data to understand how changing climate, seasonal vegetation cycles, and developing metropolitan areas are affecting water quality in the watersheds of the National Capital Region. The DEVELOP team’s findings will be shared with park managers to aid decision-making.

#### PROTECTING THE STREAMS

One thing is clear from this research: there’s a strong relationship between stream health and surrounding land use. It’s a finding echoed in many other discoveries made by Stroud Center scientists.

NASA satellite images like this one of Washington, D.C., taken by Landsat 9, can help scientists see how Earth’s land cover changes over time. In the summer of 2023, the Stroud Center collaborated with four NASA DEVELOP scientists to do just that – the team used satellite data to examine long-term changes in land cover, climate, and hydrology in the national parks of the National Capital Region.





In collaboration with the National Park Service, Stroud Center scientists have been monitoring fish habitat and analyzing water quality data from streams in some of America's favorite national parks. In addition to offering Washington, D.C., residents a beautiful outdoor escape, the parks support native plants and wildlife. Photos: (left) Laura Gooch, used under CC BY-NC-SA, flickr.com/photos/lgooch/6326360117; (right) NPS/Terry Adams; (below) Fritz Flohr Reynolds, used under CC BY-SA 2.0 Deed, flickr.com/photos/fritzflohrreynolds/15488191285

“Watersheds with more forest than development have better water quality and greater stream biodiversity. National parks protect forests and natural habitat; therefore, the more a watershed falls within a national park, the more potential there is for richer biodiversity and resilience to change,” says Ensign.

In the National Capital Region parks, the percentage of a stream’s watershed that is managed by the park service varies from 100% to less than 2%. Oviedo says future research could examine how much of a stream’s watershed must be protected within a national park to achieve desired outcomes in biodiversity, habitat, and water quality.

“The parks provide significant protection to stream habitats, but there may be a point at which they can’t provide any ecosystem services because the rest of the watershed is highly impacted by human activities,” she says. So what can park managers do to protect streams whose watersheds are mostly beyond park boundaries – when salt enters the water from surrounding cities and suburbs? As high salinity can be toxic for the fish, bugs, and other critters living in these streams, it is critical to understand potential ways to curb salt pollution.

According to Liz Matthews, Ph.D., program manager and ecologist for the park service, park managers might find success by engaging with stakeholders

and community groups in the watersheds upstream of the parks.

Matthews says, “We can describe the patterns found in the data, what’s happening in park streams, and recommend ways for park managers to reduce road salt use within parks and how they might partner with their local jurisdictions and neighbors to benefit entire watersheds.”

She adds, “We can’t protect what we don’t understand. If we value our national parks, we have to invest in them, and part of that investment includes ecosystem monitoring to ensure that resource management decisions are based on the best available science.”

Ultimately, scientific research within national parks also may help regain some of what’s been lost from nature elsewhere, as collaborations like the ones between the park service, the Stroud Center, and NASA DEVELOP help community groups apply lessons learned to both public and private landscapes closer to home.



Interested in monitoring water quality in your local area? [Email us at communitysci@stroudcenter.org](mailto:communitysci@stroudcenter.org) to become a community scientist today.

# EDUCATION

**“The outdoor science classroom brings learning to life for our students. The hands-on experience provides authentic learning opportunities and allows students to see the science all around them!”**

— THIRD-GRADE TEACHER, GREENWOOD ELEMENTARY



## PRIORITIES







As part of an initiative to help schools enhance their outdoor learning spaces, Stroud Water Research Center worked with teachers to design lessons that allow students to explore natural habitats such as the forest surrounding a woodland trail at Hillendale Elementary School and the meadow that's home to Carolina wrens at Greenwood Elementary School. Photos: (left) woodland trail by Joshua Leight; (right) Carolina wren by Ryk Naves, Unsplash



## Reimagining Classrooms

### How the Outdoors Can Become a School's Greatest Learning Space

By Diane Huskinson and Tara Muenz

The spring morning cheers of a male Carolina wren sounded through the meadow of Greenwood Elementary School's campus in southeastern Pennsylvania. "We detected it in the Merlin Bird ID app, and a song sparrow too!" whispered third-graders engaged in a habitat study lesson with Stroud Water Research Center educators.

Meanwhile, at another section of the campus, students sauntered along a woodland forest path, looking for evidence of life. "Who and what do you expect to find in this habitat?" asked Steve Mohapp, environmental educator. "How many different kinds of organisms do you notice?"

Throughout the morning, students studied the biodiversity of habitats, including a meadow, lawn, forest, and stream, all within their own schoolyard, which is one big outdoor learning space.

Greenwood is one of several schools that received financial and technical support from the Stroud Center in 2023, thanks to a grant from the Pa. Department of Environmental Protection, to enhance outdoor learning spaces.

#### WHAT IS AN OUTDOOR CLASSROOM?

These spaces, also known as living schoolyards or ecological schoolyards, are child-centered outdoor environments that enable place-based, hands-on learning while strengthening local ecosystems. They don't necessarily need to look like formal classrooms, with tables and chairs. They can exist as a schoolyard tree planting, a stream where students observe macroinvertebrates, or a native plant garden where they study pollinator species.



## Learning by Example

The Stroud Center in southeastern Pennsylvania offers opportunities for outdoor learning and serves as an inspirational campus for visiting educators seeking to create similar spaces at their schools.

At the outdoor learning laboratory, students work at cedar lab tables and learn in research teams to test water samples from the nearby creek. Another area has benches facing a whiteboard kiosk, where the teams discuss their data. There's also a pavilion with Scout-crafted tables and benches, electricity for plugging in microscopes and projectors, and stormwater management features.

These thoughtfully designed spaces allow educators to integrate the creek and streamside forest into lessons on freshwater ecosystems and how to protect them. At the same time, they keep students focused while outdoors, are accessible to those with mobility limitations, and reduce the risk of erosion by keeping students farther from the stream's edge.

School campuses can range from half an acre to thousands of acres, such as at large universities, and their potential to impact water quality in their local watershed is significant. Pavement or sprawling lawns can be transformed into more river-friendly landscapes like rain gardens, streamside forests, and wildlife meadows that better care for plants, animals, rivers, and streams. Plus, these spaces can be incorporated into lessons on ecosystems, human impacts, math, art, and more.

Stroud Center educators have been inspired by the scientists' research laboratories to create outdoor learning spaces that enable visitors to engage in real science through outdoor field studies. These active and participatory studies on the Stroud Center's

55-acre campus rely on lab-like tables for water chemistry testing and spaces designed to foster discussion for data synthesis. The fact that they are outdoors is key.

Joshua Leight, principal of Hillendale Elementary School, says, "Kids spend way too much time indoors right now. Our kids kind of grow up indoors, so the more we can bring them outside, the better." His school was another to receive support from the Stroud Center in 2023.

Taking students outside for more than just playtime first became popular in the early 20th century with the spread of tuberculosis, according to a 2020 article in *Smithsonian Magazine*. Its popularity waxed and waned in the decades that followed. More than a century later, the coronavirus pandemic again highlighted one of its benefits: fresh air. As educators looked for ways to safely bring students together, the Stroud Center's outdoor education programs became more popular than ever, and more teachers and administrators wanted to learn how they could create similar outdoor learning spaces on their school campuses.

## PROFESSIONAL DEVELOPMENT

Stroud Center educators responded by providing guidance, professional development, and resources to help them. In 2023, they supported about a half dozen public schools through the initiative. The demand continues, and more schools are joining the initiative in 2024.

Jennifer Braunstein, a teacher at Greenwood, is pleased with the support she received: "It was invaluable to work with the Stroud Center on not just the planning of the spaces but also on the outdoor lessons."

After walking through her school's campus with Stroud Center education staff, she realized that Greenwood's outdoor classrooms were surrounded by windowed school walls on all sides, "sort of in a fishbowl," she says, or they were in direct sunlight. The Stroud Center's support enabled Greenwood to purchase picnic tables that now sit farther away from the building and along the school's winding creek, where teachers deliver lessons on stream ecology.



“I love being out here and exploring. It reminds me of when we lived in Puerto Rico, and we explored the mountains.”

– FIFTH-GRADER, GREENWOOD ELEMENTARY SCHOOL



“I like bridges because they are sturdier, and the picnic tables are nice.”

– SECOND-GRADER, GREENWOOD ELEMENTARY SCHOOL

### OUTDOOR LEARNING INFORMED BY RESEARCH

There are many reasons why more time learning outside, in nature, is a good thing. The Stroud Center has documented some of them. In one study, Director of Education Steve Kerlin, Ph.D., and Nanette Marcum-Dietrich, Ph.D., from Millersville University found students experienced feelings of well-being when learning outside, and teachers reported that their students were more creative, collaborative, and better behaved and engaged.

Other studies have found similar benefits and more related to physical and mental health, as well as improved learning outcomes. As a result, the education landscape is changing. More schools, and nonformal education settings like nature centers, are creating their own outdoor learning spaces.

Kerlin says, “Outdoor learning puts the learner and the natural world at the center. People care for and protect what they value, and if we want our children to become good stewards of the natural world around them, we have to help them experience the outdoors and discover nature for themselves. Dedicated outdoor learning spaces are designed with this in mind and can be used to enhance all areas of learning – from science and math to social studies and language arts.”

Anthony Prinzo, Science Department chair at West Chester East High School, engaged students in the design process of their outdoor learning space with help from the Stroud Center. He says his school “is proud to state that our classroom was built 100% in-house by students and overseen by educators



Top: When students visit the Stroud Center, they enter a variety of intentionally created outdoor learning spaces and study the same stream that allows Stroud Center scientists to conduct long-term research. Bottom: The first cohort of educators to partner with the Stroud Center on enhancing outdoor learning spaces at their schools receive their certificates of completion.

and community members. It taught our students engineering and design processes, construction, and budgeting skills. Moreover, it has inspired other schools in the region to embark on similar initiatives, creating a ripple effect of environmental education.”

The ripple effect extends beyond southeastern Pennsylvania. The Stroud Center is advising state, regional, and national agencies and organizations on the creation and use of outdoor learning spaces and more related to environmental education. As more states seek to better utilize their school grounds for outdoor learning, the Stroud Center is leading the way, advising on best practices such as how to make outdoor learning more inclusive and accessible, while also benefiting the watershed.



For resources and tools that support the creation of outdoor learning spaces worldwide, including example conservation practices, [go to the Pennsylvania Gateway to Green website: pagatewaytogreen.org](https://pagatewaytogreen.org).

# WATERSHED RESTORATION

**“The success is not only cleaner water for the Little Conestoga and downstream. Having this buffer in such a visible space shows more people what's possible.”**

– ALLYSON GIBSON, EXECUTIVE DIRECTOR, LANCASTER CLEAN WATER PARTNERS



## PRIORITIES





# Transforming Local Parks

## Streamside Forest Project Enhances Fresh Water and Wildlife, Inspiring Sustainable Initiatives for a Cleaner Chesapeake Bay

By Diane Huskinson

With 140 acres of walking trails, athletic fields, playgrounds, a library and pool, and even a restaurant, Overlook Community Campus in Lancaster County, Pennsylvania, is a large and popular public space. The park is also home to a pilot project that's transforming eight of its acres into a highly visible demonstration site for how streamside forests can support wildlife and reduce water pollution.

Dog walkers, bicyclists, and every other kind of passerby on the adjacent path can see young trees peeking out of green tubes and an attractive pollinator garden filled with wildflowers. Many have stopped to ask questions, according to volunteers who maintain the site. What the volunteers and some educational signage tell them is that it's not only a space for nature to thrive but also for protecting clean water in their community and all the way down to the Chesapeake Bay.

Reducing water pollution in freshwater streams is a high priority and a challenge for Lancaster County. The agricultural hub has more miles of polluted streams than any other county in the state, according to the Pa. Department of Environmental Protection. It also contributes 21% of Pennsylvania's nitrogen load to the Chesapeake Bay, a stark number in a state that has fallen behind others in meeting a looming 2025 cleanup goal under the Chesapeake Bay Agreement.



Top: The Overlook Park streamside forest project is led and managed by Stroud Water Research Center, Manheim Township, and the Lancaster County Buffer Action Team. For a complete list of partners, go to [stroudcenter.org/overlook](https://stroudcenter.org/overlook). Photo: Brian Preston Photography. Left: A streamside forest and native plant garden take root at Overlook Community Campus. Photo: Rebecca Lauver



In 1992, Bern Sweeney, Ph.D., published the results of his research showing that tree shelters can increase the survival and growing speed of trees planted along streams, noting their role in a faster recovery of stream health.



Top: Lamonte Garber gives a public tour of the streamside forest and pollinator garden. Bottom: Young volunteers plant trees. Photos: Brian Preston Photography

Ashley Spotts, a restoration biologist for the Chesapeake Bay Foundation, says, "Public spaces should be the example of good land use whether it's on a farm, a private residence, or a business. Every stream in every park in Lancaster County should have a buffer."

Spotts represents one of Stroud Water Research Center's partners on the project at Overlook. Conservation professionals like her refer to the trees planted along waterways as riparian buffers for their ability to reduce the amount of fertilizer and other sources of pollution that wash off the land and into streams during storms.

The impact trees can have on water quality is significant. Stroud Center scientists have found that a 100-foot-wide buffer on each side of a stream can reduce nitrogen running off the landscape and into a stream by 26%, sediment by 50%, and pesticides by 60%.

Understanding that trees are critical to protecting clean water, Lancaster County has made streamside forests part of its pollution reduction strategy. Its Countywide Action Plan calls for the planting of 6,000 trees by 2025. Currently, only 11% of the land in Lancaster County is forested.

Lamonte Garber, the Stroud Center's watershed restoration coordinator, says the Overlook project will help the county reach its goal and serve as proof of concept for other townships that might consider adding buffers to public spaces. Lancaster County has 60 townships, each with its own local park system. Garber is working with some of them, and with local governments in other counties, to grow or start buffer programs.

The fact that Manheim Township could turn over an area of Overlook crawling with poison ivy to the care of others was a plus. In turn, it has donated maintenance support, mulch, and topsoil toward the project.

Bill Sauers, the township's director of public works, says, "It's an excellent project for the township to participate in. Our lift was pretty light, and it's going to be a dramatic change that people probably won't fully appreciate until years from now as it grows."

Ryan Davis, senior forest projects manager for the Alliance for the Chesapeake Bay, led nonprofit partners and volunteers in planting the first three of eight acres with about 600 trees in the spring of 2021. The Stroud Center and partners, led by Garber, planted the rest of the site the following year,



From left: Local residents Edward Kilbourn and his daughter, Cynthia Kilbourn, marvel at Overlook's native wildflower garden that will attract pollinators in the warmer months. Edward Kilbourn's generous donation covered all the costs for the planting and maintenance of the garden; volunteers plant a pollinator garden in front of the streamside forest at Overlook Community Campus; bee in pollinator garden (photo: Brian Preston Photography)

## Art in the Park

The streamside forest and pollinator garden at Overlook have played muse to local artists – thanks to events organized by Ashley Spotts of the Chesapeake Bay Foundation, and Matt Allyn Chapman and Nicole Duquette, who own an art gallery. Called *Made in the Shade Plein Air Art Making*, the events brought artists outside across three seasons to see the forest and garden grow and change.

Photos: Ashley Spotts and Matt Allyn Chapman



with funding from Pennsylvania's Department of Conservation and Natural Resources.

Today, the buffer has about 2,000 trees, all native species, such as silver maple, American sycamore, and pin oak. Still young and susceptible to deer and rodent damage, the trees are protected by green tubular shelters, a best practice that the Stroud Center was the first to study and launch in the United States along reforested streams.

There are also many shrubs, including cranberrybush and black chokeberry, and in front of the forest is a garden filled with nodding onion, purple coneflower, wild bergamot, and other wildflowers to attract bees and butterflies.

Volunteers led by the Stroud Center and its partners brought the forest and garden to life. Just a few years after the first planting, the beauty of the space has attracted attention.

Brenda Kauffman, one of the volunteers and a resident of Manheim Township, says she sees many people at the park walking with friends and family while she is weeding or inspecting the buffer on weekends. "They frequently ask questions, and they comment about how pretty it is," she says. "The project makes me feel proud. It makes me feel good, and I think other people feel good when they see it."

### RIPPLE EFFECT

## Taking your (volunteer) work home

The Overlook project inspired volunteers Brenda Kaufman and Wes and Linda Neumann to transform the spaces where they live.



"I pulled out all the English ivy and daylilies – although pulling out my irises was bittersweet – and I've now planted all natives. I added signage so neighbors can discover the benefits of a pollinator garden."

- BRENDA KAUFMAN



"In my retirement community, I had about 20 people come out and help, and in about two hours, we had live-staked probably 200 different species. The plants are growing, and it already looks nicer than it used to."

- WES NEUMANN

That is the kind of impact Allyson Gibson, executive director of the Lancaster Clean Water Partners, says the project partners were hoping for. She says that's especially true in public spaces, where manicured lawn is the dominant green space: "It's a shift in mindset that the look of a streamside planting is okay. It normalizes the look of a forest or meadow."

And that may be one of the biggest hurdles the project has overcome, says Garber: "When public spaces like Overlook bring back native trees and flowers around a stream, visitors discover what makes their local environment special and capable of supporting clean water and wildlife. They see how beautiful and ecologically rich a property can be compared to a traditional lawn, and it invites them to do something similar in their own spaces."

### learn more

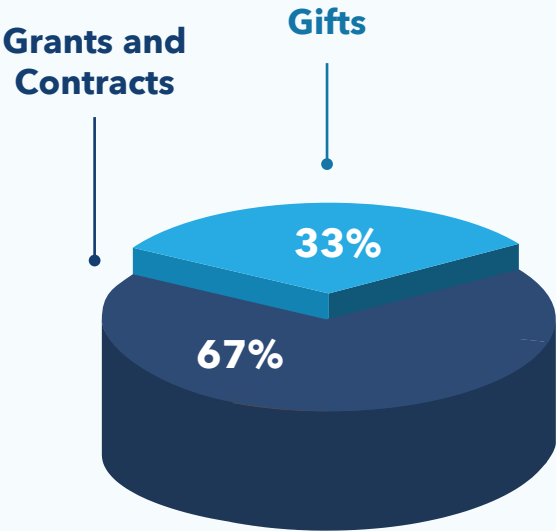
To partner with the Stroud Center and get help caring for your land and local stream, please contact us. [Email buffers@stroudcenter.org](mailto:buffers@stroudcenter.org) to discuss your project.

# A Lasting Commitment

When grant funding reaches the end of its lifespan, our commitment to the work endures. How do we continue our efforts past the original project funding?

With your support.

Donations sustain long-term projects, provide infrastructure and equipment that enable us to carry out our mission, and allow us to initiate pilot projects as we examine new research questions. Every dollar counts. Thank you for your support!



# Research Projects

Note: Research, education, and watershed restoration projects listed were active in 2023. Stroud Water Research Center scientists and staff are indicated in bold.

## Stream Health

### Assessment of Environmental Conditions in Bennett’s Run, Brandywine Creek

**Funded by:** Phoebe A. Driscoll and the Phoebe Internship Fund  
Water chemistry, temperature, aquatic macroinvertebrates, and fish are being monitored in Bennett’s Run, a small tributary to Brandywine Creek in southern Chester County, Pa., to provide critical data in support of a watershed conservation plan.

**Principal Investigators:** **John K. Jackson** and **Bernard W. Sweeney**

### Brandywine Stream Stewards: Community Action in Support of Healthy Waters

**Funded by:** William Penn Foundation  
Engaging adults and youth from Wilmington, Del., the Stream Stewards Program monitors water resources in the 1,100 acres of open space in the First State National Historical Park. The Stroud Center supports the program through community science training and resources that lead to conservation and improved management of land and water resources.

**Principal Investigators:** The Nature Conservancy – Pennsylvania/Delaware Chapter; **John K. Jackson** and **Matthew J. Ehrhart**

**Collaborators:** **Jinjun Kan**, **Melinda D. Daniels**, and **David B. Arscott**

### Consortium for Scientific Assistance to Watersheds

**Funded by:** Pa. Department of Environmental Protection’s Growing Greener Program

Education, research, and watershed restoration staff provided technical assistance to statewide conservation groups in effective watershed assessment, monitoring, and restoration.

**Project Leads:** **Scott H. Ensign**, **David B. Arscott**, **Steven C. Kerlin**, and **Tara K. Muenz**

**Collaborating Organizations:** Alliance for Aquatic Resource Monitoring at Dickinson College, Conemaugh Valley Conservancy, Del. Riverkeeper Network, Pa. Lake Management Society, U.S. Geological Survey, and Pocono Northeast Resource Conservation and Development Council

### Evaluating and Updating Data Collection Protocols in National Parks of the National Capital Region

**Funded by:** National Park Service  
The National Park Service has monitored stream water quality and quantity for more than 15 years in shallow streams located in 10 parks of the National Capital Region Network. This project analyzes the complex dataset for trends and watershed health while suggesting updates to methods deployed in the field and during analysis.

**Principal Investigators:** **Diana Oviedo Vargas**, **Marc Peipoch**, **Melinda D. Daniels**, **Jinjun Kan**, and **Scott H. Ensign**

### Macroinvertebrate Monitoring at Sites in White Clay Creek, Pa., Flint River, Ga., Susquehanna River, Pa., and Delaware River, Pa.

**Funded by:** Various public and private sources  
These projects use aquatic macroinvertebrates such as mayflies, stoneflies, and caddisflies to provide assessments of current water quality in these streams and rivers. Where long-term data are available, the most recent conditions are compared to historical conditions.

**Principal Investigator:** **John K. Jackson**



## Molecular Ecology of Archaea in Aquatic and Terrestrial Environments

**Funded by:** Southern University of Science and Technology (SUSTech) in China and Stroud Water Research Center

Less is known about archaea than the other two domains of life on Earth (bacteria and eukarya), particularly the role they play in ecosystem functions and nutrient cycling (e.g., ammonia oxidation). Applying cutting-edge molecular approaches, this project characterizes community composition and spatiotemporal distribution of archaea in White Clay Creek, Costa Rica, the Chesapeake Bay, and terrestrial environments.

**Principal Investigator:** Jinjun Kan

**Collaborating Organization:** SUSTech

## Food and Agriculture



### Agriculture Viromes in Farming Systems: Effects on Microbiome Assembly, Function, and Crop Production

**Funded by:** U.S. Department of Agriculture

This research explores how viruses function within the microbiomes of agricultural soil and investigates their impact on soil health and crop productivity.

**Principal Investigator:** Jinjun Kan

**Collaborating Organizations:** College of William and Mary and University of Georgia

### Anthropogenic Legacies: How Riparian Soils Respond to Human Disturbance

**Funded by:** U.S. Department of Agriculture

This study investigates the physical, biogeochemical, and microbial characteristics of novel anthropogenic soils that have accumulated in the valley bottoms of the mid-Atlantic U.S. due to the coupled effects of historic soil erosion and sediment trapping by milldams. Responses following milldam removal are also being studied.

**Principal Investigators:** Jinjun Kan and Marc Peipoch

**Collaborating Organization:** University of Delaware

### Biochar as a Nutrient Removal Tool on Farms

**Funded by:** William Penn Foundation and Lancaster Clean Water Partners

Researchers are studying how well biochar works in engineered structures to remove excess nutrients from runoff on agricultural fields. Results will help determine to what degree, if any, biochar can prevent surface water pollution.

**Principal Investigator:** Diana Oviedo Vargas

**Collaborating Organization:** Brandywine Conservancy

### Biological Nitrogen Removal in Sediment Plumes: A Critical but Missing Component of Watershed Models

**Funded by:** U.S. Department of Agriculture

During storms, sediment plumes play a crucial role in the export of nutrients from rivers. This project investigates the changes in nutrient concentrations within these plumes. Understanding how biological processes alter nutrient concentrations will help improve watershed management models and identify which methods of reducing nutrient pollution are most effective in agricultural watersheds.

**Principal Investigators:** Marc Peipoch and Jinjun Kan

**Collaborating Organization:** University of Delaware

## Evaluating How Conventional, Conservation, and Organic Farming Management Practices Enhance Soil Health and Improve Water Quality

**Funded by:** William Penn Foundation

This project investigates how different agricultural management practices influence water quality and soil health. Using Rodale Institute's 37-year-old Farming Systems Trial and a recent transition to organic farming at the Stroud Preserve, it examines the effect of farming techniques on water infiltration, runoff, and the export of nutrients, contaminants, and sediment. Results will inform practices that can reduce water pollution and flooding in the Delaware River watershed.

**Principal Investigators:** Jinjun Kan, Melinda D. Daniels, Diana Oviedo Vargas, Marc Peipoch, David B. Arscott, Matthew J. Ehrhart, and Bernard W. Sweeney

**Collaborating Organizations:** College of William and Mary, Rodale Institute and University of Georgia

### Evaluating the Risk for PFAS Contamination of Surface and Groundwater Through Application of Biosolids in Agroecosystems

**Funded by:** Foundation for Food and Agricultural Research

Scientists are investigating whether biosolid application on Pennsylvania farms represents a significant source of PFAS in soils and water. Per- and polyfluoroalkyl substances, commonly called PFAS, are a group of thousands of chemicals that are used in a wide range of industrial applications and represent a risk to human health. The application of contaminated biosolids on farm fields can result in the contamination of soils and adjacent surface waters.

**Principal Investigators:** Diana Oviedo Vargas and Matthew J. Ehrhart

**Collaborating Organization:** Science, Technology and Research Institute of Delaware (STRIDE)

### Exploring the Link Between Soil and Human Health: Protein, Protein Quality, and the Nutraceutical Amino Acid Ergothioneine

**Funded by:** Foundation for Food and Agriculture Research

Ergothioneine, an amino acid that has scientifically proven benefits to human health, is exclusively biosynthesized by



From left: Jan Battle and Dave Arscott of the Stroud Center and Brijilio Bolon and Peter Kjellerup of Silk Grass Farms examine a stream's health in Belize. The Stroud Center is working with Silk Grass Farms to evaluate and protect local water quality. Photo: Yeda Arscott

fungi and certain bacteria in soils. With coupled field testing and lab incubation experiments, this project investigates how soil microbes synthesize and transform ergothioneine from soil to products under different farming practices.

**Principal Investigator:** Jinjun Kan

**Collaborating Organizations:** Rodale Institute, University of Delaware, and U.S. Department of Agriculture

### **Impact of Land Management on Vegetable Yield and Post-Harvest Nutrient Density**

**Funded by:** Pa. Department of Agriculture and Grantham Foundation

By examining the bacteria, archaea, and fungi living in soils, this project will provide insights into the impact of farming practices and land management on the microbes that make soils healthy. This information will help improve guidelines for growing squash and managing nutrients on farm fields.

**Principal Investigator:** Jinjun Kan

**Collaborating Organizations:** Purdue University and Rodale Institute

### **Impact of Pesticides on Soil and Vegetables Grown in Organic and Conventional Systems in a Long-Term Vegetable System Trial**

**Funded by:** Pa. Department of Agriculture

This project examines microbial soil health by studying the detailed community structure of bacteria and fungi. It also explores how the use of pesticides affects microbial structure in both conventional and organic cropping systems.

**Principal Investigator:** Jinjun Kan

**Collaborating Organizations:** Penn State University and Rodale Institute

### **Soil Microbes and Bean Nutrients in Organic and Conventional Systems**

**Funded by:** Pa. Department of Agriculture

Little is known regarding soil microbes and nutrition levels in vegetables under various farming practices. This project measures soil microbial community structure, extracellular enzyme activity, and nutrient density in green and black beans cultivated using conventional versus organic farming methods.

**Principal Investigators:** Jinjun Kan and Diana Oviedo Vargas

**Collaborating Organizations:** Purdue University and Rodale Institute

## **Climate and Flooding**



**NEW**

### **Brandywine Flood Study**

**Funded by:** Chester County Resources Authority, Delaware County Council

The study focuses on reducing flooding along the main stem of the Brandywine Creek. It will identify areas prone to chronic flooding and develop hydrologic and hydraulic watershed models using the U.S. Army Corps of Engineers' Hydrologic Engineer Center's River Analysis System. The study will offer recommendations for both structural and nonstructural solutions to reduce flooding.

**Principal Investigators:** Brandywine Conservancy; University of Delaware Water Resources Center; **Melinda D. Daniels** and **David B. Arcott**

**Collaborating Organizations:** West Chester University, Meliora, Biohabitats, and CDM Smith

### **Tidal Rivers Biofingerprinting Sediment: Resolving Sediment Connectivity Between Rivers and Estuaries by Tracking Particles With Their Microbial Genetic Signature**

**Funded by:** National Science Foundation

This project explores how the molecular characteristics of microbes attached to sediment particles can help identify the sources of sediment in estuaries. The broader impacts include the creation and pilot of high school curricula.

**Principal Investigators:** Scott H. Ensign and Jinjun Kan

**Collaborators:** Steven C. Kerlin and Tara K. Muenz

## **Clean Water**



### **Dynamics of Phytoplankton Growth and Transport in River Networks From Local to Continental Scales**

**Funded by:** National Science Foundation

Researchers examine how fluctuations in river algae levels during river floods can help identify the impact of nitrogen and phosphorus on the Delaware River and other rivers in the United States.

**Principal Investigators:** Marc Peipoch, Scott H. Ensign, and Melinda D. Daniels

**ENDOWMENT**

### **Ecotoxicity Study for Mayflies Exposed to Elevated Concentrations of Chloride at Different Temperatures**

**Funded by:** Pa. Department of Environmental Protection and Stroud Water Research Center

In recent decades, chloride levels in surface waters across the United States have been rising, posing threats to aquatic organisms. This project uses laboratory experiments with four mayfly species exposed to elevated chloride concentrations and temperatures ranging from 5–25 degrees Celsius to determine lethal and sub-lethal impacts on mayfly metabolism.

**Principal Investigators:** John K. Jackson and David H. Funk

**ENDOWMENT**

### **Microbial Population Dynamics of Periphyton Biofilms in White Clay Creek**

**Funded by:** Stroud Water Research Center

Under natural conditions, this project grows biofilms at three different stream reaches to understand how differences in stream vegetation affect microbial community assembly and their distribution.

**Principal Investigator:** Jinjun Kan

### **Microbial Population Monitoring in Red Clay Creek**

**Funded by:** Nyssa Foundation

Scientists monitor fecal indicator bacteria on a monthly basis in the East and West branches of the Red Clay Creek Watershed.

**Principal Investigator:** Jinjun Kan

### **Recovery of Nutrient Processes and Microbial Communities in Relict Hydric Soils Following Restoration**

**Funded by:** U.S. Department of Agriculture

This research explores how microbes and biogeochemical



Since he was 8, Entomologist Dave Funk has been fascinated by bugs. He spent nearly 50 years helping to put Stroud Water Research Center on the global map with his work in freshwater insect biology and macro photography. He retired in January 2024.

processes in buried relict soils change after floodplain restoration and how these organisms and processes can be harnessed to remove nitrogen before it pollutes streams. This will help practitioners design restoration projects with conditions that fast-track microbial recovery and nitrogen processing.

**Principal Investigators:** Jinjun Kan and Marc Peipoch  
**Collaborating Organization:** University of Delaware

### **Saturated, Suffocated, and Salty: Hotspots of Dissimilatory Nitrate Reduction in Anoxic Riparian Soils**

**Funded by:** National Science Foundation

Riparian soils above low-head dams (milldams) usually contain large amounts of bioavailable nitrogen that could impair the adjacent streams if it becomes mobilized. This project investigates the origin of the nitrogen stored in the riparian soils above milldams, the dominant processes controlling its transformation, and its risk of being released into the stream.

**Principal Investigators:** Marc Peipoch and Jinjun Kan  
**Collaborating Organizations:** Berkeley National Laboratory and University of Delaware

### **Monitoring Harmful Algal Blooms in Two Reservoirs Serving the City of Wilmington, Del.**

**Funded by:** City of Wilmington

Researchers deploy and maintain two sampling buoys to gather real-time data on algae populations in two Wilmington, Del. reservoirs. Data will be used to predict and prevent the development of algal blooms.

**Principal Investigator:** Marc Peipoch

### **Using Microbial Source Tracking to Identify Potential Bacterial Sources in White Clay Creek**

**Funded by:** City of Newark, White Clay Watershed Association, and White Clay Creek Wild and Scenic River Program

Scientists monitor fecal indicator bacteria in White Clay Creek during summer and identify potential bacterial contamination by molecular microbial source tracking. The goal is to determine where the bacteria likely come from and which best management practices and implementation strategies are most effective.

**Principal Investigators:** Jinjun Kan  
**Collaborating Organization:** White Clay Creek Wild and Scenic River Program

## Land Use and Restoration Impacts



### **Watershed-Scale Evaluation of Restoration Practices on Water Quality Improvement**

**Funded by:** Pa. Department of Agriculture

To evaluate how barnyard management and other watershed restoration practices improve stream health and water quality, scientists are monitoring nutrient and sediment loads and macroinvertebrates before, during, and after implementation.

**Principal Investigators:** Diana Oviedo Vargas, Jinjun Kan, Melinda D. Daniels, John K. Jackson, Marc Peipoch, and Matthew J. Ehrhart

### **Land Protection Impact Assessment in Support of Delaware River Watershed Initiative**

**Funded by:** Open Space Institute and William Penn Foundation

This project tests the idea that preserving natural land (primarily forests) helps keep streams healthy. It does this by limiting, preventing, or redirecting changes to land cover and use away from headwaters, stream buffers, and wetlands.

**Principal Investigators:** John K. Jackson, Charles L. Dow, and David B. Arscott

**Collaborating Organizations:** Academy of Natural Sciences of Drexel University, Shippensburg University

### **Long-Term Research in Environmental Biology: River Ecosystem Responses to Floodplain Restoration**

**Funded by:** National Science Foundation

After 25 years of litigation, a massive ecological restoration is underway in the Upper Clark Fork River, Mont. Metal-laden floodplain soils are being removed, floodplains are being reconnected with river floods, and over 70 kilometers of floodplains are being restored. This project uses long-term monitoring data to discover how river ecosystem structure and function respond to changing nutrient concentrations and large-scale floodplain restoration. By testing fundamental theories and frameworks of ecology, these discoveries will guide future river restorations.

**Principal Investigator:** Marc Peipoch  
**Collaborating Organizations:** Montana State University and University of Montana

## Literature Review: Building Climate Resilience in Stream Restoration Practices

**Funded by:** Chesapeake Bay Trust

This review of published peer-reviewed research identifies river restoration techniques that effectively mitigate climate change impacts.

**Principal Investigators:** Melinda D. Daniels and Marc Peipoch

## Pohatcong Township, N.J.: Watershed Restoration and Protection Plan

**Funded by:** New Jersey Highlands Council

This project will develop a watershed restoration and protection plan with the goal of improving the waterways of Pohatcong Township, N.J. for the New Jersey Highlands Council.

**Principal Investigator:** Laura Craig, Engineering & Land Planning Associates

**Collaborator:** David B. Arscott

## Tropical Ecosystems



### **NEW** Knowledge and Stewardship of Freshwater Ecosystems in Costa Rica and Around the World

**Funded by:** Tupper Family Foundation

This project contributes to ongoing operations, monitoring, and synthesis of long-term research at Maritza Biological Station in Costa Rica. Seed funding advances collaborations between the Stroud Center and the Smithsonian Tropical Research Institute. In partnership with locally-based nonprofit partners such as ConnectOcean, it also expands education opportunities for youth in the Área de Conservación Guanacaste.

**Principal Investigators:** David B. Arscott, Nicole Wickenhauser, Diana Oviedo Vargas, John K. Jackson, and Steven C. Kerlin

### **NEW** Silk Grass Farms Water Resources Assessment

**Funded by:** Cabot Kjellerup Foundation

This project evaluates water resources at Silk Grass Farms in Belize through physical, biological, and chemical indicators and identifies potential activities at the farms that may be degrading or improving the quality of the water resources.

**Principal Investigators:** Diana Oviedo Vargas, Melinda D. Daniels, John K. Jackson, Jinjun Kan, and Marc Peipoch

## Biodiversity and Wildlife Habitat



### Monitoring Fish Populations and Stream Habitat Quality for the National Park Service

**Funded by:** National Park Service

This project monitors biological conditions, water quality, habitat integrity, and fish at 37 sites in 10 national parks in the National Capital Region Network around Washington, D.C. The National Park Service will use the findings of this project to inform conservation and management decisions in the parks.

**Principal Investigators:** Marc Peipoch, Melinda D. Daniels, Diana Oviedo Vargas, John K. Jackson, Jinjun Kan, and Scott H. Ensign

### North American Macroinvertebrate Taxonomic Certification Program

**Funded by:** Society for Freshwater Science

This program coordinates and executes the taxonomic certification program for the Society for Freshwater Science, conducting family- and genus-level tests throughout the year.

**Principal Investigators:** John K. Jackson and Bernard W. Sweeney

**Collaborator:** Michael C. Broomall

### Where Are the Brook Trout? Novel Application of eDNA to Locate Infrequent Species

**Funded by:** Trout Unlimited

Scientists are using environmental DNA to determine whether wild brook and brown trout populations are in streams near the Stroud Center, including in streams where watershed restoration practices have been implemented. eDNA is released from organisms into the land, air, and water.

**Principal Investigator:** John K. Jackson

### White Clay Creek Fish Passage Assessment

**Funded by:** White Clay Creek Wild and Scenic

This project examines whether the lower White Clay Creek in Delaware provides suitable habitat for migratory fish like American shad.

**Project Lead:** Melinda D. Daniels

## Education Projects

### Community Outreach



#### Aquatic Macroinvertebrates on Location

**Funded by:** Pa. Department of Environmental Protection and Anonymous

For this project, Stroud Center educators create aquatic macroinvertebrate touch tanks to create effective, culturally responsive, and inclusive learning environments for all audiences. Throughout the year, they provided the programming at community events. They also provided support to audiences in the Oxford, Pa., region.

**Project Lead:** Tara K. Muenz and Steven C. Kerlin



Children and adults engage with a touch tank to discover live macroinvertebrates.



A.



B.



C.

(A) HerStory in STREAM participants carry a canoe. (B) Girl Scouts record stream data at Cobbs Creek Community Environmental Center during a STREAM Girls program in partnership with Valley Forge Trout Unlimited. (C) A teacher from Red Clay Consolidated School District makes rain fall on an experimental watershed model – one of the Stroud Center's teaching tools.

### First People of the First State: Restoring Our Ancestral Watershed

**Funded by:** National Geographic Society

This project bridges Indigenous wisdom and environmental stewardship with science education to support conservation efforts in the Lenape's ancestral watershed of the Leipsic River.

**Project Leads:** Chief Coker, Jon Cox, and **Tara K. Muenz**

**Collaborators:** Simon Purchase James

### Leaf Pack Stream Ecology Kit and International Network

**Funded by:** Stroud Water Research Center and Anonymous

This bilingual international program engages students, teachers, families, and the public in water quality monitoring through the lens of aquatic macroinvertebrates.

**Project Lead:** **Tara K. Muenz**

**Collaborator:** **Steven C. Kerlin**

### On-the-Water Watershed Education Programs

**Funded by:** National Park Trust, Pa. Educational Improvement Tax Credit Program, Pa. Fish and Boat Commission, and Program fees

To provide equitable access to safe outdoor aquatic recreation, raise awareness of related careers, and foster environmental awareness, Stroud Center educators take Scouts, school groups, and public audiences on the water for fishing and canoeing programs.

**Project Leads:** **Steven C. Kerlin** and **Tara K. Muenz**

**Collaborators:** **David Kline, Kathryn Metzker,** and **Steve Mohapp**

### Seneca Nation Water Protectors

**Funded by:** Bureau of Indian Affairs

Educators engaged with and empowered youth to become Water Protectors in the Allegany and Cattaraugus territories through summer camp programming.

**Project Leads:** Mike Gates (Seneca Nation Department of Emergency Management); **Tara K. Muenz**

**Collaborators:** Simon Purchase James, **Kathryn Metzker,** **Steve Mohapp,** and **Mary Paxton-Boeni**

### Source to Sea Explorer Curriculum

**Funded by:** Stroud Water Research Center and Anonymous  
Stroud Center educators are collaborating with ConnectOcean to create a Source to Sea curriculum that will be distributed internationally to schools and scuba diving centers.

**Project Leads:** Ernst van der Poll (ConnectOcean); **Kathryn Metzker**

**Collaborators:** **David B. Arscott, Steven C. Kerlin,** **Tara K. Muenz,** and **Mary Paxton-Boeni**

### STEM Education and Independent Research Projects for Youth

With ongoing support from our donors, Stroud Center educators deliver programming to underserved populations in environmental STEM. Partnering with organizations from the Harambee Institute of Science and Technology Charter School, Mighty Writers El Futuro, The Garage Youth Support Center, and Scouts BSA and Girl Scouts makes these programs particularly important in reaching marginalized communities. Working with communities of color, socioeconomically disadvantaged populations, women and girls, English language learners, and others disproportionately harmed by environmental injustice, the programming provided through these efforts is building long-term friendships and engaging a more diverse suite of students in environmental sciences.

### Watershed-Based Climate Change Education in the White Clay Creek Watershed

**Funded by:** National Park Trust

With a theme of climate change literacy within the White Clay Creek watershed, this project delivers a series of canoeing, angling, and Watershed Education Mobile Lab programs to engage marginalized youth, their families, and educators in recreation and stewardship through watershed STEM.

**Project Leads:** **Steven C. Kerlin** and **Tara K. Muenz**

**Collaborating Organizations:** National Park Service, White Clay Creek Wild and Scenic River Program, and White Clay Watershed Association



### Environmental Literacy and MWEE Capacity Building in Delaware School Districts

**Funded by:** Del. Sea Grant and NOAA

This project strengthens state and school district capacity to integrate environmental literacy (E-LIT) and Meaningful Watershed Educational Experiences (MWEEs) into learning for Delaware students. Collaborators create a Delaware MWEE Facilitator Guide and work directly with Caesar Rodney and Appoquinimink school districts and Sussex Montessori Charter School in Delaware to expand environmental education and develop E-LIT plans that serve as models for other districts.

**Project Lead:** David Christopher (Del. Sea Grant)

**Collaborators:** Steven C. Kerlin and David Kline

**Collaborating Organizations:** Del. Department of Education, Del. Nature Society, and Del. Association for Environmental Education

### Building Sustainable and Equitable Capacity Support Systems Towards Environmental Literacy for All K-12 Audiences Across Pa.

**Funded by:** National Oceanic and Atmospheric Administration and Pa. Department of Education (PDE)

This 2022–2024 statewide project builds capacity for environmental literacy and stewardship of the Chesapeake Bay and other watersheds in Pennsylvania by expanding the inclusion and implementation of environmental education (EE), particularly Meaningful Watershed Educational Experiences, in schools through the establishment of the PA E-Lit Network and six regional E-Lit support hubs. PDE supported updates to the Pa. Gateway to Green website and creation of an online course to further support EE providers, such as classroom teachers, nonformal educators, and guardians/caregivers.

**Project Leads:** Tamara Peffer (Pa. Department of Education); Steven C. Kerlin; Michelle Niedermeier (Pa. Sea Grant Program)

**Collaborators:** Steve Mohapp, Heather Brooks, Millersville University, Pa. Association of Environmental Educators, Pa. Bureau of State Parks, Pa. Department of Agriculture, Pa.



Teachers measure water quality during a workshop exploring the impacts of climate change on tidal wetlands in April 2023. Stroud Center scientists and educators led the workshop in collaboration with ShoreRivers at the Chesapeake Bay Environmental Center in Maryland.

Department of Education, Pa. Department of Environmental Protection, Pa. Intermediate Units, and Penn State Extension

### GIS-Based Professional Development: Helping K-12 Teachers Overcome Obstacles Due to COVID-19

**Funded by:** Pa. Sea Grant and National Oceanic and Atmospheric Administration

This project builds capacity and advances environmental literacy efforts that integrate geospatial technology use among educators in the Lake Erie, Susquehanna River, and Delaware Estuary watersheds. Partners are developing, implementing, and researching a professional development module that encourages the use of GIS to support watershed-based inquiry practices in times of physical distancing and limited mobility.

**Project Leads:** Tamara Peffer (Pa. Department of Education), David Kline, and Michelle Niedermeier (Pa. Sea Grant)

**Collaborator:** Steven C. Kerlin

### Watershed Awareness Using Technology and Environmental Research for Sustainability (WATERS)

**Funded by:** National Science Foundation

For this project, educators develop and pilot a new national curriculum and extensive learning resources using principles of universal design for learning in California, Pennsylvania, and Virginia, with special attention to students who are English language learners.

**Project Leads:** Steven C. Kerlin, Nanette Marcum-Dietrich (Millersville University), and Carolyn Staudt (Concord Consortium)

**Collaborators:** Melinda D. Daniels, Diana Oviedo Vargas, David Kline, and Tara K. Muenz

### Improving Student and Teacher Engagement With National Parks of the Potomac River Watershed

**Funded by:** National Park Service (NPS)

Using a mix of methods, Stroud Center educators provide recommendations for the future of NPS watershed education. Data gathering efforts include a survey of schools in the D.C. metro region, interviews with school and NPS staff, and site visits to national parks.

**Project Lead:** Steven C. Kerlin

**Collaborators:** Nanette Marcum-Dietrich, David Kline, and Kathryn Metzker

### **NEW** Watershed Education Programs in Parochial Schools in the Greater Philadelphia Region

**Funded by:** Connelly Foundation

Professional development for teachers and K-12 field study experiences in watershed education for schools within the Archdiocese of Philadelphia.

**Project Leads:** Steven C. Kerlin

### Professional Development for School District of Philadelphia (SDP) Teachers Leading After-School Enrichment (ASE) Programs

**Funded by:** School District of Philadelphia

This project assists SDP teachers leading outdoor and environmental ASE programs by providing ongoing professional development, support, and resources. The Stroud Center and four partnering organizations provide programming at each participating school to engage students and model activities.

**Project Leads:** Steven C. Kerlin, Kathryn Metzker, and Steve Mohapp

**Collaborators:** Let's Go Outdoors, LandHealth Institute, Pa. Sea Grant, Riverbend Environmental Education Center, Schuylkill Center for Environmental Education, Pa. Department of Education

### Water Quality Monitoring of Shipetaukin Creek

**Funded by:** Fair Play Foundation

Educators are partnering with The Lawrenceville School to create and implement opportunities for students to study water quality impacts on the school campus using EnviroDIY™ Monitoring Stations.

**Project Leads:** Steven C. Kerlin, Tara K. Muenz, and Stephen Laubach (The Lawrenceville School)

**Collaborator:** David Bressler

## Outdoor Learning Spaces

### Habitat Restoration and Outdoor Education in the Caesar Rodney School District

**Funded by:** National Fish and Wildlife Foundation

This project restores underutilized space on 10 public school campuses within the Caesar Rodney School District in Delaware, providing benefits to wildlife and water quality, as well as meaningful outdoor learning opportunities for teachers and their pre-K-12 and special needs students.

**Project Lead:** Todd Klawinski (Caesar Rodney School District)

**Collaborators:** Steven C. Kerlin, Tara K. Muenz, David Kline, Del. Nature Society, and U.S. Fish and Wildlife Service

### Habitat Restoration and Outdoor Education in the Red Clay Consolidated School District (Del.)

**Funded by:** National Fish and Wildlife Federation

Underutilized space on six school campuses within the school district is being restored through student-led Green Teams, district staff, and a network of community partners. The project benefits wildlife and water quality, and it enables meaningful outdoor learning opportunities for teachers, students pre-K-12, and parents.

**Project Lead:** Brian Mattix (Red Clay Consolidated School District)

**Collaborators:** Steven C. Kerlin, Tara K. Muenz, and Del. Nature Society

### Improving Schoolyards and the Stroud Center for Outdoor Environmental Education and Stewardship Across Southeast Pa. (Cohorts 1 and 2)

**Funded by:** Pa. Department of Environmental Protection and E. Kneale Dockstader Foundation

Educators collaborated with local schools and school districts to design and construct outdoor learning spaces on school grounds while creating lessons tailored to each outdoor learning space. With the help of Stroud Center research staff, educators are designing and creating outdoor stream tables to aid student discovery of stream and hydrology concepts.

**Project Leads:** Steven C. Kerlin and Tara K. Muenz

### Lancaster Area Outdoor Learning Network Initiative

**Funded by:** Chesapeake Bay Trust

Educators planned and delivered teacher professional development in watershed education content and skills for Conestoga Valley, Ephrata, and Columbia school districts in Pennsylvania.

**Project Lead:** Sallie Gregory (Lancaster County Conservation District)

**Collaborators:** Steven C. Kerlin, Tara K. Muenz, Conestoga Valley School District, and Lawrenceville School Partnership for Student Water

### Pathways to Education: Improving Safety and Accessibility to Outdoor Watershed Education

**Funded by:** E. Kneale Dockstader Foundation

Stroud Center educators are enhancing accessibility and safety for on-site participants in Stroud Center education programs. Completed improvements, including streamside trail redesign and signage, will remove barriers to participation for visitors with physical challenges.

**Project Lead:** Steven C. Kerlin

## Student Programs

### Costa Rica Study Abroad

**Funded by:** Virginia Wesleyan University

Students from Virginia Wesleyan University in Virginia Beach joined the Stroud Center for one week in the Área de Conservación Guanacaste region of Costa Rica for an immersive study-away experience.

**Project Leads:** Kathryn Metzker, Steven C. Kerlin, and Diana Oviedo Vargas

**Collaborators:** Virginia Wesleyan University

### Delivering Meaningful, Safe, and Accessible Watershed Education

**Funded by:** Brown Brothers Harriman, CCRES Educational and Behavioral Services, First Citizens Community Bank, First Resource Bank, Meridian Bank, Pennsylvania American Water, PPL Electric Utilities, PECO.

With funding from a range of sources, educators deliver meaningful and inclusive environmental STEM programs. Programs are tailored to meet the needs of the participating schools. The programming is available to middle school students at the Stroud Center, online, and from the Watershed Education Mobile Lab. Outreach to schools in environmental justice communities is prioritized.

**Project Leads:** Steven C. Kerlin and Tara K. Muenz

### HerStory in STREAM

**Funded by:** The Fund for Women and Girls of Chester County

This project engages girls and girl-identifying individuals in a set of four programs providing experiences in watershed STEM careers and outdoor education.

**Project Lead:** Kathryn Metzker

**Collaborator:** Tara K. Muenz

### Meaningful Watershed Investigations of the NPS White Clay Wild and Scenic River

**Funded by:** National Park Foundation

A three-session model of watershed lessons is being delivered to fifth-grade students and teachers within the Red Clay Consolidated School District and White Clay Creek Watershed.

**Project Leads:** Steven C. Kerlin and Brian Mattix (Red Clay Consolidated School District)

**Collaborators:** Tara K. Muenz, White Clay Watershed Association, National Park Service, and White Clay Creek Wild and Scenic River Program



(A) Lamonte Garber and Wills Curley help lead a field day for farmers and landowners to learn about agroforestry. Photo: Ramon Madrid, Rodale Institute. (B) In a soil pit at Penn England Farm in Blair County, Lisa Blazure is joined by Pa. Secretary of Agriculture Russell Redding as she talks soil health practices with farmers. (C) Matt Ehrhart provides testimony about the value of streamside forests to the Pa. House Environmental Resources and Energy Committee.

## Water Restoration Projects

### Whole-Farm Planning and Best Management Practices



#### Agricultural Best Management Practices and Buffers Featuring Brandywine-Christina, Chester County, and Middle Schuylkill Focus Areas

**Funded by:** National Fish and Wildlife Foundation, Pa. Department of Environmental Protection, and Pa. Department of Conservation and Natural Resource

A suite of watershed restoration projects are delivering results for improving water quality. With a network of partners, the Stroud Center's watershed restoration team is providing technical assistance with planning, establishing, and maintaining conservation practices customized for "client" farms across the Delaware and Chesapeake Bay watersheds. Farmers receive assistance to plan and implement agricultural stream-friendly practices on the condition that they also install forests along their streams. Conservation actions can include no-till planting, stormwater control, manure management, and new crops such as fruits and nuts. Clients include three Plain farms representing a commitment from the regionally important traditional farming community. The Stroud Center coordinates, customizes, and manages these projects to ensure water quality improvements.

**Project Lead:** Matthew J. Ehrhart

**Collaborating Organizations:** Alliance for Chesapeake Bay; Berks County Conservation District; Brandywine Conservancy; Brandywine Red Clay Alliance; Chester County Conservation District; Cover Crop Coaching, LLC; Crow and Berry Land Management; Hicks Brothers, LLC; Mowery Environmental, LLC; Pa. No-Till Alliance; Red Barn Consulting, Inc.; Salisbury Township; TeamAg, Inc.; Propagate; and University of Pennsylvania School of Veterinary Medicine

#### Targeted Agricultural Best Management Practices and Forested Buffers for Chester County Focus Areas

**Funded by:** National Fish and Wildlife Foundation  
This project implements agricultural best management

practices on farms, such as stormwater-runoff controls for barnyards and mushroom compost processing areas, new and seasonally earlier cover crops, improved no-till practices, and streamside forests (a.k.a. buffers), and related infrastructure.

**Project Lead:** Matthew J. Ehrhart

**Collaborating Organizations:** Hicks Brothers, LLC and Mowery Environmental, LLC

### Riparian Buffer Planning, Planting, and Maintenance



#### NEW Collaboration With Pa. DCNR for Riparian Forest Buffers

**Funded by:** Pennsylvania Department of Conservation and Natural Resources

This project installs streamside forests to improve water quality and stream health. Locations include but are not limited to target areas in Chester and Lancaster counties and are responsive to countywide action plans.

**Project Lead:** Matthew J. Ehrhart

**Collaborators:** Alliance for Chesapeake Bay; Team Ag, Inc.; and Mowery Environmental, LLC

#### Forest Buffer Tree Seedling Care Initiative 2020

**Funded by:** Marshall Reynolds Foundation

This project includes site visits to check the status of recently planted streamside forests, replant any trees that haven't survived, and provide feedback to landowners on the status and success of their tree plantings.

**Project Lead:** Matthew J. Ehrhart

#### NEW Forested Buffer Installation

This project provides funding for the installation of streamside forests at New Bolton Center in Chester County, Pa.

**Project Lead:** Matthew J. Ehrhart

**Collaborator:** University of Pennsylvania School of Veterinary Medicine



## Stroud Center-Alliance for Chesapeake Bay Partnership

**Funded by:** Alliance for the Chesapeake Bay

This project supports the installation and care of about 25 acres of streamside forests after they are planted in the West Branch of Red Clay Creek.

**Project Lead:** Matthew J. Ehrhart

## Stroud Center-Pa. Department of Conservation and Natural Resources Buffer Collaborative

**Funded by:** Pa. Department of Conservation and Natural Resources

This project installs nearly 80 acres of streamside forests and demonstrates the income potential of those that grow fruits, nuts, and salable horticultural materials.

**Project Lead:** Matthew J. Ehrhart

**Collaborating Organizations:** Brandywine Conservancy; Berks County Conservation District; Chester County Conservation District; Crow and Berry Land Management; Mowery Environmental, LLC; Propagate; Red Barn Consulting, Inc.; and TeamAg, Inc.

## Stroud Center-Pa. DCNR Forested Buffer Partnership 2020

**Funded by:** Pa. Department of Conservation and Natural Resources

This project restores 30 acres of streamside forests along the West Branch of Red Clay Creek and includes care after planting. The forests are a component of broader efforts to enhance the health of the watershed's headwater streams by improving the operations of this former dairy farm.

**Project Lead:** Matthew J. Ehrhart

## Forested Buffers for Farms in the Chesapeake Bay Watershed

**Funded by:** Pa. Department of Conservation and Natural Resources

This project funds five farms in Lancaster and Chester counties in Pennsylvania to install streamside forests and any needed infrastructure to protect streams from livestock.

**Project Lead:** Matthew J. Ehrhart

**Collaborators:** Alliance for the Chesapeake Bay; Mowery Environmental, LLC; Salisbury Township; and TeamAg, Inc.

## Improving Success and Cutting Costs on Riparian Buffers

**Funded by:** Chesapeake Bay Foundation

Chesapeake Bay Foundation's Keystone 10 Million Trees Partnership contracts with the Stroud Center to test tree planting and maintenance-related materials. The goal is to demonstrate methods that maintain high levels of successful tree plantings along streams while reducing herbicide use and total costs. This work is occurring along the West Branch of Red Clay Creek.

**Project Lead:** Matthew J. Ehrhart

## NEW Lancaster County Clean Water Community Action Partnership

**Funded by:** Funded by Lancaster Clean Water Partners

This project provides funding for implementing streamside forests, streambank fencing, stabilized livestock crossings, and watering systems in Lancaster County, Pa., as part of the countywide restoration strategy.

**Project Lead:** Matthew J. Ehrhart

**Collaborators:** TeamAg, Inc.; Mowery Environmental, LLC; and TeamAg, Inc.

## Healthy Soils

### NEW "Healthy Soils, Healthy Streams" Training and Technical Assistance

**Funded by:** Amazon Web Services; Blue Yak Foundation; Pa. State Conservation Commission; Pa. Department of Environmental Protection; and National Fish and Wildlife Foundation

This collection of projects includes training, planning, and technology conversion assistance to farmers as they prioritize soil health thereby protecting water on their lands. Training sessions by the Pa. No-Till Alliance will be delivered for nearly 6,000 farmers, conservation professionals, and others. The biological principles of soil health – nurturing the microbes and other organisms that enhance soils – apply to achieving both healthy soils and healthy streams. Techniques deployed can include no-till planting, cover cropping, establishment of streamside forests, and other conservation practices. Targeted regions include farms along French Creek and the Shenango River in Pennsylvania; Berks County, Pennsylvania; and northern Virginia.

**Project Lead:** Matthew J. Ehrhart

**Collaborating Organizations:** Cover Crop Coaching, LLC; Crawford County Conservation District; and Pa. No-Till Alliance

### Support for a Coalition on Soil Health in Pennsylvania

**Funded by:** National Fish and Wildlife Foundation and Pa. State Conservation Commission

This project sustains the Pa. Soil Health Coalition to improve communication and coordination among organizations involved with soil health education, implementation, and research. Coalition member organizations conducted educational programming on soil health, collected soil health samples for analysis, and implemented no-till planting, cover crops, or rotational grazing on 12,600 acres.

**Project Lead:** Matthew J. Ehrhart

**Collaborators:** Capital RC&D, Pa. No-Till Alliance, Pasa Sustainable Agriculture, and The Nature Conservancy



Young volunteers plant trees at New Bolton Center.

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2023

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While stream sampling, scientists spot a stinkpot musk turtle.

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\* The Stroud Center is pleased to welcome Frances Moran Abbott back to the board of directors.





(A) The Moorhead Family, Founding Greens sponsor, joins Bern Sweeney, Ph.D. at Fore Fresh Water. (B) David B. Arscott, Ph.D., presents the Stroud Award for Freshwater Excellence to Laura Turner Seydel. (C) Ed and Diane Herr join Morgan McRay at The Water's Edge. Photo C: Brian Preston Photography

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We gratefully acknowledge the following 520 donors who generously contributed \$713,337 to the 2023 Annual Fund. These vital funds cover expenses associated with all the work done at the Stroud Center. On behalf of our research scientists, environmental educators, the watershed restoration team, and all other employees, thank you for strengthening our work!

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(A) Michael and Hope Wisman enjoy The Water's Edge. (B) First Resource Bank foursome enjoy a day Fore Fresh Water. (C) Alli Sirna and guest learn about the stream during Sips of Summer. Photo A: Brian Preston Photography

Diane Huskinson\* *in honor of Roseauna Good*  
 Ms. Lori Jo Jamieson  
 Mr. Russell Jones  
 Dr. and Mrs. Jinjun Kan\*  
 Mr. Nick Kerlin and Dr. Donna Queeney  
 Dr. and Mrs. Steve Kerlin\*  
 James and Denise Kilgore  
 Mr. David Kline\* *in memory of Anne P. Dennis*  
 Mr. Donald Kline  
 Mr. David B. Knapp  
 Mr. Thomas LaPoint  
 Mr. and Mrs. Stanley Laskowski  
 Mr. Jeff LeFever  
 Dr. and Mrs. Rick L. Leibold  
 Matthew Lesley  
 Mary Ann Levan and Joe Ycas\*  
 Ross and Kathy Lloyd  
 Ms. Diana Locke  
 Ms. Heidi Loncosky  
 Mr. and Mrs. Stanley Lukoff  
 Lunch Smash Bros.\*  
 Dr. Maija Luttinger *in honor of Kielbasa Con*  
 Margaret Maffitt  
 Karen and Michael Malchione  
 Mr. Zachary Manganello  
 Mr. and Mrs. Ron Maroney  
 Mr. Eric Matuszak  
 Mr. Donald McCann  
 Kristen McDonald  
 Mr. Matthew McGowen  
 Robert McMahan *in honor of Kielbasa Con*  
 John MacPherson  
 Mr. and Mrs. Karl Mehn  
 Jennifer Merrill, Ph.D.\*  
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 Hillary Murray  
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Dr. and Mrs. Dean Neely  
 Dr. Wenonah L. Nelson *in memory of Wenonah Oda*  
 Denis and Gail Newbold  
 Dave and Chris Nibouar  
 Maureen Nolan  
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 Mr. William Ostrem and Ms. Urmila Malvadkar  
 Kenneth and Karen Owens  
 Ms. Julie Pedersen  
 Ms. Kara Perella  
 Mr. and Mrs. Edward Petrow  
 Mr. and Mrs. William H. Pfeffer  
 Mr. and Mrs. Paulding Phelps  
 Ms. Trudy A. Phillips  
 Will and Kate Phipps  
 Dr. Howard and Karen Priestley  
 Jenny Rakus  
 Colleen and Rick Rasmussen  
 Alvin J. Reagan  
 Diane and David Redash  
 Dr. David Richardson  
 Sherman and Eleanor Roberts\*  
 Mr. Gregg Robertson

Mr. Christopher Robinson and Ms. Ann Faulds  
 Mr. and Mrs. Phillip Robinson  
 Mr. and Mrs. Alexander Roe  
 Mr. and Mrs. Seth Ross  
 Mr. Tim Ross  
 Mr. Rupert Rossetti  
 Ms. Karen Rothschild  
 Marc Ruschmann  
 Sandy and Honor Sage  
 Lynnette Saunders, Ph.D.  
 Fritz and Mary Schroeder  
 Dr. and Mrs. Robert C. Scott  
 Elizabeth Shafer  
 Bernard and Nancy Shapiro  
 Ms. Connie Shreiner *in honor of Bridget Reheard*  
 Mr. and Mrs. Andrew A. Smith Sr.  
 Mr. Nathaniel Smith  
 Tim and Alexia Smith\*  
 Ms. Kelly Snavely  
 Daryl Snider and Jean Sensenig  
 Mr. Charles A. Soczek  
 Jane and Sandy Sommer  
 Mr. John Starzmann  
 Ms. Lillian Stehman  
 Mr. James Stephens and Ms. Cindy Gray *in honor of Christine Stephens*

Sari Steuber  
 John and Holly Stoviak  
 Denise Strucko  
 Mrs. Nancy Stubblefield *in memory of Claire Birney*  
 Herbert Thal  
 The Providence Garden Club of PA  
 Thistle Finch Distilling  
 TisBest Philanthropy  
 Linda Titanich *in honor of Heather Titanich*  
 Mr. Stephen Tricarico  
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 Mr. and Mrs. Christopher H. Washburn  
 Mr. Charles Waterfield  
 Dr. and Mrs. Richard Weber *in honor of Sherman Roberts*  
 Matthew and Janet Weir  
 Mr. Glenn R. Welch Jr.

“Stroud Water Research Center does such an important job of educating our community on the importance of how we treat our landscapes and resources. When we think of water projects and initiatives in our community, we think of the Stroud Center – they have become synonymous. I have gained a deeper understanding of our freshwater systems thanks to the Stroud Center’s educational events and I look forward to more in the future.”

– EMILY SCOTT





“We support the Stroud Center because they provide tools to bring science to life in a human way. As we took a deep dive into the stream with Leaf Pack Network we learned more about the fragility and ecosystems of the streams, which have shaped the way we practice in our business and personal lives.”

– THE AUMAN FAMILY

Marina Westfield  
 Mr. and Mrs. John Wilkens  
 Ms. Jacqline Wolf Tice  
 Katy Worrell *in honor of*  
*Dave and Eileen Dickens*  
 Mr. and Mrs. Michael Wylam  
 Mr. George Xakellis  
 Ms. Sandra Yeager  
 Robert Yuen  
 Nazmul Zamon  
 Janice Zelenke  
 Laura and  
 David Zgleszewski\*  
 Ms. Eleanor Ziegler

*We are grateful for the following gifts made in honor of the wedding of Drs. Alex Scott and Elle Elliman:*

Annie Rose Birney  
 Kathleen Bishop and  
 Matt Shirk  
 Margaret and Antelo Devereux  
 Jamie and Maddie Devereux  
 Hunter and Charlotte Harris  
 Brice and Kelly Howard  
 Hugh and Brittany Manahan  
 Barney and Dawn Thompson  
 John and Frances Schoonover



### SPECIAL GIFTS

Mr. and Mrs. Theodore  
 W. Auman Sr. – HerStory  
 in STREAM  
 Blue Yak Foundation –  
 Operational Funds for the  
 Maritza Biological Station  
 in Costa Rica, Watershed  
 Restoration Cover  
 Crop Project  
 High Foundation – Forest  
 Buffer Maintenance  
 Mr. and Mrs. Raymond  
 P. Sarnacki – School  
 and Youth Group  
 Education Programs  
 Mr. and Mrs. Stephen M.  
 Stroud – Operational Funds  
 for the Maritza Biological  
 Station in Costa Rica and  
 Stroud Center  
 Cabin Restoration  
 The James Family Charitable  
 Trust – Marketing and  
 Communications Strategy  
 Carol E. Ware Ph.D. –  
 Octoraro Watershed  
 Research, Stroud Center  
 Cabin Restoration

### EDUCATIONAL IMPROVEMENT TAX CREDIT PROGRAM

The Education Department gratefully acknowledges these businesses for their support through Pennsylvania’s EITC program. These dollars are used specifically to subsidize costs associated with field trips from Pennsylvania public schools.

Brown Brothers Harriman  
 First Citizens Community Bank  
 First Resource Bank  
 Meridian Bank  
 PECO  
 PPL Corporation  
 Truist



First Resource Bank presents an EITC check to the Stroud Center.

## Financials

### Operating Statement

for the year ended December 31, 2023

#### Revenues and Support

Watershed Restoration Program	\$3,480,114
Research Programs (Grants and Contracts)	2,540,373
Endowment	2,506,591
Education/Public Programs	782,674
Annual Fund	713,456
Other Contributions and Income	618,542

**Total Revenues and Support \$10,641,750**

#### Expenditures

Research	\$3,337,551
Watershed Restoration Program	3,261,256
Facilities	1,285,280
Finance and Administrative	799,157
Education	735,302
Development/Outreach	523,638
Information Services	479,474
Communications	133,982
Other	86,110

**Total Expenditures \$10,641,750**

#### Financial Information

Stroud Water Research Center is a 501(c)(3) nonprofit organization registered with the Pennsylvania Bureau of Charitable Organizations. Gifts to Stroud Water Research Center are tax deductible on a U.S. return as allowed by law. The Stroud Water Research Center Employer Identification Number (EIN) is 52-2081073. The fiscal year is January 1 to December 31. The annual audit is performed by Belfint, Lyons & Shuman P.A. Investment assets are managed by The Colony Group, Passive Capital Management, and Brown Advisory. The Stroud Center is also the beneficiary of the Morris W. Stroud 3<sup>rd</sup> Pennwood No. 2 Trust managed by the Glenmede Trust Company.

#### Privacy Statement

Stroud Water Research Center donor records are not sold, bartered, leased, exchanged, or otherwise provided to any outside organizations.





join us

We hope you'll join us for fabulous events, either virtually or in person, this year. Go to [www.stroudcenter.org/events](http://www.stroudcenter.org/events) to learn more.

# Sponsors and Volunteers

## Fore Fresh Water Golf Outing

- SPONSORS**
- Greens Founding Sponsor**  
Moorhead Family Foundation
  - Eagle Sponsor**  
Mr. and Mrs. Michael Moran
  - Reception Sponsor**  
Brown Brothers Harriman  
Trust Company of Delaware, N.A.
  - Golf Cart Sponsor**  
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  - Golf Tee Sponsor**  
BNY Mellon Wealth Management
  - SWAG Sponsor**  
Tito's Handmade Vodka
  - Golf Ball Sponsor**  
USI Insurance Services
  - Hole Sponsors**  
Belfint, Lyons & Shuman P.A.  
Dawn and Bill Schieffer

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- Janssen's Market
- Johnston Family Trust
- LINKBANK
- Montchanin Builders
- Mowery Environmental, LLC
- National Association of Water Companies
- The National Bank of Malvern
- Passive Capital Management
- Patterson Schwartz Real Estate
- Robert Half
- Riley Riper Hollin & Colagrec
- Right Touch Engravers
- Taghleef Industries

- The Tamora Group
- Warren Claytor Architects
- Wilmington Trust/M&T Bank
- Zurich

- IN-KIND DONORS**
- Cause Water
  - Herr Foods, Inc.
  - Tito's Handmade Vodka
  - Waywood Beverage
- Plus the many donors to our silent auction!*

- VOLUNTEERS**
- Franny Abbott
  - Yu-Jung Change
  - Derek Donmoyer
  - Lauren Donmoyer
  - Janet Fassbender
  - Kelly Kelly
  - Therese Kovach
  - ArunKumar Mani
  - Dawn Murray

(A) Dixon and Lisa Stroud smile for the camera at an open house. (B) Crew from Delaware Center for Horticulture (C) Claudia Schultz and Bruce Balick enjoy The Water's Edge gala. (D) Eager helpers learn about electrofishing during World Water Day. (E) The Stroud Center joins partners at a weeklong celebration of water during Lancaster Water Week. (F) Kara Rahn from PA American Water poses with the Stroud Center team for a grant announcement. (G) Rainy fun was had by all celebrating Sips of Summer. (H) Tito's Handmade Vodka had the primo spot during the Fore Fresh Water Golf Invitational as a sponsor. (I) USI Gives Back on their annual day of volunteering. (J) Robert Johnston and guests enjoy a day Fore Fresh Water. (K) Blair and Charlie Fleischman at The Water's Edge. Photos: C and K by Brian Preston Photography

Dante Scoleri  
Debbie Royer  
Martha Ryan  
Katrina Rydzewski  
Donnan Sharp  
Lynn Watson

*A special thank-you to our hardworking Golf Committee!*

## Summer Solstice Celebration

### VOLUNTEERS

Emily Scott

### IN-KIND DONORS

Tröegs Independent Brewing  
Wegmans Food Markets, Inc.

## Science Seminar Series

### SPONSORS

Trail Creek Outfitters

### IN-KIND DONORS

BJ's Food Stores  
Giant Food Stores  
Victory Brewing Company

## Joan and Dick Stroud Memorial Lecture

### SPONSOR

Chester County Community Foundation  
through the Nancy Petersen  
Grantmaking Fund

## The Water's Edge

### SPONSORS

#### Premiere Sponsor

Wilmington Trust

#### Lead Sponsors

Blue Yak Foundation  
Brown Brothers Harriman Trust  
Company of Delaware, N.A.  
Colonial Pipeline Company  
Fresh Start Development Company, LLC  
Meg and Dick Hayne  
Moorhead Family Foundation

Mr. and Mrs. Stephen Stroud  
Mr. and Mrs. W.B. Dixon Stroud Jr.

### Key Sponsors

Franny and Franny Abbott  
BNY Mellon Wealth Management  
Amy Ruth Borun  
Brown Advisory  
Communications Test Design, Inc.  
Phoebe Driscoll  
Ephrata National Bank  
Fair Play Foundation  
Glatfelter Insurance Group  
The Hankin Group  
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Johnston Family Charitable Trust  
Mr. and Mrs. Michael Moran  
W.A. Speakman Family Foundation  
Morris and Boo Stroud  
Carol E. Ware, Ph.D.  
Scott and Barbara Wisman

### VOLUNTEERS

Franny Abbott  
Amy Ruth Borun  
Katherine Bucklin  
Robert DiFilippo, Ph.D.  
Kay Dixon  
Evie Dutton  
Dale Frankel  
Robert F. Johnston  
Brooke Moorhead  
Brian Preston  
Trish Scott  
Donnan Sharp  
Andrea Spahr  
Boo Stroud  
Bonnie Van Alen  
Nancy Wood

## Wild & Scenic Film Festival

### Hosted by Trail Creek Outfitters

*We are grateful to the many sponsors, volunteers, and attendees who made this event so successful.*

## Earth Week

*Special thanks to the following companies and individual volunteers who helped plant trees for healthy streams in Birmingham Township during Earth Week. This planting was funded by a grant from American Water Charitable Foundation.*

### INDIVIDUALS

Chuck Feld  
Lydia Fisher  
Betsy Pinsky  
Martha Ryan  
Reba Shall  
Candace Stephen  
Paige Worth

### CORPORATIONS

Constellation Energy  
Dansko  
LINKBANK  
Resolution Life  
SWCA Environmental Consultants  
Sycamore

## Special Projects Volunteers

*The following volunteers supported a variety of projects and activities throughout the year.*

### COMMUNICATIONS DEPARTMENT

Brian Preston

### DEVELOPMENT DEPARTMENT

Janet Fassbender  
Adelyn Overton  
Betsy Pinsky  
Martha Ryan  
H. Donnan Sharp

### WATERSHED RESTORATION PROGRAM

Carol Armstrong  
Charlie Coulter  
Joe Debes  
Tim James  
Nur Ritter  
George Seeds  
USI Insurance Services



A.



B.



C.



D.

(A) Sycamore International and (B) Constellation Energy are among the companies who help to plant trees for healthy streams during Earth Month. (C) Joan and Dick Stroud Memorial lecture guest Emily Ford shares her amazing tale of thru-hiking the Ice Age Trail during winter months. (D) A foursome from Patterson-Schwartz Real Estate proudly supports the Stroud Center as a sponsor.

# The Future of Fresh Water Initiative

We are grateful to the many donors who have made contributions to the Future of Fresh Water initiative. The fulfillment of this campaign is essential to the long-term growth and stability of the Stroud Center's important work. An investment in this campaign is an investment in the future of fresh water and helps us to continue collecting data and investing resources into projects long after the grant funding has expired. To learn how you can help sustain our work and help us reach our ambitious goal, please contact the Development Department at 610-910-0049 or [development@stroudcenter.org](mailto:development@stroudcenter.org).

## FFWI GIFTS \$10,000+

Anonymous Friends (4)  
 Mr. and Mrs. Francis H. Abbott Jr.  
 Jessie and Richard Benjamin  
 Thomas P. Bentley Muddy Boots Fund  
 Bessemer National Gift/ 24th Fund  
 Joan S. Blaine  
 Blue Yak Foundation  
 Maggie Brokaw  
 Cabot-Kjellerup Foundation  
 Cabot-Wellington, LLC  
 Chester County Community Foundation  
 Colket Family Foundation  
 County of Chester  
 Crystal Trust  
 David Family Charitable Remainder Trust  
 Estate of Dorothea S. Chidester  
 Estate of Carol Urbanc  
 Dr. and Mrs. John R.S. Fisher  
 Meg and Dick Hayne

Nathan and Marilyn Hayward  
 J. Renwick Kerr†  
 Bert Kerstetter  
 The Laffey-McHugh Foundation  
 Gerry† and Marguerite Lenfest  
 Jane C. MacElree Foundation  
 Marmot Foundation  
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 Mr. and Mrs. Frederick Meserve Jr.  
 Mr. and Mrs. Rodman W. Moorhead III  
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 Mr. and Mrs. Michael Moran  
 Nyssa Foundation  
 Oxford Area Foundation  
 Rencourt Foundation, Inc.  
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 Mr. and Mrs. W.B. Dixon Stroud Jr.  
 Dr. and Mrs. Bernard W. Sweeney  
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 The Boudinot Foundation  
 The Davenport Family Foundation  
 The Leafglen Foundation  
 Dr. Robin L. Vannote  
 John and Barbara Vogelstein Foundation  
 W.L. Lyons Brown Foundation  
 Marian S. Ware 2003 Charitable  
 Lead Annuity  
 Weglicki Family Foundation  
 Welfare Foundation  
 Penelope P. Wilson†  
 Allen Wise

*Additionally, we are grateful to the 285 donors who made contributions of up to \$9,999 to the Future of Fresh Water initiative. Together, these gifts help ensure the future of fresh water is bright!*

† Deceased

## Securing the Future

Your continued generosity through annual, endowed, and planned gifts is vital to our research, education, and watershed restoration programs. Below is a brief list of ways you can make a tax-deductible gift:



**Online**  
 Visit [stroudcenter.org/donate](http://stroudcenter.org/donate)

**Cash or Check**  
 Please mail donations to: Stroud Water Research Center, 970 Spencer Road, Avondale, PA 19311

**Credit Card or Digital Wallet**  
 Stroud Water Research Center accepts VISA, Mastercard, American Express, Discover, and Diners Club Card, as well as PayPal, Apple Pay, Google Pay, and Venmo. Gifts can be made as a one-time gift or as a monthly contribution.

**Stock**  
 Gifts of appreciated securities are an outstanding way to avoid 15% capital gains tax.

Your broker can use this information: Charles Schwab & Co.; DTC Clearing Number: 0164 - Code 40 Account name: Stroud Water Research Center; Account number: 1749-3778. Prior to transferring assets, please alert [development@stroudcenter.org](mailto:development@stroudcenter.org), since no name will be attached to the deposit of funds.

**Wire Transfer**  
 Funds may be wired directly to Stroud Water Research Center's financial institution. Please contact [development@stroudcenter.org](mailto:development@stroudcenter.org) for instructions.

**Planned Giving**  
 A planned gift can meet your short-term or long-term charitable and financial goals. Planned gifts include, but are not limited to, bequest intentions, charitable gift annuities, IRA payments, retirement plan assets, insurance policies, and other various trusts to fit your needs.

**Corporate Matching Gift**  
 Double your donation with an employer match. Email [development@stroudcenter.org](mailto:development@stroudcenter.org) to find out if your employer participates.

**Memorial and Honor Gifts**  
 Remember a friend, neighbor, or loved one with a gift in his/her name. All tributes will be listed in the annual report, and when an address is provided, a letter will be sent on your behalf.



Please visit our website: [www.stroudcenter.org](http://www.stroudcenter.org) or contact the Development Department at 610-910-0049 or [development@stroudcenter.org](mailto:development@stroudcenter.org) to learn about special giving opportunities.

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Avondale, PA 19311-9514  
USA

610-268-2153 Telephone  
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## 2023 At a Glance



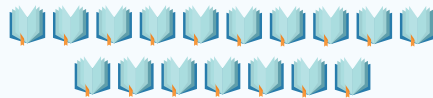
**405**

active research sites visited



**97 acres**

land reforested



**17 peer-reviewed**

articles, book chapters, and scientific reports published

**252**  
best management practices



enabled by our Watershed Restoration Program

**4,601 people**

benefited from watershed restoration workshops, trainings, and outreach



**10,725 people**

impacted by our Education Department's programs and trainings

