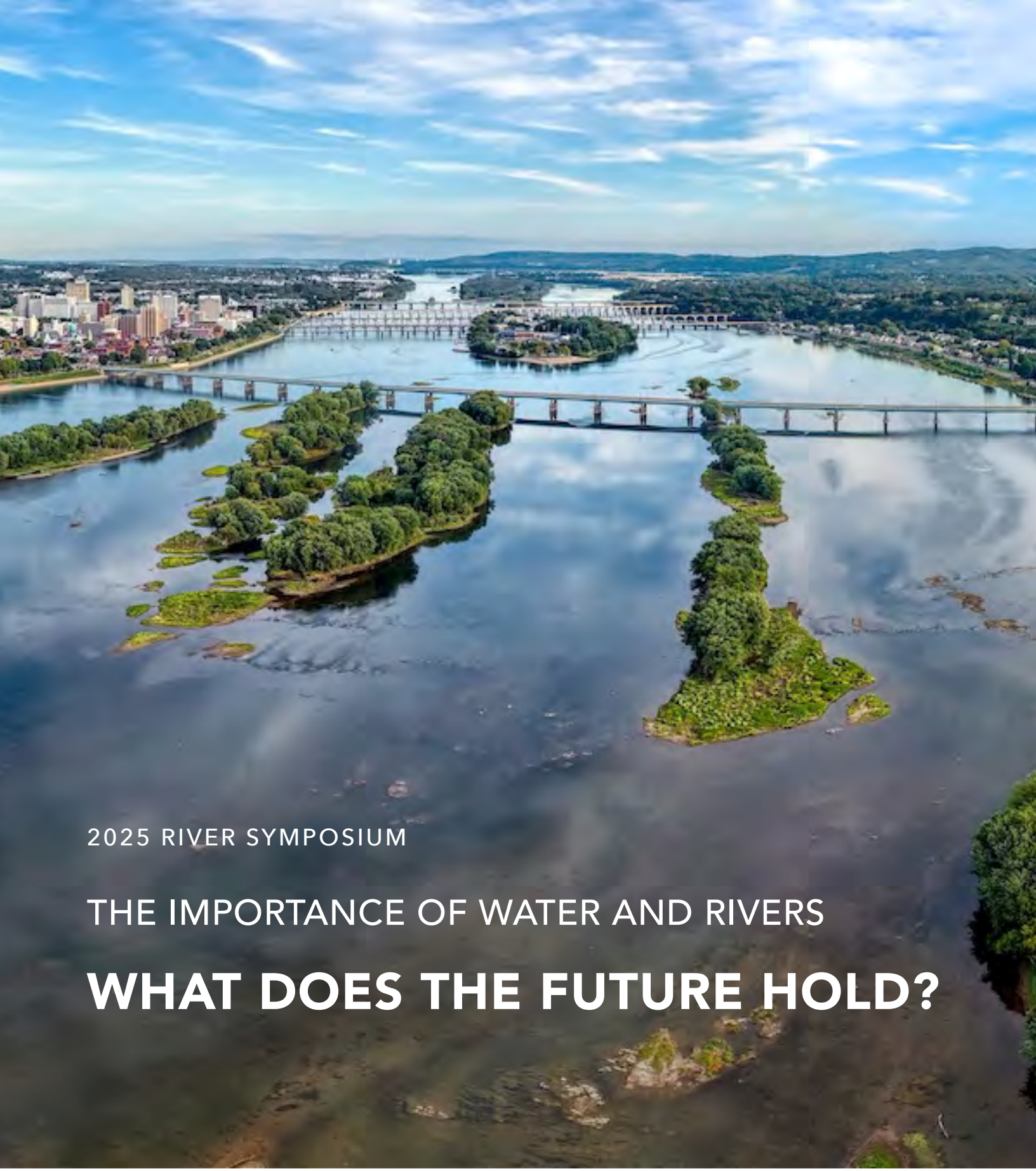

2025 RIVER SYMPOSIUM

THE IMPORTANCE OF WATER AND RIVERS

WHAT DOES THE FUTURE HOLD?

November 7 & 8, 2025
Bucknell University

Program with Abstracts

www.riversymposium.scholar.bucknell.edu

COMMITTEE

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Associate Professor, Dept. of Ecosystem Science and Management, The Pennsylvania State University

Front cover photo: A view upstream of the Susquehanna River at Harrisburg, Pennsylvania. [Photo: John Beatty].

Back cover photo: Sand Spring Run, Bald Eagle State Forest, Union County, Pennsylvania. [Photo: Nicholas A. Tonelli]

WELCOME

This symposium brings the public together with faculty, students, scientists, engineers, consultants, watershed groups, and state and federal agencies to share their latest research findings and discuss sustainable restoration and management strategies that will improve the health of watersheds and the ecosystems and communities living therein.

It features keynote and plenary addresses, exhibits, and oral and poster presentations from 156 students, faculty, consultants, agencies, and watershed groups.

Our goal is to cultivate knowledge, and discovery, all the while increasing awareness of the watershed restoration and conservation work under way throughout the Susquehanna and Chesapeake region.

All events are free and open to the public. Oral presentations are both in person and virtually via Zoom. To register and access links to the various sessions, please visit:

riversymposium.scholar.bucknell.edu

PROGRAM WITH ABSTRACTS

CONTENTS

20th Annual River Symposium

THE IMPORTANCE OF WATER AND RIVERS

WHAT DOES THE FUTURE HOLD?

FORWARD

Water and rivers are at the heart of life on Earth, shaping landscapes, sustaining ecosystems, and providing drinking water, food, and energy for billions of people. Yet across the globe, rivers are under mounting pressure from pollution, overuse, and the effects of a changing climate. Rising temperatures are intensifying droughts in some regions and floods in others, disrupting the delicate balance that rivers maintain. As populations grow and demand for water increases, competition between agriculture, industry, and communities will become even more acute — forcing societies to rethink how they value and manage this most essential resource.

The future of rivers will depend on how well we adapt to these challenges through innovation, conservation, and cooperation. Advances in water recycling, ecosystem restoration, and smarter infrastructure can help restore the natural rhythms of rivers while meeting human needs. Protecting headwaters, wetlands, and floodplains will be crucial for resilience, as these systems store water, filter pollutants, and buffer extreme weather events. Ultimately, the path forward requires a shift from viewing rivers as resources to be controlled, to seeing them as living systems to be sustained—partners in our shared future on a warming planet.

KEYNOTE ADDRESS. On Friday, from 6:15 to 7:00 p.m. in the Forum (Rm. 272), **Frieda Jacques**, Humanities scholar and Turtle Clan Mother of the Onondaga Nation, Haudenosaunee Confederacy, will deliver a keynote address entitled *"The Relationship Changes Over Time With Water, Why It Matters."* We must learn that water is a living relative, not a resource, deserving respect, reciprocity, and protection.

RESEARCH POSTERS. On Friday, from 7:00 to 8:00 p.m. in the Terrace Room (Rm. 276), over 100 students and faculty authors from universities and organizations throughout the region will present their work. Abstracts for all poster presentation are provided on pages 41-75.

EXHIBITS. On Friday, from 7:00 to 9:00 p.m. in the Terrace Room (Rm. 276), will be exhibits from watershed groups, agencies, and environmental organizations. Exhibitors (page 18) will be at their tables from 7 to 8:30 p.m.

EVENING SOCIAL. Also on Friday, an evening social with deserts and refreshments will be held in the Terrace from 8 to 9 p.m. **Awards for Best Student Poster Presentations** will be announced that night or by Monday, Nov. 10th on the symposium website:

www.riversymposium.scholar.bucknell.edu

SATURDAY, NOV. 8, 2025

ON-SITE REGISTRATION AND SELF-GUIDED TOUR OF POSTERS AND EXHIBITS. The welcome desk (located at the entrance to the Terrace Room, Rm. 276) will be open at 8 a.m. on Saturday for on-site registration. Participants can pick up their name badge and symposium folder. Coffee/tea and light breakfast snacks will be served in the Terrace Room, where you can enjoy a self-guided tour of the posters and exhibits, which will remain on display until 12 p.m.

PLENARY ADDRESSES. On Saturday, between 9:00 and 11:30 a.m., four plenary presentations will be delivered in The Forum (Rm. 272). Biographies for the keynote and plenary speakers are on pages 10-17 and abstracts for their presentation are on pages 20-24.

- **Frieda Jacques**, Humanities scholar and Turtle Clan Mother of the Onondaga Nation, Haudenosaunee Confederacy, will deliver a plenary address entitled *"Onondaga Creek and the Salt City."*
- **Laurel Etter Longenecker**, Executive Director of the RiverStewards Collaborative and **Alyssa Hannigan**, Ecological Designer at LandStudies ,will deliver a plenary address entitled *"Indigenous Heritage Initiative: Restoring a Cultural-Ecological Relationship with the Land."*
- **Megan Schmidt,** Technical Director of the Water Resources Division at AKRF Environmental Services, and **Betsy Kramer**, SEDA-COG, will deliver a plenary address entitled *"Resilient by the River: Strengthening Flood Preparedness and Preservation in Selinsgrove Borough."*
- **David Goerman**, Water Program Specialist within the Wetlands and Waterways Program at the Pennsylvania Department of Environmental Protection, will deliver a plenary address entitled *"Adaptive Approaches to Process-Based Stream Restoration."*

PANEL DISCUSSION. Following the plenary talks, from 11:30 a.m. to 12:00 p.m., a panel discussion, moderated by Dr. **Shannon Seneca**, Assistant Professor of Indigineous Studies at University at Buffalo, State University of New York (SUNY) will allow the audience to interact with the plenary speakers, ask questions, and explore things in greater detail.

LUNCH. Lunch will be served from 12:00 to 12:55 p.m. in Walls Lounge (Room 213).

ORAL PRESENTATIONS. Saturday afternoon features 16 oral presentations organized into seven sessions:

- Conservation and Restoration
- Hydrology
- Telling the Story of Rivers
- Water Quality
- Aquatic Ecology and Sustainability
- Environmental Communication
- Reflection and Inspiration

A schedule of each oral presentations is provided on pages 7-9 and associated abstracts on pages 24-40.

SPECIAL SESSION ON DATA CENTERS. From 1:00. to 2:00 p.m.in Room 256 (Center Room) a special session will be held on the topic of data centers – what they are, how they operate, and their potential impacts on water, air, and local communities. Moderated by **Kathleen Boomer**, Foundation for Food and Agricultural Research and featuring presentations by **Shannon Seneca**, University at Buffalo, **Christine Abrams**, Towanda Seneca Nation, and **Sharon and William Waltman**, agronomy and soil scientists and organic farmers near Danville, PA. Middle Susquehanna River Keeper, **John Zaktansky**, who has been organizing information relevant to a proposed data center in Northumberland and Montour counties, will also be present.

WRAP-UP. From 3:00 to 3:15 pm, everyone is invited to gather in The Forum (Rm 272) to reflect upon the symposium outcomes and provide input for next year. The symposium ends at 3:15 p.m.

ACKNOWLEDGEMENTS. This symposium would not be possible without the generous support of the Dr. Ghislaine McDayter, Associate Provost for Research and Inquiry, Office of the Provost at Bucknell University, and the Pennsylvania Water Resources Research Center at Penn State, Dr. Jonathan Duncan, Director.

Special thanks are due the symposium committee and events management staff, especially: Sean Reese, Janeen Putman, Krista Smith, James Shields, Jesse Greenawalt, Jeffrey Campbell, Kathy Boomer, Shannon Seneca, Sid Jamieson, H. W. "Skip" Weider, Robert Wagner, and Aleece Butler.

Best wishes for a great symposium!

Benjamin R. Hayes, Ph.D., P.G.
Symposium Chair

20TH ANNUAL RIVER SYMPOSIUM

SCHEDULE

FRIDAY, NOVEMBER 7, 2025

THE FORUM (RM. 272)

6:00 - 6:10 p.m.

Welcome and Opening Remarks

Jonathan Duncan
Executive Director
Pennsylvania Water Resources Research Center
Executive Director, Pennsylvania Water Resources Research Center
Associate Professor, Dept. of Ecosystem Science and Management, The Pennsylvania State University

6:10 - 6:15 p.m.

Introduction

Benjamin Hayes
Symposium Chair
Bucknell Center for Sustainability and the Environment

6:15 - 7:00 p.m.

KEYNOTE ADDRESS

"The Relationship Changes Over Time With Water, Why It Matters."

Frieda Jacques, Ph.D.
Humanities Scholar, Writer, and Turtle Clan Mother
Onondaga Nation, Haudenosaunee Confederacy

THE TERRACE ROOM (ROOM 276)

7:00 - 9:00 p.m.

Posters, Exhibits, and Evening Social

Poster presentations* by students and faculty from universities and colleges throughout the central Susquehanna River region. Students will be at their posters from 7 to 8 pm. Posters will remain on display until 12 p.m. Saturday for self-guided tours.

Exhibits from state and federal environmental agencies, consulting firms, watershed groups, and other organizations. Exhibitors will be at their tables from 7 to 8 pm.

Evening Social with refreshments will continue in the Terrace Room from 8 to 9 pm.

**Abstracts for poster presentations are on pages 41-75.*

SATURDAY, NOVEMBER 8, 2024

8:00 a.m. - 9:00 a.m.

Registration and Self-Guided Tour of Posters and Exhibits

Terrace Room (Room 276)

9:00 - 9:10 a.m.

Welcome and Opening Remarks

ELC Forum (Room 272)

Ghislaine McDayter
Associate Provost, Bucknell University

9:10 - 9:15 a.m.

Introduction

Benjamin Hayes
Symposium Chair

9:15 - 10:15 a.m.

Plenary Presentations

ELC Forum (Room 272)

9:15 - 9:45 a.m.

Onondaga Creek and the Salt City

Frieda Jacques
Humanities Scholar and Turtle Clan Mother of the Onondaga Nation, Haudenosaunee Confederacy

9:45 - 10:15 a.m.

Indigenous Heritage Initiative: Restoring a Cultural-Ecological Relationship with the Land

Laurel Etter Longenecker
Executive Director, RiverStewards Collaborative

Alyssa Hannigan
Ecological Designer, LandStudies

10:15 - 10:30 a.m.

Intermission

10:30 - 11:30 a.m.

Plenary Presentations

ELC Forum (Room 272)

10:30 - 11:00 a.m.

Resilient by the River: Strengthening Flood Preparedness and Preservation in Selinsgrove Borough

Megan Schmidt

Senior Water Resources Engineer, AKRF

Betsy Kramer

Program Manager for Community Revitalization & Resiliency at SEDA-Council of Governments (SEDA-COG)

11:00 - 11:30 a.m.

Adaptive Approaches to Process-Based Stream Restoration

David Goerman

Watershed Program Specialist, Bureau of Waterways Engineering and Wetlands, Pennsylvania Department of Environmental Protection

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11:30 a.m. - 12:00 p.m.

Panel Discussion

ELC Forum (Room 272)

A chance for everyone to interact with all four plenary speakers and openly discuss questions. Moderated by by Shannon Seneca, Six Nations Mohawk, Turtle Clan, Haudenosaunee Environmental Engineer and Assistant Professor, Department of Indigenous Studies, University at Buffalo.

12:00 - 1:00 p.m.

Lunch

Walls Lounge (ELC Room 213)

1:00 - 2:00 p.m.

Special Session: The Hidden Cost of Data Centers

Center Room (Room 256)

Moderated by Kathy Boomer, Foundation for Food and Agricultural Research and featuring presentations by Shannon Seneca, University at Buffalo, Christine Abrams, Towanda Seneca Nation, and Sharon and William Waltman, agronomy and soil scientists and organic farmers near Danville, PA.

Middle Susquehanna River Keeper, John Zaktansky, who has been organizing information relevant to a proposed data center in Northumberland and Montour counties, will also be present.

1:00 p.m. - 2:00 p.m.

Oral Presentations - Set 1

Session 1 **Conservation and Restoration**
ELC Rooms 241 A and B

Session 2 **Watershed Hydrology and Flooding**
ELC Rooms 241 C and D

Session 3 **Video Storytelling**
ELC Forum (Room 272)

2:00 - 3:00 p.m.

Oral Presentations - Set 2

Session 4 **Water Quality**
ELC Rooms 241 A and B

Session 5 **Aquatic Ecology**
ELC Rooms 241 C and D

Session 6 **Environmental Communication**
ELC Forum (Room 272)

Session 7 **Reflection and Inspiration**
ELC Gallery Theater (Room 301)

3:00 - 3:15 p.m.

Wrap-Up

ELC Forum (Room 272)

3:00 - 3:10 p.m.

Reflection and Looking Ahead

3:15 p.m.

End of Symposium

.

ORAL SESSIONS

Session 1

Conservation and Restoration

ELC Rooms 241 A and B, Saturday, November 8, 1:00 p.m. - 2:00 p.m.

1:00 p.m. **Research for restoration: Improving impact through university partnerships.**
Michaela Rolecki,* Shannon Thomas, Matthew Wilson, and Ainsle Binkley.

1:20 p.m. **Research on Methods for Establishing Riparian Forest Buffers**
David Wise*

1:40 p.m. **A Landscape Transcriptomics Approach for Evaluating the Effectiveness of Riparian Buffers to Reduce Stress in Brown Trout (*Salmo trutta*)**
Isaac Carachilo, * Megan Croke, and Jason Keagy.

Session 2

Watershed Hydrology and Flooding

ELC Rooms 241 C and D, Saturday, November 8, 1:00 p.m. - 2:00 p.m.

1:00 p.m. **Benchmarking Deep Learning Models for Improved Streamflow Prediction**
Jiangtao Liu,* Shaopeng Shen, Fearghal O'Donncha, Yalan Song, Wei, Zhe, and Hylke Beck.

1:20 p.m. **Was it "the worst we've ever seen"? An exploration of a storm event from the summer of 2025**
Benjamin Franek*

1:40 p.m. **Rising Rivers, Rising Risks: A Future Floodscape Analysis of a Central Pennsylvanian Watershed**
Digant Chavda,* Hasan Rhaf, Kostas Papakonstantinou, Gordon, Warn, Cibin Raj, and Lauren McPhillips.

** denotes presenting author.*

Above photo: A mature riparian forest buffer protects the Susquehanna River in Clinton County, PA. Credit: Will Parson/Chesapeake Bay Program

Session 3

Video Storytelling

ELC Rooms 241 C and D, Saturday, November 8, 1:00 p.m. - 2:00 p.m.

1:00 p.m. **Water on its way to the Chesapeake: Video storytelling as a tool for collaboration and public engagement**
Michael Kinney* and Joseph Simons*

Session 4

Water Quality

ELC Rooms 241 A and B, Saturday, November 8, 2:00 p.m. - 3:00 p.m.

2:00 p.m. **A Collective Identity Approach to Addressing Water Quality in the Chesapeake Watershed Region of Pennsylvania.**
Stephen Mainzer*

2:20 p.m. **Keystone Water Resources Center: A Collaborative Model for Sustaining Long-Term Water Monitoring**
Elyse Johnson* and Lexie Orr.

2:40 p.m. **Sounding The Alarm on E. coli in the Lower Susquehanna Watershed: How Can Water Quality Monitoring Empower and Engage Communities**
Aaron Dixon* and Megan McCarthy

Session 5

Aquatic Ecology

ELC Rooms 241 C and D, Saturday, November 8, 2:00 p.m. - 3:00 p.m.

2:00 p.m. **PFAS and fish consumption: Per- and polyfluoroalkyl substances in invasive Channa argus populations**
Matthew Chotlos,* Megan Schall, Geoffrey Smith, and Jason Keagy

2:20 p.m. **Bacterial assemblages respond to variations in riparian canopy in 46 headwater streams in the upper Delaware River Basin, USA.**
Steven Rier,* Tanya Dapkey, and Stefanie Kroll.

2:40 p.m. **Investigation of corrosion inhibitors for Li-ion battery discharge in aqueous electrolytes**
Ahsan Khan* and Jude Okolie

Session 6

Environmental Communication

ELC Forum (Room 241), Saturday, November 8, 2:00 p.m. - 3:00 p.m.

2:00 p.m. **Environmental Journalism: Tips and tools for local research.**
John Zaktansky*

Session 7

Reflection and Inspiration

ELC Gallery Theater (Room 301), Saturday, November 8, 2:00 p.m. - 3:00 p.m.

2:00 p.m. **A New Native American Reflection Space in the Susquehanna Watershed.**
Paul Siewers*

2:20 p.m. **Live Like a River Flows: A Journey of Healing**
Carol Parenzan*

** denotes presenting author.*

INVITED SPEAKERS

Freida J. Jacques (Whatwehni:neh)

Dr. Jacques, whose native name is Whatwehni:neh, is a highly-respected leader who has served as Turtle Clan Mother of the Onondaga Nation, Haudenosaunee Confederacy for over 50 years. An educator and cultural liaison, she advocates for Native American culture and the rights and well-being of indigeneous peoples and our planet. For over 21 years she was the Home/School Liaison for the Onondaga Nation Schools, serving as a bridge between her culture and the many educational institutions in central New York. A 1980 graduate of Syracuse University, Freida received her Doctorate of Humane Letters - honoras causa from LeMoyne College in April 2024. She has published numerous essays, including Discipline of the Good Mind, in the Northeast Indian Quarterly, Use the Good Mind, in Winds of Change magazine, and Beyond Healing a Gift to the World, in Indian Country Today. She wrote a Thanksgiving in the scholarly book, Beyond the Asterisk: Understanding Native Students in Higher Education by Heather J. Shotton and essay "Toward a Kinder Future", proposing action by churches for the affects of Indian Boarding Schools.

A New York Humanities Scholar, Dr. Jacques offers Traditional Life lessons to organizations, libraries, historical centers throughout New York State. She continues to be a sought-after speaker at commencement ceremonies and other events, sharing her wisdom and teachings. She recently helped develop the script for the Skanonh Great Law of Peace Center in Liverpool, New York. The Center makes an effort to teach others what our culture is about. Not meaning to be an end all information Center it is set up to help people understand the importance of all of humanity understanding that they depend on the natural world and also understand that Peace was established with out war in Haudenosaunee Country, finalized on the shores of Onondaga Lake.

Dr. Jacques will deliver the symposium's plenary address entitled ***"The Relationship changes over time with water, why it matters"*** on Friday, Nov. 7, from 6:15 -7:00 p.m. in Room 272 (The Forum). She will also deliver a plenary address entitled ***"Onondaga Creek and the Salt City"*** on Saturday, Nov. 8, from 9:15 to 9:45 a.m. in Room 272 (The Forum).

Laurel Etter-Longenecker

Laurel brings over a decade of experience in the environmental field and currently serves as the Executive Director of RiverStewards Collaborative. Throughout her career she has held various roles spanning the public, private, and non-profit sectors. She holds a bachelor's degree in Anthropology from Marshall University (2012) and a Master of Science in Resilient and Sustainable Communities from Green Mountain College (2017), both with concentrations in environmental studies.

Laurel's diverse experience offers a multidisciplinary perspective on the connection between humans and ecosystem health. She enjoys learning about local Indigenous lifeways, both past and present, and strives to help contribute to the preservation of these cultures. Her international experience living and working with Indigenous communities in Australia, Guatemala, and Nepal has deepened her understanding of how social and historical contexts shape environmental challenges.

She is a certified Chesapeake Bay Landscape Professional (CBLP) and completed the Woodland Steward Training course through the Horn Farm Center for Agricultural Education in 2020. She served as a 2023-2024 Ambassador to the National Wildlife Federation (NWF)'s Artemis Sportswomen Program where she helped to uplift women in sporting and conservation and advocate for important policies in support of conservation efforts.

A strong advocate for place-based and community-driven approaches, Laurel is passionate about fostering inclusive and holistic approaches to problem-solving and leading initiatives that integrate environmental stewardship with social justice. Outside of work, she enjoys spending time outdoors with family and friends, playing soccer, gardening, cooking and reading.

Alyssa will co-present a plenary address entitled ***"Indigenous Heritage Initiative: Reconnecting Land and Culture"*** on Saturday, Nov. 8, from 9:45 -10:15 a.m. in the ELC Forum (Room 272).

Alyssa Hannigan

Alyssa Hannigan is an Environmental Designer at LandStudies, where she works at the intersection of ecological restoration, cultural landscape awareness, and research-based design. Her practice is rooted in the Chesapeake Bay Watershed and the ancestral First Nations homelands of the Lower Susquehanna River Basin, including those of the Shenks Ferry, Conestoga, Susquehannock, Shawnee, Lenape, Conoy, Nanticoke, Seneca, and Haudenosaunee peoples. Alyssa specializes in ecological landscape design, architecture, and comprehensive planning, with a focus on restoring ecological systems, using native plants and low-impact materials, and implementing cultural-ecological land management and monitoring practices.

Grounded in degrees in biology and landscape architecture, Alyssa's design process begins with an in-depth study of each site's historical, ecological, and cultural systems to develop research-driven design solutions. She contributes both technical and creative expertise to a wide range of projects, from site-scale meadow and floodplain restoration to watershed-scale collaborative initiatives.

At the heart of her work is a deep commitment to connecting people and place, empowering communities to build reciprocal relationships with the land, and supporting rematriation efforts and Indigenous leadership within the design profession. She believes that restoring ecosystems must go hand-in-hand with restoring the cultural connections that sustain them.

Alyssa serves as a Member-at-Large on the Society for Ecological Restoration (SER) Mid-Atlantic Chapter Board. She earned her Master of Landscape Architecture with a focus in ecological restoration from Temple University in 2022, and her Bachelor of Science in Biology from Messiah University in 2015. Outside of her professional practice, Alyssa enjoys spending time outdoors with her family, tending the forest garden around her home, and exploring artistic practices that enrich her design thinking.

Alyssa will co-present a plenary address entitled ***"Indigenous Heritage Initiative: Reconnecting Land and Culture"*** on Saturday, Nov. 8, from 9:45 -10:15 a.m. in the ELC Forum (Room 272).

Megan Schmidt

Megan is a Senior Water Resources Engineer at AKRF, focusing on climate resiliency and adaptation planning, design, and implementation. She helps at-risk communities understand and respond to a variety of climate hazards across multiple geographic scales and time horizons. She has led the technical analysis for neighborhood scale flood studies, municipal-wide tree canopy impacts, regional greenway flood risks, urban schoolyard heat impacts, and sea level rise impacts on biodiversity in tidal wetland ecosystems. Her broad experience coupled with her passion for climate science, resilient infrastructure, and nature-based solutions informs her research-driven design approach.

Megan is a key contributor to multiple research initiatives including heat mitigation in urban spaces and use of recycled glass in green stormwater infrastructure media. She ensures a positive feedback loop from research project outcomes and community engagement so that she is consistently driving her projects toward the latest science, deep thinking, and best practices in the field. Megan graduated from Lafayette College with a double major in Engineering Studies and Film and Media Studies and completed her Master of Science in Water Resources and Environmental Engineering at Villanova University with a focus in urban stormwater management.

Megan will co-present a plenary address entitled ***""Resilient by the River: Strengthening Flood Preparedness and Preservation in Selinsgrove Borough"*** on Saturday, Nov. 8, from 10:15 -10:45 a.m. in the ELC Forum (Room 272).

Betsy Kramer

Betsy Kramer serves as the Program Manager for Community Revitalization & Resiliency at SEDA-Council of Governments (SEDA-COG), leading regional initiatives to strengthen environmental, housing, and economic resilience across Central Pennsylvania. SEDA-COG is a public development organization that serves 11 counties, helping communities access funding, technical assistance, and strategic planning to foster sustainable growth and regional collaboration.

Since establishing the Community Revitalization Program in 2019, Betsy has helped secure and manage more than $35 million in state and federal investments supporting flood-mitigation projects, levee system upgrades, Safe Streets for All (SS4A) safety planning, EPA Brownfield redevelopment, park and green infrastructure improvements, and sustainable downtown and housing initiatives.

She was the 2025 keynote speaker for Bucknell University's Sustainability Symposium and regularly collaborates with Bucknell's Coal Region Field Station to connect academic research with on-the-ground community revitalization.

Betsy is a Certified Economic Developer (CEcD) and Economic Development Professional (EDP), both through the International Economic Development Council (IEDC), and holds a Business Contracts Certification from Cornell University.

Betsy will co-present a plenary address entitled ***""Resilient by the River: Strengthening Flood Preparedness and Preservation in Selinsgrove Borough"*** on Saturday, Nov. 8, from 10:15 -10:45 a.m. in the ELC Forum (Room 272).

David Goerman

David is a Water Program Specialist at the PA Department of Environmental Protection in the Division of Wetlands, Encroachment and Training, Bureau of Waterways Engineering and Wetlands.

He's responsible for providing permitting and technical expertise on a wide range of issues involving waterways, wetlands, floodplains, and stormwater management. His most recent work has focused on aquatic resource headwater research, large-scale watershed restoration, and compensatory mitigation banking.

He has worked on projects involving over 42 miles of stream restoration and 127 acres of wetland restoration work. David has worked in the Division since 1993 and has a B.S. Degree in the Biological Sciences from Clarion University, Clarion, PA..

David will deliver a plenary address entitled *"Adaptive Approaches to Process-Based Stream Restoration"* from 11:00 to 11:30 a.m. on Saturday, Nov. 8 in The Forum (Room 272), Elaine Langone Center.

Shannon Seneca

Shannon Seneca, PhD, REHS/RS, EIT is a Haudenosaunee environmental engineer. She completed a bachelor of science in physics and then moved into civil engineering for her graduate studies. Seneca's master's work was focused on drinking water treatment, while she gained expertise in geochemistry, contaminant hydrology and groundwater remediation during her doctoral studies.

Graduating in 2012, she was the first female Native American to earn her PhD in engineering at UB. Seneca obtained ecosystem restoration training and experience through the University at Buffalo's National Science Foundation IGERT Ecosystem Restoration through Interdisciplinary Exchange (ERIE) program. For almost a decade, she worked with the Seneca Nation and served as the Seneca Nation Health System's environmental health director. She briefly worked with the Center for Indigenous Cancer Research at Roswell Park Cancer Institute as an assistant faculty member to respond to Indigenous community desires to see more active environmental health cancer research.

She brings in diversity as an Indigenous person and as an environmental engineer delving into environmental health to tackle the impact of environmental contaminants on human health. As a research assistant professor with the Department of Indigenous Studies, she strives to be a part of many interdisciplinary teams as each individual brings unique backgrounds to the table to solve large scale problems together.

Dr. Seneca will will moderate the plenary speaker panel discussion on Saturday, Nov. 8, from 10:30 – 11:00 a.m. in Room 272 (The Forum) and help lead the special session ***"The Hidden Cost of Data Centers"*** on Saturday, Nov. 8, from 1:00 – 2:00 p.m. in the Room 272 (The Forum)..

Kathy M.B. Boomer

Scientific Program Director
Foundation for Food & Agriculture Research (FFAR)

Dr. Kathy Boomer joined the Foundation for Food & Agriculture Research as a Scientific Program Director in July 2019 after serving ten years as the Lead Watershed Scientist for The Nature Conservancy's Chesapeake Bay Restoration initiative. She has led numerous research partnerships to engage stakeholders and advance targeted agricultural and urban conservation practices.

Kathy has worked in China as a monitoring consultant for the Food and Agriculture Organization of the United Nations She continues to focus on developing programs to advance crop, soil, and watershed health through innovative water management. Kathy received her bachelor's degree in natural resources, her master's degree in wetland ecology and her doctorate degree in biogeochemistry all from Cornell University.

Earlier in her career, she worked with the Smithsonian Environmental Research Center as a geospatial ecologist. In this capacity, she investigated ecosystems services provided by a range of terrestrial, wetland and coastal habitats. She continues to serve on the Executive Board of the U.S. Environmental Protection Agency's Chesapeake Bay Program's Scientific Technical Advisory Committee.

Kathy has extensive experience in landscape modeling and field research to support technical assistance and a passion for advancing science-based decision-making to provide a pathway to sustainability and resilience of humans and nature. Outside of strengthening partnerships to ensure food security and agroecosystem sustainability, she enjoys watching and attempting a wide range of sports with her family on Maryland's Eastern Shore.

Kathy will help lead the special session ***"The Hidden Cost of Data Centers"*** on Saturday, Nov. 8, from 1:00 – 2:00 p.m. in the Room 256 (The Center Room)

EXHIBITORS

SIERRA CLUB
PENNSYLVANIA

MERRILL W. LINN
CONSERVANCY
LINKING LANDSCAPES

BCWA Buffalo Creek Watershed Alliance

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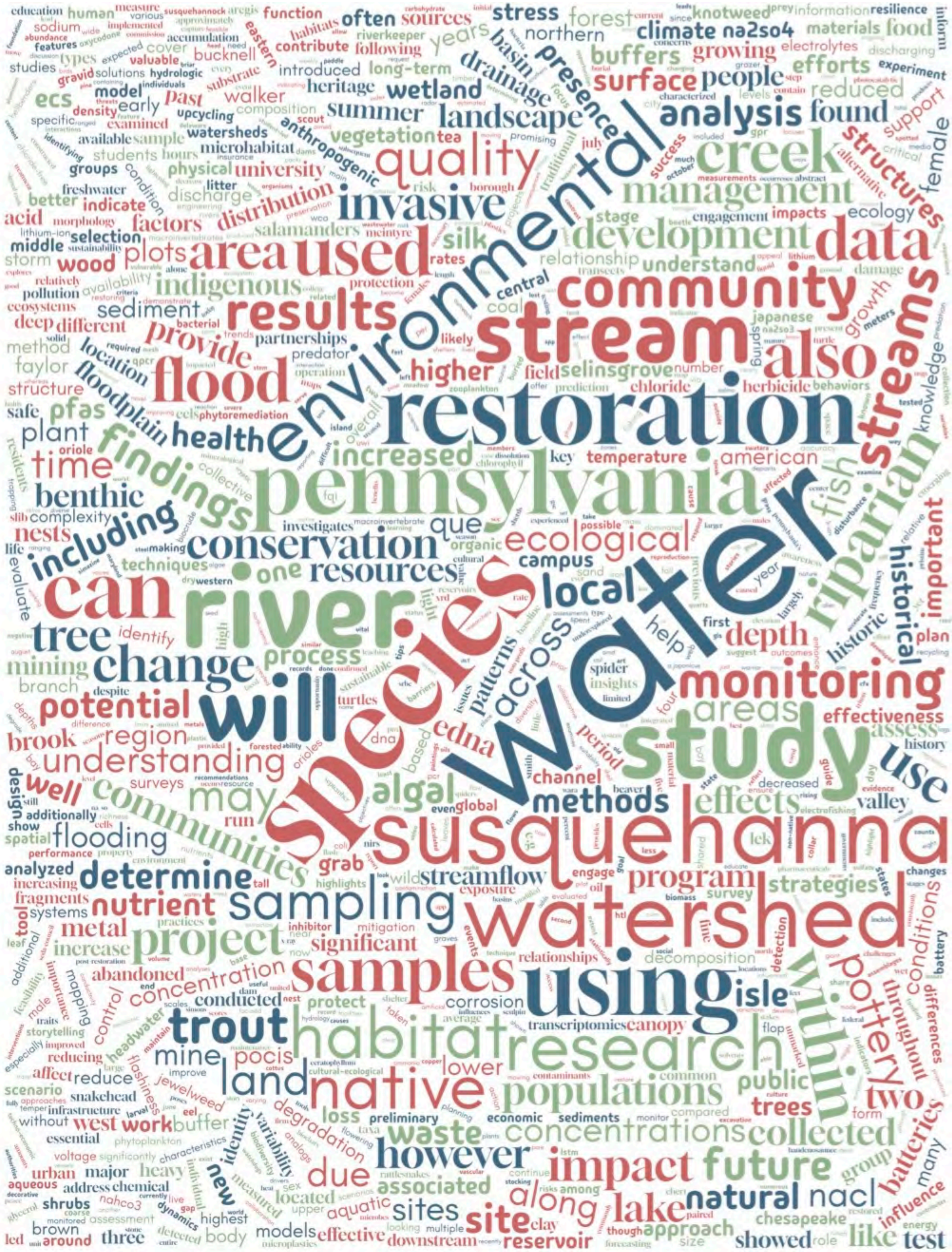

A “word cloud” visualization of the oral and poster abstracts contributed to this symposium (pages 20-75). Their relative size denotes greater prominence to the words that appear most frequently. A total of 15, 731 words were analyzed.

2025 RIVER SYMPOSIUM

INVITED PRESENTATIONS

INDIGENOUS HERITAGE INITIATIVE: RESTORING A CULTURAL-ECOLOGICAL RELATIONSHIP WITH THE LAND

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As conservation professionals we tend to focus on restoring projects for their function, such as pollutant load reductions, wildlife habitat enhancement, flood control, groundwater recharge, etc. While this is important, focusing on the functional aspects alone fails to engage people and culture in the process. Ecological restoration paired with an understanding of Indigenous lifeways has the capacity to move beyond function towards reestablishing healthy relationships between nature and culture.

Community engagement in restoration can support ecological health and cultural meaning. So, we're asking: What are the local cultural-ecological relationships prior European settlement? And what does it look like to restore this relationship today?

The local landscape carries the legacy of Indigenous cultural-ecological relationships where people lived with nature, though these legacies are sometimes buried, often hidden, and/or are largely inaccessible to the public. We will talk about Phase 1 of our project, which is to educate the general public about the interconnections between water quality, ecological restoration, and cultural heritage using the Little Conestoga Creek Watershed as a case study. Another goal of Phase 1 is to help identify and facilitate mutually beneficial opportunities that exist between the Indigenous community and conservation professionals. For example, we know now that landscapes have been managed and altered for thousands of years prior to European contact. What practices were used then that could be implemented in conservation today? What can traditional ecological knowledge (TEK) offer that is missing from Western science? Alternatively, what has science and technology allowed us to learn about the local natural history, and how can that information be shared with present-day Indigenous groups

where that knowledge may have been lost over generations of being disconnected from the land?

We will also share our processes and methodologies for conducting this kind of research, including the current barriers that exist and how our project can help overcome them. We will share our findings of this project, including recommendations for conservation groups from an Indigenous perspective and ideas that we have for future phases of our project.

Disclaimer: Pennsylvania has a very complex and complicated Indigenous history, and it is important to recognize that Indigenous people are still here. There is no state or federal recognition of Indigenous tribes in Pennsylvania, making it difficult for people with Indigenous heritage to claim legitimacy and also for researchers like ourselves in identifying who holds authority to speak for the land. We do not see it as our role to determine whose stories or lived experiences are valid. Instead, we believe it is essential to engage with both historical and contemporary Indigenous voices connected to this land and water. Therefore, this project engages with many voices through community organizations, local leadership and experts, and Indigenous allies.

ecological restoration, cultural-ecological relationship, Indigenous, conservation

Little Conestoga Creek, Lancaster County, PA [photo: Logan Beegle]

RESILIENT BY THE RIVER: STRENGTHENING FLOOD PREPAREDNESS AND PRESERVATION IN SELINSGROVE BOROUGH

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Communities along the Susquehanna River have always had a deep connection to the water, shaped by its beauty, economic value, and cultural importance. But as climate change accelerates and watershed urbanization continues, that relationship is being tested by more frequent and intense flooding. The increasing complexity of riverine and flash flooding underscores an urgent need for actionable, community-based resilience strategies.

The Borough of Selinsgrove is rising to that challenge. With grant support from the SEDA-Council of Governments, the Borough partnered with a multidisciplinary team led by AKRF to identify strategies that will improve preparation, response, and recovery efforts related to flooding. The study involved navigating a rich institutional knowledge of flooding in the Borough through stakeholder engagement with long-term residents, Borough officials, first responders, and members of the flood task force. The community's prior research and lived experience were key drivers of the resiliency plan, which focuses on organizing and formalizing procedures, response roles, resources access, and partnerships. Community messaging and outreach are critical components of this plan as they aim to increase community awareness and preparedness, even when flooding is not imminent. A key focus of the study was the often-overlooked challenge of balancing historic preservation with flood adaptation. By exploring practical solutions and real-world examples, the plan identifies pathways to protect both Selinsgrove's built heritage and its future resilience.

Studies like these highlight the urgent need for partnerships, research, and funding to protect riverfront communities from flooding and allow these areas to have a safe and prosperous relationship with the river. As flooding grows more severe across the U.S., efforts like Selinsgrove's show what's possible when resilience planning is both local and forward-looking.

Flooding, Resilience, Historic Preservation, Community Engagement

THE USE OF STAGE 0 DESIGN APPROACH IN REMEDIATION OF THE GOOD SPRING ABANDONED MINE RECLAMATION FLOODPLAIN RECONNECTION PROJECT

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The presentation will provide an overview of the design considerations and remedial activities done on a large-scale floodplain reestablishment project associated with an abandoned mine reclamation project. The project encompasses approximately 4,600 feet of floodplain valley reestablishment encompassing approximately 18 acres. The valley was originally buried under coal waste or culm that during events was heavily eroded and transported into the downstream communities along Good Spring Creek (GSC). The Donaldson Culm Bank eliminated the natural floodplain of GSC adding to the higher peak stream flows and flooding in downstream communities of Schuylkill County. A brief discussion of why intervention (aka the problems) was necessary to ensure the success of the original project objectives. A discussion of the design techniques and decisions that were made to implement this novel approach to reestablishing the wild trout watercourse. The watershed has an approximately 5 square mile drainage area.

The work included excavation and placement of additional log base level control structures that were buried below the floodplain surface to prevent and control any accelerated erosion and prevent head cutting of channels along the valley. Approximately 25,000 feet of 18–24-inch diameter logs were placed across the entire valley at a horizontal spacing based upon 1.0-1.5-foot vertical elevation increase. The design approach is intended to provide valley grade control so the stream channel(s) that form can move across the valley and maintain the same channel invert elevation and if erosion occurs it is controlled and prevented from propagating beyond the next set of valley grade control logs. No bedrock controls are present throughout the valley due to its historic mining. The surface of the floodplain was then covered in woody debris (treetops and logs) to provide habitat, roughness, and to assist in development of an anabranched channel pattern. No stream channel was constructed; the site was allowed to self-evolve though alluvial processes.

THE HIDDEN WATER COSTS OF DATA CENTERS

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As society becomes more dependent on digital infrastructure, the rapid expansion of hyperscale data centers often comes with overlooked environmental consequences. These facilities require enormous amounts of water for cooling, chemical treatments, and generating the electricity they consume. It is important to recognize that the true cost of data centers extends beyond energy and profits while protecting our vital water sources and respecting the communities that rely on them. These water demands can strain local watersheds, diminish water quality, and threaten ecosystem health, especially in regions already facing water scarcity. Moreover, communities opposed to data center projects frequently cite concerns over depleted water supplies, environmental degradation, and diminished quality of life. Despite their economic allure, the true cost of data centers extends beyond financial investments, entangling local waters and communities in long-term environmental and social challenges. Recognizing and addressing these hidden costs is essential for fostering sustainable development that balances technological advancement with water security and community resilience.

The first building at Talen Energy subsidiary Cumulus Data's nuclear-powered Susquehanna data center campus in Pennsylvania [photo: Talen-Cumulus]

2025 RIVER SYMPOSIUM

ORAL PRESENTATIONS

North Branch Susquehanna River [photo: John Reisenfeld]

RESEARCH FOR RESTORATION: IMPROVING IMPACT THROUGH UNIVERSITY PARTNERSHIPS

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Chesapeake Conservancy (CC) is a watershed-wide organization focused on the conservation of land and protection of waterways through the use of data-driven precision conservation techniques and regional partnerships. The Conservancy's partnership with Susquehanna University (SU) has allowed us to support conservation research and empower students through leadership focused internships, filling gaps in knowledge and contributing to Conservancy projects. Together we have restored a wet meadow, researched outcomes, and piloted seed collection and tree grow-out programs, showcasing the impact students can have on region-wide outcomes and the work of their university partners.

In 2021, the restoration of a historic dump-site in Selinsgrove was facilitated by the SU/CC partnership. This project is now a thriving wetland informing future restoration practices through student-led research. Results will guide future projects, improving approaches and success for conservation organizations pursuing similar management strategies in the future. In addition, CC's programs benefit in other ways from the wet meadow, as it has become a primary source of student-led seed collection and grow-out at the on-campus greenhouse. These projects provide free plant material to partners and areas of need in the Chesapeake basin. This presentation will discuss the evolution of the restored wet meadow and how we collaborate with university partners to expand our impact.

wet meadow, partnerships, restoration

RESEARCH ON METHODS FOR ESTABLISHING RIPARIAN FOREST BUFFERS

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Stroud Water Research Center is testing the following topics at the Ware site in SE PA. Data after three growing seasons are now available.

Mowing frequency: Stroud Center mows buffers at least 2x per year for at least three years as a cost of ~$1200/acre. Could we reduce mowing and reduced costs? Reduced mowing also protects natural tree regeneration. Findings: reduced mowing led to significant mortality on many plots.

Solving tree flop syndrome: Some tree species grow so fast that top growth exceeds stem strength, causing trees to flop over. Once they flop, solutions are difficult. Tests include five ideas to reduce flop. Findings: too soon to tell. Trees are only now getting to size where flop occurs.

Testing a new shelter design with a large opening at base of shelter: Some say shelters protect trees from rodents by acting as a physical barrier. Others suspect a large opening may deter rodents by not providing a fully enclosed space where they feel safe. A large opening could have other benefits:
- allow birds to escape
- avoid need for nets and the tangled tree tips they often cause
- increase air flow/water stress, perhaps reducing tree flop
Findings: Initial results on this single site are encouraging. We'll do additional trials.

Methods for flood-prone areas: Floods often break wooden stakes that support tree shelters. Plots test 1) fiberglass stakes, which bend over but restand after flooding and 2) larger trees (above deer browse) that avoid use of shelter or stake. Findings: Buck rub ruined nearly all larger trees in year one. Only limited flooding has occurred to date, with fiberglass stakes working as hoped.

Methods in reed canary grass (RCG): RCG is highly competitive and causes buffer failures. Plots test utility of a one-time herbicide application to suppress RCG prior to installing stone mulch. Findings: Does not appear useful/necessary.

Methods for multi-stem shrubs: Multi-stem shrubs valuable but are hard to protect from herbivores. Plots test:
- 4' tall fencing of groups of shrubs
- 5' shelters on individual shrubs
- individual shrubs protected with 18" diameter welded wire cages, with 4' tall and 5' tall variants.
Findings: Fencing groups or individual shrubs produces healthier forms than 5' shelters, which tend to make shrubs leggy and floppy.

forested buffers, restoration methods, research

A LANDSCAPE TRANSCRIPTOMICS APPROACH FOR EVALUATING THE EFFECTIVENESS OF RIPARIAN BUFFERS TO REDUCE STRESS IN BROWN TROUT (*SALMO TRUTTA*)

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Riparian buffers are a best management practice (BMP) often used as part of watershed management plans for improving stream habitat for cold-adapted fish species, including recreationally important brown trout (*Salmo trutta*). The effectiveness of riparian buffers for reducing nutrient and sediment inputs to streams has been well studied, but the impact of riparian buffers on cold-adapted fish physiology is largely underexplored. To address this research gap, we are examining brown trout gene expression (gill transcriptomics) to assess the efficacy of riparian buffers to reduce environmental stress. To accomplish this, we are conducting a space-for-time substitution study in Pennsylvania by monitoring eleven riparian stream buffer sites of varying age (three young [5-10 years], four intermediate [5-20 years], and four mature sites [15+ years]) to understand how buffer development influences stress in naturally reproducing brown trout. Brown trout sampling occurred during three seasons to capture times when different types of stress are expected (fall 2024 – reproductive stress, spring 2025 – low stress, and summer 2025 – thermal stress). During sampling, we conducted non-lethal gill biopsies for gene expression and indexed fish abundance (catch per unit effort). Stream and riparian buffer physical assessments were also conducted following each fish sampling period. HOBO temperature loggers were deployed at each site to continuously monitor water and air temperature variation at 30-minute intervals. Increased riparian buffer development (e.g., leading to increased percent canopy cover) is expected to be associated with a decrease in thermally stressed brown trout as indicated by expression of certain heat shock proteins. We also expect genes that are responsive to stress generally to be upregulated in fish sampled in both the summer and fall. This research will address a critical gap in our understanding of how riparian buffers affect brown trout, an ecologically and socioeconomically important species in Pennsylvania streams.

Riparian buffers, Pennsylvania, Environmental stress, Transcriptomics

BENCHMARKING DEEP LEARNING MODELS FOR IMPROVED STREAMFLOW PREDICTION

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Accurate streamflow prediction is essential for effective river management, flood mitigation, and ecological restoration. Deep learning models, especially Recurrent Neural Networks (RNNs) such as Long Short-Term Memory (LSTM), have shown notable success in predicting streamflow dynamics. Recently, the attention-based Transformer architecture has emerged as a promising alternative due to its effectiveness in capturing long-term dependencies. However, the relative performance of Transformer-based models compared to LSTM in hydrological forecasting remains unclear. In this study, we systematically benchmark 11 Transformer variants against LSTM models across diverse streamflow prediction scenarios using large-scale basin datasets, including CAMELS and global streamflow observations. Our results indicate that while LSTM models excel in regression and memory-dependent streamflow prediction tasks, Transformer models demonstrate superior performance in more complex forecasting tasks, particularly for longer prediction horizons. This benchmarking effort provides clear guidance on the applicability and effectiveness of advanced deep learning models for hydrological predictions, informing future efforts toward improved streamflow forecasting and management.

Streamflow Forecasting, Deep Learning, Hydrological Modeling,

WAS IT "THE WORST WE'VE EVER SEEN"? AN EXPLORATION OF A STORM EVENT FROM THE SUMMER OF 2025

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As climate changes due to both natural and human-augmented dynamics, understanding severity and frequency of storm events is essential to successful storm runoff management strategies. Storm data are collected at various spatiotemporal levels and are available to those wishing to understand a particular event. However, where appropriate data are not available, anecdotal evidence regarding storm intensity and impacts may help understand an event and even inform both rebuilding and mitigation efforts. This research investigates one such storm in Pennsylvania from the summer of 2025. When chatting, it was stated by multiple locals that the storm which led to immense damage along a township roadway was the worst that was ever seen in the area. Associated precipitation, which led to said damage, is examined at various scales to elicit storm severity and potentially offer credence to what might otherwise be "just conversation." Recommendations on utilization of such information are offered.

storm runoff, anecdotal evidence, mitigation

Summer storm over Susquehanna River at Sunbury, Pennsylvania. [Photo: Tony Bendele]

RISING RIVERS, RISING RISKS: A FUTURE FLOODSCAPE ANALYSIS OF A CENTRAL PENNSYLVANIAN WATERSHED

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This study investigates the impact of climate change on a flood-prone region in central Pennsylvania—the Swatara Creek watershed—by integrating global climate model (GCM) projections with hydrologic and hydraulic simulations and risk-based damage assessments. Using a calibrated hydrologic model and an ensemble of IPCC AR6 GCMs under Shared Socioeconomic Pathways (SSP) 2-4.5 and 5-8.5, we simulate future streamflow conditions through 2100. These climate-informed streamflow projections are coupled with 2D hydraulic models to simulate flood inundation for multi-day high-flow events exceeding historical flood thresholds in the region, identifying at-risk infrastructure.

To further quantify economic flood losses, FEMA's HAZUS flood damage function and a property tax assessor's dataset are integrated into the modeling framework. The study also examines the feasibility and effectiveness of various flood mitigation strategies, including nature-based solutions (e.g., wet basins, floodplain reconnection) and policy-based interventions (e.g., elevating structures, property buyouts).

The study addresses three key questions:

1. How will climate change reshape the streamflow dynamics in the Swatara Creek watershed over the 21st century?
2. What are the economic consequences of varying flood extents for urban infrastructure in the region under climate scenarios?
3. How feasible and effective are NbS and policy-based alternatives in reducing flood risk and associated damages in the Swatara Creek watershed, in changing climate scenarios?

The outcomes of this study provide a data-driven assessment of future flood risks and evaluate the feasibility of flood mitigation strategies to enhance flood resilience in the Swatara Creek watershed. The findings contribute to regional adaptation planning and underscore the importance of integrated, sustainable approaches to flood management under changing climatic conditions.

Flood-risk assessment, Climate change, Pennsylvania, Mitigation strategies

WATER ON ITS WAY TO THE CHESAPEAKE: VIDEO STORYTELLING AS A TOOL FOR COLLABORATION AND PUBLIC ENGAGEMENT

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Engaging people through powerful video-captured and edited storytelling takes quite a bit of effort, artistry, time and the proper equipment, but the end result can inspire audiences to take action, protect vital resources and develop a better appreciation for a world they may never get to otherwise experience. Renowned local videographer Michael Kinney has a growing library of compelling underwater footage and recently produced the award-winning documentary Old River from his 24-day, 228-mile paddle down the West Branch of the Susquehanna River. Meanwhile Dr. Joseph Simons III offers an arsenal of impactful videos of vital headwater adventures involving native trout on his Wild Trout Man YouTube channel that equally entertain and educate people about the importance of clean water.

Join both Kinney and Simons as they share what sparked their interest in aquatic videography, tips for capturing effective underwater clips, observations about what is so powerful about video storytelling and opportunities for collaboration with local students, advisors and other researchers.

Videography, Storytelling, Research, Aquatics

A COLLECTIVE IDENTITY APPROACH TO ADDRESSING WATER QUALITY IN THE CHESAPEAKE WATERSHED REGION OF PENNSYLVANIA

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For 50 years the Chesapeake Bay Watershed has faced long-standing challenges to its poor water quality despite local successes, substantial investment, and organization. Pennsylvania is a major contributor of freshwater runoff from the Susquehanna River Basin, yet has faced lawsuits from adjacent states alleging insufficient action to address water quality. This situation is a classic collective action problem. Collective identity, an individual's understanding that they belong to a group and hold shared consequences with group members, is a prerequisite of collective action. We suggest that the problem cannot be addressed without first raising awareness among residents that they live within a common watershed – thereby creating a watershed-based collective identity. Rooted in social identity theory and social categorization theory, we proposed a stage model of collective identity (Mainzer, Dillard, & Cole 2024) that describes four sequential stages of watershed-based identity development. The stages describe an individual's: knowledge of the group, meaning their understanding of the basic definition of a watershed (Stage 1), knowledge of group membership, i.e. the ability to correctly name their watershed(s) (Stage 2), understanding of shared pro-environmental values among the group (Stage 3), embracing of a sense of personal consequence and interdependence with group members (Stage 4).

Supported by the Pennsylvania Water Resources Research Center, we designed knowledge-based and psychometric measures corresponding to each stage. We then validated each measure through a series of statewide surveys in Pennsylvania. Here, we present the process of developing those measures, the resulting items, and preliminary results among Chesapeake Bay Watershed and non-Chesapeake Bay Watershed residents.

Chesapeake Bay, collective identity, watershed, scale development

KEYSTONE WATER RESOURCES CENTER: A COLLABORATIVE MODEL FOR SUSTAINING LONG-TERM WATER MONITORING

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Long-term, high-resolution water quality and quantity data is an essential foundation for adaptive watershed management and land-use planning, yet such monitoring networks face real challenges related to financial and operational sustainability. The Keystone Water Resources Center's (KWRC) 27 year-old Spring Creek Water Resources Monitoring Project (WRMP) in Centre County, Pennsylvania, is a resilient long-term water monitoring network that unites municipal, private and non-profit interests around a shared environmental resource.

Since 1998, our mission has been to collect scientifically useful water data, make that data available to the public, and educate about our surface and groundwater resources. We record stream flow, temperature, chemical and nutrient content across 36 monitoring stations (22 surface water, 8 springs, 3 wells) in the karst Spring Creek Watershed.

The project's funding pools resources from local municipalities, water and wastewater authorities, academic institutions, and non-profit conservation groups. This collaborative model is sustained by the critical, public utility of its data. This supports local decision-making and is routinely utilized by a wide array of end-users, including local government planners, water authorities, consulting firms, and federal agencies such as the U.S. Geological Survey (USGS) and the Susquehanna River Basin Commission (SRBC).

Visit keystonewaterresources.org to view our methods, request data and access annual reports.

Water Monitoring , Adaptive Watershed Management , Operational Sustainability , Collaborative Model

SOUNDING THE ALARM ON E. COLI IN THE LOWER SUSQUEHANNA WATERSHED: HOW CAN WATER QUALITY MONITORING EMPOWER AND ENGAGE COMMUNITIES

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Lower Susquehanna Riverkeeper Association's vision is to ensure drinkable, fishable, swimmable water on the Lower Susquehanna River and raise community awareness for current and future generations on the ecological and economic value of the Lower Susquehanna Watershed.

In June 2023, we launched our Water Watchdogs Bacteria Monitoring Program for the Lower Susquehanna River Watershed which has currently been operating between the Swimming Months between Memorial Day and Labor Day. The purpose of this program is to inform people when popular public river/creek accesses are safe for recreating or not based on the Pennsylvania Department of Environmental Protection's safe swimming recommendations for Escherichia coli (E. coli) which we analyze by the IDEXX Colilert-18 Method for detecting Total Coliforms and *E. coli.*

Since 2023, the program has expanded from 5 monitoring locations to 22 monitoring locations and has engaged over 50 volunteers who help operate the program dedicating many hours and miles of driving. As our program has grown internally, our external community engagement with the program has grown too.

Each week during the program, we publicly share our results in easy-to-understand infographics to the community through the SwimGuide app, Facebook, Instagram, our website, a weekly email, and many events that we have hosted or have attended. We have also worked with two Franklin & Marshall College interns who improved the program and were able to translate the infographics we use for community outreach in Spanish to improve our reach outside of those who speak English.

We aim to continue growing this program and are currently working on ways that we can determine trends, further engage communities, and how we can provide our collection of data to the Pennsylvania Department of Environmental Protection for their biennial Pennsylvania Integrated Water Quality Report. By engaging with the communities of the Lower Susquehanna Watershed through our Water Watchdogs

Bacteria Monitoring Program, we can bring awareness, education, and advocate for a swimmable River.

PFAS AND FISH CONSUMPTION: PER- AND POLYFLUOROALKYL SUBSTANCES IN INVASIVE *CHANNA ARGUS* POPULATIONS

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Non-native invasive species and emerging contaminants are two global change drivers that have the potential to reshape aquatic communities, especially in understudied urban ecosystems. Per and polyfluoroalkyl substances (PFAS) are of particular concern due to their persistence in the environment, global distribution, and potential for negative ecological and human health outcomes associated with exposure. The consumption of fish is an important PFAS exposure pathway for humans. Northern snakehead (*C. argus*) are a recent non-native invasive species in the eastern US that is growing in popularity as a sport and food fish. Despite recent studies finding sport fish with high PFAS concentrations and many snakehead populations occurring in areas likely to have PFAS contamination, there is limited information about PFAS in northern snakehead populations. The objectives of our research are to (1) quantify PFAS occurrence and concentrations in northern snakehead populations across an urban development gradient, and (2) use a landscape transcriptomics approach to identify molecular markers of sublethal PFAS exposure. In the fall of 2024, we sampled surface water and sediment at nine sites in the Susquehanna and Delaware River basins, PA with confirmed northern snakehead presence. Out of the 40 chemicals tested, perfluorooctanoic acid (PFOA) was the most commonly detected in surface water samples, ranging from 0.0018 to 0.08 ug/L. The highest PFAS concentrations were in sediment samples from an urban lake. Fish sampling was completed in the fall of 2025 and tissue analyses are ongoing. This study will provide novel insights into the interplay between an invasive fish predator and PFAS exposure risk while investigating the physiological effects of PFAS on wild fish through transcriptomics.

PFAS, Fish consumption, Northern snakehead, Transcriptomics

BACTERIAL ASSEMBLAGES RESPOND TO VARIATIONS IN RIPARIAN CANOPY IN 46 HEADWATER STREAMS IN THE UPPER DELAWARE RIVER BASIN, USA

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Headwater streams are crucial for the health and resilience of entire watersheds; therefore, understanding how human activities disrupt the structure and function of these vulnerable ecosystems is paramount. Bacterial assemblages respond to a myriad of environmental changes and have the potential to indicate subtle anthropogenic impacts to relatively pristine headwater streams. We collected benthic samples from 46 headwater streams throughout the upper Delaware River Basin, USA. Streams were relatively pristine with upstream forest covers >50%. Bacterial community compositions for each stream were characterized following DNA extraction, amplification of the 16S rRNA V4 gene, and sequencing in the laboratory of Mehrdad Hajibabaeui at the University of Guelph. Nonmetric multi-dimensional scaling was used to visualize between-site differences and potential relationships with environmental variables. We found that bacterial community composition was most strongly related to canopy cover. It is likely that increased algal dominance of stream biofilms associated with reduced riparian canopy leads to detectable shifts in the bacterial community. These results demonstrate how subtle impacts, such as a reduction in the riparian tree canopy, can have measurable effects on the microbial assemblages.

INVESTIGATION OF CORROSION INHIBITORS FOR LI-ION BATTERY DISCHARGE IN AQUEOUS ELECTROLYTES

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Lithium-ion batteries are promising alternatives to conventional energy sources, but repeated charge discharge cycling limits their service life. At end of life, cells are often deactivated by discharging in aqueous sodium chloride (NaCl), a simple and low-cost method. However, chloride ions accelerate corrosion of copper and aluminum current collectors and promote transition-metal leaching from cathodes, posing environmental risks. This study explores corrosion-mitigation strategies that maintain discharge performance while reducing metal loss. Cylindrical Li-ion cells were discharged in NaCl containing Na2SO3, glycerol, or TEA, and in chloride-free or inhibitor-modified electrolytes. In NaCl media, Na2SO3 scavenged dissolved oxygen, glycerol reduced water activity and formed diffusion-limiting films, and TEA acted as an organic film-forming inhibitor, together minimizing corrosion of steel, Cu, and Al. Chloride-free solutions 3 wt% Na2SO4 with 0.3 wt% NaHCO3, 3 wt% Na2SO4 in water-glycerol and water-ethanol, and 3 wt% Na2SO4 with 5 wt% reline were also evaluated, along with a two-step discharge sequence (20 wt% NaCl in first step and 3 wt% Na2SO4 with 0.3 wt% NaHCO3 in second step). Voltage drops were recorded over 30 hours, and post-discharge electrolytes were analyzed by ICP-MES for Cu, Al, Ni, Co, and Mn. Relative to NaCl, sulfate-based electrolytes such as Na2SO4 and NaHCO3 are expected to reduce metal dissolution by limiting chloride activity and promoting protective surface films. Mixed-solvent sulfates should further suppress corrosion through decreased ionic mobility and improved inhibitor interaction. In contrast, baseline NaCl is anticipated to cause rapid Cu dissolution and visible deposits, while the addition of TEA or Na2SO3 may partially mitigate chloride-induced pitting. Overall, this study highlights those electrolytes that are chosen to balance inhibitor chemistry, conductivity, and corrosion protection, enabling safer and more efficient battery deactivation with reduced environmental impact.

Lithium-ion batteries, discharging, inhibitors,

ENVIROMENTAL JOURNALISM: TIPS AND TOOLS FOR LOCAL RESEARCH

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Over the past year, the greater watershed has experienced a wide number of hot-button environmental issues. These have included a massive sewage spill near Selinsgrove that highlights the aging infrastructure concerns across our area, a fracking wastewater incident near Williamsport that left a rainbow-color sheen on the river and questions about public health, increasing concerns about emerging contaminants such as microplastics, pharmaceuticals and PFAS, a growing number of invasive species threats and more. The Heartland region is blessed with a wide number of quality universities with research components that study a wide number of environmental issues, but much of that work never connects with the general public. Meanwhile, mainstream media is struggling to cover a growing number of major stories with shrinking newsrooms and resources. Reporters have to multi-task as photographers, videographers, editors and social media influencers on each beat, leaving little time for meaningful research and indepth reporting.

This session is focused on bridging the gap between these two areas and how groups like the Middle Susquehanna Riverkeeper Association can help. We will look at easy-to-locate resources and tips for people on all sides of this situation ... students and professors looking to simplify their work for the general public without taking away its importance and impact. Journalists looking to beef up their environmental reporting while having just a minimal layman's understanding of bigger concepts, and how they can broaden their toolbox. We will be looking at specific examples of events over the past year and hot-button issues to see what questions are not being asked and how to better educate the public about issues so they can respond, protect themselves and their families and better address some of the sources of these concerns.

Environmental, Journalism, Research, Storytelling

A NEW NATIVE AMERICAN REFLECTION SPACE IN THE SUSQUEHANNA WATERSHED

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Stories of the Susquehanna Valley is an ongoing student-faculty project at Bucknell, which has joined with the President's Sustainability Council and Athletic and Facilities Departments to plan a Native American reflection space at the campus in the Susquehanna watershed, as the first pilot project of the Bucknell Greenway. The plan, developed with help from design students in Bucknell's College of Management and journalism students in the College of Arts and Sciences, will involve gathering the Seventh-Generation Sculpture blessed by Haudenosaunee leaders to a new location adjacent to the Tree of Peace given to Bucknell by the Haudenosaunee. The area will feature also new historical markers commemorating the Tree of Peace and Seventh-Generation Sculpture, early Native American leaders in the region (Chief Shikellamy and Madame Montour), and Haudenosaunee elder and long-time Bucknell coach Sid Jamieson, who inspired the project. Students will also develop online interpretive materials for the site. The story of the project will briefly be told at the presentation, and its significance. The outdoor location at Bucknell's campus, located adjoining to the North Branch of the Susquehanna near the Susquehanna Confluence, and along the Capt. John Smith Chesapeake Bay National Historic Corridor and Water Trail, will provide an opportunity both for the Bucknell and larger community to reflect on Native American history and continued presence at the university and in the region.

history, culture, landscape art, Native American

LIVE LIKE A RIVER FLOWS: A JOURNEY OF HEALING

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Former Middle Susquehanna Riverkeeper Carol Parenzan returns to the Susquehanna River Symposium to share her unexpected and lifechanging river journey story.

In 2020, Carol was diagnosed with numerous rare medical conditions, placing her on long-term medical disability. In *"Live Like a River Flows,"* she shares the role that her beloved Susquehanna River played in guiding her home to healing.

Carol's connection with the river began in her childhood when she would travel along the river with her family, memorizing the placement of every rock and ripple. After years of competitive swimming and whitewater paddling, she ventured west in the watershed to earn an environmental engineering degree with a focus in water from Penn State.

In 2015, she founded Middle Susquehanna Riverkeeper Association and served as its inaugural Riverkeeper, where she and the organization received numerous honors and recognitions, including Woman of the Susquehanna River Watershed, 2018 Pennsylvania River of the Year (Loyalsock Creek), PA Governor's Award for Environmental Excellence, People Who Make a Difference, and a PA Environmental Justice Advisory Board appointment. She created the Floating Classroom Program on the Hiawatha Paddlewheel Riverboat, trained "Little Keeper Susquehanna" -- a Nova Scotia Duck Toller, as one of the few nose-work dogs sniffing out water pollution, and spent a week in the PA Wilds, residing with six prisoners from Quehanna Bootcamp and introducing them to environmental work.

Her water-focused career was spotlighted by Wiley Publishing in its 2022 "Global Environmental Careers: The Worldwide Green Jobs Resource."

She recently earned two certifications: Mindfulness Outdoor Guide and Blue Water Therapist. She is currently penning several new books: a memoir titled "River Unfolding," a middle-grade novel about the challenging migration of the American eel up the Mighty Susquehanna, and a children's book about coal mining that parallels two communities, one here in Pennsylvania's Anthracite Region and the other in northern Europe.

She thanks her river colleagues that have kept her in their thoughts and prayers these past five years, and she is truly grateful to be among the finest (and gnarliest) river rats once more.

inspirational, healing, Riverkeeper

2025 RIVER SYMPOSIUM

POSTER PRESENTATIONS

[Photo: Chesapeake Bay Foundation; used with permission

QUANTIFYING WOOD TURTLE (GLYPTEMYS INSCULPTA) FINE-SCALE HABITAT SELECTION IN A FUTURE RIPARIAN RESTORATION SITE

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Wood turtles (*Glyptemys insculpta*) are semi-aquatic turtles native to the northern United States and Canada and are currently proposed for federal protection with the USFWS. Wood turtles rely on a mosaic of aquatic and terrestrial habitats, making them vulnerable to multiple threats, including habitat loss, road mortality, and invasive vegetation. Despite high overlap between wood turtle populations and stream restoration projects in Pennsylvania, little is known about how such interventions affect their spatial ecology. In this study, we used radio telemetry to assess fine-scale habitat selection of wood turtles on a property slated for future riparian restoration. We tracked turtles (n = 4) from March to August 2025 and collected habitat data within 3x3 m plots (27 used and 27 random plots). We used paired logistic regression models to evaluate factors influencing habitat selection. Wood turtles most frequently used floodplain forest, bank, and stream habitats. Canopy cover was found to be a significant negative predictor of habitat selection. While sun exposure negatively influenced habitat selection, and both food availability and substrate temperature increased selection, these trends were not statistically significant. This study provides baseline data for future post-restoration comparisons of habitat selection and contributes information regarding wood turtle use of riparian environments. Continued monitoring will enhance insights into the effects of restoration practices on wood turtle spatial ecology and inform habitat management strategies for this declining species.

habitat selection , stream restoration , telemetry , wood turtle

PLAYING WITH CLAY – REPRODUCING NATIVE POTTERY: SUSQUEHANNOCK STYLE

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Pottery sherds collected from the Isle of Que in Selinsgrove, PA, provided design, compositional (mineralogical and chemical), and size information that guided our reproduction of pottery in the Susquehannock style. Susquehannock pottery is characterized by its cord-marked bulbous body and tall collar decorated with incised triangular or diamond patterns, often accompanied by horizontal bands of impressions just below the lip. Some vessels also feature distinctive effigies incorporated into the collar. To reduce cracking, the Susquehannocks tempered their clay with chert, quartz sand, and shell fragments.

We analyzed the pottery sherds to better understand the designs, dimensions, and materials used in Isle of Que pottery. The sherds were examined using calipers, X-Ray Diffraction (XRD), Wavelength-Dispersive X-Ray Fluorescence (WDXRF), and thin-section petrography. Sherd thickness ranged from 0.2 cm to 1.13 cm. Our results suggest that local illitic clays were likely collected from Penns Creek, Middle Creek, and the Susquehanna River. Sand from nearby streams and the river, shell fragments from mussels, and crushed Shriver chert (Devonian) may also have been used as tempering materials.

For pottery reproduction, we gathered wild clay from local sources and hand-filtered it to remove pebbles and organic matter. Shriver chert debitage collected from the Isle of Que, quartz sand, and crushed mollusk shells were ground into sand-sized grains and added to the clay as temper (~20%). Pots were formed beginning with a rounded pinch-pot base, which rested in a sand-filled reservoir to maintain its shape. We experimented with bulbous boulders, squash, and pukis as molds and casts to achieve the desired bulbous form but found that a coarse sand reservoir worked best. Coils were added to the pinch pot to construct the tall collar. Because the local clay required firming before it could support the heavy collar, the vessels were left to partially dry to a leather-hard consistency.

At this stage, cord-marking was applied to the body using a cord-wrapped paddle and anvil. The paddle was made from a piece of wood wrapped with cordage woven from native milkweed fibers, while a rounded stone served as the anvil. Additional tools such as bones, sticks, and stone points were used to create decorative patterns and motifs on the pots. The finished vessels were air-dried and then fired using the campfire method, successfully reproducing the form, texture, and stylistic qualities of traditional Susquehannock pottery.

Susquehannocks , Reproduction Pottery , Isle of Que , Selinsgrove

ANTHROPOGENIC INFLUENCES ON HISTORICAL NESTING OF ORIOLES: ISLE OF QUE, SELINSGROVE, PA

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In central Pennsylvania, the spring arrival of the Baltimore Oriole *(Icterus galbula*), their choice of nest location, and nest building materials appear to be strongly influenced by climate change and anthropogenic activities. For the last 12 years, data provided by residents of the Isle of Que (Selinsgrove, Pennsylvania) documents an earlier arrival time for the orioles. In this study, before the leafing-out of trees, historical oriole nests were mapped throughout the Isle of Que and Boy Scout Island using the Arc GIS Field Maps app. These islands are located along the Susquehanna River. There were 56 nests located on the Isle of Que and 2 nests observed on Boy Scout Island. Additionally, nests were examined using binoculars and a Mavic Pro 3 drone to determine if they contained anthropogenic materials like yarn or plastics.

On the Isle, most of the nests were located along Front Street or around houses in developed areas. The abundance of nests near residents over forested spaces (33%) seemed inconsistent with oriole habitat suitability, which prompted us to examine why they chose to live near people. In comparison, Boy Scout Island, which is completely forested, contained very few nests. The dominance of agriculture (58%) and development (9%) on the Isle of Que, in comparison to the Boy Scout Island, which is mostly forested (~100%), caused us to question why the birds preferred living on the Isle of Que near people. On major difference is in the occurrence of flowering vegetation. Flowering trees and bushes (entomophilous plants) were mapped the day after the arrival of the first oriole (April 26, 2025). This study found that early blooming vegetation used in residential landscaping like flowering dogwood, lilac, Japanese Cherry, and apple trees attract insects that represent an important dietary requirement for orioles. Boy Scout Island did not contain the same kinds of flowering vegetation. Insects provide protein for reproduction; other fruit and berry resources become abundant in forested areas and along the riparian buffer after the young have hatched. Though orioles are known to occupy open woodlands, the forest environment in this area is dominated by woodpeckers, which may offer greater competition for food resources in the forest. Nearly all the oriole nests (99%) were also found to be constructed with some form of plastic. The plastic consists of monofilament fishing line, degraded strands of tarp, bail binding, plastic zip ties, polyester yarn, plastic twine, and polyester batting. Most of the nests were in mature deciduous trees (sycamore and maple) in the residential/developed region of the Isle of Que.

The mapping of historic nests reveals a possible explanation for the preferred habitats (and possible changing behaviors) of orioles. The durability of man-made plastics causes the nests to be longer-lasting and resistant to weather and decomposition. Global climate change, the use of plastics and other man-made materials, and the nest location preference demonstrates the influence of our changing world on oriole populations in central Pennsylvania.

Baltimore orioles , Isle of Que , Anthropogenic , climate change

RELATIONSHIP BETWEEN PHYTOPLANKTON DISTRIBUTION AND NUTRIENT CONCENTRATIONS IN TWO LOCAL RESERVOIRS ON THE UPPER MIDDLE CREEK DRAINAGE

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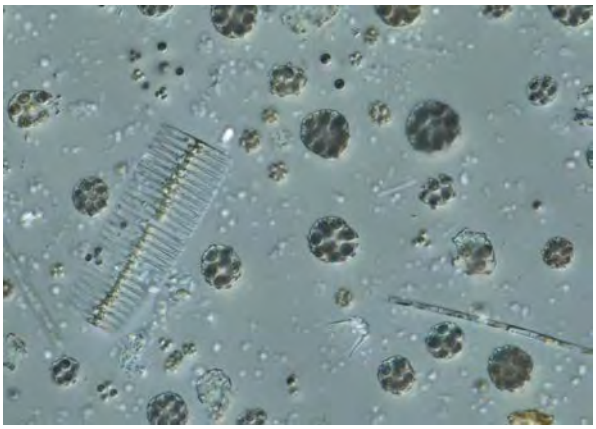

The Upper Middle Creek Drainage in Central Pennsylvania encompasses two recreational reservoirs, Walker and Faylor Lakes, which vary greatly in size and thermal history. Faylor Lake, only a maximum of 4.5 meters deep, holds a volume of .7 x 10^6m^3, as opposed to Walker Lake, which is 9 meters deep, and holds a volume of 4.1x10^6 m^3. Temperature and oxygen measurements reveal that Walker Lake stratifies in June until October, while Faylor Lake weakly stratifies. This past summer, the phytoplankton communities of these two reservoirs were studied, alongside water quality, precipitation, and nutrient concentration primarily during the month of July. The dominant taxa of each reservoir differed, with Walker Lake consistently dominated by Cyanophyta, and Faylor initially being dominated by *Bacillariophyta*, then Cryptomonas, and finally Chlorophyta. Walker Lake had a maximum of 23 taxa, while Faylor had a maximum of 40 taxa. The Shannon Diversity Index (SDI) of Faylor Lake was also greater than Walker Lake from June to August, with the SDI of Faylor Lake increasing gradually from 1.4 to 2.4, whereas Walker Lake decreased from 1.4 to 0.9. Nutrient concentrations of nitrate, nitrite, ammonia, and phosphate were also measured both within each reservoir at multiple depths, and at the streams above and below. Our data show that concentrations of both phosphate and ammonia decreased from July to October at all depths in both reservoirs. In July, there was a noticeable difference in the highest nutrient, with phosphate being much higher in Faylor, and ammonia being much higher in Walker. While nitrite initially decreased across all depths in Walker Lake, it greatly increased in early October. Nitrate concentrations initially peaked in both Faylor Lake and at the surface of Walker but returned to similar concentrations in October. Comparing the nutrient data and phytoplankton compositions between both reservoirs suggests that nutrient concentrations play a role in shaping phytoplankton communities, and vice versa.

Phytoplankton , Reservoir Ecology , Nutrients ,

USING NEAR-INFRARED REFLECTANCE SPECTROSCOPY FOR SEX DISCRIMINATION IN EASTERN HELLBENDERS (*CRYPTOBRANCHUS A. ALLEGANIENSIS*)

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The Eastern Hellbender (*Cryptobranchus a. alleganiensis*) is a large-bodied (≤74 cm TL), long-lived (~50 yrs) aquatic salamander endemic to streams in the eastern United States and serves as an important indicator of stream habitat quality. Populations have declined significantly over the past five decades due to land use change, increased sedimentation, and reduced reproductive success. Because sex is indistinguishable outside of the breeding season (late August – September), traditional methods such as hormone analysis and ultrasonography have limited field applicability. In this study, we evaluated the use of Near-Infrared Reflectance Spectroscopy (NIRS) combined with chemometric analyses to identify sex-specific biochemical signatures in hellbenders. We collected hellbenders (n = 25 males; n = 14 females) from artificial nest box arrays in western Pennsylvania, a region with relatively stable populations. Spectral data were collected during the pre-breeding season (July – August) and analyzed to detect sex-related differences, and sex was confirmed via ultrasound. NIRS detected distinct spectral patterns between males and females, indicating biochemical variation associated with sex. However, the accuracy of classification was likely reduced by the small number of female samples. These findings demonstrate that NIRS has the potential to noninvasively discriminate sex in hellbenders outside of the breeding season and may offer a valuable tool for conservation and management of this declining Appalachian indicator species.

hellbender , amphibian , NIRS , sex discrimination

MICROHABITAT COMPLEXITY AND ITS IMPACT ON BENTHIC COMMUNITY STRUCTURE IN BUFFALO CREEK

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Rivers and streams exhibit a hierarchical organized system of habitats, ranging across scales from whole river systems to segments or reaches to riffles and pools to microhabitat subsystems. These microhabitat systems, such as patches of distinct substrate types (e.g., detritus, sand-silt, cobbles, fine gravel, and vegetation) within larger habitat units, contribute to natural variability within river ecosystems. While research on the role of nutrients is well documented, especially in lakes, far less research has been conducted on how physical habitat variability shapes algal communities in flowing water systems (ie, streams, rivers). This research targets how substrate complexity and microhabitat conditions influence benthic algal growth, which remains underexplored at fine spatial scales. This study aims to address this gap in the literature by measuring how variation in substrate complexity, and grazer presence influence benthic algal biomass and community composition in Buffalo Creek. Using artificial substrate types designed to mimic natural microhabitats, we measured how varying flow, light and depth conditions influence algal accumulation, as well as how benthic grazers may impact benthic algae abundance. Algal biomass was quantified using chlorophyll a concentrations, and benthic samples were scrubbed from the artificial substrata. Additionally, benthic grazer counts were used to assess potential top-down controls on algal growth. Following this top-down control concept, we expected grazers to reduce algal biomass through top-down interactions. However, we found that increasing microhabitat complexity led to increased algal biomass, as well as increased grazer density. Patterns of algal biomass and benthic grazer density on artificial substrata enhanced our understanding on how algal communities develop and how physical habitat characteristics affect algal dynamics. This research has important implications for how algal community development may be altered by physical habitat structure on the underexplored micro-levels. Findings from this study will contribute to our understanding of algal growth and the role of microhabitats complexity on benthic growth.

Microhabitat Complexity , Benthic Community Structure

EFFECTS OF DEPTH AND NUTRIENT AVAILABILITY ON BENTHIC ALGAE PRODUCTION IN THE SUSQUEHANNA RIVER

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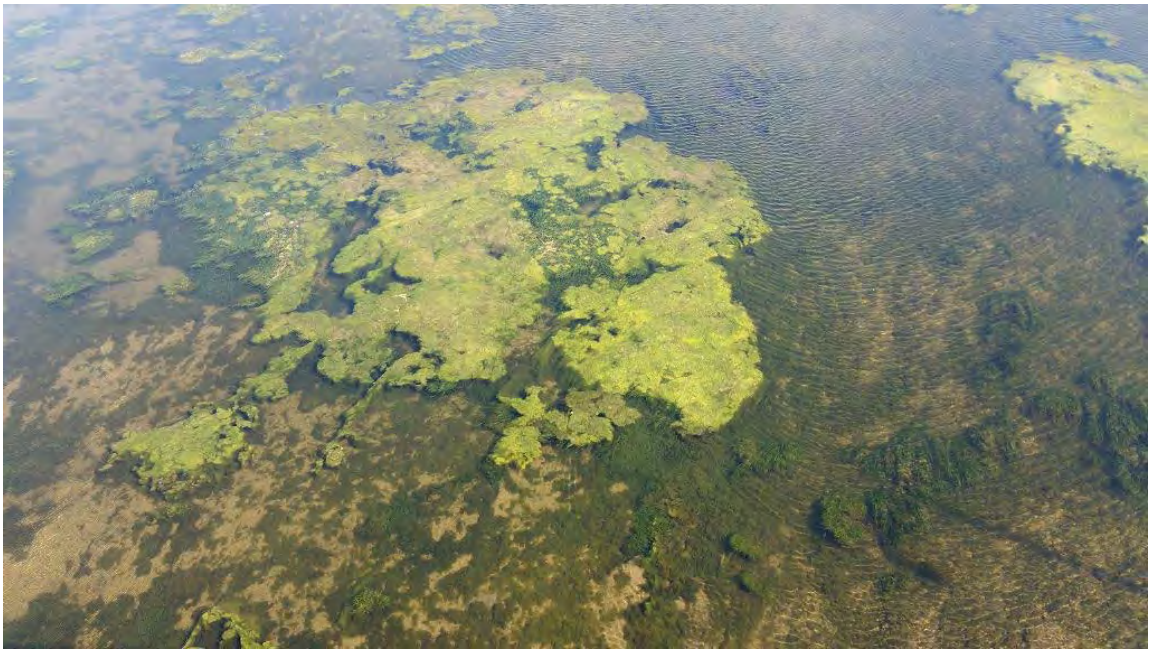
Many previous studies have measured chlorophyll concentrations at varying depths in lake water columns, finding a near-linear decrease in chlorophyll levels with increasing depth (*Demidov & Mosharov, 2015*). While these studies provide valuable insights into algal productivity, they primarily focus on lentic systems and neglect benthic algae and flowing water environments. The goal of this research was to determine whether algae in flowing water systems are similarly influenced by light and nutrient limitations. To address this, we conducted two experiments: a nutrient-diffusing substrate (NDS) experiment in Stony Run, Cowan, Pennsylvania, and a controlled in-tank experiment at Bucknell University. In both experiments, we varied light intensity and nutrient availability to evaluate how resource availability affects algal growth. In the NDS (field) experiment, nutrient supplementation was the primary driver of algal growth, with nitrogen and phosphorus treatments producing the highest chlorophyll concentrations, followed by phosphorus alone. In contrast, the in-tank experiment showed that light was the most influential factor overall, while combined nitrogen and phosphorus supplementation had the strongest nutrient effect, followed by nitrogen alone. Previous literature suggests that algal growth in freshwater systems is typically nitrogen-limited (*Tank et al., 2017*), and our in-tank results support this pattern. However, our field results differed, indicating that further investigation of nutrient dynamics in Stony Run is warranted.



PREDICTORS OF EGRESS FOR GRAVID TIMBER RATTLESNAKES (*CROTALUS HORRIDUS)* IN NORTH-CENTRAL PENNSYLVANIA

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Gravid female Timber Rattlesnakes (*Crotalus horridus*) exhibit modified behaviors during gestation compared to non-gravid individuals. There is adequate research on non-gravid and male Timber Rattlesnakes in the northern United States, but limited research has been done on gravid individuals and what environmental factors may be impacting their behaviors. Gravid female Timber Rattlesnakes exhibit thermoregulatory behaviors during gestation and travel relatively short distances each day. We set up cameras at known gestation sites in Rider Park, Pennsylvania, and using time-lapse photography, we were able to monitor behaviors in gravid females. The site we monitored is located in a highly managed and human trafficked area of the park, providing us with a unique opportunity to observe how human disturbance and modified landscapes may influence rattlesnake behavior. In this study, we are specifically looking at time of egress from their shelter.

Rattlesnake, Gravid,

UPDATING THE CITY OF SHAMOKIN'S FLOOD INSURANCE RATE MAP

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Accurate mapping is essential for communities to know and understand their potential flood exposure and risk. Changes in land development, precipitation, and infrastructure can impact the probability of flood hazards. Updating flood mapping determines insurance rates and can influence the direction of development and revitalization efforts in communities. When flood maps are redraw, communities have a period in which to appeal. However, without adequate engineering support, a community's capacity to engage in an informed appeal process can be limited. In 2019, the City of Shamokin requested that the appeal period for a revised Preliminary Flood Insurance Rate Map (FIRM) be extended due to initial lack of engineering support for appealing. This Preliminary FIRM projected a doubling of the flood plain. At the request of SEDA-Council of Governments (SEDA-COG), a Bucknell University student intern mapped potential impact of this change and a history of flood insurance claims. This information was used by SEDA-COG, on behalf of the City, to successfully request permission and funding to do a hydrology and hydraulics study as part of the extended appeal process. With a grant of $130,000, the City hired an independent consulting engineering firm to assess the physical hydraulics and hydrology of the city, generating a report which deemed that the original FEMA assessments were much higher than the hydrologic realities of the landscape. Their revised map showed an increase in the floodplain of about 25%, not 100%. Another student intern then created public outreach materials for residents to help explain the flood mapping process and its impact on the community. In this poster, we review the process and findings of this mapping reassessment, reflect on university-community partnerships in the process, and highlight the impact of the new findings.

Flooding , Revitalization , Partnerships ,

MCINTYRE WILD AREA PILOT STUDY ON ACID MINE DRAINAGE IN STREAMS LOCATED WITHIN ABANDONED MINE LAND

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Bituminous coal mining operations have been impacting many regions of Pennsylvania since the mid-1700s. Even when these operations are abandoned, they continue to have negative effects on biodiversity and human ability to use the land. From 1870 to 1886, McIntyre Wild Area, a 7,500-acre natural area located in Lycoming County, Pennsylvania, was a bituminous coal mining operation controlled by the McIntyre Coal Company. Even though the mining operation is now abandoned, the effects are still being felt. The goal of this pilot study was to determine the effects of an abandoned mine operation on the stream structure and biodiversity to guide future restoration work and keep visitors safe. We utilized ArcGIS Pro to designate priority zones based on their proximity to the mining extent identified by the PADEP. Streams were then selected based on whether they were expected to be more or less impacted by acid mine drainage due to their location in relation to the priority zones. We characterized streams using two field survey types. The first field survey was a stream ecology survey conducted using backpack electrofishing, as well as, sediment and gravel sampling, Surber macroinvertebrate sampling, water quality sampling, and channel measurements. The second field survey type provided smaller snapshots of stream health with Surber macroinvertebrate sampling, water quality sampling, sediment sampling, a visual fish assessment, and channel measurements. Historical mine maps were georeferenced using ArcGIS Pro to determine the extent of the mining in the area. Findings indicate that Dutchmans Run is the most heavily impacted stream in McIntyre Wild Area due to its central location in the mining operation and its proximity to the incline plane. Most exposed coal was found in and along Dutchmans Run, but coal was also found in the upper parts of the two streams within and bordering the priority 1 area, Abbott and Miners Run. The subsurface geology of the area is a sulfuric rock unit, so typical acid mine indicators such as acidic water were skewed by the natural rocks in the area. This caused some of the streams predicted to be less impacted to have acidic water, even though they were not draining from the mining area. Additional samples are still being processed and are necessary to generate a clearer picture of the effects of abandoned mine land. Sediments are being analyzed for metal content, water samples for carbon and nitrogen, and macroinvertebrates for species composition and abundance. The georeferenced material indicates a much more extensive mining operation than what is shown on PADEP maps. These new findings improve our ability to plan restoration efforts to improve ecosystem health and trout productivity in connecting streams. It is vital that visitors be aware of the dangers associated with hiking through abandoned mine land which can appear largely untouched and disguised within the forest. Future work will be required to pin down specific actions to take to ensure safety and environmental health within McIntyre Wild Area.

acid mine drainage

XTHEN AND NOW - A WATER QUALITY, MICROPLASTICS, & LAND COVER CHANGE STUDY

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As people continue to develop and change the landscape around us, anthropogenic effects on stream systems become ever more apparent. Assessing trends within the watershed context is a practical and effective approach to understanding these impacts. This research adds to studies, by the Briar Creek Association for Watershed Solutions (BCAWS), on temporal variations in specific chemical properties of surface water to help determine if there has been an improvement or degradation in stream health since implementation of a watershed conservation plan. Additionally, the inclusion of a microplastics investigation and land cover change spatial analysis allows us to further understand anthropogenic influences in the watershed system. This work is a steppingstone into further studies for the entirety of Briar Creek Watershed. Water quality and overall watershed viability continue to be assessed, and this work offers perspective on the future direction of such efforts.

watershed assessment , anthropogenic influences , microplastics , spatial analysis

CHANGE IN SUMMER ZOOPLANKTON COMMUNITY STRUCTURE FOLLOWING THE LOSS AND RETURN OF *CERATOPHYLLUM DERMERSUM* IN FAYLOR LAKE, A SMALL RESERVOIR IN SNYDER COUNTY, PA

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Faylor Lake is a reservoir of the west branch of the upper Middle Creek watershed. The volume of Faylor Lake is 0.7x106m3 with a mean depth of 1.24m. This study focuses on the zooplankton communities of Faylor lake through the months of June and July during 2023, 2024, and 2025. Until 2024, the common free-floating vascular plant, *Ceratophyllum dermersum*, was found throughout the lake. At the beginning of the summer of 2024, however, *Ceratophyllum* had all but disappeared and was found only in small clumps on the shore of the reservoir. Toward the end of summer 2025, *Ceratophyllum* returned in small patches near the shore and open water. The zooplankton community of Faylor Lake in 2023 had 10 taxa, which were dominated by widely distributed Cladocera taxa, such as *Ceriodaphnia dubia* and *Bosmina longirostris*. However, following the loss of Ceratophyllum in 2024, the zooplankton community shifted to rotifers (e.g. *Asplanchna priodonta*). *Cladocera* returned in 2025 dominated by *Diaphansoma birgei* and *Ceriodaphnia dubia*. The dominant zooplankters of Faylor Lake are filter feeders (*Keratella* and *Brachionus*) and raptorial predators (*Asplanchna*). The mean Shannon diversity for 2023 was 1.97, fell to 1.45 in 2024, and rose to 1.71 in 2025. We suspect that differences in zooplankton ecology and community complexity in Faylor Lake are connected to the loss and subsequent return of *Ceratophyllum dermersum.*

Zooplankton , Ceratophyllum dermersum , Aquatic , Lake

PRESERVING THE PAST: USING GROUND PENETRATING RADAR TO IDENTIFY UNMARKED GRAVES AT THE WARRIOR RUN CHURCH CEMETERY, WATSONTOWN, PA.

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This project highlights the importance of integrating geophysical methods into heritage management to protect and commemorate the early settlers and veterans of Watsontown, Pennsylvania, without disturbing protected burial grounds. A Ground Penetrating Radar (GPR) survey was conducted at the historic Warrior Run Church Cemetery, established in 1767 and containing over 600 burials of early settlers and military veterans. As the cemetery is legally designated a no-dig site, GPR was employed as a non-invasive alternative to excavation to identify unmarked graves, including the possible burial site of Col. Matthew Smith, a Revolutionary War figure.

Using a 400 MHz antenna, four separate GPR surveys were conducted, each employing a grid composed of transect lines oriented in both north–south and east–west directions, spaced at 0.5 m intervals. A dielectric constant of 6 was applied to account for the dry soil conditions present during the July surveys, while surface depressions and topographic variations were recorded as indicators of potential subsurface disturbance. Fourteen anomalies were identified, several displaying hyperbolic reflections and spatial patterns consistent with historic graves. Sites 1 and 2, located in the northeastern section where historical records suggest Col. Smith may be buried, exhibited the strongest grave-like reflections.

Although the specific burial site of Col. Smith could not be confirmed without excavation, the results provide compelling evidence of multiple unmarked graves, reflecting a loss of burial records over time. This study demonstrates the effectiveness of GPR as a non-destructive tool for investigating historic cemeteries and supports the mission of the Warrior Run Fort Freeland Heritage Society to preserve Pennsylvania's early heritage.

Heritage Management , Unmarked Graves , Historical Preservation , Ground Penetrating Radar (GPR)

CONSERVATION OF IMPERILED GIANT SALAMANDERS: IS LOCAL ECOLOGICAL KNOWLEDGE RELIABLE?

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Japanese Giant Salamanders *(Andrias japonicus)* are fully aquatic, stream salamanders, endemic to Western Japan. Despite federal protection as a special national monument, it is threatened with extinction, and the declining trend continues due to habitat destruction, such as dam and concrete bank construction, as well as hybridization with Chinese Giant Salamanders. Wara in Gifu Prefecture, Japan, is one of the critical habitats for *A. japonicus*. However, information about the species is still largely based on local ecological knowledge (LEK), and only a few preliminary surveys have been conducted. Integration of LEK and citizen science into the monitoring of rare or threatened species has become a popular approach in conservation biology. Yet, the accuracy of LEK has rarely been assessed. To test the accuracy of LEK, we (1) conducted formal interviews with the locals, (2) investigated the fine-scale distribution of *A. japonicus* via environmental DNA (eDNA) and nighttime surveys, and (3) evaluated the accuracy of LEK based on the comparison between the interview results and the field surveys. With IRB approval, we distributed 200 surveys across Wara during the summer of 2025, yielding 96 responses. We collected water samples from various streams and estimated eDNA concentration of each sample using qPCR. With a few discrepancies, the interview results largely agreed with the field surveys. Our findings contribute to conservation biology and provide insights into the accuracy of LEK as a tool to assess the status and location of endangered species.

Andrias japonicus, LEK, Conservation,

CREATING A STREAM RESTORATION PLAN FOR LIMESTONE RUN, A SMALL AGRICULTURALLY IMPACTED STREAM IN CENTRAL PENNSYLVANIA

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Stream restoration is a critical component of watershed management aimed at improving the ecological integrity, hydrological function, and aesthetic value of degraded waterways. Many streams in the Central Pennsylvania region can be candidates for restorative uplift. One such stream is Limestone Run, a small agriculturally impacted stream that begins near Limestoneville, Montour County and enters the West Branch of the Susquehanna River in the borough of Milton in Northumberland County. Limestone Run has been classified as an impaired waterway according to the Pennsylvania Department of Environmental Protection, but it holds potential as a trout habitat with historical records showing prior holdings. We assessed the lower sections of Limestone Run in Northumberland County to help create a stream restoration plan in coordination with the borough of Milton. Initial water quality results show that stream temperatures in late August are still well below the lethal threshold for native trout. However, this section of stream has reduced habitat for macroinvertebrates and fish. The lower section of the stream runs through borough property and would be a great area for community connections to the natural environment through native plant gardens, walking trails and reflection sites. Our plan emphasizes restoring riparian buffers, improving instream habitats and water quality while reestablishing natural flow regimes to support aquatic and terrestrial ecosystems. Through adaptive management and long-term monitoring, the plan seeks to ensure the sustainability and effectiveness of restoration efforts while fostering community involvement with the local town of Milton and its residents.

Restoration, Trout, Limestone Run

THE INTERSECTION OF ART, CULTURE, AND SCIENCE: AN EXAMINATION OF THE NATIVE AMERICAN POTTERY AND TOOLS FROM THE ISLE OF QUE: SELINSGROVE, PA

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Analysis of pottery and associated artifacts collected from the Isle of Que, Selinsgrove, PA, reveals evidence of interaction and exchange among native groups. Pottery fragments, recovered from surveys of plowed fields, represent a cultural transition between the Archaic and Woodland periods (4,300–300 years BP). Among the 593 pottery pieces donated to the university, fragments of steatite, argillite, and metarhyolite were identified—rock types whose sources lie nearly 140 km downstream in Lancaster and South Mountain, PA. This study investigates the physical, chemical, and mineralogical composition of the pottery to identify the natural resources used in its production. Samples were prepared as thin sections for petrographic analysis, pressed pellets for geochemical analysis using wavelength-dispersive X-ray fluorescence (WDXRF), and powders for X-ray diffraction (XRD).

Modern sediment was removed from shards using a sodium metahexaphosphate solution. Pottery was sorted into four color categories; dimensions, textures, and decorative designs were documented. Colors ranged from off-white to pale brown, pink, maroon, and dark gray, with some shards showing iron staining likely influenced by iron-rich groundwater. The pottery varies in thickness from 0.2 to 1.13 mm and in size from 5.6 to 22.6 cm^2. Decorative motifs include square stylus marks, circular punctations, deep incisions, cord marking, fabric draping, and sand pressing; some fragments lack visible decoration.

The pottery, constructed using the coil method, is composed primarily of illitic clay with a quartz-rich temper. Temper materials include quartz sand, quartzite, quartz sandstone and wacke, fine to coarse chert, gneissic and granitic grains, grog (recycled pottery), and organic matter. Pore morphology suggests the possible inclusion of shell fragments. Compared to modern river sediments, the pottery exhibits a distinctive geochemical signature with elevated barium and lower sulfur, iron, and manganese concentrations—elements typically associated with coal combustion or waste.

Situated downstream from the confluence of the West and North Branches of the Susquehanna River, the Isle of Que occupies a landscape where native trails and cultures converged. Native peoples used locally available clays derived from the Keyser and Tonoloway Formations along Penns Creek and from the Hamilton Group along Middle Creek, or they transported clay from deposits along the Susquehanna River. Temper was collected from local sand sources, including river sand, tool debitage derived from Shriver Chert, and pottery fragments (grog). The sediments they used did not contain the constituents associated with recent coal mining. Continued geochemical and mineralogical analyses will help clarify the natural resources used in pottery production and illuminate patterns of cultural exchange in this region.

CAMPUS STRUCTURES AND THEIR IMPACT ON LANDSCAPE TREE HEALTH

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Landscape trees are an important part of both the aesthetic appeal and environmental health of college campuses. The Arbor Day Foundation has a Tree Campus Higher Education project that focuses on empowering campuses to lead the way in sustainability, student engagement, and long-term community impact. This study focuses on the impact of human structures on tree health and will help to create a plan to encourage a healthy and diverse tree community on campus while minimizing tree losses due to poor health and growing conditions. Data will be collected using ArcGIS to record the species, size, and health of campus trees and their proximity to campus structures. 400 trees have been surveyed this year in the core academic areas with another 600 planned to be surveyed in the residential areas on campus. The results of this study will be presented to the community to further ecological education and engage the community by developing a program that highlights the environmental and ecological value of urban forests while also completing the criteria for the Tree Campus Higher Education project.

Urban forestry, Tree health, ArcGIS, Environmental Education

EVEN NATURE LIKES TO FLASH: FINDING CORRELATIONS BETWEEN STREAM FLASHINESS AND LAND DEVELOPMENT

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Flash flooding poses a danger to life and property, so knowing how to accurately calculate and notice trends can help predict areas at risk. To examine stream flashiness the Richards-Baker Index (RBI), metric of flashiness, was applied to small (<50 mi^2) drainage basins with a USGS gage across Pennsylvania, and factors contributing to stream flashiness were examined (i.e. land cover/use). R-code was used to gather USGS data and calculate annual RBI averages. Land cover/land use was calculated within each basin using ArcGIS. The results were then put through a linear regression model to test significance. It was found that increasing development and agriculture land in the state were the greatest drivers of flashiness. Since it is not feasible to place stream gages in every waterway, knowing what factors and how they affect stream flashiness can be an alternative way to predict which watersheds are more prone to flash flooding.

Flashiness , Streams , Land Development , Flood Risk

BEAVER DAM ANALOGS AND THE EFFECTS ON FINE EARTH SEDIMENTS

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Beaver dam analogs are an essential technique in stream restoration by trapping sediment and restoring damage to stream beds but have not yet been used in the eastern United States. In 2023, eight beaver dam analogs (BDAs) were installed by staff, students, and volunteers on Susquehanna University's campus. Their purpose in trapping sediment is to prevent it from moving further downstream and reducing the damage done by flooding. Beaver Dam analogs are meant to act essentially the same as a natural one. They are semi-permeable and are meant to slow the natural flow of water while also holding back the sediment. This has resulted in the trapping of coarse and medium pebbles. The trapped sediments are strongly skewed fine and poorly sorted. Beaver dam analogs have appeared to be successful at trapping suspended sediments, slowing water velocity. Hopefully this study will demonstrate that the BDAs are helping to reconnect the stream to the floodplain.

Beaver Dam Analogs, sediment

HOW DO INVASIVE PLANT DENSITY AND HERBICIDE APPLICATION RATES INFLUENCE THE SUCCESS OF RIPARIAN BUFFER RESTORATION OVER A THREE-YEAR PERIOD?

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Riparian buffers are one of the most effective strategies for improving stream water quality, stabilizing streambanks, and supporting wildlife. Yet many restored sites experience inconsistent maintenance and invasive plant species succession, leading to reduced native vegetation diversity and loss of function over time. Herbicide is a common management tool for restored riparian buffer maintenance. This study examines how invasive plant populations respond to herbicide application rates and methods — which influence the success of riparian buffer restoration. We collected data on different types of herbicide treatments and compared target invasive plant relative density over a three-year period (2023-2025) across 16 restoration sites in Lycoming, Synder, and Union Counties, Pennsylvania. Our results indicate herbicide management helps mitigate some invasive plant populations. For example, callery pear (*Pyrus calleryana*) populations declined from 0.05 occupancy rate across all sites from 2024 to <0.01 in 2025 ($p = 0.01698$, $R2 = 0.1581$). However, this trend is not the case for all species, such as reed canary grass (*Phalaris arundinacea*; $p = 0.0877$, $R2= 0.066$). These findings suggest that moderate herbicide use paired with consistent monitoring may gradually improve restoration outcomes by limiting invasive plant densities and promoting native plant biodiversity to recover. Next steps will involve returning to 5 sites that overlap across three years to measure diameter breast height of tree species to determine which specific tree species are showing significant growth.

restoration effectiveness, buffer maintenance, riparian, invasive species

LEAF LITTER DECOMPOSITION OF NATIVE SPOTTED JEWELWEED AND INVASIVE JAPANESE KNOTWEED IN A HEADWATER STREAM

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The leaf litter decomposition in streams is an important stream ecosystem process. The fallen leaves support the stream food web providing nutrients for microbes and macroinvertebrates as well as shelter. Invasive species are known to easily overtake riparian habitats, due to frequent disturbance making these areas vulnerable. Invasive species can simplify the food web, change available nutrients, and reduce biodiversity. Japanese knotweed (*Reynoutria japonica*) is an invasive perennial that invades wetlands, riverbanks, and roads. Spotted jewelweed (*Impatiens capensis*) is a native annual that has fragile watery stems, favoring shady moist areas of wetlands and riparian areas. We chose these species for this study because of the frequency at which knotweed invades and replaces jewelweed along streams, making it important to understand how their decomposition rates compare. During decomposition both microbes and macroinvertebrates play a role; microbes biodegrade while macroinvertebrates shred. These differences affect the speed at which the leaves break down and food availability across trophic levels. The goal of this experiment is to measure the decomposition rates of spotted jewelweed and Japanese knotweed when placed in different size mesh packs, to include or exclude macroinvertebrate shredders. These packs were placed in three sites in an unnamed tributary to Chillisquaque Creek at the Bucknell Natural Area in Milton, Pennsylvania. To determine the decomposition rates of the leaf litter, leaves are removed from the packs, and we take a dry mass and ash-free dry mass of each sample. After one week, it was clear jewelweed decomposes faster overall then knotweed with an average of 48.7% mass loss of jewelweed while knotweed lost 25.0% of its mass. Additionally, litter in coarse mesh decomposed twice as fast as in fine mesh across species. By looking at the decomposition rates between a native annual and a non-native perennial we can understand how invasion by knotweed may alter microbial breakdown and macroinvertebrate shredding of leaf litter in streams.

Spotted jewelweed, Japanese knotweed, Decomposition, Leaf Litter

MAPPING OUTCOMES: DETERMINING THE EFFICACY OF RESTORATION STRUCTURES ON STREAM HABITAT DEVELOPMENT OVER TIME

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Stream restoration is performed with many different goals ranging from fish habitat improvement to reduction in nutrient and sediment transport. To achieve these goals, many different restoration techniques are often employed at a single site, making it difficult to track effectiveness of individual practices. The purpose of this study is to determine the relationships between restoration structures and physical habitat characteristics over time. Using 6 years of site mapping data, we translated hand-drawn structures into quantified effort by technique and restoration technique and included natural features to characterize the development of stream habitat over time following in-stream restoration. We grouped features by type (e.g., instream and on-bank) and material (e.g., woody and rocky); a feature type generalizes its role in developing habitat over time, and its material informs its construction. By recording features over time, it enables us to understand how specific structures inform channel development, as well as trends, such as where restoration structures may have failed, or where some structures may be more commonly implemented based on a stream's morphology. Preliminary results from multivariate redundancy analyses show relationships between watershed and some channel morphology characteristics like bankfull width and riffle-run sequence length while measures of channel depth or incision are not. We also found significant changes in stream structures over time when controlling for watershed. Our results indicate strong patterns of change in stream morphology and habitat related to the combination of structures installed that may support future restoration structure design and implementation.

Habitat, Stream Ecology, Geomorphology, Restoration

A SLIMY SITUATION: LANDSCAPE EFFECTS ON SLIMY SCULPIN (*COTTUS COGNATUS*) MORPHOLOGY WITHIN WEST BRANCH SUSQUEHANNA RIVER WATERSHEDS

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Freshwater sculpin are a small-bodied, benthic fish species found in cool-to cold-water rocky streams. They can be a useful environmental indicator due to their partial tolerance to turbidity and siltation as well as intolerance to warmer temperatures, chemical pollution, and acidification. Slimy Sculpin *Cottus cognatus* (Richardson, 1836) is distributed within West Branch Susquehanna River watersheds. We vouchered specimens in the field within the Loyalsock Creek, Pine Creek, and Kettle Creek watersheds. Then examined specimens for meristics such as fin ray counts, pore counts, and spine counts as well as categorical traits used for identification. Previous research within these watersheds showed variability in traits between sites. We are utilizing landscape characteristics to investigate if location is affecting the variability of traits. We hypothesize that there will be an increase in variability in traits depending on landscape characteristics like elevation and distance of the site from the main stem.

Freshwater, Fish, Sculpin, Species Distribution

PRIORITIZING NATIVE SPECIES OR INVASIVE ACCUMULATORS FOR PHYTOREMEDIATION IN AREAS AFFECTED BY ACID MINE DRAINAGE

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Acid mine drainage (AMD) and its subsequent pollution of waterways are common problems throughout Pennsylvania. Phytoremediation has been shown to be an effective method for diminishing the negative effects on ecosystems affected by AMD. However, determining the best plants for use in phytoremediation can be complicated due to the concentration of heavy metals that a plant can accumulate, the environmental factors that affect accumulation and the effects of the chosen species on the rest of the environment. This study will examine the effects of water depth and the use of native versus nonnative species on the concentration of metal accumulated by each plant, including the translocation factor and the weekly rate of absorption. *Typha latifolia* and *Phragmites australis* will be the comparisons for native and nonnative species respectively. The two types of plants will be grown in synthesized AMD water similar to the affected water of Shamokin Reservoir, with distilled water as the control for each species. Each group will have water depths of 5 cm, 15 cm and 55 cm. Samples from the water and the roots, shoots and leaves of *T. latifolia* and *P. australis* will be taken weekly to determine change in water pH, metal concentration in the water and absorbed heavy metal concentration. Atomic Absorption Spectroscopy and Inductively Coupled Plasma Mass Spectrometry will be used to determine the absorbed concentration in each group as well as the metal concentration of the initial water sample taken from Shamokin Reservoir. The differences between species in amount of accumulation, translocation factor and rate of accumulation depending on water depth will be used to contribute to the discussion of prioritizing native species or alternative accumulators for phytoremediation in Pennsylvania acid mine drainage affected sites.

Acid mine drainage, Phytoremediation, Typha latifolia, Phragmites australis

USING eDNA FOR POPULATION MONITORING OF AMERICAN EEL (*ANGUILLA ROSTRATA*) IN THE SUSQUEHANNA RIVER BASIN

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There are growing concerns regarding the safe passage of aquatic organisms over large hydroelectric dams on major rivers like the Susquehanna River. It is unknown if efforts to mediate this issue such as increased stocking and fish passage facilities are significantly effective at restoring populations of a freshwater species of note, *Anguilla rostrata*. *A. rostrata* (common name American eel) faces population decline due to impediment of anadromous migration from the North Atlantic. They are major hosts of important native freshwater mussels such as *Elliptio complanata* (Eastern elliptio mussel) and are key food web members, serving as both predator and prey during different life stages. Eels are cryptic organisms, which poses a challenge for traditional electrofishing sampling methods; environmental DNA (eDNA) is a popular method for detection of cryptic species. Use of eDNA is also less invasive and poses less risk to organisms. The Susquehanna River Basin Commission (SRBC) has made great conservation efforts via stocking throughout the Susquehanna watershed in the past few decades. Preliminary trials of eDNA sampling in the Pine Creek watershed in September 2024 indicated that our procedures for aquatic eDNA sampling were feasible for detecting presence of eels around SRBC stocking locations. Our efforts have now shifted to sampling the entire Susquehanna basin in order to better understand how these eels are moving throughout the Susquehanna. We began sampling in the West Branch Susquehanna sub-basin in September 2025, targeting the main river as well as corresponding tributaries. Samples were taken and filtered onsite both upstream and downstream of major barriers throughout the watershed using the Smith-Root eDNA Sampler Backpack. Samples would be taken by filtering ~1L (±0.10) of water through 0.45 micron filters. Filters were stored in ethanol until they were processed via DNA extraction and qPCR. DNA was extracted using the Qiagen DNeasy Blood & Tissue Kit, and qPCR procedures were completed using a recently developed PCR marker for American eels referred to as AME1. The Bio-Rad CFX Opus 96 Real-Time PCR System was used for 15 µL qPCR reactions, and the CFX Maestro computer program was used to analyze PCR results. Water quality measurements were taken at each site to better our understanding on potential predictors of eel movement. Current findings indicate presence of eels downstream of major hydroelectric dams on tributaries feeding into the West Branch of the main river, but no presence around low head dams on the main river. More sampling will be completed in eastern and southern Pennsylvania, around the mouth in northern Maryland, as well as the headwaters in upstate New York. Understanding where eels are present as well as how they are moving will guide future stocking and conservation efforts, especially in relation to fish passage systems.

American eel, eDNA, Barriers, Susquehanna

ASSESSING ACTIVE AND PASSIVE SAMPLING TECHNIQUES FOR EMERGING CONTAMINANTS USING NESTED WATERSHED MONITORING

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Even at trace levels, emerging contaminants (ECs), in surface water resources pose potential adverse ecological and human health impacts. The assessment of monitoring approaches used in tracking spatial-temporal patterns of ECs is key in the development of cost-effective monitoring networks. In this study, a nested watershed monitoring approach was implemented to quantify 24 ECs over the 2023-2024 growing seasons at five sampling sites within an agriculturally impaired headwatershed with no point sources of ECs. Using grab sampling and polar organic chemical integrative samplers (POCIS), both active and passive stream samples were collected every two weeks to (1) compare the effectiveness of the methods in documenting spatial-temporal patterns of ECs, and (2) examine the relationship between estimated POCIS time-weighted average (TWA) and grab sample concentrations over the monitoring period. POCIS sampling detected ECs at equal or higher frequencies than grab sampling did. Atrazine, simazine, clothianidin and caffeine were the most frequently detected ECs in at least 68% of grab and POCIS samples. At seasonal scales, grab samples showed highest detection frequencies for most ECs in summer while POCIS samples had higher detection frequencies in both spring and summer. However, grab samples showed seasonal variability that was within or exceeded the range captured by POCIS. Both methods were effective in identifying hotspot sites for the different ECs, giving insights into contamination levels at different site sub-catchments that would have been missed by single-site monitoring. However, only caffeine, clothianidin and carbamazepine showed statistically significant differences in concentration between the sampling sites in both methods. PERMANOVA analysis revealed that POCIS captured differences in EC profiles between sites while grab samples documented within site variability. ECs that remain in their neutral state at environmental pH including atrazine, simazine, clothianidin and caffeine, sorbed better to POCIS and had higher estimated POCIS TWA than grab samples concentration. However, this was not true for carbamazepine which is relatively persistent in water and had estimated POCIS TWA largely within the range of grab sample concentration. Ionic ECs such as Sulfamethoxazole may not sorb well to HLB POCIS indicated by the estimated POCIS TWA being lower or within the range of grab sample concentration. Overall, the findings of this study enhance understanding of the extent of ECs contamination in agricultural watersheds and the relationship between the sampling methods that would guide monitoring approaches.

MONITORING VEGETATION ESTABLISHMENT AFTER WETLAND RESTORATION AT ROBERT PORTER ALLEN NATURAL AREA

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Robert Porter Allen Natural Area (RPANA) is a 227-acre former farmstead in South Williamsport, Pennsylvania, with one of the largest remaining floodplain wetlands on the Susquehanna River's West Branch. This area underwent dredging in 2024 to restore previous hydrologic patterns. Pre-restoration sampling of vegetation and water depth provided baseline data of the biotic and abiotic conditions of the wetland on eight transects established throughout the area. This year's study aimed to monitor restoration impacts on the wetland over time. During the summer of 2025, the four transects that were most impacted by restoration practices were resampled to assess recolonization of vegetation communities, measure water depth to track hydrologic changes, and monitor the early stages of restoration impact. Transects ranged from 144 meters to 405 meters, with sampling occurring every 40 meters. Vascular plant species, phenology, wetland indicator status, percent cover, and native or introduced status within a total of 29 1m² plots was determined. Water depth was measured using a Stadia rod. A Wilcoxon Signed-Rank Test compared the change in species richness from 2024 to 2025. The Floristic Quality Index (FQI) was calculated for each plot to compare the ecological quality of the site before and after restoration. A total of 115 vascular plant species were identified, with 71% (82 spp.) native and 29% (33 spp.) introduced. Sixty-six percent of plots showed increased species richness one year after restoration. The Wilcoxon signed-rank test yielded a test statistic of 103.5 and a critical value of 126, indicating a significant positive change in species richness following restoration with a 95% confidence interval ($p<0.05$). Some plots on transects one and two saw a recolonization of introduced species like Velvetleaf, Wormwood, and Barnyard grass. Fourteen plots achieved a higher average FQI post-restoration, 11 had a lower average FQI, and four plots maintained an FQI of zero. The seven plots with the highest FQI scores supported Green Arrow Arum-Scarlet Smartweed plant associations and experienced an increase in water depth post-restoration. The water depth of the wetland increased an average of 0.33 inches from 2024 to 2025. Restoration of this wetland resulted in increased species richness with native species and wetland obligates being the dominant taxa. Plots with higher FQIs should be closely monitored to protect the ecological integrity, whereas plots in transects one and two experiencing colonization of introduced species should be reseeded with native warm season grasses and perennial forbs. Hydrology should also continue to be monitored due to ongoing agricultural operations adjacent to the wetland. The increased species richness, native and high FQI species, and water depth are promising signs of future success for this wetland restoration project.

Wetland restoration, Wetland vegetation, Ecological monitoring, Hydrology

BROOK TROUT eDNA SAMPLING AND HOTSPOT ANALYSIS

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Brook trout (*Salvelinus fontinalis*), Pennsylvania's only native trout species, serve as key indicators of water quality. However, their populations have experienced significant decline due to habitat loss, rising water temperatures, and competition from invasive species. Since 2010, the Pennsylvania Fish and Boat Commission (PFBC) has relied on multiple public and private entities to locate populations of brook trout for their Unassessed Waters Initiative (UWI). While this program has generated valuable data, the waters left to assess are becoming increasingly inaccessible. Additionally, the UWI relies on electrofishing to monitor brook trout populations, which can be labor-intensive and may cause unnecessary stress to organisms in the water. Environmental DNA (eDNA) offers a non-invasive, efficient alternative for detecting brook trout presence. This study aimed to assess the distribution of brook trout within targeted areas of the Susquehanna River watershed using eDNA sampling. Previous UWI data was compiled to perform a heat map analysis to identify regions most likely to contain brook trout. Water samples were collected along edges of brook trout hot spots, with the majority of samples coming from areas surrounding dams to investigate the effects barriers have on brook trout distribution. The samples were analyzed for brook trout DNA using quantitative PCR (qPCR) techniques. This study investigates the feasibility of utilizing eDNA to monitor brook trout populations to extend the PFBC's UWI and ensure implemented water quality protections are in place.

READING BETWEEN THE DRAGLINES: THE EFFECT OF MALE AND FEMALE FISHING SPIDER *(DOLOMEDES TRITON)* SILK ON WHIRLIGIG BEETLE (*DINEUTUS ASSIMILIS*) BEHAVIOR AND PREDATION.

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Dolomedes triton is a semi-aquatic spider that deposits hydrophobic silk across the water surface. Female silk attracts males but could also act as a trip-line to increase prey detection or function as an aquatic web. Alternatively, neustonic silk may alert prey to the predator's presence. The whirligig beetle, *Dineutus assimilis*, swims across surface water and may encounter fishing spider silk. We measured space use of beetle pairs in the presence or absence of male or female silk. We also compared silk quantity deposited by male vs. female spiders. In a second experiment, we measured beetle pair survival with live male or female spiders with or without their silk. Females deposited significantly more silk on the water surface and showed significantly higher predation than males. Female silk also decreased prey capture time by female spiders. Beetles avoided silk-laden areas and showed no avoidance difference between male and female silk, but their silk-mediated behaviors only increased spider predation. Our results suggest a trip-line function for silk that enhances prey detection, but mostly with female spiders. Fishing spider silk may mediate neustonic arthropod trophic interactions.

enemy-avoidance kairomone, neustonic, spider, beetle

PHOTOCATALYTIC DEGRADATION OF OXYCODONE HYDROCHLORIDE

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The photocatalytic degradation of oxycodone hydrochloride is being evaluated to determine the time required to degrade the pharmaceutical to a non-detectable concentration, as monitored using high performance liquid chromatography (HPLC). Photocatalytic degradation of pharmaceuticals in ultraviolet (UV) light is a promising alternative for proper disposal of unused prescriptions. Pure samples were dissolved in water at 100 ppm and were treated in a UV reactor containing eight 254 nm UV lights. An identical "control" sample was kept in the dark, and both samples were stirred continuously. Samples were removed at time intervals and analyzed by HPLC calibrated using external standards from 0.5 to 100 ppm. Results show that oxycodone exposed to UV radiation alone, required more than 55 hours of degradation to reach the limit of detection (0.5ppm). To increase the speed of degradation, titanium (IV) oxide (TiO2) and hydrogen peroxide (H2O2) catalysts were introduced separately into samples. Degradation time decreased to 10 hours and 2 hours, respectively with the addition of these catalysts. Control samples did not degrade at all in the same time period indicating that the UV light was responsible for the degradation of the drug. Further research continues to determine the effect of combining catalysts in the sample, and to determine the toxicity and identity of degradants after treatment.

oxycodone, pharmaceuticals

HYDROTHERMAL LIQUEFACTION OF CARBOHYDRATE WASTE AND WASTE COOKING OIL: OPTIMIZING PROCESS CONDITIONS TO PRODUCE BIOCRUDE OILS

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Significant amounts of food produced in the U.S. ends up in landfills, which leads to severe environmental challenges including underground water pollution, methane emissions, and land degradation. Furthermore, Waste Cooking Oil (WCO) contributes to the standard challenges of food waste and also adds by causing disposal hazards because of its tendency to clog waterways and pose environmental threats. Therein lies the motivation of this study. The research explores the impact of process conditions during hydrothermal liquefaction (HTL) of carbohydrate waste and WCO into biochars and biocrude oils for potential upgrading into sustainable aviation fuels (SAF). HTL has the potential to decrease landfill waste and offer a new carbon-sourced renewable energy source. Unlike prior HTL experiments, which use simulation or only food waste, this work explores WCO as a cosolvent paired with carbohydrate feedstocks or used alone. Reaction conditions, including temperature [280-320°C], feedstock composition [rice and water, water and WCO, or WCO, water, and oil] , and reaction time [20-60 minutes] were strategically manipulated to evaluate their effect on product quality and distribution. The resulting solid and liquid products of heavy biocrude oil (HBC), light biocrude oil (LBC), biochars (BC), and the aqueous phase (AP) were characterized using testing techniques including GC-MS, XRD, SEM-EDX, CHN, and TOC to assess their composition and fuel potential. Experimental results lead to key findings including enhancement of product quality due to WCOs and increase in product amounts with increased time and temperature. Overall, this research will provide insight into the benefits using WCO has to the quality and distribution of HTL products capable of upgrading into SAFs, while also tackling issues of waste disposal and clean energy sources.

Liquefaction, Environmental, Sustainable, Aqueous

DISCHARGE PROCESS OPTIMIZATION AND EVALUATION OF WASTE STREAMS FROM SPENT LITHIUM BATTERIES

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Lithium-based batteries are increasingly replacing traditional battery technologies, leading to a growing accumulation of spent lithium batteries. These used batteries contain valuable heavy metals that can be recovered through various recycling methods. However, due to their residual voltage, they must first be safely discharged before dismantling can occur. This research investigates optimal solvents for discharging lithium-based batteries to a safe voltage level for handling and recycling. Additionally, the study evaluates the environmental impact of the discharging process, with a focus on potential pollution risks if the resulting waste enters the environment without further treatment. Analytical techniques included ICP-MS and GC-MS for waste liquid analysis, and XRD and SEM-EDS for waste solid characterization. Three solvents were tested: sodium chloride (NaCl), sodium sulfate (Na_2SO_4), and iron sulfate ($FeSO_4$). These solvents were chosen because of their high electrical conductivity in aqueous solution. NaCl had the highest discharge efficiency, nearly 40%, and consistently reduced the batteries to a relative voltage of about one volt. At this voltage, the batteries can be safely dismantled, allowing the heavy metals to be recycled. Preliminary results show that NaCl produced the highest heavy metal ion concentrations, with nickel, lithium, and magnesium being the most abundant. Na_2SO_4 produced lower concentrations overall but still showed elevated levels of nickel, copper, and zinc. GC-MS analysis confirmed that none of the solvents caused leakage of volatile organic compounds. Waste solid characterization revealed that sodium chloride use leads to precipitates of iron oxide (Fe_2O_3) and some unreacted NaCl. Sodium sulfate use results in the formation of solid copper sulfate ($CuSO_4$). Although no volatile organic compounds were detected, the high heavy metal concentrations and precipitate formation indicate that the waste could cause significant environmental pollution if not treated further.

BRIDGING THE PAST AND PRESENT: UNDERSTANDING FOREST ECOSYSTEM CHANGE THROUGH HISTORICAL ART

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Understanding how ecosystems have responded to past disturbances provides valuable insights for predicting future ecological change. Historical ecology often relies on land surveys, sediment cores, and dendrochronology, but artistic paintings remain an underutilized resource. This project investigates how early landscape paintings can inform post-modern forest structure and composition in north-central Pennsylvania.

We focused on areas in the Susquehanna River watershed, which experienced intensive timber harvesting, pest outbreaks, and industrial development during the 19th and early 20th centuries. Artwork of the Susquehanna area included works by *A. Wall, G. Hetzel Scapl, and W. Sonnetag*. We quantified the presence/absence and frequency of ecological features in 10 selected works from the museum collections at Carnegie Mellon in Pittsburg PA. Paintings were systematically analyzed for ecological indicators, including canopy density, tree species diversity, understory presence, and microhabitat features such as cavities, moss, and dead wood.

Statistical comparisons are in-process to evaluate how forest structure has changed from post-modern times, using similar landscape criteria in other studies (*Forman & Russell, 1983; Warren et al., 2023*) for evaluating historical records in ecology. Our research aim is to highlight how visual records can expand the evidence base for historical ecology. The results will contribute to understanding long-term forest change and inform management of contemporary ecosystems under ongoing disturbance.

forest canopy structure, historical ecology, Susquehanna river, Old growth

SPENT LITHIUM BATTERY UPCYCLING TO CARBON DIOXIDE CAPTURE ADSORBENT: AN INTEGRATED TECHNO-ECONOMIC, ENVIRONMENTAL, GIS-BASED APPROACH

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This study highlights the techno-economic assessment (TEA) and spatial analysis integrated with the life cycle assessment of upcycling spent lithium-ion batteries (SLIBs) into a CO_2 adsorbent. The analysis integrates both economic feasibility and geographic considerations to evaluate the potential of this sustainable approach. Based on critical suitability geospatial criteria for identifying optimal siting locations for SLIB upcycling, factors such as population density, digital elevation model, CO_2 sources, land cover, recycling facilities, and environmentally sensitive areas were examined using high-resolution geographic information system (GIS) data from the region. The suitability maps show that high-potential zones around central & western Pennsylvania, Southern portion of New Jersey and central & western Maryland. Overall, CWPA and northern western Virginia are the most viable areas for location of SLIB recycling facilities, based on feedstock availability, land availability, optimal infrastructure connectivity, and minimal conflict with environmental or urban constraints. Two scenarios for repurposing SLIB to Li4SiO4, traditional method and the proposed techniques, were evaluated through a holistic TEA to determine its economic feasibility and cost-effectiveness of siting a SLIB upcycling facility in the most suitable location within the region. Scenario 1 includes the conventional leaching method while scenario 2 follows high temperature pyrolysis. Comparative cost analysis shows that the minimum selling price (MSP) of Li-based sorbent for scenario 1 is US$1.97/kg, while scenario 2 is US$ 2.02/kg. The payback period (PBP) for scenario 1 and scenario 2 is 10 and 11 months respectively. The results indicate that scenario-1 is more economically profitable for SLIB upcycling within the mid-Atlantic region. Scenario 1 (leaching) is also environmentally preferable, showing a lower global warming potential of ~2.5 kg CO_2-eq/kg due to its lower energy requirement and despite its higher acidification and chemical-related burdens. Our findings would serve as a helpful tool for upscaling and commercialization of this sustainable precious metals' recovery process, enabling investors to determine the worth-venturing technique to explore for SLB upcycling and regional decarbonization planning.

Lithium Orthosilicate, Battery, Techno-economic, GIS

HABITAT QUALITY AND PREDATOR PRESENCE IMPACTS ON LARVAL EURYCEA BISLINEATA BODY CONDITION

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There are a number of variables that can affect the body condition of larval salamanders, such as habitat factors, predator presence, and introduced or invasive species. Habitat-level factors, both biotic and abiotic, can inhibit the ability of individuals to contribute to populations via individual fitness. Body condition is often used to evaluate fitness of individuals by analyzing length and weight linear regressions. We collected length and weight data from *Eurycea bislineata* populations within headwater streams in the West Branch Susquehanna River Watershed using triple-pass electrofishing protocols. In doing so, we aimed to investigate the relationship between length and weight in our species across a gradient of habitat conditions. We found that body condition varies by site for our species, which led us to propose the use of abiotic factors such as streambed particle size, water temperature, and alkalinity as measures of habitat quality. Lastly, we will use body condition scores for *Salvelinus fontinalis*, a native predator, and *Salmo trutta*, an introduced predator, to evaluate the effects of native and introduced predator presence on the body condition of our species. The results of this study will provide additional insight into local habitat factors and species interactions that limit body condition of larval salamanders.

Predation, Invasive, Larval Salamanders, Stream Quality

AUTHOR INDEX

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River Symposia

2006 to 2008

From The Branches to The Confluence

October 18-19, 2006

1st

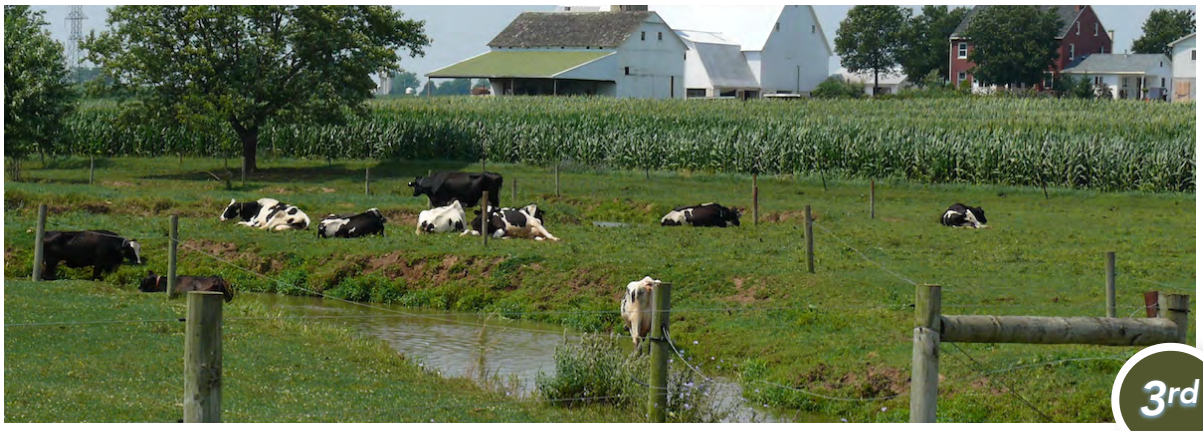
Pennsylvania Abandoned Mine Drainage Remediation

September 28, 2007

2nd

The Susquehanna and Agriculture

September 12-13, 2008



3rd

River Symposia

2009 to 2011

4th

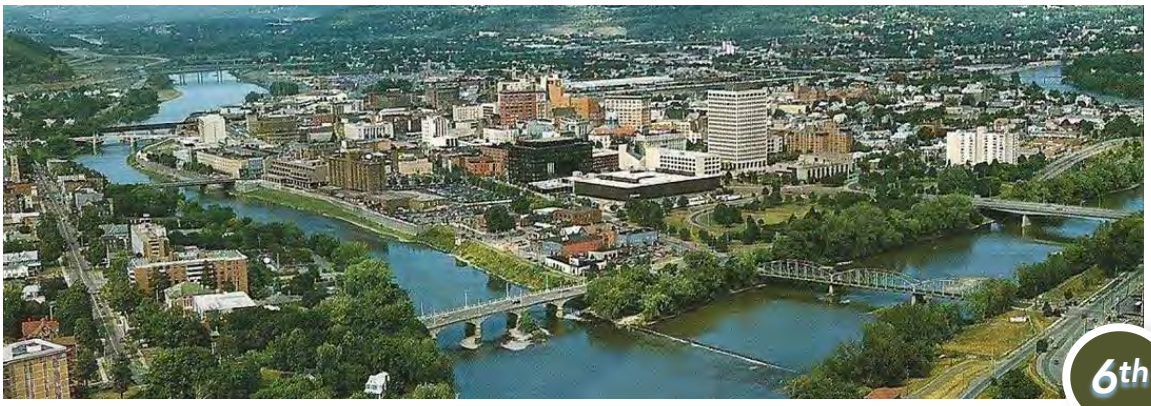
River Health and The Chesapeake Bay

October 22-23, 2010

5th

River Towns in the 21st Century

October 18-19, 2011



6th

River Symposia

2012 to 2014

A Fragmented Systems - Dams On The Susquehanna

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Science and the River

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13th

Healthy Rivers, Healthy Communities

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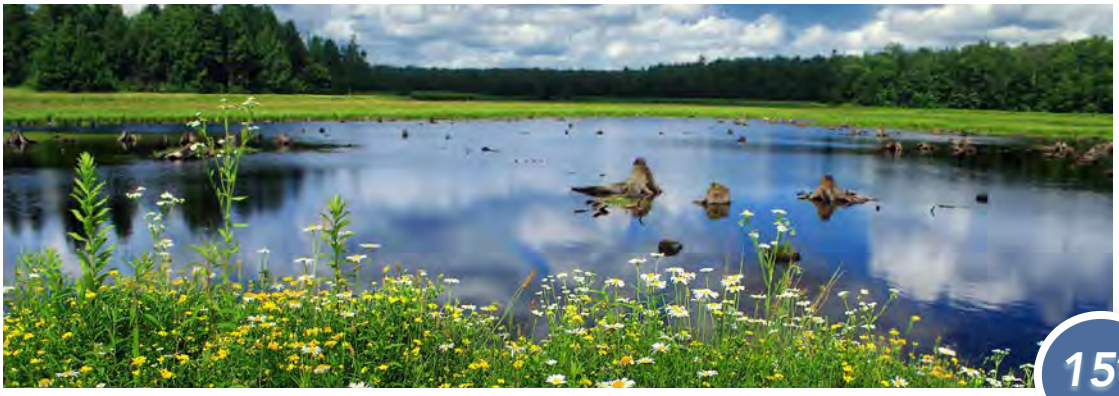
14th

Watersheds, Ecosystems, and Sustainability

November 6-7, 2020



15th

River Symposia

2021 to 2023

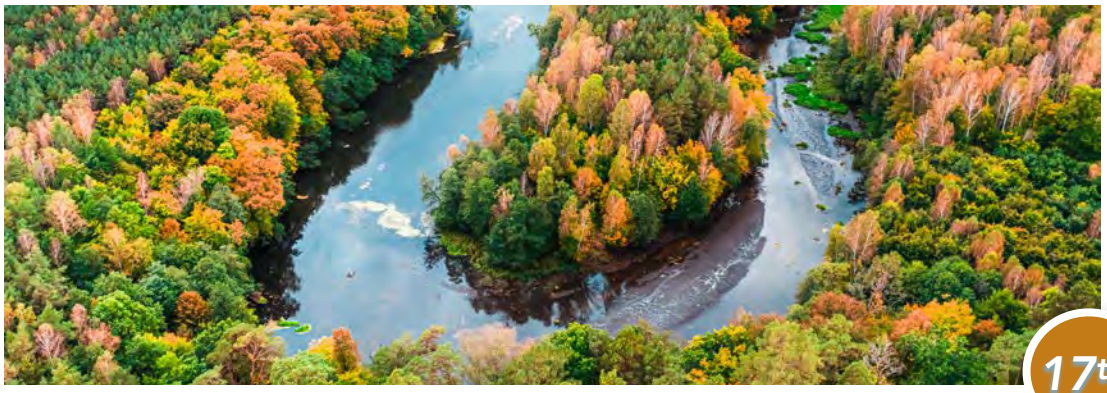
Restoration to Resilience: Creating Partnerships

November 5-6, 2021

16th

The River is Everywhere

November 4-5, 2022



17th

Navigating the Flow

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2024 to 2026

Abandoned Mine Discharge and The Susquehanna River

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19th

Water and Rivers: What Does The Future Hold?

November 7-8, 2025

20th

River Health and Resiliency in a Changing World

November 6-7, 2026

21st

Photo: SRHCES student researchers collecting water samples on Fishing Creek near Bloomsburg, PA under the supervision of Dr. Steven Rier, Professor of Biology.

SRHCES

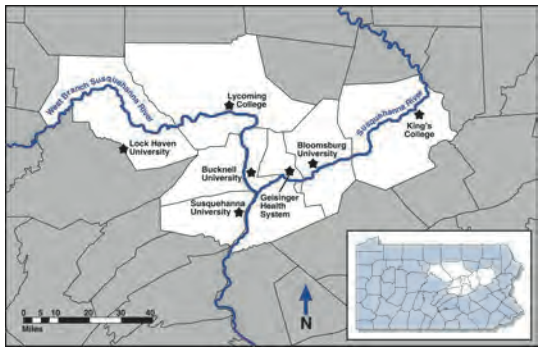
The **Susquehanna River Heartland Coalition for Environmental Studies** has played a major part of the River Symposium since its beginning 20 years ago. Established in 2005, the SRHCES is a unique collaboration of regional universities, environmental agencies, watershed groups, and the Geisinger Health System, all working together on interdisciplinary research projects in the "heartland" of the Susquehanna River waters.

Its members meet quarterly to discuss ongoing research projects, opportunities for collaboration, and emerging issues in the watershed.

The Coalition creates educational opportunities that promote student interest and involvement in the natural resources of the Susquehanna watershed.

It creates a unique collaboration that connects post secondary students attending institutions in the Susquehanna heartland region with local communities and environmental organizations.

Members present their findings at the Susquehanna River Symposium and other public events throughout the year.



www.srhces.org

PENNSYLVANIA WATER RESOURCES RESEARCH CENTER

The **Pennsylvania Water Resources Research Center (PAWRRC)**, founded in 1964, is authorized by Congress as one of the nation's 54 water resources research centers and institutes comprising the National Institutes of Water Resources. The program is administered by the U.S. Department of the Interior through the U.S. Geological Survey, in a unique Federal-State-University partnership. The institutes emphasize the role of University research, education, and outreach in advancing problems related to water quality and quantity. The PAWRRC is located at Penn State University, the primary land-grant University within Pennsylvania. At Penn State, PAWRRC is resides within and is administered by the Institutes of Energy and the Environment (IEE), organized under the Office of the Vice President for Research.

The Pennsylvania Water Resources Research Center cooperates with the National institutes of Water Resources, the U.S. Geological Survey, and Penn State Institutes of Energy and the Environment to support, coordinate and facilitate research through several programs:

Annual State Base Grants via USGS 104b. The PA-WRRC receives USGS 104B federal base funding from the USGS 104B program that is distributed via a small grants competition to researchers at academic institutions across Pennsylvania. Each federal dollar received through the program is matched with two non-federal dollars, and federal funds are not to used to pay indirect costs. PAWRRC uses the base grants to facilitate research on water resources issues, to help train new scientists, disseminate research results, and to cooperate with other colleges and universities and with other NIWR institutes to promote regional coordination. The FY 2019 USGS draft 104b and final 104b request for proposals describe the nationwide program and the role of PAWRRC. For applications from colleges and Universities in Pennsylvania, see the PA-WRRC 104b request for proposals.

Annual National Competitive Grants via USGS 104g. The U.S. Geological Survey in cooperation with the National Institutes for Water Resources supports an annual call for proposals to focus on water problems and issues that are of a regional or interstate nature or relate to a specific program priority identified by the Secretary of the Interior and the Institutes. The goals are to promote collaboration between the USGS and university scientists in research on significant national and regional water resources issues, promote the dissemination and results of the research funded under this program, and to assist in the training of scientists in water resources. See the FY 2019 104g request for proposals.

The PWRRC is a proud sponsor of this year's River Symposium.

PENNSYLVANIA WATER RESOURCES RESEARCH CENTER

20th River Symposium

THE IMPORTANCE OF WATER AND RIVERS

WHAT DOES THE FUTURE HOLD?

November 7-8, 2025

Bucknell UNIVERSITY | Center for Sustainability & the Environment

PENNSYLVANIA WATER RESOURCES RESEARCH CENTER